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Dear editor,

Please find enclosed the a manuscript titled "**Size-differentiated Export in Different Dynamical Regimes in the Ocean**". This study addresses the impacts of ocean dynamics at submeso-scales ($<$10 km) on the vertical fluxes of particulate organic matter. Due to the challenges associated with resolving submeso-scales observationally, in both space and time, we rely on a process-oriented numerical model and particle-tracking to quantify the changes in fluxes of particulate matter. The model is initialized to statistically represent ocean conditions at Station Papa, in the Subpolar Northeastern Pacific, as this is a site where the NASA-funded EXPORTS program will be focusing a large part of its observational effort. A key aspect of our work is to consider the interactions between vertical currents at submeso-scales, and the sinking velocities spectrum for particulate matter.

The main conclusion of this work is that the traditional one-dimensional paradigm of a vertical flux driven exclusively by fast-sinking particles does not hold when submeso-scales dynamics are present. Our findings can be summarized in three key points:

(1) Ocean dynamics in the subpolar Northeast Pacific, often described as an "eddy desert", indeed exhibit submesoscale activity in the wintertime.

(2) Submesoscale dynamics generally enhance downward fluxes by increasing the contribution of slower-sinking particles to the total flux. The contribution of slower-sinking particles to the total flux is found to be at least significant, and can be dominant in certain conditions.

(3) Remineralization unexpectedly enhances the role played by slower-sinking particles in vertical fluxes of particulate matter.

We confirm that this work is original and has not been published elsewhere nor is it currently under consideration for publication elsewhere. We have no conflicts of interest to disclose.

Thank you for your consideration of our work. Please address all correspondence concerning this manuscript to mdever@whoi.edu.

Cordially,

Mathieu Dever