An Interferometric Synthetic Aperture Radar Simulation for Urban Areas

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Interpretation of the Interferometric Synthetic Aperture Radar (IFSAR) measurements over urban areas are complicated due to the complex interaction of the radar signal with the urban environment. The returned radar signal from an urban environment is, in general, a coherent sum of a direct returned signal plus signals which have gone under a number of reflections. The accuracy of height measurements from interferometric measuremnets is affected as a result of multiple scattering. Furthermore, shadowing and overlay effects introduce additional inaccuracies in the computed height profiles. In this talk the simulation results for IFSAR over urban areas are presented, and compared with measurements, The simulation is carried out in two steps, First the forwad scattering data is synthsized using a three dimensional scattering model based on Geometrical Optics (GO). The urban profile is represented by a facet based model, and a forward ray tracing algorithm is used to provide efficient computation of multiple paths for arbitrary geometrical arrangements. The second step is to invert the generated data for a high resolution image of the the urban scene. A conventional range-Azimuth algorithm is used to produce a complex (magnitude, phase) image of the scene. An estimate of the height profile is then computed from two complex images derived from two synthesized receivers displaced in the range direction by a baseline length, The relative phase difference between the complex images is used to locate the position of the dominant scattering center for each resolution cell on the scene. It is of interest to characterize the multiple scattering and shadowing effects in the derived height profile. Multiple scattering in the range direction, in general, displaces the scattering center position due to the increase in the effective path lenght of the contributing signal, In this presentation a number of geometrical configurations which produce single and multiple scattering, layover, and shadowing effects are considered. The derived height accuracy as a function of radar parameters, angle of incidence, and the height profile will be disccused. The simulated results will be compared with the IFSAR measurements over a selected number of urban areas.