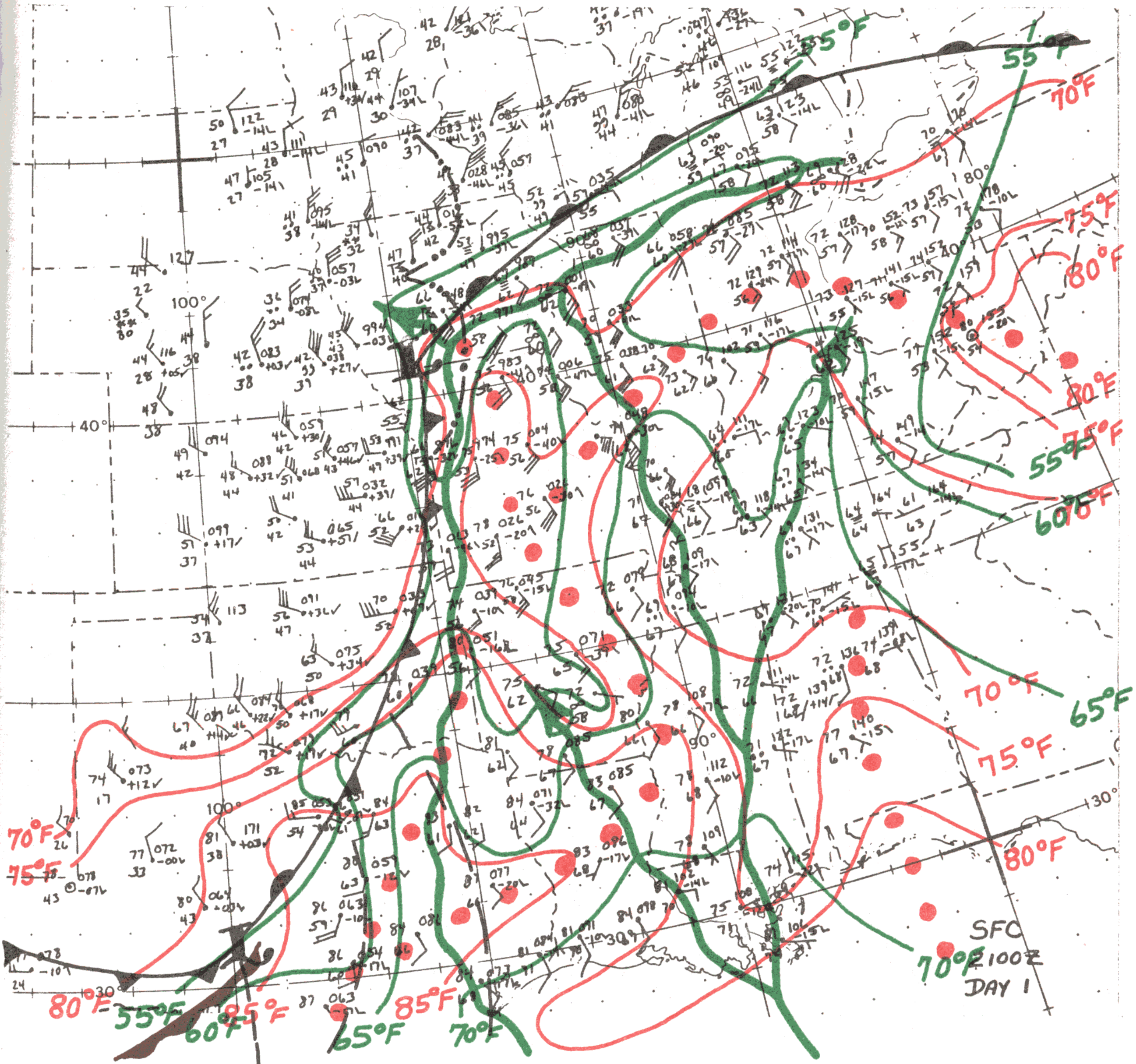


Isodrosotherms (Green)

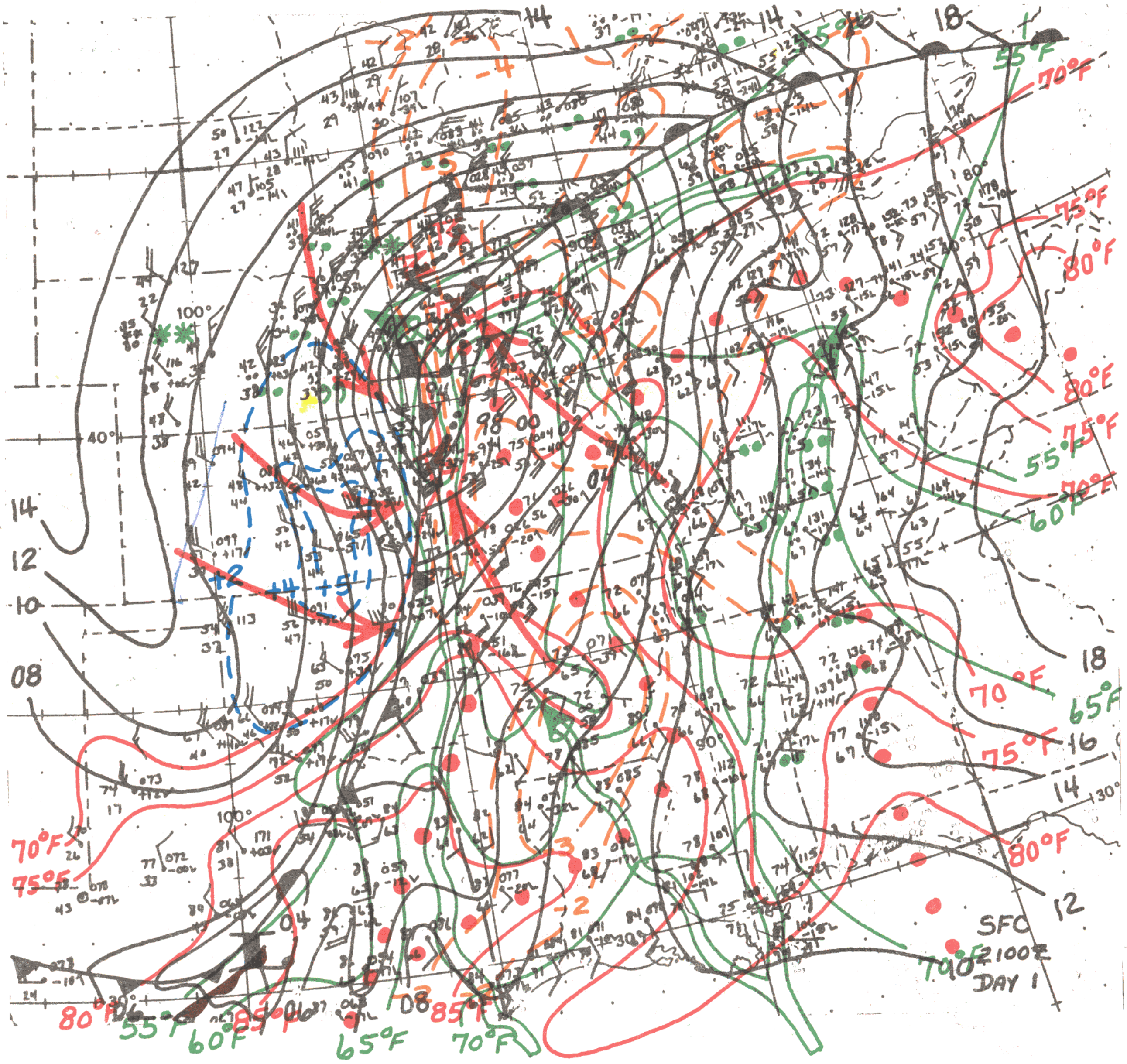
Isotherms (Red)

Axis of Maximum Moisture Advection (Green)

Thermal Ridge (Red)

Axis of Maximum Moisture (Green)

Figure 21. Surface Thermal and Moisture Analyses.



Cold Front (Black)

Dry Line (Brown)

Warm Front (Black)

Squall Line (Black)

Pressure Trough (Black)

L H

Low Pressure Center (Black)

Figure 22. Completed Surface Analysis.

3 SYNOPTIC PATTERNS

An outline of the synoptic patterns, as consolidated from the details presented in Chapter 3 of AWSTR 200(Rev), is included to highlight major characteristics of severe weather. This outline includes the distinguishing characteristics, initial outbreak location, severe weather area placement, secondary zone, triggering mechanism, convective development pattern, and duration of activity. Caution: Do not expect to see these classical patterns in all cases. Most of the severe weather occurrences are associated with combinations of two or more patterns or modifications of the classical pattern.

3.1 Pattern A: Dry-line Thunderstorms (Type 1 airmass).

3.1.1 Distinguishing characteristics:

3.1.1.1 A well-defined SW jet at 500 mb.

3.1.1.2 A warm, dry intrusion from the SW (surface to 700 mb).

3.1.1.3 An area of significant maximum moisture advection from the south (surface to 850 mb).

3.1.1.4 Considerable streamline convergence along the dry line (850 mb and 700 mb).

3.1.1.5 Very large hail, damaging winds, and tornadoes (most often in groups or families).

3.1.2 Initial outbreak location:

3.1.2.1 In the area of maximum moisture gradient between the dry air and the maximum moisture axis.

3.1.2.2 Usually confined to the edges of the dry air at 850 mb and 700 mb.

3.1.3 The severe weather area should extend along and 200 miles to the right of the 500 mb jet (in the area of difluence) and from the maximum low-level convergence downstream to the place where the low-level moisture decreases to a value insufficient to support severe weather.

3.1.4 The secondary severe weather area will be located along and 150 miles to the right of the 500 mb horizontal speed shear zone and from the low-level convergence downstream to the place where the low-level moisture decreases to a value insufficient to support severe weather.

3.1.5 The triggering mechanisms are maximum diurnal heating, low-level intrusion of warm, moist air, and/or upper-level jet maximum passage.

3.1.6 Convective development is characterized by unusually rapid growth (15 to 30 minutes) from inception to maturity with almost immediate production of large hail, damaging winds, and/or tornadoes.

3.1.7 The severe weather activity will normally last from 6 to 8 hours or until the mixing of moist and dry air masses is complete and the low-level winds diminish. Though rare, an exception to this guidance occurs when there is an unusually well-defined dry intrusion driven by strong winds (usually greater than or equal to 30 knots from the surface to 700 mb) which causes the severe activity to continue for a much longer time.

