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Impact of atmospheric effects on PSInSAR results

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Results obtained during the last 7 years at TRE by processing more than 12,000 SAR scenes acquired by different sensors (JERS, ERS, Envisat and Radarsat) clearly show how multi-temporal data-sets can be successfully exploited for terrain monitoring, by identifying, within the area of interest, coherent radar targets (the so-called Permanent Scatterers – PS) where very precise range measurements can be carried out. Apart from phase-unwrapping, a key task to be performed is an effective removal of the atmospheric disturbances (usually referred to as the Atmospheric Phase Screen – APS) superimposed on each radar acquisition. These signals are mostly due to spatial heterogeneity of the wet component of atmospheric refractivity, impacting on the radar signal propagation through the troposphere. Lately there has been a growing interest within the geophysical community for the design of filtering procedures based on GPS observations or other information (e.g. MERIS images, meteo data, etc.). Unfortunately, prior or auxiliary information is available only very rarely and the exploitation of multi-interferogram strategies is still the most widely applied approach to mitigate the impact of APS on the deformation signal. In general, in order to design an optimum filtering procedure for APS, a statistical characterization of this signal is mandatory. In this paper, we report on the latest results obtained from a statistical analysis of many interferometric data-stacks (hundreds of SAR scenes) acquired over Italy by the Canadian satellite RADARSAT and the ESA-ENVISAT ASAR sensor. Key questions that will be addressed in the paper are the following: (1) is it possible to improve PS results by better estimating the APS? (2) How can we characterize the APS? (3) What is the impact of the local topography? (4) What about the impact of atmospheric leakage on the final results?