Troposphere delays from ground-based GNSS-R - self-calibration and new possibilites for atmosphere research

Thomas Hobiger, Joakim Strandberg, and Rüdiger Haas

Department of Earth and Space Science, Chalmers University of Technology, Sweden (thomas.hobiger@chalmers.se)

Ground-based GNSS reflectometry (GNSS-R) has been proven to be a useful tool for a variety of geophysical applications. In particular, the fact that in most cases existing GNSS sites can be used for reflectometry purposes makes this concept very appealing. Successful ground-based GNSS-R applications include sea-level monitoring, soil moisture , snow or vegetation. By a recent approach by Strandberg et al. (2016) it was demonstrated that it is feasible to carry out rigorous inverse modeling of signal to noise ratio (SNR) data in order to improve the retrieved parameters concerning accuracy and precision.

Based on the concept of inverse modelling, as we discuss in this paper, it can be shown that it is possible to account for troposphere delays by means of self-calibration which means that target parameters will not be biased by un-modeled atmosphere excess path delays. This implies that also troposphere delay information can be deduced from the SNR pattern that is related to multi-path interference. Thus, we can access troposphere information related to domains which are below the antenna and laterally offset and thus are not sensed with classical GNSS applications. In order to motivate this new concept, we will discuss the idea of troposphere self-calibration in GNSS-R processing and demonstrate the effectiveness of this approach concerning accuracy and precision of the target parameters. It will be shown how troposphere contributions need to be considered in inverse modeling and a thorough interpretation of the obtained troposphere parameters will be given. We will also provide an outlook concerning the question how and to which extent ground-based GNSS-R observations could contribute to atmosphere research and which novel applications could emerge.