3.2 Pattern B: Frontal thunderstorms (Type 1 air mass).

3.2.1 Distinguishing characteristics:

3.2.1.1 A well-defined SW jet at 500 mb.

3.2.1.2 A dry intrusion from the SW (surface to 700 mb).

3.2.1.3 A low-level jet transporting significant moisture from the south (surface to 850 mb).

3.2.1.4 A major low pressure center with a cold and warm front.

3.2.1.5 Strong cold advection from the W-NW (surface to 500 mb).

3.2.1.6 Cool, moist air at the 700 mb and 500 mb cold trough axes. These troughs will lie immediately west of the threat area.

3.2.1.7 The tornado families are usually associated with mesoscale lows.

3.2.2 Initial outbreak location:

3.2.2.1 Look for initial activity along or just ahead of the surface cold front in the region of strong upper-air cold advection, strong low-level warm moist advection, and SW dry instrusion.

3.2.2.2 Location depends on the speed of the cold front and the dry surge into the moist air.

3.2.3 The severe weather area should extend along and 200 miles to the right of the 500 mb jet (in the zone of difluence) and from the dry intrusion to the place where the low-level moisture decreases to a value insufficient to support severe weather activity.

3.2.4 A secondary area may be located along and 150 miles to the right of the horizontal speed shear zone and from the dry intrusion to the place where the low-level moisture decreases to a value insufficient to support severe weather activity.

3.2.5 The triggering mechanisms are:

3.2.5.1 Intersection of the low-level jet (850 mb) with the warm front.

3.2.5.2 Intersection of the low-level jet (850 mb) with the 500 mb jet.

3.2.5.3 Movement of the dry-line (dry intrusion).

3.2.5.4 Intersection of discontinuity lines, particularly the special case of intersecting squall lines.

3.2.6 The convective development pattern is characterized by pre-frontal squall lines with one or more mesoscale lows (25 to 100 miles in diameter) that form at the intersection of the low-level jet (850 mb) and the 500 mb jet. Mesoscale lows will also form at the intersection of the low-level jet (850 mb and the warm front and in the area where two discontinuity lines intersect.

3.2.7 The severe activity can occur during all hours of the day or night, since it does not depend on diurnal heating to act as a trigger. This activity will continue as long as the air mass ahead of the squall line remains critically unstable. The Type B pattern is usually the last of a series of Type A severe weather producing systems.

3.3 Pattern C: Frontal overrunning.

3.3.1 Distinguishing characteristics:

3.3.1.1 A WSW-WNW 500 mb jet or a strong 500 mb westerly horizontal wind speed shear zone is present.

3.3.1.2 A dry intrusion from the SW is present at 700 mb.

3.3.1.3 An east-west stationary frontal zone is present with warm, moist tropical air overrunning it.

3.3.1.4 Isolated tornadoes may occur with surface temperatures of 50° F or higher. Widespread large hail and damaging winds may also be present.

3.3.2 Initial outbreak location:

3.3.2.1 Scattered thunderstorms develop on and north of the front as a result of overrunning.

3.3.2.2 Thunderstorm activity reaches severe limits as the squall line forms along the leading edge of the dry intrusion.

3.3.3 The severe weather (threat) area is delineated on the north side by the 500 mb jet and on the south side by the stationary front. The western boundary will be 50 miles west of the axis of maximum overrunning of moisture. The eastern boundary will probably depend on a decrease in the temperature lapse rate, a decrease in overrunning, or a combination of both.

3.3.4 There is no known secondary area of activity.

3.3.5 The triggering mechanism is the dry intrusion into the active thunderstorms produced by overrunning. If this dry intrusion is lost, the activity will decrease to an intensity less than severe.

3.3.6 Convective development patterns.

3.3.6.1 Overrunning thunderstorms are intensified by the dry intrusion.

3.3.6.2 Threat areas are favorable for the development of mesoscale lows and mesoscale highs. These mesoscale features move in a direction 30 degrees to the right of the 500 mb flow toward higher temperatures and lower pressures.

3.3.6.3 Intense pressure gradients are present around the mesoscale features.

3.3.6.4 Tornadoes occur either singly or by two's and three's separated by 25 to 50 miles.

3.3.6.5 This Type C pattern changes to Type E pattern if a well defined cold front accompanied by strong cold-air advection overtakes the active thunderstorm area.

3.3.7 Maximum activity occurs for 6 hours, starting at the time of maximum heating or when the dry intrusion enters the active area. Life of the dry intrusion and the mesoscale system also determine the life of the severe activity.

3.4 Pattern D: Cold-core Tornadoes.

3.4.1 Distinguishing characteristics:

3.4.1.1 The 500 mb jet is more southerly than in the other patterns.

3.4.1.2 The surface low will be deepening with cool, dry air advection at all levels around the bottom of it.

3.4.1.3 The low-level jet transports warm, moist air from the SSE toward the north and under the cold air aloft.

3.4.1.4 There is a 500 mb cold-core low present.

3.4.2 The initial outbreak location is found in the warm, moist underrunning air between the 500 mb jet and the cold closed isotherm center at 500 mb.

3.4.3 The severe weather area extends from approximately 150 miles to the right of the 500 mb jet to the cold core low center and from the intense low-level convergence ahead of the dry intrusion (SW boundary) to the east or northeast limit of the underrunning unstable warm, moist air.

3.4.4 There is no known secondary zone.

3.4.5 Triggering mechanisms are the intense low-level convergence and increasing instability caused by the 500 mb cold-air advection over the low-level warm moist advection.

3.4.6 Convective development characteristics:

3.4.6.1 Widespread storms produce hail of increasing amount and size westward from the jet to the 500 mb cold-core low.

3.4.6.2 Numerous funnel clouds occur, but tornadoes seldom occur. When they do, they occur singly and not in families.

3.4.7 The most violent storms occur between noon and sunset when warm, moist air is most unstable by virtue of maximum low-level heating. Weaker storms may occur at any hour, however, the intensity of the storms decreases rapidly after sunset.

3.5 Pattern E - Squall line.

3.5.1 Distinguishing characteristics.

3.5.1.1 A well defined westerly jet is present at 500 mb.

3.5.1.2 A dry source is well defined by the 700 mb warm sector.

3.5.1.3 A south to southwest low-level flow pattern carries warm moist air into the area.

3.5.1.4 The warm, moist air overruns cooler air (usually a warm front).

3.5.1.5 There is considerable low-level convergence and a squall line forms in all cases.

3.5.2 The initial outbreak location is where the 700 mb dry air intrusion meets the frontal lifting of warm, moist low-level air and the strong 500 mb cold advection.

3.5.3 The severe weather area extends along and south of the 500 mb jet but north of the 850 mb warm front and from the 700 mb cold front to the place where instability decreases to a value below the minimum required to support severe activity.

3.5.4 If the 700 mb dry intrusion is strong enough to extend well to the south of the 850 mb warm front, the secondary zones may occur along the 500 mb horizontal speed shear zone and along transitory, but active, squall lines.

3.5.5 The triggering mechanisms are frontal lifting, cold advection at 500 mb, diurnal heating, and the 700 mb dry intrusion.

3.5.6 Convective development pattern.

3.5.6.1 The frontal or pre-frontal squall line is almost always well defined.

3.5.6.2 The timing of the 500 mb cold advection and its intensity are difficult to forecast.

3.5.6.3 Many severe thunderstorms continue until midnight, or until the air mass becomes too stable to produce severe activity.

3.5.7 The maximum severe activity (both quantity and intensity) occurs from the time of maximum heating until a few hours after sunset.

3.6 Conclusion. It is imperative that the forecaster know how the various severe weather parameters, outlined in Section 2, interact to produce severe weather. The first step toward the accomplishment of this is the understanding of the idealized severe weather synoptic patterns outlined in this section. After this understanding has been achieved and experience gained, the forecaster will begin to see how the day-to-day synoptic patterns deviate from the idealizations and at times combine to produce somewhat more complex severe weather patterns.

4 SHORT-RANGE PARAMETER FORECASTING

4.1 The short-range parameter forecasting method to be described here is only one of many methods of prognostication. The description of any step-by-step method is demonstrated well by example. The analyses shown in Figures 1 through 22, the surface continuity chart (Figure 23), and the 0000Z upper-air composite prognosis (Figure 24) will be used to help describe the method. For severe weather to occur many parameters of moderate to strong intensity must occur, in the same place at the same time. A description of what constitutes a weak, moderate, or strong parameter can be found in Chapter 5 of AWSTR 200(Rev). These descriptions will be used to evaluate the analyses and prognoses of the following example. In order to summarize the shortrange forecast method and to show the importance of the parameter intensities, the thought processes which should be followed when producing a severe weather area forecast are described. The forecast area is shown in Figure 24, and the actual reports of severe weather (from STORM DATA, see reference 2) are shown in Figure 25. The forecast area superimposed on the severe weather reports and the reports themselves are for the period 2100Z on 9 Nov 75 to 0300Z 10 Nov 75.

4.2 The short-range parameter forecast, in most cases, is directly related to the movement of surface lows and discontinuity lines, especially fronts and squall lines. The surface system is used because it is available each hour. Positions of the various upper-air parameters must be inferred by vertical consistency.

4.2.1 Various methods are used to forecast the movement of surface systems. The example described here uses a combination of continuity and an empirical movement rule. In the latter the 500 mb wind direction and 40 to 50% of the 500 mb wind speeds are used.

4.2.1.1 Movement of the surface system may be determined by continuity. This essentially means that the system will continue to move as it has in the past (reference Figure 23). Care should be taken in using this method. If the surface system is not well developed, continuity may be unreliable and some other method should be employed. Continuity should never be used alone. Consideration must always be given to possible changes that may affect the surface system's movement and intensity.

4.2.1.2 The empirical rule using the 500 mb flow as the steering and driving mechanism for surface-based systems works well for an organized dynamic system. However, consideration must be given to changes in the vertical stacking of the system (especially with developing systems). Thought must also be given to changes that may occur in the 500 mb flow pattern. These changes will affect the development and steering of the surface system.

