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Topic: 4 Polarimetry

Time and wavelength impact on SAR coherence: preliminary analyses

The coherence of SAR interferometric images is limited by the ever changing landscape of our solid earth, the more, the higher the central frequency. Permanent Scatterers techniques give the possibility of practically removing disturbing effects like atmospheric phase screen and satellite jitter. Thus, a quantitative analysis is possible of temporal decorrelation of Differential SAR Interferometry data intended for surface deformation monitoring. An analysis is presented of two C band ERS data-sets, namely 26 scenes acquired over Rome. One (C3) is taken with a 3-day repeat cycle (Second Ice Phase 1993-1994) while the second (C35) spans a 5-year temporal window (1995-2000) mimicking the same normal baseline distribution. The PS density is obviously much higher in C3 than in C35. Then, to evaluate the effects of a longer wavelength, interferometry in L band is studied using 44 days repeat cycle data (L44) taken by the Japanese satellite JERS on the Noubhi area, in Japan. Proper processing makes it possible the identification of Permanent Scatterers in urban and semi urban areas, with very high density (up to 150/km2) and coherence up to .9 over several years. As indicated by simple theoretical considerations, similarities are found between L44 and C3 results, with the ratio of repeat cycles approximately correspondent to that of the wavelengths squared. The longer wavelength appears to correspond to a longer decay time of the temporal coherence. The higher average coherence allows to combine the phase information of many points, and thus partially reduce the effects of the higher geometric dispersion of the differential interferometry outcomes due to the longer wavelength.
Thus L and C band surveys could have complementary applications since in rural areas many more PS can be retrieved in L than in C band, whereas the accuracy of measurements in C band is 4 times higher than in L band. Furthermore, as indicated by the SRTM results, also X band surveys could be exploited for the design of a global monitoring system, if characterized by short revisiting times or aimed at very stable targets.
These considerations might be useful for the selection of optimum frequencies and revisiting times for future SAR missions, to extend in the years to come the astounding albeit serendipitous results of C band interferometry. A few years overlap with the more than decadal C band surveys should anyway be provided, to be able to interweave the interferometric archives.