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A CATALOGUE OF SOME FORECASTER HINTS APPLICABLE TO EUROPEAN FOR--ETC(U)
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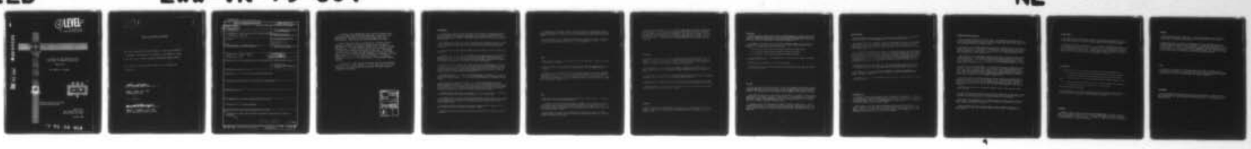

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2D WEATHER WING
TECHNICAL NOTE 79-004

A CATALOGUE OF SOME FORECASTER HINTS APPLICABLE TO EUROPEAN FORECASTING

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A catalogue of some hints pertinent to weather forecasting in Europe is presented.

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In October 1977, 2WW/DN began publishing a forecaster hint in the Wing Staff Meeting Minutes each week. These hints have been garnered from many sources and many people have made contributions. When known the source has been given credit.

Many of the hints apply to forecasting in central Europe, however, the majority are general enough to apply anywhere. The reader may not always agree with the hints - several have been controversial. It must be kept in mind that brevity was one of the constraints placed on the drafter of the hint. The purpose of this program is to get the 2WW forecaster to think and recall many of the basic ideas originally presented in forecaster training. Another purpose and perhaps the most important is to provide information on some of the unique aspects of the European Weather regimes.

An attempt has been made to catalogue the hints by phenomena or by some other logical grouping. In many cases the hint relates to more than one area hence this system has not been followed religiously throughout.

FOG AND STRATUS

In central Europe, forecast fog to persist all day if it hasn't broken by the following times (Zulu): Sep 9Z, Oct 10Z, Nov 11Z, Dec 12Z, Jan 11Z, Feb 10Z, Mar 9Z. This rule can be remembered easily as the month of the year, but counting backwards once December is past. This is an empirical rule. We don't have any verification data to support it. Several people have challenged this rule as physically incorrect. What do you think?

When contemplating a radiation fog forecast with temperatures near freezing do not overlook the effects of frost formation on the timing of your forecast. Frost will inhibit the formation of radiation fog; however, as the frost melts, usually within an hour or two after sunrise, fog can and often does form very rapidly.

Our fog studies here in DN have shown that on 850mb wind speed in excess of 15 kts is an excellent no fog predictor.

The fog season has arrived! How can you tell when a new regime is about to begin or an old one break down. The EFU is now retransmitting the 4-panel 500mb 72 hour prog (FUEU 50 EDAC) which provides an invaluable aid in looking for significant changes in the synoptic pattern. The first day under ridging often begins the regime. The end of the regime often ends with an increase of upper-level winds which will bring in "New" non-fog producing air even without a well defined frontal passage.

Many times during the "fog season in central Europe you are faced with the question "Will it be fog or stratus in the morning?" To be sure this is one of our most difficult forecast problems. We of course, can't give you a sure fire solution to this problem; however, you should consider the following elements: local effects and rules of thumb, minor changes in pressure gradient (you can't get this off a map - you must monitor adjacent stations pressure tendencies), expected weakening or strengthening of surface and upper air inversions and finally changes in the upper-wind flow.

850mb temperature advection is a powerful fog forecasting parameter. Warm advection will increase low level stability increasing fog potential, while cold advection at 850 will decrease the boundary layer stability, decreasing fog potential. This rule assumes the surface temperature is not effected by the 850 advection.

