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Comment

## ***Interactive comment on “Oceanic controls on the primary production of the northwest European continental shelf under recent past and potential future conditions” by J. Holt et al.***

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### General Comments

In this paper the authors have used a high resolution 3D coupled hydrodynamic and ecosystem model to quantify nutrient exchange and infer primary production on the north east Atlantic shelf and European shelf seas. They compare a limited set of climate scenarios and speculate on future changes in nutrient supply and productivity on the shelf.

The tracer experiment gives clear insight to the simulated transport of water masses across the shelf. After 10 years the water on the shelf in many areas appears to

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originate almost fully from water off the shelf break. Fig 9 shows the main influx is of surface water which is seasonally depleted in nutrients. It would be interesting to quantify the winter ingress of surface ocean water to the various shelf seas as a driver of seasonal productivity.

The authors cite a number of papers in general support of their model simulation of cross shelf circulation, however no quantitative comparison is given. The paper could be improved by the addition of some validation of this critical component of the study for example by including a table or some discussion summarising the flux estimates of other studies. It would be really good to know if this component of the model is supported by observations especially if an estimate of uncertainty in the flux terms can be given. Can the authors suggest an experiment to validate this aspect of their model results?

Can the authors comment on whether the regional, depth and temporal amalgamation of model output is a good way to summarise results? For each of the given areas I imagine a huge range in properties across these spatial & temporal scales and I am concerned that you might be throwing away valuable fine scale information. Do you have the resources to report on 1 or 2 regions in more detail?

There is little discussion of the benthic component of this study. Benthic-pelagic coupling plays a key role in the seasonal modulation of shelf productivity and it would be good to understand whether the model is representing this component of the system dynamics, including changes in the future scenarios, realistically. For example do your simulations include wave induced resuspension, and does this increase in the future scenarios?

Specific Comments

Section 2.1.1

'Ecosystem boundary conditions use monthly values from WOA... ' Do you match the

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depth of the nutricline with the depth of the pycnocline? If yes, how? In no, does this lead to propagation of predator prey oscillations into the model domain from the boundaries?

Section 2.1.3 Is the bias correction described in 2.2.2 also applied to scenarios A1B and A1Bb? If not, why not?

Section 2.2 How deep are ‘..the top 8 model s-levels’? Please give some indication of depth or depth range.

Shetland shelf & NE Atlantic also have high error with cost fn > 2 for chlorophyll!

Primary production is depth integrated but shown in table 1 with units of m<sup>-3</sup>; did you divide by depth again?

Annual netPP in Celtic Sea outside observed range too!

Is SeaWiFs comparison comment for CNTRL or both model simulations?

Section 3 I am bemused by Shutlers et al., 2011 finding that reliability of a model increases when averaging over more grid cells. This suggests the model resolution exceeds the ability of the model & model inputs to constrain the system dynamics. Would a coarser model grid not be more appropriate?

When referring to fig 7 please state what the relationship is that you want us to see.

In the context of the regional spatial and temporal averaging of results are the rather small differences noted in Fig.7 of significance? Do you have the resources to explain how these differences arise in more detail for 1 or 2 regions?

Section 4. Is simulation A1B capturing the on/off slope circulation (Fig 9). Fig 9 appears to have a column missing? Also I took quite a while to understand this figure. Please can you label the x axis and explain that the 200m isobath = 200m contour along the shelf break (projected onto latitude).

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## Technical corrections

Section 2. The authors cite a number of papers where the model is described however scant detail is included in the current publication. Can an appendix be added summarising more fully and unambiguously the features of the current model configuration.

Section 2.1.1 Remove stray )

Section 2.2.2 Please refer to section number not ambiguous 'see below'

Section 4. Omit 'the' before Ireland

Section 4.1 Please number subsection

When referring to Ns do you mean in table2?

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**BGD**

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