U.S. DEPARTMENT OF COMMERCE
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
NATIONAL WEATHER SERVICE
NATIONAL METEOROLOGICAL CENTER

OFFICE NOTE 18

AN EVALUATION OF MATS AIRCRAFT WINDS

G. Stanley Doore
Computation Branch
National Meteorological Center

This is an unreviewed manuscript, primarily intended for informal exchange of information among NMC staff members

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This evaluation was undertaken during September 1961 over the Atlantic area. Due to the nature of the data and the area covered, most of the evaluation had to be subjective. Dual analyses with and without the aircraft reports were made for comparison and in one case a dual forecast was made.

This study shows the usefulness of the aircraft wind reports supplied by EASTAF for use by NWP. These data have been so satisfactory that Numerical Weather Prediction at Suitland, Maryland is now using them on an operational basis. Therefore, NWP recommends increased reporting and that MATS place this reporting on an operational basis.

Altitude limits established for this evaluation according to pressure levels may be found in table 1. The time limits were plus and minus six hours from ØØZ (12Z).

Table 2 shows the number of aircraft reports processed by machine. The total number accepted was the number of reports used in the analyses. The total rejected reports either failed the time test or the altitude range test for the levels shown in table 1. The largest number of reports processed during a single analysis was 54 (at ØØZ 13 September 1961) of which 30reports were accepted.

Also in reference to table 2 the following code errors were found:

1. Entire groups missing
2. Missing data within groups were encoded "Msg" or "Ø"s rather than "X" for each missing digit.
3. Latitude longitude groups containing "Ø"s place the report at the equator and prime meridian.

Report errors were infrequent. Those which occurred were the type of 90° or 180° direction error, which were rejected by the numerical analysis scheme by a vector error check against the forecast. Two were accepted with a 90° error and a very light wind. These did not visibly injure the contour analysis due to good surrounding reports, however, the isotach analyses had the minimum wind placed too far north. More care in reporting will prevent most of these errors and make the report useable.

Reports which were accepted and used in the analyses improved the analyses. Due to the sparse data over the Atlantic, i.e. only permanent ships and the Azores, the aircraft reports helped fill the large gaps. The analyses were improved in the following ways:

1. Better positioning of troughs and ridges.
2. Better definition of systems.
3. Better horizontal resolution of the wind field.

Since the time limits imposed by NWP for aircraft data were ØØZ(12Z) plus or minus six hours, placement of systems could be improved by placing a restriction of four hours plus or minus ØØZ (12Z). This will be done shortly. A project for NWP in the future will be to devise a method of updating the aircraft reports to the proper analysis time.

Refering to example I, the comparison of analyses at 700 mb shows the advantage of using good aircraft data. Ship "E" had a south wind at 5 knots in the original analysis. This caused a ridge to be induced north of "E" as shown. By including aircraft data (in this case only two observations) the ridge was removed, a better flow pattern established, and an analysis more comparable to the subjective analysis accomplished. It should be noted that all three analyses

were prepared independently and the subjective analysis was made without the aid of the aircraft reports.

In the forecasts made at 500 mb with and without aircraft data similar errors occurred in direction of flow; however, the gradients were better in the forecast incorporating the aircraft data.

Recommendations:

1. Aircraft report winds at least every five degrees to give more dense coverage.
2. More reports at 500 mb.
3. More care in encoding of reports.
4. Prime transmission times to NWP should be 00Z(12Z) plus three and plus five hours.
5. Aircraft reports for NWP containing doppler winds should have an identification character. This could be accomplished by making the height group a four character group in the case of doppler winds, the first three for height, the fourth a "D" for doppler identification i.e. 300D for a 30,000' doppler wind. Since doppler winds would be made at the position given at the beginning of the coded message to NWP, it would not be necessary to include the midpoint position group necessary for conventional winds. Each doppler wind would be contained in a separate report for NWP. Conventional wind reports would remain the same.

NWP proposes the recommendations stated be implemented in an effort to fill the relatively silent data ocean areas so as to improve analyses as an aid to better forecasts over these areas.

