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Finite Size Lyapunov Exponents as lagrangian diagnostics of barriers effects in stratosphere

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Strong jet current systems, like the one surrounding the polar vortex in the stratosphere, may behave (or not) as dynamical barrier to Lagrangian cross-stream mixing, dependently on some flow characteristic parameter. This phenomenon can be studied in detail with the aim of simplified meandering jet models, defined in terms of a kinematic velocity field having qualitatively a similar large scale shape as the actual polar jet. We employ analysis techniques coming from the dynamical systems theory, e.g. the finite-scale Lyapunov exponents, already well established as the most reliable tool when dealing with relative dispersion problems in strongly nonlinear fields. In particular we define a 2D spatial map of the "mixing rate" at a given location by means of the finite-scale Lyapunov exponents computed between a given minimum and maximum particle separation, and identify the presence of a barrier to (meridional) mixing as the region of zero mixing rate (the set of all initial positions of those particle pairs which do not attain the given maximum separation threshold within the observation time). We present preliminary results relative to a 3D version of the meandering jet model, and in perspective we plan to reply our analysis to realistic Lagrangian stratospheric trajectories integrated from meteorological wind data relative to the winter polar stratosphere, in order to study both the climatological and the thickness features of the polar jet barrier.