Abstract Submitted
for the MAR13 Meeting of
The American Physical Society

Non-Condensable Gas Absorption by Capillary Waves MATTHIEU A. ANDRE, PHILIPPE M. BARDET, The George Washington University — Oceans and atmosphere are constantly exchanging heat and mass; this has a direct consequence on the climate. While these exchanges are inherently multi-scales, in non-breaking waves the smallest scales strongly govern the transfer rates at the ocean-atmosphere interface. The present experimental study aims at characterizing and quantifying the exchanges of non-condensable gas at a sub-millimeter scale, in the presence of capillary waves. In oceans, capillaries are generated by high winds and are also present on the forward face of short gravity waves. Capillary waves are thus present over a large fraction of the ocean surface, but their effect on interphase phenomena is little known. In the experiment, 2D capillary waves are generated by the relaxation of a shear layer at the surface of a laminar water slab jet. Wave profile is measured with Planar Laser Induced Fluorescence (PLIF) and 2D velocity field of the water below the surface is resolved with Particle Image Velocimetry (PIV). Special optical arrangements coupled with high speed imaging allow 0.1 mm- and 0.1 ms- resolution. These data reveal the interaction of vorticity and free surface in the formation and evolution of capillaries. The effect of the capillaries on the transfer of oxygen from the ambient air to anoxic water is measured with another PLIF system. In this diagnostic, dissolved oxygen concentration field is indirectly measured using fluorescence quenching of Pyrenebutyric Acid (PBA). The three measurements performed simultaneously -surface profile, velocity field, and oxygen concentration- give deep physical insights into oxygen transfer mechanisms under capillary waves.

Matthieu A. Andre
The George Washington University

Date submitted: 09 Nov 2012 Electronic form version 1.4