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Interactive comment on "Unique role of jellyfish in the plankton ecosystem revealed using a global ocean biogeochemical model" *by* Rebecca Mary Wright et al.

Anonymous Referee #2

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General Comments

The manuscript fits perfectly in the scope of Biogeosciences in that it considers the role of plankton within marine biogeochemistry. It uses a currently developed model PlankTOM10 and adds a jellyfish plankton functional traits (PFT) to further resolve the global ocean plankton system. Gelatinous zooplankton within the Cnidaria and Ctenophora have been neglected in virtually all models, yet we know that they have the potential to play a significant role in structuring plankton food webs directly and indirectly via predation, and facilitate the flux of organic carbon to the seafloor via the production of mucous, messy feeding, carcasses (also known as jelly falls) and to a

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much lesser extent faecal pellets. The pelagic tunicates (salps, doliolids) can form substantive bloom events and have the capacity to graze particles down to only a few microns, but these have also not been included.

Although the authors appear to have used appropriate methods and scientific assumptions, it is difficult to make firm judgements about this as there not a detailed justification of the parameter values used. I would expect in a paper such as this for a detailed summary of all sources of parameter inputs listed in the Appendix for readers to check themselves and also reproduce the models. Without this a reader has to go on a fact finding mission themselves. The interpretation of the results are sound but not particularly substantive. The inclusion of jellyfish in the PlankTOM model is a significant step forward but the authors have not really explored this as much as I would have hoped. When I first read the title of the paper I expected a model of carbon flows from one PFT to another presented rather than just biomass outputs, and this left me feeling somewhat disappointed. If these concerns were addressed it would make the work far more powerful and novel.

Specific Comments

L33 - I am not sure jellyfish play a unique role. They do play a role, as do all the other functional groups. What are you suggesting by the term unique?

L34 - There have been a (very few) instances where jellyfish have been considered in plankton ecosystems, e.g., Ruzicka et al 2012 for the California Current System.

L86 - You do not mention, or make clear, what the composition of the macrozooplankton group is. Does it include pelagic tunicates, which are going to graze down to a smaller food size than crustacean macrozooplankton such as euphausiids. This would make a difference to how your model runs.

p114 - What are the size definitions of the two particulate detrital pools? The terms small and large are vague. You do not specify the contribution of each of the PFTs to

each pool. For example, jellyfish produce virtually nothing in the way of particulate / solid faecal pellets.

p135 - What is MGE?

p147 - You mention that jellyfsh growth rates were compiled as a function of temperature from the literature, but you do not provide any indication of which papers were used, how many were used, which taxa the growth rates were compiled from etc. It is this level of detail that is absent from the methodology which makes traceability of the data impossible to verify.

p165-166 - Continuing with the issues of transparency, the values for GGE are obtained from the literature (Moriarty, 2009), but this is difficult to verify a that is a PhD thesis. You should make it clear that the data from the literature have been collated by Moriarty, 2009. How many values were collated? What are the range of values? Stating these will make readers far more confident about the inputs into the model.

p178 - Do you have evidence that ephyrae do have a higher clearance rate for autotrophs. There are not many papers that have analysed diet of ephyrae and there are mixed messages about diet. For example, how can you take into account selective vs non-selective feeders and time of year (relative to the spring phytoplankton blooms)?

L299 - It would be useful to include a map showing the global distribution of jellyfish for the reader to gain a better understanding of the spatial distribution and coverage. Are the Cnidaria data used from the upper 200m only, as you indicate that in the original dataset jellyfish were available for a much wider depth range. Again, this is for transparency purposes.

L319 and 327 - Why do you express the values for jellyfish biomass as 0.46 - 3.11 pg C on line 319 in the methods and just 0.46 pg C on line 327 at the start of the results (where other published values are expressed as a range)?

L342-344 - It is obvious that the majority of jellyfish biomass is distributed around

the coasts because a) that is where the majority of sampling has taken place and so there will be sampling bias, and b) it is likely that the majority of jellyfish collected are scyphomedusae with a metagenic life cycle requiring a hard substrate for the benthic polyp population.

L417-418 - You state there is a high preference for jellyfish on protozooplankton. The vast majority of diet and feeding studies on jellyfish suggest that mesozooplankton are the preferred prey for the majority of jellyfish. Smaller taxa and juvenile forms (ephyrae) would consume protozooplankton, but this is not the case for most of the scyphomedusae. In the jellyfish dataset used for the PlankTOM11 model, are the classes or genera listed? If so, it would be helpful to briefly indicate the make up of the jellyfish community used in this study.

L453 - The grid resolution is stated as ~2o x 1o, but the original dataset were gridded in 1 x 1 degree. Why was the resolution changed?

L472 - Brotz et al. 2012 is not the most appropriate reference to support the description of jellyfish reproduction alternating between a sexually-reproducing pelagic medusa and asexually-reproducing benthic polyp, as the Brotz paper is about global distributions of gelatinous zooplankton and not reproduction.

L472-479 - Be careful about saying that increasing temperatures increase growth of jellyfish, which they do, but it is an oversimplification of the whole life cycle as ephyrae are typically produced following colder than average winter temperatures (certainly for temperate populations of the common jellyfish Aurelia, which likely dominates datasets).

Overall the discussion is rather brief and does not fully explore the differences between the different model outputs and the mechanisms driving those differences. The discussion feels rather superficial and far more explanation is needed to make it robust.

Technical Corrections

L55 - benthic polyp (delete s)

L177 - Obelia in italics

L195 - Aurelia in italics

L197 - data were (not was)

L394 - picophytoplankton (lower case p)

Table 1 - italicise genus names

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