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Dynamical impact on primary production variability at several spatio-temporal scales in the Northeast Atlantic Ocean

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Primary production (PP) exhibits different responses to the physics depending on the temporal and spatial scales. The North Atlantic Ocean is supposed to be an important atmospheric CO2 sink. The study area in Northeast Atlantic shows a large variability of PP from large to filamentary sub-mesoscale. Coupled 1D and 3D dynamical-biogeochemical models are used to study and quantify the impact of several spatio-temporal scales on the PP. The physical processes driving this impact are investigated through their role on light and nutrients limitation.

The ecosystem reproduced by the models shows a strong seasonal and spatial signal. The ecosystem functioning responds to nutrients and light availability driven by a succession of dynamical factors through the year. The nutrients distribution is constrained mainly by winter mixed layer depth (MLD) and next by advection. Light availability is driven by instantaneous MLD. In addition to this temporal repartition of the dynamical processes, their consequences also change according to the spatial scales. At large scale, a gradient of production regimes is visible from south to north. It is driven by winter MLD gradient which constrains both light and nutrients availability. At mesoscale, some eddies show a seasonal cycle delayed from the surrounding waters because of winter MLD and horizontal isolation of these structures. At filamentary scale (sub-mesoscale), MLD gradient and vertical speeds induce a change in light and

nutrients limitations. The high-resolution model reveals, in this region, that about 30% of the PP production in spring could be due to meso and sub-mesoscale dynamics.