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Simultaneous measurements of large-scale flow dynamics and small-scale turbulent properties by a hybrid method combining cross-correlation and optical-flow schemes[1] YE TIAN, ZHEN-YUAN GAO, SHI-DI HUANG, Department of Mechanics and Aerospace Engineering, Southern University of Science and Technology, TIANSHU LIU, Department of Mechanical and Aerospace Engineering, Western Michigan University — Particle image velocimetry (PIV) has been established a standard technique based on cross-correlation scheme for velocity field measurement. While PIV holds advantages in the measurements of large-scale flow dynamics, its accuracy in measuring small-scale turbulent quantities is always unsatisfactory due to limited spatial resolution. On the other hand, optical flow method is born with the capability of extracting high-resolution velocity field up to one vector per pixel [J. Fluid Mech. (2008), vol. 614, pp. 253–291]. In this work, we utilize a hybrid method, combining cross-correlation and optical flow schemes, to analyze the PIV images of global field measured in turbulent Rayleigh-Bnard system. Both the large-scale flow structures and small-scale turbulent properties are obtained simultaneously. It is found that the time-averaged velocity fields are consistent with the results obtained by standard PIV technique. Furthermore, the kinetic energy dissipation and structure functions obtained from present method are compared with those obtained from standard PIV method.

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