Packaged Literature Search 79-3

Weather Modification

Washington, D.C.
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Second Edition

U.S. DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
Environmental Data and Information Service

This packaged literature search contains citations from the Meteorological and Geoastrophysical Abstracts(MGA) database for the period extending from about mid-April 1976 to August 1978. It updates and extends the first edition of Weather Modification.

This database is paralleled by the journal of the same name, which is published by the American Meteorological Society, 45 Beacon Street, Boston, MA 02108. MGA provides current citations in English for the most important meteorological and geoastrophysical research published in foreign and domestic literature. More than 7,000 citations are taken annually from about 200 primary sources, including technical journals, monographs in series, proceedings, reviews, and annual publications.

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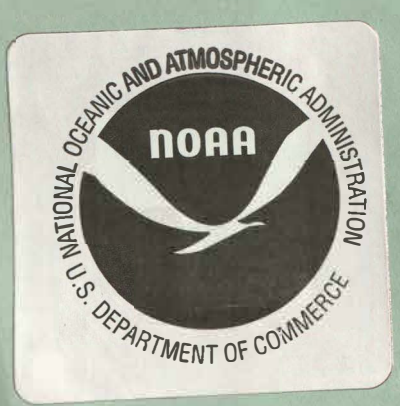

INTRODUCTION

Although the concept "Weather Modification" is succinctly expressed in the subject heading of the same name, adequate retrieval requires the use of many additional subject headings. Nearly 150 headings were used to produce this search, which updates the First Edition, Packaged Search number 77-1.

Certain citations not dealing with weather modification in a direct way but possibly relating to it indirectly have been preserved. These can be classified as laboratory studies of phenomena related to certain aspects of weather modification, as natural occurrences which also relate to weather modification problems, and as urban influences on the weather.

Coverage has been extended to about August 1978.

ID NO.- MGA29080082
National cloud-seeding operation, 1976-77.
Stevens, J. S.
Dept. of Met. Serv., Rhodesia
Journal of Weather Modification, Fresno, CA., 10(1): 4-15, April 1978. DAS (A QC 928 J6)
CTRY OF PUBL:US
The 1976-1977 operation was the fourth consecutive planned National Cloud-Seeding Operation. In many regards, it was the most useful and efficient to date. The main rains were late starting. Many areas were without useful rain until the end of Jan. From a cloud seeding point of view, Dec. and Jan. were notable. There was an anxious demand for rainfall augmentation and, fortunately, at the same time, the atmospheric conditions were suitable for worthwhile seeding. Accordingly, 90% of the seeding and 94% of the sorties for the season were achieved during these two months.
DESCRIPTORS: Cloud seeding projects; Artificial rain stimulation; United States

ID NO.- MGA29080081
Scientific planning and organization of precipitation enhancement experiments, with particular attention to agricultural needs.
Maybank, John
Saskatchewan Res. Council, Saskatoon, Canada
World Meteorological Organization, Geneva, Technical Note No. 154, 1977. 88 p. Refs. English, French, Russian, and Spanish summaries. (WMO-No. 478). DAS (A QC 851 W6445), DLC (QC851.W6445)
CTRY OF PUBL:SZ

The prospect of augmenting natural rainfall by modifying the clouds passing over an area is one possible way of relieving water shortages and droughts. The principles and various techniques for this form of weather modification via cloud seeding have been studied intensively over the past three decades. While some experiments have resulted in generally accepted rainfall increases, other equally sound experiments have ended inconclusively. The natural variability of clouds, storms, and precipitation, together with uncertainties on specific parameter values and details of the mechanisms responsible for rain production, are the primary causes for the wide range of results obtained to date. Weather modification as a method of increasing rain or snowfall in any given area and for any given season must presently be described as uncertain, but potentially promising, for some areas or some seasons at least. From the viewpoint of worldwide food needs, the improvement of crop yields and the amelioration of drought-affected agricultural areas are vital concerns, and any means of effecting such benefits through an increase in available water should be considered. This report outlines the steps that might be taken in a typical endeavor to ascertain the potential for rain augmentation in any region for which additional precipitation might be desired. After a brief survey of the principles, past performance, and present problems connected with cloud seeding, the steps to be taken in ascertaining the specific needs for additional water are described. These are related primarily to crop and pasture usage because the greatest general potential for rain augmentation lies in agriculture. Again, the needs are interpreted in line with the probable type and magnitude of the precipitation increase that might most probably be achieved. A description of the necessary steps to be taken in determining the atmospheric water resources and the potential for augmentation is provided. Various statistical designs are considered, and the problems that are met in the planning stages are discussed. Experimental details and costs for an idealized but reasonably typical cloud-seeding experiment are outlined. Incorporation of features from successful projects elsewhere is discussed. The evaluation steps that follow a completed experiment are described, together with considerations of future action if the experimental results and continued water needs warrant future cloud-seeding operations.
DESCRIPTORS: Artificial rain stimulation; Cloud seeding effects on crops

ID NO.- MGA29080080
Cloud seeding in Necaxa Watershed.
Betancourt, Jorge Estrada
Centro de Ciencias de la Atmos., Mexico
Journal of Weather Modification, Fresno, CA., 10(1): 39-50, April 1978. Refs., tables. DAS (A QC 928 J6)
CTRY OF PUBL:US
Cloud seeding experiments in the Necaxa Watershed, in Mexico, were initiated in 1949, and have been conducted long enough to produce statistically significant data. The meteorological factors that influence the diffusion of AgI smoke in seeding days have been studied. The results are evaluated by a nonparametric statistics technique, and it is inferred that a redistribution of the precipitation was probably caused by an overseeding. Statistically, it is also inferred that there was a persistence of AgI smoke on days close to those on which cloud seeding operations were conducted.
DESCRIPTORS: Cloud seeding in Necaxa Watershed, Mexico; Cloud seeding evaluation; Necaxa Watershed, Mexico

ID NO.- MGA29080079
Nekotoryye rezul'taty sravnitel'nykh ispytaniy generatorov l'doobrazuyushchikh aerozoley. .Results from comparative tests of ice-forming aerosol generators..
Belyayev, S. P.
Inst. Eksperimental'noy Met.
Meteorologiya i Gidrologiya, Moscow, No. 4, April 1978. p. 98-102. Refs. Russian summary. Transl. into English in corresponding issue of Meteorology and Hydrology, Wash., D.C. Available from NTIS, Springfield, VA. 22161. DAS, DLC
LANGUAGE: en
CTRY OF PUBL:UR
Experimental methods in the testing of full-scale ice-forming aerosol generators in wind tunnels are described. Results of experiments with several types of pyrotechnical generators currently being produced and evaluated are presented. For compounds containing silver iodide, the output of active nuclei depends greatly upon the airflow velocity, the consumption of the reagent, and the amount of silver iodide.
DESCRIPTORS: Silver iodide generators; Cloud seeding equipment

ID NO.- MGA29070510
Summary of METROMEX, Vol. 1, Weather anomalies and impacts.
Changnon, Stanley A.
Illinois. State Water Survey, Urbana, Bulletin 62, 1977. 260 p.oRefs. DAS (A QC 925.1 U8 M52)
CTRY OF PUBL:USo
This is the first of two volumes presenting the majoro findings from the 1971-1975 METROMEX field operations at St. Louis. It focuses on final interpretations and conclusions obtained primarily through climatological- statistical analyses of spatial and temporal distributions of surface precipitation and severe storms. It addresses also the impacts related to the urban-produced precipitation anomalies. Volume 2 concerns the causes of the anomalies. Key climatic effects are increased cloudiness (+10%), increased total summer rainfall (+30%), and increased severe storm activity (+100%). These increases occur over the city and 10 to 25 mi beyond (east) the urban-industrial areas. The urban-induced anomalies occur most often with squall lines and cold fronts; they maximize in the afternoon and again at night (2100-2400 hr); and they appear to be as active in dry periods as in wet periods. Impacts include more runoff, but also more local flooding, soil erosion, silting, and water pollution. The effect of altered weather leads to a 3-4% average increase in local crop yields. The urban-induced anomalies are generally not beneficial in the floodplain area and have mixed impacts in the rural uplands.
DESCRIPTORS: Urban influences; Project METROMEX; St. Louis, Missouri

ID NO.- MGA29070502
Man's influence on the atmosphere.
Karapiperis, Leonidas N.
Met. Lab., Univ. of Athens
In: Seminar on Atmospheric Physics, Athens, Greece, 17-20 Sept. 1973, Proceedings. Athens, National Hellenic Research Foundation, Jan. 1974. p. 17-32. In Greek; English summary.
LANGUAGE: other
CTRY OF PUBL:GR
The evolution of the Earth's atmosphere since the creation of our planet, as well as the climate changes that appeared during the different geologic ages, are discussed. A discussion is dedicated to climatic changes according to meteorological observations of the last two to three centuries, emphasizing those related to solar activity. Man's influence on weather and climate are examined, mainly man's attempts to modify weather (artificial rain, fog dispersion, frost and hail protection, etc.). A review is given to the effects on the climate of big cities, industrial blocks, artificial lakes, CO.SUB 2. increase, and air pollution.
DESCRIPTORS: Climatic changes; Weather modification; Man's influence on climate

ID NO.- MGA29070478
Effect of snow cover on dissipation of fog and stratus.
Johnston, Edward C.
SFSS, Kansas City, MO.
United States National Weather Service. National Environmental Satellite Service, Satellite Applications Information Note 78/5, 1978. 4 p. Mostly figs.
CTRY OF PUBL:US
During the pre-dawn hours of March 23, 1977, a band of fog and stratus developed behind a weak cold front that had been sagging southward through the plains during the night. A portion of the ground over which this band formed was covered with snow. A picture sequence illustrated vividly the effect that snow on the ground can have on the dissipation rate of fog and stratus. Only after surface winds increased and advected warmer outside air into the area did the fog break up. Even then, some persisted well into the afternoon.
DESCRIPTORS: Snow cover effects on fog; Snow cover effects on cloud; Fog dissipation; Stratus dissolution

ID NO.- MGA29070193
Development and application of a predictor control for the evaluation of a winter orographic cloud seeding project.
Hill, Geoffrey E.
Utah Water Res. Lab., Logan
Journal of Applied Meteorology, Boston, 17(4): 489-497, April 1978. Refs. DAS, DLC
CTRY OF PUBL:US
Evaluation of an operational-type winter cloud seeding project in Utah is made by developing meteorological predictors of target precipitation. Predictors (covariates) are developed by matching 1200-hr GMT rawinsonde data and 24-hr precipitation amounts. These predictors and precipitations are summed over seven unseeded seasons to form a seasonal predictor-predictand relationship, for which the correlation is 0.975 when the average precipitation for all stations is used, and 0.879 when only the two highest altitude stations are used. Then, the predictor is found for each of the seeded seasons and, based upon the unseeded predictor-predictand relationship, the predicted precipitation is obtained. Differences between predicted and observed precipitation in seeded years are compared and tested for seeding effects. Application of the method to the first two years of the project indicates a substantial chance that little or no effect of seeding occurred. It is concluded that the method offers a promising approach to the evaluation of winter cloud seeding projects.
DESCRIPTORS: Cloud seeding evaluation; Orographic cloud seeding; Utah, United States

ID NO.- MGA29070189
Note of explanation on the 1961-1967 Israeli rainfall.
Gabriel, K. R.; Neumann, J.
Univ. of Rochester, N.Y.; Hebrew Univ., Jerusalem
Journal of Applied Meteorology, Boston, 17(4): 552-554, April 1978. Refs. DAS, DLC
CTRY OF PUBL:US
The unit of experimentation in the 1961-1967 first Israeli rainfall stimulation experiment is described, including the changing definitions used. It is explained that the statistical analysis of the experimental result, which showed significant increases in precipitation under seeding, corresponded to the definitions used operationally for seeding. This is published as a rebuttal of criticism, which suggested biased a posteriori manipulation of units for analysis.
DESCRIPTORS: Artificial rain stimulation; Cloud seeding effectiveness; Israel

ID NO.- MGA29070183
Weather Modification Program Office, collected reprints: 1975-76.
United States National Oceanic and Atmospheric Administration.Environmental Research Labs., Weather Modification Program Office,Boulder, CO.
May 1977. 667 p. Refs. DAS (A QC 926.6 E56a)
CTRY OF PUBL:US
This is the first volume of collected reprints published by the Weather Modification Program Office. It includes reports of research, directed and supported by WMPO, which appeared in 1975 and 1976 as journal articles or in conference proceedings. In addition, some unpublished documentation that might be difficult to obtain has been reprinted in full. Abstracts of papers published in the NOAA Technical Report and Technical Memorandum series are included.
DESCRIPTORS: Weather modification; Collected weather modification papers; Collected reprints

ID NO.- MGA29070182
Meteorological satellites in support of weather modification.
Reynolds, David W.; Vonder Haar, Thomas H.; Grant, Lewis O.
Dept. of Atmos. Sci., CO. State Univ., Ft. Collins;
American Meteorological Society, Boston, Bulletin, 59(3): 269-281, March 1978. DAS, DLC (QC851.A6) e
CTRY OF PUBL:USe
During the past several years, many weather modification programs have been incorporating meteorological satellite data into both the operations and the analysis phase of these projects. This has occurred because of the advancement of the satellite as a mesoscale measurement platform, both temporally and spatially, and because the availability of high quality data has increased. This paper surveys the applications of meteorological satellite data to both summer and winter weather modification programs. A description of the types of observations needed by the programs is given, and an assessment of how accurately satellites can determine these necessary parameters is made.
DESCRIPTORS: Weather modification; Satellite uses in weather control

ID NO.- MGA29070181
Potential of hurricane modification for causing a systematic predictable change in a hurricane track as a result of the Rossby acceleration.
Jones, Robert W.
Natl. Hurricane and Experimental Met. Lab., Coral Gables, FL.
United States National Oceanic and Atmospheric Administration. Environmental Research Labs., Boulder, CO., Technical Memorandum (NOAA TM ERL WMPO-42), Dec. 1977. 18 p. Refs., tables, figs. DAS (A QC 807.5 U6W5)
CTRY OF PUBL:US
Results are given for two numerical experiments with a model tropical cyclone that was integrated with a variable Coriolis parameter. One case has an environment current of 5 m sec.SUPER -..SUPER 1., while the other has no current. In both cases, a nearly symmetric, balanced, initial vortex is accelerated northward. For 24 hr, the acceleration agrees with the theory of Rossby (1948, 1949). The northward acceleration ceases by 36 hr, however, as a quasi-equilibrium state evolves. After this time, the vortex motion no longer responds directly to the computed northward acceleration which, in one case, is actually increasing while the northward motion is decreasing. No evidence was found that a man-made modification of a hurricane would lead to a systematic and predictable change of the track because of the Rossby acceleration. This conclusion was based upon calculations of the Rossby accelerations, taken from the mature stage, which did not agree with corresponding changes of the track. Both a vortex that was modified by enhanced heating and an unmodified vortex were examined.
DESCRIPTORS: Hurricane modification; Hurricane movement

ID NO.- MGA29070180
Moglichkeiten und Probleme der kunstlichen Wetterbeeinflussung. .Possibilities and problems of artificial weather modification..
Gebhart, Reiner F.
Lehrbeauftragter der Fachhochschule, Munich, W. Germany
Wetter und Leben, Vienna, 29(1): 1-25, 1977. Refs. English and German summaries. DAS, DLC
LANGUAGE: ge
CTRY OF PUBL:AU
The state of the art in the field of artificial weather modification, based upon scientific principles, is summarized. Various operational methods applied for and some scientific problems associated with the increase, decrease, or redistribution of precipitation and related meteorological phenomena are discussed. In many countries, the past decade has seen increased activities in weather modification research; some of these recent advancements are also reported. Apart from the purely scientific problems, some of the economic, legal, and social aspects of artificial weather modification are outlined briefly, as well as the position of the World Meteorological Organization as an international advisory body.
DESCRIPTORS: Weather modification; Progress in weather control

ID NO.- MGA29060432
Chicago area program: a major new atmospheric effort.
Changnon, Stanley A., Jr.; Semonin, Richard G.
IL. State Water Survey, Urbana
American Meteorological Society, Boston, Bulletin, 59(2): 153-160, Feb. 1978. Refs. DAS, DLC (QC851.A6)
CTRY OF PUBL:USe
A series of mesoscale meteorological research projects hase been developed since 1975 in the area over and around the south end of Lake Michigan. These regionally focused projects, under the label of the Chicago Area Program (CAP), are performed by scientists from 12 research groups or universities using funds from a variety of state and federal agencies. Efforts to date have led to the installation and operation of a major rain-gage network, other weather networks and sondes, several weather radars, meteorological aircraft, and a ship. This sizeable program is addressing five major study areas, including lake meteorology, water resources and hydrometeorology, inadvertent weather modification, air pollution and its impacts, and severe weather. Multigroup field experiments and the exchange of data are coordinated at the scientist level.
DESCRIPTORS: Mesometeorological studies; Chicago, Illinois

ID NO.- MGA29060376

Precipitation mechanisms in a shallow convective cloud model.

Takahashi, Tsutomu

Cloud Phys. Obs., Dept. of Met., Univ. of Hawaii, Hilo

Journal of the Atmospheric Sciences, Boston, 35(2): 277-283, Feb. 1978. Refs. DAS, DLC

CTRY OF PUBL:US

Precipitation mechanisms in shallow convective clouds are studied by using an axisymmetric cloud model. Clouds are classified into continental and maritime clouds and further subdivided into warm and cool clouds. Different microphysical factors were selected in the model to represent these different cloud systems. In maritime clouds, condensation and collection processes are sufficient to develop precipitation, whereas in continental clouds graupel formation appears to be a necessary step. In the latter case, recirculation of ice crystals is required to initiate riming, so that it takes a longer time for rainfall initiation than in the maritime case. In maritime clouds, inclusion of the ice phase does not change the rainfall pattern, although both raindrops and graupel contribute equally to precipitation. The possibility of cloud modification is studied by increasing the ice nuclei concentration. In continental clouds, an increase in ice nuclei concentration of 100 times more than the natural ice nuclei concentration causes activation of a higher number of ice nuclei at warmer temperatures, so that ice crystals can grow large enough to initiate riming during a single upward journey in the cloud without requiring recirculation. In this case, it rains heavier and earlier than in the case of normal ice nuclei concentration.

DESCRIPTORS: Precipitation formation; Convective cloud models; Artificial rain stimulation

ID NO.- MGA29060359

Formation of ice phase by contact, freezing, sorption, and condensation-freezing in natural and seeded storms.

Rosinski, J.; Kerrigan, T. C.

Natl. Hail Res. Experiment, Natl. Ctr. for Atmos. Res., Boulder, CO.

Journal de Recherches Atmospheriques, Clermont-Ferrand, France, 11(2): 77-97, April/June 1977. Refs., appendices. English and French summaries. DAS, DLC

CTRY OF PUBL:FR

Formation of ice particles by contact, freezing, sorption, and condensation-freezing was examined. Natural aerosol particles in the 5-40-.MU .m diameter size range form substantial concentrations of ice particles by contact and delayed-on-surface ice nucleation. The rate of formation of ice particles depends upon the concentration, size, and mineralogical composition of aerosol particles, cloud temperature, droplet and ice particle distributions, and updraft velocity. Equations were derived for ice particle formation by the phoretically modified Brownian diffusion and the delayed-on-surface ice nucleation. The physical parameters upon which the ice nucleation mechanisms depend prevail at magnitudes that make these mechanisms impossible to ignore.

DESCRIPTORS: Ice particle formation; Ice nucleation; Cloud seeding effects

ID NO.- MGA29060116

Southwest Minnesota cloud seeding program: a summary of weather modification activities conducted over the counties of Pipestone, Murray, Rock, and Nobles in Minnesota, 20 June 1976-31 August 1976.

Henderson, Thomas J.

Fresno, CA., Atmospherics, Inc., Dec. 1976. 51 p. Refs., appendices. DAS (A QC 928.6 H48)

CTRY OF PUBL:US

In early June 1976, a series of weather modification discussions developed between a number of residents in southwest Minnesota and Atmospherics, Inc., of Fresno, CA. Because of extremely dry conditions in many areas of the state, the agricultural communities were investigating several options for drought prevention, particularly in those areas where water stress was already reaching the critical stage. These initial discussions led to the development of the Minnesota Weather Modification Association, and a contract was subsequently signed between this formal organization and Atmospherics, Inc. The contract called for the operation of an airborne cloud seeding program designed to enhance rainfall over Pipestone, Murray, Rock, and Nobles counties during the period June 20-Aug. 31, 1976. Because of the urgency to initiate operations, one of the cloud seeding aircraft operated by Atmospherics, Inc., in southeast South Dakota conducted the first seeding operation for this Minnesota group on June 26, 1976. By July 2, 1976, the weather radar system was completely installed and operating atop the Nakomis apartment building in Pipestone, and the cloud seeding aircraft was on a full standby status at the Pipestone Airport. During the two-month period, the aircraft logged a total of 27 seeding flights, including the two flights of the South Dakota aircraft on June 26, 1976. A total of 11,046 g of silver iodide were dispersed during these flights from pyrotechnic seeding devices and liquid fuel wing tip generators. Approximately 235 radar overlays were accumulated by the radar meteorologist during the operational period. Although it is not possible to assess the precise result of this short-term, limited cloud seeding program, an analysis of the radar data suggests that seeded storm cells covered a much larger area and produced precipitation on the ground for longer time periods than nonseeded storms in adjacent areas.

DESCRIPTORS: Cloud seeding in Minnesota; Artificial rain stimulation; Minnesota, United States

ID NO.- MGA29060115

Technique for evaluating the effectiveness of hurricane modification experiments.

Knight, Richard W.; Brier, Glenn W.

Natl. Hurricane and Experimental Met. Lab., NOAA, Coral Gables, FL.; Dept. of Atmos. Sci., CO. State Univ., Ft. Collins

Journal of Applied Meteorology, Boston, 17(2): 222-227, Feb. 1978. Refs. DAS, DLC

CTRY OF PUBL:US

Plans are underway to attempt to reduce the destructive force of hurricanes by modifying their structure artificially by cloud seeding. Since the natural variability of meteorological elements observed in hurricanes is high, the success of the project depends upon establishing a cause and effect relationship between the seeding and the hurricane's response. The small sample of mature hurricanes coupled with rigorous selection criteria makes a randomized experiment impractical; therefore, an evaluation technique based upon the concept of randomization in time is developed.

DESCRIPTORS: Hurricane modification evaluation

ID NO.- MGA29050129

Rainfall fields in Israel and Jordan and the effect of cloud seeding on them.

Sharon, David

Inst. of Earth Sci., Hebrew Univ. of Jerusalem, Israel

Journal of Applied Meteorology, Boston, 17(1): 40-48, Jan. 1978. Refs. DAS, DLC

CTRY OF PUBL:US

Spatial correlation functions of daily rainfall were derived separately for various parts of the study area, and for unseeded and seeded days. The structure of respective rainfall fields was studied by using the relationship between the geometry of isocorrelation contours of daily rainfall and the average geometry and/or kinematics of cloud systems that produce the rainfall. Results were obtained on the prevalent direction of storm movement over the study area and the change in size of rainfall areas under varying conditions. Evidence is presented of an average increase of about 10 km in the dimensions of rainfall areas on seeded days. Expanded rainfall areas have a twofold effect on the augmentation of the total yield of individual storms: 1) an increase of point rainfall resulting from prolonged exposure to moving cloud systems, and 2) an increase in the area thus affected. Consequently, the increase in water yield of a storm over the entire area covered by it may not be fully represented by point measurements. In the regional context, a contraction of storm areas was found in the transition to the arid zone. It is suggested that the size of rainfall areas is one of the fundamental factors controlling regional variations of rainfall and variations resulting from cloud seeding.

DESCRIPTORS: Artificial rain stimulation; Areal rainfall distribution; Cloud seeding effectiveness; Israel; Jordan

ID NO.- MGA29050128

Practicability of dry ice for on-top seeding of convective clouds.

Holroyd, Edmond W., III; Super, Arlin B.; Silverman, Bernard A.

Bur. of Reclamation, Dept. of the Interior;

Journal of Applied Meteorology, Boston, 17(1): 49-63, Jan. 1978. Refs. DAS, DLC

CTRY OF PUBL:US

Dry ice is an attractive agent for on-top seeding of convective clouds. A modest payload of small dry ice pellets can effectively seed dozens of clouds, depending upon cloud volumes encountered and crystal concentrations desired. A dry ice pellet size of about 7-mm diameter is suggested for efficient use as a seeding agent when dropped from the -10°C level. Supercooled convective clouds that were seeded on top with dry ice were investigated to determine empirical nucleation effectiveness values. The clouds were repeatedly penetrated to measure the resulting ice crystal concentrations. The experiments gave conservative effectiveness values of 2 to 5 MULTIPLIED BY 10.SUPER 1..SUPER 1. crystals per gram of dry ice, but with possible error bars extending an order of magnitude to each side of those values. A well-documented experiment giving effectiveness values twice as large is discussed in detail.

DESCRIPTORS: Cloud seeding with dry ice; Cloud seeding effectiveness

ID NO.- MGA29050126

Iskusstvennyye vozdeystviya na oblaka i osadki. .Artificial modification of clouds and precipitation..

Buykov, M. V.

In: Danilina, I. P. (ed.), Meteorologiya i klimatologiya, Tom. 3. Moscow, VINITI, 1976. p. 284-300. Refs. p. 300-305. Refs. DAS (A QC B51 M45)

LANGUAGE: rs

CTRY OF PUBL:UR

The current state of investigations and developments in the field of artificial modification of clouds and precipitation is examined on the basis of a review of the published literature for the period 1973-1974. The following aspects are presented: 1) physical bases of modification; 2) control of precipitation; 3) counter-measures against hail; 4) seeding of clouds and fog; 5) reagents and methods of their preparation; and 6) economical, ecological, and social aspects of weather modification.

DESCRIPTORS: Artificial cloud modification; Artificial precipitation stimulation; Hail prevention; Weather modification research

ID NO.- MGA29050125

Interaction of a turbulent planar heated jet with a counterflowing wind.

Klein, Milton M.

United States Air Force, Geophysics Lab., Hanscom AFB, MA., Air Force Surveys in Geophysics, No. 375, Sept. 26, 1977. 30 p.tRefs. (AFGL-TR-77-0214). DAS, DLCt

CTRY OF PUBL:US

Experimental and theoretical programs are being conducted tc aid in the development of an operational. warm fog dispersal system by using momentum driven, ground-based heat sources. In previous investigations, the wind was in the same direction as the jet (coflowing). The present investigation is concerned with a jet opposite in direction to the ambient wind (counterflowing or opposing jet). A model for calculating the dynamic characteristics of a cold counterflowing jet was extended to take into consideration the effect of heating upon the jet. The effect of buoyancy upon the motion of the jet will be presented in a subsequent report. The calculated velocity and temperature distributions are in fair to good agreement with the corresponding experimental results. In general, the calculated results drop off more rapidly than the experimental curves in the inner region, and more slowly in the outer region. The calculated jet lengths are in good agreement with the experimental values for an unheated jet, but tend to be greater than the experimental results for the heated jet at large jet speeds relative to ambient velocity. The dependence of jet length, axial velocity, and axial temperature upon initial jet temperature is obtained for both planar and round jets, and the results are consistent with those obtained for a submerged nonisothermal jet.

DESCRIPTORS: Fog dissipation by heat sources

ID NO.- MGA29040111

Assessment of NHRE hail suppression seeding technology based on silver analysis.

Linkletter, G. O.

Desert Res. Inst., Univ. of NV., Reno

Journal of Applied Meteorology, Boston, 16(12): 1332-1348, Dec. 1977. Refs. DAS, DLC

CTRY OF PUBL:US

Detailed analyses of three storms seeded in the National Hail Research Experiment (NHRE) during 1974 investigated the relationships between the occurrence of silver (from AgI) in precipitation and both the seeding activity and the storm histories as documented by radar, aircraft, the precipitation network, and radiosondes. Although the results show that the AgI was broadly dispersed when weak, poorly organized storms were seeded, the seeding agent was confined to only limited regions of the more vigorous storms which had well-defined internal circulation patterns. In several cases, it was possible to use radar data to identify a specific cell within a storm which produced seeded precipitation and, thereby, define roughly the pathways taken by the AgI aerosol after release from the aircraft. Analyses were performed on precipitation from 18 storms seeded by NHRE in the 1973 and 1974 seasons to determine the proportion of samples that contained seeding silver. In 1973, 50% of the samples contained silver significantly above the background concentration of 10.SUPER -..SUPER 1..SUPER 1. g ml.SUPER -..SUPER 1.. In 1974, the figure was 70%; however, by comparing the observed concentrations with those from theoretical predictions, the proportions of samples containing enough silver to represent a significant seeding effect were low (probably <10%). If the silver content of the precipitation is taken as an index of targeting effectiveness for modification of hail, then its spotty distributions, both temporally and spatially, suggest that there may be serious difficulties in assessing hail mass modification based on a statistical comparison of seed vs. no-seed days.

DESCRIPTORS: Hail suppression evaluation; Silver in precipitation

ID NO.- MGA29040110

Change in the weather.

