Vertical moist thermodynamic structure of the Madden-Julian Oscillation (MJO) from the Global Positioning System (GPS) radio occultation (RO) measurements

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The MJO is the dominant form of intraseasonal (30-90 day) variability in the tropical atmosphere and can influence the global weather and climate at all time scales. However, the MJO is still not well understood nor well represented in the current global climate and weather models. Documenting the large-scale vertical moist thermodynamic structure of the MJO is very important for us to better understand the MJO dynamics and to improve the MJO simulation in global models as demonstrated by our recent studies using the atmospheric temperature and water vapor profiles from the Atmospheric Infrared Sounder (AIRS) (Tian et al., 2006, 2010). While useful, the AIRS data are still limited in the following ways: poor diurnal sampling (twice daily), modest vertical resolution (~1-2 km) and obscured under heavily cloud conditions (cloud cover > ~70%). However, the GPS RO instruments, such as COSMIC, provides unique measurements of atmospheric temperature profiles in the lower stratosphere and upper troposphere and water vapor profiles in the lower troposphere under all-weather and all-cloud conditions with much higher vertical resolution (~200 m) and complete diurnal-cycle coverage. This paper will present the vertical thermal structure of the MJO in the upper troposphere and the vertical moist structure of the MJO in the lower troposphere based on the GPS RO measurements and a comparison with those from AIRS.