

ASSESSMENT OF SYSTEMATIC BIASES OF RADIOSONDE TEMPERATURE AND MOISTURE MEASUREMENTS USING GLOBAL POSITIONING SYSTEM RADIO OCCULTATION FROM COSMIC

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Radiosondes are the only operational instruments that have provided continuous atmospheric pressure, temperature, and humidity measurements in the troposphere and lower stratosphere (25 km) for more than three decades. Although their horizontal distribution is inhomogeneous (particularly over the oceans and polar regions), radiosonde measurements are widely used for air temperature trend analysis. However, because radiosonde sensor characteristics can be affected by the changing environment, its measurement accuracy varies considerably in times and locations for different sensor types. In this study, we compare temperature profiles derived from Global Positioning System (GPS) Radio Occultation (RO) data from the Constellation Observing System for Meteorology, Ionosphere, and Climate (COSMIC) from August to November 2006 with those from different types of radiosonde systems from 12 to 25 km to assess the performance of these radiosonde systems in the upper troposphere and lower stratosphere. Because the measurements obtained from the GPS RO limb-sounding technique are free of satellite-dependent and geographical-dependent biases, the radiosonde temperature biases for different instrument types at different geographical locations can be identified. In addition, we compare specific humidity profiles derived from COSMIC RO in the same period with those from different types of radiosonde and from ECMWF global analysis. Comparisons show that COSMIC specific humidity data agree well with ECMWF analysis over different regions of the world for both day and night times. On the contrary, evaluation against COSMIC specific humidity shows a distinct dry bias of Shang-E radiosonde (China) and obvious wet biases of VIZ-type (USA). No obvious specific humidity biases are found for MRZ (Russia) and MEISEI (Japan) radiosondes. These results demonstrate the usefulness of COSMIC water vapor for quantifying the dry/wet biases among different sensor types.