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Exploring foam coverage variability: a tentative to take into account fossil foam in the relationship between foam coverage and wind speed.

A. Weill (1), G. Caniaux (2) and L.Eymard (3)

(1) CETP/CNRS, 10 - 12, Avenue de l'Europe, 78140, Velizy, France

Tel : 33 1 39 25 4900, Fax : 33 1 39 25 4872, E-mail : alain.weill@cetp.ipsl.fr

(2) CNRM/Meteo France, 32 Avenue G. Coriolis, 31057 Toulouse Cedex, France

(3) LOCEAN/IPSL/UMR7159,CNRS/IRD/UPMC/MNHN Université Pierre et Marie Curie aile 45-55 4ème étage Case100-4PlaceJussieu75252Pariscedex05, France

Numerical photography of sea surface from moving platforms as ships or fixed platforms as buoys or oil platforms have shown well correlated relationships between foam surface fractions or percents with mean wind speed with a power law close to 3. (see for example Monahan papers) and also Sea Surface Sound, Natural Mechanisms of Surface Generated Noise in the Ocean (Br. Kerman Editor, NATO ASI Series) for theoretical and experimental points of view. However the observed scatter is very large and often beyond 30%. One part of the scatter can be related to different origins as differences between active and fossil foam, fetch and differences between SST and air temperature, Monahan; 1988. However, systematic observations from different campaigns of measurement using the same system of cameras for foam percent determination as (WISE 2000, 2001, FETCH 1998 and POMME 2001) have shown for large fetch and same order of SST and air temperature differences that correlation with mean wind speed was always large but variable and significant scatter in the exponent of the power law was also observed. To understand the scatter in the observed relationships, statistics of foam percents observations are undertaken from foam observed in sea surface pictures estimated every two minutes. The surface dimension of the observation corresponds to typically 40 m by 40 m. Each observation corresponds

to at least to one hour duration with thirty samples during one hour.

1. results show that exponent range in the relationship is found typically between 1.6 and 3.5.

2. the differences between mean foam percents corresponding to mean wind speed and mean foam as computed from different observations is at first interpreted from a theoretical consideration.

3. Statistics of observed foam observed every two minutes show very robust relationships between mean foam percents and foam standard deviations and also between skewness and kurtosis. The statistics however suggest a different behaviour from classical self similarity behaviour related to atmospheric diffusive processes. However, at least for POMME and WISE experiments in which long samples are got, interesting statistics between foam level classes and probability of foam percents are estimated close to PARETO probabilities.

4. Simple stochastic normal simulations of time variation of mean wind speed are undertaken and related foam percents with a theoretical power law behaviour around 3. are computed. Then, we take into account fossil foam percents in the total foam estimate choosing an exponential foam decay as function of time. It is shown that computed total foam and its relation with wind speed seems to explain the statistics of observed foam as function of wind speed and observed scatter in the power law exponent.

To conclude it is found that one can explain the main scatter in the power law in the statistics of the relationship between mean wind speed and foam percents and the statistics in the foam amplitude. The foam statistics mainly depend on the foam time decay which has to be precisely studied and estimated. These results have applications in acoustic, optical and electromagnetic remote sensing.