

Interactive comment on “Small phytoplankton contribution to the total primary production in the Amundsen Sea” by Sang H. Lee et al.

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The manuscripts “Small phytoplankton contribution to the total primary production in the Amundsen Sea” by Lee et al. presents observational data in Amundson during 1-14 January 2014 cruise and discussed an important issue on the small phytoplankton contribution to the total primary production. I found the data and discussion deserved for publication in BG with minor revision. I suggest the authors to improve description of the differences between non-polynya and polynya regions, maybe a regroup those stations in order to make the conclusions stronger. ⇒ Since our study region was separated into polynya and non-polynya areas based on sea ice concentration data from National Snow & Ice Data Center during the cruise period (Fig. 1) as we mentioned that in line 88-92, page 4, regrouping those stations based on the result outcome is rather arbitrary. Therefore, we would like to stick with the previous two groups based

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on sea ice concentration.

It is also important to include time period of measurements when discuss comparison with other studies in many places in the manuscript. Here are some details: L223-225: “our total 223 daily carbon uptake rate in 224 polynya region (0.84 g C m⁻² d⁻¹) is within the range between Lee et al. (2012; 2.2 g C m⁻² d⁻¹) and Kim et 225 al. (2015; 0.2 g C m⁻² d⁻¹).” The wide range of carbon uptake rates are mainly due to the different measurement timing (or location). This is an example where it is necessary to add which month (not just year) the data were measured when comparing those numbers. ⇒ Yes, the different carbon uptake rates among different studies are mainly due to the different measurement timing. We indicated the time period of the measurement for each study for the comparison of the rates in line 225-227 and line 239-240, page 10.

L274 states “small phytoplankton were higher in non-polynya region (Table 1)”. L281 states ‘diatoms are relatively dominant in the non-polynya regions (Lee et al., 2012)’. Please explain why they are different as we normally think diatom is large phytoplankton. ⇒ We are not saying diatom is small phytoplankton in this paragraph. As we mentioned in line 143-145, the average contributions of small phytoplankton to the total chlorophyll-a concentration were 42.4 % (S.D. = ± 37.2 %) for non-polynya based on different sizes of chlorophyll-a concentration which indicating there were still some large amount of small phytoplankton (< 5 μm) although they were not dominant group. Since it is rather confused, we rephrased it in line 284, page 12.

In Fig 2-4, small phytoplankton were lower in non-polynya stations 3 and 3-1, higher in 1 and 2. Stations 1 and 2 had very low production and its ratio may not represent the ratio when bloom occurs in those locations. It is necessary to note whether the ratios in Table 1 is the average of ratios in each station or calculated from the average of chl-a, PP. ⇒ The ratios in Table 1 are the euphotic water column values averaged from all stations, non-polynya station, and polynya stations. We clarified that in the caption of Table 1.

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L315: 'anticipating small-dominant ecosystem under warming oceans'. We have found increasing small phytoplankton due to warming Arctic, but in Amundson, small phytoplankton contribution was found to be higher under ice (cold) rather than in polynya (warm) in this study. It looks like we are heading to large-dominant ecosystem under warming ocean in Amundson. ⇒ Polynya and non-polynya regions are different systems with different environmental conditions so that we can not simply say that. That is a main reason for why we separated them in this study. Actually, the data in Figure 7 included all stations from polynya and non-polynya regions.

Please also note the supplement to this comment:

<http://www.biogeosciences-discuss.net/bg-2016-453/bg-2016-453-AC1-supplement.pdf>

Interactive comment on Biogeosciences Discuss., doi:10.5194/bg-2016-453, 2016.