

## Turbulence controls size distribution of aggregates: in-situ observations by a microstructure profiler and a cabled observatory

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Marine aggregates are ubiquitous particles formed from the accretion of smaller biogenic and non-biogenic components. Visible aggregates, known as marine snow, are typically in the 0.5 to few mm size range. Aggregates are well recognised as hotspot of microbial and planktonic activities. Aggregates formation is an important pathway for transferring materials and carbon flux from surface to the deep ocean. Because aggregate sinking velocity and carbon mass content is size dependent, understanding the physical mechanism controlling aggregate size distribution is fundamental to determining the biological carbon pump efficiency.

Turbulence is a physical mechanism in the aggregates formation and destruction. However, the relative roles of turbulence in aggregates formation and destruction have not been fully tested in observational studies. In this study, we analysed simultaneous in-situ observations of turbulence and aggregate in the various aquatic systems. A microstructure profiler (TurboMAP-L) and a cabled observatory(OCEANS) were used to collect shear data and a digital still logger camera was used to collect images of aggregates. Digital images were subsequently used to determine aggregates abundances and size distributions. Direct comparison of turbulence intensity and aggregate size distributions show that turbulence below TKE dissipation rate= $10^{-6}$ [W/kg] enhances aggregation, increasing average particle size; greater turbulence causes particle breakup, limiting the average maximum aggregate size and decreasing the slopes of size distributions. This indicates the role of turbulence controlling aggregate size distributions. We also present fluorescence data collected by TurboMAP-L and focus on difference of aggregates size distributions among different aquatic systems.

Keywords: Turbulence, Aggregate, Carbon flux