Variability of Precipitable Water in the Northern Chile observed by GPS and MODIS: Implications for SAR Ground deformation measurements

D. Remy (1), M. Falvey (2), J.L Froger (3), S. Bonvalot (1), G. Gabalda (1)

(1) Institut de Recherche pour le Développement (IRD) - UR154 - UMR5563 (LMTG) - UPS-CNRS-IRD, Obs. Midi-Pyrénées - 14, av. E. Belin, 31400 Toulouse, France, (2) Departamento de Meteorología, Facultad de Ciencias Físicas y Matemáticas, Universidad de Chile - Plaza Ercilla 803, Santiago, Chile, (3) UMR6524 (LMV) -UBP-CNRS-IRD, Obs. de Physique du Globe de

Numerous studies have demonstrated the potential of synthetic aperture radar interferometry (InSAR) for giving high accuracy surface displacement measurements related to volcanic or tectonic activity in northern Chile. The unique, hyper-arid climate of this region makes it an ideal setting for application of such a technique because surface features change little between images acquisitions. The same fact might inspire some to suggest that the errors introduced by water vapour delay are of minor importance in this arid area. However, despite the fact that rainfall has never been recorded in some parts of this arid area, water vapour is abundant in the atmosphere and exhibits a high spatio-temporal variability. The large topographic gradient of the region mean that even small changes in the vertical stratification of water vapour may lead to significant atmospheric noise in SAR interferograms. Thus, the reliable application of SAR interferometry requires that the atmospheric water vapour be taken into account in the northern Chile as in other geographical settings. The relatively recent advent of satellite based solar spectrometers providing high resolution spatial imagery of Precipitable Water Vapour has given to the SAR community a powerful new mean to mitigate the effects of atmospheric errors.

In this short contribution, we investigate the potential of MODIS PWV data in SAR application in northern Chile. First, we compare the MODIS data with GPS estimates of PWV from eight semi-permanent GPS stations situated at various locations in the study area and encompassing a range of altitudes from near sea level to 3800 m. Next, we quantify the tropospheric contribution from MODIS PWV data in ENVISAT data over an active volcanic area (Lastarria-Cordon del Azufre) and over an active tectonic area (Tarapaca, Earthquake, 7.8 M). In both case MODIS PWV data significantly reduce water vapour effect on interferogram.