Comments on "Rapid Frontal Wave Development"

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19 January 1976

Johnston (1974) has presented a series of SMS-1 pictures for 12 June 1974 which show the rapid and dramatic evolution of a frontal cloud band into a vortical structure in the central Atlantic. The accompanying synoptic interpretation, along conventional Norwegian lines, seemed reasonable, as I have experienced and analyzed rapid small-scale cyclogenesis in the Sargasso Sea and elsewhere (e.g., Sanders, 1972). The National Meteorological Center (NMC) analysis for this time and place, however, did not seem consistent, especially as it displayed a low near 39°N, 39°W at 1200 GMT, rather than at about 37°N, 42.5°W as implied by Johnston's account.

I was thus led to plot and analyze the surface observations from ships, available on Service C teletype at MIT. To my surprise, the analyses shown in Figs. 1–4 emerged. At 0000 GMT a pronounced surface front lies within the broad satellite cloud band, though it does not seem to be marked by any particular structural feature within the band. The surface observations show winds as high as 35 kt on the warm side, but briskly rising pressure almost everywhere. The cloud amounts (except at PGRZ) are consistent with the satellite picture.

By 0600 GMT a new wave has formed, to judge from the SMS-1 pictures and from the surface observations. Falling pressures and continuous precipitation at EIDF and YTAE confirm the satellite indication. The snow at the latter station is beyond belief, and later comparison with other nearby ships indicates that the pressure value at this ship is consistently 5 mb too high, that the reported wind speeds may be too great, and that the thermometer is stuck at 23°C. The other elements seem acceptable at this time and later.

The last comparison with SMS-1 imagery is at 1200 GMT when the surface observations, especially the one from GRAN, seem to give the lie to both the satellite inference and the NMC analysis. The satellite vortex occurs in a region of quite uniform northerly surface winds, with speeds of 15–20 kt. The report from EIDF, now less than 50 n mi from the position of the vortex, shows scattered stratus clouds at low levels, with altocumulus and cirrus above, and nothing particularly menacing in the way of weather phenomena. The surface low center and wave crest, on the other hand, appear to be about 250 n mi to the east, near 37°N, 37.5°W and along the eastern edge of the satellite cloud band. The position of this center is less certain than it might be because no observations from ships were available east of 35°W, but it is limited to the eastward by the position of the 1016 mb isobar in the vicinity of the Azores, which was guided by the NMC analysis, itself presumably based on accurate pressure observation.

The pronounced westward development of cloud near 39°N, 42°W, to develop the vortex depicted in the SMS-1 series, is evidently related to the development of the circulation pattern in the middle troposphere rather

