An Overview of the First Annual Scientific Workshop for NOAA's National Earth Watch Service (NEWS)

February 22-23, 1993

Silver Spring, MD

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Executive Summary

On February 22-23, 1993 many of NOAA's leading scientists, program managers, laboratory and center directors gathered to discuss specific proposals for improving NOAA's ability to deliver environmental information to policy/decision-makers and the general public. Workshop participants identified a number of attributes that would enable such an effort. Additionally, they identified a large number of environmental issues (20) that NOAA should incorporate into such an effort. Suggestions from the workshop include:

(1) Begin to address the 20 problems and issues by focusing on a subset (2 or 3). This could be accomplished by initiating a series of NOAA NEWS special information reports (the NOAA News Special Editions). The attributes of these reports include:

  a) issues and problems are selected using the advice and suggestions of an Executive Science Committee to help guide the NOAA effort.

  b) Science Teams and Champions (for given issues) write the report.

  c) support is provided to the Science Teams and Champions in the form of:

    i) a professional science editor to work with each team.

    ii) typesetting, color illustrations, and publication.

    iii) establishing and overseeing a review process.

    iv) logistics for meetings requested by the Science Teams, and

    v) distributing the NEWS reports.

(2) Use the basic concept behind the old NOAA Environmental Digest, which describes indicators of environmental change, to initiate an electronic version of the Digest called the NOAA NEWS Regular Edition. Major differences between the content of the old Digest and the NOAA NEWS Regular Edition should be:

  a) linkages to peer-reviewed analysis techniques related to the integrity of the data should accompany each of the environmental variations presented.

b) linkages to specific environmental issues and problems should accompany any information about environmental change.

c) the distribution of the information should occur both in hard-copy <u>and</u> electronic formats. Electronic systems should be both PC and work-station (Internet) compatible.

The implementation of these recommendations has come to be known as NOAA's National Earth Watch Service (NOAA NEWS). The NOAA NEWS Project OFFICE, housed within the National Climatic Data Center, is in the process of implementing these ideas presented and discussed at the NOAA NEWS workshop.

1.0 BACKGROUND

Workshop participants

The First Annual Scientific Workshop for the NOAA National Earth Watch Service (NEWS) was held on February 22-23, 1993 with approximately 55 NOAA employees (center and program directors, administrators, program managers and senior scientists) participating. In addition, representatives from academia also attended. Attendees are listed in Appendix A.

Workshop goals

The Workshop was organized to address the following topics:

a. Define the environmental issues and problems considered relevant to private and public policy/decision-makers and the general public.
b. Identify the environmental variations relevant to these issues.
c. Propose external review mechanisms to ensure the scientific integrity of the environmental information presented to policy/decision-makers and the general public.
d. Address the input/output time and space scales relevant to the problems.
e. Discuss the most convenient means to collect and aggregate the data and information.
f. Discuss the most effective means to update the information.
g. Discuss information delivery systems, e.g., electronic and hard copy components.

An earlier, related workshop

The need and basis for the NOAA NEWS has its roots in an earlier NOAA Information Workshop held on May 26-27, 1992. This workshop focused on improving NOAA's capability to assimilate and disseminate reliable, clearly expressed, and comprehensive problem specific Earth system information to a wide spectrum of users. A number of ideas resulted from this workshop with respect to the most effective means for NOAA to develop and distribute Earth system information. A primary recommendation was the transformation of the NOAA Environmental Digest into a regular edition of the NOAA NEWS. This recommendation included specific goals to effect this transformation: the selection of issues, development of mechanisms for user evaluation of the relevance of the NOAA NEWS, establishment of an Executive Science Committee and peer-review process, and the exploitation of existing hypermedia and data base management technologies. The broad scope of these goals and the requirement to include the entire NOAA community in the transformation process led to the organization of the first NOAA NEWS Workshop.

2.0 WORKSHOP OVERVIEW

2.1 Workshop Structure

General Workshop Issues

NOAA scientists and program managers presented views and perspectives on various environmental issues during the Workshop. These issues included:

(1) Greenhouse Gases and Ozone Depletion
(2) Natural Hazards, and
(3) Health of the coasts, wetlands, and Living Marine Resources.

The presentations and round-table discussions identified numerous environmental parameters that are critical to addressing these issues. Presentations and discussions also focused on various means of delivering information about these issues to policy and decision makers, both in and outside of government. This included electronic, hard-copy, and multi-media dissemination.

Identifying problems within each major issue

Specific environmental problems were identified and discussed by the participants for each of the major issues. Discussion focused on the importance and timeliness of new information to help clarify various environmental issues for decision/policy-makers and the general public. Based on these discussions the participants identified numerous problems that the NOAA NEWS could address.

An Executive Science Committee

The structure and mandate of the Executive Science Committee was discussed. It was generally agreed that this committee should recommend specific topics to be addressed, and provide general guidance regarding appropriate NOAA Champions and Science Team members for each specific issue.

Transformation and incorporation of the NOAA ENVIRONMENTAL DIGEST into the NOAA NEWS

Discussion also centered on the means of delivering general broad-based information about environmental variations pertinent to specific environmental problems. Several means of disseminating this information were discussed ranging from a PC based Informatics hypermedia system to the Wide Area Information Network (WAIS) available through INTERNET.

2.2. Speakers and Content

Lectures

Presentations were given by leading scientists from all of NOAA's Line Offices as well as outside the Agency. A brief synopsis of their salient points is presented in Appendix B with an extended summary of each presentation provided in Appendix C.

2.3 Special Environmental Problems to be Addressed by the NOAA NEWS

Issues and Problems

Workshop participants produced a list of topics for consideration as potential NOAA NEWS special issues. The topics were considered on the basis of their timeliness relative to ongoing policy issues, potential economic and human impacts, and current availability of new information. Two or three of these topics will be selected for the NOAA NEWS Special Editions. Each Special Edition will focus on a different topic, based on relevance on the topic to ongoing issues as well as the value of the information to the issue. The candidate list of topics is provided in Appendix D along with a brief synopsis of their importance.

3.0 NEXT STEPS

Overview

Based on workshop discussions, the NOAA NEWS will have two parallel efforts focused on improving our ability to disseminate environmental information related to specific problems and issues. First, a series of environmental reports will focus on new, misunderstood or little known scientific information, specific to given issues, called the Special Editions of the NOAA NEWS. These special editions of the NOAA NEWS are likely to have significant impacts on policy. Second, information about the status of environmental variations, as related to specific environmental issues, will be distributed through the regular edition of the NOAA NEWS. Each Special Edition of the NOAA NEWS will focus on a single topic, but the NOAA NEWS Regular Edition will touch on many topics and problems, providing some information on environmental variations pertinent to each issue and problem.

NOAA NEWS Special Editions

The special editions of the NOAA NEWS will be easy to comprehend, without jargon, and heavily illustrated to readily convey the information. They must be timely. The information within the NOAA NEWS special editions may often be later included in major scientific assessments, but because of the importance of the timeliness or need for clarification of existing information, the special edition of the NOAA NEWS will provide a means to disseminate information as early as possible. Using Science Teams and Champions, these reports will be of the highest scientific standards. They will be edited by professional science editors. The editors will work with the Science Teams to tailor the report to specific user groups. Two free-lance editors who are regular contributors to Science magazine have already been signed on to work with the NOAA Science Teams. The NOAA NEWS Office will support the interaction of these editors with the Science Teams and Champions of the teams. An outreach activity will be maintained to interact with possible constituencies and assess their needs (agriculture, water resources, forestry, education, etc.)

Narrowing the list of possible Special Editions

As recommended during the NEWS workshop, a subset of topics listed in Appendix D will be selected. Each of the issues/problems will be headed by a NOAA Champion or Co-Champions and involve of an adequate number of Science Team members. NOAA must have considerable expertise within any topic selected, but members of the Science Teams are not necessarily restricted to NOAA scientists. At this time, topics will be selected on the basis of the recommendations of the Executive Science Committee and the readiness of the Champions and Science Teams. Those topics that are not selected will be considered later as the NOAA NEWS matures.

NOAA NEWS Regular Editions

All previous contributors to the NOAA Environmental Digest and those who participated in the NOAA NEWS workshop will be asked to consider whether they have valuable information about the status of environmental variations that can be specifically tied to topical problems and issues. These environmental variations must be updatable in a timely fashion. Timeliness is defined relative to the problem of interest. The veracity of the information presented should be linked to peer-reviewed publications so that it can stand up to scientific scrutiny by scientists outside the agency. A living information system will be developed which can be regularly updated. This will include electronic information systems such as the Informatics PC-based system (see Appendix B and C, presentations by Husar, Webster, and Barton), the Wide-Area Information Server (WAIS), and other systems as appropriate. Full credit to the scientists and the organizations contributing information will be given along with appropriate linkages to obtain more data and/or information. Appendix E provides an example of the information that will be part of the regular edition of NOAA NEWS.

One benefit of the electronic version of the NOAA NEWS Regular Edition will be the ability of users to integrate information from various disciplines in a common graphical format. This will aid in integrating various types of information.

Mr. William Brown and Dr. Bruce Baker will be the technical contacts for this information. Each contributor is asked to follow the format in Appendix E so that a consistent set of information can be developed.

Publication of Reports for the Special Editions of NOAA NEWS

As soon as the Executive Science Committee provides the NOAA NEWS Project Office with its suggestions and advice regarding the selection of topics for the special editions of the NOAA NEWS, the NOAA NEWS Project Office will set in motion the infrastructure needed to complete the reports. This includes word processing support, illustrations, editing, publication (including printing authority), soliciting external reviews, distributing the NEWS reports, and other activities as requested by the Science Teams and/or Champions. The Science Teams, Champions, and pertinent laboratories will be responsible for the scientific content of the report, and this will be prominently indicated within the report. As dictated by the Science Team, portions of the information about environmental variations also be incorporated into the regular edition of the NOAA NEWS.

User Interaction

Concern was expressed at the workshop regarding the incorporation of user requests for information. The NOAA NEWS Project Office (Appendix F) stands ready to facilitate workshops, professional meetings, and one-on-one discussions with various user groups.

