

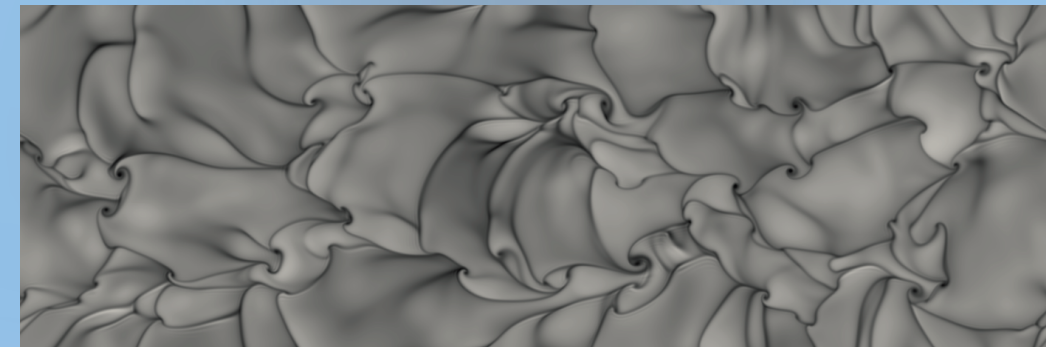
Estimating the Air-Water Gas Transfer Velocity during Low Wind Conditions

The abundances of atmospheric carbon dioxide, CO₂, and methane, CH₄, are increasing. This increase affects e.g., the global carbon cycle and the climate both regionally and globally. To better understand the present and future atmospheric CO₂ and CH₄ concentrations and their climate impact, the gas exchange between water and the atmosphere is important. The gas exchange is influenced by interfacial shear stress from wind, natural convection due to surface heat flux, microscale breaking waves at moderate wind speeds, breaking waves at high wind speeds, bubbles, and rain. This thesis focuses on the low wind condition where the forcings due to shear stress and natural convection are important, and summarizes three papers where the gas exchange has been studied numerically with direct numerical simulation (DNS) and one paper where field observations have been used. The relative importance of buoyancy and shear forcing is characterized via a Richardson number $Ri = Bv/u_*^4 \approx 0.004$, which implies that the buoyancy is important up to approximately 3 ms⁻¹ for natural conditions. Here B , v , and u_* are the buoyancy flux, kinematic viscosity, and friction velocity, respectively.



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