Green, Fitzhugh

N.Y., W. W. Norton & Company, Inc., Nov. 14, 1977. 248 p. Refs. .$.9.95. DLC (QC928.G73)

CTRY OF PUBL:US

This book is a briskly written, up-to-date, popular scientific discussion of man's role in effecting purposeful and inadvertent change in weather, climate, and the environment as a whole, and of the present and possible effects of these changes upon human life. The book is based upon a survey of the scientific literature on climatic and weather changes, upon interviews with scientists studying the problem and officials engaged in controlling such changes, and upon the author's personal experience as a member of official bodies. The subject is treated under three general aspects. The first one considers modification of weather and climate to produce specific beneficial results, and it includes the history of scientific cloud seeding to increase precipitation; attempts to modify hurricanes; proposed methods to ameliorate the climate of the Northern Hemisphere by reducing the snow and ice cover and by altering the courses of rivers and ocean currents; creation of artificial climates by enclosing cities under roofs and building cities underground and below the ocean surface; etc. The second aspect examines the harmful action of man's activities upon weather and climate which may be purposeful but are overwhelmingly inadvertent. The former involves the application of weather modification to military tactics and strategy. The latter presents a survey of threats to the ozone layer, increased heat and CO.SUB 2. production, atmospheric pollution, etc., and their specific action upon climate. The third aspect describes the international and national effort to counteract and reverse man's harmful effects on weather and climate. A description is given of the organization and aims of the United Nations Conference on Environmental Protection held in Stockholm, and measures effected in different countries to protect the environment.

DESCRIPTORS: Popular meteorology books; Weather modification textbooks; Man's influence on climate

ID NO.- MGA29040045

Hole boring in clouds by high-intensity laser beams: theory.

Harney, R. C.

MIT, Lincoln Lab., Lexington, MA.

Applied Optics, Wash., D.C., 16(11): 2974-2978, Nov. 1977. Refs. DAS, DLC (QC350.062)

CTRY OF PUBL:US

The physics of hole boring in clouds and fogs by high-intensity IR laser beams is investigated in a zeroth order approximation. Simple analytical expressions are obtained which describe the phenomena of interest. Application of these expressions to various types of clouds and fogs yields order-of-magnitude estimates of the laser powers required to bore holes of a given size and quality. The power requirements for hole boring through light ground fogs or thin overcasts are in excess of 100 kW, while hole boring through thicker overcasts will require laser powers much in excess of 10 MW. Dispersal of ground fogs over an extended area will require laser powers in the 10.SUPER 8.-10.SUPER 9.-W range and, thus, may not be cost effective simply in terms of energy consumption.

DESCRIPTORS: Fog dissipation by lasers; Cloud modification with lasers

ID NO.- MGA29040039

Kriticheskoye znacheniye Z (mnozhitelya otrazhayemosti) dlya opredeleniya ploshch adi konvektivnogo oblaka, podlezhashchey posevu kristalliziruyushchimi reagentami. .Critical value of Z (the multiplier of reflectibility) for determining the area of a convective cloud subject to seeding with crystallizing reagents..

Petrov, R.

Khidrologiya i Meteorologiya, Sofia, 26(4): 3-9, 1977. Refs. English summary. DAS, DLC (GB651.K5)

LANGUAGE: bu

CTRY OF PUBL:BU

In this work, from modern physics of convective clouds, the value of the radar reflectibility of the contour determining the zonal area of accumulation for the layer between isotherms, -5" to -10"C (where the introduction of the crystallizing reagents occurs), is measured. For calculating the value, critical water was used to determine the dry and wet regime of the increase in hailstones, the critical value of the ascending flow for hail formation in the cloud, and the distribution of the hydrometeors. The obtained value of reflectibility coincides with the one experimentally established as critical for hailing.

DESCRIPTORS: Radar observation of convective clouds; Radar hail detection; Hail suppression

ID NO.- MGA29040001
Regimes for the ocean, outer space, and weather.
Brown, Seyom
Wash., D.C., Brookings Institution, 1977. 257 p. DLC (GC1005.R43), DAS (A GC 1005 R43)
CTRY OF PUBL:US
This study is primarily a layman's introduction to the problems of managing the Earth's commonly used resources. They constitute a number of major river systems, some lakes and inland seas. most of the oceans, Antarctica, the atmosphere beyond the air space immediately above the land, all of outer space, and the Earth's weather and climate. Attention is given to fundamental policy questions that are a consequence of the expansion of economic and political activity in each of the realms mentioned: They deal with what criteria should determine how the realms are used, how and by whom should the rules for their use be formulated, and who should have authority to implement the rules and by what processes. The characteristics of the ocean, outer space, and the weather, which hinder effective international allocation, and the alternative regimes for the nonland realms as reflected in use accountability, resource ownership, and criteria for use are discussed. This is followed byachaptersadealingawith: 1) alternative regimes for the oceans; 2) management of navigation and fisheries; 3) offshore oil and gas exploitation; 4) hard mineral exploitation of the deep seabed; 5)athe module industry; 6) scientific research; 7) development of a durable regime of the oceans on an international level; 8)a alternative regimes for activities in outer space; 9) remote sensing of the Earth from outer space; 10) televisiona broadcasting by way of satellites; 11) maritime satellites; 12)afrequency and orbit; 13) international accountability ofa the use of outer space; 14) regime alternatives for weathera and climate including inadvertent modification of weather and climate, purposeful attempts at changing weather and climate, the distribution of weather modification capabilities, and managing human impact on weather and climate; 15) rainmaking and typhoon modification; 16) major changes in weather and climate; 17) international accountability in the alteration of weather and climate; and 18) effective international management of the ocean, outer space, and weather.
DESCRIPTORS: Environmental sciences textbooks; Earth science textbooks; Natural resources management

ID NO.- MGA29030443
Theoretical investigation of the generation and dissipation of radiation fog.
Zdunkowski, W. G.
Dept. of Met., Univ. of Utah, Salt Lake City
In: International Symposium on Radiation in the Atmosphere,a Garmisch-Partenkirchen, W. Germany, Aug. 19- 28, 1976,a Proceedings. Princeton, Science Press, 1977. p. 105-109. Refs. DLC
CTRY OF PUBL:US
The generation and dissipation of radiation fog are examined theoretically by applying a more complete radiative treatment which includes multiple scattering by droplets in the entire solar spectrum and in the atmospheric window region. The model equations of wind, temperature, and moisture fields are governed by the equations of motion and the continuity equation. The radiation model uses a subdivision of the spectrum into the solar and IR emission bands. The droplet-attenuated coefficients are taken as weighted averages. The transmission of water vapor in the solar spectrum is treated as the sum of exponential forms. Fluxes in all scattering regions were calculated by the spherical harmonic method. The spectrum of the IR region is treated by means of an emission method. The dissipation of fog by absorption of solar radiation by droplets is described with the aid of graphs of temperature and liquid water distribution as a function of height. In the case of heavy fog layers, fog dissipation is due to thorough mixing and evaporation, which are a consequence of surface warming by solar radiation; and the formation of super adiabatic lapse conditions leading to higher soil temperature inhibits fog formation.
DESCRIPTORS: Radiation fog formation; Fog formation; Fog dissipation

ID NO.- MGA29030438
Experimentelle Untersuchungen uber die Eisbildungsaktivitat einer anorganischen und einer organischen Substanz. .Experimental investigations of the ice-formation activity of an inorganic and an organic substance..
Levkov, L.
Geophys. Inst. der Bulgarischen Akad. der Wissenschaften, Sofia,Bulgaria
Bolgarskaya Akademiya Nauk, Sofia, Doklady, 30(9): 1275-1276, 1977. Ref. DAS, DLC
LANGUAGE: ge
CTRY OF PUBL:BU
The experimental procedure involved in investigating in a cloud chamber the ice-forming action of an inorganic substance represented by the pyrotechnic mixture CuS of type C-2 and an organic reagent R-S (copperacetylacetanate) is described. The characteristic of the ice-forming activity of a substance is expressed by the temperature threshold of crystallization-the number of ice crystals which form in a supercooled fog when a unit mass of reagent is dispersed at the temperature threshold of crystallization. The number of ice crystals produced at temperatures of -10 and -15"C indicate that both substances are promising reagents for use in weather modification.
DESCRIPTORS: Ice nucleability; Cloud seeding substances

ID NO.- MGA29030170

Detection of silver iodide particles in seeded storms.

Rosinski, J.

Natl. Ctr. for Atmos. Res., Boulder, CO.

Journal de Recherches Atmospheriques, Clermont-Ferrand, France, 10(4): 243-248, Oct./Dec. 1976. Refs. English and French summaries. DAS, DLC

CTRY OF PUBL:FR

Detection of single silver iodide particles or particles mixed with silver iodide (AgI clay or AgI organic particles) was accomplished by separating those particles in an NCAR ice nucleus counter, subliming the ice, and analyzing the residual particles for the presence of silver iodide by an ion microprobe analyzer. Silver iodide particles present in precipitation were detected through complexing silver iodide with piperidine and analyzing the AgI C.SUB 5.H.SUB 1..SUB 1.N complex by an ion microprobe analyzer. Silver iodide was also detected indirectly through tagging silver iodide particles with easily ionizable atoms. The detection limit was single particles, approximately 10.SUPER -..SUPER 1..SUPER 8. g in mass (85 A in diameter).

DESCRIPTORS: Silver iodide aerosol particles; Silver iodide detection; Silver iodide in rainwater

ID NO.- MGA29030169

O sootnoshenii mezhdu kolichestvom dopolnitel'nykh osadkov iz frontal'nykh oblakov i skorost'yu ikh perenosa. .Relationship between the amount of supplementary precipitation from frontal clouds and the velocity of transport..

Leskov, B. N.

Kiev, Ukraine. Nauchno-Issledovatel'skiy Gidrometeorologich-eskiy Institut, Trudy, No. 146, 1976. p. 55-57. Refs. Russian summary. DAS, DLC (QC801.K5A1)

LANGUAGE: rs

CTRY OF PUBL:UZ

The study concerning the results of seeding of winter frontal clouds and the velocity of transport of seeded clouds is investigated. Fifty-six experiments conducted in 1966-1973 are analyzed. The quantity of artificial precipitation, generated by a fixed area of seeded clouds, increases as the velocity of cloud transport increases. In experiments that were made at wind speeds of 15-20 m/sec, the magnitude of additionally generated precipitation was twice as large at wind speeds of 5-10 m/sec. The increase in the magnitude of additionally generated precipitation with an increase in wind velocity is so significant that it masks the effect of dispersed precipitation over a large area and causes an increase of the quantity and intensity of artificial precipitation falling at a fixed point of a precipitation zone.

DESCRIPTORS: Artificial precipitation stimulation; Cloud seeding effectiveness; Cloud seeding of frontal clouds; Cloud movement

ID NO.- MGA29030168

O nekotorykh aspektakh mekhanizma obrazovaniya ledyanykh kristallov na poverkhnosti l'doobrazuyushchikh reagentov tipa AgI. .Aspects of ice crystal formation on the surface of AgI-type reagents..

Bakhanova, R. A.

Kiev, Ukraine. Nauchno-Issledovatel'skiy Gidrometeorologich-eskiy Institut, Trudy, No. 146, 1976. p. 99-109. Refs. Russian summary. DAS, DLC (QC801.K5A1)

LANGUAGE: rs

CTRY OF PUBL:UZ

The latest Soviet and foreign investigations on the mechanism of ice crystal formation on the surface of ice forming reagents of the AgI type are reviewed. Three aspects of ice formation are examined in detail: 1) the action of nuclei of ice formation as nuclei of water drop freezing and as nuclei of ice sublimation; 2) nonuniformity of the ice forming surface (presence of active loci of ice formation); and 3) orientating action of the substrate on absorbed water layers. The following conclusions are drawn: 1) depending upon conditions, nuclei of ice formation may act as nuclei of freezing or nuclei of crystallization (sublimation); 2) the surface of a nucleus of ice formation is not uniform; active loci may exist upon it in which embryos of the crystalline phase of water are most likely to develop; and 3) the effectiveness of crystals of pure AgI as ice forming crystals may be increased either by the addition of hygroscopic salts or by small doses of exposure, bringing about the liberation of a small excess of metallic silver on the surface of a crystal.

DESCRIPTORS: Nucleation processes; Cloud seeding with silver iodide

ID NO.- MGA29030167

Kvantovo-khimicheskiy raschet vzaimodeystviya ionov yoda s molekuloy vody. .Quantum-chemical calculation of the interaction of iodine ions with water molecules..

Bakhanova, R. A.

Kiev, Ukraine. Nauchno-Issledovatel'skiy Gidrometeorologicheskiy Institut, Trudy, No. 146, 1976. p. 110-115. Refs. Russian summary. DAS, DLC (QC801.K5A1)

LANGUAGE: rs

CTRY OF PUBL:UZ

The elementary act of interaction of the water molecules with the nucleating substrate is of large significance in the mechanism of action of ice forming reagents. By the method of molecular orbitals-linear combinations of atomic orbitals in semiempirical approximations, based upon the total neglect of differential overlapping, there was calculated the interaction of molecular H.SUB 2.O with one and two ions of iodine, located at a distance of 4.59 A from each other-a distance corresponding to the position in an AgI crystal. The water molecule was considered structurally rigid with a bonding length O-H equal to 0.96 A and a valence angle of 104.5 deg. As a result of calculations, the authors obtained equilibrium distances, charges on the atoms of the H.SUB 2.O molecule, energies of interactions, and the orbital population of the atomic orbital of the oxygen atom for different positions of the iodine molecule in relation to iodine ions.

DESCRIPTORS: Nucleation processes; Cloud seeding with silver iodide

ID NO.- MGA29030165

O vozmozhnosti otsenki evolyutsii iskusstvennykh zon rasseyaniya v oblakakh St-Sc. .Evaluation of the evolution of artificial seeding zones in St-Sc..

Polovina, I. P.

Kiev, Ukraine. Nauchno-Issledovatel'skiy Gidrometeorologicheskiy Institut, Trudy, No. 146, 1976. p. 47-54. Refs. Russian summary. DAS, DLC (QC801.K5A1)

LANGUAGE: rs

CTRY OF PUBL:UZ

On the basis of 153 experiments on the seeding of stratiform St-Sc clouds, the possibility of estimating the development of clouds after artificial seeding is examined. Data on thickness and mean water content of clouds and the coursee of relative humidity at the Earth's surface were used as indices of cloud development. The investigations showed that the probability of cloud formation after seeding rose with an increase in cloud thickness. Clouds with a thickness of 310-400 m developed in 50% of the cases, but clouds with a thickness of 510-600 m developed in 87.5% of the cases. The probability of formation of clouds rises with an increase in their mean water content. Clouds with a mean water content less than 0.05 g/m.SUPER 3. after seeding never developed, but clouds with a mean water content greater than 0.10 g/m.SUPER 3. formed always. Clouds with a thickness of 300 m and with a mean water content greater than 0.10 g/m.SUPER 3. developed in all cases after seeding. Clouds with a thickness greater than 270 m, in which the mean water content amounted to 0.07-0.10 g/m.SUPER 3., formed in individual cases. After seeding, clouds did not form with a water content less than 0.07 g/m.SUPER 3., regardless of their thickness. In the formation of clouds after seeding, the relative humidity at the Earth's surface increased in 79.4% of the cases. If clouds failed to form after seeding, the relative humidity at the Earth's surface decreased 80.5% of the cases. The probability of cloud formation during a rise in humidity, and the probability of the absence of cloud formation during a drop in relative humidity, at the Earth's surface amounted to 85%.

DESCRIPTORS: Cloud seeding of stratiform clouds; Cloud modification experiments

ID NO.- MGA29030164

Dispersal of warm fog with electrostatically charged bubbles.

Carroz, John W.

Earth and Planetary Sci. Div., Res. Dept., Naval Weapons Ctr., ChinaLake, CA.

Journal de Recherches Atmospheriques, Clermont-Ferrand, France, 11(1): 61-73, Jan./March 1977. Refs. English and French summaries. DAS, DLC

CTRY OF PUBL:FR

Theory suggests that electrostatically charged bubbles could serve to capture and precipitate water droplets from natural fog. To test this concept in the field, a generator capable of producing approximately 375,000 charged bubbles (with 0.5-10-cm diameters) per minute was designed and fabricated. The field tests demonstrated conclusively that such bubbles do remove water from fog. However, the bubble production by the generator was insufficient to disperse fog completely. Larger and longer-sustained quantities of bubbles than those generated appear to be required to clear fog for operations such as aircraft landings.

DESCRIPTORS: Fog dissipation by charged drops

ID NO.- MGA29020111

Potential weather modification from cooling tower effluents at conceptual power parks.

Lee, Jiin-Lang

Energy and Environ. Systems Div., Argonne Natl. Lab., IL.

Atmospheric Environment, Oxford, 11(8): 749-759, 1977. Refs. DAS, DLC (TD881.A8)

CTRY OF PUBL:UK

A numerical model for multiple plumes is developed to study the enhanced convection of merged plumes from a cluster of cooling towers at a conceptual power park. The model is based on the equations of motion for a quasi-incompressible fluid derived from the laws governing the change of momentum, the first law of thermodynamics, and the conservation of mass. The microphysical processes are simplified in the model by a parameterization approach similar to the work of Kessler (1969), with the assumption that the droplet size distributions in the cooling tower plume are the same as those of cooling tower drift measured near the top of cooling towers. The numerical model is used to simulate the merged plume convection from clusters of (as many as 40) natural draft cooling towers, where each tower serves to dissipate 2400 MW of waste heat. It was found that the plume rise from 40 towers is predicted to be approximately 360 and 130% of that from a single tower for an average July afternoon and average Jan. morning sounding, respectively, taken in the Louisiana area if the towers are arranged in a near square grid and spaced at 300 m apart; however, it is not uncommon to predict an induced convective cloud developing over 4000 m in height from more than five towers in a group for an individual afternoon sounding in the southeastern United States. Comparison of the predicted precipitation by using Kessler's microphysical parameterization with Marshall and Palmer's (1948) drop size distribution and the similar approach with available observed droplet size distribution from cooling tower drift is also made. The model predictions are in good agreement with observations at existing power plants to 3000 MWe generating capacity.

DESCRIPTORS: Cooling tower effects; Industrial plant effects on cloud; Industrial plant effects on precipitation; Louisiana, United States

ID NO.- MGA29020109

Preliminary tests of a cumulus cloud seeding technique.

Issac, G. A.

Atmos. Environ. Serv., Downsview, Canada

Journal of Applied Meteorology, Boston, 16(9): 949-958, Sept. 1977. Refs. DAS, DLC

CTRY OF PUBL:US

A cloud seeding technique is proposed which has the objective of stimulating rainfall from cumulus clouds drifting over forest fires. Preliminary tests of the ice crystal production capability of the cloud seeding technique were conducted on five cumulus clouds near Yellowknife, N.W.T., Canada, during July 1975. These clouds were over, but not near, forest fires. A T-33 turbulence research aircraft performed the seeding by burning wing-mounted TB1 AgI flares while flying through the clouds at the -5 to -10°C level. The T-33 turbulence measurements permitted estimates to be made of the rate of dispersion of the AgI. Microphysical measurements were made before and after seeding by an instrumented DHC-6 Twin Otter aircraft flying at the seeding level, and these were compared with measurements in six untreated cumulus clouds. High concentrations of ice crystals appeared after seeding in four of the five seeded cumulus clouds, and on two occasions precipitation-sized particles appeared at the seeding level. The evidence indicates that the AgI aerosol produced large quantities of ice crystals.

DESCRIPTORS: Cloud seeding with silver iodide; Cloud seeding from airplane; Cumulus cloud seeding; Yellowknife, Northwest Territories, Canada

ID NO.- MGA29020108

Method for determining the point of lift-off and modified trajectory of a ground-based heated turbulent planar jet in a coflowing wind.

Klein, Milton M.

United States Air Force. Geophysics Lab., Hanscom AFB, MA., Air Force Surveys in Geophysics, No. 361, Feb. 2, 1977. 23 p. Refs. (AFGL-TR-77-0033). DAS, DLC

CTRY OF PUBL:US

Experimental and theoretical programs are being conducted to aid in the development of an operational warm fog dispersal system using ground-based heat sources. To help determine optimum heat and thrust combinations for the system, investigations were made of the buoyant motion of heated turbulent jets in coflowing (same direction) ambient winds. In a previous investigation the effect of the ground, which keeps the jet near the ground for a considerable jet distance, was ignored. To take account of the ground effect, an analysis was made of the experimental data for the planar jet at the point of lift-off, in terms of the local Froude number at this point. From this correlation, a procedure was developed for determining the lift-off point, by using the ambient wind and initial velocity and temperature of the jet as input variables. A new jet trajectory may now be easily calculated with only a simple modification of the original method in which the ground effect was ignored. The agreement between the calculated and experimental trajectories, obtained by the present method, is considerably improved over that yielded by the original procedure. The method of calculating the jet trajectories, when the ground effect is taken into account, appears accurate enough to be used in the development of a control model for the warm fog dispersal system.

DESCRIPTORS: Fog dissipation by jet exhaust

ID NO.- MGA29020107

Microwave radiometric detection of corona from chaff within thunderstorms.

Rust, W. David

NOAA, Boulder, CO.; N.M. Inst. of Mtning and Tech., Socorro

Journal of Geophysical Research, Wash., D.C., 82(27): 3945-3950, Sept. 20, 1977. Refs. (Paper 7C0428). Reprint available from American Geophysical Union, Wash., D.C. 20006. DAS, DLC

CTRY OF PUBL:US

A microwave radiometer that operates at a frequency of 3 GHz was used onboard an aircraft to determine the presence of radiation generated by a corona from within untreated control thunderstorms and thunderstorms in which 10-cm chaff was released. There was no sustained radiation recorded from the control storms. Sustained radiation was detected, however, when chaff was dispersed within thunderstorms. This indicates that chaff seeding results in the production of a corona discharge that causes a discharging current to flow within the thunderstorm. For a typical example from measurements made on a relatively small, isolated thunderstorm, the total current from the corona intercepted by the receiving antenna beam is estimated to have been 12-25 A, with a resulting current, based on a simple analysis, of 0.070-0.140 A available for discharging the thunderstorm.

DESCRIPTORS: Thunderstorm electricity; Corona discharges; Thunderstorm modification

ID NO.- MGA29010148

1976 Florida Area Cumulus Experiment (FACE): operational summary.

United States National Oceanic and Atmospheric Administration.Environmental Research Labs., Boulder, CO.

Its Technical Memorandum (NOAA TM ERL WMPO-38), June 1977. 185 p. Refs., appendix. DAS (A QC 807.5 U6W5)

CTRY OF PUBL:US

The Florida Area Cumulus Experiment (FACE) continued in 1976 for the 92 days between June 1 and Aug. 31, with randomized seeding and other studies conducted over an area of 1.3 MULTIPLIED BY 10.SUPER 1. Km.SUPER 2.. The project consisted of a Core seeding program and several sub-programs. The Core program consisted of randomized (by days) dynamic seeding of cumulus groups in the FACE target. This document summarizes all aspects of FACE 1976 and presents preliminary results where available. Highlights and milestones, as well as problem areas, receive extensive treatment. The lessons learned in FACE 1976 and the outlook for the future are discussed. Complete listings of the type, amount, frequency, and quality of data obtained during the program are provided.

DESCRIPTORS: Cloud seeding experiments; Cumulus cloud seeding; Florida Area Cumulus Experiment (FACE); Florida, United States

ID NO.- MGA29010147

Methodology to estimate the value of weather modification projects: an illustration for hail suppression.

Sonka, Steven T.

Dept. of Agri. Economics, Univ. of IL., Urbana-Champaign; Atmos. Sci. Section, IL. State Water Survey, Urbana

Journal of Applied Meteorology, Boston, 16(7): 677-682, July 1977. Refs. DAS, DLC

CTRY OF PUBL:US

A methodology to estimate the potential value of proposed weather modification projects is described. An illustration of the technique is given to evaluate a hypothetical hail suppression project. This methodology requires that three crucial sets of data be developed: 1) the benefits attributable to altered weather; 2) the probabilities that such alterations can be accomplished; and 3) the costs associated with this technology. Given these data, a net benefit variable is determined, and present value techniques are used to discount that quantity to current dollars.

DESCRIPTORS: Weather control benefits; Economic aspects of weather modification; Hail suppression

ID NO.- MGA29010146

Observed and computed microstructure of hail-producinge clouds in northeastern Colorado.e

Sartor, J. Doyne

Natl. Ctr. for Atmos. Res., Boulder, CO.e

Journal of Applied Meteorology, Boston, 16(7): 708-714, Julye 1977. Refs. DAS, DLC

CTRY OF PUBL:US

The modification of thunderstorms to suppress hail requirese a knowledge of where, when, and how much to seed. Growth by accretion of precipitating particles (hail, rain, and graupel) in a summer convective storm depends upon the path that the particles take with respect to the air circulation of the cloud in which the cloud droplets are embedded, and upon the ambient atmospheric parameters of temperature, moisture, stability, and larger-scale circulations. For this purpose,e a two-dimensional simulation of the circulation is used, in which the most important features of the one-dimensional, time-dependent microphysics simulation can be incorporated into the calculations at each time step. The effect of changes in the altitude of ice particle initiation is calculated by using simulations of the clouds and their environment on two days during this period in which the total amount of hail differed by more than an order of magnitude. The simulated hail size and amount varied in the same sense as the observed. The simulation is applied to the case used by Browning and Foote (1976) to develop a conceptual model of a severe hailstorm. The results show that to obtain the tilt of the updraft shown by Browning and Foote, the presence of a squall line or gust front would be required-a situation that may be possible from their observed meteorological data.

DESCRIPTORS: Hail suppression; Hail clouds; Hail growth; Colorado, United States

ID NO.- MGA29010143

State of Washington's emergency cloud seeding program (February-June, 1977).

Hobbs, Peter V.

Washington (State). Univ., Seattle. Dept. of Atmospheric Sciences, July 1977. 28 p. Figs. (Contributions from the Cloud Physics Group).

CTRY OF PUBL:US

As a result of the record dry winter season (> 1/2 normal from Sept. 1, 1976 through Jan. 1977) in the Cascade Range of Washington, the water supply for agriculture, power, fisheries, and domestic use was threatened. The State Senate Committee on Agriculture recommended, and the Legislature passed, an Emergency Cloud Seeding Bill on Feb. 18, 1977, calling for the Dept. of Natural Resources to contract with the University of Washington's Cloud Physics Group to conduct a program of emergency cloud seeding, and later (March 7, 1977), asked the University of Washington to give highest priority to increasing snowpack across the Cascade Mountains to try to increase spring and summer runoff into the reservoirs of the Yakima, Naches, and Tieton rivers. Seeding was done just west of the Cascade Crest from Mt. Rainier north to Skykomish and, at first, in the Yakima Valley. Results were naturally not scientifically conclusive since this was an operational, not an experimental, program. Dry ice seeding operations; flights; areas seeded; some examples of effects of seeding as determined from cloud photographs (before and after seeding); graphs of liquid water content; cloud droplet concentrations; ice particle concentration and rate of rainfall (increases of 25 to 250 times previous rate in 6-8 min after seeding); development of turrets; etc. are described and illustrated. A brief study of droughts in western Washington since 1878 is included, with data presented graphically.

DESCRIPTORS: Cloud seeding in Washington, United States; Washington, United States

ID NO.- MGA29010139

Possibilites d'augmentation des precipitations de printemps et d'ete en Anatolie centrale. .Possibilities of increasing spring and summer precipitation in central Anatolia..

Dalmaz, M.

Faculte des Sci. d'Istambul, Turkey

La Meteorologie, Paris, Serie 6, No. 7, Dec. 1976. p. 143-157. Refs. DLCe

LANGUAGE: fre

CTRY OF PUBL:FRe

The rainfall regime of Turkey is described by the geographical distribution of the total means of March-Aug. The meteorological situation of spring and summer at the surface and aloft is outlined. The correlation between the number of rainy days and the number of cloudy days is determined. The physical structure of clouds with vertical development in Anatolia is analyzed by computing instability, convective motion, cloud water content, and vertical temperature distribution. Examples of such calculations are presented. The formulas for making the calculations are presented, and the computation procedure is illustrated. It is shown that precipitation in Central Anatolia can develop under the following conditions: thermal depression at the surface or a col situation (creating an instability layer) exists; the presence of water in a sufficient quantity in the instability layer (in order to form and supply a cloud); condensation or freezing nuclei in sufficient quantity and suitable quality (to form rain drops and ice crystals and for agents to cause clouds); and a thalweg or depression aloft (to produce supercooling of clouds). The first three conditions were found in 60% of the spring and 30% of the summer days. It is concluded that it is possible to increase the precipitation by 25-30% in the warm season in various regions of Turkey (illustrated on a map). It is also possible to increase the number of rainy days in summer by 17%.

DESCRIPTORS: Cloud seeding potentialities; Anatolia, Turkey

ID NO.- MGA29010137

Numerical simulation of warm fog dissipation by electrically enhanced coalescence, Pt. 2, Charged drop seeding.

Tag, Paul M.

Naval Environ. Prediction Res. Facility, Monterey, CA.

Journal of Applied Meteorology, Boston, 16(7): 683-696, July 1977. Refs. For abstract of Pt. 1, see Met. Abs., 25.9-144. DAS, DLC

CTRY OF PUBL:US

A numerical study of the use of highly charged water drops to clear warm fog has been conducted. The mechanism studied is the polarization of neutral fog droplets and their capture by the charged drops. A multilevel microphysical model is used to investigate the degree of visibility improvement resulting from the variations in seeding drop size and charge, the concentration of seeding material, and the fog being seeded. It is determined that visibility improvement decreases with decreasing fog droplet size and increases with increasing seeding rate and seeding drop charge. For the same amount of seeding water, a treatment spectrum with an average radius of 10-15 .MUt.mtis ideal. In contrast to the findings of Part 1t (an aoplied electric field), visibility improvement resultst both from a removal of fog water (to the ground) and from at transfer of water from the fog spectrum to the larger treatment drops. Field tests of this technique have provent inconclusive. A further evaluation is made by comparing modelt results to numerical experiments of hygroscopic seeding, at technique that has been field tested on several occasions. Itt is concluded that the charges and treatment concentrationst simulated in this study would not be adequate for clearing fog; unless charges and seeding concentrations can be greatly increased, charged drop seeding is probably not a viable fog dissipation technique.

