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Interactive comment on “Rapid formation of large aggregates during the spring bloom of Kerguelen Island: observations and model comparisons” by M.-P. Jouandet et al.

M.-P. Jouandet et al.

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1-Particle aggregation experiments were conducted during the Kerguelen Ocean and Plateau compared Study (KEOPS2). Water sampled by Niskin bottle at Station A3 was incubated in roller tanks to form marine snow by physical aggregation via differential settling (Laurenceau et al., submitted). The aggregates formed were a mixing of different species: Chaetoceros subgenus Hyalochaete spp., Fragilariopsis spp. including the species kerguelensis and rhombica, small centrics represented mainly by Thalassiosira spp., Pseudo-nitzschia spp and Eucampia antarctica. While this study didn't find that only one species was aggregating, it did demonstrate that F.Kerguelensis does

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aggregate.

Previous studies have mainly focused on the formation of the diatoms *Thalassiosira* and *Skeletonema* (Hamm et al., 2002; Grossart et al., 2006; Ploug et al., 2008; Gardes et al., 2011) but unfortunately not on *Fragilaropsis* and *Chaetoceros*, which were the dominant species in our studies. As noted above, aggregation experiments made with *Fragilaropsis* during the cruise showed that this species does form phyto-aggregates. Our model is a simplified view of the ecosystem that does not explicitly describe multispecies aggregation. The model was also run with different initial cell sizes but the results did not affect our interpretations. Aggregation in both the model and the observations occurred over similar very short periods.

2- The section dealing with the fractal dimension has been improved according to the reviewer comments and is now :

"The value of d_a is calculated from d_c using the fractal relationship and a fractal dimension of 2 (Appendix A). Note that reported values of the fractal dimension vary widely, from 1.3–2.3 (Burd and Jackson, 2009). The value of 2 used here is in this range and yields peaks in the nV_d distributions similar to those determined from UVP measurements, unlike values of 2.1 and 1.9 (not shown). "

And this issue is discussed in the section '4.2 Limitation of the model

"One important parameter that was varied during model development to adjust the results was the fractal dimension. Decreasing it decreased the diameter of the peak value of nV_d . The value that was chosen, $D_{fr}=2$, was similar to some of the estimates of fractal dimension noted above and did provide the correct nV_d distribution when coagulation occurred. "

3.The discussion has been improved. We focus the comparison of our results to those from other iron fertilization experiments to understand the relative roles of coagulation and zooplankton grazing on particle export during different parts of the bloom cycle.

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The section "4.2.2 Potential impact of coagulation after iron fertilization (L 458-502)" has been rewritten. The review shows that phyto-aggregation was the mechanism responsible for large particles formation in two experiments among the whole iron fertilisation experiments. Both were at bloom onset and with low stirring.

Here we modelled diatom coagulation in the MLD that corroborated observations that show how fast aggregation can change particle sizes and export. While we were able to show the rapidity of aggregation, we were unable to follow the export because of cruise constraints. We acknowledge that following the fate of the aggregates requires a more elaborate model that would include a better turbulence description capable of improved predictions of phytoplankton distributions as well the bacterial and zooplankton distributions and their effects. Such a model requires more information than was available.

Please also note the supplement to this comment:

<http://www.biogeosciences-discuss.net/11/C2771/2014/bgd-11-C2771-2014-supplement.pdf>

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