



# **Ocean Circulation and Climate: Chapter 4. Remote Sensing of the Global Ocean Circulation (International Geophysics)**

*Lee-Lueng Fu, Rosemary Morrow*

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The past decade has seen tremendous progress in the application of ocean remote sensing to the study of the global ocean circulation. This chapter provides a summary of the resultant advances in our understanding of the key processes of the ocean that affect climate variability. Many of the advances result from the combined usage of remote sensing from multiple types of measurement and in situ observations. Remotely sensed ocean variables include sea surface height, wind, temperature, salinity and color, as well as the variable mass of the ocean and ice from spaceborne measurement of the earth's gravity field. These observations have often been analyzed with various in situ observations, including moored buoys, hydrographic profiles, surface drifters, and Argo floats. The general circulation of the ocean as manifested by the ocean surface dynamic topography from satellite altimetry, and the geoid from satellite gravity measurements, can now be determined at scales approaching 100km. The information from surface drifters and Argo floats has added more details through the upper ocean depths. The large-scale changes of the ocean on decadal scales reveal complex geographic patterns in relation to the changes in the atmospheric forcing. The causes for the slow rise of the global mean sea level are diagnosed in terms of the steric and mass change of the ocean. The bottom pressure inferred from ocean mass change measured from space provides direct observation of the barotropic variability of the ocean. The detailed information of ocean surface wind measured from scatterometry and temperature from infrared and microwave radiometry reveals a positive correlation between the two, leading to new understanding of air-sea interactions at scales below 1000km. Data combined from multiple satellite altimeters through optimally designed processing have revolutionized the study of the global ocean mesoscale processes, revealing new information on the spectral transfer of energy and on global eddy propagation characteristics, which vary in relation to the mean circulation, bottom topography, and the nonlinearity of eddy dynamics. The gridded fields of remote sensing data have made satellite observations routinely accessible to general users for scientific and operational applications. The outlook for future development in ocean remote sensing is also discussed.

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