Referee 2

Dear Sirs (English version):

Referee comment: The model presented by Angela Bahamondes Dominguez is interesting and it is related to the scope of the journal (Geoscientific Model Development). Overall, I find the model showing a considerable fit with the field data, and this suggest that could be useful to improve our understanding about how phytoplankton blooms take place in situ. For all these reasons, I think this article is within the standards of excellence of the journal.

Response: Thank you for your comment regarding the standards of this paper. We think that describing developments in a model at a technical level complies with the aims of Geoscientific Model Development.

Referee comment: The model presented (S2P3 v8.0) is a modification of a previous NPZ model (S2P3 v7.0) to which the photo-acclimatization of phytoplankton is introduced. This new model improves the previous model, as the results of the new model are better adjusted to in situ observations. However, the temperature is taken into account only in the respiration process, while it is not considered in photoacclimation and grazing, and both processes depend on it (Sarmento et al . 2010, Vázquez-Domínguez et al. 2013 and references therein). Furthermore, the model is slightly decoupled to the field data, as it happens in the second period (Fig. 3a) or the zooplankton biomass (Fib 3b), and besides it presents a mismatch with nitrogen (Figure 4c). This should be discussed.

Response: We appreciate the points raised by the reviewer. Firstly, we are aware of the effects of temperature on phytoplankton physiology and grazing. Within the developed model iteration we explicitly include the representation of temperature on phytoplankton physiology using the model of Geider et al. (1998). We acknowledge that representation of temperature effects on zooplankton grazing could also have been included. However, we note that there are always further processes which could be included and decided that the development step of the model described here was substantive enough to be worth a formal description within GMD. We note that there remains discrepancy between the model and the data, indicating further potential avenues for development.

Changes to manuscript: We will add the full equations of S2P3 v8.0 in Supplementary Material (see Appendix A). Furthermore, regarding the no-temperature dependencies of grazing and photo-acclimation in this model, a sentence is added regarding this assumption in L216. Finally, in L225-226 is explained about the differences in DIN for Figure 4c.

Referee comment: Two additional questions: 1) it would be good to unify units in figure 6 since they are mixed (Chla, N, C), and this does not allow to estimate a transfer efficiency between trophic levels. If a scale with mmol C m-3 is added, the efficiency in carbon transfer can be estimated between phytoplankton-zooplankton, and if the same is done with N we would know the transfer

between N-P-Z. This is important at the biogeochemical level; and, 2) similarly, perhaps two columns could be added in Table2, indicating the mg C m-2 of phytoplankton and zooplankton.

Response: We agree that showing the transfer efficiency between trophic levels should be added.

Changes to manuscript: Figure 7 is changed to more easily represent this transfer efficiency, by adding a subpanel of phytoplankton N. Therefore, the transfer efficiency between trophic levels can be seen in terms of mmol N m-3 between phytoplankton-zooplankton-nutrients.

Referee comment: Finally, figure 7 (a) shows an inter-annual change in the intra-annual temperature variability, which may be due to temperature changes at the decadal level. All these changes seem to affect the biomass of phytoplankton, but they are not so apparent in the remaining variables. Perhaps, you have an explanation of these differences.

Response: We agree that this variability can be more clearly presented.

Changes in manuscript: Figure 7 has been modified to give the reader better insights about the dynamics of the model. The new figure shows the annual seasonal cycle of each variable (black line) and with the red lines representing the 95% quantiles (i.e. 95% of the data lie between these lines) of each variable over the 51 years of simulation to show the inter-annual variability of each variable. It is more apparent in this figure that not only biomass of phytoplankton shows changes through each year, but also all the remaining variables.