GNSS Reflectometry Data Assimilation into Severe Weather Predictions

Although current meteorological approaches are reasonably able to predict the location, extend and intensify of storms, they dramatically fail to resolve the fast storm growth evolutions in severe weather events. The Numerical Weather Prediction (NWP) models are evaluated poor in predicting these phenomena in the first few hours of model integration. This fact is caused by the lack of high-resolution observational data in the current operational Data Assimilation (DA) systems. In addition, deficiencies in the collection and assimilation of real-time inner core data is the main factor for the slow pace of improvement in intensity forecasts. The lack of data from inner core of hurricanes is due to the heavy clouds and intense precipitations during storms which cause rejection of satellite observational data during the quality control procedures.

Accordingly, newly emerged Global Navigation Satellite System Reflectometry (GNSS-R), can be the solution of the problem due to its promising characteristics, including high transmissivity and the ability to retrieve the wind velocity for strong rain and measuring at up to 30 locations in parallel. It is demonstrated that satellite wind data have a significant impact on the prediction of storms whereas the influence of the very promising GNSSR data is not yet investigated. This technique can be structurally able to provide the unaffected required data in the presence of cloud and rain while most of current DA systems only assimilate the clear-sky radiances.

According to the briefly noted potential of GNSS-R in storm scale NWP and emergence of GNSS-R satellite constellations producing a huger source of data, i.e. the eight-satellite GNSS-R mission CYGNSS (Cyclone Global Navigation Satellite System, launch: 19 December, 2016), significance of a research studying assimilation of this data is clearly sensed. Hence this research addresses retrieval of wind information by GNSS-R techniques. The errors will be characterized which will enable us for more accurate wind data retrievals. This can result in resolving and accurately predicting atmospheric events on storm scales. In addition, we will evaluate GNSS-R data assimilation effects on storm predictions. These investigations is started by studying TechDemoSat-1 (TDS-1) GNSS-R based wind data. CYGNSS data are expected to be available on these days. This will allow the continuation of the study with a huge set of GNSS-R observation data.