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Poster

Water vapor (WV) is one of the most important greenhouse gases in the atmosphere. Vertical distributions of water vapor profiles and spatial, and temporal distribution of total precipitable water (TPW) play a critical role in quantifying cloud feedbacks associated with global change. Passive microwave (MW) radiometers are among the very few satellite missions that are able to provide long-term (more than 25 years) all-weather time series of water vapor measurements using a similar satellite sensors and retrieval techniques. Recently a new version of daily ocean products mapped to 0.25 degree grid from SSM/I and similar satellite-borne microwave radiometers including SSMIS, AMSR, AMSR-E, WindSat, and TMI are released by Remote Sensing System (RSS).

The Global Positioning System (GPS) Radio Occultation (RO) is an active remote sensing technique, which is complementary with the passive microwave and infrared sounders and microwave imagers. Because GPS RO data are not sensitive to clouds and precipitation, GPS RO derived water vapour products are very useful to identify the possible TWP biases retrieved from measurements of passive microwave sounders and imagers under different meteorology (i.e., clear, cloudy, non-precipitation/cloudy and precipitation/cloudy) conditions. In this study, we compare atmospheric total precipitable water (TPW) derived from SSM/I (Special Sensor Microwave Imager) and SSMIS (Special Sensor Microwave Imager Sounder) radiometers and WindSat to collocated TPW estimates derived from COSMIC (Constellation System for Meteorology, Ionosphere and Climate) radio occultation (RO) under clear and cloudy conditions over the oceans from June 2006 to December 2013. Results show that the mean microwave (MW) radiometer - COSMIC TPW differences range from 0.06-0.18 mm for clear skies, 0.79-0.96 mm for cloudy skies, 0.46-0.49 mm for cloudy but non-precipitation conditions, and 1.64-1.88 mm for precipitation conditions. Because RO measurements are not significantly affected by clouds and precipitation, the biases mainly result from MW retrieval uncertainties under cloudy and precipitating conditions. All COSMIC and MW radiometers detect a positive TPW trend over these eight years. The trend using all COSMIC observations collocated with MW pixels is 1.79 mm/decade, with a 95% confidence interval of (0.96, 2.63), which is in close agreement with the trend estimated by all MW observations (1.78 mm/decade with a 95% confidence interval of 0.94, 2.62). These two trends from independent observations are larger than previous estimates and are a strong indication of the positive water vapor-temperature feedback in a warming planet.

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