

A Fully Polari metric SAR Imagery Classification Scheme for Mud and Sand Flats in Intertidal Zones

Abstract:

Sediments on exposed intertidal flats are very dynamic and perform vital ecosystem functions. This paper proposes a new classification scheme for mud and sand flats on intertidal flats using fully polarimetric synthetic aperture radar (SAR) data. Freeman-Durden (FD) and Cloude-Pottier (CP) polarimetric decomposition components as well as double bounce eigenvalue relative difference (DERD) are introduced into the feature sets instead of the original intensity polarimetric channels. Classification is carried out using the random forest (RF) theory, and the results are evaluated using confusion matrices, kappa coefficients, and RF variable importance indices. Three study sites with different environmental conditions are chosen to demonstrate the effectiveness of the proposed classification chain. To further assess the performance of the proposed feature set, we set different feature combinations and process with the same processing chain. Results show that the DERD parameter can detail the sediment mappings on exposed intertidal flats and is a useful SAR feature to distinguish mud and sand flats efficiently. The combined FD and CP components have the ability to describe the polarimetric characteristics of sediments more correctly than the commonly used original intensity channels. Meanwhile, the RF theory shows great potential in distinguishing sediments in intertidal zones accurately and time efficiently.