Satellite Remote Sensing of Submesoscale Eddies in the Russian Seas.

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Abstract: Numerous field measurements (especially large in number since the 1970s when the Soviet experiment POLYGON-70, the American experiment MODE, and the Soviet-American experiment POLYMODE were performed) and satellite imagery showed that the oceans are full of eddies of different formation mechanisms and different spatial and temporal characteristics. Among the inhabitants of the eddy zoo: frontal eddies of large-scale currents, open sea eddies, topographic eddies, eddies generated under atmospheric influence, intrathermocline lenses, dipoles, tripoles, etc. Their diameters vary in the wide range from a few kilometers to over 200 km and lifetimes from a few days to tens of months and even years (in case of intrathermocline lenses). Eddies with a horizontal scale *D* of order of the Rossby internal radius of deformation *Rd* relate to mesoscale (synoptic in Russian literature) ones. These geostrophic or quasi-geostrophic eddies with anticyclonic or cyclonic rotation (clockwise or counter-clockwise in the Northern Hemisphere, respectively) are the most studied to date both with in-situ measurements and with satellite observations. They are a powerful mechanism of horizontal (due to the involvement of the surrounding waters on the eddy periphery) and vertical (due to upwelling/downwelling motions of the water at the eddy center) mixing in the ocean.

Observations (photographs in sunglitter areas on the sea surface) of American space oceanographers from the spacecrafts, especially during shuttle mission 41-G, US (1984), have shown that submesoscale (*D* less than *Rd*) eddies exist throughout the ocean. They have a spiral form, rotate in the cyclonic direction and are observed in the ocean beyond six degrees north and south latitude. Such eddies are also found on the radar images in different regions of the ocean/seas.

It is assumed that submesoscale flows are characterized by a larger Rossby number (Ro of O(1)) and higher (on order of magnitude) vertical velocity than the mesoscale, which determines their important role in the vertical exchange between surface and deeper layers of the ocean/sea. However, to date, information on the mechanisms of their generation, life history and vertical structure is clearly insufficient. In-situ measurements in the eddies' areas are practically absent because of their small time of life and small spatial sizes. Therefore, the accumulation of satellite observations of submesoscale vortices in various oceans/seas together with related information on hydrophysical and meteorological conditions is extremely important.

In this paper, observations of submesoscale eddies in the Russian seas (the Black, Caspian, Baltic, and White) are discussed and assumptions are made about possible mechanisms of their formation.