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Analysis of small scale turbulent structures and the effect of spatial scales on gas transfer

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The exchange of gases through the air-sea interface strongly depends on environmental conditions such as wind stress and waves which in turn generate near surface turbulence. Near surface turbulence is a main driver of surface divergence which has been shown to cause highly variable transfer rates on relatively small spatial scales. Due to the cool skin of the ocean, heat can be used as a tracer to detect areas of surface convergence and thus gather information about size and intensity of a turbulent process. We use infrared imagery to visualize near surface aqueous turbulence and determine the impact of turbulent scales on exchange rates. Through the high temporal and spatial resolution of these types of measurements spatial scales as well as surface dynamics can be captured.

The surface heat pattern is formed by distinct structures on two scales - small-scale short lived structures termed fish scales and larger scale cold streaks that are consistent with the footprints of Langmuir Circulations. There are two key characteristics of the observed surface heat patterns: 1. The surface heat patterns show characteristic features of scales. 2. The structure of these patterns change with increasing wind stress and surface conditions. In [2] turbulent cell sizes have been shown to systematically decrease with increasing wind speed until a saturation at u* = 0.7 cm/s is reached. Results suggest a saturation in the tangential stress. Similar behaviour has been observed by [1] for gas transfer measurements at higher wind speeds.

In this contribution a new model to estimate the heat flux is applied which is based on the measured turbulent cell size und surface velocities. This approach allows the direct comparison of the net effect on heat flux of eddies of different sizes and a comparison to gas transfer measurements. Linking transport models with thermographic measurements, transfer velocities can be computed. In this contribution, we will quantify the effect of small scale processes on interfacial transport and relate it to gas transfer.

References

[1] T. G. Bell, W. De Bruyn, S. D. Miller, B. Ward, K. Christensen, and E. S. Saltzman. Air-sea dimethylsulfide (DMS) gas transfer in the North Atlantic: evidence for limited interfacial gas exchange at high wind speed. *Atmos. Chem. Phys.* , **13**:11073–11087, 2013.

[2] J Schnieders, C. S. Garbe, W.L. Peirson, and C. J. Zappa. Analyzing the footprints of near surface aqueous turbulence - an image processing based approach. *Journal of Geophysical Research-Oceans*, 2013.