

## ***Interactive comment on “Photosynthetic production in the Central Arctic during the record sea-ice minimum in 2012” by M. Fernández-Méndez et al.***

### **Anonymous Referee #2**

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#### General comments

The manuscript present a comprehensive view of primary production (PP) in the Central Arctic Ocean. This study provides measurement of PP during August and September 2012 for sea-ice, melt ponds and water column. The authors suggest that sub-ice algae are an important component of total PP and may represent up to 60% of the Central Arctic PP. Overall, this manuscript is of high quality, well focus and its content is scientifically truly relevant. As acknowledge by the authors the Central Arctic is one of the least-well understood regions of the world, partly due to its remote and extreme environment which made it barely inaccessible. Therefore, this manuscript, as a part of a larger scheme, is leading to a better understanding of regional and temporal this

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remote area.

The authors are also using complementary approaches in order to assess the impact of a decreasing ice-cover environment, but they could go further with these approaches. I also have minor comments about the manuscript (list below). Nevertheless, I'm confident that the manuscript, after revision, will make a significant contribution to the field.

#### Specific comments

##### Abstract

P. 2898 L15 - What do you mean by “end of the season”. Please define the “season” here or in the introduction.

##### Introduction

P. 2901 L18-20 – These approaches should be more developed throughout the manuscript.

##### Method

P. 2902 Section 2.1 – What were the sampling depth for the water in ice-free area? Is only one depth was sampled for PP measurement?

What was the method use for the taxonomy data (or cited the study where these data where coming from)?

##### Results

P. 2909 Section 3.1 – Is ammonia data are available from the cruise? It could be interesting to add ammonia data to the nutrient overview.

P.2910 L 1-6 – What is the criteria (concentration's threshold) used to determined nutrient depletion for nitrate and silicate?

P.2910 L 15-25 – What is the sampling depth for “under-ice” and “ice-free” water phytoplankton?

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P.2911 L 6 – Why a depth of 25 m was chosen for the nutrient addition experiment?

P.2914 L 21-28 – Please elaborate here. The model proposed is really interesting, but it should be more developed in this section. Is it possible to assess the contribution of melt pond, sea-ice and under water to total PP with the model? Is the change in the dynamic of the ice cover lead to significant change in the contribution of each group?

P.2914 L 21, 25 and 27 – Please add absolute data to relative data presented here.

P.2914 L 26 – I understand that the ice-free scenario represent September 2050 conditions?

#### Discussion

P.2916 L 5-15 – I'm getting a bit lost in here. Please rephrase in order to clarify the meaning of these three sentences.

P.2918 L 6 – What was the depth of the phytoplankton community sampled?

P.2918 L 16 – What about ammonia?

P.2921 L1-8 – Palmer 2011 (Polar Biol., 34, 1915–1928) also observed that change in photosynthetic parameters can be very quick in the Arctic (within few days).

P.2922 L 3-4 – Are you referring to the September 2050 model?

P.2922 L 1-17 – What about the September 1982 model? What is the response in PP to 1982 conditions? Plus, some references about effect of ice reduction on PP should be added and discussed in this section.

P.2922 L 18-21 – Why is the community will shift? Some more explanation are need to this conclusion.

P.2922-2923 Section 4.4 –There is also vertical variability to photosynthetic parameters in the water column. I think this should be addressed in this section. I also think that new versus regenerated production should be briefly discussed there.

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#### Figures

Figure 1 – Please explain what the red number on figure is. The orange line is very difficult to see.

Figure 5 – “Sea-ice” should be rescale in order to increase the contrast for NPP. The unit should also appear in the caption. The authors should add a note to notice the different scales with the panels.

#### Supplement

Figure S7 – Maybe try a log scale in order to increase contrast.

Figure S8 – The different scales are confusing. Please try something else (maybe log scale) or make sure to notice the reader about it.

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Interactive comment on Biogeosciences Discuss., 12, 2897, 2015.

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