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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Parameterization of oceanic whitecap fraction based on satellite observations" *by* M. F. M. A. Albert et al.

Anonymous Referee #1

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The authors describe a new empirical parameterization which predicts whitecap fraction (W) as a function of wind speed. Whitecap fraction estimates were based on WindSat retrieved brightness temperature at two different frequencies, 10 and 37 GHz for seven oceanic regions. W was correlated with a U10 parameter derived from a correcting QuiKSCAT wind speed with a wind speed dataset from European Centre for Medium range Weather Forecasting. The new relationship was evaluated in a global model which suggested lower sea-spray aerosol flux in the Antarctic and higher flux in the tropics in the supermicron size range of sea-spray aerosol. Furthermore, the authors compared their new parameterization with other recent whitecap parameterizations.

General Comments

In general, the manuscript has poor flow. The authors jump from topic to topic with little flow between main points. There is a lot of redundancy in the text that makes it hard to follow.

There is no independent verification of the parameterization. Without comparison with other measured, remotely sensed or modeled data I do not see sizable contribution to scientific progress in the field. While the proposed parameterization for W has fair agreement with other parameterizations, the authors fail to distinguish the proposed formulation from previously proposed parameterizations after using similar retrieval algorithms (i.e. SAL13).

When applying the new parameterization to a global model which predicted SSA flux, the authors showed their parameterization reduced SSA emissions in polar regions while increasing emission s in tropical regions. Model analyzes were in the context of mass concentration and was limited to supermicron sized SSA. The argument for using supermicron sized aerosols (i.e., that sub-micron size range additionally includes organic material) does not hold water. Organic enrichment becomes important for particles with <200 nm in diameter. Such particles do not contribute considerably to overall mass. At the end, the point of this exercise is not well explained. The total predicted sea spray aerosol mass varies by several orders of magnitude. So if the emissions inferred by the current parameterization are within this range, does that prove its validity? The submicron range is the most likely size range influencing direct and indirect radiative forcing. The authors' analysis of SSA emissions with the new parameterization fails to highlight this reality.

There are lots of speculations in the paper that are not supported by the facts. For example, the discussion regarding 37GHz vs 10 GHz intercept is not convincing. The discussion about the "secondary factors" being "imbedded in the exponent of the wind speed dependencies" is misleading. The influence of secondary factors can only be ascertained by the satellite based estimates of W augmented by additional data sets for directional wave spectra, currents (speed and direction), and proxies for surfactants

such as ocean color, chlorophyll a, or oceanic primary production. Such studies should be conducted as case studies on regional scales.

The new parameterization fails to reduce uncertainty in predicting sea-spray aerosol (SSA) flux. To what degree is the uncertainty in SSA flux attributed to uncertainty in predicting W versus other aspects of traditional sea-spray source functions (SSSF)?

Figures appear to have been generated with different software packages.

Specific Comments

Page 21221; Line 1: Awkwardly worded first sentence which fails to highlight the importance of reducing uncertainty of SSA flux.

Page 21223; Line 15: Acronym SSA used prior to defining SSA. SSA acronym is defined on Page 5, Line 24.

Page 21224; Line 11: Neither evidence nor citation is made to support this statement. Suggest this as an explanation versus declaring as fact.

Page 21225; Line 23: Continue to use whitecap fraction instead of “W”. Authors flip back and forth (e.g. Page 7; Line 24) on notation. Please use W to represent whitecap fraction after defining whitecap fraction as W.

Page 2138; Line 27: Please reword.

Interactive comment on Atmos. Chem. Phys. Discuss., 15, 21219, 2015.