DESCRIPTORS: Fog dissipation by charged drops; Fog seeding evaluation

ID NO.- MGA28120371

Study of the development of tropical cumulus clouds.

Valdes, Mario

Khidrologiya i Meteorologiya, Sofia, 26(3): 58-60, 1977. Refs. DAS, DLC (GB651.K5)

CTRY OF PUBL:BU

Tropical cumulus clouds were observed by radar and their vertical development was analyzed for planning weather modification experiments. To obtain effective methods of cloud modification, it is necessary to consider factors that eliminate the random effects in the results. The observations made with an MP.A.-2 meteorological radar over cumulus clouds are displayed, with parameters related to the cloud vertical development. These parameters permit the evaluation of modification experiments and, at the same time, derive aspects of the internal mechanism of cloud formation. Part of the data analyzed and the methodology are described in a separate paper, with additional data for 1972 and 1973 so as to compile three years of information on the months May to July in a daily 12-hr plan of diurnal observation.

DESCRIPTORS: Cumulus cloud development; Tropical cloud studies; Radar observation of cumulus clouds

ID NO.- MGA28120099

Ice nucleation by micas.

Shen, J. H.

Ctr. for Surface and Coatings Res., Lehigh Univ., Bethlehem, PA.;

Journal of the Atmospheric Sciences, Boston, 34(6): 957-960, June 1977. Refs. DAS, DLC

CTRY OF PUBL:US

A fluorine mica, fluorophlogopite, produced higher bulk water freezing temperature than many other nucleating agents, including the parent hydroxyphlogopite, and even silver iodide. It is the most efficient catalyst yet found in this laboratory. Fluorophlogopite has an inherently large mismatch with ice crystals, but the water cluster embryo is sustained by an F-H-O hydrogen bond assisted by neighboring potassium ions.

DESCRIPTORS: Cloud seeding substances; Nucleating agents

ID NO.- MGA28120098

Environmental impacts of precipitation management: results and inferences from Project Skywater.

Howell, Wallace E.

Div. of Atmos. Water Resources, Bur. of Reclamation, Dept. ofInterior, Denver, CO.

American Meteorological Society, Boston, Bulletin, 58(6): 488-501, June 1977. Refs. DAS, DLCt

CTRY OF PUBL:USt

Recent completion of several research projects into weathert modification impact on the environment provides an opportunity for placing this subject in a new perspective. Studies of physical and biological processes relating precipitation and ecosystem changes show relatively few discernible effects, all of them minor in nature and magnitude. Direct effects of nucleating agents no longer appear consequential. Since no acute problems have surfaced, the focus is likely to shift to possible long-term effects on ecosystems as a whole, whereas changes associated with natural precipitation gradients and climatic fluctuations provide a model for those to be expected from precipitation management. The weakness of environmental impacts of weather modification compared to the consequences of other human actions renders it unlikely that these impacts will be decisive within a behavioral framework.

DESCRIPTORS: Project Skywater; Cloud seeding effects; Ecological aspects of weather modification

ID NO.- MGA28120096e
Hypothetical cloud-seeding method for facilitating the occurrence of lightning.
Griffiths, Richard F.
Atmos. Sci. Res. Ctr., State Univ. of N.Y. at Albany
Journal of Applied Meteorology, Boston, 16(6): 658-661, June 1977. Refs. DAS, DLC
CTRY OF PUBL:US
From the available literature, arguments are presented to support the thesis that lightning initiation requires that positive corona streamers be produced in a region where the electric field E exceeds a certain critical value E.SUB 0.. Under normal circumstances, electrically stressed precipitation particles provide this necessary corona. A method of cloud seeding is proposed in which suitable corona-giving bodies are artificially introduced into the cloud to facilitate the triggering of lightning. The required properties of the seeding material are discussed, and applications of the technique are suggested.
DESCRIPTORS: Artificial lightning

ID NO.- MGA28120095
Teoreticheskiye issledovaniya svoystv kristallogidratov. .Theoretical consideration of the properties of gas hydrates..
Miroshnichenko, V. I.
Moscow. Tsentral'naya Aerologicheskaya Observatoriya, Trudy, No. 104, 1976. p. 85-96. Refs. English and Russian summaries. DAS, DLC (QC851.T8A1)
LANGUAGE: rs
CTRY OF PUBL:UR
The results of theoretical studies on the formation of gas hydrates are examined to determine the possibility of using these chemical compounds for the artificial modification of supercooled clouds and fogs. The results show that criteria for choosing the most effective hydrate formers may be obtained. However, the theory does not solve the problem of gas stability in the absence of partial pressure of a gas hydrate former.
DESCRIPTORS: Fog dissipation techniques; Cloud modification

ID NO.- MGA28120094
Nekotoryye dannyye o mekhanizme vzaimodeystviya gidratoobrazuyushchikh veshchestv s vodnym aerozolem. .Some data related to the mechanism of interaction hydrate formers and water aerosol..
Krasnovskaya, L. I.
Moscow. Tsentral'naya Aerologicheskaya Observatoriya, Trudy, No. 104, 1976. p. 97-107. Refs. English and Russian summaries. DAS, DLC (QC851.T8A1)
LANGUAGE: rs
CTRY OF PUBL:UR
On the basis of experimental studies and observational data obtained on the physical and chemical properties of active sites that are formed when propane-type agents are released into fog, a hypothesis is suggested which accounts for the mechanism of the agent's effect.
DESCRIPTORS: Fog dissipation by propane spraying

ID NO.- MGA28120093
Mezhdunarodnaya konferentsiya po aktivnym vozdeystviyam na meteorologicheskiye protsessy. .International conference on the artificial modification of meteorological processes..
Khrgian, A. Kh.
Moscow. Tsentral'naya Aerologicheskaya Observatoriya, Trudy, No. 104, 1976. p. 124-131. English and Russian summaries. DAS, DLC (QC851.T8A1)
LANGUAGE: rs
CTRY OF PUBL:UR
The article reviews the principal subjects treated at the conference. Discussion of some of the papers is included.
DESCRIPTORS: Weather modification conferences

ID NO.- MGA28110306
Chemical composition of surfaces of natural ice-forming nuclei.
Rosinski, J.
Natl. Ctr. for Atmos. Res., Boulder, CO.
Journal de Recherches Atmospheriques, Clermont-Ferrand, France, 10(4): 201-210, Oct./Dec. 1976. Refs. English and French summaries. DAS, DLC
CTRY OF PUBL:FR
Natural ice-forming nuclei in Colorado and Montana, U.S.A., were analyzed and found to be mostly clay particles. The elemental chemical composition of the surfaces of these nuclei were compared with those of the general aerosol population. A large number of particles that exhibit ice-nucleating properties are mixed particles, i.e., clay particles presumably with nucleating sites containing silver iodide, copper compounds, etc. Clay particles containing hygroscopic compounds nucleated ice readily, indicating that the mode of ice nucleation for those particles is condensation-freezing. The -12 and -19°C ice-forming nuclei population derived from organic particles was 2 and 1% of the natural aerosol, respectively. Mixed clay-AgI particles found in aerosols over northeastern Colorado, as a consequence of previous seeding operations, contribute to inadvertent weather modification.
DESCRIPTORS: Ice nuclei composition; Ice nucleability; Montana, United States; Colorado, United States

ID NO.- MGA28110108
Cloud seeding: taking science into the sky.
McCutcheon, Sean
Natl. Aeronautical Estab., NRC
Science Dimension, Ottawa, 9(3): 22-27, 1977. In English and French.
LANGUAGE: fr
CTRY OF PUBL:CA
NRC's National Aeronautical Establishment, Environment Canada's Atmospheric Environment Service, and the Canadian Forestry Service are cooperating in an attempt to find out whether it is possible to control forest fires by seeding clouds. The project began in 1973 when a Canadian delegation was touring Russia to learn how the Russians combat forest fires. Since clouds differ with environment, the Russian seeding techniques could not be readily adopted, and further research was required. Each summer, aircraft from the NAE are used for fire suppression experiments. Cloud seeding is a technology in its infancy. If it matures, it could be useful not only in preventing fire destruction and saving fire fighting costs, but in other applications as well.
DESCRIPTORS: Cloud seeding effects on forest fires; Forest fire control

ID NO.- MGA28110107
Project Foggy Cloud VI: design and evaluation of warm-fog dispersal techniques.
Reinking, R. F.
United States Naval Weapons Center, China Lake, CA., NWC Technical Publication 5824, May 1977. 106 p. Refs., figs., appendices. DAS (A VF 23 U55)
CTRY OF PUBL:US
This report describes the warm fog modification experiments conducted under Project Foggy Cloud VI, and presents and evaluates the results obtained. The aim of the experiments was to develop an inexpensive, reliable, rapid method of dispersing warm fog and stratus. The following techniques were tested: 1) the dispensing of electrostatically charged droplets from aircraft to induce fog droplet coalescence and rainout, and the dispensing of electrostatically charged buoobles from the surface to collect and precipitate fog droplets (at Arcata-Eureka Airport in CA.); and 2) spreading and maintaining monomolecular films on the water surface to suppress evaporation and inhibit fog formation (in the Panama Canal). The field test sites and conditions and the instrumentation and procedure are described with the aid of diagrams and photographs. In the case of aerial dispensing of charged water droplets, the results of 13 experiments were inconclusive, but produced indications that electrostatically induced coalescence is a sound principle in dispersing fog and stratus.The use of charged hygroscopic bubbles, while based on the same principles of charged droplets, is more adaptable to a surface-based system; but the problems of bubble production and buoyancy and, also, of targeting must be resolved. The results of evaporation suppression to reduce fog by establishing and maintaining a monomolecular film of long-chain fatty alcohols on the water surface of the Canal showed the existence of a strong correlation between fog intensity and film coverage. In areas where the film remained intact (100% cover), fog (stratus) ceiling held at 100 to 200 ft with good surface visibility, while in areas where the film became broken and patchy, ceilings lowered and visibility fell below that required for safe navigation. Appendices contain details of airborne fog dispersal tests and results of measurements of cloud condensation nuclei at the Arcata-Eureka Airport.
DESCRIPTORS: Project Foggy Cloud; Fog dispersal techniques; Fog prevention

ID NO.- MGA28110106
Preliminary test program in chaff dispersal within thunderstorms at Kennedy Space Center.
Rust, W. David
Atmos. Phys. and Chem. Lab., Boulder, CO.;
United States National Oceanic and Atmospheric Administration, Environmental Research Labs., Technical Memorandum (NOAA TM ERL APCL-20), April 1977. 13 p. Refs. DAS (A QC 807.5 U6A6)
CTRY OF PUBL:US
Chaff seeding was successfully used to alter lightning production and intense electric fields in isolated thunderstorms over the high plains of the western U.S. Because of the meteorological differences in Florida thunderstorms, a brief (two-week) study of the feasibility of modifying thunderstorms over Kennedy Space Center by releasing chaff was conducted. From this nonstatistically configured test, it appears that releasing chaff at the base of Florida thunderstorms will not be as successful as it was in the West. Furthermore, it may be necessary to use more than one aircraft to release the chaff, even after the optimum locations for dispersal are known. Recommendations for future studies in the application of chaff seeding to mitigate hazardous electric fields in Florida include the determination of optimum altitudes or temperature levels for chaff release, development of a ground-based instrument to map the areas of the chaff-produced corona, and the formulation and undertaking of a statistical experiment to determine more accurately the effects of chaff dispersal upon these storms.
DESCRIPTORS: Thunderstorm modification; Lightning prevention ; Chaff seeding; Kennedy Space Center, Florida

ID NO.- MGA28110016e
Annual report, 5th.e
United States National Advisory Committee on Oceans ande Atmosphere,Wash., D.C.e
June 30, 1976. 64 p. A report to the President and the Congress. DAS (A QC 801 U5)e
CTRY OF PUBL:US
This fifth annual report of the National Advisory Committee on Oceans and Atmosphere presents reviews, assessments, and recommendations on the status of the scientific marine and atmospheric activities of the U.S. The contents include 1) policy and planning for marine affairs; 2) energy from offshore sources; 3) the Sea Grant Program and its influence; 4) energy research, development, and demonstration; 5) air pollution research and development; 6) weather and air safety; 7)eresearch relating to decompression procedures of diving ande physiological effects; and 8) investigation of climatic changee and weather modification.e
DESCRIPTORS: Annual reports; U.S. National Advisory Committee on Oceans and Atmosphere; United States

ID NO.- MGA28100515
Impacts of urban-modified precipitation on man's activities.
Changnon, Stanley A., Jr.
IL. State Water Survey
Journal of Weather Modification, Fresno, CA., 9(1): 8-18, April 1977. DAS (QC 928 J6)
CTRY OF PUBL:US
The effects of urban-modified precipitation upon man's activities are examined on the basis of climatic studies of nine cities made during the METROMEX program. Discussion focuses on atmospheric processes such as convective cloud formation and precipitation, weather modification efforts, effects on agriculture in the rain increase area; alterations in insurance-related losses, impact on water resources, impact on urban and regional planning efforts, and on government agencies involved in pollution control and energy development. The St. Louis studies showed an increase in cloudiness (up 10%) and in summer rainfall (up 10-100%). These increases occurred above and just east of St. Louis in an area of 4000 km.SUPER 2.. The more intense and polluted rains led to more runoff (+15%), more local flooding (+50 to 100%), and more stream- and groundwater pollution (+1 to +400%). The urban-modified precipitation resulted in local increases of 2-5% in grain crop yields.
DESCRIPTORS: Urban effects; Urban influences on precipitation; St. Louis, Missouri

ID NO.- MGA28100405
Theoretical study of the evolution of mixed-phase cumulus clouds.
Scott, Bryan C.
Atmos. Sci. Dept., Univ. of WA., Seattle
Journal of the Atmospheric Sciences, Boston, 34(5): 812-826, May 1977. Refs. DAS, DLC
CTRY OF PUBL:US
A warm and cold cloud microphysical description was incorporated into a one-dimensional, time-dependent, Eulerian cumulus cloud model. The relationship of the ice phase to the development of precipitation, and interactions between cloud microphysical processes and cloud dynamics were examined. Ice crystals in the form of plates, columns, and dendrites were permitted to interact among themselves and with water droplets, to produce graupel, unrimed and rimed ice crystals, and snowflakes. The effects of possible ice multiplication were investigated by permitting ice splinters to be produced during riming and during the freezing of isolated drops. Comparative studies with shallow, nonprecipitating maritime and continental cumulus clouds showed the importance of the drop size distribution in determining the dominant mechanism for forming graupel embryos. In the maritime cloud, graupel embryos originated on frozen drops produced after collisions with ice crystals. In the continental cloud, graupel embryos tended to originate on ice crystals. The riming- splintering mechanism never produced significant increases in ice crystal concentrations in the continental cloud, but in the maritime cloud it produced orders of magnitude increases after the updraft velocity had decreased sufficiently to permit the formation and sedimentation of larger drops and graupel. The ejection of four ice splinters during the freezing of each isolated drop (>50 .MU .m) in the maritime cloud increased graupel concentrations at cloud top by 100 times. When the number of ejected splinters was reduced to one per drop in the maritime cloud, the concentrations of graupel were only increased by about a factor of two. Even the ejection of four splinters per isolated freezing drop in the continental cloud did not significantly increase the concentrations of ice particles. Model case studies of artificial seeding indicate that it should be possible to produce large increases in the concentrations of graupel in the maritime cloud by seeding it at cloud top with artificial ice nuclei in concentrations of 250 1.SUPER -..SUPER 1.. The model showed significant increases in the concentrations and sizes of graupel in the continental cloud when it was seeded with 250 crystals 1.SUPER -..SUPER 1. at cloud base.
DESCRIPTORS: Cumulus cloud models; Graupel processes; Cumulus cloud seeding

ID NO.- MGA28100402
Simulation of cold cloud precipitation in a three-dimensional mesoscale model.
Chappell, Charles F.
Atmos. Phys. and Chem. Lab., Boulder, CO.
United States National Oceanic and Atmospheric Administration. Environmental Research Labs., Boulder, CO., Technical Report (NOAA TR ERL 381-APCL 40), Oct. 1976. 24 p. Refs. DAS (A QC 807.5 U66)
CTRY OF PUBL:US
A cold cloud microphysical model is developed and merged with a 15-level primitive equation mesoscale dynamical model. The microphysical model partitions ice particles into three categories: unrimed, partially rimed, and graupel. Each is considered to have a Marshall-Palmer distribution, and is assigned its own set of physical characteristics. Criteria for converting from one ice particle category to another are based on a comparison of accretional to depositional growth rates. Six prognostic equations predict the concentration and mixing ratio for each ice particle category. Processes in the model include deposition, accretion, condensation, evaporation, sublimation, nucleation, and sedimentation. Microphysical processes are coupled back into the dynamical prediction equations so that the effect of ice processes on the airflow can be investigated. The mesoscale model is used to investigate numerically the development and distribution of snowfall over a mountain massif during a 4500-sec integration. It appears to simulate realistically the nucleation and growth of ice particles, their transport, and their sedimentation to the mountain surface. Snowfall distribution, including the leeward extent of precipitation, also appears reasonable and consistent with that observed along the continental divide of Colorado for similar wind regimes. When further developed, the model will be applicable to studies relating to prediction and modification of snowfall over mountainous terrain.
DESCRIPTORS: Cloud models; Ice particles in clouds; Cloud physics; Snow formation

ID NO.- MGA28100123
Eksperimental'noye issledovaniye ispareniya aerozolya floroglyutsina.e .Investigation on the evaporation decay of phloroglucinol aerosol..
Yershova, N. G.
Moscow. Tsentral'naya Aerologicheskaya Observatoriya, Trudy, No. 104, 1976. p. 70-73. Refs. English and Russian summaries. DAS, DLC (QC851.T8A1)
LANGUAGE: rs
CTRY OF PUBL:UR
A study was made of the evaporation of phloroglucinol aerosol at temperatures between 6-7 and 24-26°C. A finely dispersed aerosol produced by a heating generator was left in an aerosol chamber for two hours, and the ice forming activity was measured during this period. Experimental results, presented graphically, indicate no evaporation of phloroglucinol aerosol at the above temperatures.
DESCRIPTORS: Cloud seeding with phloroglucinol; Cloud seeding effectiveness

ID NO.- MGA28100122
Izmeneniye rezhima zhidkikh osadkov pri iskusstvennykh vozdeystviyakh na gradovyye protsessy. .Variation ofe precipitation regime under artificial modification of hail processes..
Vychuzhanina, M. V.
Moscow. Tsentral'naya Aerologicheskaya Observatoriya, Trudy, No. 104, 1976. p. 64-69. English and Russian summaries. DAS, DLC (QC851.T8A1)
LANGUAGE: rs
CTRY OF PUBL:UR
The results of investigations concerned with the distribution of rain precipitations over target and control areas for the period before the controlling of hail processes and thunderstorms, as well as for the period of operations, are given. The effect of an artificial treatment upon the variation of precipitation intensity is discussed on the basis of rainfall measurements obtained from the network of recording rain gages and radar observations.
DESCRIPTORS: Cloud seeding effects; Precipitation modification; Hail suppression

ID NO.- MGA28100121e

Termopretsipitator dlya elektronnomikroskopicheskikh issledovaniy l'doobrazuyushchikh aerozoley.e .Thermal precipitatore for microscopic examination of nucleating aerosol..e

Aksenov, M. Ya.

Moscow. Tsentral'naya Aerologicheskaya Observatoriya, Trudy,e No. 104, 1976. p. 79-84. Refs. English and Russian summaries.e DAS, DLC (QC851.T8A1)e

LANGUAGE: rs

CTRY OF PUBL:UR

A thermal precipitator was constructed and used to sample silver iodide and phloroglucinol aerosols for their subsequent electron microscopic examination. The device is cooled by flowing tap water: it consists of three sequentially arranged precipitating elements that are heated by an electric current passing through a bifilar winding. The aerosol particles are deposited on a colloidal film covering the polished surface of a metal plate. To obtain a uniform distribution of the particles of different size over the collecting surface, the unit of heating elements may be set in reciprocating motion by an electric motor. The size of the operating gap is 0.01 MULTIPLIED BY 1 cm.SUPER 2.. Studies on the efficiency of the deposition of silver iodide and phloroglucinol particles (mean size being r .APPROX. . 1.5 MULTIPLIED BY 10.SUPER -..SUPER 6. and .APPROX. . 6.5 MULTIPLIED BY 10.SUPER -..SUPER 6. cm, respectively) showed that the optimum conditions for a complete deposition are grad T = 3000 deg/cm and v = 35 cm/sec.

DESCRIPTORS: Cloud seeding with silver iodide; Cloud seeding with phloroglucinol; Cloud seeding effectiveness

ID NO.- MGA28100120

Rezul'taty opytov vozdeystviy na konvektivnyye oblaka grubodispersnymi poroshkami.e.Results of artificial control of convective clouds using roughly disperse powders..

Gayvoronskiy, I. I.

Moscow. Tsentral'naya Aerologicheskaya Observatoriya, Trudy, No. 104, 1976. p. 49-63. Refs., tables. English and Russian summaries. DAS, DLC (QC851.T8A1)

LANGUAGE: rs

CTRY OF PUBL:UR

Experimental results are given of the use of powdery seeding agents having different specific gravities and particle dispersity for modifying cumulus congestus clouds. It was found that the amount of seeding material required for successful treatment can be reduced by increasing the agent's specific gravity. An analysis of the experimental data revealed a strong dependence of the effectiveness of artificial modification upon the instability of an atmospheric layer in which convective clouds are developing.

DESCRIPTORS: Convective cloud seeding; Cloud modification

ID NO.- MGA28100119

Laboratornyye issledovaniya mekhanizma vzaimodeystviya reagentov tipa propana s vodnym aerozolem. .Laboratory investigation of the mechanism of interaction between propane type reagents and water aerosol in the temperature range of -3 to 0"..

Krasnovskaya, L. I.

Moscow. Tsentral'naya Aerologicheskaya Observatoriya, Trudy, No. 104, 1976. p. 108-116. Ref. English and Russian summaries. DAS, DLC (QC851.T8A1)

LANGUAGE: rs

CTRY OF PUBL:UR

The article presents the procedures and results of an experimental investigation of the mechanism of interaction between propane type reagents and water aerosol. The data obtained on the temperature threshold of these reagents and their nucleation activity as a function of temperature are reported.

DESCRIPTORS: Fog dissipation by propane spraying

ID NO.- MGA28100118

Sposoby vvedeniya reagenta tipa propana v pereokhlazhdennyy tuman. .Development of the techniques for releasing a propane type agent into supercooled fog..

Khizhnyak, A. N.

Moscow. Tsentral'naya Aerologicheskaya Observatoriya, Trudy, No. 104, 1976. p. 117-123. Refs. English and Russian summaries. DAS, DLC (QC851.T8A1)

LANGUAGE: rs

CTRY OF PUBL:UR

This article presents the results of efforts devoted to the search for means of releasing propane type agents into fog. A spray nozzle for the ground-based propane dispenser, which is assumed to be incorporated in an automatic system designed for artificial fog dispersal at airports, is described.

DESCRIPTORS: Fog dissipation by propane spraying

ID NO.- MGA28100117
Randomizirovannyye opyty vozdeystviya na grozovyye oblaka. .Randomized modification experiment on thunderclouds..
Gayvoronskiy, I. I.
Moscow. Tsentral'naya Aerologicheskaya Observatoriya, Trudy, No. 104, 1976. p. 40-48. Refs. English and Russian summaries. DAS, DLC (QC851.T8A1)
LANGUAGE: rs
CTRY OF PUBL:UR
A randomized modification experiment on thunderclouds was conducted in the northern part of Moldavia in 1972. In eight cases, 14 clouds were seeded by PbI.SUB 2., with the help of large antihail rockets, with the remainder being used as control clouds. Modification results were estimated by radar and a local-lightning counter. The lightning frequency (number of lightnings per one minute) was decreased 2.5 times as the result of cloud seeding.
DESCRIPTORS: Thunderstorm modification; Hail suppression; Lightning prevention; Moldavian S.S.R.

ID NO.- MGA28100116
Dvadtsat' pyat' let issledovaniy v tsao v oblasti iskusstvennykh vozdeystviy na oblaka i tumany (obzor). .Twenty-five year research activities of the Central Aerological Observatory in the field of artificial modification of clouds and fogs..
Gayvoronskiy, I. I.
Moscow. Tsentral'naya Aerologicheskaya Observatoriya, Trudy, No. 104, 1976. p. 3-23. Refs. English and Russian summaries. DAS, DLC (QC851.T8A1)
LANGUAGE: rs
CTRY OF PUBL:UR
A review is given of the investigations performed at the Central Aerological Observatory for a 25-yr period (1949-1974) in the field of artificial modification of clouds and fogs. Extensive studies were made along the following major lines: a search for means of artificial modification of clouds and fogs, either supercooled or warm; the modification of thunder and hailstorms; and the control of the electrical activity of clouds. Most of the field tests were conducted in Moldavia, at the experimental base of the Central Aerological Observatory. Data on the protection of crops from damaging hail in Moldavia over the period 1964-1973 are reported.
DESCRIPTORS: Cloud seeding research; Weather modification research; History of weather control; Moldavian S.S.R.

ID NO.- MGA28090500
Saskatchewan hail research project, 1973-1976.
Paul, Alexander H.
Univ. of Regina, Canada
Atmosphere, Toronto, Vol. 15, .Special Issue., 1977. p. 43. Abstract only, No. 159. DAS
CTRY OF PUBL:CA
This paper describes some preliminary results of a climatological study of hailstorms in southeastern Saskatchewan. Comparisons are drawn between data on the Saskatchewan hail, derived from farmers' reports in the same manner as Alberta Hail's surface hailfall data, and data from other hail research projects. Case studies of a number of Saskatchewan storms are reviewed, and the variety of synoptic situations in which damaging hail may occur is emphasized. The implications of the findings regarding the logistics of any potential cloud seeding program to suppress hail in southern Saskatchewan are examined. While the general behavior of the Saskatchewan storms is similar to that of the Alberta storms, certain factors such as the greater length of the Saskatchewan hail season, the occurrence of multiple storms on the same day, and the greater frequency of nighttime storms appear to militate against the possible success of a modification program.
DESCRIPTORS: Hail research; Hailstorm studies; Hail suppression; Saskatchewan, Canada

ID NO.- MGA28090126
Comparisons of calculations and observations of ice crystal growth following seeding.
Strapp, J. W.
McGill Univ., Montreal, Canada
Atmosphere, Toronto, Vol. 15, .Special issue., 1977. p. 42. Abstract No. 155. DAS
CTRY OF PUBL:CA
For the past several years, the Atmospheric Environment Service, the National Aeronautical Establishment, and the Canadian Forestry Service have been involved in a joint program to study the feasibility of inducing precipitation in cumulus clouds by AgI seeding. The immediate economic incentive would be the suppression of large fires by downwind seeding of suitable clouds. The Yellowknife Cumulus Seeding Experiment has provided detailed microphysical information of rapid particle growth after seeding in several cases. The rate of growth of these particles has been compared to predictions of an ice crystal growth model, and agreement has been found. The model has also been useful in estimating the delay in activation of the AgI in these cases, and has provided evidence supporting aggregation of crystals in two cases studied.
DESCRIPTORS: Cloud seeding with silver iodide; Cumulus cloud seeding; Yellowknife, Northwest Territories, Canada

ID NO.- MGA28090125e

Potential economic benefits of hail supression to crope producers in different regions of the United States.e

Potter, Craig W.

Agri. Economics Dept., Univ. of IL.e

Journal of Weather Modification, Fresno, CA., 9(1): 100-116,e April 1977. Refs. DAS (QC 928.J6)e

CTRY OF PUBL:US

The potential economic benefits of hail suppression weree investigated for wheat, cotton, soybeans, corn, and tobacco ine different locations in the U.S. To account for thee year-to-year variation of the hail hazard, average income ande variability of income from crop production, were evaluated by using a specified level of hail suppression effectiveness. Three levels of reduction in crop damage from hail weree considered: 20, 50, and 80%. Three levels of rainfall variation were associated with each level of crop damagee reduction- namely, 10% decrease, no change, and a 10% increasee in rainfall during the hail season. An equation is presentede for calculating the annual net income associated with eache potential effectiveness level of hail suppression coefficients. A considerable E-W differential in potential benefits was found in the Plains States. In the north-centrale region, the potential benefit of hail suppression is the promise it holds for reducing the income variability of the grain farmer. The importance of the effect of rainfall fluctuations possibly associated with hail suppression activities is stressed.

DESCRIPTORS: Hail suppression; Hail damage to crops; Economic aspects of weather modification; United States

ID NO.- MGA28090124

La desactivation photolytique des particules d'iodure d'argent et leur dispersion atmospherique a partir du sol, une revue de 25 annees de recherches. .Photolytic deactivation of silver iodide particles and their atmospheric dispersion from the ground, a review of 25 years of research..

