Processing of SAR Interferograms by Independent Component Analysis

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In repeated pass interferometry, the total phase shifts measured in SAR interferograms are given by the sum of single contributions driven by sources of different nature. Generally, the major sources are: the ground topography (in the sense of the relative altitude among pixels of the same interferometric image), the terrain displacements in the direction along the line of sight and the phase differences between the sounding signal delays driven by the atmosphere at the two different acquisition times of the SAR images of the interferometric couple. Except special cases of flat terrain and uniform atmosphere above the considered region, the separation of these components is not always possible. In particular, in cases of mountainous areas the temperature and humidity of the atmosphere can vary significantly, with spatial scales included in the same image. Therefore the atmospheric correction computed for pixels above the permanent scatters may be not valid for farther pixels, which represent the region of maximum interests for satellite observations because these are not regularly monitored on the ground. For these reasons, the possible application of blind source separation techniques has been considered. In particular, the independent component analysis (ICA) is applied, based on the fact that the sources of interferometric phase shift, mentioned above, can be considered statistically independent. Results obtained on simulated data are presented to illustrate how precise can be the correspondence between the original and the estimated phase-shift components. Some applications on real data are shown for the ERS-1/ERS-2 observations of a mountainous region on Appennini mountains around Benevento city, southern Italy.