Reconstruction of turbulent flows from partial measurements and statistics

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Abstract

Turbulent flows are characterized by a wide disparity of scales and complex spatio-temporal dynamics. Numerical simulations can provide exhaustive information about the flow over limited periods of time , while experiments only give access to partial instantaneous measurements. While flow statistics are usually relatively easy to obtain, having access to full instantaneous realizations may be critical to understand specific physical mechanisms and possibly control them. We show how second-order statistics can be coupled with partial instantaneous information in order to recover the full flow field. Two examples are given:(i) we reconstruct the 3D flow above a cavity from 2D measurement planes (ii) we reconstruct the flow close to the wall in a turbulent channel from outer layer information.

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