Executive Science Committee
As recommended during the workshop, an Executive Science Committee drawn from the Office of the Chief Scientist and other senior scientists within and outside NOAA will be established to have the following responsibilities:

Terms of Reference

Provides the NOAA NEWS Project Office with advice and/or suggestions regarding:

- Overall project assessment.
- Selection of topical issues and problems of interest.
- Nomination of Science Team members and Champions working on NOAA NEWS issues.
- Identification of potential users of the reports and/or electronic information.
- Recommendation of scientific reviewers of the reports and information.

Timetable
The NOAA NEWS Project Office expects to have 2 or 3 special editions of the NOAA NEWS and the regular edition of the NOAA NEWS ready for distribution during the first quarter of FY 94.

APPENDIX A - List of Workshop Participants

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Appendix B - Abbreviated Summaries of Presentations

APPENDIX B: Abbreviated Summaries of Presentations

Some Corporate History
William Hooke,
Deputy Chief Scientist for NOAA

Hooke presented an overview of the Department of Commerce's evolving information role beginning in the 1800's and continuing through the present. Beginning with the Bureau of the Census report in 1880, which covered many of the economic statistics for the U.S., he emphasized the varied national data reported by the Department. These data provide the basis for action by others. The National Weather Service plays a unique role in the information business since it provides products triggered by immediate events.

He also emphasized that the increase in population, technology use, etc., coupled with a new Administration's changing emphasis, provides NOAA with new opportunities to distribute issue-oriented information.

NEWS: Its Structure, Prospective Composition, and its Champions
Thomas Karl, Senior Scientist
National Climatic Data Center

Karl discussed the purpose of the NEWS effort in providing information for decision and policy-makers. This information should be problem specific, focused, unbiased, and authoritative. It should establish new working relationships within NOAA as topical issues often cross-cut many Line Offices. An additional goal is a modernized NOAA information system. Karl provided information on the prospective content of the NOAA NEWS, its design, and the delivery systems. He also emphasized the important requirement within NOAA NEWS for designating Champions/Co-Champions for topical issues, and the need to establish a credible, high quality program.

Karl explained the role of NCDC in the NEWS as a facilitator for the flow of information, identifying issues, providing support to the Science Teams, and providing the NEWS information in electronic and paper form.

Global Warming and the Greenhouse Effect: A Modeling Perspective
Jerry Mahlman, Director,
Geophysics Fluid Dynamics Laboratory

Mahlman's presentation covered the known and anticipated climate changes due to the greenhouse Effect as deduced from modeling results. He applied various levels of scientific confidence to specific background issues concerning the Greenhouse Effect and the projected effects by the middle of the next century.

Mahlman emphasized that, given the question whether global warming has been detected, both theory and natural variability were not inconsistent with the observations. He also provided estimates when evidence for specific effects may be available.

He summarized his presentation by noting that although much is known about the Greenhouse Effect, much is still uncertain or unknown. He listed areas for improvement including impact analysis and economic response, and particularly emphasized the need for improved linkages between climate scientists and impacts/policy researchers.

Global Warming and the Greenhouse Effect: An Empirical Perspective
Thomas Karl, Senior Scientist
National Climatic Data Center

Karl provided an empirical perspective on the Greenhouse Effect based upon two general categories of relevant environmental variations-forcings and feedbacks such as greenhouse gases, aerosols, snow cover etc., and response variables such as temperature, precipitation, snow cover etc. He posed a variety of questions concerning climate forcings, climate feedbacks, and climate responses. The detection of changes in potential atmospheric parameters as possible Greenhouse fingerprints was also discussed. Information requirements to further understand the greenhouse problem were presented, including data needs and model requirements. He also applied various confidence levels to uncertainties regarding observed changes in atmospheric parameters ranging from certain (>99%) to possible (>50%).

Ozone Depletion and the Health of the Atmosphere
Dan Albritton, Director
Aeronomy Laboratory

Albritton formulated the atmospheric ozone problem relative to the levels in the atmosphere at which it can be found: the stratosphere, troposphere above the planetary boundary layer, and the troposphere within the boundary layer. He provided a history of the evolving interaction between scientists and policy-makers regarding the ozone issue. Beginning in the mid-1970's, the deduced effects of stratospheric ozone depletion were not translated into policy. Increasing evidence of the human involvement in ozone depletion beginning in the mid to late-1980's led to progressively shorter schedules for phase-out of ozone depleting chemicals.

Albritton presented two scenarios for describing the anticipated decrease of ozone-destroying chemicals. The first is based on an immediate phase-out and a second on the use of an "ozone-friendly" substitute for the next 30-40 years. Under both scenarios, it is expected that the 1975 level of atmospheric chemical concentration would not be reached until the year 2075.

Science information needs were cited for the next 20 years for issues such as the use of new ozone depleting chemicals and the potential effects of new versions of the supersonic transport. Albritton summarized by recommending that scientists avoid slippage into a policy role, and that assessments be made by the international community rather than individual countries.

Variations and Changes of Natural Hazards in the Climate System
David Rodenhuis, Director
Climate Analysis Center

Rodenhuis discussed climate hazards in terms of weather hazards with short response time as well as anomalies with a period shorter than the economic system's response time.

Climate reports and assessments are available from CAC on a regional and global scale. The Climate Analysis Center (CAC) is also investigating new forecast products to better forecast longer range weather conditions. He also discussed the various facilities for dissemination of CAC's climate products.

Variations and Changes of Natural Hazards in the Earth/Solar Environment
David Clark, Assistant Director
National Geophysical Data Center

Clark presented NGDC's role as a data center for the space and solid earth environments which includes preservation of observations, developing trends and information from the observed data for use in model verification among other items. The space environment includes solar and near earth activities including sun spots and magnetic storm data. The solid earth environment covers seismic activity, the earth's geo-magnetic field and Tsunamis. Clark argued that apparent trends in some data are suspect due to the short period of record available.

Variations and Changes of Natural Hazards in/over the Oceans
Robert Quayle, Acting Chief, Global Climate Laboratory
National Climatic Data Center

Quayle provided sources (location and point of contact) for a variety of marine hazards. Points of contact included individuals/organizations inside and outside of NOAA and also included both data and narrative sources. Parameters included flooding, wind (including tropical cyclones), waves, extreme cold, fog, icing, sea ice and sea level data.

Variations and Changes in Wetlands and other Coastal Ocean Parameters
Maggie Ernst, Ecologist
Coastal Ocean Program

Ernst estimated that over 50% of the U.S.A's wetlands have been lost over the past 200 years. She described the basic functions of wetlands, especially their role as ecological support to more than 75% of marine resources. Major stressors on wetland include toxic contamination, physical alteration and upstream changes to fresh water resources.

She described NOAA's role in wetland's analysis and preservation, and also described data pertinent to the improved management of coastal habitats. Problems are inherent in the delineation of wetlands for the purposes of regulation, especially in areas with variable water levels or periodic wet conditions. She recommended changes of wetlands, especially along the Gulf of Mexico and Atlantic coasts, as NOAA NEWS topics.

Variations and Changes in the Health of the Coasts
Charles Ehler, Director
Thomas O'Connor
Office of Ocean Resources, Conservation and Assessment

Ehler and O'Connor described the decreasing yields of estuarine-based fish and the decreasing areas along the coasts approved for shell fishing. Beach closing also appear to be increasing. Open ocean environments are still relatively clean, however, coastal areas are increasingly affected by humankind to include plastic fouling, coastal development, microbial contamination and toxic pollution. Specific toxic contamination appears to be decreasing in species over the past 5 years along all coast lines of the U.S.

Variations and Changes in Living Marine Resources
Kenneth Sherman, Chief Ecosystem Dynamics Branch
NW Fisheries Center

Sherman pointed out major legislation which govern fisheries resources, and also presented examples of the numerous specialized reports prepared each year which document current trends in fisheries resources. The U.S.A.'s living marine resources potential yield is nearly 10% of the world's total. Much is unknown about the state of utilization of nearly one-third of fish stocks with another one-third considered to be over utilized. He outlined specific strategies for future resource managers including risk adverse decision-making, reducing uncertainty by expanding the information base and controlled access to fisheries.

Appendix C - Extended Summaries of Presentations

Informatics: A PC-based Information Delivery System
Rudolf Husar, Professor
Washington University

Husar's presentation included a hypermedia demonstration of his PC-based Informatics delivery system. He demonstrated the flexibility of the windowing environment and its ability to access various levels of information. He emphasized the facets of the system which are similar to an encyclopedia, such as the use of compound (text, graphs, images etc.) documents, no ideal set of arrangements of the contents, authoritative information, and easy accessibility.

A Workstation-based Information System
Ferris Webster, Professor
University of Delaware

Webster's presentation included an explanation of two information systems in use at the University of Delaware which contain information relative to the World Ocean Circulation Experiment (WOCE) and the Coupled Ocean-Atmosphere Response Experiment (COARE). He described the type of information collected, the dissemination system, network availability, and user instructions. Both systems contain metadata (data about data) with the intent to include actual data in the near future. In addition, he has incorporated which the text of the most recent NOAA Environmental Digest on-line and it is available for demonstration.

WAIS and the NOAA Directory
Gerry Barton, Supervisory Physical Scientist
Environmental Information Services

Barton described the NOAA directory including its network access, content, and users. Basic contents include descriptions of over 1200 NOAA data sets including a point of contact. He explained the development of a U.S. Global Change Data and Information System (GCDIS) for use by researchers to locate and access data held by all of the U.S. agencies. The system is a prototype for international data exchange. Enhancements to the current NOAA directory will include the addition of information from NEDRES and the NOAA Product Information Catalog.

Some Corporate History

William Hooke,
Deputy Chief Scientist for NOAA

o **Our past and how it has shaped us**

Bureau of the Census issued the following reports as early as 1880:

- Report on the Mortality & Vital Statistics of the United States
- Report on the Forests of North America
- Statistics and Technology of Precious Metals
- Report on the Mining Industries of the United States

o **Our present**

Department of Commerce is tasked with measurement/ statistical analysis and interpretation of national data:

- Ocean depth
- Homeless population
- Fish stocks
- Consumer price index
- Coastal wetland acreage
- Balance of payments
- Marine biodiversity
- Etc.

