Analysis and validation of GPS/MET data in the neutral atmosphere (paper, 1997)

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Analysis and validation of GPS/MET data in the neutral atmosphere

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Abstract

The Global Positioning System/Meteorology (GPS/MET) Program was established in 1993 by the University Corporation for Atmospheric Research (UCAR) to demonstrate active limb sounding of the Earth's atmosphere using the radio occultation technique. The demonstration system observes occulted GPS satellite signals received by a low Earth orbiting (LEO) satellite, MicroLab- 1, launched April 3, 1995. The system can profile ionospheric electron density and neutral atmospheric properties. Neutral atmospheric refractivity, density, pressure, and temperature are derived at altitudes where the amount of water vapor is low. At lower altitudes, vertical profiles of density, pressure, and water vapor pressure can be derived from the GPS/MET refractivity profiles if temperature data from an independent source are available. This paper describes the GPS/MET data analysis procedures and validates GPS/MET data with statistics and illustrative case studies. We compare more than 1200 GPS/MET neutral atmosphere soundings to correlative data from operational global weather analyses, radiosondes, and the GOES, TOVS, UARS/MLS and HALOE orbiting atmospheric sensors. Even though many GPS/MET soundings currently fail to penetrate the lowest 5 km of the troposphere in the presence of significant water vapor, our results demonstrate 1°C mean temperature agreement with the best correlative data sets between 1 and 40 km. This and the fact that GPS/MET observations are all-weather and self-calibrating suggests that radio occultation technology has the potential to make a strong contribution to a global observing system supporting weather prediction and weather and climate research.

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