Earth Syst. Sci. Data Discuss., 7, C37–C40, 2014
www.earth-syst-sci-data-discuss.net/7/C37/2014/

Open Access Earth System Science Data Discussions

Interactive comment on "Global ocean biomes: mean and temporal variability" *by* A. R. Fay and G. A. McKinley

Anonymous Referee #4

Received and published: 23 April 2014

The manuscript " Global ocean biomes: mean and temporal variability " by A. R. Fay and G. A. McKinley proposes a methodology to define seventeen large biomes in the global open ocean, using set of biogeochemical and physical parameters such as sea-surface temperature, sea-ice fraction, mixed-layer depth and satellite-derived chlorophyll. The authors propose these new biomes as useful framework for intercomparison studies such as RECCAP. I read the article with high interest. The manuscript is clearly structured and reads well. Nevertheless, I think this paper needs some clarification that have to be addressed first, and which prevent me of accepting this paper in its present form. Therefore, I recommend acceptance of this manuscript after major revisions.

While I am convinced by the use of such a framework, my largest concern is in the lack of quantitative information proving the robustness of such biomes definition. A

extended quantitative analysis performed on (1) the sensitivity to the observational datasets (using alternatively other data or reanalysis such as SST from (Reynolds et al., 2002), GlobColour for surface chlorophyll or MODIS/MERIS), (2) the sensitivity to threshold/characteristics for each biome (How small changes in characteristics would changes biomes coverage ?). (3) Finally, a proof of concept is needed to my point of view. For example, comparing biomes surface areas in various models (across the CMIP5 database or RECCAP) and the surface areas defined by latitudinal boundaries would further support the main point of the study than looking at the gyres expansion/contraction.

Specific comments:

L 21 p108: Definition of alternative "physical" boundaries has a long story. For examaple, physical oceanographers use watermasses as a physical framework since a long-time (e.g., Walin, 1982). Therefore consider citing related references:

- Iudicone, D., Rodgers, K. B., Stendardo, I., Aumont, O., Madec, G., Bopp, L., Mangoni, O. and Ribera d'Alcala, M.: Water masses as a unifying framework for understanding the Southern Ocean Carbon Cycle, Biogeosciences, 8(5), 1031–1052, doi:10.5194/bg-8-1031-2011, 2011.

- Resplandy, L., Bopp, L. and Orr, J., C. and Dunne, J., P. Role of Mode and Intermediate waters in ocean acidification : analysis of CMIP5 models (2013). Geophysical Research Letters. doi: 10.1002/grl.50414.

- Sallée, J. B., Shuckburgh, E., Bruneau, N., Meijers, A. J. S., Bracegirdle, T. J., Wang, Z. and Roy, T.: Assessment of Southern Ocean water mass circulation and characteristics in CMIP5 models: Historical bias and forcing response, Journal of Geophysical Research-Oceans, 118(4), 1830–1844, doi:10.1002/jgrc.20135, 2013.

- Séférian, R., Iudicone, D., Bopp, L., Roy, T. and Madec, G.: Water Mass Analysis of Effect of Climate Change on Air–Sea CO2 Fluxes: The Southern Ocean, J. Climate,

25(11), 3894–3908, doi:10.1175/JCLI-D-11-00291.1, 2012.

- Walin, G.: On the relation between sea-surface heat flow and thermal circulation in the ocean, Tellus, 1982.

Other definition related to satellite-derived chlorophyll clustering should be also included in this manuscript:

- D'Ortenzio F., and M.R. d'Alcala, (2009). On the trophic regimes of the Mediterranean Sea: a satellite analysis. Biogeosciences 6 (2), 139-148.

Finally, definition related stressors of marine ecosystem should also be discussed here:

- Bopp, L., Resplandy, L., Orr, J. C., Doney, S. C., Dunne, J. P., Gehlen, M., Halloran, P., Heinze, C., Ilyina, T., Séférian, R., Tjiputra, J. and Vichi, M.: Multiple stressors of ocean ecosystems in the 21st century: projections with CMIP5 models, Biogeosciences, 10(10), 6225–6245, doi:10.5194/bg-10-6225-2013, 2013.

L 2 p109: please mention which observations were used. Note that satellite-derived chlorophyll are not direct observations.

L 10 p109: explain how coastal region are defined

L 24 p110: Why using latitudinal boundaries for EQU domain. Regarding the pattern of surface chlorophyll in the EQU region, I agree that 5°S-5°N box makes sense. But this is not the case for the variability of this variable and for the sea surface temperature (as well as the mixed layer depth).

S 3.3 p116: Regarding the definition of the EQU biome, I am not surprised that only high-latitude biomes do core biomes. I think the inclusion of physical/biogeochemical characteristics for the EQU biome would substantially change this view. EQU is the only biome defined by latitudinal boundaries (Table 1). Consequently, this biome does not vary in term of surface area in core location.

L 26 p 117: limitations of the framework. I think here further discussion is needed. The

definition of the EQU is clearly one limitation. The use of more quantitative clustering methods to create an objective definition of biomes characteristics is one other (even if such methodology requires alternative dataset to cross-validate definition of biomes and is therefore preclude considering the lack of some data).

Reynolds, R. W., Rayner, N. A., Smith, T. M., Stokes, D. C. and Wang, W.: An Improved In Situ and Satellite SST Analysis for Climate, J. Climate, 15(13), 1609–1625, 2002.

Interactive comment on Earth Syst. Sci. Data Discuss., 7, 107, 2014.