CONSIGLIO NAZIONALE DELLE RICERCHE
ISTITUTO DI SCIENZE MARINE

CICLO DI SEMINARI

https://cnronline.webex.com/cnronline/j.php?MTID=mee9ed5ac4049a6b7b8adf0cf915468df

17 April, 14h30

Dynamical Decomposition of Multiscale Oceanic Motions

Professor Zhiyu Liu

College of Ocean and Earth Sciences, Xiamen
University, Xiamen, China

To date, large uncertainties remain in our quantitative understanding of the mechanical energy transfers in the world ocean characterized by multiscale and multi-regime motions. A robust decomposition of multiscale oceanic motions is crucial to exploring dynamics of various flow regimes and quantifying oceanic scale interactions and energy exchanges, but remains a great challenge. Conventional approaches focus on time-scale or space-scale decomposition which usually achieves /incomplete/ separation of different flow regimes.

In this talk, I will show how fundamental dynamics of oceanic flows can be used to develop simple approaches for disentangling various dynamical regimes. First of all, dynamical characteristics of prototypical oceanic motions are utilized to decompose realistic oceanic flows into six distinct regimes (i.e., large-scale circulations, barotropic tides, low-mode internal gravity waves, mesoscale flows, high-mode internal gravity waves and submesoscale flows). Moreover, the classic theory of vortical and wavy modes is extended with the introduction of a background flow, and a dynamical filter for disentangling the vortical and wavy motions in /spectral /space is devised according to the extended theory; correspondingly, the governing equations of the vortical and wavy motions are rigorously derived from the primitive equations.

The usefulness and robustness of the proposed decomposition approaches are elaborated with proof-of-concept applications to simulated flows from a global, tide-resolving and submesoscale- admitting configuration of MITgcm (i.e., LLC4320). It is hoped that these dynamics-based decomposition approaches for disentangling multiscale oceanic motions will help reveal the mechanisms of oceanic scale interactions and the associated energy transfers