Curvature Effects in Ocean Surface Scattering

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Curvature effects in EM scattering from ocean surface are described using a generalized curvature expansion of the fields at an elevated non-perfect conducting surface.The new expansion formalism allows us to describe analytically and in general, without separating into different scales, the scattering of EM waves from an undulated ocean surface. The model is exact to first order in curvature for non-shadowing imaging geometry, and obeys the law of reciprocity and tilt invariance. Explicit expressions for EM fields at the surface, including both the projection and the self induced fields, are derived up to first order in surface curvature. Analytic closed form expressions for the scatter fields are derived from the surface field solutions, and applied to the case of backscattering, providing a general expression for the normalized radar cross section. The analytic expression for the normalized radar cross section is implemented for a linear Lagrangian surface model. The results show that the model is capable of describing the expected dependency on polarization, incidendence angle, and wind field with minimal restrictions in terms of range of validity. Comparison of polarization ratio shows good agreement between the model and measurements from the Envisat ASAR instrument.