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A CASE STUDY USING THE MOISTURE CONVERGENCE CHART

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On March 31, 1986 a line of VIP 3 to 4 level thunderstorms developed in northwest Iowa near a Pacific cold front. Before long a line of thunderstorms extended from Wisconsin through Iowa into Kansas. Watch boxes (mostly blue) were issued for areas to the southwest and northeast of Iowa and eventually a blue box covered parts of western and central Iowa. As it turned out, severe weather occurred in Minnesota and Kansas, but none in Iowa; that this would be true was not obvious in advance, however.

Attached are hourly satellite photos of the episode starting at 21Z (Figs. 1a-f). Also attached are hourly surface moisture convergence (MCV) charts. From the satellite pictures it can be seen that from 21Z to 22Z (Figs. 1a and 1b) the line grew quite rapidly with the coolest top located in south central Nebraska. A check of the 21Z MCV chart (Fig. 2a) shows the greatest convergence in south central Nebraska. On the 22Z MCV chart (Fig. 2b) the pattern is better organized and the maximum has moved to east central Nebraska. At the very least, one would expect the line to become better organized and stronger over the next one to three hours from eastern Nebraska into Iowa.

A check of the 23Z and 00Z satellite photos (Figs. 1c and 1d) shows the line is indeed more organized as indicated by increased blowoff and colder tops, especially in Iowa. At this point one should be continually monitoring radar and other sources of information for the first indication of severe weather.

Another run of the MCV for 23Z data (Fig. 2c) showed a slight increase in the MCV maximum in Nebraska and a much more significant increase in western Kansas. This was the first hint that the Kansas portion of the line was to become the main threat area. It may also indicate that the Iowa/Nebraska portion may be at maximum strength. These thoughts can only hold "if" the 23Z trend continues into the next hour or so. One must remember that MCV charts act as short-term forecast tools and that several hours are required to see a change in the thunderstorm activity.

By 00Z another hour has passed with no severe weather in Iowa, and the 00Z MCV run (Fig. 2d) shows increased convergence in Kansas as the eastern Nebraska maximum moves into northeast Kansas. One would think the Iowa thunderstorms should be going downhill shortly. The 02Z satellite picture (Fig. 1e) does indeed show warmer tops in Iowa. Cold tops extend from near Lamoni to Hutchinson, Kansas -- right along the axis of the elongated MCV maximum at 00Z.

Another MCV run at 02Z (Fig. 2e) says it all with a collapse of maximum convergence values to about 50 or 60 percent of those from the 00Z run. At this point, it was difficult to locate any VIP 3 return in Iowa with thunder. The line of thunderstorms several hours before had been transformed into a stratiform line of light to moderate rain. The rainfall area in Kansas continued to shrink very slowly as it moved toward extreme northeast Oklahoma.

This shows how MCV charts can be used to the advantage of forecasters and radar operators. One should look for trends over a one-to-two hour time frame. Significant jumps in convergence to values approaching -80 have been observed with fairly severe weather. It should become automatic to run a PLOT34 hourly followed by a MCV chart during a severe weather threat.

This was a "null" situation for Iowa since no severe weather occurred there, but the MCV charts were nevertheless useful in that state since they suggested that Kansas and Minnesota, and not Iowa, would get the severe weather. One might have expected severe weather in southeast Nebraska by looking at the 22Z and 23Z MCV charts, but there was none. It will be left to posterity to determine why Nebraska escaped.

There is one other tool developed by TDL that uses moisture convergence. It is the 2-6 hour severe thunderstorm probability AFOS graphic product (Ø10). The Eastern Region has been using this chart with quite a bit of success over the last two years. They have shown that when thunderstorms approach closely or move into the maximum severe threat area, severe weather usually occurs. Note that one must compare the maximum probability on the graphic to the proper threshold probability (in our case, the "Great Plains"). This graphic should also be used heavily by radar operators. An example is attached.