4.2.2 One method of upper-air parameter forecasting is the use of vertical consistency (stacking) of upper-air parameters relative to the

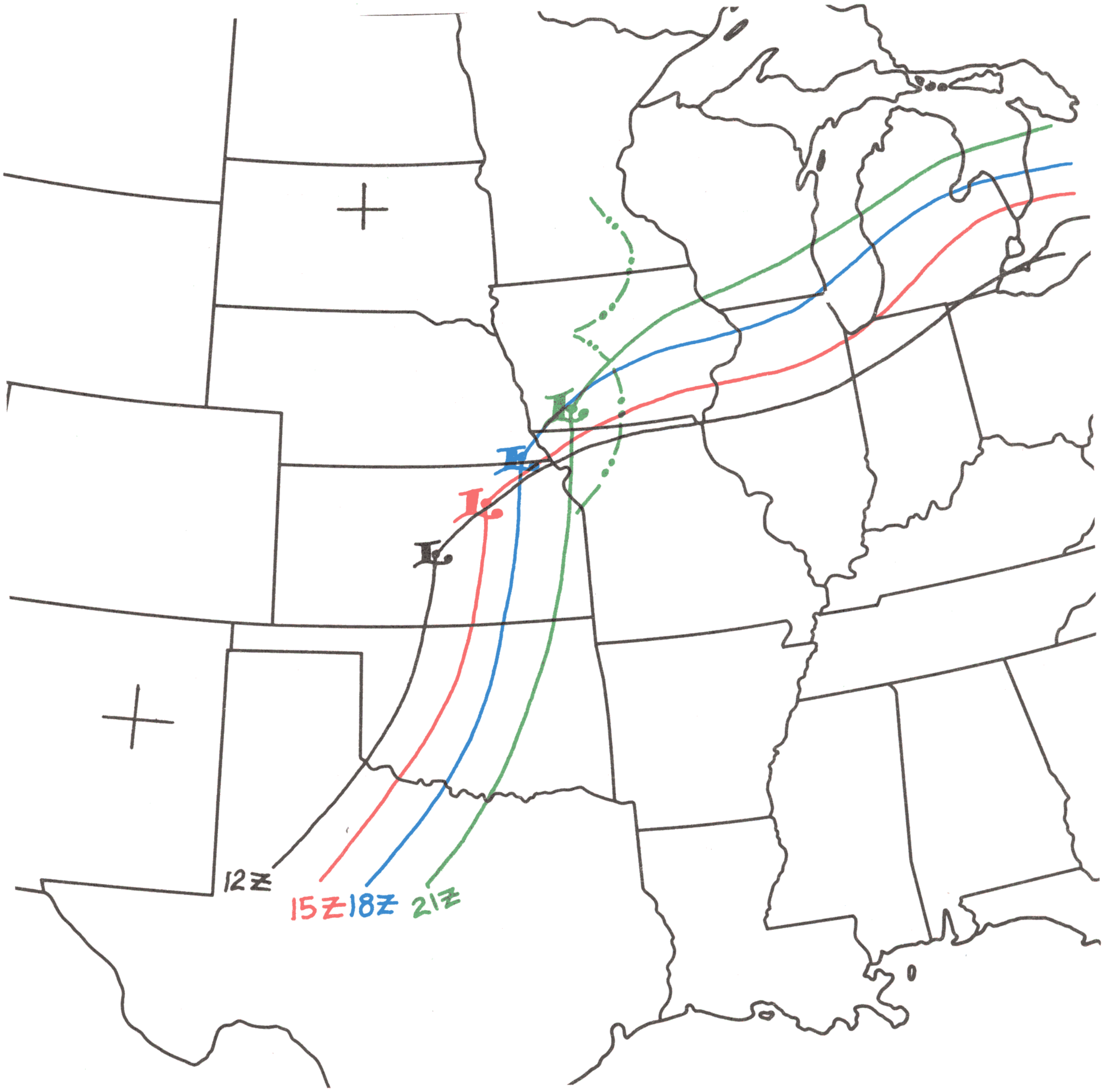


Figure 23. Surface Continuity Chart.

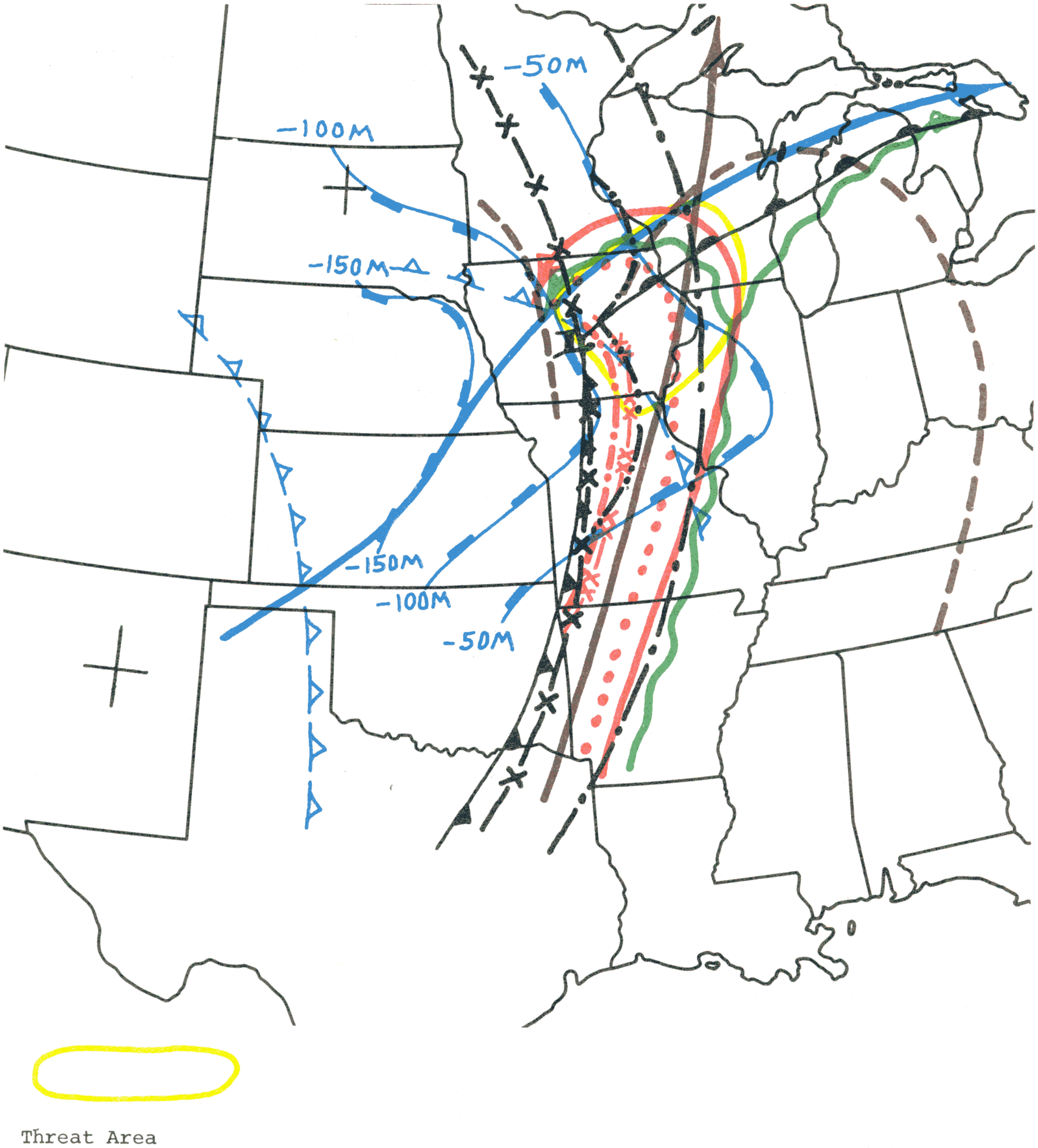
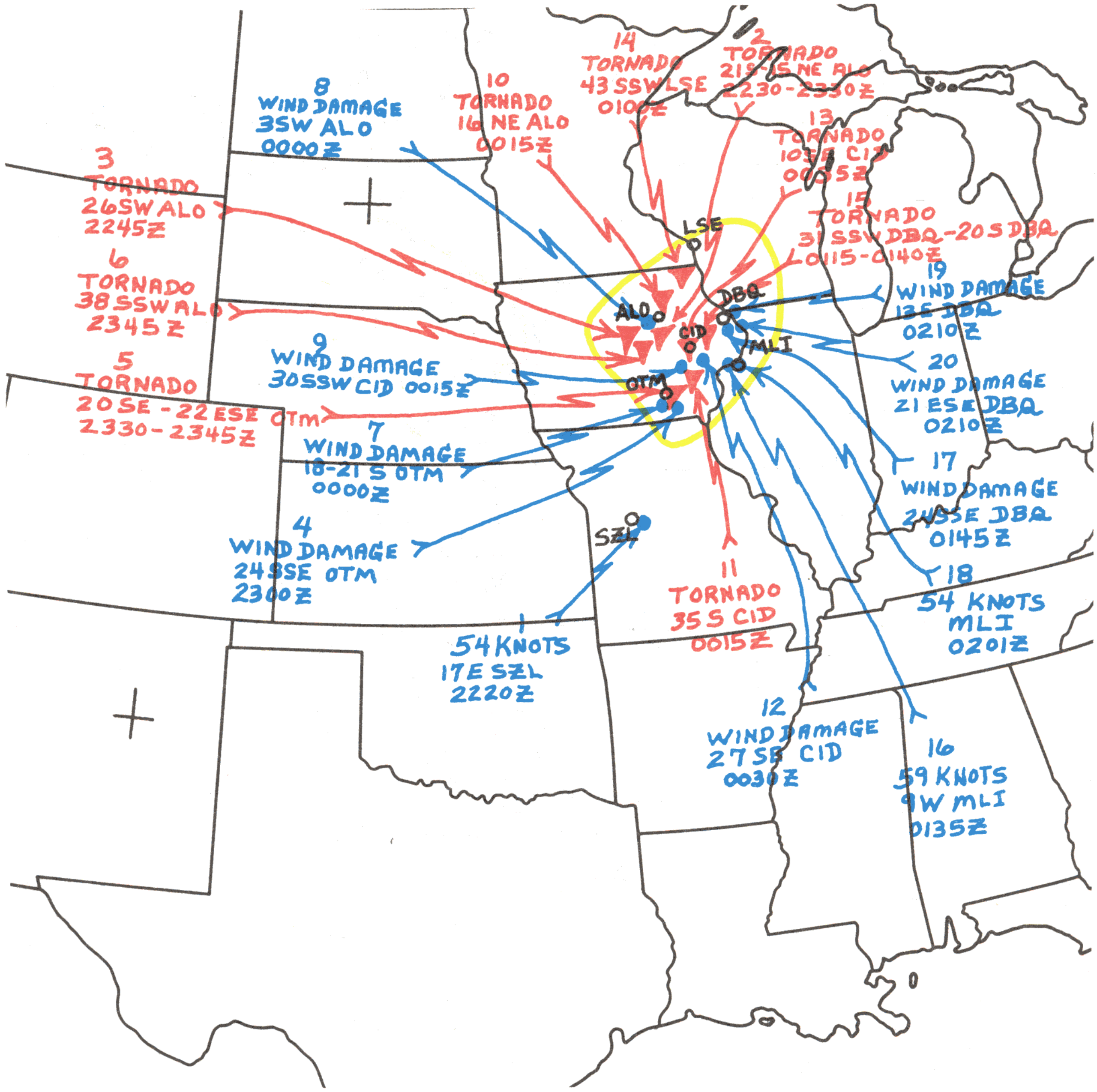


Figure 24. 12-hr Composite Prognostic Chart (Valid 0000Z 10 Nov 75).



