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Interactive comment on "Challenges in modelling spatiotemporally varying phytoplankton blooms in the Northwestern Arabian Sea and Gulf of Oman" *by* S. Sedigh Marvasti et al.

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The purpose of this paper is to examine how models may capture interannual variability of phytoplankton blooms in the northwestern Arabian Sea. To assess that, the authors evaluate interannual variability from ocean color observations. This is only possible during the winter bloom because no data are available during the SWM due to the heavy cloud cover. They find a strong correlation between ocean color and SLA at the scale of eddies during winter and conclude that interannual variability is driven by eddy activity. Then they evaluate interannual variability from a suite of different models, and conclude that, for various reasons (not proper mean state in the model or not enough resolution), none of the models are able to capture the observed interannual variability.

Understanding what drives interannual variability of blooms, how it may be driven by

eddy activity, and how models are able to capture is clearly a topic worth of investigation. However, I did not find that this work provided a significant advance in the understanding for the following reasons; 1) the analysis are very qualitative and in many instances, the authors jump to conclusions without sufficient support; 2) a large part of what is shown regarding the data analysis has already been published elsewhere and these papers are not referenced here (Gaube et al., 2014), and 3) regarding why the model fails are reproducing the observations is not particularly interesting and not convincing either. In particular, I was not at all convinced that interannual variability of the bloom was driven by eddy activity. Another important contribution comes from the variability of the mixed-layer depth, which is not addressed here (Keerthi et al., 2015, Climate Dynamics). Moreover, the authors do not clearly show that eddies are supplying nutrients to the euphoric layer but this was shown with another eddy resolving model of the Arabian Sea by Resplandy et al (2011, JGR). It should also be noted that the NEM bloom is very likely driven by convective supply of nutrients - but possibly also by reduced grazing during convection (Marra et al. 1995).

Regarding the analysis: - the scale at which the study is performed (a rather small box in the WAS) is not suited to address the question of interannual variability (Fig. 2). - the correlations between Chla and SSHA are convincing (Fig 5 and 6) but not Fig 4 - Fig 7 does show interannual variability in the data and also in all models - but the bloom amplitudes are so different that it is difficult to conclude anything on the ability of the model to reproduce the interannual variations since they do a bad job at reproducing the seasonal variations already. - Fig. 8 is clearly not sufficient to explain what drives the bloom in the model. What about grazing ? - Fig 9. over what level ? for what nutrient ? It is not because the main source is vertical mixing that vertical mixing is too strong during winter. The question is how the mixed-layer depth compare with observations.

The anti-correlation between satellite Chla and SSH was already reported by Gaube et al. To sum up, the authors seem to have missed recent literature that have examined

their hypothesis in much more details than what they are doing:

- Gaube et al, 2014, JGR, looked at Regional variations in the influence of mesoscale eddies on near-surface chlorophyll and the cross-correlation between SLA and Chl at the global scale, including the Arabian Sea where they find a negative correlation

- Resplandy et al. , 2011, JGR, Looked at the contribution of eddies to the nutrient budget in the AS using a 1/12° model are highlighted the important role of eddies in supplying nutrients to the euphoric layer during both the NEM and SWM blooms

- Levy et al. , 2014, GRL, examined how mesoscale variability could affect the interannual variability of the bloom in the NA and their conclusion suggests that the variability is shared between internal (eddy) and external (atmosphere) forcings.

The introduction discusses red tides with no relation with the content of the paper. The diagnostics are performed over a region which is too small The conclusions regarding the inability of the model to reproduce interannual variability are not convincing and do not bring sufficient insight.

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