Geophysical Research Abstracts
Vol. 20, EGU2018-8350-1, 2018
EGU General Assembly 2018

Near-term predictability of net primary production in the Atlantic Ocean

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With recent predictions of future world population reaching 9.6 billion by 2050 (Gerland et al., 2014) and the related spectre of a global food crisis, the necessity to improve our ability to manage world's fisheries has never been more pressing. One important step in this direction is the improvement of near-term (i.e. seasonal to decadal) predictions of Net Primary Production (NPP). NPP is the rate of production of phytoplankton biomass, the primary source of food for marine animal life and thus a fundamental environmental variable to be taken into account in fishery management strategies. Here, we present results from a suite of simulations carried out with the Earth System Model EC-Earth. These simulations include reconstructions of the biogeochemical state of the Atlantic ocean for the period 1960 to present and a set of near-term predictions initialized every 3 years for the period 1994 to present. The simulations are designed to test the ability of two different initialization techniques to provide predictive skill to the simulation. One initialization technique is based on data-assimilation of physical fields only while, the second technique proposed is based on an attempt to partially reconstruct 3D nutrient fields. This combines information from climatological nutrient fields and reconstructed water masses variability. This combination is meant to exploit the ability of Atlantic mode waters to propagate a signal on nutrient distribution on interannual timescales providing a source of predictability for nutrients and thus for NPP. Skill scores are used to validate these retrospective predictions derived from both techniques in order to obtain a complete evaluation of the predictive capability of the modelling system (ESM+initialization technique).

References

Gerland P., et al. Science. 346: 234–237; 2014.