Pham, Van Dinh

Ctr. de Recherches Atmos. Henri-Dessens, Lannemezan, France

Journal de Recherches Atmospheriques, Clermont-Ferrand, France, 10(3): 175-185, July/Sept. 1976. Refs. DAS, DLC

LANGUAGE: fr

CTRY OF PUBL:FR

Seeding clouds with ground-released silver iodide is attractive because of technical ease for particle dispersal, but the method may be doubtful since the nuclei may not reach the clouds. Moreover, when they are carried to higher levels by natural convection, they may have lost their ice-forming ability by photo-deactivation. This paper reviews the last 25 yr of published research about the feasibility of using groundbased generators for clouds seeding.

DESCRIPTORS: Cloud seeding with silver iodide; Silver iodide dispersion; Silver iodide effectiveness

ID NO.- MGA28090123

Collection kernels for the capture of silver iodide nuclei by cloud water drops.

Mathews, L. A.

Earth and Planetary Sci. Div., Naval Weapons Ctr., China Lake, CA.

Journal of Weather Modification, Fresno, CA., 9(1): 125-145, April 1977. Refs. DAS (QC 928.J6)

CTRY OF PUBL:US

The collection kernel used in the stochastic collection equation best defines the rate of capture of nuclei. The collection kernel, or the collection volume swept out per unit time per drop, is defined as: K(A,a) = .PI . (A+a).SUPER 2.E(A,a) (V.SUB A.-V.SUB a.), in which A and a are the drop and droplet, or particle radii, respectively; E(A,a) is thee collision efficiency, which accounts for the fact that throughe microphysical processes such as Brownian diffusion, hydrodynamic impactions, wake capture, turbulence, electrophoresis, thermophoresis, and diffusionphoresis, the collection volume will differ from the geometrical sweep-out volume; V and V.SUB a. are the velocities of the drop and droplet, or particle. Only the processes of initial and interceptive impaction, Brownian diffusion, and wake capture are included in this study. Also, the collection efficiency is assumed to be equal to the collision efficiency. The collision efficiency for the capture of a small particle by a waterdrop is a function of the dimensionless parameters of drop Reynolds number, Schmidt number, interception, viscosity ratio, and the Stokes number. The determination of collision efficiencies is described, and their application to the determination of a collection kernel for AgI nuclei by cloud drops is set forth. For the capture of AgI nuclei with radii from 0.01 to 10 .MU .m by cloud droplets with radii 50 .MU .m or greater, the collection kernels are greater than 10.SUPER -..SUPER 6.. They are large enough to bring practical concentrations of AgI nuclei into contact with cloud drops at a rate capable of causing rapid freezing of cloud water by a large heat release, if the updraft portion of a cloud is seeded. In downdraft portions of a cloud, impractically large concentrations of nuclei would have to be injected to contact droplets. The effects of turbulence, diffusionphoresis, thermophoresis, and electrophoresis upon collection kernels are discussed.

DESCRIPTORS: Cloud seeding with silver iodide; Cloud microphysics

ID NO.- MGA28090122

Cloud seeding experimental program in Rhodesia: 1974-75.

McNaughton, D. L.

Dept. of Met. Serv., Salisbury, Rhodesia

Journal of Weather Modification, Fresno, CA., 9(1): 79-92, April 1977. Refs., tables, appendices. DAS (QC 928.J6)

CTRY OF PUBL:US

By using randomized instructions, isolated cumulus clouds were either left alone or seeded near cloud top from an aircraft fitted to fire pyrotechnic cartridges. The rain falling from seeded and untreated clouds was measured at cloud base with a rainwater collector. Seeded clouds with tops warmer than about -10°C gave much the same rain as similar nonseeded clouds. With colder clouds, however, the average rainfall was greater on seeded than on nonseeded occasions. When rain falling earlier than 40 min after the beginning of the experiment was excluded from the calculations, the apparent bias in favor of the seeded clouds in the two-season period 1973-1974, 1974-1975 was significant at the 10% level. Excluding early rain, the six heaviest falls all came from seeded clouds; the probability that this was pure chance is less than 0.04. However, there were also several seeded clouds that failed to yield rain.

DESCRIPTORS: Cloud seeding experiments; Rhodesia

ID NO.- MGA28090121

Ecological impacts of nucleating agents used in weather modification programs: an interdisciplinary assessment.

Klein, D. A.

Dept. of Microbiol., CO. State Univ.

Journal of Weather Modification, Fresno, CA., 9(1): 51-56, April 1977. Refs. DAS (QC 928.J6)

CTRY OF PUBL:US

General conclusions and recommendations regarding the environmental impacts of nucleating agents in weather modification are summarized under the following headings: chemical equilibria; disposition and analysis of silver in the environment; effects on human beings and domestic and sports animals; biochemical equilibria and potentiation of other metals and agents in the environment; aquatic biologic processes, including aquatic invertebrates and fish populations; the soil-plant environment; sewage treatment processes and anaerobic environments; effects on birds; monitoring strategies for silver and silver-based seeding agent concentrations and biological effects; and non-silver-based nucleating agents.

DESCRIPTORS: Cloud seeding effects; Ecological aspects of weather modification

ID NO.- MGA28090120

Increases in silver iodide attributable to ground generators: highlights of the 1975 Alberta ground generator experiment.

Grandia, K. L.

Intera Environ. Consultants Ltd.

Journal of Weather Modification, Fresno, CA., 9(1): 57-65, April 1977. Refs. DAS (QC 928.J6)

CTRY OF PUBL:US

As part of an evaluation potential for cloud seeding from ground-based experiments, an attempt was made to determine the heights and concentrations of silver iodide by means of selected aircraft traverses at different levels. The measurement system (including the aircraft instrumentation and ground support equipment), and the design of analysis procedures are described. The following conclusions are drawn from the results: 1) investigations of afternoon background ice nuclei measurements revealed an increase in the areally-averaged ice nuclei concentration by a factor of two to four over background up to a height of 10,000 ft. m.s.l., which is a typical cloud base for Alberta hailstorms; 2) an apparently elevated maximum around 2500 ft. a.g.l. may be the result of differences in upward and downward mixing under convective conditions; 3) a network of ground generators, with approximately one generator per township, led to an average concentration of 5-100 c/min, or two to four times over background, decreasing slightly with height to typical cloud base heights. Within the updraft of a thunderstorm, there was a variation in concentration ranging from background to a factor of three over background. Morning inversion tests showed the trapping of the AgI beneath the inversion surface. Local circulation caused by the thunderstorm induced large variability in spatial distribution of AgI.

DESCRIPTORS: Silver iodide dispersion; Cloud seeding with silver iodide; Alberta, Canada

ID NO.- MGA28090119

Examination of the rainfall distribution over the targett area of the Colorado River Municipal Water District's weathert modification program.t

Girdzus, John

CO. River Municipal Water District; TX. Water Devel. Board

Journal of Weather Modification, Fresno, CA., 9(1): 93-99, April 1977. Refs. DAS (QC 928.J6)

CTRY OF PUBL:US

Information is presented on rainfall distribution within, and adjacent to, the Colorado River Municipal District's target area during cloud seeding and before the cloud seeding program was in operation. The data used covers the period 1935-1975; the seeding period was 1971-1975. The seeding program was in operation from April to Oct., but only the data for the May-Sept. period were examined. In the analysis, the data are presented by isohyets, and in tabular form. For the cloud seeding period 1971-75, the target area of the weather modification program received more rainfall than in any other 5-yr period since 1935. Rainfall over the target area during the seeded years was at least twice that observed in any othert similar 5-yr period during the interval 1935-70. Rainfallt increases in the target area during the seeded years were 17%t greater than those of the control area in the same period.

DESCRIPTORS: Cloud seeding evaluation; Colorado River region, Southwestern U.S.

ID NO.- MGA28090118

Community response to proposed snowpack augmentation in the Sierra Nevada Mountains.

Farhar, Barbara C.

Human Ecology Res. Serv., Boulder, CO.

Journal of Weather Modification, Fresno, CA., 9(1): 154-192, April 1977. Refs. DAS (QC 928.J6)

CTRY OF PUBL:US

A study of community organizations in counties of the Sierra Nevada Mountains was carried out to obtain a response to proposed orographic snowpeak augmentation by cloud seeding and to develop a set of recommendations regarding public response and communications for officials involved in the project. The organizational sample and method of study are described, and findings on a number of relevant societal characteristics are presented. These include perception of water needs in the area; knowledge of current, previous, and proposed projects; belief in the effectiveness of snowpack augmentation; the principal economic activities of the area and its weather needs; the history of public response to weather modification; the repute and credibility of weather modification personnel; the existence of trade offs in connection with weather modification projects; and information sources of weather modification. Preferred decision procedures are discussed. Organizations were found to adopt a position toward the proposed snowpack augmentation project that reflected their assessment of how it will affect their interests. There was a high rate of agreement that Northern California needs more water, although not everyone agreed that snowpack augmentation was the most desirable way of obtaining increased water supplies. Most respondents believed cloud seeding to be effective in increasing snowfall.

DESCRIPTORS: Artificial snow stimulation; Weather modification and the public; Sierra Nevada, North America

ID NO.- MGA28090117

Effects of carbon black dust on cumulus-scale convection.

Chen, Ching-Sen

Univ. of IL., Urbana; Inst. of Atmos. Sci., S.D. School of Mines and Tech., Rapid City

Journal of Applied Meteorology, Boston, 16(4): 401-412, April 1977. Refs. DAS, DLC

CTRY OF PUBL:US

The effect of seeding with carbon black dust in the tropical atmosphere is simulated in a two-dimensional time- dependent cloud model that covers a region 6.4 kmMULTIPLIED BY3.2 km in the x and z directions, with 200 m grid intervals. Initial conditions are taken from the mean hurricane season soundings for the West Indies area (Jordan, 1958). An equation for the continuity of carbon black dust is added to the model. Scavenging of the carbon black dust by precipitation and cloud water content and diffusion of carbon dust to the ocean surface are included in the model. Radiative heating of the atmosphere by the carbon black is simulated. The heating rate is set proportional to the concentration of carbon black dust at a grid point. Air motion is simulated by horizontal density differences caused by horizontal gradients of the heating rate. The circulations lead to cooling and moistening in updrafts and warming and drying in downdrafts in a conditionally stable atmosphere. In the meantime, the carbon black is redistributed. Three cases are used to test the concept of carbon black dust seeding. Results of this numerical study are not encouraging for the direct formation of cloud lines by the spread of carbon black dust in the tropical atmosphere, unless the atmosphere is much more humid than normal. No conclusions concerning mesoscale effects of the solar heating and indirect formation of cloud lines are possible within the framework of this cloud-scale model.

DESCRIPTORS: Cloud seeding with carbon black

ID NO.- MGA28090116

Preliminary evaluation of the 1976 rain modification project in central Illinois.

Changnon, Stanley A., Jr.
IL. State Water Survey, Urbana

Journal of Weather Modification, Fresno, CA., 9(1): 66-78, April 1977. DAS (QC 928.J6)
CTRY OF PUBL:US

This report is concerned with the joint effort of the College of Agriculture of the Univ. of Illinois and the Illinois State Water Survey to assist in a rain modification program in east central Illinois in the summer of 1976. Facilities were organized for evaluating the precipitation data and interpreting the measurements in a preliminary evaluation of the outcome. The history of the project and the organization of the evaluation effort are reviewed. The limitations of the data are considered, and the analytical procedure is described. The results presented relate to statistical evaluation of radar echo data and precipitation data. A comparison of the seeded and control echo values (averages vs. averages, medians vs. medians) shows that seeded values exceeded the control values in all cases, except when the first indication of an echo appeared. The results, which are not significant statistically, suggest that the seeded echoes grow larger than the control echoes after initiation. The percentage differences (increases or decreases) between the seeded rain and echo values and the comparable control values differed little statistically. However, everything but the T.SUB 0. echo value (before seeding began) indicated an increase varying between 12 and 50%. The area in which storms were seeded definitely received more rain than the areas that were not seeded. It cannot be said with certainty that the increased rainfall was caused by seeding, by chance, or by seeding more vigorous rain producing clouds.

DESCRIPTORS: Cloud seeding evaluation; Illinois, United States

ID NO.- MGA28090115

Characteristics of silver iodide ice nuclei generators currently used by S.O.R.E.M.

Buscaglione, Aldo
Societa Richerche Esperienze Met.

Journal of Weather Modification, Fresno, CA., 9(1): 146-153, April 1977. DAS (QC 928.J6)
CTRY OF PUBL:US

The technical and operational characteristics of two advanced types of ground-based AgI generators developed and used in Italy for rain enhancement and hail prevention campaigns are set forth. The first (type S- 11) is intended for operation from a fixed station; it is rugged, highly reliable, and can be operated by unskilled personnel. The second (type GM-10) is designed for mobile operation; it is trailer-mounted and equipped for travelling stations that are connected with the operational center by radio link, and is directed through radar echo observations. Diagrams of the generators and the operational parameters are given.

DESCRIPTORS: Silver iodide generators; Italy

ID NO.- MGA28090113

Possible effect of surfactants on the evolution of cloud droplet size spectrum.

Podzimek, Josef
Grad. Ctr. for Cloud Phys., Univ. of MO., Rolla

Journal de Recherches Atmospheriques, Clermont-Ferrand, France, 10(3): 129-142, July/Sept. 1976. Refs. English and French summaries. DAS, DLC
CTRY OF PUBL:FR

A one-dimensional model is used to investigate the behavior of droplets originated on salt nuclei covered by a thin layer of in-water insoluble surface active material. The original study of the uniform coating of all-salt nuclei (Podzimek and Saad) is extended to the case of coatings of only several size classes of nuclei and to different updraft velocities. It was found that the coating by in-water insoluble surfactants could influence the microstructure and supersaturation in water cloud at least for several minutes after the coated nuclei were introduced into the cloud at the updraft corresponding to the just developing cumulus type cloud.

DESCRIPTORS: Cloud modification

ID NO.- MGA28090112e
Values of diffusione coefficients deduced from the closing times of helicopter-produced clearings in fog.e
Plank, Vernon G.
United States Air Force. Geophysics Lab., Hanscom AFB, MA.,e Environmental Research Papers, No. 590, Jan. 12, 1977. 21 p.e Refs. (AFGL-TR-77-0019). DLCe
CTRY OF PUBL:US
Values of diffusion coefficients,e determined from the observed closing times of nine conical-shaped clearings in fog, produced by hovering helicopters at Lewisburg, W.V. in Sept. 1969, are presented. The values were established according to the method of Elliott, by assuming that the geometric and diffusive properties of the clearings and surroundings could be approximated by theoretical equations ofe the type governing the diffusion of heat and water substancee in a bounded, circular cylinder of infinite length, withe appropriate specification of the condensation conditions. Thee diffusion coefficients for the experiments ranged in valuee from 0.7 MULTIPLIED BY 10.SUPER 5. to 1.9 MULTIPLIED BY 10.SUPER 5. cm.SUPER 2./sec.e The values were consistent for experiments performed on the same days, but no other correlations with meteorological or geometric parameters of clearing were found. The values are larger than those reported previously for fog situations and, although they are certainly the effective values pertaining to helicopter clearing, there is a question whether they are characteristic of the ambient fog surroundings. This matter is discussed. Summary diagrams are presented to illustrate how a cylindrical or slot-shaped clearing will close-in with time, depending upon the values of the diffusion coefficient and upon the initial temperature and humidity differences between clearing and surroundings.
DESCRIPTORS: Helicopter dissipation of fog; Fog dissipation techniques; Lewisburg, West Virginia

ID NO.- MGA28090111
Early account of a flight to modify lightning storms.
Schaefer, Vincent J.
Journal of Weather Modification, Fresno, CA., 9(1): 1-7, April 1977. DAS (QC 928 J6)
CTRY OF PUBL:US
This paper contains a memorandum written by H. T. Gisborne, Chief of the Division of Fire Research, on an attempt (1948) to seed clouds with dry ice from an aircraft to modify lightning storms. The oxygen apparatus, the dry ice, the C-47 equipment, and the procedure of seeding are described. The experiences in the course of the experiment are summarized.
DESCRIPTORS: Thunderstorm modification; Lightning prevention ; Cloud seeding with dry ice

ID NO.- MGA28090110
Weather & climate modification: problems and progress.
National Research Council. Committee on Atmospheric Sciences, Wash.,D.C.
Wash., D.C., National Academy of Sciences, 1973. 258 p. Refs., appendices. DAS (A QC 928.7 N37)
CTRY OF PUBL:US
This report reviews and updates the findings of an earlier panel report. The findings on an increase in orographic precipitation in the U.S. were confirmed by randomized experiments under physically plausible conditions, which made it possible to discriminate better among levels of precipitation changes. Additional evidence was accumulated that cloud seeding can cause decreases, as well as increases, in precipitation for certain types of clouds. Significant advances were made in mathematical modelling of clouds, precipitation and hurricanes; the physical and statistical design of experiments; and the technology and measurement of cloud seeding. Experiments to diminish the intensity of hurricanes provide some basis for optimism. Experimentation guided by models was conducted to augment precipitation from tropical cumulus; and experiments on cumulus towers were begun. A major program to explore the possibility of decreasing damage from hail was initiated in Colorado; and the effects of supersonic transports upon inadvertent climate modification were studied.
DESCRIPTORS: Weather modification; Climate modification; Progress in weather control; Progress in cloud seeding

ID NO.- MGA28080389
Current research on hailstorms and their modification.
Canada. Alberta Research Council, Edmonton
Its Atmospheric Sciences Report 77-3, March 1977. 103 p. Refs. Pertinent articles abstracted separately.
CTRY OF PUBL:CA
This publication contains seven papers dealing with results of research on hailstorm systems. They deal with the testing of the Ninomiya criteria for severe convection; use of simple numerical cloud models in evaluating a hail suppression project; methodological approach analysis and results of radar observation; computer analysis of radar data; hailfall studies and the relationship of hailfall to crop damage; a study of silver iodide; area concentration and average concentration of silver in precipitation during cloud seeding; and analysis of Alberta hail crop insurance data.
DESCRIPTORS: Hail research; Hail suppression; Collected works

ID NO.- MGA28080096
Silver disposition.
Zacharuk, E.
Canada. Alberta Research Council, Edmonton, Atmospheric Sciences Report 77-3, March 1977. p. 63-72. Refs.
CTRY OF PUBL:CA
During the 1976 Alberta Hail Project field season, the concentration of silver iodide in precipitation was measured by atomic absorption spectrophotometry in 1565 rain samples and 287 mixed samples (samples of rain and hail obtained at the same time and location). Seeding material, dispersion area, contamination, and average concentration of silver in precipitation were investigated. It was found that the mean concentration of silver in precipitation from unseeded clouds was approximately 2.5 MULTIPLIED BY 10.SUPER -..SUPER 1..SUPER 2. gml.SUPER -..SUPER 1. and that 97% of the samples showed silver concentration less than 6.0 MULTIPLIED BY 10.SUPER -..SUPER 1..SUPER 2. gml.SUPER -..SUPER 1.. The remaining three percent of the samples showed concentrations greater than 6.0 MULTIPLIED BY 10.SUPER -..SUPER 1..SUPER 2. gml.SUPER -..SUPER 1. and, hence, were regarded as contaminated because of their widely varying concentration values.
DESCRIPTORS: Cloud seeding with silver iodide; Silver in precipitation; Alberta, Canada

ID NO.- MGA28080095
Rainfall results, 1970-1975: Florida area cumulus experiment.
Woodley, William L.
Cumulus Group, Natl. Hurricane & Experimental Met. Lab., NOAA, CoralGables, FL.
Science, Wash., D.C., 195(4280): 735-742, Feb. 25, 1977. Refs. DLC
CTRY OF PUBL:US
Analysis without the benefit of data stratification and appropriate covariates of the 48 random experimentation days, obtained through 1975, provided no evidence that dynamic seeding altered rainfall appreciably over the fixed target area (1.3 MULTIPLIED BY 10.SUPER 4. km.SUPER 2.). Partitioning of the experimentation days, according to whether the convective echoes moved across the Florida peninsula or developed in situ, was more informative. Use of this echo motion covariate, using five meaningful predictor models of natural rainfall, in a step- wise regression program produced persuasive evidence for an effect of seeding in both echo motion categories. For days with moving echoes, there is evidence for a positive, statistically significant treatment effect on the rainfall from the subject clouds (the floating target) and in the overall target area. The results for days with stationary echoes, although considerably more tentative, suggest that seeding produces more rainfall in the floating target, but produces no net change of the precipitation in the overall target area. The ramifications of this result and a possible explanation are discussed.
DESCRIPTORS: Cloud seeding evaluation; Florida Area Cumulus Experiment (FACE); Artificial rain stimulation; Florida, United States

ID NO.- MGA28080093
Covariance analysis technique based on bivariate log-normal distribution with weather modification applications.
Mielke, Paul W., Jr.
Dept. of Statistics, CO. State Univ., Fort Collins; Dept. of Computer Sci. and Statistics, CA. Polytech. State Univ., SanLuis Obispo
Journal of Applied Meteorology, Boston, 16(2): 183-187, Feb. 1977. Refs. DAS, DLC
CTRY OF PUBL:US
A statistical technique based on the bivariate log-normal distribution is presented for analyses of treatment (cloud seeding) effects on measurements (precipitation amounts) when appropriate covariates (correlated control area measurements) are available. An example is given which evaluates effects of seeding on specific 500-mb temperature partitions of 24-hr precipitation amount data from the 1964-1970 Wolf Creek Pass wintertime orographic cloud seeding experiment. In addition, an appendix includes an analogous analytic technique based on the bivariate log-normal distribution for cross-over designs.
DESCRIPTORS: Cloud seeding evaluation; Orographic cloud seeding; Statistical tests of cloud seeding; Wolf Creek Pass, Colorado

ID NO.- MGA28070047
Photos of seeded Alberta storms.e
Warner, Charles
McGill Univ., Montreal, Canada. Stormy Weather Group, Scientific Report MW-89, Jan. 1977. 27 p. Refs.e
CTRY OF PUBL:CA
Photographs and supporting data are presented in six casee studies of seeded Alberta hailstorms. The author accompaniede aircrews on 37 seeding missions during 1976, on 27 different days, during which about 75 kg of silver iodide were injectede into 37 different storms, either by dropping flares from about the -10°C level into small clouds adjacent to the main updrafts (top seeding) or by burning flares at cloud base. About 1800 photos were taken, of unseeded and seeded stormse before, during, and after seeding. No evidence from this worke indicated that large storms, of which two were photographed, differ fundamentally from smaller multicellular storms,e composed of towers appearing in succession. On many occasions,e apparently because of release of latent heat of fusion, tope seeding seemed to result in enhanced growth of the small clouds, in an array of towers of relatively small sizes, withe glaciation following. Small storms often dissipated after seeding. On many other occasions, no phenomena suggestive of abnormal behavior were discerned in the photos.
DESCRIPTORS: Hail suppression experiments; Hailstorm modification; Alberta, Canada

ID NO.- MGA28070046
On the status of hail suppression.
Changnon, Stanley A., Jr.
IL. State Water Survey, Urbanae
American Meteorological Society, Boston, Bulletin,e 58(1): 20-28, Jan. 1977. Refs. DAS, DLC (QC851.A6)
CTRY OF PUBL:US
A technology assessment of the future potential of hail suppression and all its possible ramifications in the U.S. includes an attempt to define the current status of hail suppression. Hail suppression is at the stage in which the socioeconomic impacts of its use and the means to optimize its future utilization can be adequately treated. The estimation of a wide range of future suppression capabilities was based on the current status, which was defined after inspecting three sources of information: 1) results from preliminary evaluations of six recent projects; 2) findings on four published assessments of weather modification; and 3) results from two opinion surveys. This investigation indicates that 1) scientific beliefs about existing capabilities are widely different, with the majority of experts believing that there is no capability; 2) the published reviews are optimistic, but largely nondefinitive; and 3) the results of five recent suppression projects show suppression levels of 20-50%, but the results are largely not significant at the 5% level. This difference between average beliefs of experts and the results of recent projects suggests the need for an extensive investigation of the data and results of these recent projects.
DESCRIPTORS: Hail suppression; United States

ID NO.- MGA28070045
Weather modification in the Soviet Union, 1976.
Battan, Louis J.
Inst. of Atmos. Phys., Univ. of AZ., Tucson
American Meteorological Society, Boston, Bulletin, 58(1): 4-19, Jan. 1977. Refs. DAS, DLC (QC851.A6)
CTRY OF PUBL:USe
The U.S.S.R. has a large investment in weather modification research and operations. Major cloud physics experiment facilities exist at the Institute of Experimental Meteorology and at the Institute of Geophysics of the Georgian Academy of Sciences. Hail suppression operations are being conducted over about 5,000,000 ha of farmland. Although claims of success in these activities are more modest than they were in 1969, it is still reported that the benefits far exceed the costs. There is relatively little research and, at this time, apparently only one small-scale operational program dealing with precipitation augmentation. Research in the Ukraine over the last three years has led scientists there to conclude that ice nuclei seeding of cumulonimbus clouds over a substantial area caused rainfall increases of about 30%. It was also reported that snow from frontal clouds was increased.
DESCRIPTORS: Weather modification; Cloud seeding research; Union of Soviet Socialist Republics

ID NO.- MGA28060405
Bacteria acting as natural ice nucleants at temperatures approaching -1°C.
Schnell, Russell C.
NRC, Atmos. Phys. and Chem. Lab., NOAA/ERL, Boulder, CO.
American Meteorological Society, Boston, Bulletin, 57(11): 1356-1357, Nov. 1976. Refs. DAS, DLC (QC851.A6)
CTRY OF PUBL:US
Bacterial ice nucleants may be playing an important, if not pivotal, role in some atmospheric ice nucleation processes that occur at temperatures warmer than -10°C, and some species of bacteria are probably intimately involved in reducing plant resistance to freezing temperatures. Control of the ice-nucleating bacteria active between 0 and -5°C present on high-value crops, such as orchard fruits, ornamentals, and vegetables, holds promise of saving millions of dollars per year at a cost-to-benefit ratio of at least 1:10 and perhaps even 1:1000.
DESCRIPTORS: Frost damage prevention; Natural ice-forming nuclei

ID NO.- MGA28060117
Olympus cumulus project, Pt. 2, Artificial draining of summer ground-clouds by cloud catchers of different types.
Kyriazopoulos, B. D.
Thessaloniki, Greece. Univ. Meteorological Institute, Meteorologika, No. 25, 1976. p. 3-47. Refs. English and Greek summaries. For abstract of Pt. 1, see Met. Abs., 20.1-166.
CTRY OF PUBL:GR
In the course of the Olympus Cumulus Project of the Meteorological Institute of the University of Thessaloniki, different types of water-cloud catchers were tested in the Meteorological Observatory of Agios Antonios' peak of Mount Olympus from ground-cloud formations of great altitudes (2817 m). For the purpose of obtaining the most suitable instrument, during the five-year period 1965 to 1969, many types of mesh cloud catchers were designed and used in Olympus. They were different in size, form, material of manufacture, and in the detailed structures of the cloud catcher's mesh. The main conclusions of this study are 1) in regard to the material of manufacture, the plastic meshes drain more cloud water than those made of metal; 2) in regard to the form, the cloud catcher consisting of two single-axle cylinders presents certain advantages; and 3) in regard to the structure of the mesh elements and within the limits of the experiment, the water collection increases in proportion to the thickness of the wiring and the area of the mesh openings.
DESCRIPTORS: Olympus Cumulus Project; Cloud modification research; Mt. Olympus, Greece

ID NO.- MGA28050116
Effects of weather modification on Northern Great Plains Grasslands: a preliminary assessment.
Perry, David A.
MT. Dept. of Natural Resources and Conservation, High Plains Program,Miles City
Journal of Range Management, 29(4): 272-278, July 1976. Refs.
CTRY OF PUBL:US
Possible effects of weather modification on Northern Great Plains grasslands are examined by using published reports on community-water relations. It is concluded that 1) long-term incremental forage production will be governed by the effect of added water on nutrient cycling rates; 2) community composition will change, but the nature of the change will depend upon the timing of added precipitation; and 3) increased forage in the absence of increased nitrogen may have a neutral or negative effect on livestock weight gains.
DESCRIPTORS: Cloud seeding effects on crops; Forage crops; Grass ecology; Northern Great Plains, North America

ID NO.- MGA28050115
Molecular studies of the ice-forming capabilities of different surfaces.
Morachevsky, V. G.
Leningrad Hydromet. Inst., Leningrad, U.S.S.R.
Journal of the Atmospheric Sciences, Boston, 33(1): 1989-1994, Oct. 1976. Refs. DAS, DLC
CTRY OF PUBL:US
The objective of the present study was to determine the nature of ice-forming capabilities of different chemical compounds, the effectiveness of which is determined by the character of the forces binding water molecules to the surface of the compound. Adsorption layers of water and ammonia on the salts of silver and lead were studied. Dependence between the surface properties and ice-forming capabilities of the chemical compounds was investigated. Direct molecular structural analysis by IR spectroscopy and nuclear-magnetic resonance were used in those studies. An active nucleus, the surface of which stimulates the water-to-ice phase transition for water molecules condensed on it, must have a hydrophobic matrix with open structure and centers capable of interacting with water molecules. There seem to be two reasonable ways of artificially modifying a surface with the objective of stimulating the water-to-ice phase transition of condensed water: 1) contamination of the hydrophobic surface with active centers, which can interact with water molecules, or 2) suppression or removal of part of the active centers of a hydrophilic surface.
DESCRIPTORS: Cloud seeding substances; Ice nucleability

