

Estimation of Air-Sea CO₂ Gas Exchange Coefficient in the North Pacific Using Satellite Data

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Abstract

The carbon dioxide (CO₂) flux estimation between the atmosphere and the ocean is very important in carbon cycling and climate change research. Generally the carbon dioxide flux is proportional to the difference of gas concentration (or partial pressure) and to the gas exchange coefficient. In this research, the CO₂ exchange coefficient is investigated based on whitecap model assuming that CO₂ transfer velocity is proportional to whitecap coverage, which is related to wind friction velocity. We estimate the gas exchange coefficient using the relationship between wind friction velocity and wave age. The gas exchange coefficient and its distribution, seasonal and annual variation in the North Pacific were estimated based on the modified whitecap model by using the observations of the scatterometer on the European Remote Sensing (ERS) satellites, the Special Sensor Microwave / Imager (SSM/I) on the operational spacecraft of the Defense Meteorological Space Program (DMSP) and the Advanced Very High Resolution Radiometer (AVHRR) on the National Oceanic and Atmospheric Administration satellites. The global mean CO₂ exchange coefficient is close to the result derived from ¹⁴C data and the global mean value has shown an increase trend during the period 1991 – 1992.