ABSTRACT

RADARSAT-2 quad polarized imagery (FQ15) was acquired over a controlled oil-on-water exercise in June 2011. During the exercise, three types of oil were released: plant oil, oil emulsion, and crude oil. The Cloude-Pottier entropy was calculated from the 3x3 coherency matrix after the application of 5x5 Lee polarimetric filter. The entropy indicated discrimination between the three oil types and the ocean surface. The crude-oil entropy had the largest value, followed by emulsion, plant oil, and the ocean surface.

The RADARSAT Constellation Mission 30 m resolution mode was simulated using the CCMEO RCM CP simulator. The simulator formats the RADARSAT-2 quad-polarized data as a Kennaugh matrix and then a 7x7 filter was applied. From the Stokes vector, a number of compact polarimetry parameters were generated, based on the RCM circular transmit, linear receive configuration. The entropy from the ocean surface, plant oil, emulsion, and crude oil were compared to various compact polarimetry parameters. The parameters that had the best correlation with the entropy variability were the conformity, degree of polarization, and the correlation coefficient. When viewed as a pseudo-colour, there was a distinct difference between the ocean surface and the three oil types for each of the compact polarimetry parameters. The visual observations were verified quantitatively by digitizing the boundary of each oil type and calculating the average value for conformity, degree of polarization, and the correlation coefficient. An ocean surface sample was taken, but well removed from the oil slicks. The quantitative results agreed with the visual observation and were consistent with the results from the Cloude-Pottier entropy.

The initial results bode well for the application of compact polarimetry for not only oil slick detection, but oil slick characterization. Further, the RCM 30 m mode, although a coarser resolution with respect to the RADARSAT-2 quad-polarized mode and likely the RCM quad-polarized mode, has a swath-width that is slightly more than double the RADARSAT-2 Wide quad-polarized mode and approximately five times the current RCM quad-polarized mode swath-width, thus providing a reasonable balance between resolution and spatial coverage.