ID NO.- MGA28050070
Monitoring cloud-seeding conditions in the San Juan mountains of Colorado.
Kahan, Archie M.
Bureau of Reclamation
United States Geological Survey, Wash., O.C., Professional Paper 929, 1976. p. 214-216. OLC
CTRY OF PUBL:US
The use of ERTS data collection platforms (DCPs) in Project Skywater, the weather modification program of the U.S. Bureau of Reclamation, is described. Data information obtained by the platforms high in the rugged San Juan Mountains of southwestern Colorado, relayed rapidly by the data collection system (DCS), is incorporated into the decision making process of the Colorado River Basin Project, a part of the Skywater Project. Sensing devices, linked to the platforms, monitor precipitation, temperature, relative humidity, wind direction, wind speed, snow water content, and streamflow. Samples of Project Skywater DCS platform data are given.
DESCRIPTORS: Satellite uses in weather control; Cloud seeding potentialities; Project Skywater; ERTS-1; San Juan Mts., Colorado

ID NO.- MGA28050024e
Comparison of the Z-R relationships for seeded and nonseededе Florida cumuli.
Cunning, John B., Jr.
Natl. Hurricane & Experimental Met. Lab., NOAA, Corale Gables, FL.
Journal of Applied Meteorology, Boston, 15(10): 1121-1125,e Oct. 1976. Refs. DAS, DLCe
CTRY OF PUBL:US
Raindrop size distributions were measured at cloud basee during the 1971-73 Florida Area Cumulus Experiment to studye the effect of cloud seeding on the Z-R relationship. The Z-Re points derived from the seeded distributions appear within thee 95% confidence limits for the Z-R relationship and well withine the natural variability of Z-R points on a day-to-day basis.e
DESCRIPTORS: Rainfall rate-radar reflectivity relationships;e Cloud seeding effects; Florida, United States

ID NO.- MGA28040279
Fine-scale structure of convective storms: implications for cloud seeding in Alberta.
Barge, B. L.
Alberta Res. Council, Edmonton
Canada. Alberta Research Council, Edmonton, Atmospheric Sciences Report 76-3, .1976.. 19 p. Refs.
CTRY OF PUBL:CA
Recently, the existence and nature of fine-scale radar reflectivity patterns within hailstorms were revealed by Barge and Bergwall (1976). These patterns have characteristic horizontal dimensions of about 4 km; new patterns form at a rate of about one every two minutes. The patterns are smaller, more numerous, and form more frequently than previously observed cells within multicellular storms. These time-dependent, fine-scale patterns are also found within storms often classed as supercells. The patterns are, therefore, considered to provide a vital link among storm types, which fall within a continuum of hailstorm structures. It is suggested that the fine-scale radar reflectivity patterns are associated with hailgrowth, and that the patterns provide a common basis for cloud seeding, regardless of storm type. These new results have prompted amendments to cloud seeding procedures based upon multicellular storm models. It is proposed that a physical basis now exists for more frequent and extensive cloud seeding, where the intent is to promote beneficial competition among hail embryos and, thereby, to reduce hail. To seed generation regions as early as possible, the cloud seeding reagent is to be placed at freezing temperatures into the shelf cloud, an extensive region of new growth on the edges of storms thought to contain natural hail embryos. These results stress the need for cloud seeding aircraft to drop seeding reagents (produced by pyrotechnic flares) into clouds at temperatures between 0 and -7"C. Seeding at cloud base where updrafts are weak is also proposed as an alternate to seeding the strongest updrafts associated with storms.
DESCRIPTORS: Hailstorm structure; Radar observation of hailstorms; Hail prevention techniques; Alberta, Canada

ID NO.- MGA28040076
Silver content of precipitation from seeded and nonseeded Florida cumuli.
Wisniewski, Joe
Dept. of Environ. Sci., Univ. of VA., Charlottesville; Dept. of Atmos. Sci., CO. State Univ., Ft. Collins; Natl. Hurricane and Experimental Met. Lab., NOAA, Coral Gables, FL.
Journal of Applied Meteorology, Boston, 15(9): 1004-1011, Sept. 1976. Refs. DAS, DLC
CTRY OF PUBL:US
A subprogram of NOAA's 1973 Florida Area Cumulus Experiment (FACE) was undertaken to determine the silver content of precipitation associated with convective clouds massively seeded with silver iodide nucleant over southern Florida. An atomic absorption analysis of 127 rainwater samples collected just below cloud base by a polypropylene- lined scoop mounted on the fuselage of the NOAA DC-6 aircraft indicated that the mean concentration of silver obtained on seed days (69 samples) was no greater (and, in fact, appreciably less) than that obtained on no-seed days (58 samples). In both sets of samples, the median concentration of silver was more than two orders of magnitude lower than the U.S. Public Health safety limit of 5 MULTIPLIED BY 10.SUPER -..SUPER 8. g ml.SUPER -..SUPER 1.. Of the 69 aircraft samples collected on seed days, only two contained a concentration of silver in excess of 1 MULTIPLIED BY 10.SUPER -..SUPER 9. g ml.SUPER -..SUPER 1.. Of the 58 aircraft samples collected on no-seed days, eight contained silver in concentrations exceeding 1 MULTIPLIED BY 10.SUPER -..SUPER 9. g ml.SUPER -..SUPER 1.. The samples collected from the aircraft showed higher mean concentrations of silver than did those collected on the ground. An atomic absorption analysis of 79 rainwater samples collected at both fixed and mobile sites on the surface showed that the mean concentration of silver on seed days was three orders of magnitude less than 5 MULTIPLIED BY 10.SUPER -..SUPER 8. g ml.SUPER -..SUPER 1.; the maximum concentration of silver found in any sample did not exceed 1 MULTIPLIED BY 10.SUPER -..SUPER 9. g ml.SUPER -..SUPER 1.. Statistical results from the nonparametric Mann-Whitney-Wilcoxon test suggest that the surface seeded (34 samples) and surface nonseeded (45 samples) data come from the same population (i.e., no significant differences between the two data sets). There is some evidence (from a separate set of surface rainwater samples collected upwind of the target area) to suggest a persistently higher (by about a factor of 2 or 3) mean concentration of silver during the course of the experiment than either before or after the experiment.
DESCRIPTORS: Cloud seeding with silver iodide; Silver in precipitation; Florida, United States

ID NO.- MGA28040075

Supersonic expansion method of ice nuclei generation for weather modification.

Fukuta, N.

Denver Res. Inst., Univ. of Denver, CO.

Journal of Applied Meteorology, Boston, 15(9): 996-1003, Sept. 1976. Refs. DAS, DLC

CTRY OF PUBL:US

Aerosols of organic ice nucleating agents were formed by rapid adiabatic expansion, by passing superheated steam laden with the organic vapors through a supersonic nozzle. The effect of the Mach number of the flow through the nozzle upon the aerosol particle size and number concentration was investigated. It was found that the number of particles formed increased by a factor of 10.SUPER 3. as the Mach number increased from 1 to 2, but further increases in Mach number had little effect. The ice nuclei activity spectra of the organic aerosols thus generated showed plateaus at colder temperatures, with approximately 10.SUPER 1..SUPER 4. nuclei per gram below -9°C for 1.5-dihydroxynaphthalene and 10.SUPER 1..SUPER 3. g.SUPER -..SUPER 1. below -7°C for metaldehyde. Coagulation rates of both organic smokes were determined. Coagulation of 1.5-dihydroxynaphthalene aerosols followed the Smoluchowski equation. Coagulation of metaldehyde aerosols was extremely rapid, and the coagulation constant increased with time. The latter effect was attributed to the strong electrical dipole of metaldehyde particles.

DESCRIPTORS: Aerosol generators; Cloud seeding substances

ID NO.- MGA28040074

Social acceptance of weather modification: the emergent South Dakota controversy.

Farhar, Barbara C.

Colorado. Univ., Boulder. Institute of Behavioral Science. Program on Technology, Environment and Man, Monograph No. 23, 1976. 193 p. Refs., tables. (NSF Grant nos. GA-28364, GI-35452, GI-44087, and ERT74-18613 A01). DAS (A QC 928)

CTRY OF PUBL:US

This monograph constitutes an analysis of public opinion in South Dakota concerning cloud seeding. It is based upon longitudinal and monitoring surveys conducted prior to the development of public opinion against cloud seeding and in the course of development of opposition to it. The development of the South Dakota Weather Modification Program (SDWMP) is described. The methodology of the research, including the survey procedures, the sampling, and the limitations of the data, are set forth. The emergence of organized opposition to SDWMP at the grass-roots level is described. The public response to weather modification in South Dakota from 1972-1974 is presented on the basis of a longitudinal survey conducted in 20 counties. The following aspects are included: general attitudes toward weather modification; belief in the effectiveness of cloud seeding; perception of weather; knowledge about SDWMP; local and non-local programs; knowledge and opinion on decision-making and funding processes; and knowledge and public opinion about cloud seeding and the Rapid City flood. The question of change in attitudes and opinion over time is analyzed using multivariate analysis. Opinions are given on respondent change from respondents who were initially favorable and unfavorable and the important factors in the respondent assessment of their local cloud seeding programs and of SDWMP. Before the beginning of the SDWMP, majority favorability to the idea of modifying weather for the benefit of agriculture existed in participating counties. By 1973, basically favorable attitudes remained the majority point of view, but a sizable minority constant expressed reservations about cloud seeding on the grounds of possible undesirable consequences or thought that modification should be left to nature or to God. This minority constituted 40%. By 1974, belief that cloud seeding could increase rainfall had fallen off somewhat; evaluation of programs was less favorable than it had been in previous interviews, but the majority of respondents was in the neutral favorable range. Concern about side effects, religions, and attitudes toward nature were the most important factors in determining evaluation of the SDWMP programs before inception. In the course of time, these concerns were replaced by perception of the effects of the projects.

DESCRIPTORS: Weather modification and the public; Cloud seeding in South Dakota, United States; South Dakota, United States

ID NO.- MGA28030265
National hail research experiment.e
Lansford, Henry
Natl. Ctr. for Atmos. Res., Boulder, CO.
Weatherwise, Boston, 29(4): 168-171, 190-191, Aug. 1976. DAS, DLC
CTRY OF PUBL:US
The NHRE, which began its field work in 1971, is designed to gain new knowledge about the dynamics and microphysics of hailstorms and to evaluate the feasibility of using cloud seeding as a tool to reduce crop damage from hail. The field research is done in ''Hail Alley,'' the region of highest hailstorm frequency in the U.S., centered around the point where Colorado, Nebraska, and Wyoming join. The 1976 NHRE field research program was a vigorous effort to study the structure and behavior of high plains convective thunderstorms in detail. A network of radar systems probed storms that passed across the research area. An extensive network of ground based instruments for measuring precipitation, temperature, wind and other atmospheric parameters was spread across an area of several hundred square miles stretching eastward from Grover toward Sterling, CO., and Kimbal, NB. Although no cloud seeding was done during the 1976 NHRE field program, this vigorous research effort was aimed at designing a cloud seeding experiment to be conducted in future summers. Two types of hailstorms are possible in this area: the supercell and the common multicell.
DESCRIPTORS: National Hail Research Experiment; Hail research; Hail suppression; United States

ID NO.- MGA28030113
Typhoon intensity changes in the Pacific Stormfury area.
Sadler, James C.
Dept. of Met., Univ. of Hawaii, Honolulu
Hawaii. Univ., Honolulu. Dept. of Meteorology, UHMET-76-02, April 1976. 13 p. + 37 figs. Refs. DAS (A QC 851 H3)
CTRY OF PUBL:US
A climatology of typhoons within the proposed Pacific Stormfury operating area is compiled for the months of July-Oct. during the period of 1967-1974. A steady-state typhoon for even 24 hr is rare within the area. Case studies of supertyphoon ''Rita'' and intense typhoons ''Phyllis'' and ''Tess'' of July 1972 are shown to relate their major intensity changes to changes in the large-scale circulation of the upper troposphere. Common to each during the rapid deepening phase were 1) a strong cyclonic cell in the tropical upper tropospheric trough positioned north of the typhoon for vigorous outflow toward the north and 2) an outflow channel toward the south into the near equatorial easterlies. Each typhoon began to fill when either of these efficient outflow channels was denied to it.
DESCRIPTORS: Typhoon development; Typhoon intensities; Pacific Ocean

ID NO.- MGA28030058
Mesure du pouvoir glacogene de l'air au centre d'un reseau de generateurs d'iodure d'argent. .Measurement of ice forming capacity of air in the center of a network of silver iodide generators..
Association Nationale de Lutte contre les Fleaux Atmospheriques, Toulouse, .Rapport sur la campagne., No. 24, April 1976. p. 25-33. Refs. DLC, DNAL
LANGUAGE: fr
CTRY OF PUBL:FR
The continuous measurement of the ice forming capacity of the atmosphere during the operation of silver iodide generators was measured over a long period in an NCAR type acoustical detection chamber. The measurement procedure is described, and the results of daily measurements are presented. The ice-nuclei-forming capacity of the atmosphere was closely associated with AgI emission. Interruption during a long seeding period (about 10 days) was marked by a reduction in the ice-nuclei-forming capacity of the atmosphere. Sometimes persistent increase in the number of nuclei seemed not to be associated with a known continuous source of AgI. At times, also, the emission of AgI did not lead to an increase of nuclei.
DESCRIPTORS: Silver iodide effectiveness; Silver iodide ice forming properties

ID NO.- MGA28030057

Etat actuel des connaissances sur la dispersion des particules d'iodure d'argent a partir du sol. .State of knowledge on the diffusion of silver iodide particles from the ground..

Association Nationale de Lutte contre les Fleaux Atmospheriques, Toulouse, .Rapport sur la campagne., No. 24, April 1976. p. 35-41. Refs. DLC, DNAL

LANGUAGE: fr

CTRY OF PUBL:FR

Current knowledge on the actual dispersion of AgI particles emitted into the atmosphere from ground generators is discussed on the basis of a review of the literature on the photolytic deactivation of AgI and the dispersion of silver iodide from the ground. A detailed analysis of the studies made in the past 25 yr on the behavior of AgI particles under natural or artificial UV radiation indicates that these radiations do not act in the same manner on all nuclei, whose capacity to resist this action depends in a large measure upon the manner in which they have been produced-the nature of the fuel and solvent used play a dominant role. In addition, when a particular type of AgI generator is used, it is necessary to study the ice nuclei forming capacity of the aerosol under all aspects, both in the laboratory and atmosphere, because results obtained by others, frequently under different conditions, may be unreliable. It is necessary to make certain that the aerosol used conserves its ice forming capacity at least in a suitable proportion under solar action, since there is some evidence that the intense heat of storm days disperses the AgI particles sufficiently high for cumuliform clouds to be seeded.

DESCRIPTORS: Silver iodide diffusion; Silver iodide effectiveness

ID NO.- MGA28030055

Visit to various weather modification operations sites in the USSR, 15 August-7 September 1974, summary report.

Henderson, Thomas J.

Fresno, CA., Atmospherics Inc., March 16, 1975. 56 p. Appendix. DAS (A QC 928.74 R9H4)

CTRY OF PUBL:US

This publication constitutes the diary of a visit to the sites of weather modification operations in the U.S.S.R. made by the author in 1974. Descriptions of the visits to Tiflis, Nalchiki, and Kishinev; of the investigations and operations of hail modification at each of these sites, including the rockets and radar, the cloud seeding procedures, etc.; and summaries of discussions with some of the investigators are presented. The effectiveness of hail prevention in the U.S.S.R. and the comparative hail prevention operations in the U.S.S.R. and U.S.A. are discussed.

DESCRIPTORS: Weather modification operations; Union of Soviet Socialist Republics

ID NO.- MGA28020122

Theoretical study of some effects of artificial seeding on mixed phase cumulus clouds.

Scott, Bryan C.

Cloud Phys. Group, Atmos. Sci. Dept., Univ. of WA., Seattle Washington (State). Univ., Seattle. Dept. of Atmos. Sciences, Contributions from Cloud Physics Group: Collection of Reprints, Vol. 19, .1976?.. .6 p... Refs. Reprint of the paper presented at WMO Scientific Conference on Weather Modification, 2nd, Boulder, CO., Aug. 2-6, 1976. p. 117-122. DAS

CTRY OF PUBL:US

The development of the ice phase in maritime and continental cumulus clouds was investigated by means of a one-dimensional, time-dependent, Eulerian model, in which five different particle classifications interacted among themselves and with cloud droplets. The ice particles consisted of unrimed and rimed plates and columns, graupel, and snowflakes. The effects of possible ice multiplication were investigated by permitting ice splinters to be produced during riming and during freezing of isolated drops. Drop size distribution was found to be the dominant mechanism for forming graupel in shallow, nonprecipitating, maritime and continental clouds. The ice splintering studies demonstrated the sensitivity of the ice multiplication process to the presence of large cloud drops. In the continental cloud, the riming mechanism never produced significant increases in ice crystal concentrations, but in the maritime cloud, it produced orders of magnitude increases after the updraft had decreased sufficiently to permit the formation and sedimentation of large drops and graupel.

DESCRIPTORS: Cumulus cloud seeding; Cloud seeding effects

ID NO.- MGA28020121

Watershed management:e state of the practice precipitation modifications.

Farnes, Phillip E.

USDA, Soil Conserv. Serv., Bozeman, MT.

In: Heady, Harold F.; Falkenborg, Donna H.; Riley, J. Paul (eds.), Watershed management on range and forest lands. Logan, Utah. State Univ., Utah Water Research Lab., March 1976. p. 175-180. Refs.e

CTRY OF PUBL:USe

This paper discusses snow management, weather modification, and lightning control. Snow surveys have evolved into a data-gathering program that encompasses collecting information on total precipitation, temperature, wind, radiation, relative humidity, snow depth profiles, and total snowfall in addition to snow depth and water content. Since the West-Wide Cooperative Snow Survey Program began in the 1930s, snow course sites have grown to more than 1900 in the western U.S. Weather modification aims, means, and results are reviewed. Little work has been done on lightning control. Most of the work to date was done in region 1, U.S. Forest Service, in the northern Rocky Mountain area of the U.S. Project Skyfire was the first systematic program on lightning control.

DESCRIPTORS: Weather modification; Snow control; Lightning prevention; United States

ID NO.- MGA28020120

Wetterbeeinflussung: gegenwartiger Stand und Perspektiven. .Weather modification: present status and prospects..e

Breuer, Georg

Naturwissenschaftliche Rundschau, Stuttgart, 29(8): 270-272, Aug. 1976. Refs. DAS, DLC (QC.NB)

LANGUAGE: ge

CTRY OF PUBL:GE

The present state of the art of weather modification, including methods used, results obtained, and future prospects, is reviewed concisely by considering the following: fog dispersal, precipitation augmentation, reduction of lightning and forest fires, and weakening of hurricanes.

DESCRIPTORS: Weather modification

ID NO.- MGA28010358

Meteorologie et energie electronucleaire: le comportement dynamique et thermodynamique d'une masse d'air chaud et humide rejete dans l'atmosphere. .Meteorology and atomic energy: dynamic and thermodynamic behavior of a warm and humid air mass released into the atmosphere..

Tschirhart, G.

Met. Natl., Detache a Electricite de France

La Meteorologie, Paris, Serie 6, No. 2, Sept. 1975. p. 89-104. Refs. DLCe

LANGUAGE: fr

CTRY OF PUBL:FR

The operational principles of a wet cooling tower are described, and the water vapor emission of a nuclear power station of 1000 MWe is found to amount to 2200 tons, a value comparable to that required for the development of a fair weather cumulus (Meis mass of air in grams, We is water vapor discharge by the cooling tower, gsec.SUPER -..SUPER 1.). The dynamic behavior of the plume of emitted air is investigated by means of the equations of G. A. Briggs. The thermodynamics of the plume is investigated both for horizontal and vertical plumes. The heat flux emitted to a height of 150 to 200 m above the ground permits the plume to attain a height equal to several times the height of the cooling tower. Consequently, the impact of the water vapor emitted by the cooling tower may be imperceptible at the ground. The risk of fog formation at ground level is zero, and the risk is also nonexistent in the case of aerodynamic downwash of the plume. The only precipitation possible from a wet cooling power results from the priming phenomenon, which can be reduced by 99%. The principal climatic modification that may result from the water vapor condensation of a plume may be the formation of localized cloudiness several kilometers from the cooling tower.

DESCRIPTORS: Industrial plant effects on climate; Cooling tower effects; Nuclear power plants

ID NO.- MGA28010357

METROMEX 1975: a summary report, including a review of operations conducted by Atmospherics Inc. during the period 1971-1975.

Henderson, Thomas J.

Atmospherics Inc., Fresno, CA., Contract AT(11-1)-1199, for Illinois State Water Survey, Urbana, March 5, 1976. 53 p. Refs., photos. DAS

CTRY OF PUBL:US

The history of project METROMEX since its initiation in 1971, its aims, project design equipment and operations, and the results obtained for the period 1971-1975 are summarized. Particulates, temperature, and moisture (or lack of moisture) from the total urban complex produce a strong influence on the location of the first clouds of the day. On any given day, the effects from particulates, temperature, and moisture significantly influence natural cloud formation and precipitation from any particular weather system. The temperature bubble produced by the urban complex is well established, and the magnitude is on the order of 2°C. Throughout the 5-yr study period, the average particulate concentration continued to increase throughout the general rural areas surrounding the St. Louis complex, as well as over the metropolitan area itself. Also, observations on cloud height and structure, transport mechanisms, precipitation, freezing nuclei concentrations, ozone concentrations, etc. are summarized.

DESCRIPTORS: Project METROMEX; Urban influences; St. Louis, Missouri

ID NO.- MGA28010102

1975 Florida area cumulus experiment (FACE): operational summary.

United States National Oceanic and Atmospheric Administration. Environmental Research Labs., Boulder, CO., Technical Memorandum (NOAA TM ERL WMPO-28), June 1976. 186 p. Refs. DAS (A QC 807.5 U6W5)

CTRY OF PUBL:US

The Florida Area Cumulus Experiment (FACE), continued in 1975 for the 92 days between June 16 and Sept. 15 with randomized seeding and other studies over 1.3 MULTIPLIED BY 10.SUPER 4. km.SUPER 2., is summarized. The project consisted of a core seeding program and ten subprograms. The Core Seeding Program involved randomized (by days) dynamic seeding of cumulus groups in the FACE target with rain volume measured by the calibrated digitized WSR- 57 radar of the National Hurricane Center and then adjusted by rain gages. The subprograms were comprised of the following: 1) cloud physics; 2) an extensive surface network for the measurement of wind, temperature, dew point, pressure, and rainfall; 3) a field rawinsonde and piball effect; 4) mobile surface rainwater collection and analysis of seeded and unseeded rain; 5) collection of water and aerosol from an aircraft at cloud base on experimental days; 6) a tri-Doppler radar program for measurement of incloud motions; 7) airborne and ground photography; 8) analysis of synoptic-scale conditions on each day; 9) studies of Florida convection and satellite observations; and 10) a public information program. In addition to the operational summary, some preliminary data are presented.

DESCRIPTORS: Florida Area Cumulus Experiment (FACE); Cloud seeding in Florida; Florida, United States

ID NO.- MGA28010101

Project Stormfury.

Marine Observer, London. 46(253): 118-126, July 1976. Refs. DLC, CU-S

CTRY OF PUBL:UK

Project Stormfury was formed in 1962 as a cooperative venture of the Dept. of Commerce and the Dept. of Defense. Its objective is to investigate ways for man to alter tropical cyclones beneficially. The organization has changed during the past few years, and the project is now basically a NOAA program. Project Stormfury experiments are designed to alter the balance of forces in the region surrounding the eye of a tropical cyclone, thus causing a redistribution of energy concentrated near the storm's center. The Stormfury hypothesis (or model) and its verification are discussed.

DESCRIPTORS: Project Stormfury; Hurricane modification

ID NO.- MGA28010100

Weather modification and three-dimensional mesoscale models.

Cotton, William R.

Dept. of Atmos. Sci., CO. State Univ., Ft. Collins; Dept. of Environ. Sci., Ctr. for Advanced Studies, Univ. of VA.,Charlottesville

American Meteorological Society, Boston, Bulletin, 57(7): 788-796, July 1976. Refs. DAS, DLC

CTRY OF PUBL:US

The application of three-dimensional time-dependent models to weather modification experiments along with the ways in which mesoscale simulations may be used as an aid in clarifying and formulating the physical basis of a weather modification hypothesis is discussed. Such models can be an aid in the design of field experiments, in the evaluation of field experiments, and in decision making during the daily operations of the experiment. Not only does the challenge of weather modification require considerable advancement in the understanding of the complex physics and dynamics of mesoscale processes, but it is also essential to develop parameterizations of these processes for a mesoscale model to be of value in the post hoc analyses of weather modification experiments and as a decision aid.

DESCRIPTORS: Weather modification; Mesoscale models

ID NO.- MGA28010099e
Statistical analyses of a randomized lightning modificatione experiment.
Baughman, Robert G.e
USDA Forest Serv., Northern Forest Fire Lab., Missoula, MT.;e Dept. of Statistics, CO. State Univ. Fort Collinse
Journal of Applied Meteorology, Boston, 15(7): 790-794, Julye 1976. Refs. DAS, DLC
CTRY OF PUBL:US
Analyses and interpretations of data from a randomized lightning modification experiment yield strong evidence that AgI seeding of mountain thunderstorms reduces the frequency of lightning and alters several lightning characteristics. Statistical procedures include likelihood ratio tests based on the log-normal distribution and two nonparametric tests (Wilcoxon and sum-of-squared ranks tests). Specifically, the estimated reduction in the long continuing current intervals in cloud-to-ground flashes is about one-fourth (two-sided p-values of both nonparametric tests are less than 0.04). Seeding appears to reduce the frequency of cloud- to-ground flashes and the duration of lightning activity by about one-half (two-sided p-values of both nonparametric tests are all less than 0.03). These results could have important applications in forest fire management programs.
DESCRIPTORS: Lightning suppression

ID NO.- MGA28010080
Settling cloud chamber for ice nucleus counting.
Ohtake, Takeshi
Geophys. Inst., Univ. of Alaska, Fairbanks
, International Workshop on Ice Nucleus Measurements, 3rd, Univ. of WY., Laramie, 19 May-6 June, 1975, Proceedings. Laramie, WY., Jan. 1976. p. 151-158. Refs.
CTRY OF PUBL:US
The construction and operation of the settling cloud chamber (SCC) for ice counting are described with the aid of a diagram. Its main aim is to prevent warm air in the upper chamber from mixing with cold air in the lower chamber. Typical results of measurements are presented. Measurements of natural ice nuclei made with SCC, MF (membrane filter technique), DFC (droplet freezing chamber), and centrifugal deposition are in agreement. In the case of AgI samples, the results for SCC were as follows: 1) the humidity in the lower chamber was deficient in the case of highly concentrated AgI samples; 2) deficiency of water droplets in the lower chamber was noted frequently; 3) the concentration measured by DFC was similar to that measured by SCC; and 4) the temperature spectrum of the ice nucleus concentration by MEE (MEE Automatic Nucleus Counter) was about three orders of magnitude lower than that reported by DFC and SCC. The ice nucleus concentrations measured by SCC were consistently higher than those measured by the MF techniques.
DESCRIPTORS: Ice nuclei counters; Ice nuclei concentration measurement techniques

ID NO.- MGA28010079
Ice nucleus measurements in the field.
Mossop, S. C.
Div. of Cloud Phys., CSIRO, Sydney, Australia
, International Workshop on Ice Nucleus Measurements, 3rd, Univ. of WY., Laramie, 19 May-6 June, 1975, Proceedings. Laramie, WY., Jan. 1976. p. 146-150. Refs.
CTRY OF PUBL:US
Reasonably good agreement exists between membrane filter measurements of natural ice nuclei and those made with the settling cloud chamber and the drop freezing counter. Several sources of variability in the membrane filter results can be eliminated by standardizing 1) the height diffusion chamber in which the filters are processed; 2) the brand of filters used; and 3) the nominal supersaturation used in processing. In the case of artificial ice nuclei, it seems that the difficulties of obtaining a reliable measurement of their concentration were exaggerated at the Workshop by using pure AgI as the test aerosol. The problem of measuring concentrations of ice crystals produced in real clouds by artificial nuclei in the absence of a simple portable instrument is discussed.
DESCRIPTORS: Ice nuclei concentration measurement techniques

ID NO.- MGA28010077
Contact-freezing nucleation measured by the DFC instrument.
Vali, Gabor
Dept. of Atmos. Sci., Univ. of WY.
, International Workshop on Ice Nucleus Measurements, 3rd, Univ. of WY., Laramie, 19 May-6 June, 1975, Proceedings. Laramie, WY., Jan. 1976. p. 159-178. Refs.
CTRY OF PUBL:US
The basic concepts of the contact-nucleus instrument (or drop freezing counter, DFC) are to force aerosol particles into contact with supercooled water and to observe resulting individual freezing events. The supercooled drops that are to serve as detectors are supported on a cold stage whose temperature is controlled. Aerosol particles are deposited onto the drops by electrostatic precipitation. The design and operation of the instrument and the procedure for measuring contact freezing nucleation for determining the collection efficiency for a flat collecting electrode are described. The temperature range (T) and concentration range (N.SUB e.) at which measurements can be made with the DFC instrument are: -22"C < T < 0"C and 0.2).SUPER -..SUPER 1. < N.SUB C. <e 10.SUPER 5. 1.SUPER -..SUPER 1.. The concentration of nucleie formed as a result of nucleation by aerosols, after contact with supercooled water and measured by the DFC instrument, exceeded the results obtained with other instruments or was close to the highest values measured. Good agreement was found between the SCC (settling cloud chamber) for natural aerosols and, also, for AgI when additional condensation nuclei were provided for the SCC.
DESCRIPTORS: Drop freezing counter; Nucleation processes

ID NO.- MGA28010075
NCAR filter processing results.
Langer, Gerhard
Natl. Hail Res. Experiment, Natl. Ctr. for Atmos. Res., Boulder, CO.
, International Workshop on Ice Nucleus Measurements, 3rd, Univ. of WY., Laramie, 19 May-6 June, 1975, Proceedings. Laramie, WY., Jan. 1976. p. 123-127. Refs.
CTRY OF PUBL:US
The flow system currently used at NCAR to develop membrane filter samples for ice nuclei is described with a diagram, and results obtained by NCAR for membranes exposed during the Workshop are presented. The count of the SUNYA was used as a reference and, then, the ratio of NCAR count to SUNYA (static diffusion chamber) was plotted as well as the ratio for other participants for equivalent samples. It was found that different developing systems can give widely varying results. On the whole, the NCAR system responds to a higher SS (supersaturation). The SUNYA device indicated that thermal AgI, which is relatively pure, reaches most of the activity at a given temperature before saturation is reached.
DESCRIPTORS: Diffusion cloud chamber

ID NO.- MGA28010074
SUNY diffusion chamber measurements and related analyses.
Jiusto, James E.
Atmos. Sci. Res. Ctr., State Univ. of N.Y., Albany
, International Workshop on Ice Nucleus Measurements, 3rd, Univ. of WY., Laramie, 19 May-6 June, 1975, Proceedings. Laramie, WY., Jan. 1976. p. 99-122. Refs.
CTRY OF PUBL:US
The construction and operation of the SUNY thermal gradient diffusion chamber used to process membrane filters are described briefly. The results of experiments involving the processing of 150 filters are presented and discussed by considering the volume effect of the filter method, the effect of chamber height upon peak filter humidity achieved, the filter type, filter pore sealants and background, supersaturation spectra, and AgI activation as a function of CCN (cloud condensation nuclei). Experiments were made to compare the results of the thermal gradient diffusion chamber with those obtained with the settling cloud chamber (SCC) and drop freezing counter (DFC) apparatus. Individual equipment and agreement between instruments was fairly consistent. Small humidity variations produced large differences in nuclei activation.
DESCRIPTORS: Diffusion cloud chambers

ID NO.- MGA28010039
Exploratory study by radar of the effect of seeding two maritime cumulus clouds.
Krishna, K.
Indian Inst. of Tropical Met., Poona
Indian Journal of Meteorology, Hydrology, and Geophysics, Delhi, 27(1): 78-81, Jan. 1976. Refs. DLC
CTRY OF PUBL:IN
The procedure and results of a study undertaken at Bombay towards the end of the monsoon season of 1973 to determine the effect of salt seeding on maritime clouds by using the X-band BEL radar and S-band surveillance radar are presented. Seeded and unseeded clouds grew in the area; the echo intensities increased from moderate to strong after seeding, while they remained moderate in the unseeded clouds. The echoes from the seeded clouds attained maximum height after seeding; and rain was clearly observed sometimes after seeding. Neither of these phenomena was noted for the unseeded clouds.
DESCRIPTORS: Radar observation of cloud seeding; Cumulus cloud seeding; Bombay, India

ID NO.- MGA27120462

Hypothesis for urban rainfall anomalies.