These provide the basis for action and debate by others.

The National Weather Service provides products on a schedule plus products triggered by events. It is science-based and impact-focused. It provides starting point for action by others.

Global trends of population, resource use/capita, technology etc. are rapidly increasing. Transition to a new administration with emphasis on environmental threats, research in context of action, possible Department of the Environment, and strong industrial policy provides new opportunities.

o **Our future**

Based on good fundamentals, punctuated by worrisome events, a complex earth system with large monetary stakes---poses a challenge to NOAA, especially in terms of the substance and delivery of issue oriented information.

NEWS: Its Structure, Prospective Composition, and its Champions
Thomas R. Karl, Senior Scientist
National Climatic Data Center
Attributes of NOAA NEWS

- Primary purpose of the NOAA NEWS is improved environmental decision making and policy setting. Information will be authoritative, integrated, succinct and problem focused.

- Secondary goals:

  More timely and comprehensive response to new information
  Better communication and working relationships within NOAA
  More accessibility to NOAA information
  Modernized NOAA information system

- Content of NOAA NEWS:

  Statement of the issues/problems
  Environmental variation/changes--issue/problem specific
  Reliability/uncertainty of the variation
  Significance/importance of the variation
  Linkages to additional information, data, and scientists

- Design criteria of the NEWS:

  - Scientifically robust
  - Timely
  - Suitable for use in major assessments
  - Selected information organized by problem/issue
  - Satisfy the needs of other user groups

- Possible NOAA NEWS delivery systems:

  - Electronic-----PC/workstation
  - Paper-----loose-leaf report series/pamphlets
  - Verbal-----Press briefings/scheduled seminars

- Attributes of the electronic delivery system:

  - As easy to use as an encyclopedia, as powerful as multimedia
  - Hide complexity, windowing capability
  - Non-linear browsing
  - Concise visual portrayal (text, charts, animation, color)
  - Consistent scales/units
  - Appropriate granularity of data
  - Ability to overlay plots/graphs
  - Textual information compatible with other platforms and protocols (WAIS)

- Mechanics of the NEWS:
  - Champions/Co-Champions for issues/problems
  - Champions/Co-Champions speak for NOAA NEWS
  - Champion/Co-Champions select Science Teams

- Role of NCDC in NOAA NEWS:
  - Facilitate Science Team information flow
  - Provide information management support to Science Teams
  - Provide the means to deliver the NEWS (electronic and paper)
  - As appropriate-----scientific input into problems/issues
  - Help identify cross-cutting issues
  - Facilitate user feedback
  - Organize and coordinate

- Quality of Information:
  - Subject to peer-review
  - Feedback from users (Congress, NGOs, Corporations)
  - Routinely updated (keep Science Teams actively communicating)

- Deciding what the policy and decision-makers want:
  - Exploit the knowledge of the Science Team
  - Special workshops-----precipitation sensitive systems, agriculture, energy, forests, etc.
  - Feedback from users

- Goals of the workshop:
  - State the problems
  - Identify prospective Science Teams and Champions
  - Identify prospective data and information
  - Propose ways to ensure information quality
  - Consider granularity of time and space scales of information
  - Discuss data/information flow within NOAA
  - Discuss the possibilities for a delivery system(s)

Global Warming and the Greenhouse Effect: A modeling perspective.

Jerry Mahlman
Director,
Geophysical Fluid Dynamics Laboratory

o Various levels of scientific confidence can be applied to projected climate changes by the year 2050:

- Virtually Certain-	Nearly unanimous agreement among scientists. No credible alternative views.
- Very Probable-	Roughly a 90% chance
Probable-	Roughly a 67% chance
Uncertain-	Hypothesized effect but lacking observational or modeling support

o Scientific confidence for on the Greenhouse problem:

- Fundamental physics of the Greenhouse Effect
- Added Greenhouse gases cause added heating
- Greenhouse gases are increasing due to anthropogenic activities
- Significant reduction of uncertainty will require a decade or more
- Full recovery requires many centuries
- All of the above are considered Virtually Certain.

o Scientific confidence for projected Greenhouse effects by the year 2050:

- Large stratospheric cooling--Virtually Certain
- Global-mean surface warming--Very Probable
- Global-mean Precipitation increase--Very Probable
- Reduction of sea ice--Very Probable
- Arctic winter surface warming--Very Probable
- Rise in global sea level--Very Probable
- Summer mid-latitude continental dryness--Probable
- Arctic precipitation increase--Probable
- Antarctic Ocean and North Atlantic resistance--Probable
- Local details of climate change--Uncertain
- Tropical storm increase--Uncertain
- Details of the next 25 years--Uncertain

o Present conclusions to the question-- "Has a global warming been detected?":

- Theory not inconsistent with observations
- Natural variability not inconsistent with observations
- Cause/effect difficult to establish

- When will we have better evidence?

    - Firming up current calculations -- 1 - 5 years
    - Global cloud-radiation feedback -- $\approx$ 1 decade
    - Ocean-ice feedback -- ~ 1 decade
    - Regional details with confidence -- $\approx$ 1 - 2 decades
    - Climate-biosphere interaction -- many decades
    - Direct observational evidence -- $\approx$ 1 - 2 decades

- Summary

    - Much is known about the Greenhouse effect.

    - Much remains scientifically uncertain. (Major improvements require a decade or more).

    - Improved science is far from sufficient.

    - Major improvements needed in monitoring.

    - Major improvements required in:

        - Impact analysis
        - Economic response
        - Energy use management
        - Policy options

    - New research links required among climate scientists and impact/policy researchers.

Global Warming and the Greenhouse Effect: An empirical perspective

Thomas R, Karl
Senior Scientist, National Climatic Data Center

- Relevant Environmental Variations
  - Forcings and feedbacks e.g., greenhouse gases, aerosols, snow cover, sea ice etc.
  - Response variables e.g., temperature, precipitation, snow cover, sea ice etc.

- Fundamental Climate Issues
  - Climate forcing (natural and anthropogenic)
    - Do we know what to monitor?
    - Can we monitor changes and variations?
    - What are the likely responses to changes?

  - Climate feedbacks
    - Can we monitor and document?
    - How are we doing?

  - Climate response
    - What quantities of interest?
    - What space scales?
    - What time scales?
    - Can we monitor long-term changes?
    - How are we doing?

- Detecting the Greenhouse Fingerprint
  - Increased temperature (surface)
    Greatest in winter
    Smallest in summer
  - Net increase in precipitation
  - Accelerated hydrology cycle
    wetter winters mid-high latitudes
    drier summers mid-latitude
  - High rate of temperature increase over land compared with ocean
  - Decrease in stratospheric temperature, increase in tropospheric temperature
  - Reduced pole to equator temperature gradient
  - Cloud cover changes
    Slight decrease?
    More high clouds?
    Less low clouds?
  - Reduced snow cover
  - Increase in tropical storms?
  - Extreme events?

- o Critical information needed to further understanding
  - Data required:
    - Diurnal, seasonal and geographic changes of solar radiation, clouds and temperature
    - Key aerosol properties, e.g., scattering, efficiency, wavelength dependence, composition and concentration
  - Models
    - A diurnal cycle - improvements and/or incorporation
    - Experiments with both aerosol and greenhouse gas forcing.
- o Summary and Conclusions
  - Climate record is full of inhomogeneities which are the basis for some measure of uncertainty regarding observed changes.
  - Certain >99%
    - CO_2 and other greenhouse gases have rapidly increased over the past century
  - Nearly certain >95%
    - Global temperature increase of 0.45°C ± 0.15°C over the past 100-125 years
    - Sea level increase of 10-15 cm over past 100-125 years
    - Warming over past few decades primarily reflected in first half of the year.
    - Worldwide glacier retreat
  - Likely >75%
    - Warming over land during past few decades primarily at night, with a reduction of the diurnal range
    - No apparent decrease of the pole-to-equator temperature gradient.
    - No increase in frequency of tropical storms
    - Cooling of lower stratosphere and warming of troposphere
    - No apparent change in sea ice concentrations over past few decades

- Probable >50%

    - Rate of warming over land may now be significantly greater than warming over the oceans

- Possible >60%

    - Precipitation has increased in high latitudes
    - Snowfall has increased in the high latitudes of North America
    - Cloudiness has increased over the past century

Ozone Depletion and the Health of the Atmosphere
Daniel L. Albritton
Director, Aeronomy Laboratory

- o Three atmospheric roles and three environmental issues exist for humankind with regard to atmospheric ozone interactions:

  - Stratospheric ozone depletion and effects on the ultraviolet radiation shield. Issue- Don't lose it.
  - Global tropospheric ozone increase and effect on Greenhouse forcing. Issue- Don't increase it.
  - High levels of boundary layer ozone and effects on human health and vegetation. Issue- How to best get rid of it.

- o The conclusions of scientists and effects of these conclusions on policy has been evolutionary:

  - Mid-1970s --- scientists deduced potential atmospheric loss due to effects of man-made chlorine. No policy impacts.

  - Mid to late 1980s --- scientists discover the Antarctic ozone hole with 50% losses, potential depletion in the Arctic with downward trends locally. Attribute losses to man-made chlorine/bromine effects. Policy impacts:

    - Vienna Convention
    - Montreal Protocol with emissions freeze by the year 1990 and a 50% cut by the year 2000.
    - London Amendment identifying additional chemical species with phase-out by the year 2000.
    - Copenhagen Amendment with faster phase-outs and recommendations to control CFC substitutes.

- o The amount of chlorine in the atmosphere will peak in the next two decades. Two scenarios are possible:

    - Implement total phase-out now with a return to 1975 levels by the year 2075.
    - Interim use of an "ozone-friendly" chlorine for the next 30 to 40 years, reaching the same 1975 level by the year 2075.