Threat Area (Yellow)

Figure 25. Severe Weather Reports 2100Z 09 Nov 75 to 0300Z 10 Nov 75 (From Storm Data).

surface system.

4.2.2.1 The first step in this procedure is to locate accurately the surface system (low and any discontinuity lines, especially the fronts and squall lines). This location is done by completing an accurate surface analysis with consideration given to the vertical stacking of the system (850 mb isotherm packing, stacking of the upper-air height contour troughs, and relationship to the jet stream).

4.2.2.2 The second step is to analyze the upper-air charts (850 mb, 700 mb, 500 mb, 850/500 mb thickness, and the maximum wind) for the desired parameters outlined in Section 2. The positions of the upper-air parameters should then be related to the position of the surface low and any discontinuity lines, especially fronts and squall lines. This can be done for the example here by using the 1200Z surface position from the continuity chart (Figure 23) and relating the positions of the parameters from the upper air composite analysis (Figure 17) to that of the surface system.

4.2.2.3 The third step is to forecast the position of the surface system for the midpoint (0000Z) of the forecast period and then position the upper-air parameters relative to the surface system (as was also done in the composite analysis - step 2). Changes expected in the vertical stacking of the parameters should be considered. The combination of the forecast surface system position and the vertical stacking of the upper-air parameters relative to the surface system produces a severe weather composite prognosis.

4.3 Having completed surface and upper-air composite prognoses, the forecaster is ready to determine the severe weather threat area. This is accomplished by comparing the interaction of surface and upper-air parameters, shown on the composite upper-air and surface prognosis (Figure 24), with the five tornado-producing synoptic patterns (reference Setion 3 of this memo and Chapter 5 of AWSTR 200(Rev).

4.3.1 After comparing the interaction of parameters on the composite prognosis (Figure 24) to the synoptic patterns, the forecaster will see two synoptic patterns that this composite prognosis resembles. These two are the synoptic Type B and C patterns. The forecaster must now resolve the differences between the two threat areas (areas of potential severe weather or strong thunderstorms) and indicate one area for the final evaluation. The ideal combination of these two threat areas is shown in Figures 24 and 25. In this example the 500 mb jet was used for one side, the active squall line (at 2100Z) for the west side, and a line 200 nm to the right of the 500 mb jet for the third side. Finally, the eastern boundary was based upon the speed of movement of the system. Do not always expect to see the combination of synoptic patterns B and C to look just like this.

4.3.2 Once the threat area has been determined, the intensities of the interacting parameters are evaluated. This is done using the intensities described in Section 2 of this memo and Chapter 5 of AWSTR 200(Rev) and entering them on the Severe Thunderstorm and Tornado Parameter Worksheet (reference Figure 26 for the values determined for this example forecast). Once the values are assigned, an overall evaluation should be made to indicate the potential of the threat area. Because use of these intensities is subjective, the following is only a guide to determination of the potential of threat areas.

4.3.2.1 If a majority of the parameters on the worksheet are of strong or moderate intensity, then forecast severe thunderstorms or tornadoes.

Forecast RED (tornadoes accompanying severe thunderstorms) if most of the majority are strong.

Forecast BLUE (severe thunderstorms) if most of the majority are moderate.

4.3.2.2 If a majority of the parameters on the worksheet are of moderate or weak intensity then forecast moderate thunderstorms or general thunderstorms.

Forecast GREEN (moderate thunderstorms) if most of the majority are moderate.

Forecast ORANGE (general thunderstorm)activity if most of the majority are weak.

4.4 After all these evaluations have been completed, the final forecast can be prepared. In this example the majority of parameters considered were strong or moderate. Using this set of the majority, most were strong, consequently RED (tornadoes accompanying severe thunderstorms) is an appropriate forecast. It should be pointed out that an areal forecast such as this and any point warning issued by a centralized facility should be used as a guide to the local forecaster. The local forecaster, upon receiving a point warning, should neither ignore nor completely accept the warning but should immediately re-evaluate the potential for local severe weather using observations (such as radar) available to him locally. This additional information should be considered in light of the concepts presented here and in AWSTR 200(Rev).

SEVERE WEATHER AND TORNADO PARAMETER WORKSHEET

Area: Eastern Iowa, NW Ill., Srn MN, and Nrn MO	Forecast valid time: 09/2100Z to 10/0300Z	Date: 09/10 Nov 75

PARAMETER		1200Z Analysis Value	1200Z Analysis Rating	0000Z Prognosis, Value	0000Z Prognosis, Rating	Remarks/ Verification
500 mb Vorticity		Missing--	--------	--------	--------	
Stability	Lifted index	-6	S	-3	S-	
	Totals	56	S	52	M	
Middle Level	Jet	60-70 kt	S	60-70 kt	S	
	Shear	None----	--------	--------	--------	
Upper Level	Jet	100 kt	S	100 kt	S	
	Shear	None----	--------	--------	--------	
Low-level jet		55 kt	S	55 kt	S	
Low-level moisture		13.3	S	14	S	
850 mb maximum temperature field		West of moisture axis	S	West of moisture axis	S	
700 mb no-change line		Angle is 40-70 degrees	S	No change	S	
700 mb dry air intrusion		Angle is 60 deg 35 kt	S	No change	S	
12-hour surface pressure falls		Missing--	--------	5.9	S	
500 mb height change		Greater than 100 mb	S	Greater than 100 mb	S	
Height of the wet-bulb-zero above surface		Missing--	--------	--------	--------	
Surface pressure over threat area		999.9	S	994	S	
Surface dewpoint		63	M	63	M	

Figure 26. Severe Weather and Tornado Parameter Worksheet.

5 PARAMETER FORECASTING USING AUTOMATED MODEL OUTPUT

Section 2 discussed how the severe weather parameters were determined, Section 3 described how these parameters interacted to produce severe weather, and Section 4 developed a technique to forecast severe weather. Next, methods of using automated prognostic model output to forecast movements of these parameters will be examined. Any analysis of a chart is subjective since the forecaster must use imagination and skill in positioning the parameters. The forecast is also subjective because the forecaster depends on the subjective analysis and then must decide which prognostic model is handling the present synoptic pattern the best. The surface prognoses made by AFGWC and the NWS also provide guidance. The severe weather forecaster must constantly metwatch and update these prognoses during the day.

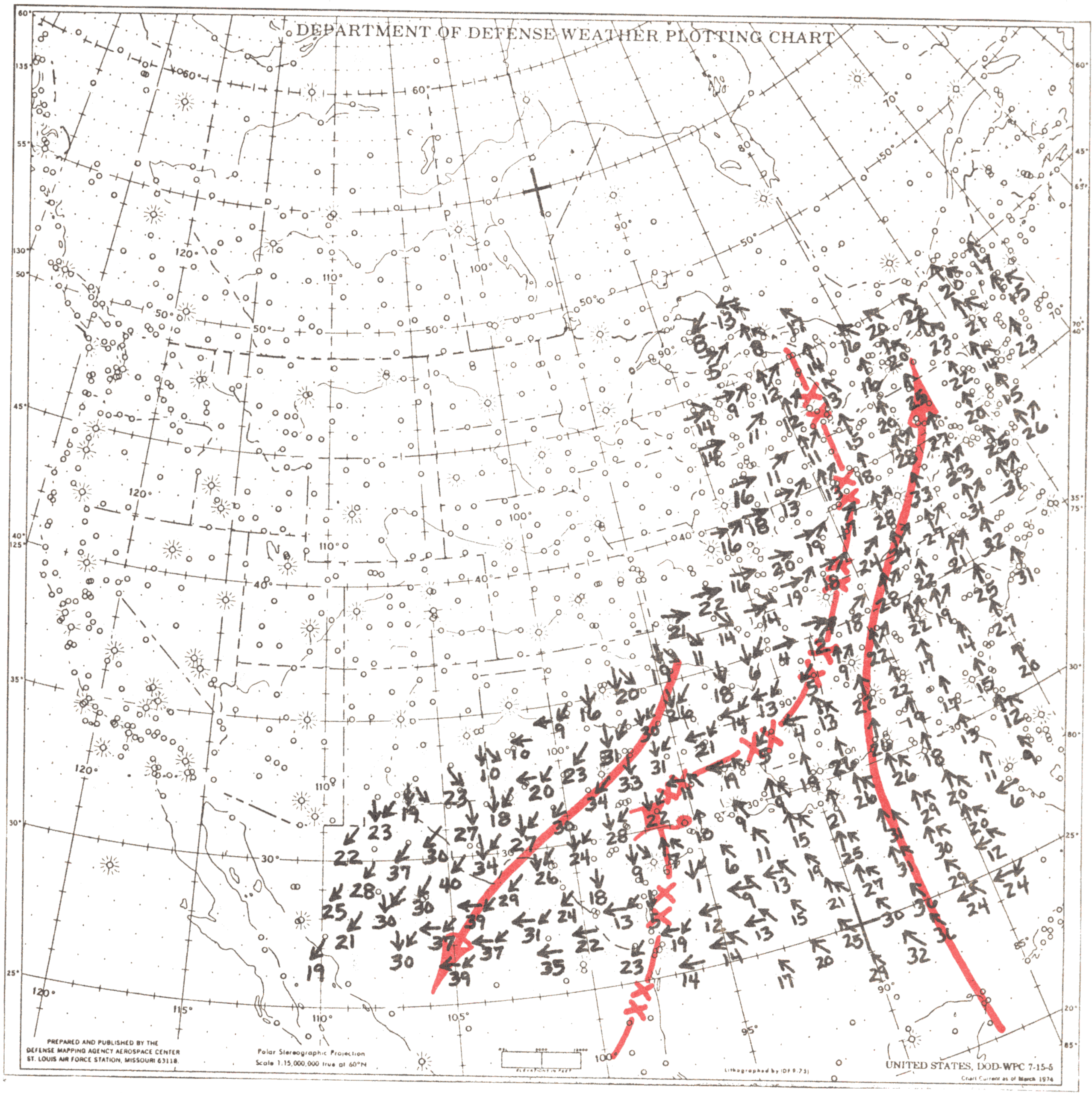
5.1 In making a composite prognosis, AFGWC's Boundary Layer Model (BLM) is used for the low-level wind, temperature, and moisture fields. The fine mesh model of AFGWC is used for the 500 mb thermal and wind fields. The automated SWEAT product, derived from output of these models, is used routinely by the advisory forecaster. By examining output from the same models as the automated program, the forecaster can see the weight placed on each parameter used to calculate the resulting SWEAT prognosis. For clarification of the parameters used to calculate SWEAT, see AWSTR 200(Rev), Appendix F. The example model output in this section <u>is not</u> for the same day as the analysis and prognosis discussed in Sections 2 and 4.

