Scaling Analysis of the Algal Blooms

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Algal blooms, also known as ‘red tide’, are extremely harmful to the marine ecosystem since they infuse toxins into seawater and stifle oxygen in the water columns. Visually, they demonstrate rich patterns in spatial due to the interaction between the ocean current and the wind. Using the satellite remote sensing data provided by the Chinese satellite Gaofeng 1, we first derive a normalized difference vegetation index (NDVI), which can be used to separate efficiently different types of cases, e.g., no algae bloom (NAB), macro algae bloom (MAB), and phytoplankton algae bloom (PAB), etc. The classical structure-function analysis is performed. Our preliminary results confirm the existence of the power-law behavior on the spatial scale range from 100 m to 400 m for the case of MAB. The corresponding scaling exponents are close to the ones of the classical passive scalar in three-dimension hydrodynamic turbulence. It suggests that the MAB could be treated as a passive scalar, which leads to not only a better understanding of the dynamics of algal blooms, but also a challenge of the modelling.