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Recent Advances of POL-SAR, POL-IN-SAR & RP-POL-IN-SAR imagery for Remote Sensing of Wet and Arid Vegetated Regions

Wolfgang-Martin Boerner, Professor Emeritus
UIC-ECE/CSN, m/c 154, 900 W. Taylor St., SEL-4210 , Chicago, IL/USA-1-312-9965
T: + [1] (312) 996-5480, E-mail: wmb1uic@yahoo.com

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 for 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.

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 (L-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 deserts & wetlands.

Therefore, it is essential to demonstrate how seasonal changes and features of vegetation in natural habitats, shallow vegetated lakes and wetlands can be recovered, provided fully polarimetric SAR image data takes can be made available for full polarimetric scattering matrix acquisition for which the standard symmetry condition HV=VH may not necessarily be sufficient.

Land cover monitoring is one of the most important applications of Polarimetric Synthetic Aperture Radar (POLSAR) sensing. Decomposition of polarimetric scattering matrices acquired by the POLSAR imaging system can provide the contribution of scattering mechanisms and extract environmental changes by comparing data sets of consecutive seasonal observations. Based on the

second order statistics of the scattering matrix, various decomposition techniques have been proposed. We focus our attention at the scattering power decomposition methods, which deal with the reflection symmetric case $\langle S_{HH} S_{HV}^* \rangle \approx \langle S_{VV} S_{HV}^* \rangle \approx 0$, and the general scattering case $\langle S_{HH} S_{HV}^* \rangle \neq 0$ and $\langle S_{VV} S_{HV}^* \rangle \neq 0$. This approach has advantages such that the decomposed power can be expressed in terms of scattering elements directly, which is, in turn, suitable for direct physical interpretation of data as related to pertinent scattering phenomena, and for uncomplicated computation and easy implementation.