5.1.1 The BLM's 12-hour 600-meter (AGL) wind prognosis is used to locate the low-level convergence zones and the low-level jets (reference Figure 27).

5.1.2 The BLM's 12-hour 900-meter (AGL) temperature and dewpoint fields are used to locate the thermal ridge, low-level axes of maximum moisture and moisture advection (use the 600 meter fields to determine advection), and other significant moisture (reference Figure 28). This chart is analyzed much the same as the 850 mb analysis.

5.1.3 The AFGWC Fine-mesh 12-hour 500 mb prognosis isotherms must be analyzed to indicate cold pools and cold troughs. The wind field is examined to find the 500 mb jet, difluence, and horizontal wind shear zone (reference Figure 29).

5.1.4 The BLM SWEAT prognosis (AFGWC) is an abbreviated composite prognosis presenting gridded SWEAT values larger than the threshold value of 250 (reference figure 30). Most of the parameters from the prognoses shown in Figures 27 through 29 are used to compute the significant values. Start with 300 (threshhold for severe thunderstorms) and draw for an interval of 100 (400 is the threshold for tornadoes). This prognosis should be used only for severe thunderstorm and tornado forecasting because it uses wind speed terms and a wind directional shear term. <u>Do not</u> use SWEAT for general thunderstorm forecasting.



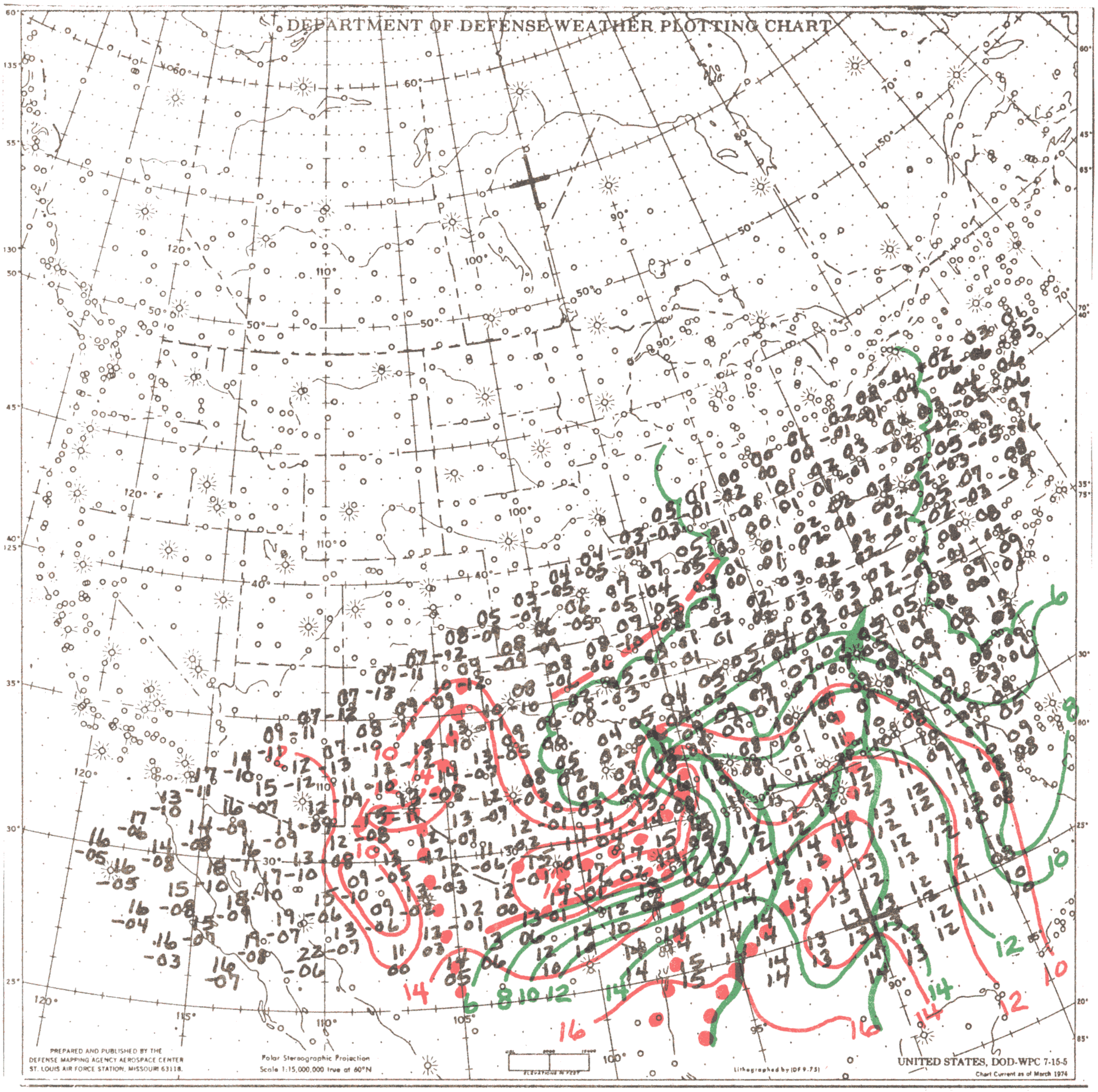
L

Cyclonic Circulation Center (Red)

Convergence Zones (Red)

Maximum Wind Band (Jet) (Red)

Figure 27. 600-m Wind Chart (12-hour Prognosis).

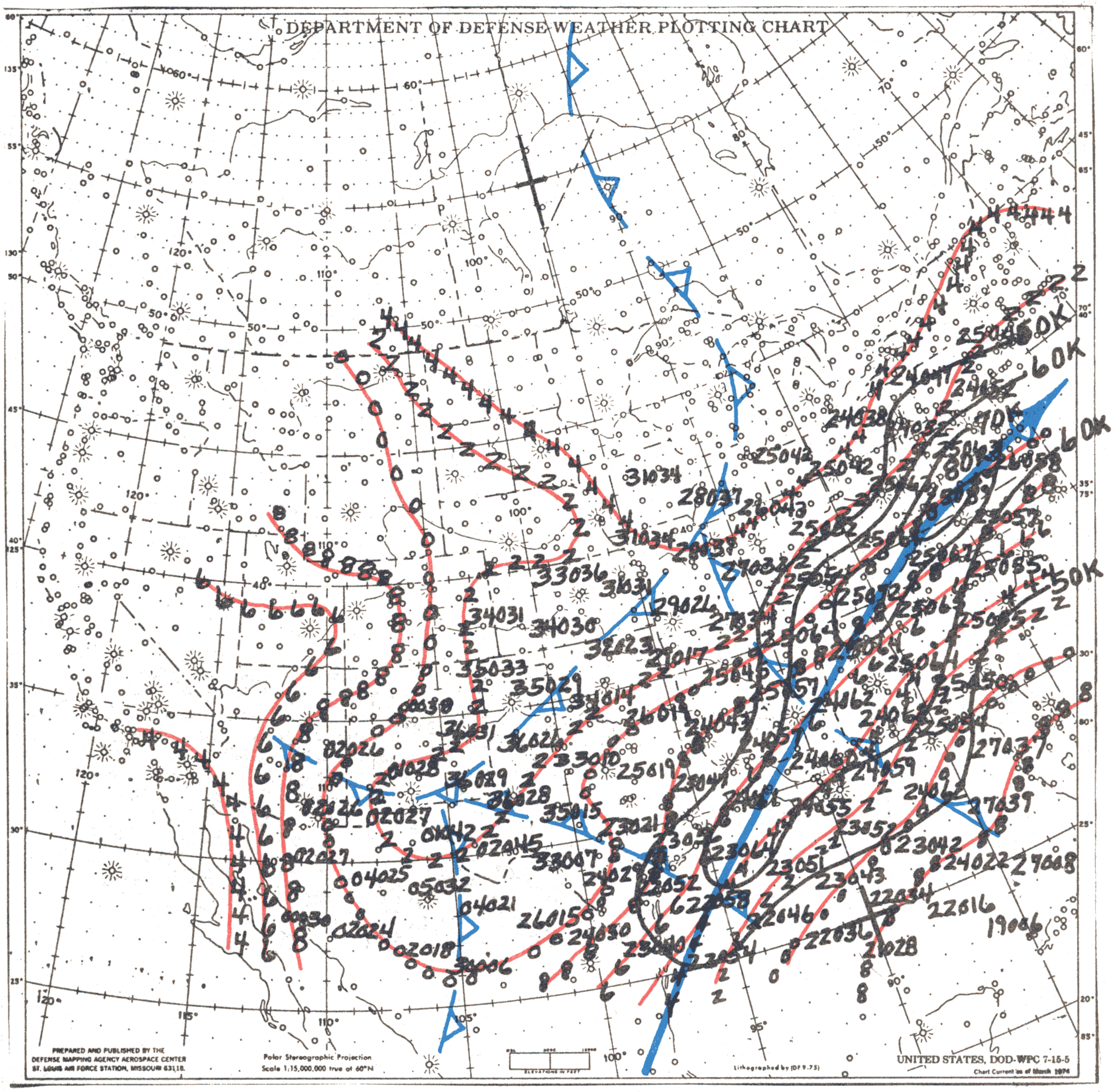


Thermal Ridge (Red)

Axis of Maximum Moisture Advection (Green)

Dry Line (Red)