- o Risks and science-information needs over the next two decades as chlorine peaks:

  - What will happen in the Arctic?
  - Magnitude of global losses.
  - Use of new ozone depleters.
  - Magnitude of Greenhouse cooling as a result of ozone loss.
  - Effects of new versions of the supersonic transport.

- Personal Comments:

  - It is critical to recognize that science is only one input to decisions. Slippage into policy must be avoided.

  - Assessments of the state of understanding of global phenomena must be done by the international scientific community. Reports should avoid the label "NOAA's view".

Variations and Changes of Natural Hazards in the Climate System

David R. Rodenhuis
Director, Climate Analysis Center.

- Categories of climate hazards include:
  - Hazards where the public response time is similar to the time scale of the hazard.
  - Hazards where the response time (economic response) is generally longer than the time scale of the hazard. Prediction is essential.

- NOAA NEWS presents the opportunity to apply climate information to economic issues.

- The Climate Analysis Center disseminates a variety of publications containing climate information.

  "Fourth" Annual Climate Assessment focuses on global warming, ozone, aerosols, ENSO and regional climate anomalies.

  Additional monitoring products include:

  - Weekly Climate Bulletin
  - Special Climate Summaries
  - Weekly Weather & Crop Bulletin
  - Climate Diagnostics Bulletin
  - ENSO Advisories
  - North American Climate Summary
  - Semiannual Winter Summary (stratospheric)

- The Climate Analysis Center is also producing additional new forecast products.
  - Experimental Long Lead Forecast Bulletin
  - Prediction of UVB at the surface from stratospheric monitoring
  - Results from ocean/atmosphere coupled models

- Climate products are disseminated through:
  - CAC Bulletins, Advisories, Outlooks
  - Climate Information Delivery System
  - Regional Climate Centers
  - Regional dial-up facilities
  - Satellite broadcasts of climate channel of NWS/Family of Services

Variations and Changes of Natural Hazards in the Earth/Solar Environment.

David M. Clark
Assistant Director
National Geophysical Data Center.

- NGDC's Role as a Data Center:

  - Preserve long-term record of observations
  - Develop information from the data
  - Derive trends from the data
  - Support development of prediction including model verification

- NGDC's responsibilities include:

  - Space Environment

    Within the Space Environment, NGDC monitors, reports and forecasts specific parameters in the Near-earth Environment and Solar Activity. Solar Activity includes a variety of sunspot cycle information, other solar parameters, and magnetic storm data.

  - Solid Earth Environment

    Solid Earth Environmental data include the earth's geomagnetic field, seismic activity and tsunamis. Observed trends in seismic activity are controversial due to scientific uncertainty of the validity of apparent trends.

Variations and Changes of Natural Hazards in/over the Oceans.

Robert Quayle,
Acting Chief
Global Climate Laboratory
National Climatic Data Center.

Marine Natural Hazards and Relevant Data Sources

- Flooding - Coastal and Estuarine
  - NOS Tide Gage Records---Time series, perspective, extremes
  - Storm Data---Narrative
  - US Army Engineer Corps---Coastal waves (10km segments), erosion time series
  - Mariners Weather Log---Broad spectrum narrative
- Wind
  - Tropical Cyclone Tracks---Frequency analyses, perspective, limited intensity data
  - Extratropical Cyclone Tracks---Frequency, perspective, some central pressures
  - Storm Data---Narrative
  - Models---Quantitative, time series, perspective
- Waves
  - COADS---General climate, some perspective
  - Models---Quantitative, time series, perspective
- Extreme Cold
  - COADS---Perspective, extremes
  - Military Standard 210---Extremes, some perspective
- Thick Fog-Reduced Visibility
  - COADS---Frequency, perspective
  - Coast Guard Records---Fog warnings, casualties
- Icing
  - COADS---Frequency, perspective
- Icebergs, Sea Ice
  - Joint Ice Center---Trends
  - International Ice Patrol Records---USCG data
  - WDC-A for Snow and Ice---Trends
- Sea Level
  - NOS Tide Gage Records---Trends, perspective
    Univ. of Hawaii Records
  - NODC GEOSAT & Following Satellites---global short term perspective

Variations and Changes in Wetlands and Other Coastal Ocean Parameters

Maggie Ernst
Ecologist
Coastal Ocean Program

- Central Wetlands Issue
  - More than half of existing wetlands have been lost over the past 200 years.

- Wetlands Provide the Following Functions:
  - Ecological support to more than 75% of marine resources (as habitat, contribution to productivity)
  - Water quality by assimilating contaminants
  - Attenuation of flooding
  - Sedimentation

- Major Stressor of Wetland Systems:
  - Changes to fresh water regimes
  - Direct physical alteration
  - Toxic contamination
  - Nutrient loading

- NOAA's Wetland-Related Roles and Responsibilities:
  - Federal steward of nation's living marine resources
  - Natural resource trustee
  - Document, understand, and predict change in coastal habitats

- Wetlands of Concern to NOAA:
  - Coastal wetlands (salt marsh, forested, scrub/shrub, mudflats, nontidal, mangrove, coral reef)
  - Shallow aquatic systems containing submerged aquatic vegetation
  - Consideration of upland influences in watershed

- Wetland Issue(s)
  - Improve management of coastal/upland habitats through:
    - Protection
    - Conservation
    - Restoration

- Data and Information Pertinent to These Issues

  - Improve scientific basis for:

    - Influencing policies, programs, and proposed projects with potential of adversely affecting habitats assessing damages, valuing what has been degraded or lost, creating or restoring wetlands

- Delineation of Wetlands for Purpose of Regulation

  - Use of criteria: hydrology, vegetation, hydric soils Mapping is difficult with short/long-term fluctuations in precipitation, runoff, groundwater levels with functions dependent on these fluctuations

  - Controversial in areas having:

    - variable water levels
    - gradual wetland-to-upland transitions, or
    - where only occasionally wet

  - Identification and delineation needs to be based on an understanding of function, using best scientific information

- Wetlands Mapping to Assess the Status, Health, and Rate of Change of Coastal Habitats

  - Where are they?
  - How healthy are they?
  - How fast are they being changed?
  - Ultimately want to relate these changes to changes in fishery production

Variations and Changes in the Health of the Coasts

Charles Ehler, Director,
Thomas P. O'Conner
Office of Ocean Resources, Conservation, and Assessment

- Over the past 10 years, commercial landings of estuarine-dependent fish and shellfish in the Southeast Atlantic and Gulf of Mexico have decreased 42%

- Over one-third of the Nation's estuarine areas that are classified for shellfishing are harvest limited; between 1985 and 1990 areas approved for shellfishing decreased by 6%. (nonpoint sources are an increasingly important cause of area closures).

- State-level data on beach closings are spotty, but the general trend for reporting states shows an increase in beach closings.

- Only 56% of U.S. estuarine waters fully support their EPA-designated uses such as fishing and swimming.

- Conditions in the marine environment vary widely.

  - The open sea is still relatively clean.
  - The margins of the sea are affected by man almost - everywhere, and encroachment on coastal areas continues worldwide.
  - The major causes of immediate concern in the marine environment on a global basis are coastal development and the attendant destruction of habitats, eutrophication, microbial contamination of seafood and beaches, fouling of the seas by plastic litter, progressive buildup of chlorinated hydrocarbons,and accumulation of tar on beaches.

- THE CONSEQUENCES OF COASTAL DEVELOPMENT ARE OF THE HIGHEST CONCERN

  - The coastal strip, encompassing the shallow-water and intertidal area along with the immediately adjacent land, is clearly the most vulnerable as well as the most abused arine zone. Its sensitivity is directly tied to the diversity and intensity of the activities which take place there,and the threat to its future is related to the increasing concentration of the world population in this area.

- The National Status and Trends Program monitors fisheries and pollutants along the entire U.S. coastline.

  - A few apparent trends:

    - Cd decreased at all Long Island sites from 1986-1990
    - Ag decreased at all Delaware Bay sites from 1986-1990
    - Concentrations of Pb, Zn, Cu, and Cr are generally decreasing in Santa Monica Basin.
    - Chemical contamination has been decreasing since at least the 1970's.
    - Recent trends, where they statistically exist, are mostly decreases.

Variations and Changes in Living Marine Resources

Kenneth Sherman
Chief,
Ecosystem Dynamics Branch, NE Fisheries Center

- o Major legislation governing fisheries resources include:

  - Magnuson Fisheries Conservation and Management Act
  - Marine Mammal Protection Act
  - Endangered Species Act

- o NMFS prepares hundreds of specialized reports on living marine resources each year with numerous presentations by scientific staff to managers, industry groups, and the public.

- o U.S. living marine resources long-term potential yield is approximately 9.5% of the total world potential.

  - Benefits:

    - Commercial---$50 billion impact on GNP
    - Recreational---17 million anglers
    - Other---subsistence fishing, aquaculture, whale watching, intangibles

  - U.S. living marine resources utilization: (for 236 stocks)

    - 26% fully utilized
    - 28% over utilized
    - 12% under utilized
    - 34% unknown

- o Issues of National Concern for Marine Mammals and Sea Turtles

  - Management concerns
  - Bycatch and multispecies interaction
  - Resource allocation
  - Jurisdiction and transboundary issues
  - Habitat concerns
  - Underutilized species
  - Recovery of protected species

- o Strategy for the Future

  - Risk adverse decisions in the face of uncertainty (err on the side of conservation-not resource depletion).
  - Reduction of uncertainty by greatly expanding the scientific information base upon which decisions are made.
  - Controlled access to fisheries.

- Development of more selective fishing practices to reduce bycatch.
- Implementation of a cohesive strategy, built on all applicable legislation authorities, to protect and restore the quality of the environments supporting living marine resources.

Informatics: A PC-based Information Delivery System

Rudolf Husar,
Professor, Washington University.

Hypermedia: Hypertext and multimedia. (Includes data courses, data forms, hypermedia document, and data output).

