NAVIER–STOKES EQUATIONS ON THE BETA-PLANE

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Abstract

Mathematical analysis has been undertaken for the vorticity formulation of the two dimensional Navier–Stokes equation on the β-plane with periodic boundary conditions. This equation describes the flow of fluid near the equator of the Earth. The long time behaviour of the solution of this equation is investigated and we show that, given a sufficiently regular forcing, the solution of the equation is nearly zonal. We use this result to show that, for sufficiently large β, the global attractor of this system reduces to a point. Another result can be obtained if we assume that the forcing is time-independent and sufficiently smooth. If the forcing lies in some Gevrey space, the slow manifold of the Navier–Stokes equation on the β-plane can be approximated with $O(\varepsilon^{n/2})$ accuracy for arbitrary $n = 0, 1, \cdots$, as well as with exponential accuracy.