Changnon, S. A., Jr.; Semonin, R. G.; Huff, F. A.

IL. State Water Survey, Urbana;

Journal of Applied Meteorology, Boston, 15(6): 544-560, June 1976. Refs. DAS, DLC

CTRY OF PUBL:US

METROMEX was the first major field program aimed at studying the reality and causes of urban rainfall anomalies suggested in several climatological studies. The results from the 1971-1974 METROMEX data portray statistically significant increases in summer rainfall, heavy (>2.5 cm) rainstorms, thunderstorms, and hail in and just east (downstorm) of St. Louis. Examination of the rainfall yield of individual showers (cells), the spatial distribution of echo (rain) developments, and areal distribution of afternoon rain clearly point to the urban-industrial complex as the site for the favored initiation of the rain process under certain conditions. The greater frequency of rain initiations over the urban and industrial areas appears to be tied to three urban-related factors, including thermodynamic effects leading to more clouds and greater incloud instability, mechanical and thermodynamic effects that produce confluence zones where clouds initiate, and enhancement of the coalescence process resulting from giant nuclei. Case studies reveal that once additional cells are produced, nature, coupled with the increased likelihood for merger with more storms per unit area, takes over and produces heavier rainfalls. Hence, the city is a focal point for both rain initiation and rain enhancement under conditions when rain is likely.

DESCRIPTORS: Urban influences on precipitation; Project METROMEX; St. Louis, Missouri

ID NO.- MGA27120428

Measurements of cloud droplet size distributions in seeded warm cumulus clouds.

Kapoor, R. K.

Indian Inst. of Tropical Met., Poona

Pure and Applied Geophysics, Basel, 114(3): 379-392, 1976. Refs. DAS, DLC (QC801.G37)

CTRY OF PUBL:SZ

Aircraft observations were made on cloud droplet size distribution in 19 cases of seeded warm cumulus clouds in three meteorologically different regions. In all the five cases at Bombay (maritime), and six out of the seven cases at Poona (modified maritime), the values of median volume diameter, maximum cloud droplet size, and liquid water content showed increase after seeding as compared to what they were before. The increases noticed in the median volume diameter ranged up to 48% at Bombay and 478% at Poona. The liquid water content and the maximum droplet size, respectively, increased upward of 56 and 25% at Bombay and 60 and 31% at Poona. In four of the seven cloud cases at Rihand (continental), the values of the parameters referred to above showed increase. The median volume diameter increased to 372%. The liquid water content and the maximum droplet size increased upward of 160 and 66%, respectively. In the cloud cases wherein the values of the parameters decreased after seeding, the decreases noticed ranged to 94%. More unstable conditions prevailed on the days when the seeded clouds showed visible rain than on the days when they did not.

DESCRIPTORS: Cloud droplet size distribution; Cloud seeding effects; India

ID NO.- MGA27120413

Observations of natural CCN and large aerosol over St. Louis.

Dytch, Harvey E.

Chicago. Univ. Dept. of Geophysical Sciences, Cloud Physics Lab., Technical Note 47, Collection of Reprints XV. Jan. 1975. Refs. .4p... Reprinted from Conference on Cloud Physics, Tucson, AZ., Oct. 21-24, 1974, Preprints. p. 5-8. Pub. by American Meteorological Society, Boston.

CTRY OF PUBL:US

CCN (cloud condensation nuclei) measurements were made during the summers of 1972 and 1973 during flights over the St. Louis, MO., area as a part of Project METROMEX of the University of Chicago Cloud Physics Laboratory. Air samples were collected in 150-l metallized Mylar bags through a large diameter sampling tube protruding ahead of the propeller line of the aircraft, and later processed within a thermal diffusion chamber. The purpose of the study was to investigate the relationship of observed CCN spectra supersaturation to the associated volume loading of larger aerosols. The observations support the conclusions that the relative volume density variation in continental atmosphere may be directly related to the form of the CCN supersaturation spectrum as described in terms of its slope and concentration parameters and, hence, of the total aerosol population. Direct extension of the derived size spectra gives predictions of variation in volume density in larger sizes, in agreement with observed values, but overestimates the volume loading of large particles as the slope of the CCN spectrum deviates from the Junge distribution. Several scatter diagrams show these relationships in terms of slopes or curves.

DESCRIPTORS: Cloud condensation nuclei spectra; Nuclei-aerosol relationships; St. Louis, Missouri

ID NO.- MGA27120412

Information content of CCN spectra vs. measurements at a single supersaturation.

Braham, Roscoe R., Jr.

Univ. of Chicago, IL.

Chicago. Univ. Dept. of Geophysical Sciences, Cloud Physics, Lab., Technical Note 47, Collection of Reprints XV. Jan. 1975. Refs. .4p... Reprinted from Conference on Cloud Physics, Tucson, AZ., Oct. 12-24, 1974, Preprints. p. 9-12. Pub. by American Meteorological Society, Boston.

CTRY OF PUBL:US

A large number of CCN (cloud condensation nuclei) spectra were obtained from air samples collected at 1500-5000 ft downwind, over and upwind from St. Louis during summer (June-Aug.) 1971, 1972, and 1973; during winter (Jan.-Mar.) 1972; and during March and April 1973 as part of Project METROMEX by the University of Chicago Cloud Physics Group. Data were obtained at supersaturation as found at subcloud levels. Parallel measurements made in the Chicago Thermal Gradient Diffusion CCN Chamber, when compared with those made within a chamber constructed by Twomey and colleagues at NRL (Navy Research Lab.) in Washington during Oct. 1972, gave CCN concentration values only one-half as large as those made at NRL. Graphical analyses presented show that the information value of k, slope parameter in predictions N (number of nuclei per unit volume), will depend linearly upon C (supersaturation spectra concentration parameter). Analysis of single supersaturation data for supersaturation of 0.5, 0.7, and 1.0% show (in tables) errors in estimating N which are tolerable within narrow size ranges, but give poor estimates in drop concentrations and sizes expected in most clouds. However, a comparison of upwind and downwind data (for summer and winter, respectively) shows that such measurements can give good estimates of local sources and sinking of cloud nuclei, if properly analyzed.

DESCRIPTORS: Cloud condensation nuclei spectra; St. Louis, Missouri

ID NO.- MGA27120141

Ob odnom sluchiyaye vliyaniya adsorbirovannoy vody na l'doobrazuyushchuyu aktivnost' yader. .Effect of adsorbed water on the ice forming activity of nuclei..

Levkov, Lyubomir

Geofiz. Inst., Bolgarskaya Akademiya Nauk, Sofiya

Idojaras, Budapest, 80 (3): 151-153, May/June 1976. Refs. English and Czechoslovakian summaries. DAS, DLC (QC851.M125)

LANGUAGE: bu

CTRY OF PUBL:HU

The author and his colleagues have been doing experimental research on the formation of ice crystals in the atmosphere. The present study is the outcome of this research. The conditions for the formation of ice crystals on AgI nuclei are described, depending upon the character of water vapor adsorption of the nuclei presented; it is stated that the ice forming activity of AgI is the greatest when dry AgI particles mix with overcooled water drops.

DESCRIPTORS: Silver iodide ice forming properties

ID NO.- MGA27120140

Activity and size of aggregate thermal AgI particles.

Gerber, H.

, International Workshop on Ice Nucleus Measurements, 3rd, Univ. of WY., Laramie, 19th May-6 June, 1975. Laramie, WY., Jan. 1976. p. 75-90. Refs.

CTRY OF PUBL:US

The nucleating efficiency of AgI aerosol particles as a function of their size was investigated by using the Stober spiral centrifuge and the Goetz conical centrifuge, which measures the size distribution of only those particles capable of nucleating ice, and the electrical aerosol analyzer for sorting particles. Using the relevant equations, the response of the centrifuges and of the electrical aerosol analyzer to chain aggregates is analyzed. A comparison is made between the conical centrifuge and the electrical aerosol analyzer. The results of experiments conducted on the nucleating efficiency of aggregate thermal AgI by using the Goetz centrifuge to collect two consecutive samples from the dilution bag containing thermal AgI and processing one sample in the University of Wyoming thermal gradient diffusion chamber and the other in a puff chamber are presented.

DESCRIPTORS: Silver iodide effectiveness; Silver iodide ice forming properties; Silver iodide nuclei

ID NO.- MGA27120139

Ratio estimators and some inherent problems in their utilization.

Flueck, John A.; Holland, Burt S.

Dept. of Statistics, Temple Univ., Philadelphia, PA.

Journal of Applied Meteorology, Boston, 15(6): 535-543, June 1976. Refs. DAS, DLC

CTRY OF PUBL:US

Ratio estimators are widely used in the physical and atmospheric sciences, although their properties and inherent problems are often unknown or overlooked. A number of problems and properties of ratio estimators are presented, and some solutions are offered. For a correlated bivariate gamma structure, approximate and exact results are given for the mean, variance, and biases of the ratio of two means. The sensitivity of these results to sample size and parameters of the bivariate gamma are indicated. The application of these results to three well known cloud seeding experiments are presented, and corrected estimates of the corresponding seeding effects are offered.

DESCRIPTORS: Cloud seeding evaluation; Statistical tests of cloud seeding

ID NO.- MGA27120137

La dissipation des brouillards froids sur les aeroports. .Dissipation of cold fogs at airports..

Heiser, L.

Aeroport de Paris

La Meteorologie, Numero Special, Aviation et Meteorologie, Nov. 1975. p. 35-40. DLC

LANGUAGE: fr

CTRY OF PUBL:FR

The dissipation of cold fog at Paris Airport is based upon creating ice crystals within the interior of the fog by locally significant reduction of temperature, by evaporating the liquified gas propane. At this airport, the liquid propane is pulverized at the ground by means of vapor pressure prevailing within a reservoir containing the liquefied gas. The ice crystals formed by the diffusion device spread within the volume occupied by the fog under the action of wind, however feeble it may be during the time of the fog. A diagram is used to describe the process of fog dissipation proceeding from the zone of microcrystals and droplets to the final zone of water deficit, precipitation, and good visibility. The installation and the operational procedure are described with a diagram and photograph. Some results of the use of the installation at Orly Airport are summarized. The possible effects of dissipation of cold fog upon the environment are considered: diffusion of propane gas in the environment, as it is highly flammable, and the possible formation of glazed frost and snow. Economic results from the use of such an installation are discussed.

DESCRIPTORS: Fog dissipation by propane spraying; Orly Airport, Paris, France

ID NO.- MGA27120136

La dissipation des brouillards chauds sur les pistes d'aerodromes. .Dissipation of warm fogs at airport runways..

Dubois, E.

Societe Bertin

La Meteorologie, Numero Special, Aviation et Meteorologie, Nov. 1975. p. 41-52. DLC

LANGUAGE: fr

CTRY OF PUBL:FR

The thermal kinetic TURBOCLAIR method for dissipating warm fog, developed in France, ensures both sufficient thermal energy necessary to warm the surrounding air and the kinetic energy indispensable for properly mixing warm gases with the surrounding air. It is based upon the principle that only a few degrees of rise in temperature are necessary for the air containing fog droplets to become unsaturated and clear. The warm gases are furnished by a turbojet engine installed in each of the emission apertures placed near the runway to be cleared of fog. The turbojet engine provides about 50 kg/sec of air at a stable temperature of 500°C, emitted at a rate of about 500 m/sec. The history of experiments and applications of this method in different airports in France from 1958 to 1974 is reviewed. The TURBOCLAIR method was installed in Charles de Gaulle Airport in 1974. The principal factors influencing the effectiveness of the system are analyzed on the basis of the extensive experimental data by considering the following: quantity of heat, the wind, the fog characteristics, the quantity of liquid water in the fog, the reactions induced by the jet of the engines, the noise, and the turbulence. The operational use of the TURBOCLAIR procedure is illustrated for the case of Orly Airport.

DESCRIPTORS: Fog dissipation by jet exhaust; TURBOCLAIR; France

ID NO.- MGA27120135

La guerre meteorologique: mythe ou realite de demain? .Meteorological war: myth or the reality of tomorrow?..

Dettwiller, J.

Met. Natl.

La Meteorologie, Paris, Serie 6, No. 2, Sept. 1975. p. 135-145. DLCe

LANGUAGE: fr

CTRY OF PUBL:FR

This article on meteorological warfare is based upon testimony presented by Pierre St. Amand and J.F. Mac Donald before a subcommittee of the U.S. Senate and published in 1974. The article cites rain-making operations conducted abroad by the U.S. Navy and techniques being developed for slowing down the movement of winter storms in order to modify their trajectories and, thereby, improve precipitation distribution, for modifying warm clouds, and for fog dispersal. Future possibilities of meteorological or geophysical warfare are discussed, such as: 1) the prevention or suppression of fog (as well as its creation or intensification); 2) production of artificial precipitation; 3)emanipulation of tropical cyclones; 4) melting of polar ice; 5)e liberation by means of rockets of CO.SUB 2., water vapor, aerosol, etc. affecting atmospheric transparency to differente radiations; 6) attack of the stratospheric ozone layer; 7) release of earthquakes and of tsunamis; and 8) manipulation ofe electrical brain waves around the globe. Actual examples ofe artifical rain operations in Indochina by the U.S. Air Forcee are described briefly.

DESCRIPTORS: Weather control benefits; Weather modification

ID NO.- MGA27120106
Ice nucleus measurements using a Stober centrifuge.
Cooper, William A.
Dept. of Atmos. Sci., Univ. of WY.
, International Workshop on Ice Nucleus Measurements, 3rd, Univ. of WY., Laramie, 19 May-6 June 1975. Laramie, WY., Jan. 1976. p. 63-74. Refs.
CTRY OF PUBL:US
The Stober air centrifuge separates different size particles and permits determination of the sizes of ice nuclei. As a result of the impaction of the nuclei onto a metal strip, it permits a comparison of the number of nuclei on this surface with a number obtained from filter strips. The experimental procedure, including determination of the calibration curve for the air centrifuge, is described. The results of determination of the sizes of ice nuclei for AgI aerosol, the effects of processing substrate, and the determination of sizes of natural ice nuclei are presented. In the case of thermally generated AgI, the sizes of the nuclei active in the filter processors (assumed to be deposition nuclei) were mostly 0.3 to 0.5 .MU . in equivalent volume diameter or in aerodynamic diameter. The fraction of aerosol nuclei active as (deposition) ice nuclei was an increasing function of size, and for the aggregates it was reasonably consistent with a D.SUB e..SUPER 3. proportionality (D.SUB e. is the equivalent volume diameter). The AgI nucleus measurements obtained by processing brass strips were about the same as those collected from air drawn through filters. Nuclei precipitated onto the surface of Millipore filters gave concentrations similar to those obtained when they were collected from air drawn through filters.
DESCRIPTORS: Nuclei size measurement methods; Ice nuclei measurement

ID NO.- MGA27120103
Test aerosols: generation and characterization.
Rogers, David C.; Vali, Gabor
Dept. of Atmos. Sci., Univ. of WY.
, International Workshop on Ice Nucleus Measurements, 3rd, Univ. of WY., Laramie, 19 May-6 June 1975. Laramie, WY., Jan. 1976. p. 20-42. Refs.
CTRY OF PUBL:US
The techniques for sampling natural aerosols; for generating AgI aerosol by means of a hot-wire and AgI complex acetone burner; and for monitoring aerosol size spectra by means of an Aitken nucleus counter, an electrical mobility analyzer, and an optical particle counter are described. CCN (cloud condensation nuclei) were measured for natural and AgI aerosol by means of two thermal diffusion chambers: the Mee Industries Model- 130 CCN counter and the University of Wyoming (UW) CCN chamber. Droplet concentrations were recorded by photographs. Aerosol size spectra measured by the Mee counter were consistently higher; and the lowest supersaturation counts were obtained with the UW instrument. The results of measurements reported in the form of coefficients for the usual CCN equation, N = CS.SUPER k., are given in a table; N(cm.SUPER -..SUPER 3.) concentration corresponding to supersaturation S(%), and C and k are the constants specific to each spectrum. The results of sampling aerosol for electron microscopy are discussed.
DESCRIPTORS: Aerosol generators; Aerosol counters; Silver iodide generators; Cloud condensation nuclei

ID NO.- MGA27110528
METROMEX update.
American Meteorological Society, Boston, Bulletin, 57(3): 304-308, March 1976. Refs. DAS, DLC (QC851.A6)
CTRY OF PUBL:US
Major achievements, to date, of the METROMEX project are interpreted in the light of three goals: 1) to define and describe the anomaly, 2) to explain the anomaly, and 3) to predict urban anomalies and translate results to other areas and users. There is a summer precipitation anomaly at St. Louis, MO., varying between a 10 and 30% excess above background, the location and intensity of which vary with the prevailing seasonal storm motions and general character of summer weather. Although local orographic effects on cloud processes exist in the area, sorting of the total rainfall by the wind directions prior to rainfall shows the city effect. Synoptic weather conditions, during which much of the rain increases occurred, are convectively unstable types, often involving squall line or squall zone conditions. Local impacts of precipitation changes are described.
DESCRIPTORS: Project METROMEX; Urban influences; St. Louis, Missouri

ID NO.- MGA27110448
Clouds, rain, and rainmaking.
Mason, B. J.
Met. Off., Bracknell, Eng.
London, Cambridge Univ. Press, 1975. 189 p. .$.12.95. For abstract of the 1st ed. (1962), see Met. Abs., 14.2-16. DLC, DAS (A QC 921.5 M38)
CTRY OF PUBL:UK
This volume attempts to present a concise up-to-date account of recent researches on the formation of clouds and the development inside them of rain, snow, hail, and lightning. It is designed for a wide range of readers who may wish to know more about cloud physics than may be obtained from popular articles, but who are not professionally interested in the subject. Much of the text requires little more than a good knowledge of elementary physics; enough mathematics is included to indicate the kind of calculations that can be made and the magnitudes involved. There are included do-it-yourself experiments designed to permit the reader to observe the phenomena at first hand. This second edition has the same structure and scope as the first edition, but the text was revised to include the principal advances made in the decade since the publication of the first edition. The individual chapters cover the following topics: cloud forms and features; nuclei of cloudy condensation; growth of cloud droplets; germination and growth of snow crystals; snow, rain, and hail; rainmaking experiments; and electrification of thunderstorms.
DESCRIPTORS: Cloud physics textbooks; Precipitation physics; Cloud seeding research

ID NO.- MGA27110447
Some remarks on modelling of the early stage of cloud formation in a simulation chamber.
Saad, Adel N.; Podzimek, Josef; Carstens, John C.
Grad. Ctr. for Cloud Phys. Res., Univ. of MO., Rolla;
Journal of Applied Meteorology, Boston, 15(2): 145-156, Feb. 1976. Refs. DLC, DAS
CTRY OF PUBL:US
A numerical model was developed to describe the early stage of cloud formation in a relatively small simulation chamber. The results for adiabatic expansion show a tendency for the cloud droplet spectrum to narrow, similar to the results obtained by other authors. The influence of updraft fluctuations is not as important as the fluctuation of temperature, which depends upon the amplitude and frequency of the fluctuations, and the expansion rate of volume. Simple models of the sedimentation of the drops show that sedimentation might be a factor limiting the rate of expansion. Nuclei suddenly introduced into the cloud parcel indicate that the seeding effect depends significantly upon the concentration and size of predominantly larger nuclei.
DESCRIPTORS: Cloud models; Cloud physics research; Cloud seeding effects

ID NO.- MGA27110146
Cloud motion and rainfall statistics.
Biondini, Ronald
Dept. of Environ. Sci., Univ. of VA., Charlottesville
Journal of Applied Meteorology, Boston, 15(3): 205-224, March 1976. Refs. DLC, DAS
CTRY OF PUBL:US
This paper presents some of the results obtained from a new analysis of the data collected during 1968 and 1970 by EML in the Florida cumulus modification experiment (the single cloud experiment). The most important new element in this analysis is the stratification of the data into categories based on cloud motion. Category 1 days are those displaying significant, relatively uniform cloud motion throughout the day. Category 2 days are those displaying no such motion. First, the rainfall data are analyzed without regard to motion categories, the log-normal model is introduced, and evidence for multiplicative seeding factor is abduced and its value estimated. The data are also analyzed on a pairwise basis. Next, the data are stratified by motion categories, and the analysis repeated with categories. Although a log-normal model can still be applied within categories, there is no basis for assuming a multiplicative seeding factor within categories. Category 1 clouds respond to seeding in a significantly different manner than do category 2 clouds. Evidence indicating that seeding tends to promote the merger of clouds is presented. The lifetimes of those clouds that did not merge are analyzed. Seeding apparently increased the lifetime of these clouds by about 40%. This holds both across and within motion categories. With the exception of a single outlier, the lifetime data can be taken as log-normal. The effects of seeding on rainfall, both within and across motion categories, of nonmerging clouds are mainly effects on intensity (average rainfall per unit time), rather than on lifetimes. The implications of these results to cloud modellers, cloud modification operations, and further statistical analyses are briefly discussed. An effort is made to identify a cloud-by-cloud seeding effect. A quantity called the rank indicated seeding effect is introduced and compared to a quantity called pairwise seeding effect. It seems that these quantities behave much more regularly for category 1 clouds than for category 2 clouds. In an appendix, some properties of the log-normal distribution are presented along with some discussion as to the relevance of these properties to these analyses and to those anticipated in the future.
DESCRIPTORS: Cloud seeding evaluation; Florida, United States

ID NO.- MGA27110145

Clearing fog by seeding with charged water drops: a numerical study.

Tag, Paul M.

United States Naval Environmental Prediction Research Facility, Monterey, CA., NAVENVPREDRSCHFAC Technical Paper No. 6-76, May 1976. 49 p. Refs., figs. DAS (A QC 983 U5S2)

CTRY OF PUBL:US

A numerical study of the use of highly charged water drops to clear warm fog has been conducted. The polarization of neutral fog droplets and their capture by the charged drops is the mechanism studied. A multi-leveled microphysical model is used to investigate the degree of visibility improvement resulting from variations in seeding drop size and charge, the type of fog being seeded, and the concentration of seeding material. An evaluation of this technique is made by comparing model results to comparable numerical experiments of hygroscopic seeding, a technique that has been field tested on several occasions.

DESCRIPTORS: Fog dissipation by charged drops; Fog dispersal evaluation

ID NO.- MGA27110144

Statistical technique for evaluating hurricane modification experiments.

Knight, Richard W.; Brier, Glenn W.

Natl. Hurricane and Experimental Met. Lab., Coral Gables, FL.

United States National Oceanic and Atmospheric Administration. Environmental Research Labs., Boulder, CO., Technical Memorandum (NOAA TM ERL WMPO-29), May 1976. 11 p. Refs. DAS (A QC 807.5 U6W5)

CTRY OF PUBL:US

A statistical technique is developed for evaluating the nonrandomized Project Stormfury hurricane seeding experiments. Modern principles of design and analysis of comparative experiments use 1) replication, from which a quantitative estimate can be made of the experimental error or the variability of the response to a treatment and 2) randomization, a process of allocating treatments to the experimental material by tossing a coin (or equivalent procedure), which may make it possible to attribute whatever effects are observed to the treatment only. Together, these two principles make it possible to assess the validity of the results in terms of a probability statement. However, in the Stormfury Project it is planned to seed nearly all experimental units, leaving essentially no controls. With the concept of randomization in time, it is possible to develop an evaluation technique to determine quantitatively whether there is an association between a treatment and the event following the treatment. A hypothetical example is presented to facilitate the understanding of the technique; the elements that are most likely to identify seeding-induced changes in a storm environment are discussed.

DESCRIPTORS: Hurricane modification evaluation; Project Stormfury

ID NO.- MGA27110114

Instrumentation for the detection of ice nuclei.

Lala, G. Garland

Atmos. Sci. Res. Ctr., State Univ. of N.Y. (SUNY) at Albany

Atmospheric Technology, Boulder, CO., No. 8, Spring 1975. p. 50-56. Refs.

CTRY OF PUBL:US

The discrepancy among various ice nuclei counters was clearly demonstrated at the Second International Workshop on Condensation and Ice Nuclei, where the typical spread in measurements was 100:1, with extremes of 10,000:1 (Bigg, 1971). This article concentrates on the principle of operation of various instruments and the relationship of their results to ice nucleation mechanisms. Four possible mechanisms are deposition (sublimation), immersion freezing, contact freezing, and homogeneous freezing. The minimum requirements for ice nuclei counters, mixing chambers, the NCAR acoustical counter, filter techniques, and the drop-freezing spectrometer are discussed. A summary of the general characteristics of ice nuclei counters is presented in a table. The wide variation of nucleus counts from different instruments is an indication of the sensitivity of ice nucleation processes to environmental conditions and not just an indication of their accuracy.

DESCRIPTORS: Ice nuclei counters

ID NO.- MGA27110077
Use of a sailplane to measure microphysical effects of silver iodide seeding in cumulus clouds.
Dye, J. E.
Natl. Ctr. for Atmos. Res., Boulder, CO.
Journal of Applied Meteorology, Boston, 15(3): 264-274, March 1976. Refs. DLC, DAS
CTRY OF PUBL:US
Experiments were conducted to determine the effects, within cumulus clouds, of seeding with silver iodide; such effects are determined by correlating the presence of ice particles with the presence of silver iodide. This correlation is made possible by the use of a sailplane that has the capability of remaining in the cloud updraft and the seeded plume for relatively long periods of time. The correlation method provided a sensitive test for distinguishing seeding effects from natural ice development. Case studies using this technique are discussed. Measurements in one small cloud having a base at -12"C showed concentrations at -15"C in the plume of up to 400 ice crystals per liter about 4 min after seeding. Aggregation of stellar dendrites occurred for particles as small as 400-500 .MU .m diameter, and about half of the available crystals were in aggregates after about 15 min. The output efficiency of the TB-1 pyrotechnic flares used in the experiment is estimated to be at least 10.SUPER 1..SUPER 1. ice particles per gram of silver iodide in the temperature range -12 to -17"C, which is close to previously reported values. Significant nucleation of ice by silver iodide occurred for at least 20 min after seeding. Linear ice crystal growth rates of stellar dendrites of the order of 0.15 mm min.SUPER -..SUPER 1. were determined from these observations.
DESCRIPTORS: Cloud seeding with silver iodide; Silver iodide effectiveness; Sailplane investigation of clouds

ID NO.- MGA27110060
Comparison of first radar echoes in seeded and unseeded convective clouds in North Dakota.
Koscielski, A.; Dennis, A. S.
Inst. of Atmos. Sci., S.D. School of Mines & Tech., Rapid City
Journal of Applied Meteorology, Boston, 15(3): 309-311, March 1976. Refs. DLC, DAS
CTRY OF PUBL:US
First radar echoes on a randomized cloud seeding project in North Dakota appeared closer to cloud base and at higher temperatures on seed days than on no-seed days. The average first echo temperature was near -11"C on no-seed days, and -7"C on seed days.
DESCRIPTORS: Radar echoes from clouds; Radar observation of cloud seeding; North Dakota, United States

ID NO.- MGA27110049
Training specialists in weather modification.
Terent'yev, E. V.
World Meteorological Organization, Geneva, WMO-No. 432, 1975. p. 213-214. (WMO/IAMAP Symposium on Educational Training in Meteorology and Meteorological Aspects of Environmental Problems, Caracas, Feb. 1975, Proceedings) DLC, DAS (A QC 851 W6445)
CTRY OF PUBL:SZ
The training of Class I specialists in the special project of weather modification at the Odessa Hydrometeorological Institute (U.S.S.R.) since 1973 is described. The duties of weather modification specialists and the knowledge and skills they must possess to be effective in their work are outlined. The theoretical courses they must take and their duration, the laboratory work they must complete, and their practical training are described.
DESCRIPTORS: Training for meteorologists; Weather modification; Odessa, Ukrainian S.S.R.

