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HOW TO USE MOS GUIDANCE EFFECTIVELY PART IV

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INTRODUCTION

In this, the fourth in a series of Technical Attachments on how to use Model Output Statistics (MOS) effectively, I will discuss the MOS temperature (TEMP) guidance. The TEMP guidance system provides maximum/minimum temperature (MAX/MIN) forecasts for up to 60 hours after 0000 or 1200 GMT, and temperature and dewpoint forecasts at 3-hr intervals for the projections of 6-51 hours after 0000 or 1200 GMT. As mentioned in PARTS I-III, significant MOS errors can occur even when the LFM is performing well. In my discussion I will focus mainly on these types of errors because they can be difficult to diagnose. Errors that occur as a result of erroneous LFM forecasts will not be discussed in as much detail.

BACKGROUND AND DEFINITIONS

A) Equations used to produce TEMP forecasts are stratified into four three-month seasons; spring, summer, fall, and winter, valid March-May, June-August, September-November, and December-February, respectively. This means that different sets of equations are used for each of the seasons. Seasonal stratification is done in order to try to take into account seasonal variations in weather patterns.

B) The data sample used to develop the equations included the period from September 1977 - November 1984.

C) MOS TEMP guidance is a single station system - this means that a separate set of equations is used to produce the TEMP forecasts for each station. As a result, the typical local conditions at a station are accounted for in the relationships for each equation.

D) The latest TEMP forecast system, which became operational in November 1985, provides MAX/MIN forecasts for periods that correspond roughly to daytime/nighttime periods.

E) For the Eastern Region, the LFM 1000-mb temperature and 1000-850 mb thickness forecasts are generally the most important predictors used by the TEMP equations for forecasting the surface temperature. The exceptions are some stations at higher elevations where the 850-mb temperature is the most important predictor. The effects of clouds and precipitation on the TEMP forecasts are accounted for only in the sense that one or more of the following LFM predictors are usually included in the equations and can help to indicate the possibility of clouds or precipitation: mean relative humidity (MEAN RH), relative vorticity, vertical velocity, K index, and precipitable water. Of these LFM variables, the MEAN RH and precipitable water are the most important.

TIPS AND GUIDELINES

- Of all the weather elements for which MOS forecasts are provided, only the MOS TEMP guidance is stratified into three month seasons. As such, of all the weather elements for which MOS guidance is available, TEMP forecasts are the most likely to account for important seasonal changes in weather patterns. Thus, when the TEMP guidance appears to be inconsistent with the unstratified MOS precipitation type and snow amount guidance, it is better to use the TEMP guidance. This is especially true in the fall and spring when these other systems have a tendency to overforecast the probability of frozen precipitation and/or the snow amount. A more detailed explanation of the consistency check was given in PART I of this series (Eastern Region Technical Attachment No. 86-19(B)).

- Forecasters should be aware of a station's long-term climatology and of the general conditions that occurred during the developmental sample, especially with regard to record-breaking or near record breaking temperatures. If such extreme temperatures never or rarely occurred during the developmental period, then the MOS TEMP relationships may not be valid during extreme weather patterns and large errors may occur. This does not imply that record-breaking temperatures cannot be forecast by MOS if record-breaking temperatures did not exist in the developmental sample, only that such predictions may not be very accurate and should be examined closely.

- Because the MOS TEMP guidance is a single station system, it will, to a high degree, account for permanent local conditions such as elevation, proximity to a large body of water, urban heat island effects, etc., and TEMP forecasts need not be adjusted due to these factors. Variable ground conditions such as snow cover, soil temperature and moisture, etc., are also accounted for, but to a lesser degree. The typical values of these ground conditions for the data sample will generally be accounted for, but the modifying effect on the air temperature produced by unusual ground conditions will not. Thus, for example, the MAX forecast for a hot airmass will tend to be too cool in the summer if the ground is also unusually hot and dry. As another example, the MAX forecasts will tend to be too warm in the winter if a warm airmass moves over a surface that is much colder than normal.

- During a prolonged period of well above or well below normal temperatures, MOS TEMP forecasts very often will indicate unwarranted cooling or warming, respectively, with increasing projection. Unless supported by the LFM or other subjective meteorological reasoning, the warming or cooling trend can usually be ignored. Due to the uncertainty produced by less accurate LFM forecasts for the longer-range projections, TEMP forecasts tend toward the climatological mean with increasing projection, and the result is a predicted warming or cooling trend.

- When low-level cold, moist air moves into an area, the MAX forecasts very often are too high because the LFM has poor low-level vertical resolution and the equations are generally based on the typical situation where the daytime sounding does not feature a low-level inversion or isothermal layer. Also, the LFM MEAN RH and precipitable water predictors are gross forecasts of moisture in approximately the lowest 500 mb of the atmosphere. Thus, a relatively dry MEAN RH or low precipitable water value may be correctly forecast by the LFM, but a saturated boundary layer may produce low overcast clouds and precipitation during the day and result in as much as a 15-20° F bust in the MAX forecast.

- Despite accurate LFM thermal field forecasts, clouds and precipitation that are unexpected by the LFM can wreak havoc with the MAX/MIN forecasts. One method to determine whether clouds and precipitation are expected by the LFM is to look at the LFM precipitation amount forecast. Another is to look at the MOS forecasts of probability of precipitation (PoP) and clouds. In terms of the MOS forecasts, if only clear to scattered clouds and a low PoP (30% or less) are indicated, then a forecaster can assume the MAX/MIN forecasts do not expect the possibility of clouds or precipitation. If after LFM run time, the forecaster determines through surface, satellite, or radar observations that precipitation and clouds are likely, then a significant adjustment to the first period MAX or MIN should be made. Generally, the MIN forecast will need to be increased while the MAX temperature will need to be decreased. This should be done even to subsequent periods if necessary. As more clouds are forecast and the PoP increases, it is increasingly likely the MAX/MIN forecasts will recognize the possibility of clouds and precipitation, and only small adjustments are usually necessary. Little if any adjustment may be required when PoP's are near 100% and clouds are forecast to be overcast through the entire period. Similar but opposite adjustments are required when expected clouds and precipitation do not occur.

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