In our fog work here in DN we have discovered that two observed parameters commonly used as fog predictors do not seem to work very well in central Europe. These are 850mb temperature or moisture advection and the SFC to 850 hydrolapse (algebraic difference between the SFC dewpoint and the 850 dewpoint). If you use either of these, or variations of them, be careful unless you have verification data indicating the rules work at your station. (Note: The previous two rules are in direct conflict with one another with respect to 850mb temperature advection. The second is most applicable in Europe.

A frequently used rule of thumb says "If you had fog today - forecast it again tomorrow". We verified this rule for Echterdingen over the past three fog seasons and it worked 70% of the time.

In the CONUS and in Asia cold fronts normally are followed by dry air. This is often not true in Europe. Dew points often increase in the cold air behind a front. Implication; Radiation fog will often form the first night after the frontal passage, and if ridging follows, the fog can persist until the ridge is replaced by another system.

The formation of nocturnal fog requires the presence of at least some wind. On nights when the air is dead calm, the moisture tends to consense out as dew or frost instead.

Transitioning from anticyclonic to cyclonically curved flow is often the first indication of the end of a fog regime.

In the absence of severe weather, visibility is your most important daily terminal forecast problem. Our office has several projects under development to help forecast fog. Even so, this element will always deserve a little extra effort on your part, to ensure that the operational customer gets the best possible service.

October is the month most of us recognize as the beginning of the fog season in Europe. Don't let this lull you into thinking that August and September will be fog free. Make sure you consider the elements that cause fog and stratus before issuing your TAF. In short - THINK FOG!

CLOUDS

When you forecast showers, be sure to consider the effect of the precipitation in lowering the ceiling and visibility during the showers.

Warm air instability is likely to give rise to clouds with high bases (say, order of 5000 ft). These may nonetheless be vertically extensive and can bring heavy showers. (M.O. 637, Handbook of Weather Forecasting).

Instability Cu - As winter gradually yields to spring, we will be increasingly faced with the problem of cold cumulus clouds. These instability Cu are a common feature behind fast moving cold fronts with rather cold air behind the front. Though topping out at only around 12,000 ft or so, these clouds can be quite turbulent. To the aviator, the hazards of turbulence, icing, and lightning are predominant. To the forecaster on the ground, the problem is one of forecasting the intensity, type, and duration of the showers. Rain, snow and graupel are common for cold Cu.

WINDS

When winds aloft are strong and all have about the same direction, expect strong gusty surface winds in the absence of a strong blocking temperature inversion.

To improve your point warning wind forecasts examine your RUSSWO to find the most prevalent directions for strong winds. Then select two reliable stations that report hourly pressures(Altimeter setting in inches) and are oriented on both sides of your station perpendicular to the isobars. The next step is to collect pressure differences between these stations to find what gradient is necessary to give your station winds reaching point warning strength.

We are currently evaluating a rule of thumb developed for the Ramstein area: Watch for increased chances of conditions below 3000 ft and/or 3 nm 24 hours after the occurrence of gusty winds. You may want to see if this ROT works at your station.

Have you often pondered whether to put out a wind warning when thunderstorms or showers are moving over your terminal? This is especially difficult with our small European storms. Your best tool to make this decision is the mean wind speed taken at the average level or midpoint of the cells in your area. Use your closest radar ob to determine tops then estimate the mid point of the cells in your area. The surface wind speed you will potentially experience will approximate the mean midpoint winds. EXAMPLE: Say your tops are averaging 180. The midpoint is then 090. Use an average taken from about 050 applying a small correction for friction. If the midlevel winds are weak then chances are you won't experience significant surface gusts.

THUNDERSTORMS

In a recent study by Bradbury of the British Meteorological Office it was found that Wet Bulb Potential temperature value at 850mb of 16°C or higher is a strong indicator of thunderstorms in Europe. This parameter is easily computed from the sounding (SKEW-T) closest to your station by following the procedures in AWSM 105-124 para 4.9 & 4.10. Make it a routine part of your SKEW-T analyses during the thunderstorm season, it will complement the other stability information you are now using.

