NEW TYPE OF CENTRIFUGAL INSTABILITY IN A THIN ROTATING SPHERICAL LAYER

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Abstract: Flows of a viscous incompressible fluid in a spherical layer that are due to rotational oscillations of its inner boundary with respect to the state of rest are numerically studied. With oscillations amplitude increasing the flow becomes unstable and in addition to circulation in meridional plane of the flow toroidal structures appears near the equator plane. It is found that three kinds of instability are observed, and each kind is associated with its own range of oscillation frequencies. For large and small frequency values well known Gortler vortices in the first case and Taylor vortices in the second are observed. In both cases rotation direction in the vortices near equator plane is opposite to the direction of rotation in adjacent meridional circulation, and there is only one extreme~~s~~ of vorticity in each, upper and lower, half of meridional plane. At intermediate frequencies new spatial structures were revealed, with characteristic scale which does not exceed half of the spherical layer thickness. Direction of rotation in these structures coincides with the same for adjacent meridional circulation, and number of vorticity extremes alternates during the cycle of oscillation.

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