TABLE 1

ALTITUDE LIMITS FOR CONSTANT PRESSURE SURFACES

LEVEL	ALTITUDE RANGE	LEVEL	ALTITUDE RANGE
1000 mb	0 - 2,500'	300 mb	27,500 - 31,000'
850 mb	3,800 - 6,000'	250 mb	34,000 - 36,000'
700 mb	8,500 - 11,000'	200 mb	38,000 - 41,000'
500 mb	14,900 - 20,000'	150 mb	43,000 - 46,000'
400 mb	22,000 - 24,000'	100 mb	51,000 - 54,000'

TABLE 2

REPORTS PROCESSED

	00Z (22 analyses)	12Z (24 analyses)	Total
850 mb	13	10	23
700 mb	80	65	145
500 mb	64	37	101
Other*	4	7	11
Total accepted	161	119	280
Total Rejected	158	186	344
Total	319	305	624
Code errors	17	16	33

* Includes levels 1000, 400, 300, 250, 200

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Addendum I

TABLE 3

AIRCRAFT REPORTS PROCESSED
February 1962

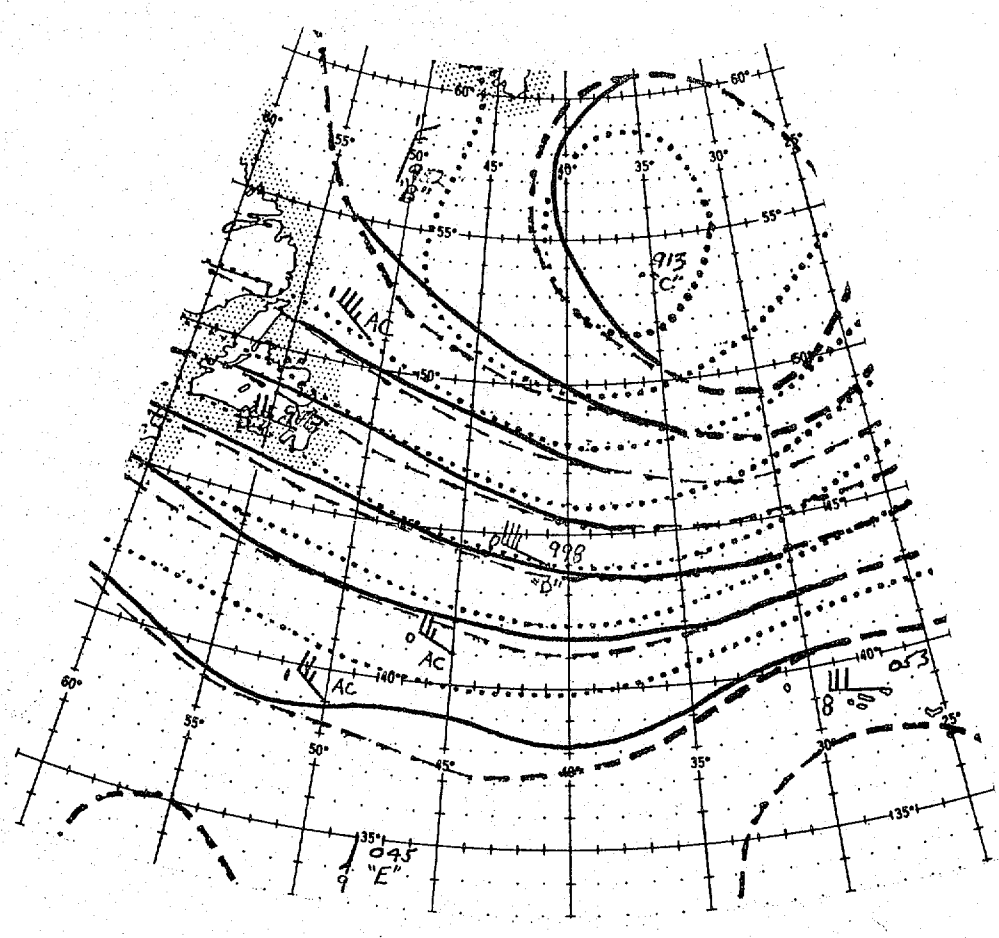
	EAST AF				WEST AF			
	00Z	12Z	Total East AF	Change*	00Z	12Z	Total West AF	TOTAL
850	3	0	3	- 25	53	10	63	66
700**	65	30	95	- 81	565	343	908	1003
500	40	17	57	- 66	65	94	159	216
[illegible]er	1	5	6	- 7	4	4	8	14
Total Accepted	109	52	161	-179	687	451	1138	1299
Rejects								
Time***	11	5	16	--	122	72	194	210
Altitude	22	4	26	--	171	111	282	308
Report Errors	14	13	27	--	86	40	126	153
Total Rejected	47	22	69	-350	379	223	602	671
TOTAL	156	74	230	-529	1066	674	1740	1970

* Shows decrease in number of reports processed for East AF from Table 2 corrected to an equal time interval

** Altitude Range changed to 8000 - 11,000"

*** Time Range changed to 4 hours ± 00Z (12Z)

EXAMPLE I



AC Aircraft Winds

Subjective Analysis

Machine Analysis with Aircraft Winds

Machine Analysis without Aircraft Winds