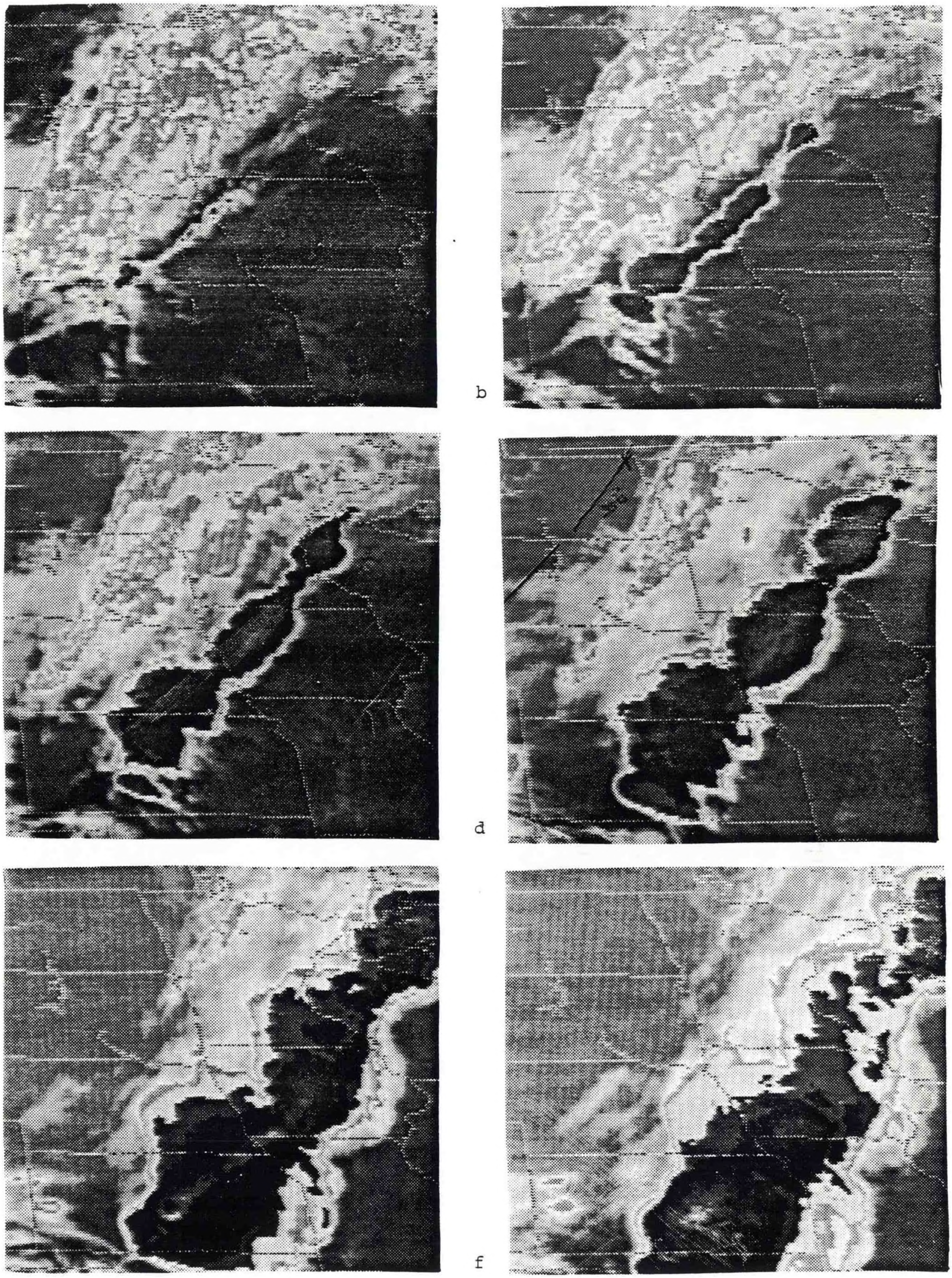

Fig. 1. IR (MB Curve) satellite images for: (a) 2100 GMT 31 March, (b) 2200 GMT 31 March, (c) 2300 GMT 31 March, (d) 0000 GMT 1 April, (e) 0200 GMT 1 April, and (f) 0300 GMT 1 April 1986.