A revised index, similar to the Lifted index but measured at the height of the -20C isotherm, is superior to the Showalter index for determining the lightning discharge potential of cold air cumulonimbus clouds. (Reference 2WW TN 72-2, "An Investigation of Thunderstorm Potential in Cold Air Cumulonimbi" by Biltoft).

In the spring in central Europe, with the breakdown of the Siberian high, the low level flow from the east, when it occurs, is often of a moist Mediterranean character as opposed to the dry conditions experienced in the winter. Watch the surface dew points and beware of thunderstorm activity.

Early morning low level stability can mislead you into thinking that it will be stable all day. Always take surface heating into consideration when considering the possibility of afternoon cumulus (TSTM) activity.

Thunderstorm season upon us? If you are in an area of Total Totals index in the high forties and higher values are upstream, forecast TSTM activity for your area.

TEMPERATURE

Winter is upon us? As of 10 November 1978, we had not had our first "cold temperature". Because of the marine influence (excepting TUSLOG) we generally do not get strong Arctic frontal passages as in the mid western U.S. Most often our "really" cold weather comes from easterly flow with a westward extension of the Siberian high.

PRECIPITATION

The axis of the thermal trough in the rear of a fully developed depression is a useful indicator of the region of maximum development of showers; this region is often located at the end and to the foward side of the axis. Showers often decrease abruptly to the rear of the axis of the thermal trough. Any cold pool which exists in the rear of a depression is a center of maximum shower activity.

On 8 December 78, there was about 1/4 inch of ice on the roads here at Kapaun AS. The freezing rain was caused by warm southerly flow overrunning the cold low-level easterly flow we had for about a week beforehand. This can happen again - watch for the key signs.

1. Cold core ridging at the surface with the low level trajectory out of eastern Europe.

2. A precip producing system approaching aloft and at the surface from the west.

3. Pay close attention to the thickness to differentiate between rain and snow.

In central Europe moderate to strong south-westerly flow in the low levels will usually be followed by precipitation within 12-18 hours.

Warm advection over underlying cold air brings snow in the winter.

In central Europe with a cold ridge over the area and surface winds south to east, expect precipitation to occur within 18 to 30 hours.

JET STREAM

The right rear quadrant of jet streaks (small jet streams) can be expected to strongly support low level convergence, upward vertical motion and cyclogenesis. In fact both the right rear and left forward quadrants support low level convergence while the right forward and left rear quadrants generally support low level divergence. This rule applies to short and straight jet streaks imbedded within the larger jet stream flow.

Surface fronts associated with a strong and clearly defined 500mb jet will normally be strong and active - moreover when the jet is above or just north of the surface front, consider the possibility of wave formation, rapid deepening and rapid eastward movement of the wave. With the jet just above the front this implies a steep front - so expect a narrow weather pattern. If the jet is displaced from the front, this implies a shallow front, so expect a broad stable type weather pattern.

A reasonable and quick way to gauge whether your weather will behave as climatology says it should is to compare the mean position of the jet stream with its current position. If the jet is further north than normal expect less frequent low ceilings and visibilities, less precipitation and warmer temperatures. If the jet is farther south expect more frequent low ceilings and visibilities, more precipitation and colder temperatures.

FRONTS AND TROUGHS

Do you ever wonder how fast to move a front? A handy rule to use in mid-latitudes is to move fronts at the speed of the 700mb wind component perpendicular to the front and on the cold air side.

The continuity and movement of troughlines are one of your most powerful forecaster aids. This applies to winds, contours, vorticity and temperature. One word of caution - make sure you use the wind field to locate upper-air pressure troughs, especially if the analysis you're using isn't your own. Small errors in trough location contribute to errors in continuity. Combination of the two errors contributes to large errors in forecast timing.

