During the last decade GNSS based atmospheric/ionospheric sounding was established as a powerful remote sensing technique with a large variety of applications in weather forecast, atmospheric and climate research and also for ionosphere and space weather related investigations. Atmospheric information, as, e.g., vertical profiles of refractivity, temperature, water vapor and electron density can be derived from space based techniques. Ground based measurements, provided by global and regional networks, allow for the derivation of vertically or along the line-of-sight (slant) integrated water vapour (IWV) or electron density (Total Electron Content) content.

We focus in more detail to recent activities related to the space based GNSS radio occultation (RO) at the German Research Center for Geosciences GFZ. The institute is responsible for the operational processing of GRACE-A, TerraSAR-X and TanDEM-X GPS RO data and involved in the data analysis of international missions, as, e.g., COSMIC and Metop. At GFZ also several applications of RO data are focussed, e.g., investigations related to climatological variations of atmospheric parameters.

GFZ is also involved in several activities related to new satellite missions with the application of the RO technique. We briefly review activities related to RO related small satellite studies, the status of GRACE-FO (Follow-on) and a recently successful proposal for GNSS based remote sensing at the International Space Station (ISS).

Inherent part of these activities is GNSS reflectometry/scatterometry for remote sensing of water and ice surfaces, which is regarded as complementary and inherent add-on to future GNSS-RO missions. In that context also recent reflectometry results (ground and airborne) at GFZ are briefly reviewed.