- The encyclopedia as a delivery model:
  - Reference work that includes up-to-date knowledge
  - Makes this knowledge conveniently accessible
  - Authoritative, written by experts
  - No agreement on how to arrange its contents
  - Well suited for hypermedia
  - Compound documents (text, graphs, images, animations)

- Environmental Informatics:
  - The science of environmental information and its use in decision-making, education, and science.
  - There is a need for a faster way to metabolize the expanding information base.
  - Informatics: a study of environmental information as branches of science and engineering.

- Science of informatics: driving forces, processes
  - Information as a resource
  - Can not be depleted by use
  - Expands and gets better with use
  - Information is in chronic surplus
  - In an information-rich environment, the user pays the refining costs.
  - Scarcity is in time to process it into knowledge

- Information has no inherent value; value is assigned by the user.
  - Driving forces:
    - Content-driven data flows "because it is there"
    - Technology-driven data flows "because it is cheap"
    - Regulation-driven data "has to" flow
    - User-driven data flows "because it is needed"
    - Content, technology and regulation-driven data flows are necessary but inadequate to handle modern information needs
    - Challenge: Develop the problem/user-driven model

- Engineering - Design of Engineering Systems
  - Specify information needed
  - Match information to the information sources
  - Design the information flow system
    identify information flow nodes connect nodes
  - Specify type, quality, quantity of information at each node identify transformation processes between modes study impediments to flow
  - Develop tools to work smarter, not harder

A Workstation-based information system.

Ferris Webster,
Professor,
University of Delaware

- o Two information systems are operated at the University of Delaware:
  - World Ocean Circulation Experiment (WOCE)
  - Coupled Ocean-Atmosphere Response Experiment (COARE) of TOGA

- o WOCE Data Information Unit (DIU) tracks the WOCE experiment
  - What data collected?
  - What problems were encountered?
  - Where can datasets be obtained?
    - Result is a meta-database. It contains information about the data, but does not necessarily contain the data.
    - WOCE DIU uses a computer system for dissemination. Accessible over many computer networks (Internet, Omnet, dial-up). System is free and open to all. Forms on metadata.

- o TOGA COARE Information Unit tracking datasets collected during COARE's Intensive Operating Period (IOP), (intensive 4-month operating period).
  - Turnaround time is short--current within 24 hours.

- o WOCE and COARE activities:
  - Getting timely information from the scientists
  - Checking information for accuracy
  - Reformatting information to express it from the user's view

- o A pilot information system for NOAA's C&GC Program has been developed containing among other items, the NOAA Environmental Digest.

WAIS and the NOAA Directory

Gerald S. Barton
National Environmental Satellite, Data and Information Services

- NOAA Directory:

  - uses DIF for describing data
  - uses the same VAX software as the GCMD
  - available via:
    - NASA Decnet (SPAN)
    - Internet
    - Dial-up
  - serves NOAA management, NOAA and others
  - contents as of September 30, 1992:
    - 1200 descriptions of NOAA data
    - 49 entries in the guide section (15 centers, 12 projects, 7 sources, 15 sensors)

  - The NOAA Directory had 30 users per month. With availability via Internet, usage is now 350 per month.

  - System Hardware Directory will be moved to a Sun workstation and the NOAA ESDIM WAIS implementation will also use the Sun.

  - Target databases for initial implementation:

    - NOAA Earth System Data Directory--1200 descriptions
    - National Environmental Data Referral Service (NEDRES)--over 22, 200 descriptions
    - NOAA Product Information Catalog (PIC)--over 1000 NOAA products and services

- The U.S. Global Change Data and Information System has:
  - data for the U.S. Global Change Research Program
  - provides capabilities for the researcher to locate and access data held by U.S. agencies
  - on-line inventory is main interface to data system
  - network connections such as Internet
  - will use existing and new data systems
  - system is a prototype for future international data exchange

- Wide Area Information Servers (WAIS): Standards-based Access to Information and Data--uses the NISO Z39.50 Standard.

- Availability of the NOAA Directory and WAIS
  - Local dial-up service
  - 800 dial-up service
  - Internet access
  - Bridges to Internet from other networks
  - Links from the Global Change Master Directory

o Future NOAA services on WAIS
  - other text services
  - NEWS information
  - data and image formats

Appendix D - Issues and Rationale

APPENDIX D: Issues and Rationale

Reduction in ozone destroying gases
Possible Champions: David Hofmann/Dan Albritton
NOAA scientists have been tracking the concentration of CFCs for several decades. They are now beginning to see evidence of a decrease in the rate of increase in the concentrations of these compounds. This may be the first signs of our efforts to curb the concentration of ozone-destroying anthropogenic gases. Such information would be extremely valuable to policy/decision-makers as well as the general public.

The impact of an agricultural fumigant on stratospheric ozone
Possible Champion: James Elkins
Methyl Bromide is a fumigant used throughout Agri-business to curb pests. Recently it has been discovered that the atmospheric chemistry related to the release of methyl bromide is extremely effective in destroying stratospheric ozone. Moreover, methyl bromide has a very long atmospheric lifetime. Policy/decision-makers and the general public need to be informed about the potential hazards of this widely-used chemical treatment.

The Carbon Cycle
Possible Champion: Pieter Tans
The time may not be far away when many governments are going to regulate CO_2 emissions attempting to keep the atmospheric CO_2 burden below certain levels. We may be able to do that effectively once we understand the carbon cycle in a reasonably quantitative way. First of all, we need to know what fraction of the CO_2 that is disappearing annually from the atmosphere today is taken up by the oceans. Secondly, we need to know why the oceans are absorbing as much as they are because it would be important to know how much we can rely on such uptake in the future. As a rule of thumb, CO_2 removed from the atmosphere by the oceans is likely to stay away from the atmosphere for a long time, hundreds of years or more, because the oceans turn over very slowly. On the other hand, CO_2 removed by plants and stored as wood and soil organic matter could be very easily released again to the atmosphere. Also, in this case, we need to know, firstly, the amount, and secondly, why plants are storing the quantity of carbon they are. There is some consensus today that, on balance, the plants are acting as a global sink. In other words, carbon loss through deforestation in the tropics is more than offset elsewhere by increased carbon storage in terrestrial ecosystems. What is totally unknown is how much longer this may continue, and how different ecosystems will respond to many stresses, some of which may be the result of climate change itself. The total amount of carbon stored in terrestrial plants is comparable to the amount present in the atmosphere, and soils contain about twice that amount. Therefore, there is clearly the potential for CO_2 in the atmosphere to be significantly affected in either direction by what will happen to the vegetation in the near future. All of these processes will have an impact on our ability to "manage" future CO_2 levels in the atmosphere.

Trends in nighttime vs. daytime temperatures
Possible Champion: Thomas Karl
Recent studies indicate that over the past 40 years, the daily mean minimum temperature is rising at a rate three times faster than the daily mean maximum temperature. Anthropogenic greenhouse gases inhibit the escape of heat from the earth and anthropogenic sulfate aerosols are known to reflect significant amounts of incoming solar radiation back to space. Evidence suggests that as greenhouse gases continue to increase, temperatures will continue to rise more rapidly at night compared to the day. Since the differential change of the maximum and minimum temperature is fundamental to understanding how these two manmade forcings operate, it is very important to understand why the minimum is rising relative to the maximum. Practical implications of projected future increases of temperature will be difficult to assess without such an explanation.

Arctic and high latitude warming, and the greenhouse effect
Champions: Open
A recent paper in Nature reported on the absence of arctic warming. Science News quoted the author of this report who stated, "one of the fundamental results that climate models have is that the Arctic should warm up more quickly than the rest of the world." The World Climate Review reported that present models predict a polar warming of over 1°C due to added greenhouse gases over the past 40 years. Several recent articles by NOAA and non-NOAA scientists, and articles in preparation, suggest that there is significant high latitude warming. NOAA has the modelling and data expertise to clarify what is known and unknown about this aspect of the greenhouse effect. It is quite likely that Congress will be calling more attention to detection issues, as the nation attempts to implement the President's greenhouse gas stabilization program.

Trends in Water Vapor
Possible Champions: Dian Gaffen/William Elliott
Water vapor is the most abundant greenhouse gas (GHG) as well as the most important in maintaining the earth's temperature. It differs from other GHGs in that it is short-lived in the atmosphere, its concentration varies markedly from place to place, and its sources are largely natural. Models suggest increased evaporation as the earth warms, thereby increasing water vapor and so warming the earth still more. Its distribution is crucial to clouds which are a major source of uncertainty in current climate predictions. Measurements of water vapor are difficult, especially above about 5 km, in the upper troposphere and lower stratosphere, where its radiative effects are also important. Several studies suggest that tropospheric water vapor has increased in the last 20 years or so but these need confirmation. Better knowledge of water vapor's variations in space and time is one of the most important requirements of a complete attribution of the causes of past climate changes and a better ability to predict future ones.

Decadal-scale variability of the North Atlantic Ocean
Possible Champion: Sydney Levitus
Recent studies indicate that the North Atlantic Ocean exhibits quasi-decadal-scale variability in two distinct regions. Examination of a 45 year temperature record (1946-1990) for the upper 125m of the subarctic gyre indicates such variability. Peak-to-trough change in annual mean temperature is typically 2.0C. The deep water (1750-2000m) of the subtropical gyre of the North Atlantic also exhibits a quasi-decadal-scale variability in temperature and salinity based on a 35 year time series measured near the island of Bermuda. Peak-to-trough change in annual mean temperature is typically 0.05C to 0.10C. Such decadal-scale variability in temperature and thus heat storage of the North Atlantic may play a role in the variability of atmospheric climate including phenomena such as droughts.

Trends in Sea Level
Possible Champion: Bruce Parker
Sea level rise, whether due to global warming, land subsidence or low-frequency natural variability, can have serious impacts on the world's coastal communities. Trends from the world's tide gauges (which average approximately 2 mm/year over the last century), would also put the IPCC estimates of future sea level rise due to global warming (2.6 to 8.8 mm/year) in perspective. The IPCC estimates are not based on data; they are based on an estimated thermal expansion of the ocean (using an upwelling- diffusion model) and an estimated increase in water from glacial melting (using a global glacial melt model) for estimated global warming scenarios. The results of research looking for an acceleration in sea level rise in these data (that might indicate a global warming effect) could also be presented.

