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TRF issues when using a numerical weather model for atmosphere zenith delay

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There is a large correlation between the estimates of atmosphere zenith delay and station height in space geodetic measurements. Therefore any errors involved in the estimation of the troposphere delay affect the site height and thus the terrestrial reference frame (TRF). Numerical Weather Models (NWMs) have recently begun to be used to provide mapping functions for the troposphere delay because they can provide estimates or predictions of meteorological parameters that are impractical to obtain by in situ or remotely sensed observations. However, the horizontal resolution that can be attained is dependent on computing resources. Given the information that NWMs can provide, we have begun an investigation to evaluate possible improvement in VLBI and GPS site position estimates using NWMs with finer horizontal resolutions than have generally been used to date.

The period of our study is the CONT02 VLBI campaign, October 15-31, 2002, and includes the eight VLBI sites. These sites are distributed in latitude from +78 degrees to -25 degrees and in height from sea level to 1400 m. For each site, we generate a series of short-term (0-12 hours) weather forecasts using the Penn State/NCAR non-hydrostatic mesoscale atmospheric model, version 5 (MM5). Our implementation of the MM5 uses nested grids with horizontal resolutions of 81, 27, 9, and 3 km.

Before we can address the question of potential improvements in VLBI site position estimates, however, we want to assess the value of the NWM forecasts. Are they accurate enough to add information to the estimation of geodetic and atmospheric parameters for the space geodetic techniques?

Measurements by radiosonde are considered the most accurate for in situ information, so we will compare the meteorological quantities temperature, humidity, and geopo-

tential height along vertical profiles from the NWM forecasts with those obtained from radiosondes near each of the eight sites. Then we will compare the difference in estimated height due to the difference in mapping functions obtained from these two sources (radiosondes and NWM) as a function of both resolution and forecast time.

One source of error is the difference in topographic height at the grid points of the different resolutions. Preliminary results for the area around Westford, Massachusetts, USA, indicate that differences of up to two mm in estimated height can occur if a correction is not made for the difference between grid point height and site height. After correction is made, the heights are consistent to better than one mm. For this case the resulting bias is less than one millimeter. Results will be presented for the other seven sites, some of which have much larger differences in topography between the NWM grid points and the radiosonde site.