Space-time characterization of sub-grid variability of air-sea fluxes

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Parts of the error in climate and weather modeling result from unresolved scales. Indeed many physical phenomena happen at scales finer than the discretization one and these interact with the resolved scales. Hence, quantifying the influence of the sub-grid scales on the resolved one is needed to better represent the resolved scales in the entire system. Sub-grid scale parameterizations have been developed to model this influence. Traditionally, such parameterizations are deterministic and physics based. More recently, parameterizations have been combined with stochastic frameworks. We propose to address the irreducible stochasticity resulting from area-averaged quantities not having a deterministic dependence on the resolved flow. This is relevant to problems such as the parameterization of turbulent air-sea fluxes, since the true turbulent flux depends on the unresolved local wind speed. We evaluate the difference between the true turbulent fluxes and those calculated using area-averaged wind speeds. We investigate a space-time characterization of this discrepancy, conditioned on the low resolution fields, with the view of developing a stochastic wind wind-flux parameterization.