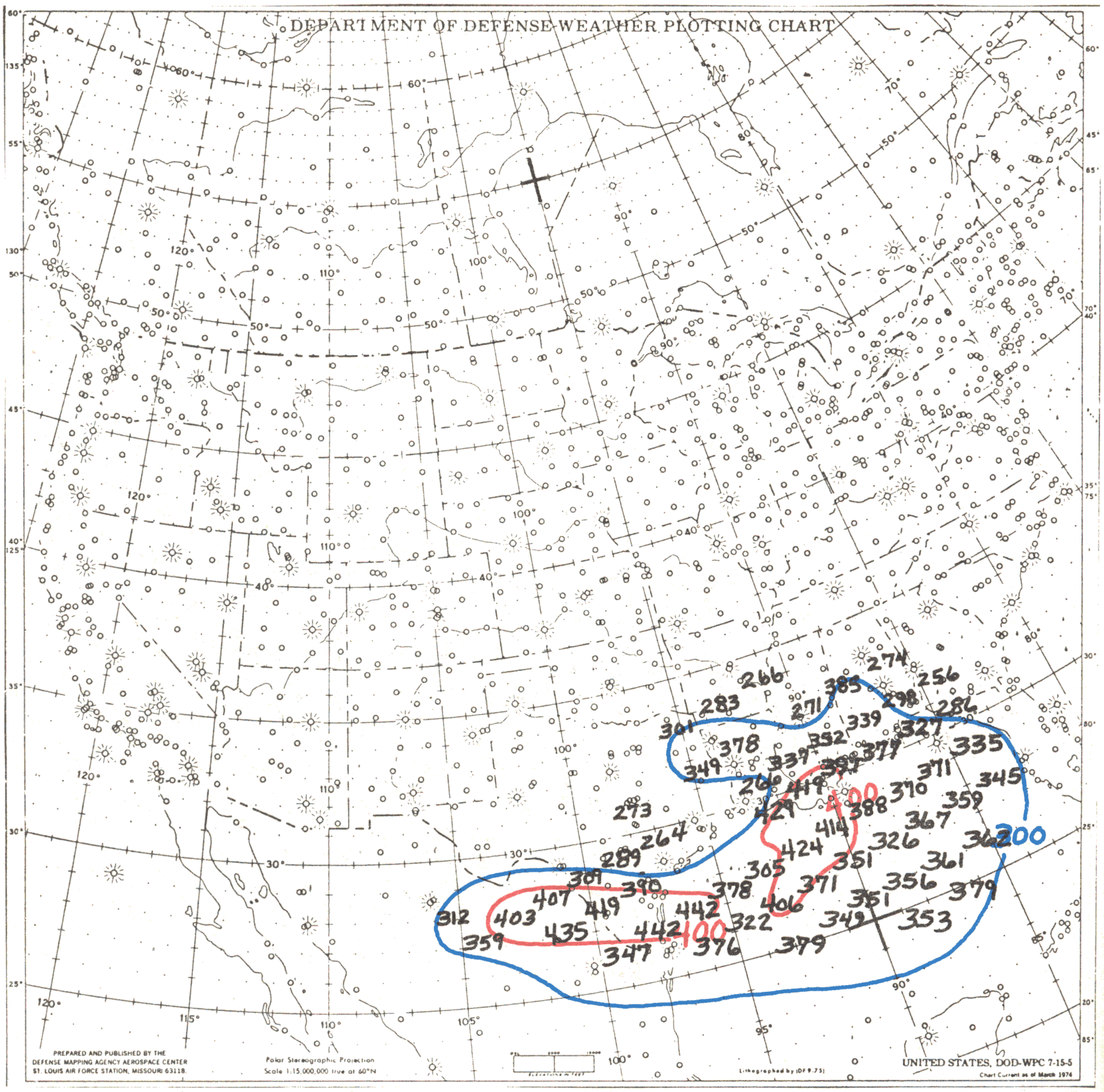
Figure 28. 900-m Temperature and Dewpoint Chart (12-hour Prognosis).



Thermal Troughs (Blue)

Maximum Wind Band (Jet) (Blue)

Figure 29. 500 mb Temperature and Wind Chart (12-hour Prognosis).



300 SWEAT Values (Blue)

400 Plus Interval of 100 - SWEAT Values (Red)

These are both transferred to the composite prognosis in yellow.

Figure 30. BLM SWEAT Chart (12-hour Prognosis).

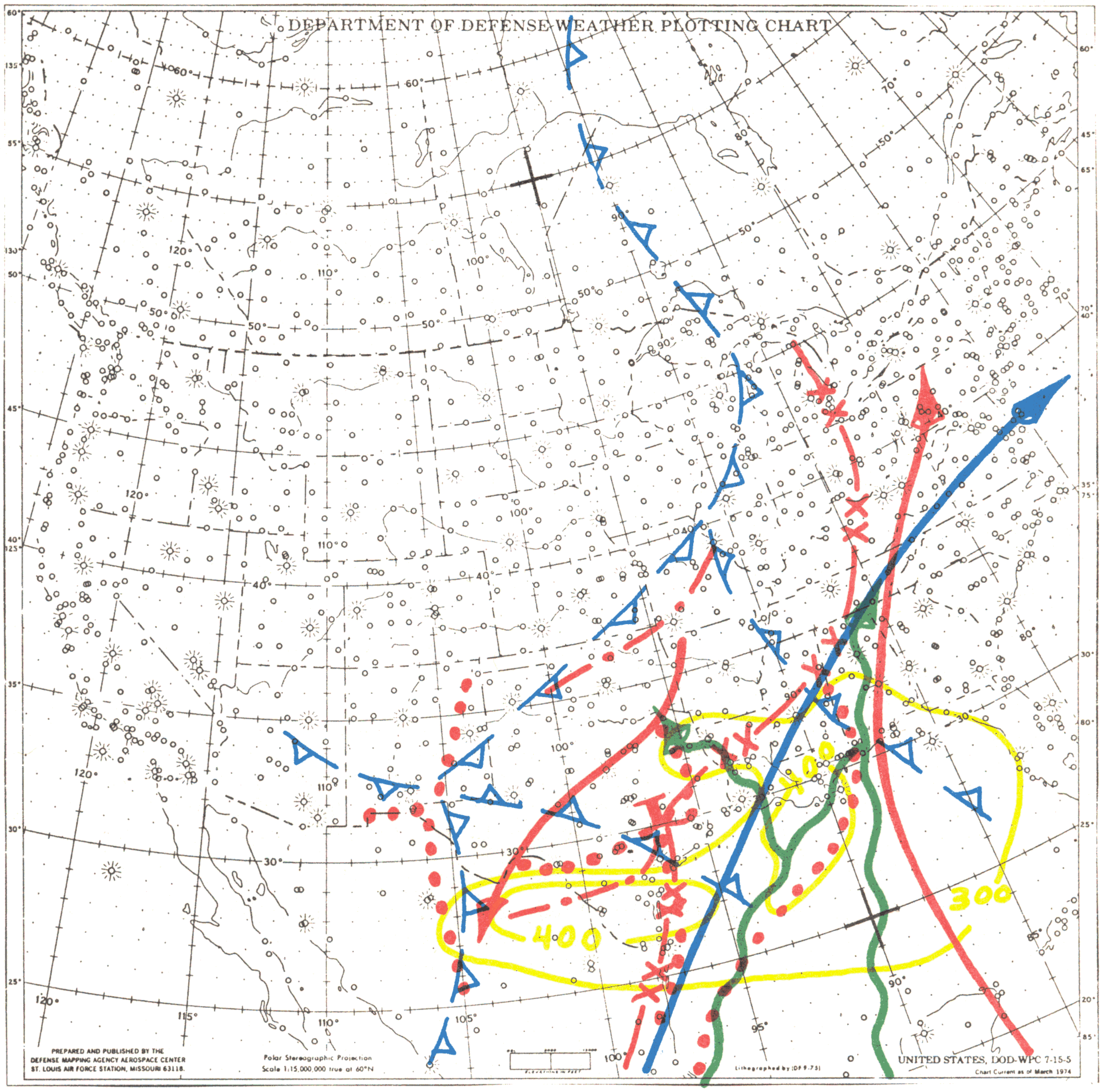


Figure 31. Composite Prognosis (12-hour Prognosis).

5.1.5 The 12-hour composite prognosis (Figure 31) should contain all of the parameters obtained from Figures 27 through 30 in the color codes indicated in each figure. The low-level dry lines may be obtained by relating Figure 27 to Figure 28.

5.2 The NWS 12-hour Limited-area Fine-mesh Model II (LFM II) forecast may be used to approximate the position of the major severe weather parameters for each level. A composite prognosis can be made from this product. The values for each parameter must be subjectively obtained by comparing the latest analysis with the prognosis.

5.2.1 The 500 mb height/vorticity panel (shown in Figure 32) is used to find the cold pools, cold troughs, jets, difluent zones, and PVA areas.

5.2.1.1 The cold pools are the vorticity centers and the cold troughs are the vorticity troughs. (Watch carefully for indications of minor short-wave troughs).

5.2.1.2 The jet should lie in the area of maximum packing of the height contours.

5.2.1.3 The difluent zones should be located where the contour gradient decreases rapidly.

5.2.2 The Mean Sea Level Pressure/1000-500 mb Thickness panel (MSL PRES/1000-500 THK) (shown in Figure 33) assists in locating fronts, convergence zones, low-level jets, the low-level thermal ridge, areas of maximum moisture advection, and the thickness ridge. The 500 mb panel and the thickness panel together aid in locating the area of maximum cold-air advection.

5.2.2.1 Generally, lows, fronts, and convergence zones lie in the 1000 mb pressure troughs. The fronts will also be indicated by thickness packing (behind a cold front and ahead of a warm front).

5.2.2.2 The low-level jets are located in the areas of strongest isobar packing. Consider the reduction of the effects of surface friction as you go aloft to assist with the direction of flow. Also consider vertical stacking when actually positioning the jet.

5.2.2.3 The low-level thermal ridge can be positioned by carefully considering its relationship to the position of lows, cold and warm fronts, convergence zones, low-level jets and the thickness ridge. Often the primary thermal ridge can be located just east of the low-level convergence zone.

