Satellite gravity missions and physical oceanography

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Oceans play a key role on mass redistribution on the Earth's surface through global water circulation, and hence influence the shape of the geoid. With the GRACE-type satellite gravity missions, possibility of detecting the oceanic variations at spatial scales of a few hundred kilometers or larger and at time scales of a few weeks or longer has been suggested. Barotropic changes are difficult to detect with conventional ship-board hydrographic observations, and the gravity missions can have significant impacts on physical oceanography.

Large scale phenomena such as the global redistribution of water mass will be major targets for the gravity missions. Combined use with satellite altimetry can be a help to distinguish steric change from mass change. The gravity missions can also be used to validate barotropic changes in Ocean General Circulation Models. Some studies have already suggested consistency of model results with altimetric observations. However, traveling speeds of barotropic waves are generally rapid, and the effect of high frequency aliasing should be carefully estimated. Some of the other interests of physical oceanographers will be proposed to estimate their feasibilities.

Some groups are planning to use sea-floor pressure gauges and validate the gravity missions. These can be a help to estimate the effect of the high-frequency aliasing. In some regions and on longer time scales, it will be important to estimate not only oceanic variations but also vertical crustal motions. Cooperation of various research communities is indispensable in utilizing the satellite gravity mission.