



How reliable are Finite-Size Lyapunov Exponents for the assessment of ocean evolution?

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Due to its inherent turbulent nature, ocean motion possess a great complexity. We can barely describe the main patterns of general circulation at large scale, but the extreme richness of circulation patterns at mesoscale and lower scales makes the assessment of ocean evolution quite complicated. These difficulties are specially relevant when one tries to study problems of Lagrangian character, such as mixing, dispersion and transport of oceanic properties. For that reason, the implementation of appropriate Lagrangian diagnostic tools are in order. A prominent Lagrangian technique which starts to be widely used in oceanography is that of Finite-Size Lyapunov Exponents (FSLE). FSLE is a local measure of particle dispersion is obtained at each point, which serves to characterize Lagrangian structures. Although mathematically appealing, it is rather unclear how robust are FSLE analyses when confronted to real data, that is, data affected by noise and with limited scale sampling. In this paper, we analyze the effect of finite scale samplings and of diverse types of noise on FSLE diagnostics. Both effects should be accounted to determine which part of the diagnostics is reliable. Most importantly, scale dependence of FSLE reveals the emergence of a cascade-like hierarchy in Lagrangian structures, which can be used to improve diagnostics and to better understand ocean dynamics.