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Impact of submesoscale variability of pCO_2 on CO_2 air-sea fluxes in the northeast Atlantic Ocean

L. Resplandy (1), M. Lévy (1), F. d'Ovidio (1) and L. Merlivat (1)
(1) LOCEAN-IPSL, UPMC, BC100, 4 place Jussieu, F-75252 Paris cedex 05, France.

The combination of a high resolution 3-D bio-physical model and high resolution observations has been used to study the submesoscale variability of sea surface partial pressure of CO_2 (pCO_2) and to examine its impact on air-sea CO_2 fluxes in the northeast Atlantic Ocean during winter and spring. Model validation was performed against the extended data set of network stations and five Carioca drifting floats collected during POMME (Programme Océanographique Multidisciplinaire Moyenne Echelle). The model shows that the large scale pCO_2 distribution is highly modulated by submesoscale filaments, where pCO_2 variations reach 25 μatm over spatial scales of 20 km, which is of the same order of magnitude as the mean seasonal pCO_2 drawdown. This variability seems to be confirmed by floats measurements. The model was used to evaluate the CO_2 air-sea fluxes in the POMME region during winter and spring. Comparison of simulations with and without submesoscale resolution shows a limited impact of submesoscale stirring on the regional CO_2 air-sea flux budget derived from the model.