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Distinguished trajectories and the Lagrangian structure of geophysical flows.

A. M. Mancho and J.A. Jimenez Madrid
ICMAT, CSIC, Spain (a.m.mancho@imaff.cfmac.csic.es)

Aperiodic geophysical flows are poorly understood as theory which is well established in autonomous or periodic flows is not directly applicable to them. In stationary systems the idea of fixed point is a keystone to describe geometrically the solutions of the dynamical system. The concept of fixed point is extended to time periodic vector fields by means of the Poincaré map, as periodic orbits with T period become fixed points on the Poincaré map. In order to gain insight in the Lagrangian structure of geophysical flows in this presentation we propose a generalisation of the concept of fixed point to aperiodic dynamical systems: the distinguished trajectory. In the context of highly aperiodic realistic flows our definition characterizes special trajectories and states that they hold the property of being distinguished in a finite time interval. Previous works by Ide *et al.* and Ju *et al.* have addressed the existence of distinguished hyperbolic trajectories but our new definition shows that non-hyperbolic orbits may also fall within this category. This type of trajectories might be of special interest for their applications in oceanography as they are related to eddies or vortices.