Cyber-enabled investigations in Lagrangian turbulence

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Direct numerical simulation (DNS) of three-dimensional homogeneous isotropic turbulence on a periodic domain constitute an important laboratory for the study of the fundamental dynamical properties of advected particles. Along with the standard integration of the Eulerian field, several models for the transport of Lagrangian particle can be used: from the most simplistic to the more sophisticated ones. We will report on recent state-of-the-art numerical efforts aimed at paralleling recent, current (and future) experimental investigations. As a matter of fact, at present, both experiments and numerical simulations do not have enough resolution in order to fully disclose the phenomenology of the many aspects of Lagrangian turbulence. In this respect the route towards Petascale computing is definitely an essential way for investigating the physics of Lagrangian turbulence. Particularly important, when dealing with large-scale simulations, is the issue of large-volume I/O and, in particular, of its successive post-processing. Efforts towards collaborative explorations, towards the development of common data-formats, of state-of-the-art numerical databases, and other ideas directed at maximizing the outcome from numerical efforts will be presented and discussed. The international database of CFD cases, iCFDdatabase - http://cfd.cineca.it, from where raw data -coming from tens of different scientific cases- can be freely downloaded, will also be briefly presented and discussed.