Volcanic Activity
Possible Champions: James Angell, David Hofmann, Ellsworth Dutton, Larry Stowe
Strong volcanic eruptions can inject massive quantities of aerosols into the earth's atmosphere. These aerosols may remain in the atmosphere for months or years with consequent effects on the earth's climate, atmospheric constituents, and satellite-based observations. For example, scattering of incoming solar radiation by aerosols from Mt. Pinatubo's eruption may have been responsible for a general global cooling trend over the past 2 years, thereby masking potential greenhouse gas-induced warming. Additionally, the infusions of gases may have altered the reaction chemistry in the earth's stratospheric ozone layer, potentially enhancing ozone depletion. Stratospheric aerosols can also interfere with satellite-based readings of earth, ocean and atmosphere sensors. Understanding the effects of volcanic eruptions is essential in order to recognize their interaction with global atmospheric systems.

Severe Storms
Possible Champion: Michael Changery
The commerce of the U.S. is critically dependent on a strong and viable economic base. Impacts of severe weather on industry, agriculture and individuals are ameliorated through a healthy insurance structure. As the population and economic base of the U.S. continues to increase, the actual and potential effects of severe storms (tornadoes, tropical storms, hail, flooding, rains, wind, coastal waves, snow storms) can reach potentially devastating levels. This includes both economic damage and death/injury to citizens. The increasing close linkages among many segments of the economy makes an accurate assessment of trends and effects of severe storms a critical component of national economic policy. For example, the recent effect of exceptionally severe winter storms compounded by the devastation caused by Hurricane Andrew have led to a crisis within an insurance industry which does not anticipate losses exceeding 25 billion dollars in one year. Similar losses in future years would have the potential to bankrupt segments of the insurance industry, with consequent severe impacts on the country's economic base. Trends in storm activity have also been considered a fingerprint of possible global warming.

Solar Activity
Possible Champion: Joe Allen
Electromagnetic radiation and energetic particles emitted by solar flares, and geomagnetic storms at Earth are sources of hazards for technology and humans in space or on the surface. Spacecraft failures and malfunctions ("anomalies") occur mainly during times of solar and magnetic disturbance. Crew and passengers of high-altitude aircraft receive measurable doses of radiation during the most intense events. Astronauts are uniquely susceptible to space radiation such that mission planners should take account of their likely exposure to extremes. Telecommunications involving ground sites and satellites is degraded. Navigation systems are disabled. Technology on Earth's surface is adversely impacted by magnetic storms, especially electrical power generation and distribution. All have human impact. The cumulative knowledge in NOAA about the patterns and trends of solar activity and its consequences should be summarized and available to policy makers involved in any of these issues.

El Niño/Southern Oscillation (ENSO)
Possible Champion: Vernon Kousky
During the warm phase of the Southern Oscillation, semi-arid regions such as northern Australia, Northeast Brazil, Southeast Africa and Northwest India suffer drought. Weather patterns in the Pacific/North American sector are also altered with heavier than normal rainfall occurring throughout the Gulf Coast region of the United States and warmer than normal temperatures in western Canada and Alaska. Anomalously warm ocean surface temperatures along the west coast of the Americas (El Niño) affect the distribution and availability of nutrients in the ocean thereby affecting fish and wildlife, and economies which depend on them. Improved monitoring and prediction of ocean surface temperatures in recent years has helped to minimize the economic impacts of ENSO.

Water Resources
Possible Champion: Henry Diaz
Availability of clean water for civil supply, for irrigation and hydropower generation, for navigation, recreation and a myriad other uses will grow in economic and social importance in the coming decades. East of the 100th meridian, where two-thirds of the U.S. population resides, water resources is critical to the economic health of the nation. West of the 100th meridian, where annual supplies are less than can support the current population, the development and maintenance of water storage system for irrigation, hydropower and civil supply is the single most important element that sustains life in the region.

As the nation's leading environmental information agency, material on water resources-related topics must be one of the main topics addressed by the NEWS. The need for information on climate issues as they relate to the management and planning of the nation's water resources systems is already large and will continue to grow at an accelerated pace. As some of the water resources systems approach their capacity limit, information about climatic change and variability will become the most critical factor affecting water resources policymaking.

Great Lakes Water Levels
Possible Champion: Frank Quinn
The Great Lakes contain 95% of the U.S. fresh surface water resources. Their water levels have significant environmental and economic impacts on the region's inhabitants. The lakes' drainage basin is home to 39,000,000 U.S. and Canadian citizens who depend on the lakes for water supply, power generation, commercial shipping, recreation, and wildlife habitat. Great Lakes water levels fluctuate on a daily basis due to meteorological disturbances, on a seasonal basis as a result of normal cycles in precipitation and temperature, and on an annual basis in response to climate trends. Over the past 25 years, the lakes have been in a very high levels regime, setting record highs in 1973 and again in 1985 and 1986. At present, several of the lakes are again approaching critical levels. Understanding the mechanisms which force water level fluctuations is necessary in order to forecast near-term water levels and simulate the lakes' response to potential climate change. Prediction and simulation capabilities are required for better management of Great Lakes water resources, emergency preparedness, and adaptation planning.

Trends and changes in coastal wetlands and upland landcover.
Possible Champion: Maggie Ernst
The extent and changes in land cover in coastal watersheds can serve as a surrogate for monitoring the effect of land use activities on coastal habitats and living marine resources. Technical capability exists to use satellite (Landsat) imagery and aerial photography to provide a rapid determination of the extent and rate of change of critical coastal habitats. These findings allow resource managers to target geographic area for reevaluation of existing management strategies. Research must be conducted to relate land cover change analyses with declines in resource productivity. These spatially registered information bases can be linked also to functional ecosystem models, leading to landscape - scale modeling of management scenarios.

Health in Coastal Ecosystems
Possible Champion: Thomas O'Connor
The coastal and estuarine parts of the world's oceans are more accessible and therefore valued to a greater extent and for more reasons than the open ocean. Concerns for coastal beauty and continued use tend to be local, but in toto, combining all the local interests, there is universal regard. NOAA tracks the influences of human activity on the coastal ocean by monitoring population and building trends, pesticide use, levels of chemical contamination in organisms and sediments, bacterial contamination on shell fish beds, and effects of environmental change on living resources. NOAA data are required to establish the status and trends of human effects in order to define beneficial management actions.

Fish Stocks/Endangered Species
Possible Champion: David Dow
The National Marine Fisheries Service (NMFS) combines data from fishery surveys of demersal/pelagic fish stocks, catch statistics, and sea sampling (bycatch estimates) in order to provide the eight Fishery Management Councils (FMCs) with scientific assessment advice on the status of fishery stocks. The FMCs use this information to develop plans (guidelines) for actually managing fishery stocks (with plan concurrence by the NOAA Administrator). Current information suggests that 28% of the living marine resources (LMRs) stocks are over-utilized, while 33% of potentially utilizable LMR stocks lack scientific assessments. For endangered species (fish, turtles, and marine mammals) 74% of the stocks lack adequate assessments. This problem is especially acute for marine mammals and sea turtles. The Marine Mammal Protection Act directs NMFS to establish the OSP (optimum sustainable population) size for marine mammal stocks. Current efforts are directed at developing rebuilding strategies for overfished LMR stocks; reducing bycatch and adjusting harvesting rates for threatened LMR stocks; developing recovery plans for endangered species by protecting critical habitat, diminishing man-made pollutants, and eliminating anthropogenically-induced mortality; and developing OSP estimates for marine mammals.

Habitat Degradation
Possible Champion: David Dow
The lower 48 states have lost 54% of their wetlands (coastal marshes and sea grass beds) which provide an important food source for coastal food webs; offer an important nursery area for juvenile LMRs; and provide protection from predation. Along the Southeast and Gulf Coasts 94 to 98% of the commercial landings are dependent upon inshore estuaries/wetlands. Commercial landings in this region have decreased 42% since 1983. In the Pacific Northwest and Northeast Atlantic regions toxic chemical pollution and nutrient enrichment of coastal waters appear to be the major forms of habitat degradation. In highly urbanized estuaries 15 to 33% of representative fish species contain liver cancers. Freshwater diversion from estuaries due to dams along rivers or agricultural water diversions have modified habitats in California and the Pacific Northwest. In California's Central Valley state and Federal water projects have diminished 90% of the salmon spawning habitat and resulted in the Chinook salmon being designated as threatened under the Endangered Species Act (ESA).

Seafood Safety

Possible Champion: David Dow

In 1991 the National Academy of Sciences released a report on "Seafood Safety" in which the Committee on Evaluation and Safety of Fishery Products identified biological hazards (bacteria, viruses, and biotoxins) as the primary threats to humans from consuming seafood from polluted areas. Marine Vibrio vulnificus bacterial contamination of oysters from Apalachicola Bay in Florida has resulted in 9 deaths in the last year. The deaths occurred in people with liver diseases or persons who are immunocompromised (such as AIDs victims), but does not threaten healthy individuals. Members of the Norwalk-family of viruses can cause gastroenteritis in humans consuming contaminated shellfish. Biotoxins are produced by microscopic algae (mostly dinoflaggelates and diatoms) which are accumulated by filter-feeding shellfish, resulting in the shellfish posing a threat to humans. The most serious biotoxin threats in North America are those due to ciguatera fish poisoning (CFP), paralytic shellfish poisoning (PSP), amnesic shellfish poisoning (ASP), and neurotoxic shellfish poisoning (NSP). Severe intoxication from CFP and ASP can lead to death. Increasingly large areas of the U.S. coastline are being closed to shellfish harvesting due to either biotoxin threats or bacterial/viral contamination.

Estuarine Eutrophication Trends

Possible Champion: Thomas O'Connor

Eutrophication, the nuisance growth of too much algae or the wrong kind of algae, is a problem common to many coastal areas. While the excessive growth is often blamed on nutrient additions subject to human control, there are myriad natural factors involved. A first step in addressing the problem is assessing the spatial extent and temporal variation of eutrophication in relation to natural and controllable factors. NOAA is doing this through retrospective analysis and through active monitoring programs.

