HPC Day 4-7 Medium Range 5-Km Grid Methodology
(as of 4/15/2010)

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 for days 4-7 at approximately 448 points. The forecaster starts the forecast from the 00Z GFS Extended MOS or they can blend (i.e., weight) together various deterministic or ensemble models to produce the forecast. The forecaster's blender choices can be viewed at http://www.hpc.ncep.noaa.gov/medr/blended/blender.html.

To create more detailed 5-km forecast grids from these points, PRISM data obtained from the Spatial Climate Analysis Service, Oregon State University, http://www.ocs.oregonstate.edu/prism/ is mapped to a 5-km grid and applied to the forecasts. The PRISM grids are 30-year monthly climatology for Maximum Temperature and Minimum Temperature from 1971 to 2000. The ~448 HPC points are taken from the PRISM grid and the difference between the HPC points and the PRISM ~448 points is taken to get HPC-PRISM increment at each point. An objective analysis on the HPC-PRISM increments is performed to get 5-km increment grids. These HPC-PRISM increment grids are added to the appropriate PRISM grids to get a detailed 5-km HPC forecast grid. Over offshore waters, values from the National Digital Forecast Database (NDFD) are used to obtain the Maximum and Minimum Temperatures. On Day 7 which is not included in the NDFD until the 1800Z update, the NDFD Day 6 Forecast is substituted for day 7. For the waters beyond the NDFD area, Sea Surface Temperature is used to obtain the Maximum and Minimum Temperatures over the offshore waters. A climatology of SST-Air Temperature obtained from moored buoys and C-MAN stations for the Atlantic Ocean, Pacific Ocean and the Great Lakes is applied to the sea surface temperature to obtain the Maximum and Minimum Temperature.

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%.