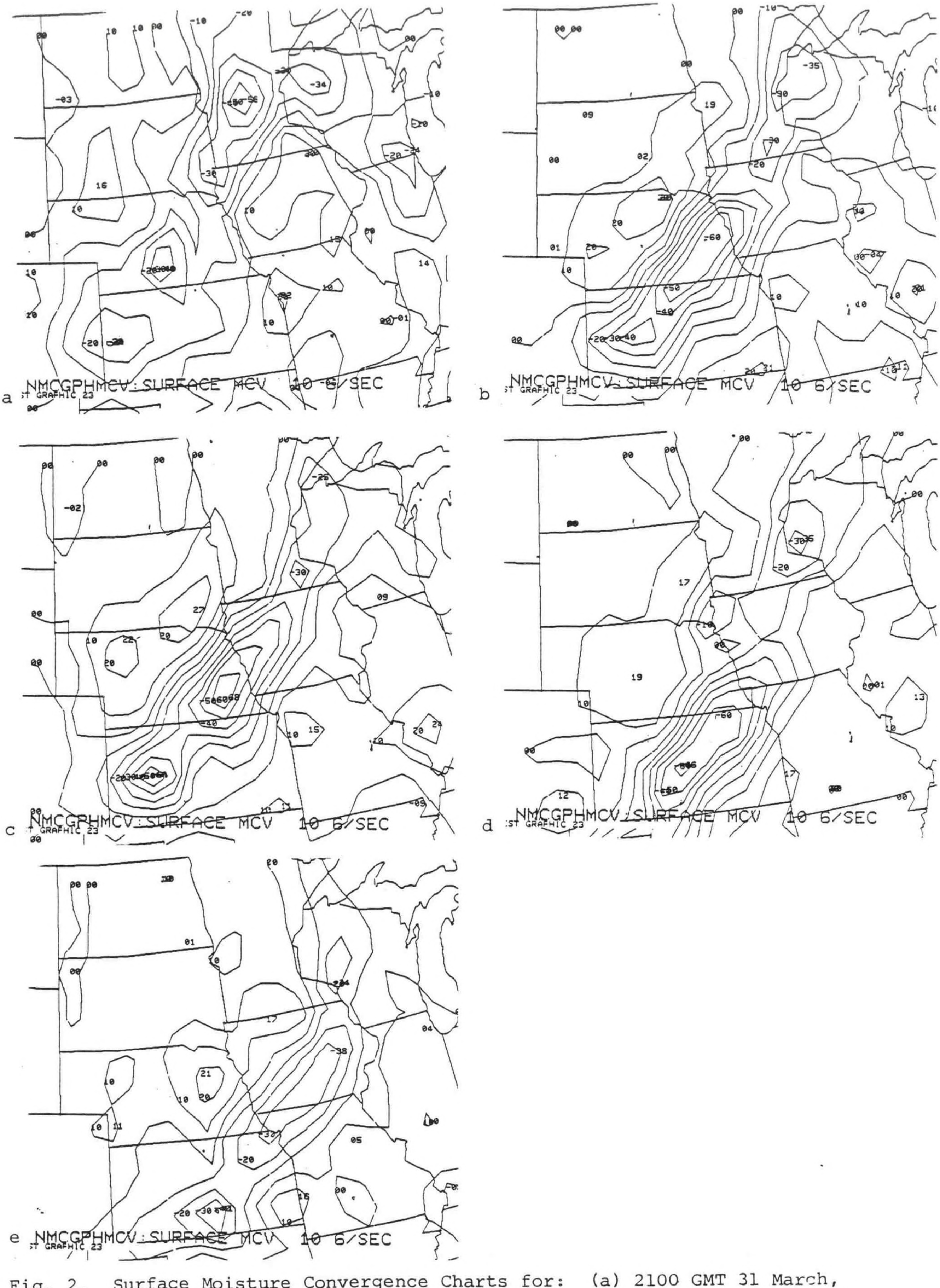

Fig. 2. Surface Moisture Convergence Charts for: (a) 2100 GMT 31 March, (b) 2200 GMT 31 March, (c) 2300 GMT 31 March, (d) 0000 GMT 1 April, and (e) 0200 GMT 1 April 1986.

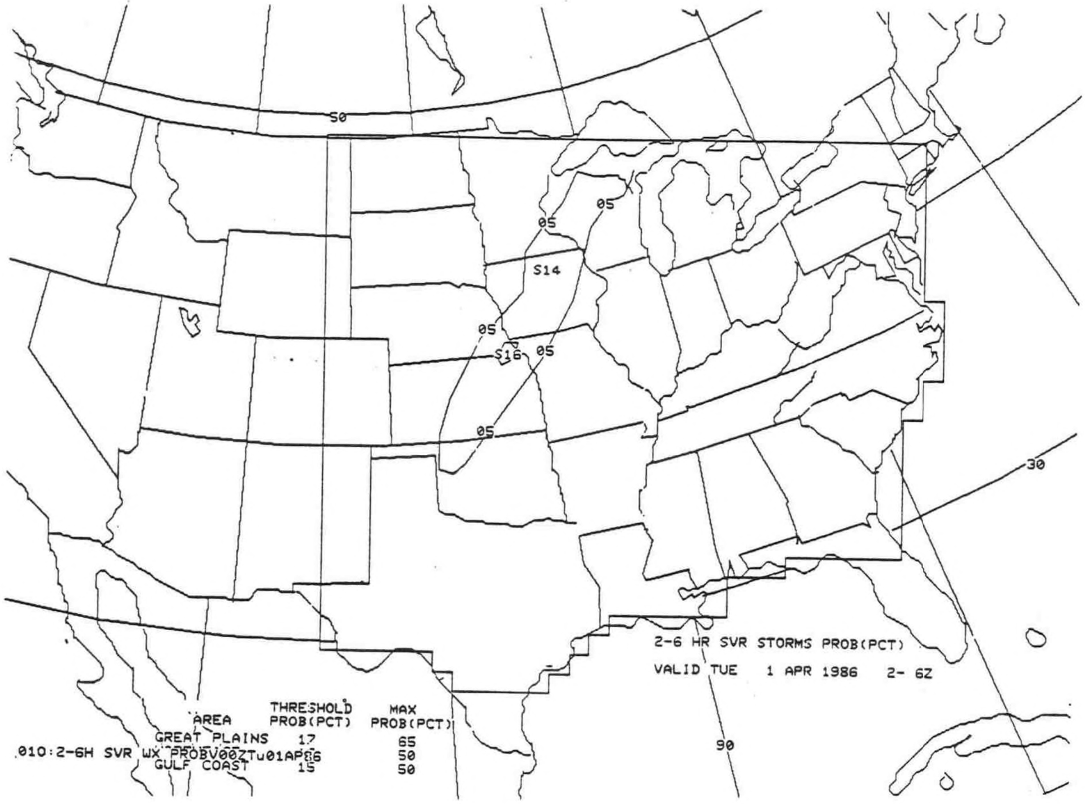

Fig. 3. 2-6 Hour Severe Storm Probability Chart valid 0200-0600 GMT 1 April 1986.