

The Use Of Polarimetric And Interferometric SAR Data In Floodplain Mapping

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The human and economic impact of flooding in both inland and coastal lowlands is enormous. Inland riverine watersheds are subject to episodic rainfall events, while low relief coastal watersheds are prone to flooding from both uplands and from the sea. Hydrologic models can be used to predict the occurrence of flooding provided that the required input fields are accurately described. Of these inputs, some of the most important include an accurate description of the topography of the floodplain, as well as the state of soil moisture and vegetation cover.

Floodplains, both riverine and coastal, present some of the most difficult challenges to remote sensing instruments. First, the topography is usually characterized by exceedingly small relief, so that systematic errors in the remote sensing data can easily be of the same magnitude as the actual topography. Second, floodplains usually contain significant amounts of vegetation, and it is the topography of the underlying surface that is important to the modeling of the hydrologic process.

Recent advances in polarimetric SAR show promise for augmenting the capability of traditional interferometric SAR and laser altimetry. In particular, a polarimetric topography technique provides useful slope information, and polarimetric interferometry may be used to decompose the topographic response into vegetation and ground surface contributions. All of these sources of remotely sensed topography, land cover characterization, and even soil moisture provide valuable information for hydrologic mapping for flood prediction and management. Unfortunately, currently available analysis techniques are typically applied to individual data sources, and the information is later integrated subjectively. This paper describes results of a study to develop a methodology which is capable of jointly and objectively extracting and using information from a suite of data types in mapping terrestrial features over extensive areas. We discuss an integrated approach that utilizes the combined capability of regular (single channel) interferometry, polarimetric interferometry and polarimetric topographic mapping for topographic mapping of flood-prone areas. Additionally, polarimetric SAR data are used to provide soil moisture and land cover characterization inputs from the same remotely sensed data. Results are illustrated using data acquired with the NASA/JPL AIRSAR and TOPSAR system.

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