THE RELATIONSHIP BETWEEN RADAR POLARIMETRIC AND INTERFEROMETRIC PHASE

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Generally, the polarimetric phase difference between the VV and HH channels is interpreted in terms of the spatial difference between the HH and VV scattering centers. In the case of interferometry, the phase difference at a particular polarization combination is usually interpreted as a three-dimensional position of a scattering center, allowing one to reconstruct the topography of the scene.

Recent results from polarimetric radar interferometers suggest that a slightly different phase value is measured when different polarizations are used at each end of the interferometric baseline. If this interferometric phase difference is indeed interpreted in the same way as the traditional interferometric phase, it suggests that a slightly different elevation would be measured at each polarization, leading to the idea that polarimetric interferometry could provide information about the vertical structure of vegetation.

We have analyzed data sets acquired with both a single pass interferometer (NASA/JPL TOPSAR operated in polarimetric mode) as well as data acquired with repeat-pass interferometry from SIR-C operated in the fully polarimetric mode. The data from SIR-C are particularly interesting in that we have analyzed data sets over the same area, Mahantango, Pennsylvania, that were acquired with different baseline lengths. The startling result from this data set is that the differential polarimetric interferometric phase is the same for the different baseline lengths! This suggests that a different interpretation may be required to explain this differential interferometric phase, especially if one wants to translate this phase difference into a physical separation of scattering centers.

This paper examines the relationship between the phase measured by a radar polarimeter and a radar interferometer. In particular, we attempt to explain the result observed with the SIR-C Mahantango data set, and suggest an interpretation that allows one to translate polarimetric differential interferometric phase into a physical separation of scattering centers.

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