WPC Day 4-7 Medium Range 2.5-Km Grid Methodology
(as of 9/25/2014)

Several steps are taken to obtain a 2.5-kilometer (km) forecast for Maximum Temperature, Minimum Temperature, 12-hour Probability of Precipitation (PoP), 12-hour Winds and 12-Hour Dew Point Temperatures based off of the WPC medium range point forecasts.

Maximum/Minimum Temperature – WPC medium range forecasters create Maximum Temperature and Minimum Temperature forecasts from the model of choice or a blend of the forecaster selected NCEP and International deterministic/ensemble model guidance. Before each model is weighted in the blend, the model is first downscaled to 2.5-km horizontal resolution. To downscale the 1x1 degree model maximum/minimum grid to a 2.5-km resolution grid, downscale vectors are created for temperature at each 6-hour time step. The downscale vectors are created by differencing the GDAS temperature analysis and the high-resolution RTMA temperature analysis. The GDAS-RTMA difference is accumulated by applying a decaying weight to obtain the downscale vector, which is updated each day by weighting the current GDAS-RTMA difference by 0.02. The 6-hour maximum/minimum temperature grids are then downscaled using the mean downscale vector for each 6-hour period. At each grid point, the downscaled 6-hour maximum/minimum temperature grids are compared to each other to find the highest (lowest) values for maximum (minimum) temperature to get a final maximum/minimum grid.

The resulting Maximum and Minimum temperatures are extracted from the grid to ~449 WPC points for the forecaster to edit where necessary. An objective analysis is performed on the forecaster increment changes at the ~449 WPC points to create a difference grid. The WPC forecaster change difference grids are added to the original blender output grids to get an adjusted 2.5-km WPC forecast grid.

12-Hour Probability of Precipitation – WPC medium range forecasters create 12-hour Probability of Precipitation forecasts from the model of choice or a blend of the forecaster selected NCEP and International deterministic/ensemble model guidance. The Ensemble model PoP is derived from the relative frequency of QPF > 0.05 inches. Deterministic models derive PoP by scaling the QPF amounts and adjusting based on the Boundary Layer Mean Relative Humidity.

The resulting 12-hour Probability of Precipitation are extracted from the grid to the ~449 WPC points for the forecaster to edit if necessary. An objective analysis is performed on the forecaster increment changes at the ~449 WPC points to create a difference grid. The difference grids are added to the original blender output grids to get an adjusted 2.5-km WPC forecast grid.

6-Hour Precipitation Likelihood Index – The 6-hour Precipitation Likelihood Index (PLI) grids are generated using the WPC 12-hour PoP and the gridded GFS MOS 12-hour PoPs and 6-hour PoPs. The WPC 12-hour PoP is split into two 6-hour PLIs by multiplying the gridded MOS 6-hour PoP for the first 6-hour period by the ratio of the WPC 12-hour PoP and the gridded MOS 12-hour PoP. By using the equation

$$pp12 = (pp06_1 + pp06_2) - p_i \qquad (1)$$

where $pp12$ is the 12-hour PoP, $pp06_1$ and $pp06_2$ are the two 6-hour PoPs and p_i is the intersection probability, the intersection probability is calculated from the gridded MOS 12-hour PoP and two 6-hour PoPs and multiplied by the ratio of the WPC and MOS 12-hour PoPs. Equation (1) is then solved for $pp06_2$ using the calculated intersection probability, the WPC 12-hour PoP, and the calculated WPC first 6-hour PLI to get the WPC second 6-hour PLI. The higher of the two WPC 6-hr PLI is replaced by the WPC 12-hour PoP.

Dew Point Temperature – WPC Dew Point Temperature Grids are created from a blend of the NCEP and International deterministic and ensemble model output and then downscaled to 2.5-km grid resolution. The model weights are determined from the maximum and minimum temperature blend chosen by the WPC medium range temperature/PoP forecaster. The dew point grid is downscaled using downscale vectors to interpolate the 1x1 degree blend grid to a 2.5-km grid. The downscale vector is created by comparing the difference between the GDAS dew point analysis and the high-resolution RTMA dew point analysis. The GDAS-RTMA difference is accumulated by applying a decaying weight to obtain the downscale vector which is updated each day by weighting the current GDAS-RTMA difference by 0.01. After the model blend is downscaled, the dew point temperature grid is checked against the maximum temperature forecast grid. If the dew point is greater than the maximum temperature, the dew point temperature is lowered to the maximum temperature.

Wind Speed and Direction – WPC wind speed and direction forecasts are created from a blend of the NCEP and International deterministic and ensemble model output. The model weights are determined from the sea level pressure blend chosen by the WPC medium range Pressure/Fronts forecaster. Finally, the 2.5-km wind speed grid is bias corrected using a 30 day running average derived from the RTMA.

Cloud Cover – WPC cloud clover forecast grids are created from a blend of the NCEP and International deterministic and ensemble model total cloud cover output. The model weights are determined from the probability of precipitation blend chosen by the WPC medium range temperature/PoP forecaster. A smoother is applied to certain models before performing the blend to reduce excessive sky cover detail.

Weather Type – Weather type is created using an algorithm based on the temperature profile at the 2m, 925mb, 850mb and 700mb levels. The temperatures at each level are created from a blend of the NCEP and International deterministic and ensemble model chosen by the medium range forecaster. Weather type will be defaulted to rain everywhere on the grid except for the following conditions. The following conditions results in the precipitation type of snow,

$$T_{850mb} < 0^{\circ}C \;\&\; T_{2m} < 1^{\circ}C, or$$

$$T_{700mb} < -2^{\circ}C \;\&\; T_{925mb} < T_{850mb} \;\&\; T_{2m} < 1^{\circ}C$$

The precipitation type is freezing rain the following conditions must be met,

$$T_{850mb} > 0^{\circ}C \,\&\, T_{925mb} < T_{850mb} \,\&\, T_{2m} < 0^{\circ}C$$

To determine possible convection, the GFSXMOS 6-hour probability of thunderstorms is used to determine the coverage of convection using a threshold of 30%. Each precipitation type is given an uncertainty condition based on the WPC 6-hour Precipitation Likelihood Index (PLI). The precipitation type uncertainty is a ‘slight chance of’ with a PLI greater and equal to 15% and less than 25%, a ‘chance of’ with a PLI greater than or equal to 25% and less than 55%, and a ‘likely’ for PLI greater than or equal to 55%. Any PLI less than 15% will be designated as ‘no WX’.