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Observing the oceanic mesoscale processes with satellite altimetry: the state of the art and outlook

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Satellite altimetry has enabled the study of global oceanic mesoscale variability with increasing accuracy and resolution for the past three decades. The combination of the series of precision missions beginning with TOPEX/Poseidon and the series of missions beginning with ERS-1 has created a data record of sea surface height measurement from at least two simultaneously operating altimeters. This 19-year record has fundamentally expanded our knowledge about the dynamics of ocean circulation, in particular at the mesoscale. The progress made to date from the data record will be briefly reviewed, with emphasis on the remaining open questions.

Spectral analysis of the existing altimeter data suggests that the spatial resolution is about 150 km in wavelength in space-time gridded data, and about 70-100 km in along-track data. The unresolved short scales, however, have important roles in the energy balance of ocean dynamics as well as the transport and dissipation of many properties of the ocean such as heat and dissolved chemicals. The prospect of the technique of radar interferometry for making high-resolution wide-swath measurement of sea surface height will be discussed with an update on the development of the SWOT (Surface Water and Ocean Topography) Mission, which is being jointly developed by NASA and CNES with contributions from the Canadian Space Agency. SWOT is being designed for applications in both oceanography and land surface hydrology and setting a standard for the next-generation altimetry missions.