5.2.2.4 Thickness contours will indicate the location of the thickness ridge axis.

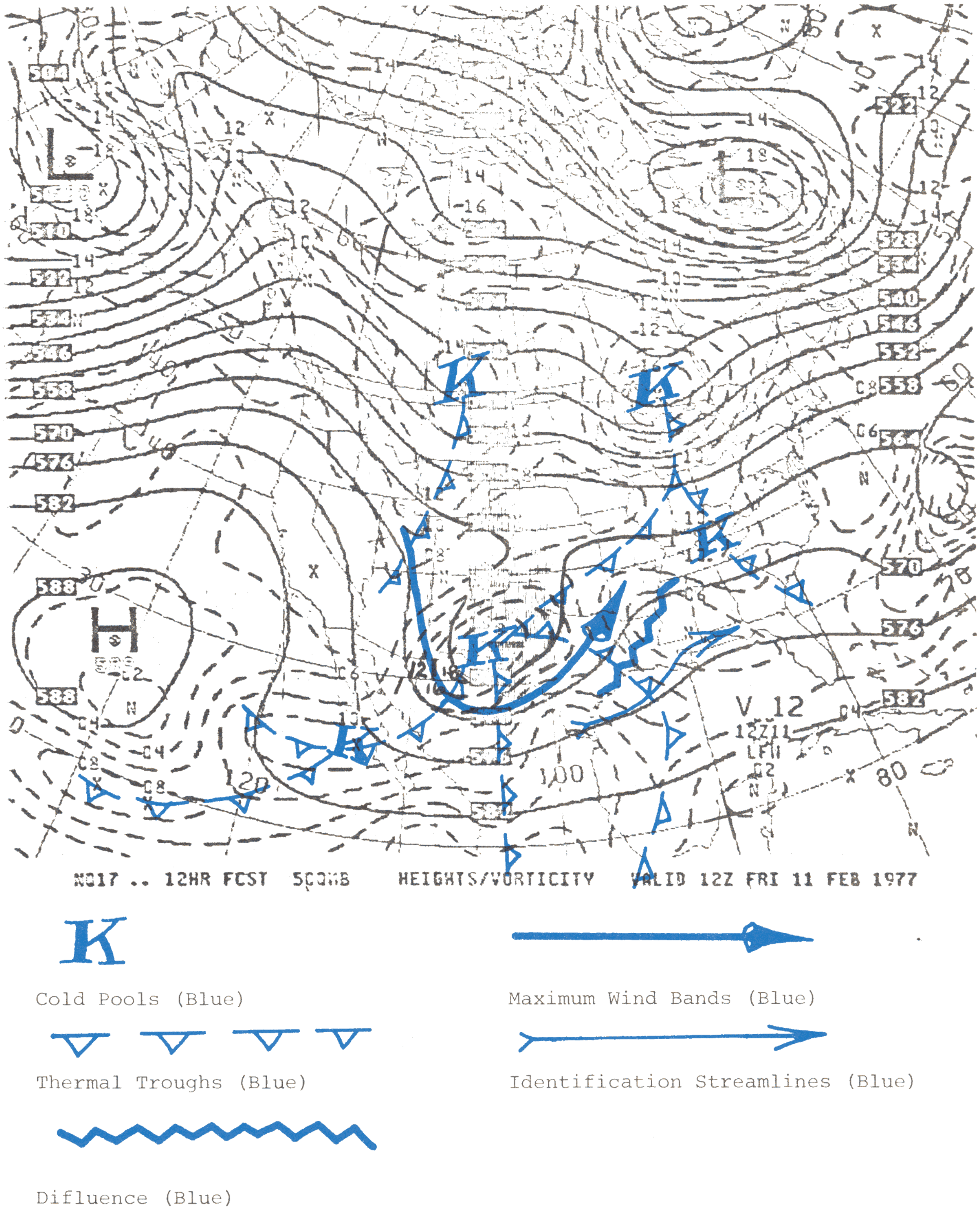


Figure 32. LFM 500 mb Vorticity Panel (12-hour Prognosis).

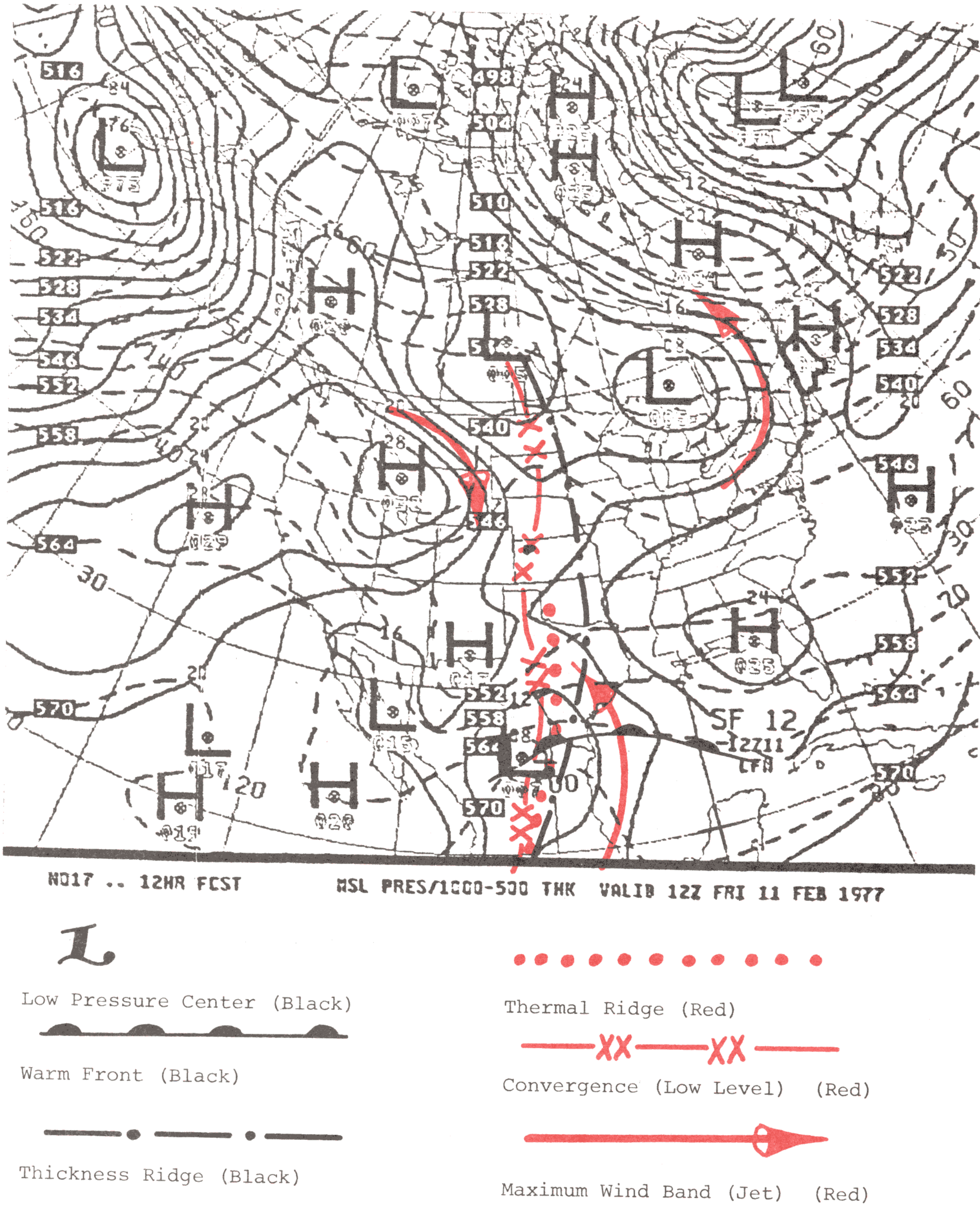


Figure 33. LFM MSL Pressure/1000-500 mb Thickness Panel (12-hour Prognosis).

5.2.3 The low-level axis of moisture advection is the most difficult feature to find. The Precipitation and 700 mb vertical velocity panel (Precip /700 VERT VEL) (reference Figure 34) will, in strong situations, show precipitable moisture and assist in locating the area of maximum moisture. To find the axis of maximum moisture advection, check the latest 850 mb analysis and then relate this to the convergence zones and the low-level jet. This will allow close approximation of the location of the maximum moisture advection axis.

5.2.4 The 700 mb height/relative humidity panel (reference Figure 35) will show the 700 mb dry line.

5.2.4.1 The 700 mb jet will be located in the area of strongest contour gradient.

5.2.4.2 The dry line will form between the area with relative humidities greater than 70% and the area with relative humidities less than 50%. Of course, the dry intrusion will be that part of the dry line under the 700 mb jet.

5.2.5 First, assemble the LFM-II composite prognosis (reference Figure 36) by taking all the parameters (with proper color coding) and placing them on one chart. Then compare this with the severe weather synoptic patterns. Determine which pattern, or which combination of two or more patterns exists and forecast the threat area.

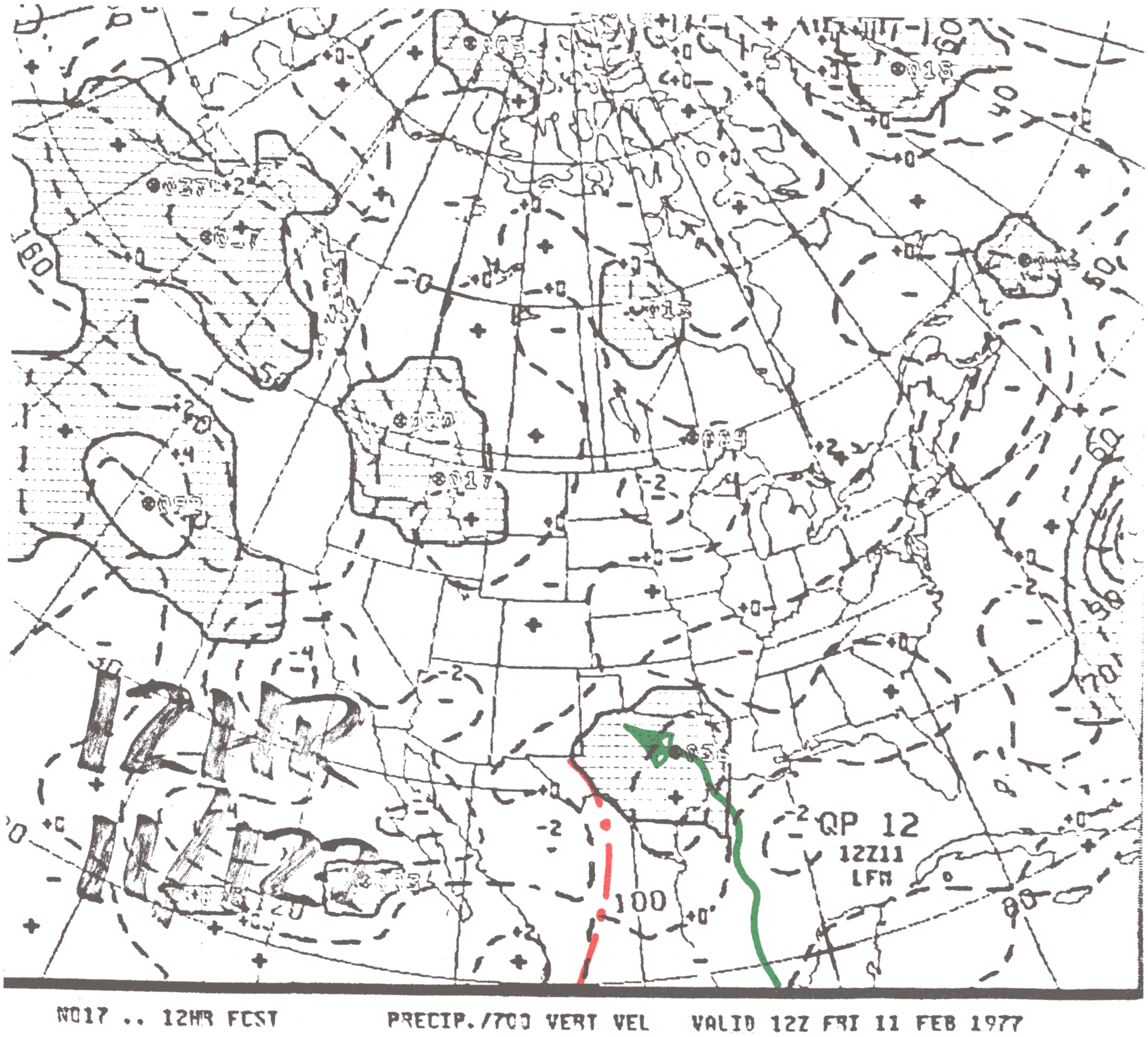
5.2.6 If the LFM-II is not handling the situation very well, then adjust each panel to fit the NWS model that is handling the situation best. There are certain situations in which one of the three NWS models w ll work better than the others.

