The atmospheric precipitable water (PW) derived from measurements of ground based Global Navigation Satellite Systems (GNSS) are especially useful for climate studies because of its continuous sampling, high accuracy, and long-term stability. The long-term stability of raw GNSS measurements and SI traceability make it appealing for climate monitoring. The GNSS PW data have also been used for other climate studies, including validating radiosonde, satellite and reanalysis data, studying PW diurnal variations, and documenting the current state of climate.

In this talk, we will show several applications of NCAR global, 2-hourly, GNSS-derived PW dataset related to climate. First, the GNSS-PW data are used to quantify systematic errors in global radiosonde humidity data and assist homogenization of long-term radiosonde records. Second, the dataset has been used to document PW variability in 2008-2010 as part of “State of the Climate”. There is general agreement in annual PW anomalies between the GNSS and microwave satellite data at locations where overlaps occur. The GNSS PW data were also capable of capturing PW inter-annual variability, such as the dramatic moistening of the Tropical Pacific in 2009 as the climate system shifted from strong La Niña in 2008 to moderate El Niño by the end of 2009. Third, we will present the 14-year (1997-2010) PW trend at ~70 GNSS stations where continuous data are available. Finally, some future opportunities and challenges in using GNSS for climate studies will be presented.