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Inference of super-resolution ocean pCO_2 and air-sea CO_2 fluxes from non-linear and multiscale processing methods

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In recent years the role of submesoscale activity is emerging as being more and more important to understand global ocean properties, for instance, for accurately estimating the sources and sinks of Greenhouse Gases (GHGs) at the air-sea interface. The scarcity of oceanographic cruises and the lack of available satellite products for GHG concentrations at high resolution prevent from obtaining a global assessment of their spatial variability at small scales. In this work we develop a novel method to reconstruct maps of CO_2 fluxes at super resolution (4km) using SST and ocean colour data at this resolution, and CarbonTracker CO_2 fluxes data at low resolution (110 km). The responsible process for propagating the information between scales is related to cascading properties and multiscale organization, typical of fully developed turbulence. The methodology, based on the Microcanonical Multifractal Formalism, makes use, from the knowledge of singularity exponents, of the optimal wavelet for the determination of the energy injection mechanism between scales. We perform a validation analysis of the results of our algorithm using pCO_2 ocean data from in-situ measurements in the upwelling region off Namibia.