Response of the North Atlantic Ocean carbon sink to climate change : role of submesoscale processes

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In the North Atlantic, one of the largest oceanic carbon sink, both the biological pump (through primary production) and the physical pump (through subduction/obduction processes) are likely to be affected by climate change : earth system models predict a decline of primary production and changes in water mass formation. However, these models do not resolve submesoscale processes which have been shown to significantly modify both primary production and subduction at the scale of the basin. In order to examine how our current predictions of these changes are biased due to the absence of submesoscale processes, we carry a model study in which an idealized configuration of the North Atlantic ocean is run for several decades with 3 horizontal resolutions : 100km, 12km and 4km. Two scenarios are examined : a preindustrial scenario, with a seasonally repeating atmospheric forcing, and a climate change scenario where a constant temperature trend is added to the previous forcing. Comparing the results for the different horizontal resolution, we investigate the contribution of submesoscale processes to 1) the predicted decline of primary production, 2) the physical carbon fluxes in preindustrial conditions and 3) in climate change conditions.

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