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# *Interactive comment on* "Role of zooplankton in determining the efficiency of the biological carbon pump" *by* Emma L. Cavan et al.

**Anonymous Referee #1**

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Cavan et al. have compared estimated fluxes from marine aggregates collected using a marine snow catcher with model fluxes using the ecosystem model MEDUSA. The model differentiates between fast and slow settling particles and since the marine snow catcher can also separate fast settling from slow settling particles, the authors have compared the estimated fluxes from the observations (the marine snow catcher) with the predicted model results. The model was able to predict primary production that correlated well with satellite-derived estimates for the three study regions (the Southern Ocean, the Porcupine Abyssal Plain, and the Equatorial Tropical North Pacific oxygen minimum zone). However, the model predicted higher fluxes than those calculated from the particles collected with the marine snow catcher. The authors also observed inverse relationships for the slow sinking particles with increasing depth between the observations and the model for the Porcupine Abyssal Plain, while there were better



correlations between model predicted and marine snow catcher estimated fluxes at the ETNP OMZ. Since the model does not allow zooplankton grazing on fast settling particles, the authors concluded that zooplankton was important for fragmentation (creating small particles with increasing depth) and grazing on settling particles (high flux attenuation in the Southern Ocean and the Porcupine Abyssal Plain). The authors argued that there are few zooplankton in the oxygen minimum zones and therefore the potential lack of zooplankton in the ETNP OMZ caused the better correlations between model predictions and flux estimates from the marine snow catcher. The flux estimates from the aggregates collected by the marine snow catcher were done with literature conversion factors (Alldredge 1998). Unfortunately this makes the whole data set very weak. The aggregates measured in Alldredge (1998) were collected by Scuba diving in the Santa Barbara Channel, California, at depths between 10 and 20 m. Therefore, it is not possible to use these conversion factors to estimate carbon content of aggregates collected from depths down to 170 m from three very different regions than the Santa Barbara Channel. There are large differences in carbon content between shallow and deep ocean aggregates and generally aggregate composition and carbon content differs with both season and oceanic province. This means that the differences between the model outputs and the estimated fluxes from the marine snow catcher aggregates could just as well be due to the conversion factors used and the paper could just as well have been discussing different carbon content within aggregates from different study sites. In order to study the role of zooplankton for export fluxes, it would have been useful to have abundances and species composition of zooplankton from the different regions, is there for example any evidence that zooplankton grazing is different above an OMZ than in other euphotic zones? Furthermore, information about the aggregate types, e.g. marine snow versus zooplankton fecal pellets, information about particle transformation through the water column, and the vertical distribution of zooplankton in relation to the depths where the highest flux attenuation occurred would be required. The authors have an impressive data set with many stations where they collected aggregates with the marine snow catcher and I am convinced that this data set contains very valuable information, but it cannot be used to conclude anything about the role of zooplankton for flux attenuation and particle transformation through the water column.

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