IGARSS-09, Invited Session 20-64 (ID #34, 2nd ID #569), SAR Polarimetry: Theory and Applications"

Invited Paper 20-64.1

Recent Advances in Microwave Multi-modal (Polarimetric and Interferometric) SAR Remote Sensing of the Terrestrial Covers

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Abstract

Land cover monitoring is one of the most potential applications of Polarimetric Synthetic Aperture Radar (POLSAR) sensing and so is Repeat-Pass Polarimetric-Interferometric SAR (RP-DIFF-POL-IN-SAR) stress-change assessment by air/high-altitude/space-borne SAR sensor deployment. Provided fully polarimetric SAR information can be made available, a plethora of novel POLSAR matrix decomposition methods can be implemented for recovering rather precise scattering contributions from isolated and distributed scattering scenarios, and so can rather exact environmental changes from consecutive repeat-pass observations at 1 m resolution from air and from space. With the recent launches of the fully polarimetric satellites JAXA-ALOS (PAL-SAR-L-Band), the DLR TerraSAR-X (X-Band) and of RADASAT-2 (C-Band), a new era in space imaging of the terrestrial terrain and ocean surfaces has arrived providing unforeseen advantages.

Whereas in the past, POLSAR applications were focused mainly on information product gathering for agriculture, forestry and the fisheries, little emphasis was placed on demonstrating its full capacity also for the assessment of natural habitats and especially wetlands and desert regions. Specifically, we are now able to demonstrate how seasonal changes and features of vegetation in natural habitats, shallow vegetated lakes and wetlands & deserts can be recovered under worst weather conditions and at day and during night at most distant and often inaccessible hidden sites, where for example migrant birds rest.

Land cover monitoring is one of the most potential applications of Polarimetric Synthetic Aperture Radar (POLSAR) sensing and so is Repeat-Pass Polarimetric-Interferometric SAR (RP-DIFF-POL-IN-SAR) stress-change assessment by air/high-altitude/space-borne SAR sensor deployment. Provided fully polarimetric SAR information can be made available, a plethora of novel POLSAR matrix decomposition methods can be implemented for recovering rather precise scattering contributions from isolated and distributed scattering scenarios, and so can rather exact environmental changes from consecutive repeat-pass observations at 1 m resolution from air and from space. It is essential to emphasize that fully polarimetric SAR image data sets are strictly required for optimal information extraction, and compacted or hybrid quasi-polarimetric SAR imaging will fail to discover intricate detailed feature characteristics and parameters.