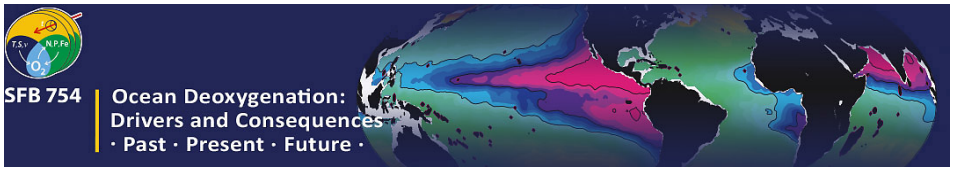

Contribution ID : **110** Type : **Oral**

As good as it gets: Fitting a global biogeochemical model to oxygen minimum zones

Wednesday, 5 September 2018 15:00 (15)

Global biogeochemical ocean models are now routinely used to estimate the potential increase of tropical and subtropical oxygen minimum zones (OMZs). However, to date many of these models do not accurately represent the current extent and location of these. Beside the representation of physical processes, biogeochemical model parameters might be of importance for a model's fit to observed OMZs.

The manual calibration of a global biogeochemical model against observations is a time-consuming and rather subjective approach. Based upon a recently developed framework for automatic model calibration, here we investigate whether the degree of overlap between simulated and OMZs helps to constrain these models and results in a better fit to the extent and location of OMZs. The interplay between the different cost functions, parameter values and their identifiability is examined. We finally investigate how the parameters reflect upon model dynamics and biogeochemical fluxes, and discuss how model calibration can help to improve models used for projecting climate change and its effect on fisheries and climate gas emissions.

Results from three different optimisations suggest that a good fit to observed OMZs is obtained with parameters that enhance fixed nitrogen cycling; this comes at the cost of too low nitrate concentrations and a too high global pelagic denitrification rate. A good fit to nutrient and oxygen concentrations is achieved with a different set of parameters, and a lower global fixed nitrogen turnover; this results in a worse fit to OMZs. Encouragingly, model calibration against OMZ location and extent helps to improve the model not only with respect to the OMZ criterion used in the optimization, but across a range of different criteria, which are of relevance for organisms of higher trophic levels. These results and the associated methodology may help to construct and set up global models that aim at simulating the transient response of the ocean to climate change, and thus the potential economic and ecological consequences.

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Session Classification : 10 Biogeochemical Cycles: Feedbacks and Interactions

Track Classification : 10 Biogeochemical Cycles: Feedbacks and Interactions