A POLARIMETRIC SEA SURFACE BACKSCATTERING MODEL

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ABSTRACT

Two main considerations are at the base of the study here proposed. The first one is that radar polarimetry plays an important role in environmental remote sensing and parameters retrieval. As a matter of fact, the extra-information provided by the polarimetric Synthetic Aperture Radar (SAR), taking into account the vectorial nature of the scattered field, allow retaining all the information in the scattered wave and describing the polarimetric properties of the observed scene [1].
The second one concerns the scattering problem of electromagnetic waves from randomly rough surfaces. Although it has been an actual research topic over last decades, it is still not completely solved. However, for many practical applications, approximate solutions are sufficient. In the field of radar remote sensing, the small perturbation model (SPM) [2], [3], although valid only within a limited range of rough surface conditions, it is one of the classical and widely used approaches and the analytic conditions for its validity has been investigated in detail in several studies. A practical application in which the SPM model may be considered not-sufficient is the case of sea surface scattering. In fact, the cross-polarized backscattering, which can be not negligible in SAR marine scenes, is not described by the SPM. To overcome SPM drawbacks and, in particular, to take into account also cross-polarized backscattering, two-scale approaches have been proposed, which represent a good compromise between accuracy, practical implementation and interpretation issues. [2].
Dealing with polarimetry this means considering the whole scattering matrix (S) (i.e. full polarimetric measurements). To exploit fully the polarimetric information contained in S, a promising approach consists of analyzing the polarimetric coherency matrix (T) which contains the second-order moments of the scattering process. This approach has lead to the definition of an extended Bragg scattering model in terms of T which has been successfully used for the extraction of surface parameters such as soil moisture or roughness [3]-[4].
In this study, the use of the extended Bragg scattering model is proposed for the case of the sea surface. Moreover, the proposed model is considered to examine the scattering contributions from sea surface and detected dark areas due to the presence of anthropogenic and biogenic slicks [5]-[6].
Experiments, accomplished on SIR-C/X-SAR C-band Multi Look Complex (MLC) and on ALOS PALSAR L-band polarimetric SAR data, confirm the consistence of the proposed approach.

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