Method for Measuring Two-Dimensional Velocities of Moving-Targets Using ATI and MAI inteferometries

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Albeit an along-track synthetic aperture radar interferometric (ATI) technique capability has been demonstrated for measuring the velocities of moving objects, but is limited to measurement of velocities along the radar line-of-sight (LOS) direction. It is difficult to determine two-dimensional (2D) surface velocities of moving objects from ATI data, because SAR satellites have near-polar orbits (i.e., approximately N-S ground tracks and E-W look directions).

Recently, Bechor and Zebker [1] developed a multiple aperture SAR interferometry (MAI) technique that introduced a remarkable improvement in measuring along-track deformation than the pixel offset tracking method. An MAI interferogram is created by the forward- and backward-looking interferograms using sub-aperture InSAR processing. Jung et al. [2] proposed an improvement to MAI processing, designed for enhancing coherence and correcting the phase contributions from the flat Earth and topographic effects caused by the difference between the perpendicular baselines of the forward- and backward-looking interferograms. And Jung et al. [3] also measured 3D surface deformation by integrating the improved MAI technique [2] and conventional InSAR using one (or more) descending and one (or more) ascending interferogram pairs.

This MAI technique can be used for measuring along-track velocities of moving objects, if two satellites move along the circular orbit with short time interval such as TanDEM-X. ATI and MAI SAR pairs for six moving targets were simulated using TanDEM-X system parameters, and it was validated that the measurement of 2D velocities for moving targets can be achieved by combination of ATI and MAI pairs.

[1] N. B. D. Bechor and H. A. Zebker, 2006, Measuring two-dimensional movements using a single InSAR pair, *Geophys. Res. Lett.*, **33(16)**, p. L16311, doi:10.1029/2006GL026883.

[2] H.-S. Jung, J.-S. Won, and S.-W. Kim, 2009, An improvement of the performance of multiple-aperture SAR interferometry (MAI), *IEEE Trans. Geosci. Remote Sens.*, **47(8)**, pp.

2859-2869.

[3] H.-S. Jung, Z. Lu, J.-S. Won, M. P. Poland, and A. Miklius, 2009, Mapping three-dimensional surface deformation by combining multiple aperture interferometry and conventional interferometry: application to the June 2007 eruption at the Kilauea volcano, Hawaii, *IEEE Trans. Geosci. Remote Sens.Lett.*, in review.