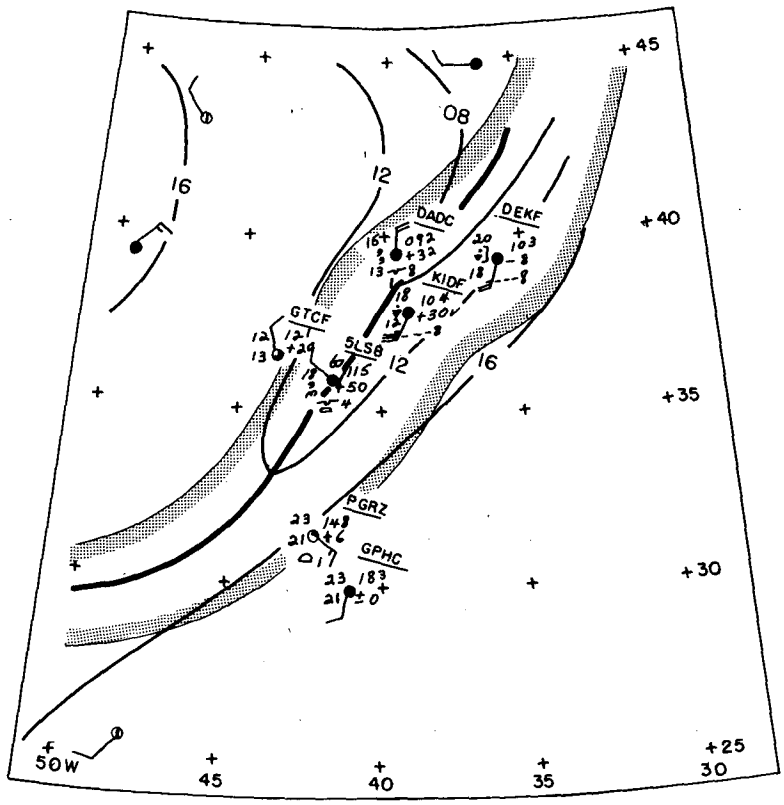

FIG. 1. Surface analysis, 0000 GMT 12 June 1974. The heavy line represents the frontal system, and the thin lines isobars, labelled in mb excess over 1000. The stippled bands enclose the region of main satellite cloudiness. Observations of particular interest are shown in a reduced version of the Abbreviated U. S. Model. For others, only sky cover, wind and weather phenomena are plotted.

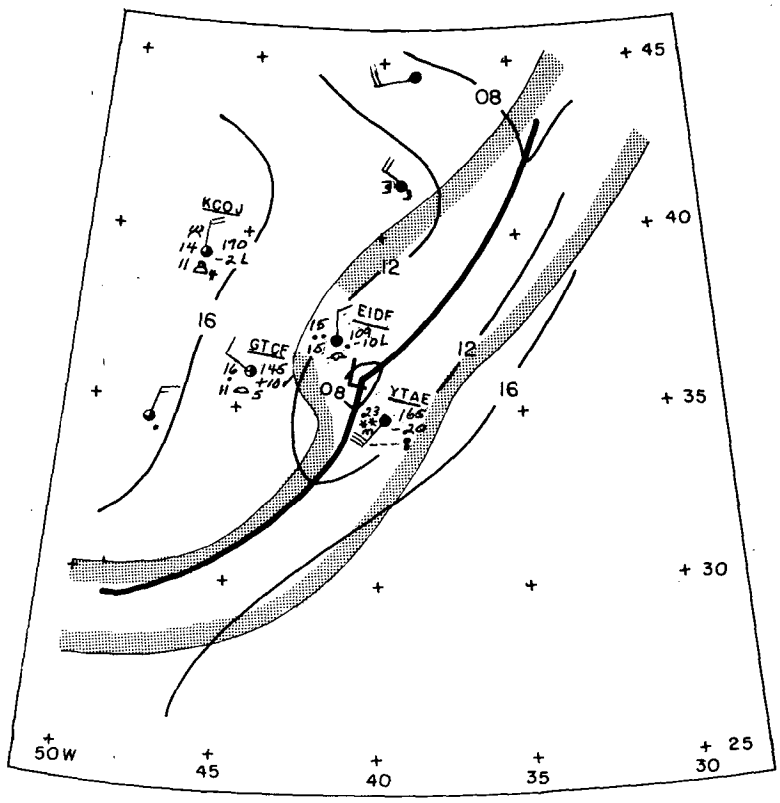

FIG. 2. As in Fig. 1 except for 0600 GMT.

