Ocean Surface Current multiscale Observation Mission (OSCOM): Status and Progresses

Yan Du, Xiaolong Dong, Xingwei Jiang, Yuhong Zhang, Di Zhu, Wen Chen et al.

Ocean current is one of the major drivers of water mass, energy, and biogeochemical cycles in the global ocean-atmosphere boundary layer and also a key variable in the formation of extreme climate events (e.g., El Nino). Ocean near-surface current has enormous energy, involving processes in multiple spatial and temporal scales. Nearly 90% of ocean kinetic energy clusters in mesoscale and sub-mesoscale. No direct observation of the global ocean surface current now. Current satellite measurements are unable to achieve the the global ocean water motions in non-equilibrium states, such as submesoscale processes.

OSCOM will launch a satellite equipped with a Doppler Scatterometer to directly measure ocean surface currents with a very high horizontal resolution of 5-10 km and a 3-day global coverage. The accuracy of currents is 0.1 m/s in speed and 15° in direction.

Key Scientific Objectives
- To directly observe global OSC at a (1 km) scale (5-10 km), filling the gap of OSC observation in the space measurements;
- To advance the research of ocean sub-mesoscale dynamics, multiscale processes, mass-energy exchanges between ocean and atmosphere, and biogeochemical cycles, promoting the development of theoretical research on ocean science and climate change;
- To establish the foundation for numerical simulation of ocean non-equilibrium processes, providing theoretical and technical support for earth system modelling and earth observation applications.

Scientific Requirements

The quasi-geostrophic current in the middle and high latitudes has a scale of 20–100 km, and the ageostrophic and non-equilibrium processes in the tropical oceans can reach 10 km. The sub-mesoscale dynamics vary rapidly, typically with a time scale of 0 (1 day).

In the global oceans, the drifter-observed 6-hour mean currents with speed larger than 0.1 m/s account for ~81% of total currents. This value rises to ~95% of in-situ observations in the South China Sea. The kinetic energy of the currents with speed larger than 0.1 m/s accounts for more than 99% of all kinetic energy in both data. The non-geostrophic currents determine the directions of the total currents in the near-equatorial trade winds and mid-latitude westerly winds prevailing regions, where the maximum non-geostrophic speed can reach twice the geostrophic speed and exceed 60% of the total current.