It is a rare day in central Europe when our weather is not influenced in one way or another by the warm waters of the Gulf Stream. One effect all forecasters should consider is the frequent lack of a significant temperature contrast from the "warm" to "cold" sides of fronts as they move across our area. Quite often such a discontinuity is modified by the warm Atlantic waters to the extent that the surface characteristics of the fronts all but disappear. These fronts still exist aloft and they can significantly affect your surface weather. The best way to maintain continuity of analysis is to use the 850mb level data. This is one more example where standard meteorological analysis principles must be modified to account for the unique aspects of the European weather regime.

Slow-moving fronts usually have a shallow slope - fast moving fronts have a steep slope. Take this into consideration by examining the thermal patterns at 850 and 700 when estimating the speed of fronts. This is especially useful when continuity has been broken or shows irregular movement of surface fronts.

The west coast of France is a favored area for frontogenesis. Often weak fronts regenerate in this region. In the warmer months thunderstorms usually develop over most of Europe as these fronts move eastward. See page 5-13, 2WWP 105-12.

With weak frontal systems, examining the 850mb level is quite helpful and often a necessity in locating the general frontal zones.

MEDITERRANEAN LOWS

Cyclogenesis in the Mediterranean frequently follows the passage of a cold front southward through France with a cold air flow down the Rhone Valley into the Mediterranean. Following cyclogenesis the storms tend to move eastward bringing locally severe weather to northern Italy and later bringing heavy precipitation to southeastern Germany and Austria as warm Mediterranean air is forced up and over the Alps. This type of storm system is a major snow producer in central Europe.

When the pressure at Paris is 9mb above that at Marseille the winds in the Rhone Valley and at Marseille will gust up to 45 knots. This situation, given upper air support, often is followed by cyclogenesis in the Gulf of Genoa. The low as it tracks east to northeast will bring heavy rain/snow to both northern Italy and southern Germany. (This forecaster hint relates to the hint immediately above. It was submitted to us by Major Henry A. King, formerly of EFU and 2WW/DOOF)

ATMOSPHERIC STRUCTURE AND ANALYSIS

Most mid-latitude depressions are "cold-core" systems. In a cold-core low, the thermal structure is such that the thermal winds enhance the low-level winds so that the vortex is strong at upper levels. The occlusion process gradually lifts the warm air away from the surface so that cold air covers the entire area. (After the Handbook of Weather Forecasting, BMO, 1975).

The August 77 issue of the Monthly Weather Review contained an interesting article on a relationship between convective activity and the shape (tilt) of 500mb troughs. Researchers have found that troughs which slope or tilt toward the SE, or stacked vertically, are associated with considerably more upward vertical motion than those which tilt toward the NW. Therefore vertically or SE tilted troughs had been found to cause considerably more convective precipitation.

When is the last time you tried isallobaric analysis? Chances are it was in school. Sometimes doing a normal isobar analysis on a surface chart in the rough terrain we have in Europe can be a frustrating, if not misleading pursuit. On the other hand analyzing pressure rises and falls in rough terrain can be very often revealing and useful. Try it - you'll like it. A clue to deciding when to do this is to let the jet stream be your guide. If it's in or approaching your region do isallobaric analysis. If the flow is weak and anticyclonic aloft don't do it.

Inversions - We live with them everyday. It is seldom you look at an upper air sounding that you don't have one (or at least a stable layer) somewhere on your sounding. Do you always ask yourself, when an inversion is present what the mechanism is that caused it? Quite often this is important and provides useful clues on what the atmosphere is doing. There are four basic types: Radiation, subsidence, frontal and turbulence. The existence of the latter is often important in deciding whether you will have fog or stratus. The first few pages of chapter 6, AWSM 105-124 provide an excellent review of this subject. A quick review of this section will pay you dividends this coming winter.

Using the analyzed areas of warm and cold advection, consider a column from the surface to 500mb. If the entire column cools, the height of the 500mb surface will fall. Visualize this by remembering that the number of pieces of air or molecules remain the same when the column of air shrinks, the molecules at the top of the column have to move downward. Remember, when looking for warm and cold advection consider the entire column of air, not just one level. (Extracted from 5WW Seminar 78-1, "Back to Basics, March 1978).