ID NO.- MGA27110034
Education and training in weather modification.
List, Roland
World Meteorological Organization, Geneva, WMO-No. 432, 1975. p. 201-212. Refs. (WMO/IAMAP Symposium on Educational Training in Meteorology and Meteorological Aspects of Environmental Problems, Caracas, Feb. 1975, Proceedings) DLC, DAS (A QC 851 W6445)
CTRY OF PUBL:SZ
The contents of an advanced course in weather modification which would provide specialists for advising governments on the feasibility of weather modification projects and for proposals and leadership in weather modification studies and projects are discussed. The major components in such a course are special synoptic aspects, cloud microphysics, cloud dynamics, weather modification theory, design and evaluation of weather modification and operations, observational systems and techniques, technology of weather modification, and related aspects involving agriculture, hydrology, ecology, etc. The contents of each of the proposed fields of study is itemized.
DESCRIPTORS: Training for meteorologists; Weather modification

ID NO.- MGA27100372

Precipitation dependence on synoptic-scale conditions and cloud seeding.

Estoque, M. A.; Fernandez-Partagas, Jose J.

Univ. of Miami, Coral Gables, FL.

Geofisica Internacional, Mexico City, 14(3): 181-206, July 1974. Refs. English and Spanish summaries. DAS

CTRY OF PUBL:MX

Precipitation over south Florida, as indicated by radar, was analyzed to determine its dependence upon synoptic- scale conditions and cloud seeding. The synoptic-scale parameters that are used are the prevailing flow, the humidity, the stability, and the vertical wind shear. The variation of synoptic-scale conditions is, by far, more important than multiple cloud seeding in determining precipitation. This finding indicates that cloud seeding experiments in Florida which do not take into account the effect of the varying synoptic conditions can lead to misleading conclusions.

DESCRIPTORS: Precipitation sources; Synoptic conditions for precipitation; Cloud seeding effectiveness; Florida, United States

ID NO.- MGA27100136

Ustanovleniye korrelyatsionnoy svyazi kolichestva osadkov teplogo perioda na kontrol'nom i rabochem poligonakh. .Establishment of correlations between amount of precipitation in the warm season on controlled and operational testing sites..

Sulakvelidze, G. K.; Klimovskaya, L. P.

Nal'chik, U.S.S.R. Vysokogornyy Geofizicheskiy Institut, Trudy, No. 22, 1973. p. 214-220. Refs. Russian summary. DAS, DLC

LANGUAGE: rs

CTRY OF PUBL:UA

On the basis of 25 yr of observations on precipitation amount in the warm period over control and experimental sectors, a functional relationship was established by calculating the amount of precipitation during the period April-Oct., i.e., the warm season-the time of anti-hail field operations. The correlation coefficients between the amount of precipitation falling on the control and experimental sectors before the execution of anti-hail measures and during experimental modification of hail processes were calculated. It was found that the natural march of precipitation in the warm period on the two sectors investigated was identical before execution of the anti-hail operations. During the anti-hail operation, the correlation between precipitation on the control and experimental sectors in the warm period either diminished or disappeared entirely. The mean amount of precipitation on the experimental sector increased in the warm period during the period of anti-hail operations; this cannot be explained by natural causes.

DESCRIPTORS: Precipitation correlations; Cloud seeding effects; Hail suppression experiments

ID NO.- MGA27100135

Precipitation augmentation from cumulus clouds and systems: scientific and technological foundations, 1975.

Simpson, Joanne

Ctr. for Advanced Studies, Univ. of VA., Charlottesville

Advances in Geophysics, N.Y., Vol. 19, 1976. p. 1-72. Refs. DAS (A QC 801 A 283), DLC

CTRY OF PUBL:US

In this authoritative article, Joanne Simpson reviews and systematically evaluates the current scientific and technological foundations of cumulus cloud or system modification on the basis of her own extensive experience since 1949 and that reported in nearly 200 papers on convective cloud modification (25 of these papers are on the physics of convective or tropical clouds and their modification, published by the author or in collaboration with her colleagues). Beginning with a chapter on the scientific basis of cloud physics and aerosol processes, cumulus-dynamics, and models, the article gives a thorough review of the technological basis for cloud modification, modification agents, delivery systems, and targeting; a discussion of evaluation systems and techniques (that are more costly than the original seeding operations); and, finally, a summary with conclusions, including an appendix containing a summary of cumulus model simulations (three-, two- , one-, and one and one-half- dimension and tuned or calibrated models). After 25 yr of cumulus cloud modification experiments, only half a dozen experiments have been conclusively established as successful. However, advances have been made in the last few years in 1) precipitation measurement, 2) cloud physics and dynamics observations, 3) application of statistical tools, and 4) numerical simulation models. Doppler radars and use of tracers and chemical sampling of precipitation are two of the most hopeful areas for improved design and evaluation of experiments.

DESCRIPTORS: Cloud seeding; Cloud seeding evaluation; Artificial precipitation stimulation; Progress in cloud seeding

ID NO.- MGA27100134
Utochneniye metodiki ekonomicheskoy otsenki effektivnosti protivogradovoy zashchity. .Improvement of the method of determining hail modification effectiveness by economic evaluation..
Naurzokov, Yu. Kh.; Legkostup, S. S.
Nal'chik, U.S.S.R. Vysokogornyy Geofizicheskiy Institut, Trudy, No. 22, 1973. p. 196-200. Ref. Russian summary. DAS, DLC
LANGUAGE: rs
CTRY OF PUBL:UR
The economic evaluation of a method of combating hail requires evaluation of the characteristics of anti-hail measures by using such parameters as the coefficients of hail hazard P.SUB 1., of hail activity of the year P.SUB 2., of the expected damage G.SUB i., and of the area of sowing of the i-th crop K.SUB p..SUB i.. Equations are derived for calculating the annual economic effect of a method, for comparing the economic effectiveness of two counter-hail methods, etc.
DESCRIPTORS: Hail suppression evaluation

ID NO.- MGA27100133
O vybore kontrol'noy territorii pri otsenke effektivnosti protivogradovykh rabot. .Selection of a control territory in evaluating the effectiveness of hail modification experiments..
Koval'chuk, A. N.; Naurzokov, Yu. Kh.; Chepovskaya, O. I.
Nal'chik, U.S.S.R. Vysokogornyy Geofizicheskiy Institut, Trudy, No. 22, 1973. p. 183-187. Refs. Russian summary. DAS, DLC
LANGUAGE: rs
CTRY OF PUBL:UR
A new approach to the selection of a control territory for use in evaluating the effectiveness of anti-hail measures is set forth. Before comparing the damage produced by hail on protected and control territories, it is necessary to establish factually the development of the phenomena capable of bringing about the growth of hail. Hail fall is accompanied by rainfall. The mean seasonal amount of precipitation correlates well with the area of sowing of farm crops destroyed and damaged by hail. The coincidence of the value of mean seasonal (May-Sept.) amount of precipitation on the control and protected area is an important condition in choosing the control territory. In evaluating the effectiveness of counter-hail operations, it is necessary to consider the degree of hail hazard of the protected and of the selected control territories.
DESCRIPTORS: Hail suppression evaluation

ID NO.- MGA27100132
Rezul'taty protivogradovykh rabot na Severnom Kavkaze v 1970-1971 gg. .Results of anti-hail efforts in the Northern Caucasus in 1970 and 1971..
Burtsev, I. I.
Nal'chik, U.S.S.R. Vysokogornyy Geofizicheskiy Institut, Trudy, No. 22, 1973. p. 117-128. Refs. Russian summary. DAS, DLC
LANGUAGE: rs
CTRY OF PUBL:UR
The principal results of artificial modification of hail processes in the Northern Caucasus in order to protect farm crops from hail are presented. The artillery method developed in the Vysokogornyy Geofizicheskiy Institut was used. The region of operation is described; the aerosynoptic conditions during the days with hail fall and with cloud seeding are analyzed by months during the hail season of 1970-1971, and the most intense hail processes are described. An analysis of the results obtained from two territorial anti-hail field operations showed the effectiveness of the artillery method in preventing hail. On the average, the hail losses on the protected territory were reduced 3-4 times.
DESCRIPTORS: Hail prevention effectiveness; Northern Caucasus, R.S.F.S.R. (European)

ID NO.- MGA27100131

K voprosu o zagraznenii atmosfernogo vozdukha i osadkov produktami aktivnogo vozdeystviya na gradovyye protsessy na Severnom Kavkaze. .Atmospheric pollution and precipitation caused by products used in hail modification in the Northern Caucasus..

Burstev, I. I.

Nal'chik, U.S.S.R. Vysokogornyy Geofizicheskiy Institut, Trudy, No. 22, 1973. p. 201-213. Refs. Russian summary. DAS, DLC

LANGUAGE: rs

CTRY OF PUBL:UR

An experimental investigation was conducted in the region being protected against hail along the northern slopes of the Caucasus, in order to determine the degree of atmospheric pollution produced by the AgI and PbI reagents used to modify hail clouds. The experimental procedure, involving an automatic precipitation collector and an analysis of the emission of the spectral lines of Ag and Pb, is described. The concentration of Pb in the near surface atmospheric layer, after introduction of the reagents, increased by 10-12 times in comparison with the mean values, but it failed to reach critically permissible health levels. The accumulation at the end of the season was 0.8 km Ag and 7.3 kg Pb/km.SUPER 2.. Both Ag and Pb are, to a considerable degree, washed out of the atmosphere locally immediately during the period of introduction; and the concentration of these substances in rain increases in relation to the quantity introduced. The rate of accumulation of Ag and Pb on a unit surface depends upon the period of experimental modification.

DESCRIPTORS: Cloud seeding effects; Hail suppression experiments; Northern Caucasus, R.S.F.S.R. (European)

ID NO.- MGA27100130

Analiz rezul'tatov rabot po aktivnomu vozdeystviyu na gradovyye protsessy. .Analysis of results on active modification of hail processes..

Belentsova, V. A.; Burtsev, I. I.; Fedchenko, L. M.

Nal'chik, U.S.S.R. Vysokogornyy Geofizicheskiy Institut, Trudy, No. 22, 1973. p. 129-148. Refs. Russian summary. DAS, DLC

LANGUAGE: rs

CTRY OF PUBL:UR

The development and movement of convective clouds during their artificial modification is analyzed on the basis of aerological, synoptic, meteorological, and radar data obtained in the course of modification of hail processes of differing intensities, conducted in 1970-1971 in the Northern Caucasus. The aims of the investigation are to determine the possibility of classifying hail processes by intensity on the basis of a short series of meteorological observations and of hail damage to plots of farm crops, to propose classification criteria, and to clarify the effectiveness of modification on processes of differing intensities. A ten-year series of observations of meteorological stations on hail fall may, with adequate reliability, replace long-term (20 yr) series in evaluating the hail hazard of a large-scale region (Northern Caucasus). The increased elucidation of network observations by data of meteorological posts provides a more detailed picture of the distribution of hail fall frequency over an area, but cannot provide accurate limits of the degree of hail hazard of a small area (for example, a territory protected by a single anti-hail battery). The use of a combination of parameters permits the accuracy of classification processes to be increased, and permits values of criteria characterizing the intensity of a hail process to be formulated. Analysis of the results of anti-hail operations for processes of differing intensities from the point of view of skill score showed that, for intense processes in experiments on hail fall interruption (59%), the ratio of successful trials to unsuccessful ones was 3/5, and in experiments to prevent hail fall (41%), the ratio was 1/5. In cases of slight hail damage, experiments on preventing hail fall did not yield positive results.

DESCRIPTORS: Hail suppression evaluation; Northern Caucasus, R.S.F.S.R. (European)

ID NO.- MGA27100129

Nekotoryye voprosy vozdeystviya na gradovyye protsessy. .Modification of hail processes..

Abshayev, M. T.; Dadali, Yu. A.

Nal'chik, U.S.S.R. Vysokogornyy Geofizicheskiy Institut, Trudy, No. 22, 1973. p. 104-116. Refs. Russian summary. DAS, DLC

LANGUAGE: rs

CTRY OF PUBL:UR

The merits and defects of operational methods of artificial modification of hail processes by seeding hail clouds with reagents introduced by using ground-based generators, rockets, and artillery shells are analyzed; and ways to improve the methodology and technique of modification in order to increase the effectiveness of anti-hail operations are examined. The authors describe a new method for interrupting and preventing hail fall, based upon the introduction of crystalline reagents into a cloud in the initial stage of hail formation up to which natural hail nuclei begin to develop or into that part of a cloud where hail nuclei are not yet present. For this purpose, preliminary local seeding of the space near a cloud in the direction of movement of hail formation is proposed, with subsequent treatment of the frontal part of the cloud, where ascending flow and the zone of accumulation develop. Experimental verification of the proposed method, conducted in a three-year period, demonstrated the effectiveness of the method in interrupting and preventing hail damage.

DESCRIPTORS: Hail suppression

ID NO.- MGA27100128e

Chislennoyee modelirovaniye vozdeystviya iskusstvennymi yadrami kondensatsii na protsess razvitiyae radiatsionnogo tumana. .Numerical simulation of radiation fogemodification by artificial condensation nuclei..e

Zakharova, M.; Sedunov, Yu. S.e

Inst. Eksperimental'noy Met.e

Meteorologiya i Gidrologiya, Moscow, No. 2, Feb. 1976. p.e 3-8. Refs. English and Russian summaries. Transl. into Englishe in corresponding issue of Meteorology and Hydrology,e Wash., D.C. Available from NTIS, Springfield, VA. 22161. DAS, DLCe

LANGUAGE: othere

CTRY OF PUBL:URe

On the basis of numerical simulation, effects of the modification of radiation fog formation and evolution by artificial condensation nuclei (added at the time of activation) are examined. The increase in drop condensation at the initial stage of fog formation (at the upper limit of the fog in the growth of its intensity) caused a decrease in drop size and an increase in water content of the fog. The visibility in the fog layer decreased approximately three times.

DESCRIPTORS: Fog modification

ID NO.- MGA27100126

Iskusstvennyye vozdeystviya na meteorologicheskiye protsessy vo Frantsii. .Artificial modification of meteorological processes in France..

Burtsev, I. I.

Nal'chik, U.S.S.R. Vysokogornyy Geofizicheskiy Institut, Trudy, No. 22, 1973. p. 3-11. Russian summary. DAS, DLC

LANGUAGE: rs

CTRY OF PUBL:UR

The state of investigations conducted in France during the past 20 yr on the artificial modification of hail processes, supercooled and warm fogs, and artificial seeding to initiate precipitation, and of studies on the ice forming reagents used in seeding clouds and fogs is reviewed briefly. Considerable success has been attained in the investigation and development of methods of fog dispersion and in their practical application in opening up fog-bound airports. The method of hail modification has proven to be of slight effectiveness and has no firm scientific basis. Work in cloud modification to induce precipitation is in the initial developmental stage. Investigations on cloud physics and cloud modification are being set up on a firm foundation.

DESCRIPTORS: Weather control research; Progress in weather control; France

ID NO.- MGA27100036

Nekotoryye rezul'taty radiolokatsionnykh issledovaniy vremennoy izmenchivosti kharakteristik gradovykh oblakov i voprosy otsenki effektivnosti vozdeystviya na grad. .Results of radar studies of temporal variability in the characteristics of hail processes and problems of the evaluation of the effectiveness of hail modification..

Dadali, Yu. A.; Kuchmezov, O. M.

Nal'chik, U.S.S.R. Vysokogornyy Geofizicheskiy Institut, Trudy, No. 22, 1973. p. 149-164. Refs. Russian summary. DAS, DLC

LANGUAGE: rs

CTRY OF PUBL:UR

The technique for measuring the radar parameters of hail processes before and after modification of hail clouds, by using a two-wave radar operating on wavelengths of 3.2 and 10.55 cm, in order to evaluate the physical effectiveness of modification, is described. These parameters are height of the upper boundary of the radar echo of the cloud, temperature at the height of the upper boundary of the radar echo, the ratio of the height of the supercooled part of the cloud to the height of its warm part, the value of maximum radar reflectivity on the two long waves, the height of maximum radar reflectivity, the temperature at this height, etc. The results and regularities of temporal transformation of the following parameters of hail clouds during natural development are presented: absolute value of the maximum radar reflectivity at 10-cm wavelength, the magnitude .DELTA .(.DELTA .z) or the difference of the signal between two points of two moments of time, the maximum hail fall intensity, and the probability of hail fall. A series of conclusions is formulated regarding the characteristics of the dynamics of hail clouds. The regularities of transformation of hail clouds during artificial modification are set forth, and different characteristics of hail damage to farm crops are analyzed with the aid of an equation that is derived in order to determine their suitability for evaluating the hail damage and the effectiveness of modification. The most suitable characteristic is the magnitude of flux of kinetic energy created by the falling hail. The formula for estimating kinetic energy or intensity of hail damage expresses the latter as a function of radar measurements. The construction and operation of a device for automatic recording and computing of damage from hail fall are described.

DESCRIPTORS: Hail suppression evaluation; Radar hail detection

ID NO.- MGA27100034

Transformatsiya kuchevo-dozhdevykh oblakov i kontrol' fizicheskoy effektivnosti vozdeystviya na gradovyye protsessy. .Transformation of cumulonimbus clouds and control of the physical effectiveness of modification of hail processes..

Abshayev, M. T.; Berezkin, V. V.

Nal'chik, U.S.S.R. Vysokogornyy Geofizicheskiy Institut, Trudy, No. 22, 1973. p. 165-182. Refs. Russian summary. DAS, DLC

LANGUAGE: rs

CTRY OF PUBL:UR

The transformation of the radar characteristics of cumulonimbus clouds during the process of natural development and after artificial modification of hail clouds was investigated. The transformation of geometrical, thermodynamic, and microstructural characteristics; the variations of the radar echo of cumulonimbus cloud; and the direction and velocity of their movement were studied. The laws of transformation of the following parameters were analyzed: H.SUB u. is the height of the upper boundary of a cloud in kilometers; t.SUB H..SUB m. is the air temperature at the level of the upper boundary of the radar echo in .SUPER o.C; H.SUB m. is the height of the position of the maximum radar reflectivity in kilometers t.SUB H..SUB m. is the air temperature at the level of the height of the maximum radar reflectivity in "C; .DELTA .h.SUB -./.DELTA .h.SUB +. is the ratio of vertical thickness of the radar in the region of negative temperatures to its value during positive temperatures; .ETA ..SUB m..SUB a..SUB x. is the value of maximum radar reflectivities in cm.SUPER -..SUPER 1. on long waves of 3.2 and 10 cm; H.SUB DELTA ..SUB ETA . is the height of the upper boundary of the zone of high reflectivity in cm.SUPER -. .SUPER 1.; and t.SUB H..SUB DELTA ..SUB ETA . is the air temperature at the level of the upper boundary of the zone of high reflectivity in .SUPER o.C. The method of radar control of the effectiveness of modification of hail processes is described with the aid of the relevant equations. The investigation showed that many parameters, for example geometrical and thermodynamic characteristics of cumulonimbus clouds, may be transformed during seeding-in each case in a different manner (increase or decrease). Parameters possessing close relationships with the microstructure of the clouds or with the physical formation and growth of hail are most suitable for the control of the effectiveness of modification. Such parameters are .ETA ..SUB 3..SUB ...SUB 2./.ETA ..SUB 1..SUB 0.; a function of the diameter of particles being dispersed, .ETA ..SUB 1..SUB 0. is the determining presence in a cloud of large water content necessary for the growth of hail; and t.SUB H..SUB DELTA ..SUB ETA .. .is an index of the position of the high water content in the region of negative temperatures. These three parameters were found to vary during modification, and the critical values determining the beginning or cessation of modification are as follows: .ETA ..SUB 3..SUB ...SUB 2./.ETA ..SUB 1..SUB 0. = 100, .ETA ..SUB 1..SUB 0. = 4 MULTIPLIED BY 10.SUPER -..SUPER 3.cm.SUPER -..SUPER 1.; and t.SUB H..SUB DELTA ..SUB ETA .. .= -15ëC.

DESCRIPTORS: Radar observation of cloud seeding; Hail modification effectiveness

ID NO.- MGA27090142

In-situ silver iodide coated titanium dioxide as an ice nucleant.

Corrin, M. L.; Barnes, Roy

Dept. of Atmos. Sci., CO. State Univ., Ft. Collins

Journal of Applied Meteorology, Boston, 15(4): 413-414, April 1976. Refs. DLC, DAS

CTRY OF PUBL:US

It was found possible to prepare a smoke from a conventional thermal AgI generator in which the particles consist of titanium dioxide coated with AgI. The process involves addition of tetra-butyl-orthotitanate to the generator feed; this substance is oxidized in the generator flame to TiO.SUB 2.. As much as 90% of the AgI content of the generator feed solution may be replaced with the titanate without reducing the ice nucleation efficiency of the output. Certain advantages of this method are discussed, and it is pointed out that this system is not yet optimized.

DESCRIPTORS: Silver iodide production

ID NO.- MGA27090141

Alberta hail project field program, 1974.

Canada. Alberta Agriculture, Interim Weather Modification Board,Alberta

Its Report No. 1, Feb. 1975. Ed. by Richard J. Deibert and James H. Renick. 37 p.

CTRY OF PUBL:CAe

This first report of the Interim Weather Modification Boarde describes the field program operation and the observational systems, and summarizes the data recorded during the 1974 season. The 1974 field program operated at the Red Deer Industrial Airport from May 1 to Sept. 10. Full operational status was maintained from June 20 to Sept. 10, 1974. During this period, cloud seeding operations were conducted over an 18,500-mi.SUPER 2. target area. In the southern half of this area, all storms were seeded; in the northern half, all storms were seeded on approximately one-half of the storm days. Seven seeding aircraft deployed 3018 fifty-gram droppable flares and 1476 seventy-gram wing-mounted flares during 591 hr of flight operations on 31 days. Hailfall was recorded on 42 days inside the target area during the season and an additional 13 days outside the target area, but within the province. A total of 3066 hail reports was received; 528 hr of C-band weather radar data were obtained from 34 days; 98.3 hr of this data were recorded on computer tape. The precipitation sampling network returned 1212 samples of rain, 384 of hail, and 468 hailpods from 42 storm days. Various results are tabulated.

DESCRIPTORS: Hail suppression experiments; Alberta, Canada

ID NO.- MGA27090140

Lightning suppression by chaff seeding at the base ofe thunderstorms.

Kasemir, H. W.

Atmos. Phys. & Chem. Lab., NOAA, Boulder, CO.e

Journal of Geophysical Research, Wash.,e D.C., 81(12): 1965-1970, April 20, 1976. Refs. DAS, DLCe

CTRY OF PUBL:US

An aircraft equipped with cylindrical electric field millse and a chaff dispenser was used to release large numbers ofe 10-cm-long chaff fibers at the base of thunderclouds. Thee electric fields and lightning discharges were monitored duringe repeated flight passes at cloud base. Twenty-eighte thunderstorms that met certain qualifications were seeded with chaff or left unseeded, the unseeded storms becoming control cases. An analysis of the data from 10 thunderstorms seeded with chaff and 18 unseeded control storms shows that seeding thunderstorms with chaff reduced the number of observed lightnings to about one third or less of those observed in the control storms. A statistical evaluation of the occurrence of lightning discharges in the time interval before seeding and in the corresponding time interval of the control storms revealed that there was no significant difference between seeded and control storms. This indicates that both categories of storms belong to the same population. If the same test is applied to the time interval after seeding and the corresponding interval of the control storms, it is found that there is a significant difference between seeded and control storms after seeding. Therefore, the lightning reduction by chaff seeding is not due to chance.

DESCRIPTORS: Lightning suppression by chaff seeding

ID NO.- MGA27090139

Preliminary estimate of a tropical cyclone track change caused by artificial enhancement of convective heat release.

Jones, Robert W.

U.S. National Hurricane Res. Lab.

United States National Oceanic and Atmospheric Administration. Environmental Research Labs., Boulder, CO., Technical Memorandum (NOAA TM ERL WMPO-27), April 1976. 23 p. Refs. DAS (A QC 807.5 U6W5)

CTRY OF PUBL:US

The response of a three-level, three-dimensional model of a tropical cyclone to artificial enhancement of the convective heating rate, such as may occur by man's efforts to modify a hurricane, is examined. Results with symmetric and asymmetric distributions of enhanced convection show that the principal short-term (to 21 hr after the enhancement begins) effect of the enhancement upon the track of the vortex is to induce a trochoidal oscillation about the mean path of the control experiment. The track deviations at 21-hr range from 1 to 6% of the 315-km displacement. After this time, the track deviations grow and, by 48 hr after the termination of a 10-hr symmetric enhancement, systematic track deviations of about one eyewall diameter occur perpendicular to the mean track of the control. These latter deviations seem to be related to the poor vertical alignment of the upper-level cyclonic circulation center compared with the middle- and low-level centers (25-km differences). The planetary, or .BETA .-effect, is not yet included in the model, but this influence upon possible track changes resulting from enhanced convection is discussed, with the conclusion that changes of the northward and westward drifts of about 5 km in 30 hr may be reasonable. Because this model is still being developed, the control experiment has a small domain size and a poor eyewall structure. These results must be considered preliminary.

DESCRIPTORS: Tropical cyclone modification; Tropical cyclone tracks; Tropical cyclone models

ID NO.- MGA27090138

Weather modification by carbon dust absorption of solar energy.

Gray, William M.

Atmos. Sci. Dept., CO. State Univ., Ft. Collins

Journal of Applied Meteorology, Boston, 15(4): 355-386, April 1976. Refs. Longer version published as Colorado. State Univ., Ft. Collins. Dept. of Atmospheric Science, Atmospheric Science Paper No. 225, July 1974. 191 p., same abstract. DAS, DLC

CTRY OF PUBL:US

Growing global population pressures and predicted future food and energy shortages dictate that manefully explore his potential use of solar energy. This paper investigates the possibility of beneficial weather modification through artificial solar energy absorption. A variety of physical ideas related to artificial heat sources on different scales of motion is considered. Interest is concentrated on the feasibility of mesoscale (.APPROX. .100-300 km) weather modification through solar energy absorption by carbon aerosol particles of size .APPROX. .0.1 .MU .m or less. Particles of this size maximize solar energy absorption per unit mass. It is hypothesized that significant beneficial influences can be derived through judicious exploitation of the solar absorption potential of carbon black dust. There is an especially high potential for this in the boundary layer over tropical oceans and in the formation of cirrus clouds and the consequent alteration of the tropospheric IR energy budget. If dispersed in sizes .LESS OR EQUAL. 0.1 .MU .m, solar energy absorption amounts as high as .APPROX. .2MULTIPLIED BY10.SUPER 1..SUPER 0.e cal lb.SUPERe -..SUPER 1. per 10 hr or about 4MULTIPLIEDe BY10.SUPER 1..SUPER 1. cal per dollar per 10 hr can be obtained. This is a tremendously powerful heat source, especially if it stimulates additional radiation energy gains from extra cloud formation and/or enhanced surface evaporation. Preliminary observational and modelling information indicates that this artificial heat source can be used on the mesoscale (.APPROX. .100-300 km) to achieve significant economic gains by means of precipitation enhancement and tropical storm destruction alleviation. It may also be possible to use carbon dust to enhance precipitation over interior land areas, alter extratropical cyclones, inhibit high daytime summer temperatures and severe weather, prevent frosts, and speed up springtime snowmelt in agriculturally marginal regions. A discussion of this physical hypothesis from the meteorological, radiational, engineering, and ecological points of view is presented.

DESCRIPTORS: Weather modification schemes; Absorption by dust; Solar energy utilization

ID NO.- MGA27080143

Heterogeneous nucleation of water and ice in the transient supersaturation field surrounding a freezing drop.

Rosinski, J.; Nagamoto, C. T.; Kerrigan, T. C.

