Oceanic whitecaps as progenitors of sea-spray aerosol: Measurements, variability and parameterizations

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The sea-spray source function currently used in climate models to estimate emissions of sea-spray aerosol is based on the relation between whitecap fraction, *W*, and wind speed, *U*. An account for dependences of *W* on environmental variables in addition to *U* has the potential to provide more realistic predictions of the sea-spray aerosol flux. Limitations of the existing database for oceanic whitecaps, based on photographic measurements of *W*, preclude investigations of the geophysical variability of whitecap fraction.

Within the framework of WindSat mission, Naval Research Laboratory has developed an alternative method of estimating whitecap fraction from satellite-based passive radiometric data. The algorithm relies on changes of ocean surface emissivity at microwave frequencies (6 to 37 GHz) due to presence of sea foam on a rough sea surface. The shortcomings of the feasibility-study algorithm were improved by usage of independent sources for the input variables of the algorithm; physically based models for the emissivity of rough sea surface and emissivity of foam; improved rain flag, and improved atmospheric model necessary for the atmospheric correction.

Estimates of whitecap fraction for one year (2006) were computed and used to characterize its geographical and seasonal variability. The *W* data were matched in time and space with data for wind speed and direction, sea surface temperature, air temperature, significant wave height, and peak wave period available either from satellites or global geophysical models. This database of *W* and additional meteorological and oceanographic data was used to investigate the geophysical variability of whitecaps.

The method of microwave remote sensing of whitecap fraction will be outlined; the first extensive database of whitecaps and other meteorological and oceanographic factors will be described; results on whitecap fraction spatial and temporal features over the globe and the relative importance, in different geographic regions, of each of the additional factors in shaping the whitecaps variability will be reported; and the use of the new measurements and database for improved parameterization of sea spray source function will be presented.