

## ***Interactive comment on “Increasing cloudiness in Arctic damps the increase in phytoplankton primary production due to sea ice receding” by S. Bélanger et al.***

**Anonymous Referee #2**

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### General comments

This paper presented the recent trends in PAR, chlorophyll a, and PP. Authors also explained the PP trend by a parameter CHL/KPUR, which is different from previous studies. The PP change in the Arctic region and its controlling factor is one of the important topics to consider biogeochemical and ecological change to global climate change. Therefore, this paper is scientifically important and within the scope of Biogeosciences. However, some parts are still difficult to understand and need to provide clearer descriptions and evidences. I hope the authors to make all figures clear and larger to understand results easily.

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### Specific comments

1. Details of primary production model as expressed by equation (1) should be described. Authors wrote that "Our model uses satellite derived spectral diffuse attenuation ( $K_d$ ) to ...." at lines 15-19 on page 13997. However, equation (1) is not including  $K_d$  or KPUR and it is difficult to understand how the  $K_d$  or KPUR govern in the model. If you have written in previously published paper, it is probably acceptable.
2. Authors assumed the  $PB_{max}$  to be constant. As you wrote on page 13996,  $PB_{max}$  varies with temperature. Nutrients and other many environmental conditions can be a controlling factor of  $PB_{max}$ , too. Although, one of important results in this study is PP increase due to rising of CHL/KPUR, induction of the result by assuming of constant  $PB_{max}$  is anticipated.
3. What is the index CHL/KPUR? Authors explained a meaning as only "biomass divided by attenuation coefficient of PUR". I tried to consider intuitive meaning for interpretation of this paper, but it is still confusing. Inverse of the index can be  $KPUR/CHL = KBPUR$ , so is it related to  $a^*_{ph}$  and photosynthetic rate? If so, it conflicts with constant  $PB_{max}$ .
4. Analysis of trends such as relationship among PP, CHL, CHL/KPUR is lacking statistic results. Most of the trend analysis showed only each increase/decrease rate or comparison of patterns on satellite images. Authors should show the results statistically.

### Technical corrections

Line 13, page 13988: "+8%" Is this "-8%"?

Line 9 and 10, page 13997: "< +0.5" and "< -0.3" Is this ">+0.5" and ">-0.3"?

"mol photons" is better than "Einstein" as a SI unit.

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