MISSION DESIGN AND PERFORMANCE FOR SYSTEMATIC DEFORMATION MEASUREMENTS WITH A SPACEBORNE SAR SYSTEM

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1. INTRODUCTION

At DLR we are currently carrying out preliminary studies for an L-band SAR satellite mission called Tandem-L. This contribution illustrates some results obtained by integrating a performance analysis tool for d-InSAR applications into a mission simulator.

The Tandem-L SAR mission will measure and monitor over time a variety of parameters ranging from surface deformation (d-InSAR) to forest height and structure (Multi-baseline pol-InSAR), ice flows, ocean currents etc.

The current study is oriented towards the development of a systematic and extensive acquisition plan over the areas of interest for the different applications. Such an acquisition strategy is driven by the desire to give complete and consistent snapshots of a variety of dynamical processes taking place on Earth.

2. PERFORMANCE ANALYSIS FOR MISSION DESIGN

Given the variety of applications, the mentioned desired acquisition policy and the wide regions of interest, it is clear that the mission design faces a number of challenges in the allocation of system resources such as data volume and acquisition opportunities. Besides this we have to consider geographical conflicts between the various applications (e.g. seismic areas covered by forests).

In order to optimize the resource allocation we have developed for each application a performance model. We want to have predictions about the quality of intermediate and final products based on an acquisition scenario and instrument performance.

For the d-InSAR applications we based our performance analysis for image stacks on the hybrid Cramér-Rao bound [1] (single line of sight) and using well know formulas for the optimum linear combination of measurements for the multi-dimensional case (3D and 2D vector displacements).

3. MISSION SIMULATOR

These performance predictions are integrated into a mission simulator that can provide parameters for each available acquisition on a given point on the earth. Besides the acquisition dates the simulator outputs geometrical information such as look directions, incidence angles, baselines, resolution, plus NESZ and ambiguity level. All these parameters are inputs for the d-InSAR performance module.

The advantage of using such a simulator is that conflicts between different requirements are taken into account and the impact on the performance can be the immediately quantified.

We present simulation results of d-InSAR performance that we will use to guide us in the mission scenario development and integration.

[1] A. Monti Guarnieri, S. Tebaldini, "Hybrid Cramér-Rao Bounds for Crustal Displacement Field Estimators in SAR Interferometry," *IEEE Signal Processing Letters*, 2007