ID: 131
Poster presentation
Topics: Methods and Algorithms, Validation and Accuracy

Analysis of the Oil Seep-affected Sea Surface Microwave Backscattering

Horiya Khenouchi[1], Andrea Buono[2], Ferdinando Nunziata[2], Domenico Velotto[3], Maurizio Migliaccio[2], Youcef Smara[1]

[1]University of Sciences and Technology Houari Boumediene, Algiers, Algeria; [2]Università degli Studi di Napoli Parthenope, Italy; [3]Remote Sensing Technology Institute, German Aerospace Center (DLR), Germany

In this study, the sensitivity of environmental and sensor parameters that rule microwave backscattering of sea oil seeps is investigated by contrasting analytical models with actual satellite synthetic aperture radar (SAR) measurements. The topic that will be addressed is of paramount importance in many marine and maritime applications as remotely sensed oil seep observation, that is very interesting not only from a scientific point of view, but also from an economical and environmental perspectives being related to oil and gas exploration and extraction activities. Moreover, the problem of sea oil seep backscattering, i. e., the backscattering from reserves of hydrocarbons naturally coming up from the bottom of the ocean to sea surface, is rather challenging and needs further investigation since the processes that lie at the basis of the escape, the development and the lifespan of oil seeps are extremely variable and irregular. The latter result in a quite different backscattering modeling approach if compared to conventional scattering models that deal with sea surface backscattering with and without oil slicks. Hence, in this study, the two scale Boundary Perturbation Method (BPM) is adopted as a reference scattering model to predict sea surface backscattering and, then, the effects of the presence of the oil seep, that include damping properties, reduction of friction velocity and changes in the dielectric permittivity are taken into account. The firsts are considered including the rheological parameters of different kinds of surfactants, i. e., weak-damping biogenic films and strong-damping crude oil; the second is included by applying a penalty factor to slick-free sea surface friction velocity and the third is accounted for by modeling the heterogeneous oil seep according to the effective medium approximation theory, i. e., different kinds of mixture of seawater and oil droplets are considered. Then, the influence of all of those parameters to sea oil seep backscattering is evaluated for different SAR acquisition parameters, i. e., incident wavelength and angle of incidence, sea state conditions, i. e., wind speed, and surfactants' properties, i. e., damping and concentration. Preliminary results, obtained by contrasting model's predictions and actual backscattering SAR measurements collected at L-, C- and X-band over well-known sea oil seeps, demonstrated that wind speed, damping properties and incidence angles most affected the backscattering from sea oil seeps, while incident wavelength and the adopted oil/water mixture have a negligible impact on their backscattering.

Keywords: surface films, polarimetry, multi-frequency, ocean backscattering