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Dynamically equilibrium shapes of the mesoscale eddies and mechanism of their motions in the ocean

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Full-scale measurements indicate that ocean mesoscale vortexes (submerged lenses and near surface rings of the ocean currents) have density homogeneous or weakly stratified cores.

We offer the model of the submerged lens as homogeneous rotating mass of the ideal fluid in linear stratified ocean, which is at rest with respect to the rotating Earth. Both components (vertical and horizontal) of the Earth's rate are taken into account. The dynamically equilibrium closed shape of the interface between water masses is determined by the condition of the pressures equality on the interface. This shape is an exact hydrodynamic spatial non-axisymmetric solution. For anticyclonic lens this shape is a triaxial ellipsoid closely related to a rotation ellipsoid. The main axes in the meridian plane are inclined with respect to horizon on the little angle so that south edge of the ellipsoid is below and its north edge is higher than horizon on the depth of the corresponding isopycnic surface. The angle of inclination is defined depending on parameters of the phenomenon. This shape creates the moment of hydrostatical forces, which support the precession of the lens –gyroscope angular momentum in absolute space according to the Earth rotation.

The departure from the hydrostatic equilibrium of the lens (for example owing to thermohaline change of its density) results in its forward movement. During analysis this movement anisotropic additional masses are introduced as for rigid body. The motion along parallel circle occurs in geostrofic balance, when the projection of the

slide down force or of the slide up force is balanced with the Coriolis inertia force. The velocity along meridian is connected by the angle of inclination with the vertical velocity. This can explain the general motion of the Mediterranean lenses in Atlantic towards southwest.

Some similar results for rings of ocean currents are mentioned. In particular dynamically equilibrium shapes of the anticyclonic rings have height over the quiet ocean surface and the cyclonic rings have cavities. This is in accordance with satellite observations. The explanation of the motion of both types Gulf Stream rings to the southwest is offered.

Received results explain the prolonged lifetime of the lenses and rings in the ocean, the reasons and directions of their motions.

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