Dong
Wu
NASA Goddard Space Flight Center
Jie Gong, USRA/GSFC
Oral
GNSS-RO signals are strongly impacted by sharp moisture layers in the lower troposphere with amplitude (signal-to-noise ratio, SNR) fluctuating significantly at the straight-line height (HSL) below -80 km. There is still a lack of understanding about the presence of GNSS-RO SNRs at these deep HSL and how they are related to atmospheric planetary boundary layer (PBL) moisture and dynamics. In this study we analyze the monthly SNR climatology from COSMIC-1 observations with careful treatment of receiver noise, received transmitter power, and receiver orbital altitude. We find that the normalized signal amplitude at HSL= -100 km, or SNR/SNR0 (where SNR0 is the receiver power in the free atmosphere), is proportional to specific humidity at ~950 hPa (~400 m) in the marine PBL, when compared the ERA5 analysis data. The good correlation is particularly significant in the tropics and subtropics where specific humidity is greater than 4 g/kg. We attribute these deep refraction signals to the PBL moisture layer that has relatively uniform distribution over a horizontally-stratiform and dynamically-quiet domain. These layers can often be found over marine PBLs. The deep refraction SNR tends to be lower in other situations such as the rugged terrains where the height standard deviation is >30 m over 200 km or the dynamically-disturbed PBLs where a strong vertical motion is present. In these cases, the coherence in RO refraction is relatively poor along the signal path, which prevent a constructive signal from reaching the receiver at a deep occultation height. While the preliminary results are encouraging, the use of GNSS-RO SNR to infer regional/global PBL water vapor abundance requires more dedicated studies.
Presentation file
[wu-gnss-presentation.pdf]
[Download to PDF]