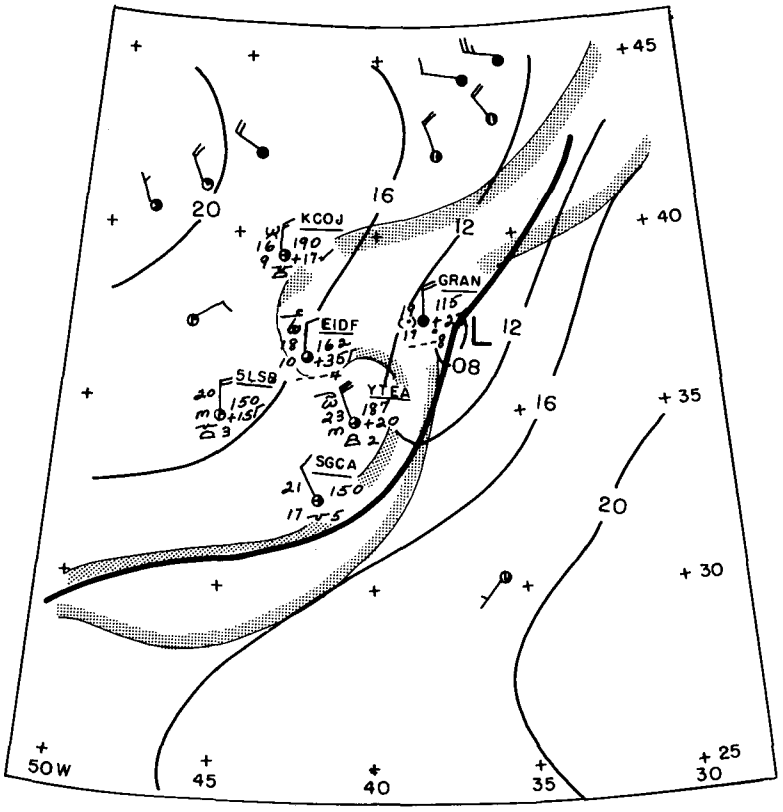

FIG. 3. As in Fig. 1 except for 1200 GMT.

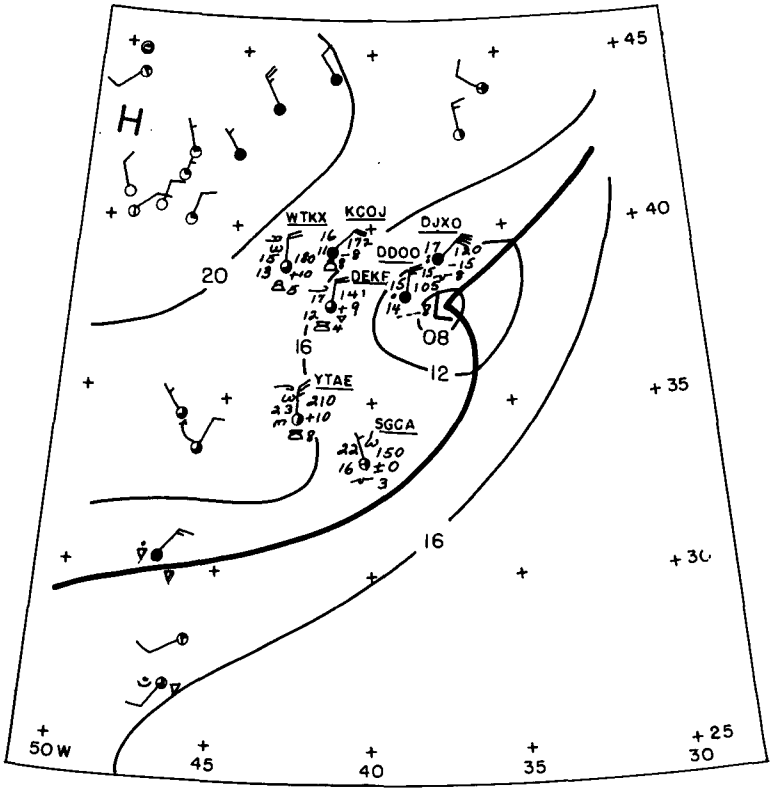

FIG. 4. As in Fig. 1 except for 1800 GMT.

than at low levels. Such a vortical development aloft would imply slow further motion of the surface system to the northeast, an inference which is confirmed by the surface analysis at 1800 GMT. The surface analysis shows a considerable closed circulation about a nearby stationary center near 37.5°N, 37.5°W, with northeasterly winds up to 35 kt. (The longitude of the observation from DJXO was received as 48°W, but was evidently in error by 10°). In the vicinity of the previously observed satellite vortex the northerly flow now shows signs of cyclonic curvature, with deep convective clouds at a number of places and a shower at DEKF. These phenomena are not unexpected near an upper-level cyclone over a warm sea surface.

Now it is hardly a novel suggestion that satellite information should be used in conjunction with conventional data, but the *caveat* evidently bears repeating. In this case the acceptance of a surface circulation center on the basis of the satellite vortex would have led to an error in the initial analysis, of a magnitude which is barely tolerable in a 48 h forecast. In this case it appears that the satellite information should have been used to enrich and refine a picture which was readily obtainable from careful study of a type of observation which has been available for more than a century.

REFERENCES

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