

# ***Interactive comment on “Wind-driven interannual variability of sea ice algal production over the western Arctic Chukchi Borderland” by E. Watanabe et al.***

## **Anonymous Referee #1**

Received and published: 22 June 2015

The paper “wind-driven interannual variability of sea ice algal production over the western Arctic Chukchi Borderland” by Watanabe et al. is a coupled ice ocean-ecosystem model study evaluating potential causes for the large difference in observed particle flux from sediment traps for two consecutive years. The model study is nicely done and thoroughly looks at several environmental factors responsible for interannual variability in the region. Results show reasonable links to wind patterns and related nutrient transport as well as irradiance, which highlights the use of models for analyses like this. I hence recommend the publication of the paper with minor revisions on the science and major revisions in language, (see below).

Additional general comments:

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The ice algae component is new and some components might need further question, e.g. the lack of zooplankton grazing within the water column and the hybrid nutrient supply. However, with respect to the limited observations on sea ice algal processes and the early stage of sea ice algal modelling in regional scale models, the applied parameterizations seem no less applicable than other published parameterizations, and hence appropriate for the study. However I am missing at least a few number inter-comparisons, giving an idea if the ice algae biomass is within the limited observations of the area (e.g. does the Icescape study show any ice algae obs?) . For the lack of observations a ballpark comparison with other ice algae models would also be helpful (works by Dean, Jin and Dupont are cited, but no number comparison given). And finally a comment should be added expressing that a proper evaluation of the ice algae model with observed data is simply not possible at the time due to the lack of data. For the future I would suggest including the model it potential inter comparisons of ice algae models, when they come up as part of a group exercise.

It seems that the only actual observation used for comparison is the sediment flux /PON flux which doesn't correspond very well with the model results. However, this is discussed in the paper and essentially shows how such observations can trigger a modelling study.

I think the paper would also profit from a discussion section, i.e. take out some of the discussion within the subsections of section 4 and combine in one discussion section. This might help to better link the various contributions to the discussed interannual variability.

Unfortunately there are some English language issues which make it hard to focus on the content. Particularly the authors seem to avoid the use of articles (the or a, about 100 in the whole article are missing), some are placed wrongly, sometimes they could be avoided if the noun would be used in plural rather than singular. I don't think this should cause the paper to be rejected, but the issue should be improved before publication. I will not go through the effort to list every single one of those missing

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articles, but I am adding a scanned copy, which I hope will give enough indication of where articles should be. Further to the English language, there are a few cases where I think a verb has been used inappropriately, so it changes the meaning of the sentence. I am indicating those for the authors to make sure the meaning is understood correctly.

Detailed comments:

7740 l2 – was reported => was recorded ??? l20 rm certainly - superfluous l21 The simulated sinking flux l23 suggest: the ice algal patch with shelf origin ( if that is what is meant) 26 on=> of 7741 l11 => fill many gaps ??? observational gaps ? L14 rm however l21/22 This sentence does not make sense – rephrase l26/27 What does the last sentence mean?

7742 l6 demonstrated => simulated ? L16 was – is a L16 A pioneer work => Pioneering work L20 target region ? Modelled region? L27 reached three => reached values three L28/29 suggest: Seawater in the ocean surface column is => The ocean surface water is

7743 L10 lose – loose L10 Modeling configurations

7744 L20 rm additionally L21 called as => called

7745 L17-19 not clear if this is preset or out of the parameterisation => clarify

7746 L21-22 Unclear, please rephrase

7747 L20 How does respiration reduce biomass? L23/24 This is stated multiple times in the text, I think it can be stated once and themn be ignored ( Why introduce the variable in the first place?

L27 The German...tested ..(ref) => Boetius et al. 2013 indicated rapid . . .

7748 L19 vertical grid width => vertical resolution L20 rm level 2x L23 rm - in the 2011(2012)case

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7749 1 Is there a reference or info to the prescribed Bering Strait inflow ? 19 divided into

7750 14 and 14 was => were Last paragraph, please clarify if you are still talking about the model ( E.g. compared with simulated sea ice conditions ?) L22/23 The negative anomaly... attributed to two melting events I think this should be “can be attributed” otherwise it would mean the lower sea ice causes the melting events rather than the melting events cause the lower sea ice??? 7751 L27rm area 7752 L12-17 Is this still ice algae or pelagic? Are there any numbers from observations? L22 rapidly improved => rapidly increased???? L28/29 same as before could be attributed not could attributed 7753 L6 in landfast ice , rm one L12/13 upwelling or downwelling ??? L18 by up to L21/22 nitrite content had to reflect =>nitrate content reflected

7754 L1 rm certainly L17/18 which ranged lower => which had lower L27 rm “timing” after beginning

7755 L1 recorded => simulated (?) L8 in sea ice => of sea ice L16/17 The use of would implied that it would have doen that but it actually didn't, it is not clear if this is what the authors want to say. If so please add why it didn't

7756 L3 which warm pool L7 induced Ekman . . . => unclear, please clarify L 15 preconditioning, rm certainly L22 abundance => concentrations of nitrate were 7757 L2 was fixed or was initialized ? L9-11 Besides ...coast – I do not understand this sentence, please rephrase L18 January of 2011 and 2012 ( rm seasons) 7758 L2 What is basin side plankton biomass ? L11-12 Besides . . . This sentence missies at lest one word to understand it , please rephrase L17 intend mortality => lead to loss

L23-25 unclear, please rephrase

7759 L6 The flux amount was underestimated L8 rm was before originated L10 took ??? => was L11-12 The 67 – Don't understand this sentence, please clarify L14 The simulated PON flux ( ?) Here and below make clear when talking about model and

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when talking about obs! L23 the cold core eddy which was generated by a narrow jet or the cold core eddy that generated a narrow jet ???

I would consider putting the following section or at least part of it into a discussion, since it links the PON flux with the previous investigation of physical structures ( wind etc) 7760 L2 The surface flux which was remarkably L7 sea floe => ice flow L8 It was => it is L11 attributed to=> from L14 wind speed or vector wind???? L15 paid attention => considered L19 did => does L26 deepening of the trap from 260 to 320m suggests an inclination L29 could => can 7761 L1 rm from ours , would => should L15-17 This sentence needs to be rephrased L21 remains => contains or suggestion: A lot of uncertainties still remain with respect to the PON sinking process. L23 Suggest Biogeochemical structures in the western Arctic

7762 L5 assumed => suggested L11/12 sentence confusing, I think it should read: ... northwesterly wind associated with an extension of the Siberian High distributed oligotrophic water from within the Canada Basin toward the northern Chukchi shelf. (??)

Figures/captions

Figure 2 caption

decomposition (December) – looks like an autocorrect error...

Figure 3 caption non-dimension => non-dimensional

Figure 4/(6)/7,(8)

It is really hard to see what is the dashed line, maybe use a light grey or colored line instead???

Figure 6

Figure 6 caption I do not understand the last sentence

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Figure 9 captions suggest giving the color coding after the indicator variable: e.g, skeletal layer ( blue lines) . . . water column ( pink lines) suggest change: Total PON fluxes of (red lines) model outputs and (gray bars) trap values . . . . to Total simulated (red lines) and observed (gray bars) PON fluxes at 180m.

Fig 11 The thin white lines indicating the isobaths cannot be seen, hence get confused with te thick white contours. Any other color options????

Please also note the supplement to this comment:

<http://www.biogeosciences-discuss.net/12/C3000/2015/bgd-12-C3000-2015-supplement.pdf>

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