Natl. Ctr. for Atmos. Res., Boulder, CO.;

Journal de Recherches Atmospheriques, Clermont-Ferrand, France, 9(3): 107-117, July/Sept. 1975. Refs. English and French summaries. DAS, DLC

CTRY OF PUBL:FR

Nucleation of water and ice by particles in the transient supersaturation field surrounding a freezing drop was studied in the laboratory. Silver iodide particles (400- to 1000-A diameter) nucleated water at temperatures warmer than -9.8 .PLUS OR MINUS .0.1"C and ice at lower temperatures. Soil particles larger than 40 .MU .m nucleated ice below -16.8"C. Particles smaller than 40 .MU .m nucleated ice at lower temperatures, e.g., 20 .MU .m nucleated ice at -20"C. Soil particles acted as condensation nuclei at warmer temperatures. Comparison of ice particle formation in a seeded parcel of a cloud by two modes of ice nucleation (by contact and condensation followed by freezing) is presented.

DESCRIPTORS: Heterogeneous nucleation; Nucleation processes; Nucleation of ice; Cloud seeding effects

ID NO.- MGA27080142

Vurkhu izmeniniyeto na ledoobrazuvashtata aktivnost na CuS, AgI i Pb1.SUB 2. pri potopyavaneto im vuv voda. .Relation between the iceforming activity of CuS, AgI, and Pb1.SUB 2. and the history of their immersion in water..

Levkov, L.; Genadiyev, N.

Khidrologiya i Meteorologiya, Sofia, 25(1): 69-73, 1976. Refs. English and Russian summaries. DAS, DLC (GB651.K5)

LANGUAGE: bu

CTRY OF PUBL:BFSRT

It is shown experimentally that the ability of the substances CuS, AgI, and PbI.SUB 2. to form ice depends essentially upon the history of their immersion in water. The experiments are conducted with two types of substances: 1) unwashed and untreated, technically obtained CuS, AgI, and PbI.SUB 2., and 2) treated ones washed with water. The ice-forming properties of PbI.SUB 2. particles change the most; those of AgI change more slightly; but the ice-forming properties of CuS particles do not change at all. Two basic reasons for the deactivation are 1) in the washed samples' smoothing of the imperfections in the crystal, lattice takes place which makes difficult the formation of ice embryos; 2) e the retaining of water molecules on the walls may be due to the properties of the crystal wall or to the accumulated minimum amounts of hydroscopic substances. If these hydroscopic impurities are dissolved in water, it is most probable that the conditions of ice formation will be made worse, as it will be more difficult for the nuclei to retain the water molecules.

DESCRIPTORS: Cloud seeing substances; Copper sulfide effectiveness; Silver iodide effectiveness; Lead iodide effectiveness

ID NO.- MGA27080141

Obrazuvane na led vurkhu chastitsi ot PbI.SUB 2. polucheni pri izgaryane na pirotezhnicheski sustav. .Ice formation one the PbI.SUB 2. particles obtained from the burning of ae pyrotechnic compound..

Genadiyev, N.; Konstantinov, P.; Todorova, S.e

Khidrologiya i Meteorologiya, Sofia, 25(1): 61-68, 1976.e Refs. English and Russian summaries. DAS, DLC (GB651.K5)e

LANGUAGE: bu

CTRY OF PUBL:BU

The possibility is examined of ice formation on the PbI.SUB 2.eparticles obtained from the burning of pyrotechnic compound OB-1. The criterion used to find ice on the PbI.SUB 2. particle, is that if, on contact, the particle freezes, then a droplet overcools slightly more than the characteristic temperature of the contact nucleation, and it follows that 1) at burning of the PbI.SUB 2. pyrotechnic compound, nearly monodispersal aerosol with dimensions of the crystal about 3.5e .MU .m (counted at magnification MULTIPLIED BY 1000) ise obtained; 2) the mean characteristic temperature of thee contact nucleation of the PbI.SUB 2. particles obtained frome this compound is -2.5"C, and the temperature of precoolinge necessary for obtaining of ice on them is -5"C; and 3) ase distinguished from other pyrotechnic compounds, the icee forming properties of the OB-1 compound do not differ frome those of the pure PbI.SUB 2. dust.e

DESCRIPTORS: Cloud seeding with lead iodide; Lead iodidee effectiveness

ID NO.- MGA27080140

Eksperimental'nyye issledovaniya prosvetleniya tumana lazernym izlucheniyem s .LAMBDAe.e= 10,6 mkm. .Experimental investigation of fog clearing by 10.6-.MU .m laser radiation..

Belyayev, V. P.

Inst. Eksperimental'noy Met.

Akademiya Nauk, Moscow, Izvestiya. Fizika Atmosfery i Okeana, 11(10): 1075-1078, Oct. 1975. Refs. DAS, DLC. Transl. into English in corresponding issue of Izvestiya. Atmospheric and Oceanic Physics, Wash., D.C. la DAS.

LANGUAGE: other

CTRY OF PUBL:IN

The dependence of the stationary regime of the clearing of a liquid drop cloud by continuous illumination by a CO.SUB 2. laser with .LAMBDAe.e= 10.6 .MU .m upon 1) the parameters of the emission source and the properties of the medium being cleared, and upon 2) the velocity of a constant wind was investigated. An attempt was made to discover nondimensional parameters determining the clearing process. The clearing experiments were conducted in a large aerosol chamber along a horizontal path of 4 m. The dependence of the effect of clearing of fog upon the initial optical thickness .TAU ..SUPER 0..SUB 0..SUB ...SUB 6..SUB 3. (optical thickness of fog for .LAMBDA . = 0.63 along the length before action of the laser) is represented on a graph for different velocities of crosswind, and a single value of the diameter of the laser beam is represented on a graph. A characteristic of the clearing effect is its saturation of large values of .TAU ..SUPER 0..SUB 0..SUB ...SUB 6..SUB 3.. Physically, this means that, for given values of output intensity of the laser, beam diameter, crosswind, and medium being cleared, limiting values of cleared optical thickness exist. For a quantitative description of the experimental results, a simple model of the clearing effect is presented, consisting of an expression for the steady- state distribution of intensity of the effective emission and .LAMBDA . = 10.6 .MU .m in a plane. Good agreement is obtained between experimental and computed results. In clearing a cloud medium as a result of heating the air by evaporating drops, convective currents develop whose velocity does not exceed 10 cm/sec in a wide range of values of voltage, beam diameter, crosswind, and wavelength. This convective flow is equivalent to the action of a constant with effective velocity close to the velocity of convective flow.

DESCRIPTORS: Fog dissipation by lasers

ID NO.- MGA27070411

Precipitation research.

Peck, Eugene L.

Hydro. Res. Lab., Natl. Weather Serv., NOAA, Silver Spring, MD.

Reviews of Geophysics and Space Physics, Wash., D.C., 13(3): 431-433, July 1975. Biblio. DASe

CTRY OF PUBL:USe

The research conducted in the U.S. on precipitation during 1971-1974 is summarized briefly as follows: the deficiencies in point measurement and on methods of improving the representativeness of such measurements and on measurement of snowfall and snow cover; use of weather radar to measure precipitation and snowfall; establishment of a method for design of precipitation measuring systems based on the requirements of the ultimate uses of the measurements; development of design criteria for gaging thunderstorms; investigations on the meteorology of extreme storms, particularly in the region between the Cascade-Sierra Nevade crest and the Continental Divide; precipitation frequency studies; studies on probable maximum precipitation and inadvertent weather modification; and development of storm precipitation models.

DESCRIPTORS: Precipitation research; United States

ID NO.- MGA27070103

Florida area cumulus experiment: rationale, design, procedures, results, and future course.

Woodley, William L.; Sax, Robert I.

United States National Oceanic and Atmospheric Administration. Environmental Research Labs., Boulder, CO., Technical Report (NOAA TR ERL 354-WMPO 6), Jan. 1976. 204 p. Refs. DAS (A QC 807.5 U66)

CTRY OF PUBL:UR

The FACE program is an outgrowth of the single cloud-seeding experiments in Florida, which showed that dynamic seeding can be effective in increasing the sizes and lifetimes of individual cumuli and the localized rainfall resulting from them. FACE is a program to determine whether dynamic seeding can be used to augment precipitation over an extensive area (1.3 MULTIPLIED BY 10.SUPER 4. km.SUPER 2.) by promoting larger and better organized convective systems. The program design includes a fixed target area with randomized seeding instructions; surveillance of the clouds in the target by 10-cm radars of the Univ. of Miami (in 1970 and 1971) and the National Hurricane Center (in 1972 and 1973); suitable days for experimentation; flights by seeder aircraft on suitable days; and final acceptance of a day for inclusion in the area analysis only after expenditure of 60 flares (50 g of silver iodide each) or after seedings of six clouds, or both. The experiment is, therefore, vulnerable to daily fluctuations in radar performance. The sample of experimental days in FACE is still too small to hope for definitive results. Nevertheless, the experiment is moving in the right direction as is shown by a factor of two increase in rainfall from single clouds in FACE and the greater tendency of the seeded clouds to merge. It may well take until 1980 before an adequate description of Florida convective systems is possible by using observations and models.

DESCRIPTORS: Cloud seeding in Florida, United States; Cumulus cloud seeding; Florida, United States

ID NO.- MGA27070102

Iskusstvennaya kristallizatsiya moshchnykh kychevykh oblakov. .Artificial crystallization of highly developed cumulus clouds..

Vorob'yev, B. M.; Ponomareva, O. V.

Leningrad. Gidromet. Inst.

Akademiya Nauk SSSR, Moscow, Izvestiya. Fizika Atmosfery i Okeana, 11(5): 529-534, May 1975. Refs. DAS, DLC. Transl. into English in corresponding issue of Izvestiya. Atmospheric and Oceanic Physics, Wash., D.C. DAS

LANGUAGE: other

CTRY OF PUBL:UR

Model calculations are performed for estimating the influence of individual factors upon the microphysics and macrodynamics of crystallizing cumulus clouds. For the numerical solution of a multiphase turbulent current, a system of differential equations is solved for the vertical velocity of motion, temperature, radius, droplet concentration, pressure, relative humidity, radii of water, and ice particles; all averaged along a cross section. The differential equations are integrated over altitude, from some initial level for which initial current parameters are given as boundary conditions, to an arbitrary level at which the unknown current parameters are being determined. The initiale atmospheric parameters in different numerical models and thee results of computation of concentration parameters ofe different models are presented. The intensification ofe crystallizatcn processes in the most highly developed cumuluse clouds does not bring a substantial change in theire macrodynamics. The intensity of crystallization processes is expressed more strongly as a greater concentration of crystalse is introduced into the clouds-the lower is their seeding levele and the smaller is the velocity of ascending motions in the supercooled parts of the cloud.e

DESCRIPTORS: Cloud seeding effects; Cumulus cloud seeding

ID NO.- MGA27070101

Mezhdunarodnaya tekhnicheskaya konferentsiya po vozdeystviyu na tayfuny (Manila, Filippiny, 15-18 Okt. 1974). .International Technical Conference on Typhoon Modification (Manila, Philippines, 15-18 Oct. 1974)..

Vul'fson, N. I.

Akademiya Nauk SSSR, Moscow, Izvestiya. Fizika Atmosfery i Okeana, 11(5): 542-544, May 1975. DAS, DLC. Transl. into English in corresponding issue of its Izvestiya. Atmospheric and Oceanic Physics, Wash., D.C. DAS

LANGUAGE: other

CTRY OF PUBL:UR

This article presents a summary of the papers delivered at the Technical Conference on Typhoon Modification. The papers dealt with the mechanism of rain formation in warm clouds; typhoon studies from surface and satellite data; storm waves produced by typhoons; results of experiments on hurricane seeding; artificial rain production from warm cumulus clouds; etc.

DESCRIPTORS: Typhoon conferences; Typhoon modification; Hurricane modification

ID NO.- MGA27060402e
Availability of atmospheric water.e
Torrance, J. D.
Dept. of Met. Serv., Salisbury, Rhodesia
Rhodesia Scientific Association, Salisbury, Proceedings ande Transactions, 56(2): 3i-45, March 1975. Ref.e
CTRY OF PUBL:RH
A study was undertaken to investigate the relationshipse between atmospheric moisture and rainfall. It was found that 1) there is a small interseasonal variation in totals ofe precipitable water, compared with the corresponding variatione in rainfall; 2) there is good agreement between interseasonale totals of precipitable water on rain days only, and rainfalle totals; 3) there is good agreement between precipitable watere and rainfall index; 4) as to daily values, there is a generale increase in the amount of rain as the precipitable water totale increases, but dry days can still occur with any value ofe precipitable water; 5) high values of precipitable water aree then a necessary, but not by themselves sufficient, conditione for conversion of atmospheric moisture into rainfall. Computer modelling was used to show that the quantities of water vapor used by a thunderstorm are comparable with those held by the atmosphere per unit area. It is shown that even periods of heavy, widespread rain do not deplete the reserves of moisture held in the atmosphere excessively, and it is clear that cloud seeding activities are not likely to utilize more than a small proportion of the water vapor available in the air. There need be no concern that cloud seeding will deprive any area of its rightful share of the atmospheric moisture.
DESCRIPTORS: Precipitable water-precipitation relationships; Precipitation-humidity relationships; Cloud seeding effects

ID NO.- MGA27060148
Santa Barbara convective band seeding test program, final report.
Thompson, John R.; Brown, Keith J.; Elliott, Robert D.
United States Naval Weapons Center, China Lake, CA., NWC Technical Publication 5804, Oct. 1975. 228 p. Refs. DAS (A VF 23 U55)
CTRY OF PUBL:US
Tests to determine the effectiveness of seeding convective portions of winter storm systems passing over Santa Barbara county were conducted from a 1065-m mountain ridge by using a pyrotechnic fuse during four winter seasons from 1967-1968 through 1970-1971 (phase 1). After an experimental period in 1970-1971, full-scale phase 2 aerial operations were continued through the 1973-1974 seasons. Aerial seeding using an AgI-NH.SUB 4.I- acetone solution was conducted just west of Santa Barbara County, with the nucleant being dispensed by a burner developed by the Naval Weapons Center. A limited amount of seeding was also conducted from the mountain ridge site by using a modified version of the Naval Weapons Center acetone burner. Organized areas of convection (convective bands) were identified and tracked through the project area by means of telemetered rain gages and radar. In both phases, the program was randomized, with approximately one half of the convection bands being seeded. However, the randomization scheme in phase 2 was revised so that all the convection bands that occurred in a given storm period (48-hr duration) were treated similarly (either all seeded or all not seeded). The primary mode of evaluation was a comparison of rainfall from bands with a test area of about 27,000 m.SUPER 2. containing approximately 100 rain gages available for analysis. Single ratio analyses of seeded to not seeded convection band precipitation, band duration, and storm precipitation are presented. In addition, several analyses based on temperature, wind direction, and pressure distributions were made to investigate mesoscale effects related to seeding. On the basis of the statistical results, it is concluded that seeding convective bands is an efficient means of augmenting water supplies, with increases on the order of 50 to 100% indicated within seeded bands.
DESCRIPTORS: Cloud seeding evaluation; Santa Barbara County, California

ID NO.- MGA27060147
Raschet protsessa iskusstvennoy kristallizatsii konvektivnykh oblakov. .Computation of the artificial crystallization process in convective clouds..
Stoyanov, St.
Khidrologiya i Meteorologiya, Sofia, 24(5): 3-10, 1975. Refs. English summary. DAS, DLC (GB651.K5)
LANGUAGE: bu
CTRY OF PUBL:BU
By using a simulation of convective clouds in the form of turbulent nonisothermal jet in the stratified atmosphere, a possibility for computing the transformation process of the thermodynamic characteristics in the cumulonimbus cloud is examined. This transformation results from the artificial cloud modification by crystallizing reagents. The artificial modification is simulated as involving in the computation ice particles at any height and in a given concentration. Computations using different parameters of seeding with artificial crystals are made, which permit such important characteristics of modification to be evaluated as the concentration of ice embryos and the level of their seeding in the cloud.
DESCRIPTORS: Cloud seeding effects; Convective cloud seeding

ID NO.- MGA27060146

Vurkhy yedin fiziko-statisticheski model za otsenka na yefektivnostta ot aktivnoto vuzdeystviye sreshtu gradushkata. .ePhysical and statistical model for evaluating the efficiency of artificial modification of hailstorms..e

Stanchev, K.; Simeonov, P.

Khidrologiya i Meteorologiya, Sofia, 24(5): 29-43, 1975. Refs. In Bulgarian; English and Russian summaries. DAS, DLC (GB651.K5)

LANGUAGE: bu

CTRY OF PUBL:BU

Sixty-eight cases of hail damage during a 5-yr period without artificial modification in a mesoregion in the Vratchansky district are examined. Graphical dependences of regression between the conditional total instability energy of the atmosphere are found, .DELTA .T.SUB SIGMA .(T - T).SUB 7..SUB 0..SUB 0. + (T - T).SUB 5..SUB 0..SUB 0., as well ase between the energy at the 500-mb level, .DELTA .T.SUB 5..SUB 0..SUB 0., before the beginning of the hail process, and the damages caused (damaged areas and paid compensation). The dependences are derived for the months of May, June, July, and Aug., when agricultural crops are most intensive and the hailstorms are most frequent. The accuracy estimation of the regression curves is done by computing from these curves the relative error between the calculated damages and the real ones for every year. The errors for heavy- hail-damage years are on the order of .PLUS OR MINUS .0.5-12%, and the annual mean errors for the different dependences in the form f(.DELTA .T.SIGMA .) are from 6 to 14%. This gives the opportunity, after improving the model, to apply it for evaluation of the economic efficiency of the artificial modification conducted in the given range for hail intervention (RHI), as the model connects the thermodynamic conditions of the atmosphere before the hail-forming process with the economic effects from it.

DESCRIPTORS: Hail damage statistics; Hail suppression evaluation; Economic aspects of weather modification; Vratchansky district, Bulgaria

ID NO.- MGA27060143

Vurkhu ledoobrazuvashchata aktivnost na chastitsi ot PbI.SUB 2..e.Ice formation activity of PbI.SUB 2. particles..

Genadiyev, N.

Khidrologiya i Meteorologiya, Sofia, 22(3): 81-85, 1973. Refs. DAS, DLC (GB651.K5)

LANGUAGE: bu

CTRY OF PUBL:BU

Results of five series of experiments are tabulated and discussed. Lead iodide crystals were used to test the nucleation efficiency of PbI.SUB 2. under various conditions at 10" intervals of temperature from -1.1 to -2.0 and down to -9.1 to -10.0"C. The laboratory and experimental equipment ise described and illustrated, and the theoretical aspects aree treated briefly. Work of other authors in the U.S., U.K., U.S.S.R., and Czechoslovakia is considered in drawinge conclusions as to sensitivity.

DESCRIPTORS: Cloud seeding with lead iodide; Lead iodide effectiveness

ID NO.- MGA27060142

Compressed air for supercooled fog dispersal.

Weinstein, Alan I.; Hicks, James R.

United States Air Force. Cambridge Research Labs., Hanscom AFB, MA., Air Force Surveys in Geophysics, No. 329, Oct. 22, 1975. 32 p. Refs. DAS, DLC

CTRY OF PUBL:US

Series of controlled and free environment tests were conducted to determine the technical feasibility of using the cooling resulting from the adiabatic expansion of compressed air to initiate ice crystal production in a supercooled fog. It was found that approximately 10.SUPER 3. cm.SUPER 3. of air, when compressed to 60 psig and released through a supersonic nozzle, will produce the same number of ice crystals as does the evaporation of 1 cm.SUPER 3. of liquid propane.

DESCRIPTORS: Fog dispersal techniques; Supercooled fog dissipation

ID NO.- MGA27060139

Electrostatic induction parameters to attain maximum spray charge to clear fog.

Carroz, John W.; Keller, Patrick N.

United States Naval Weapons Center, China Lake, CA., NWC Technical Publication NWC TP 5796, Jan. 1976. 30 p. DAS (AVF23U55)

CTRY OF PUBL:US

Laboratory experiments using sprays of charged drops were conducted to support a fog clearing program. Sprays from 1 g/sec hollow-cone industrial spray nozzles were induction-charged to one-quarter of the Rayleigh charged drop stability limit. As the nozzle size was increased, a smaller fraction of the Rayleigh stability limit was achieved. Increasing the airflow past the nozzle increased the charge on the spray. Increasing induction surface, fluid conductivity, and voltage increased the spray charge to a limit beyond which further increases decreased the spray charge. Increasing the fluid pressure increased the total spray current, but not the charge-to-mass ratio. The laboratory data agree with a qualitative derivation relating drop charge to the nozzle spray geometry. The derivation shows that the greatest charge-to-mass ratio is achieved with narrow-cone-angle nozzles.

DESCRIPTORS: Fog dissipation by charged drops

ID NO.- MGA27060138t
Weather modification activity reports, calendar year 1974.t
U.S. National Oceanic and Atmospheric Administration,t EnvironmentalModification Office, Rockville, MD.t
March 1975. 17 p. + data. Refs.t
CTRY OF PUBL:US
By law, nonfederally sponsored weather modification activities must be reported to the National Oceanic andt Atmospheric Administration (NOAA); federal projects are alsot reported by agreement with applicable agencies. Reports oft activities conducted at 74 locations in the U.S. during 1974t are summarized herein. The analysis covers the purpose of thet weather modification project, location, sponsors, ooerators, modification equipment, techniques, target areas, seeding agents, seeding duration, and target areas. Discussions of environmental impact and project safety are also included.t Some trends in nonfederal activities from 1973 to 1974 aret indicated. A list of reported activities is given in ant appendix.
DESCRIPTORS: Weather modification; United States

ID NO.- MGA27050140
Growth of the ice phase in strong cumulonimbus updrafts.
Young, Kenneth C.
Inst. of Atmos. Phys., Univ. of AZ., Tucson
Pure and Applied Geophysics, Basel, Vol. 113(5/6): 1005-1017, 1975. Refs. DAS, DLC (QCB01.G37)
CTRY OF PUBL:SZ
A numerical model of ice phase growth in an ascending parcel is used to delineate seeding requirements under the competing embryo and glaciation hypotheses. The strong updraft core is found to remain virtually all liquid until homogeneous freezing occurs, AgI or dry ice seeding have negligible effects with achievable seeding rates. This suggests that the glaciation hypothesis is untenable. Natural hail embryo formation is limited to updrafts less than 3 to 4 m sec.SUPER -..SUPER 1. at cloud base. AgI seeding of such updraft regions at rates currently used is found to produce concentrations of hail embryos sufficient to enhance competition in multicell hailstorms, although supercell storms may require significantly greater seeding rates.
DESCRIPTORS: Hail formation; Hail suppression

ID NO.- MGA27050139
Flare test initiates NOAA's 1975 Florida area cumulus experiment.
Sax, R. I.; Woodley, W. L.; Holle, R. L.
Natl. Hurricane & Experimental Met. Lab., NOAA, Miami, FL.; American Meteorological Society, Boston, Bulletin, 56(11): 1172-1174, Nov. 1975. Refs. DAS, DLC (QC851.A6)
CTRY OF PUBL:US
The Florida Area Cumulus Experiment (FACE-75) program incorporates an ambitious attempt to examine in detail all aspects of the dynamic seeding hypothesis, beginning with the in-cloud conversion of supercooled water to ice, progressing through the effects of buoyancy on the internal kinematic structure of the convective system, and continuing with an investigation of how cloud groups merge and organize and an analysis of how the production of floating-target and total-target rainfall is altered by seeding. The dynamic seeding hypothesis is predicted upon the thermodynamic principle that the massive conversion of supercooled water to ice releases heat that can significantly enhance the buoyancy of a cumulus tower. The release of this heat can lead to increased vertical growth with an attendant, longer cloud lifetime and a more efficient processing of the available moisture. Typically, an aircraft penetrates a young, actively growing cumulus tower in a direction parallel to the shear vector at about the -10°C isotherm level, and 6-12 silver iodide pyrotechnics are released into the moist updraft portions of the cloud at intervals between 100 and 200 m. New towers and developing upshear of the original are successively penetrated, usually in a direction normal to the shear vector, in an effort to expand the breadth of the convective system and to induce merger with neighboring cells. The program is a cooperative effort involving NOAA and university groups.
DESCRIPTORS: Cumulus cloud seeding; Cloud seeding in Florida, United States; Florida, United States

ID NO.- MGA27050138

Mesure continue du pouvoir glacogene de l'air a Campistrous, printemps-ete 1974. .Continuous measurements of the ice forming capabilities of the atmosphere at Campistrous (High Pyrenees), spring- summer 1974..

Pham, Van Dinh; Buades, L.

Association Nationale de Lutte contre les Fleaux Atmospheriques, Toulouse, .Rapport sur la campagne., No. 23, April 1975. p. 33-42. Refs. DLC, DNAL

LANGUAGE: fr

CTRY OF PUBL:FR

Continuous measurement by night and day of ice forming nuclei at 15-16°C from May to Sept. during a cloud seeding experiment with AgI have yielded the following results. Most frequently, the ice forming property of the atmosphere is well correlated with emissions of AgI. Sometimes, the most considerable increase of ice forming nuclei in the atmosphere does not seem to be associated with any known source of AgI nuclei. More rarely, the generation of artificial nuclei does not involve any increase in the ice forming capacity of the atmosphere. The experimental procedure, including the instrumentation, its installation, and operation, are described with the aid of diagrams, and the data are presented in tables.

DESCRIPTORS: Ice nuclei concentration; Cloud seeding with silver iodide; Silver iodide ice forming properties; Campistrous, Pyrenees, Europe

ID NO.- MGA27050137

K voprosu ob evolyutsii spektra krupnykh kapel' v konvektivnykh oblakakh. .Evolution of the large drop spectrum in a convective cloud..

Mishveladze, B. A.; Mal'bakhov, V. M.

Zakavkazskiy Nauchno-Issled. Gidromet. Inst., Vychislitel'nyy TsentrSO AN SSSR

Akademiya Nauk SSSR, Moscow, Izvestiya. Fizika Atmosfery i Okeana, 11(11): 1153-1160, Nov. 1975. Refs. English and Russian summaries. DAS, DLC. Transl. into English in corresponding issue of Izvestiya. Atmospheric and Oceanic Physics, Wash., D.C.

LANGUAGE: other

CTRY OF PUBL:UR

The evolution of the large drops spectrum is considered, which appear in the local area of an axially symmetrical convective cloud or which are inserted there under an active influence aimed to stimulate precipitation processes. Analytical solution is given of the equation of coagulation of large drops with cloud droplets, taking into account convective transfer, turbulent mixing, and sedimentation. On the basis of the solution obtained, several examples are considered.

DESCRIPTORS: Cloud drop growth; Convective cloud seeding

ID NO.- MGA27050132

Weather-climate modification.

Mordy, Wendell A.

Ctr. for the Study of Democratic Inst. and the Ctr. for the Future,Santa Barbara, CA.

Reviews of Geophysics and Space Physics, Wash, D.C., 13(3): 746-752, July 1975. Biblio. DAS

CTRY OF PUBL:USe

The aims, methods, and results of weather-climate modification in the U.S. during 1971-1974 are reviewed by summarizing the most important studies published in this period. The material is treated under the following categories: hazard mitigation (National Hail Research Experiment, hail suppression research, fog dispersal, and lightning suppression); precipitation modification-climate experiments, Project Skywater, experiments on snowfall displacement, and mesoscale modification involving the Santa Barbara Project of seeding prefrontal mesoscale convection bands in winter to increase precipitation, and carbon dust seeding to increase atmospheric solar absorption in order to influence clouds and rainfall along tropical coastlines; inadvertent weather modification; seeding materials and delivery systems; evaluation of seeding experiments and aerial evaluation of cloud-seeding potential; and implications of weather modification.

DESCRIPTORS: Weather modification research; Climate modification; United States

ID NO.- MGA27050131

O vozmozhnosti upravleniya elektricheskoy aktivnost'yu grozovykh oblakov putem izmeneniya kristallizatsionnykh potentsialov. .Possibility of controlling electrical activity of thunderstorm clouds by changing the crystallization potentials..

Kachurin, L. G.

Leningrad. Gidromet. Inst.

Akademiya Nauk SSSR, Moscow, Izvestiya. Fizika Atmosfery i Okeana, 11(7): 764-768, July 1975. Refs. DAS, DLC. Transl. into English in corresponding issue of Izvestiya. Atmospheric and Oceanic Physics, Wash., D.C. DAS

LANGUAGE: other

CTRY OF PUBL:US

The results of experimental studies of the electrical potentials in freezing salt solutions and the charging of crystals are presented and analyzed; they are used to model the control of the intensity of electrification of crystallizing drops of aqueous aerosol. The results indicate that the introduction into clouds of insignificant amounts of some admixtures may alter substantially the electrical activity of the clouds. The amount of reagent necessary for suppressing the electrical activity of a thunderstorm center is estimated by assuming that the cloud is characterized by a maximum electrochemical readiness for the thunderstorm stage because of the presence of a slight quality of admixture (acid). An equation is presented for calculating the amount of acid necessary for altering, in unit mass of water, the concentration of hydrogen ions from pH.SUB 1. to pH.SUB 2..

DESCRIPTORS: Lightning suppression

ID NO.- MGA27050034

Annual report, 4th.

United States National Advisory Committee on Oceans and Atmosphere,Wash., D.C.

June 30, 1975. 49 p. A report to the President and the Congress.

CTRY OF PUBL:US

The findings and recommendations of NACOA are presented in an introductory summary and are followed by three focal interests of the Committee: management of an extended resource zone; a proposal for an Institute for Engineering Research in the Ocean; a discussion of programs such as those of ONR and Sea Grant; and atmospheric affairs including topics such as weather modification, climatic variation, stratospheric pollution, and hurricane reconnaissance. An appendix reproduces the act establishing NACOA.

DESCRIPTORS: Annual reports; U.S. National Advisory Committee on Oceans and Atmosphere

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