5.2.6.1 The seven-layer hemispheric, primitive equation model (7LPE) best handles the situation in which a short wave is progressing down the back side of the long-wave trough until it reaches the axis of the longwave trough (digging trough).

5.2.6.2 The barotropic model best handles the situation in which the short-wave moves from the axis of the long-wave trough up the front side.

5.2.6 3 The LFM-II appears to split the difference between the barotropic and the 7LPE models.

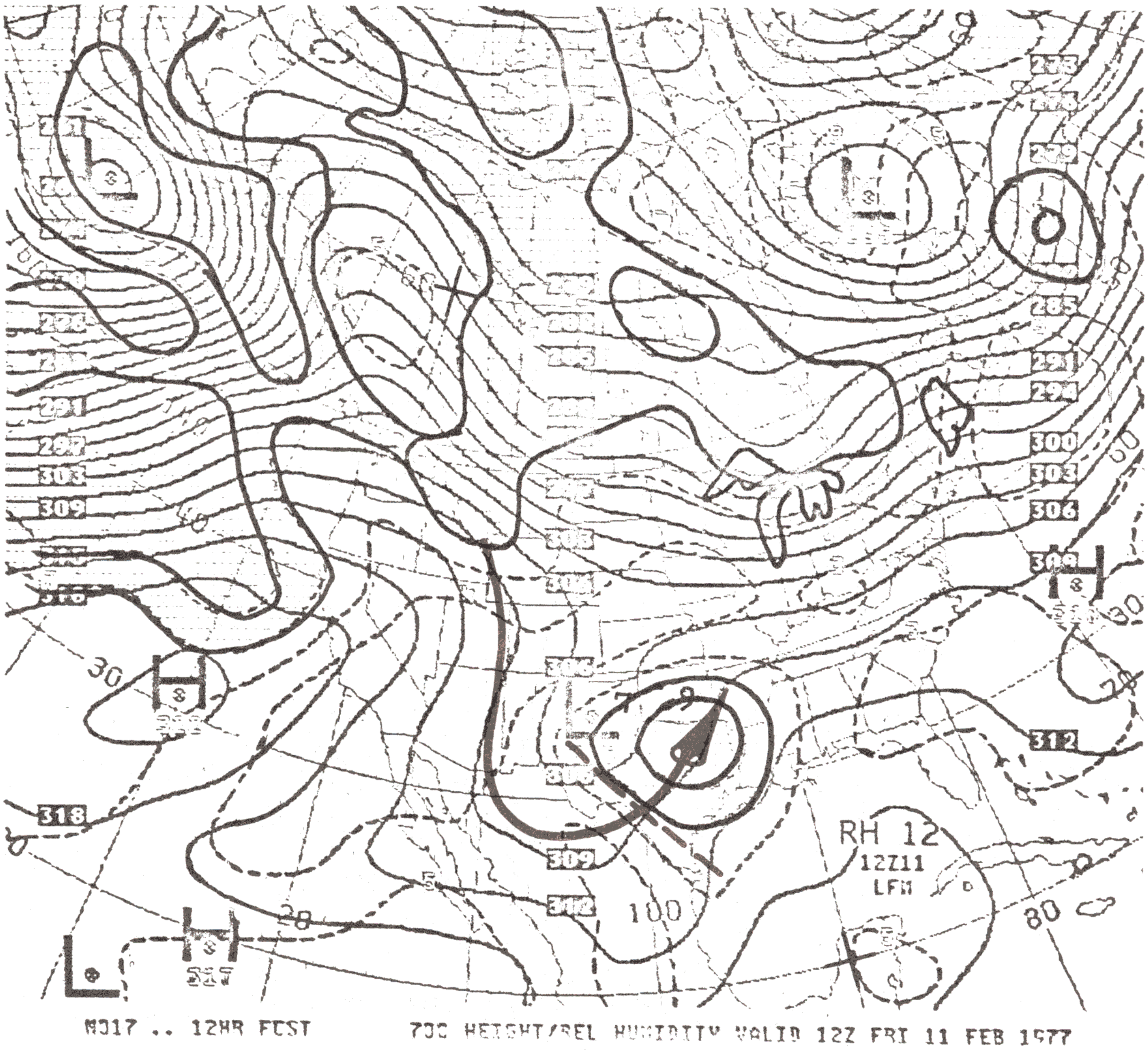
5.2.7 The barotropic and 7LPE prognoses only provide the forecasts of the 500 mb height field and the vorticity field, so it would be a major project to construct the panels shown on the LFM-II. If the barotropic or 7LPE prognosis is handling the situation best, then use an adjustment procedure for finding the major parameters needed for a complete composite prognosis. Adjust the LFM-II 500 mb height/vorticity panel to coincide with the barotropic or 7LPE and then relocate all the other panels accordingly.



Axis of Maximum Moisture Advection (Green)

Dry Line (Red)

Figure 34. LFM Precipitation/700 mb Vertical Velocity Panel (12-hour Prognosis).



Maximum Wind Band (Jet) (Brown)

Dry Line (Brown)

Figure 35. LFM 700 mb Height and Relative Humidity Panel (12-hour Prognosis).

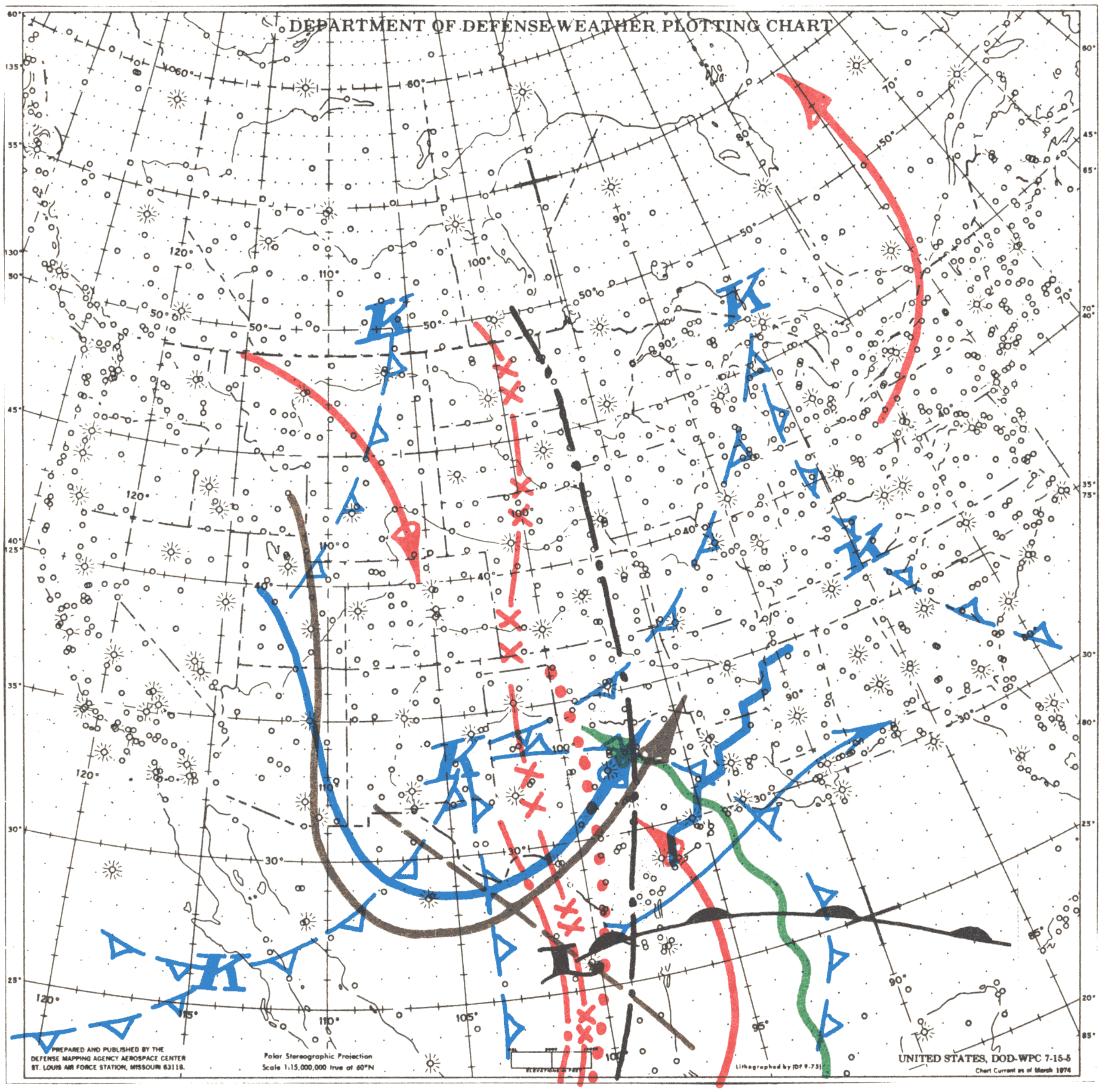
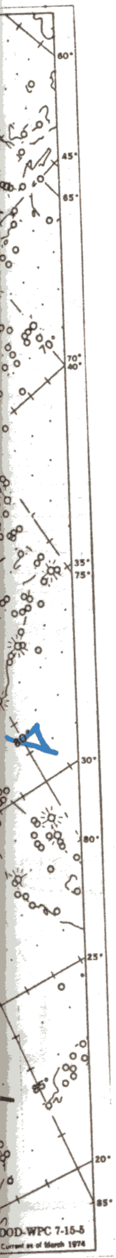


Figure 36. LFM 12-hour Composite Prognosis.



6 CONCLUSIONS AND COMMENTS

The emphasis on analysis cannot be overstressed. At almost any step in making a severe weather forecast, reference is made to the analysis package. The analysis package and the composite analysis are used for comparison with the ideal severe weather synoptic patterns. The knowledge of severe weather parameter interactions at various levels in the atmosphere (the five synoptic patterns) is absolutely essential in making a severe weather forecast. The accuracy of the example prognosis and severe weather forecast shown in Section 4 depended heavily on the accurate analyses of all charts involved. To evaluate properly any of the AFGWC or NWS atmospheric prognostic models, the analysis package must be used to evaluate the intensities of the severe weather parameters. At its best, the composite prognosis and consequently the forecast of severe weather is only as good as the prognostic tools and the original analysis.