Appendix E - Example Format for NOAA NEWS Regular Edition

Recent rise of nighttime temperatures

It is now well established that the mean temperature of the planet has increased over the past century by about 0.5°C. New information about how this warming has taken place indicates that a substantially greater warming is occurring during the night compared to the day. Data have been analyzed for over 50% (10%) of the Northern (Southern) Hemisphere land mass, accounting for 37% of the global land mass. During the period 1951 to 1990 the rate of temperature increase over the areas studied indicate that the daily mean minimum temperature is rising at a rate three times faster than the daily mean maximum temperature (0.84°C/100 yr versus 0.28°C/100 yr). As a result, the average daily temperature range (the difference between the maximum and minimum temperature) has decreased at a rate approximately equal to the increase of mean temperature.

Relevance

Anthropogenic greenhouse gases, clouds, and water vapor inhibit the escape of heat from the earth. This effect is especially notable at night over the land because of the lack of solar heating and land surface radiative properties. There is some evidence to suggest that as greenhouse gases continue to increase the tempera- will rise more rapidly at night compared to the day. Additionally, anthropogenic sulfate aerosols are known to reflect significant amounts of incoming solar radiation back to space. Since the differential change of the maximum and minimum temperature is fundamental to understanding just how these two man-made forcings operate, it is very important to understand just why the minimum temperature is rising relative to the maximum temperature.

A satisfactory explanation of the observed increase of mean temperature over the past several decades also requires an explanation for the observed increase of the daily minimum temperature relative to the maximum temperature. The practical implications of projected future increases of temperature will be difficult to assess without such an explanation.

Data Quality

A critical question arises related to the reliability of the data used to calculate the changes of the maximum and minimum temperature. The degree to which precautionary measures have been taken to minimize data inhomogeneities varies considerably from country-to-country. Probably of greatest concern however, is the extent to which the urban heat island can explain the observed variations. It is well known that the urban heat island often tends to manifest itself strongest during the nighttime hours.

Many steps have been taken to test the degree to which increased urbanization may have affected the temperature records presented in this section. Results indicate that although increasing urbanization may partially explain some of the increase in minimum temperatures, other explanations must be considered.

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The National Climatic Data Center (NCDC) continues to refine and expand the data base of mean maximum and minimum temperatures. Data from portions of Europe and Indonesia are being incorporated into the data base. NCDC provides and develops global and regional data bases for the detection of climate change.

ILLUSTRATIONS

The time series related to environmental variations in the electronic version can be static or dynamic. The user can only view illustrations exactly as the author intended them to be viewed, the information is static. These diagrams and tables will be "hard wired" into the electronic version of the NEWS. Additional data that can be dynamically viewed e.g., higher space and time resolution may also be included at the discretion of the contributor. In the example provided, static information will include the Tables and Figures provided, but station data and regional averages are also provided so the user could view time series of his/her choosing.

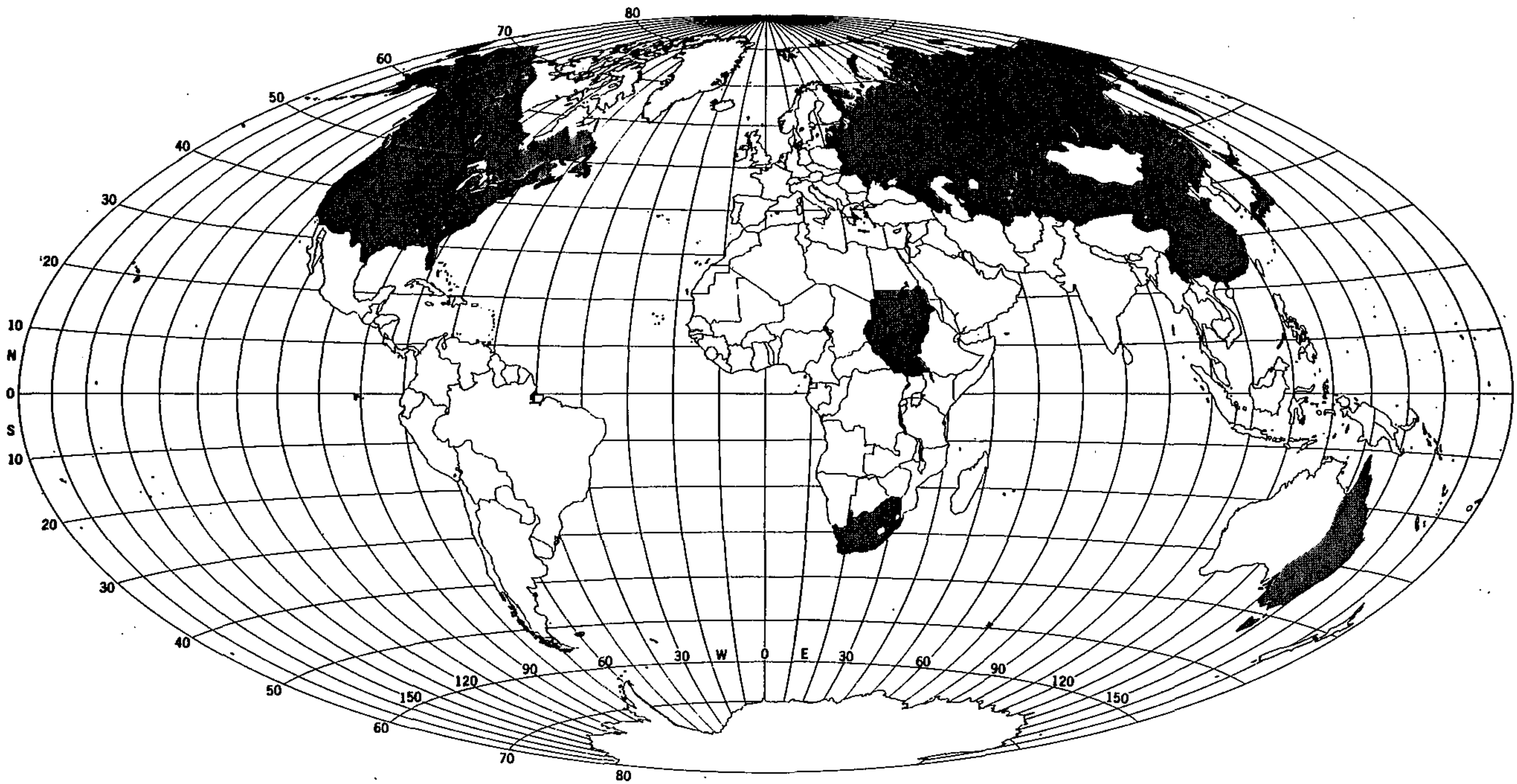

Figure 1 Shaded areas represent areas of the globe which have been analyzed for changes of mean maximum and minimum temperature.

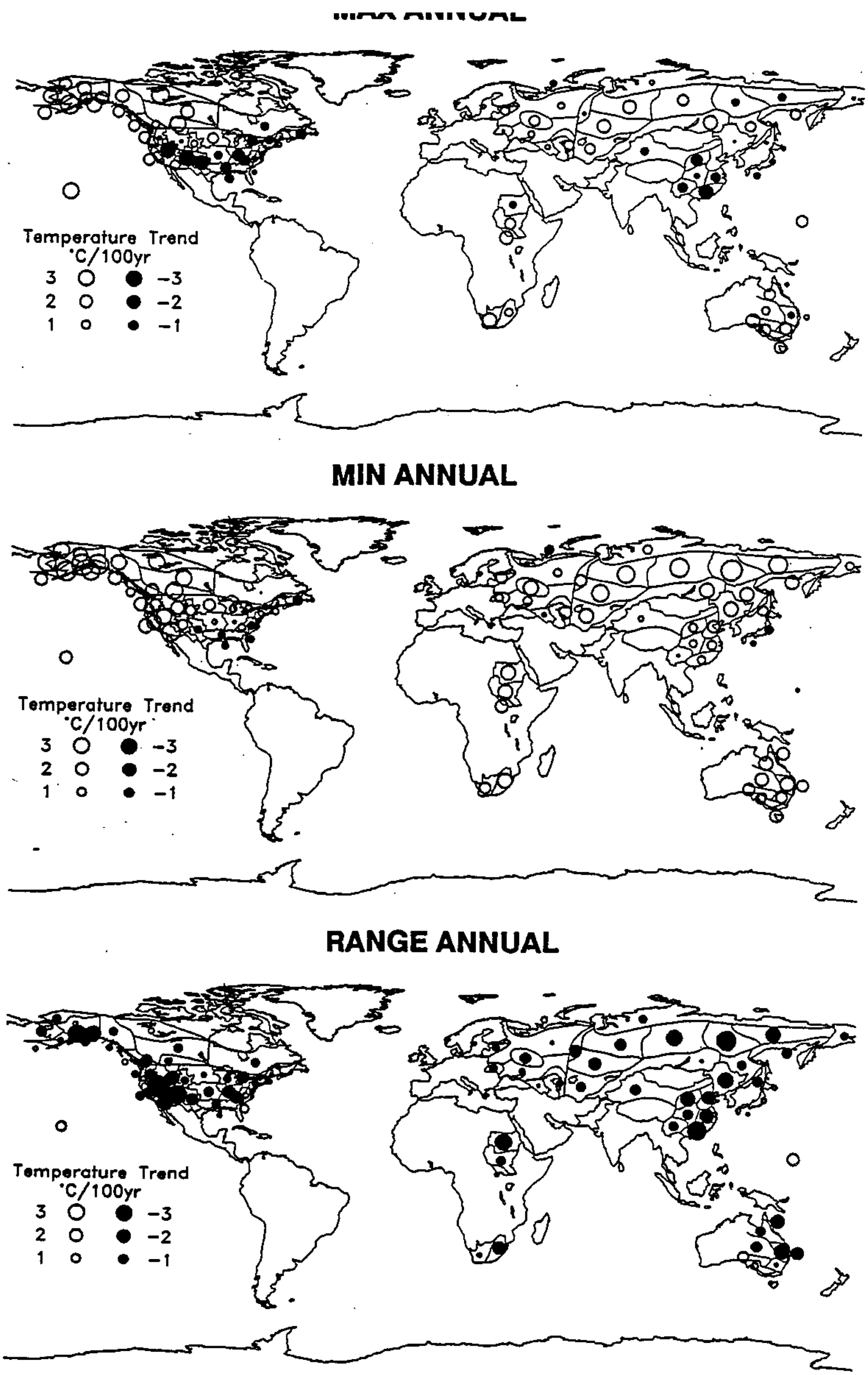

Figure 2 Spatial patterns of annual trends of mean maximum, minimum, and diurnal temperature range (mostly 1951-90) in °C/100 years. Diameter of circles is proportional to the trend and solid (open) circles represent negative (positive) trends. Circles pertain to regions within each country except for island stations e.g., South Pacific, and Hawaii.

