HPC Day 4-7 Medium Range 5-Km Grid Methodology
(as of 11/2/2010)

Several steps are taken to obtain a 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 HPC medium range point forecasts.

Maximum/Minimum Temperature – HPC 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 5-km horizontal resolution. To downscale the 1x1 degree model maximum/minimum grid to a 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 10%. 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 ~448 HPC points for the forecaster to edit where necessary. An objective analysis is performed on the forecaster increment changes at the ~448 HPC points to create a difference grid. The HPC forecaster change difference grids are added to the original blender output grids to get an adjusted 5-km HPC forecast grid.

12-Hour Probability of Precipitation – Initial background grids for 12-hour PoPs are created from the GFSXMOS with approximately 1500 points. A difference between the HPC PoP forecast at ~448 stations and the GFSXMOS PoP forecast is performed to obtain an HPC-MOS increment at each point. An objective analysis is then performed for each forecast time to obtain 5-km increment grids that are added to the GFSXMOS grids. The results are 5-km HPC forecast grids for 12-hour PoP. No PRISM data is available for PoP, so the grids are left as they are.

Dew Point Temperature – HPC Dew Point Temperature Grids are created from a blend of the NCEP and International deterministic and ensemble model output and then downscaled to 5-km grid resolution. The model weights are determined from the maximum and minimum temperature blend chosen by the HPC medium range temperature/PoP forecaster. The dew point grid is downscaled using downscale vectors to interpolate the 1x1 degree blend grid to a 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 10%. 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 – HPC wind speed and direction forecasts are created by taking the day 4-7 HPC medium range pressure/fronts forecasts and calculating the geostrophic wind from the pressure field. Interpolation is performed between the pressure forecast times to obtain the winds at 6-hour time increments. To ensure a realistic wind speed forecasts, the GFSXMOS 12-hr maximum sustained winds are used to cap the wind speed forecast at each HPC forecast point. If the HPC wind speed forecast exceeds the GFSXMOS 12-hr maximum sustained wind speed, the HPC wind speed is lowered to that speed.

The wind speed and direction are further adjusted to better reflect frictional forces on the geostrophic wind. A consistent high bias was found in the wind speed forecast so a 10% reduction in the HPC wind speed is applied. The wind is also backed by 40 degrees to better represent a wind direction forecast over land. A bias correction of 2.5 knots is applied to any wind greater than 5 knots to correct an observed wind speed bias at the 00Z, 06Z, and 12Z. An objective analysis is then performed on the HPC forecast points to create wind speed 5-km grids and wind direction 5-km grids. Once the wind forecast is on the grid, the winds are adjusted back towards geostrophy over water based on stability. The stability is determined by the differences between the sea surface temperature and the HPC forecast. If the difference is positive, the winds are adjusted closer to geostrophy and for a difference greater that 25 degrees F, the wind will become supergeostrophic. Finally, the 5-km wind speed grid is bias corrected using a 30 day running average derived from the RTMA.

Cloud Cover – HPC 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 HPC 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 the HPC Maximum or Minimum Temperature. The Max T (at 00z) or Min T (at 12z) is used to determine the precipitation type. Weather type will be defaulted to rain everywhere on the grid except for the following conditions. If the temperature is less than 40°F, the precipitation type is snow. If the temperature is less than 33°F and the 1000-500mb thickness is greater than 543dm, the precipitation type is freezing rain. To determine possible convection, the GFSXMOS 12-hour probability of thunderstorms is used to determine the coverage of convection using a threshold of 30%.