

Interactive comment on “Picophytoplankton biomass distribution in the global ocean” by E. T. Buitenhuis et al.

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Received and published: 5 July 2012

Reply to reviews of “Picophytoplankton biomass distribution in the global ocean” ESSDD 5, 221-242 Reviewer 1. Reviewer comments in italics.

My main concern is that this database is not really global. The data sources are restricted to the work by the European and North American community. I don't know if the authors have tried to obtain data from other scientists. To my knowledge, there have been numerous measurements in western Pacific by Chinese and Japanese scientists (e.g., Jiao et al. Cont. Shelf Res. 2005; Ning et al. MEPS 2005; Liu et al. Deep-Sea Res. II 2002, 2007; Chen et al. Cont. Shelf Res. 2011). It seems that the British AMT cruises data (e.g., Zubkov et al. DSR1 1998, Zubkov et al. PIO 2000, Zubkov and Burkill Cytometry 2006) have not been included, either. I believe the available

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data should be much more than the current database.

The referee is right that our database does not contain all available data on picoplankton cell counts worldwide, but this was hardly feasible. Our database however includes data from all oceanic basins. To take this comment into account, we have changed the abstract as follows: from : “with the best data coverage in the North Atlantic, the South Pacific and North Indian basins”, to: “with the best data coverage in the North Atlantic, the South Pacific and North Indian basins, and at least some data in all other basins”. We therefore feel justified to use the words “in the global ocean” in the title. The database is the second largest out of 11 in the MAREDAT special issue. As such it represents both a significant amount of work and as far as we are aware it is more than 3 times as large as any previously published database on picophytoplankton and the first publicly available one. We make no claim that the database is a complete collection of all published data. Indeed, within the MAREDAT community we have already discussed future work to extend the present databases.

Another concern is on the vertical variations of carbon-to-cell conversion factors, as the authors also noted. Apparently, the cellular carbon content is much greater in lower euphotic zone than in upper euphotic zone and one conversion factor is not sufficient for accurately estimating picophytoplankton carbon. For example, Liu et al. (DSR2, 2007, vol54, 1602-1616) have used two conversion factors (24 fg C cell⁻¹ for Prochlorococcus above 60 m and 62 fg C cell⁻¹ below 60 m).

We have added a new figure to the manuscript showing the increase in size as a function of depth for the three groups of picophytoplankton, and expanded the discussion of the vertical variation in conversion factors in the third paragraph of the discussion, which now reads: “It has been repeatedly shown that Prochlorococcus and Synechococcus increase in cell size with depth up to 150 m. In contrast, previously published results for picoeukaryotes showed little variation in size as a function of depth (Li et al., 1993; DuRand et al., 2001; Grob et al. 2007). We compared the increase in size for the three groups at two locations. At BATS (which includes the data of DuRand

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et al., 2001), we also find an increase in cell size of Prochlorococcus and Synechococcus but not picoeukaryotes (Fig. 8A). However, in the Western Mediterranean (Almo 1 and 2, Jacquet et al., 2010), we find a similar increase in cell size of Prochlorococcus and Synechococcus, but a much larger increase of picoeukaryotes (Fig. 8B). The difference this could make to the global picophytoplankton biomass is large. If we use the standard conversion factors in the surface, and increase these linearly up to a factor 3 below 150 m depth (blue lines in Fig. 8), then the global biomass becomes 1.32 Pg C (+78

Specific comments: Methods: Please give a description of how you gridded the data.

All data in the ESSD special issue on MAREDAT have been gridded with the same program. We therefore added in the Results: "For further details on the gridding, see (Buitenhuis et al., 2012, this issue)."

Page 227, line 25-27, it seems unnatural to put this paragraph here. The context is on the picophytoplankton biomass, not the ecological adaptation strategies of picophytoplankton.

We have deleted this paragraph, and have instead given more details on the number of observations with depth in the Results: from: "Observations in the top 112.5 m make up 81 to: "Observations in the top 112.5 m make up 81

Figures: I suggest drawing a figure with number of observations shown in each grid.

We have added a new Fig. 1.

Technical corrections: Fig. 2 I only see two figures.

This has been corrected.

Please also note the supplement to this comment:

<http://www.earth-syst-sci-data-discuss.net/5/C84/2012/essdd-5-C84-2012-supplement.pdf>

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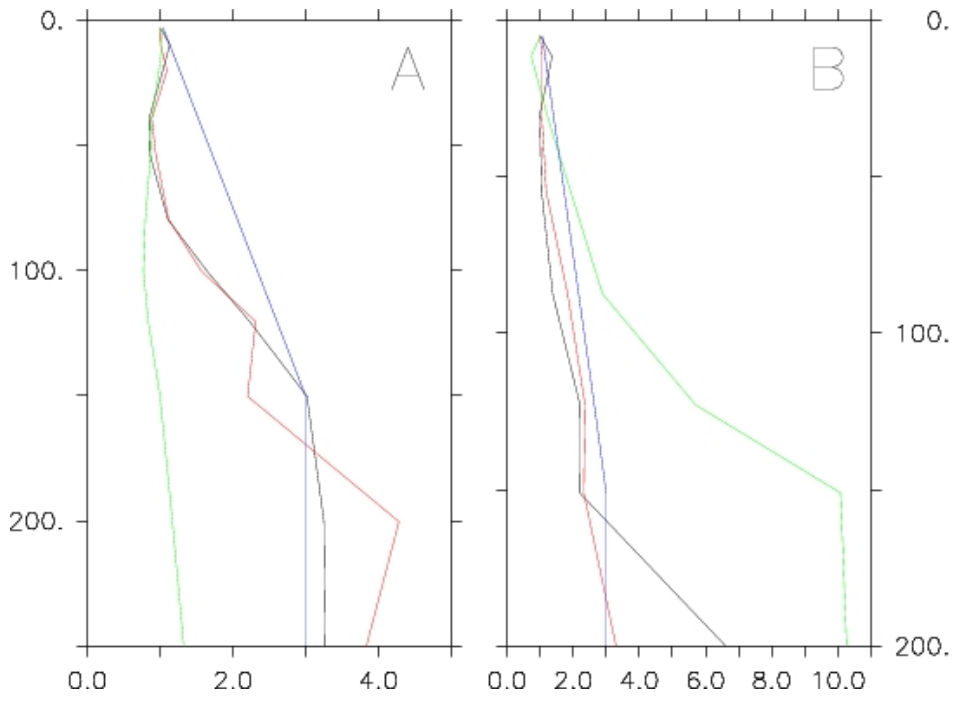


Fig. 1. Figure 8. Cell size as a function of depth, normalised to cell size at the surface. Black) Prochlorococcus, Red) Synechococcus, Green) picoeukaryotes, Blue) Exploratory conversion factor that increase