PACIFIC REGION TECHNICAL NOTES

No. 78-024

THE EFFECT OF ANALYSES ON SUBSEQUENT PROGNOSES
A SUBJECTIVE EVALUATION

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INTRODUCTION.

Goes satellite imagery can be used to assess initial upper air analyses (500 mb. and 250 mb.) over the eastern Pacific. Upper air flow patterns, location of vorticity centers, the shape of vorticity advection areas and the intensity of the vorticity advection areas can be assessed by careful examination of the imagery. Furthermore, the imagery can be used to gain much useful information as to the intensity and extent of the major trofs by examining the nature of the convective clouds. Such an examination will then indirectly lead towards an assessment of thickness patterns over the sparse ocean data areas. The following questions may well be asked:

1. What constitutes a good upper air analysis?
2. Does a good initial upper air analysis lead to a good prognosis?
3. Are some initial analysis errors tolerable?
4. What initial analysis errors will have the greatest impact on a prognosis?
5. Are there certain synoptic situations which can be identified more readily with certain initial errors?

An investigation was undertaken with the hope of answering some of the above questions and with the hope of developing some guidlines which might be used in critically assessing some of the computer products.

The investigation was undertaken from May 15 to June 15, 1978. It is fully realized that an investigation of one month is an extremely short time for such a project and it is likely that some of the conclusions reached may at some later date have to be modified. However, it is hoped that some of the findings may provide some useful guidance to meteorologists, and hopefully stimulate an interest in a critical assessment of computer products.

PROCEDURE.

CMC's spectral initial 500 mb analyses were examined in order to locate errors in the location, shape and intensities of vorticity patterns. Implied thickness patterns were also examined by making use of the convective cloud features found on satellite imagery. The implied locations of vorticity centers as determined by the satellite imagery, as well as the shape of these patterns were transferred

to the 500mb. analyses. The errors in the shapes of the patterns as revealed by the cloud structures were subjectively assessed as were the errors of the location of the positions of the centers. Intensities were also subjectively assessed by examining cloud structures and changing cloud patterns.

The prognoses that resulted from these initial alalyses were then examined with regard to any system under consideration and assessed subjectively.

DISCUSSION.

During the above time span of one month various synoptic patterns were observed over the eastern Pacific and B.C.. However, only one moderately intense development occurred during this period, which is in sharp contrast to the recurring intense developments of the winter season. In general, the flow patterns at 500 mb. and 250 mb. were in phase which is quite frequently not the case during the winter season. The speeds of the travelling vorticity centers were generally 10 to 20 knots less than during the winter when speeds of 30 to 50 knots are usually observed. The wide spectrum of synoptic situations included the cut-off low, the split flow, the zonal flow, the meridional flow and the blocking situation. During the month 55 initial analysis were examined. Many of these analyses had three to five distinct vorticity centers in the area of interest. The over-all analysis for the prognostic input was assessed subjectively. In order to merit a good analysis no location of any of the vorticity centers could be in error by more than 3 degrees latitude in position and both the intensity and shape of the systems had to be at least assessed as fair. For a poor rating a position error of 6 degrees latitude or more of any of the centers was sufficient or more than half of the shapes and intensities examined had to fall in the poor category. A similar assessment was done with the 36 hour prognosis. Needless to say such an assessment is highly subjective. It is not the purpose of this note to publish the statistical data which was gathered during the investigation, but rather to list a number of conclusions to which the investigation seemed to point.

CONCLUSIONS.

1. Over-all subjective assessment of analyses and prognoses

Number of analyses examined---- 55
Number of good analyses-------- 20
Number of fair analyses-------- 20
Number of poor analyses-------- 15

Number of 36 hour progs examined------- 55
Number of good prognoses---------- 12
Number of fair prognoses---------- 24
Number of poor prognoses---------- 19

2. In order to obtain a good 36 hour prognosis, a good initial analysis appears to be necessary. All 12 good prognoses followed from good analyses. Investigation of the other 8 good analyses indicated that they were associated with cold lows. Here, although the progged position was quite acceptable the shape and intensity associated with the cold low was generally fair initially and poor on the prognoses.

3. Cut-off lows that were initially analysed quite well with regard to position were also progged well with regard to position. However, good and fair initial details around the low's center (shape and intensity of vorticity advection areas) became highly inaccurate after 12 to 24 hours. It is extremely difficult to find good details of vorticity patterns on initial analyses of cold lows. The details improve in data areas, but even there are generally unreliable.

4. The following errors in initial analysis appear to produce the most drastic effects on the subsequent prognoses:

1. Incorrect location of major circulation features. It appears that if the location of the major trof or ridge is incorrect the progs eminating from this erroneous analysis should be suspect. Major trofs can be placed quite accurately over the Pacific by examining the convective cloud structures appearing in the imagery. On the other hand long wave ridges can be identified by the behavior of high clouds and the structure of the jet stream. If in addition the major circulation features are progressive and an initial error is made in their location then it would appear that the subsequent prognoses are likely to be quite poor.

2. Incorrect shape of the upper level circulation pattern. If errors in the shape of the upper circulation pattern are present on the initial analysis the subsequent prognosis will usually exhibit large height errors. Satellite imagery can illustrate by the structure and motion of the"clouds" whether the upper flow is cyclonic or anticyclonic and this structure of the upper circulation should be compared to that of the initial analysis.

3. Incorrect location of vorticity center embedded in "stream" affecting area of interest. If the intensity and shape of vorticity advection area are relatively accurate then the resulting error will be one of timing. Such an error can usually be quite readily anticipated.

4. Incorrect intensity or shape of vorticity center embedded in "stream" affecting area of interest. The error in the resulting prog will likely be more serious than that of 3 and usually not so readily anticipated. This type of error will be one of degree and result in forecasts that perhaps should have been sunny instead of cloudy or rain instead of cloudy. The initial examination of the imagery in respect to cloud structure, areal extent and changing cloud features should

give considerable information as to the"correctness" of the initial vorticity pattern.

5. The shape of a vorticity pattern appears not to improve with time. In other words a vorticity pattern that is initially "good" may end up "good", "fair" or "poor" but a pattern that was initially "poor" will not end up "fair" or "good".

6. The intensity of the vorticity pattern may or may not improve with time, but in general some weakening of the intensity occurs with time.

7. Erroneous vorticity analysis at the southern edge of a "stream" (in light wind field) appears not to affect the prognoses very much.

It is hoped to illustrate some of the above points using using analyses, satellite imagery and prognoses.