AIRBORNE DInSAR TIME SERIES AT X-BAND

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Differential SAR Interferometry (DInSAR) today makes it possible to carry out very accurate monitoring of ground deformation by means of repeat-pass satellite SAR data [1]. This is due to the stability of the orbits covered by satellites, which allows generating in a (computationally) efficient way well phase calibrated focused images [2] suitable for interferometric applications.

Recent DInSAR algorithms [3], [4] are able to properly combine multi-pass data in order to detect and follow the temporal evolution of ground deformation via the generation of spatially dense time series.

Notwithstanding, the use of satellite SAR sensors implies also some limitations to the flexible exploitation of the DInSAR technique. First of all, the time elapsing between subsequent satellite SAR acquisitions relevant to the same region cannot be freely changed according to the needs. This fact poses a limitation in case of emergency: even for the new generation satellite SAR sensors daily or hourly interferometric acquisition is an impossible task. Moreover, satellite orbits do not allow monitoring ground deformation components in North-South direction. All above limitations, basically related to the characteristics of the orbits covered by SAR satellite sensors, may be overcome by employing airborne SAR sensors.

Unfortunately, differently from the satellite case, interferometric processing of repeat pass airborne SAR data is in general a much harder task, due to the presence of the so-called motion residual errors [5], [6] which commonly impair the accuracy of airborne focused SAR data. It is worth underlining that such residual errors are critical in repeat-pass interferometry because they are different in the two interferometric channels; accordingly they do not tend to cancel each other during the pair beating as it happens for the single pass case thus impairing the quality of the final interferogram [5]. Use of proper solutions aimed at limiting [7],[8] or estimating [9],[10] such aberrations affecting airborne repeat pass interferograms is thus needed. Applications of these solutions allowed to obtain in the last years accurate airborne DInSAR interferograms [8], [11], [12] at different wavelengths and, more recently, to generate airborne C/L-Band DInSAR time series [12].

In this work we present airborne X-Band DInSAR time series.

It must be noted that in this case residual errors are more critical if compared to the wavelength; nevertheless, accurate X-Band airborne repeat-pass interferograms have been achieved in [8], where the results of an experiment carried out over the Perugia area, center of Italy, by using the X-Band OrbiSAR system are shown. In particular, in [8] it is performed the analysis of several DInSAR interferograms relevant to a region 2 Km (in azimuth) by 4 Km (in range), and the accuracy of such interferograms is also validated by means of measurements carried out on corner reflectors. In this paper we present further investigations of the results presented in [8]. More specifically, we first of all perform an analysis of DInSAR interferograms for tracks longer than those considered in [8]. Then, we apply to the achieved interferograms the technique in [4], properly tailored for the airborne case. This allows generating airborne X-Band DInSAR time series relevant to a region 16 Km (in azimuth) by 4 Km (in range). The analysis of the achieved accuracy is finally included.

Keywords: SAR Differential Interferometry; DInSAR time series; Airborne DInSAR.

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