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## ***Interactive comment on* “On the treatment of particulate organic matter sinking in large-scale models of marine biogeochemical cycles” by I. Kriest and A. Oschlies**

### **Anonymous Referee #1**

Received and published: 17 October 2007

The study gives some interesting insights in the characteristics of particle flux parameterizations and investigates the role of different sinking speed parameterizations such as constant speed, change with depth and particle spectrum parameterization.

The vertical particle flux is of importance for the global carbon cycle, hence a detailed investigation of particle flux parameterizations is of relevance.

In general, the paper is well-written; I recommend the following moderate revisions before publication:

Major comments:

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1. The paper focuses on a comparison of global parameterizations of particle fluxes. Recent publications (e.g. Armstrong et al., 2002 or Francoise et al., 2002, Buesseler et al., 2007) indicate that the particle composition and hence the sinking speed do vary substantially from site to site. Therefore, the different sinking speed parameterizations should be validated regionally instead of globally. For example, in Figure 3 the fit of the flux ratio to the observations can be done for K2, ALOHA, NABE, etc in different plots, so that the reader can better evaluate the regional dependence of the sinking speed parameterizations.

2. Processes controlling the particle size and sinking speed should be discussed in more detail, for example, how zooplankton migration and density and how advection of currents influence the local particle composition, and how different particle aggregations influence the particle flux.

3. A test of different sinking speed parameterizations in a three-dimensional carbon cycle model would be worthwhile to explore, in order to study how the different parameterizations feed back on the tracer distribution. This may yield another constraint on the selection of the parameterization, particularly because the sediment trap data include substantial uncertainties.

4. The conclusions can be improved by highlighting the most important findings of this study.

Specific comments:

Title: I recommend rewording of the title since the paper focuses on particle flux parameterization formulations and not on the application in large-scale biogeochemical models (see major comment 3).

3007, 26: POM is defined as a fraction not passing a 0.45 micrometer filter (see e.g. Carlson et al., 1985)

3008,3: reword (e.g.): because predominantly the particles with large size and high

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sinking speed reach the deep ocean.

3008,14: power law (hereafter Martin curve) (Note: avoid quotation of Martin throughout the text)

3008,27: three-dimensional large scale ....

3011,1: The Martin curve

3011,10: With  $z=z_0+z'$  and  $r/a=0.858$ , eq. 6 represents the parameterization from Martin et al. (1987).

3011,13: and, for  $r/a=0.858$ , yields a ....

3011,20-23: reword without questions

3012,9: Keep formulas (7-13) consistent throughout the text: change  $M_i$  to  $M_i(t, z')$

3013,15: while particles with small size dissolve predominantly in the upper layers, as illustrated in Fig. 2.

3013,16: delete sentence

3014,6: looks quite similar -> is similar

3014,7: of magnitude) .. . 3014,8: Reword sentence or delete it.

3015,3: This indicates that the fine discretization

3015,17: delete or reword ...unfortunately in a quite complicated manner

3016,1: Delete or reword last sentence.

3016,10: Reword 'flat' power law

3016,19: Sentence 'Although' is unspecific

3017,8: Sentence unclear and unspecific

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3018, 3: ...scales improved the simulated tracer distribution (...).

3019, 6: Delete 'Obviously'

3022, 2: Maier-Reimer (1993) used a time step of one month

3022,8: The assumption to disregard the temporal resolution is not valid in areas of high eddy activity (high organic matter accumulation) and in areas of high vertical mixing (e.g. parts in the Southern Ocean)

3022,15: Summarizing,.. See 3022, 8 Reword.

3023,2: Reword sentence "Thus, ..."

3023,11-14: Sentences unclear.

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Interactive comment on Biogeosciences Discuss., 4, 3005, 2007.

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