



GNSS-based remote sensing: Innovative observation of key hydrological parameters in the Central Andes

Nikolaos Antonoglou^{1,2}, Bodo Bookhagen¹, Danilo Dadamia³, Alejandro de la Torre⁴, and Jens Wickert^{2,5}

¹Institute of Geosciences, University of Potsdam, Potsdam, Germany (antonogl@gfz-potsdam.de)

²German Research Centre for Geosciences GFZ, Potsdam, Germany

³Comision Nacional de Actividades Espaciales, Buenos Aires, Argentina

⁴Facultad de Ingenieria, Universidad Austral, Buenos Aires, Argentina

⁵Institute of Geodesy and Geoinformation Science, Technische Universität Berlin, Berlin, Germany

The Central Andes are characterized by a steep climatic and environmental gradient with large spatial and temporal variations of associated hydrological parameters. In this region, important hydrological components are integrated water vapor (IWV) and soil moisture. Both parameters can be monitored in parallel by using Global Navigation Satellite System - Reflectometry (GNSS-R) techniques. Soil moisture can furthermore be estimated using Synthetic Aperture Radar (SAR) data.

As part of International Research Training Group-StRATEGy project, our research aims at monitoring IWV and soil moisture with new station data in the Central Andes. According to the needs of the research, four independent GNSS ground stations and in-situ soil-moisture sensors were installed in spring 2019. Each station is located at different altitude along the climatic gradient and contains various quality GNSS receivers. It has been shown that high-quality receivers provide precise measurements, while low-quality receivers have not been widely tested for these applications. A goal of this project is the direct comparison of data quality from each site and receiver type. Additionally, soil moisture sensors were installed at each site. This set-up will help to evaluate the quality of the GNSS receivers. Moreover, the GNSS-based remote sensing approaches are directly compared to traditional Time-Domain Reflectometry (TDR) techniques. Meteorological data are used for studying the relation between the magnitude of precipitation events and soil moisture, as well as the time needed to spot a significant change in soil moisture after a precipitation event.

GNSS-R soil moisture estimations and in-situ measurements were compared with estimations derived from SAR data. More specifically, we used data from Sentinel-1 and Satélite Argentino de Observación COnd Microondas (SAOCOM) missions. Sentinel-1 is a fully operational mission that uses C-band wavelengths, while SAOCOM relies on L-band wavelength, but is still in a calibration phase. We analyze both wavelengths and estimate the potential for soil-moisture measurements in the Argentinean Andes.

