# Improvements in an Anisotropic Ocean Surface Emissivity Model Based on WindSat Polarimetric Brightness Observations

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The goal of this research has been to develop a standardized fast full-Stokes ocean surface emissivity model with Jacobian for a wind-driven ocean surface applicable at arbitrary microwave frequencies, polarizations, and incidence angles. The model is based on the Ohio State University (OSU) two-scale code for surface emission developed by Johnson (2006, IEEE TGRS, 44, 560) as presented in our 2013 URSI talk. A total of five physical tuning parameters were identified, including the spectral strength and the hydrodynamic modulation factor. The short wave part of the spectrum is also allowed to have an arbitrary ratio relative to the long wave part. The foam fraction is multiplied by a variable correction factor, and also modulated to allow an anisotropic foam fraction with more foam on the leeward side of a wave.

The model is being tuned against multi-year sequences of WindSat and Special Sensor Microwave/Imager (SSMI) data as analyzed by Meissner and Wentz (2012, IEEE TGRS 50, 3004) for up to four Stokes brightnesses and in all angular harmonics up to two in twenty five wind bins from 0.5-25.5 m/s and of 1 m/s width. As a result there are 40 brightness coefficients per wind bin, for a total of 1000 data points used to constrain the modified model. A chi-squared tuning criterion based on error standard deviations provided by Meissner (2011, private communication) is used. An important part of fitting to the data is adjusting the parameter set to obtain a global minimum to chi-squared. A genetic algorithm (GA) has been implemented in Matlab to reliably obtain this global minimum.

To improve the minimization of chi-squared a frequency dependent foam fraction is used to more accurately model foam emissivity as a function of wind speed based on Anguelova's model (2013,'Parametrization for Wind Speed Dependence of Whitecap Fraction', submitted to Remote Sensing of Environment). Its implementation has resulted in a chi-squared minimum 2.8% lower than with a frequency independent foam fraction.

With both of these improvements the minimum chi-squared for two cases were calculated. The first case was for just the first two Stokes parameters. The minimum chi-squared was 1022. The expected chi-squared was 673 so the ratio of the minimum chi-squared to the expected chi-squared is 1.52 indicating close to a good fit. The second case was for all four Stokes parameters for which the minimum chi-squared was 9882. The expected chi-squared was 973 so the ratio of the minimum to the expected for the full Stokes vector is still unacceptable. Further work on reducing this ratio is in progress.