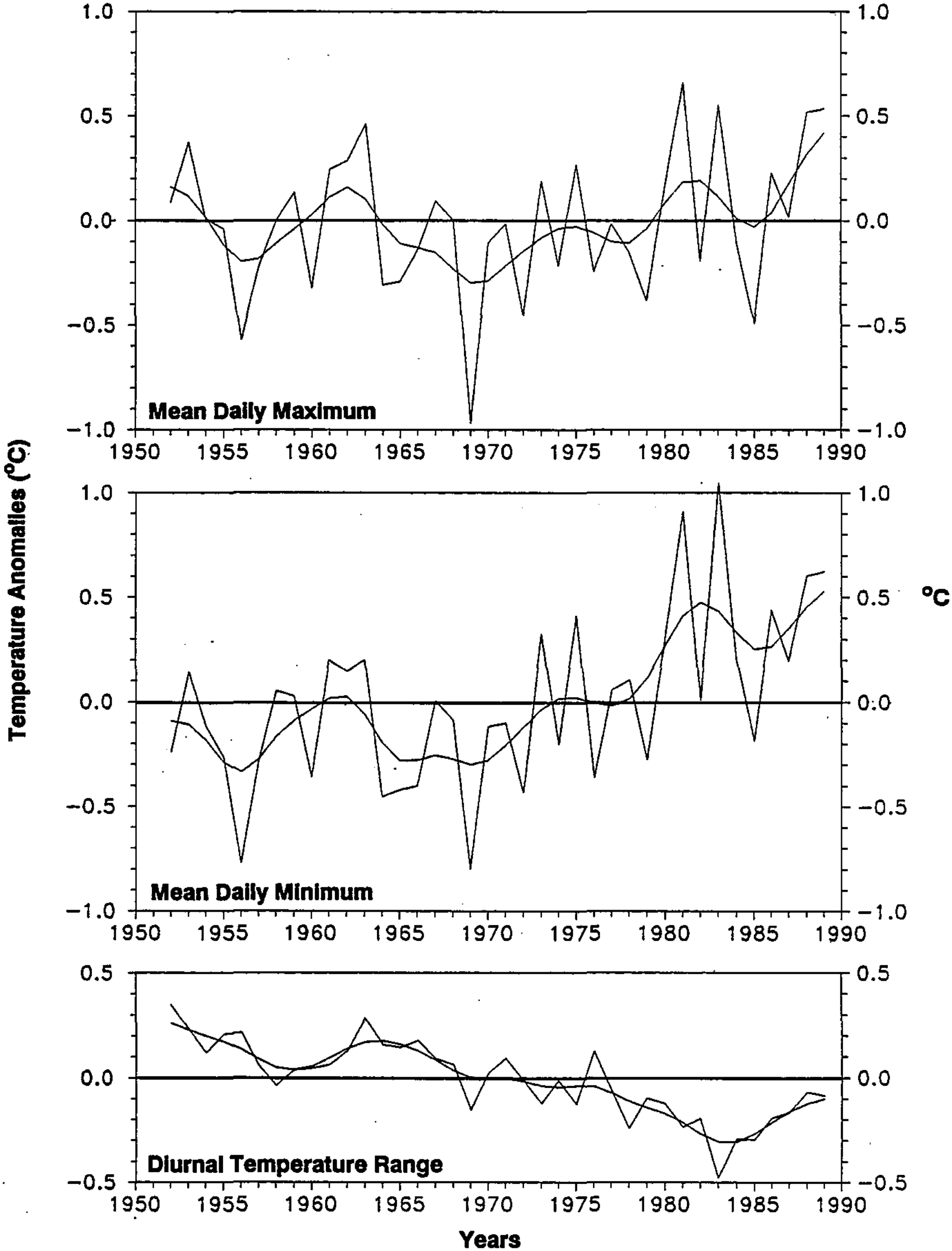

Figure 3 Time series of the temperature anomalies of the annual mean maximum, minimum, and diurnal temperature range for 37% of the global land mass (areas shaded in Fig. 1, less Pakistan, Denmark, and N. Finland). Smooth curve is a nine point binomial filter with "padded" ends.

Table 1 Trends of temperature (°C/100 years) for annual and three-month mean maximum (MAX), minimum (MIN) and diurnal temperature range (DTR) based on a weighted average of the regions (by Country) in Fig. 1. Additionally, trends significant at the .01 level (two-tailed t-test) are double underlined and those significant at the .05 level are single underlined. Trends with significant change points are denoted with an asterisk. The number of stations used to calculate the trends (in parentheses) and the time period relative to the trends is given for each country. PRC implies the People's Republic of China, USA the contiguous United States of America, E. Australia the eastern half of Australia, USSR the former Union of Soviet Socialist's Republics, and S. Africa South Africa.

ALASKA (39) 1951-1990			
SEASONS	MAX	MIN	DTR
D-J-F	6.0	8.8	-2.8
M-A-M	3.1	6.3	-3.2
J-J-A	0.9	2.4*	-1.5
S-O-N	-1.4	0.4	-1.9*
ANNUAL	2.1	4.5	-2.4

USSR (FORMER) (165) 1951-1990			
SEASONS	MAX	MIN	DTR
D-J-F	2.8	4.2	-1.3
M-A-M	2.5	3.8	-1.2
J-J-A	-0.4*	0.9*	-1.3
S-O-N	0.6	2.2	-1.6
ANNUAL	1.4	2.8	-1.4

CANADA (227) 1952-1990			
SEASONS	MAX	MIN	DTR
D-J-F	1.8	2.1	-0.2
M-A-M	3.7	3.8	-0.1
J-J-A	0.5	1.4	-0.9
S-O-N	-2.2	-1.2	-1.0
ANNUAL	0.9	1.5	-0.6*

JAPAN (66) 1951-1990			
SEASONS	MAX	MIN	DTR
D-J-F	-0.5	-0.2	-0.2
M-A-M	-0.4	-0.7	0.3
J-J-A	0.5	0.0	0.4
S-O-N	-0.3	-0.5	0.2
ANNUAL	-0.2*	-0.4	0.2

USA (494) 1951-1990			
SEASONS	MAX	MIN	DTR
D-J-F	-2.3	-0.7	-1.5
M-A-M	2.3	2.5	-0.2
J-J-A	-0.3*	1.0*	-1.4
S-O-N	-1.7	1.3	-3.0
ANNUAL	-0.6*	1.0	-1.5

PRC (44) 1951-1988			
SEASONS	MAX	MIN	DTR
D-J-F	0.5	3.5	-3.0
M-A-M	-0.8	1.4	-2.2
J-J-A	-1.8	-0.8*	-1.0
S-O-N	-0.6	1.0	-1.6
ANNUAL	-0.7*	1.3	-2.0*

SUDAN (15) 1951-1987			
SEASONS	MAX	MIN	DTR
D-J-F	-1.2	2.7	-3.9*
M-A-M	0.4	3.3	-2.8
J-J-A	2.8	2.1	0.7
S-O-N	1.4	2.5	-1.1
ANNUAL	0.9	2.7	-1.7

S. AFRICA (12) 1951-1991			
SEASONS	MAX	MIN	DTR
D-J-F	0.8	2.0	-1.2
M-A-M	2.2	1.7	0.5
J-J-A	1.3	1.3	0.0
S-O-N	-0.7	1.8	-2.4
ANNUAL	0.9	1.7*	-0.8*

E. AUSTRALIA (44) 1951-1991			
SEASONS	MAX	MIN	DTR
D-J-F	1.8	2.3	-0.4
M-A-M	1.6	2.8	-1.2
J-J-A	0.8	1.4	-0.5
S-O-N	1.3	2.2	-0.9
ANNUAL	1.4	2.2	-0.7

Table 2 Trends of temperature (°C/100 years) for annual and three-month mean maximum (MAX), minimum (MIN) and diurnal temperature range (DTR) for the areas denoted in Figure 1 (less Pakistan, northern Finland, and Denmark). Percent of the land area covered for the Northern and Southern Hemisphere and the Globe is denoted within parenthesis.

N. Hemisphere (50%) 1951-1990			
SEASONS	MAX	MIN	DTR
D-J-F	1.3	2.9	-1.5
M-A-M	2.0	3.2	-1.3
J-J-A	-0.3	0.8	-1.1
S-O-N	-0.4	1.3	-1.7
ANNUAL	0.5	2.0	-1.4

S. Hemisphere (10%) 1951-1990			
Seasons	MAX	MIN	DTR
D-J-F	1.6	2.2	-0.6
M-A-M	1.7	2.5	-0.8
J-J-A	1.0	1.3	-0.4
S-O-N	0.8	2.1	-1.3
ANNUAL	1.3	2.0	-0.8

GLOBE (37%) 1951-1990			
SEASONS	MAX	MIN	DTR
D-J-F	1.3	2.9	-1.6
M-A-M	1.9	3.1	-1.2
J-J-A	-0.2	0.8	-1.1
S-O-N	-0.3	1.4	-1.7
ANNUAL	0.7	2.1	-1.4

Appendix F - NOAA NEWS Project Office

APPENDIX F: NOAA NEWS Project Office

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