Warm and/or moist advection into the area beneath a 500mbs trough will usually cause the trough to intensify and deepen.

In central Europe in the winter easterly low level flow brings generally good but cold weather. However, if the flow is strong cyclonic or if a warm overrunning southerly current exists prolonged cloudiness can be expected. Watch the 850 and 700mb levels for clues to development of this overrunning.

When a surface low and a 500mb low travel on intersecting paths, the surface storm tends to reach its maximum intensity - hence maximum winds - near the point of intersection. Thereafter as a nearly barotropic system the storm tends to fill and dimish.

At a given pressure level a moist area that increases in size from one map time to the next is indicative of upward vertical motion. The rate of growth is directly related to the magnitude of the vertical motion.

AIR MASS ANALYSIS

Do you know the source region of the air over your station? Knowing the characteristics of the air over your station is a critical input to your forecast. All 2WW forecasters can benefit from a review of air mass analysis techniques. If you don't have a good reference on this subject, contact 2WW/DN.

How often do you consider air mass modification in your forecasts? For example the passage of cold air over a warm water surface will result in a decrease in stability due to both the warming and addition of moisture to the lower layers of the air mass. To apply this rule you must of course know the temperature of the water bodies surrounding your station. Another example of airmass modification is the decrease in stability of the air on the windward side of a mountain and the increase on the leeward side. Consider these and other air mass modification effects and your forecasts will improve.

SYSTEM MOVEMENT

Following are some rules for the movement of short waves based on the isotherm-contour pattern.

1. If isotherms are in phase and parallel to the contours the wave will be quasi stationary.
2. If isotherms are in phase but of less amplitude than contours, the wave may retrograde.
3. If the isotherms are in phase but of greater amplitude than the contours the wave will move slowly.
4. If the isotherms are 90° out of phase the wave will move with the speed of the gradient wind.
5. If the isotherms are 180° out of phase the wave will be fast moving.

These rules were contributed by 1WW/DON

It is most often folly to try to move a surface low pressure system into a well entrenched high. The keys to avoid mistakes are to consider the relative strength of the systems (central pressure) and to consider the upper-air steering winds over the two respective surface systems.

CLIMATOLOGY

Frequently it takes us a month or so to adapt to seasonal weather changes in our forecast thinking. A monthly review of the climatology section of your TFRN and your RUSSWO tables will help you to adapt more quickly to these changes. The best way to do this is to compare the frequencies of the various parameters of the current and past month noting the trends. It is helpful if a summary containing this type information is prepared each month for review by each forecaster.

CONTINUITY

Do your locally plotted SKEW-T's always have a 12 or 24 hour trace plotted? If not you may be overlooking a valuable forecaster aid. Small changes in temperature and moisture structure are often important and will go undetected without the trace.

Keeping a running log of your stations surface observations in a way that previous hours and days observations can be readily compared to your current weather is a valuable short range forecast tool. Consider using AWS Form 52 (Recovery Forecast Worksheet) for this purpose. The blocks on the rear of the form in sections F and G can be used to plot an abbreviated plotting model of your (or an upstream stations) surface observation. You will note that the form was not designed to be used in this way, however, using this concept allows up to two weeks observations to be plotted on one sheet. Give it a try - it will take no more than 30 seconds of your time each hour and you'll be surprised at the dividends.

ICING

Aircraft icing is most common in the temperature range from 0°C to -20°C. In Germany conditions favorable for aircraft icing occur from late fall into early spring. Summertime icing is mostly associated with thunderstorms. The probability of encountering icing conditions over Germany is about 0.15 to 0.20 at 5000 ft during the winter. In summer the probability of icing is less than 0.05.

MISCELLANEOUS

This week's forecaster hint deals with human nature rather than meteorology. Circumstances sometimes lead us to inadvertently allow our forecasts to be based on wishful thinking, customer pressure, etc. Make every attempt to avoid this. Base your forecast only on meteorological inputs - try to screen out the human-nature factor.