Abstract Submitted
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Investigation of the influence of the subgrid-scale stress on non-intrusive spatial pressure measurement using an isotropic turbulence database[1] SETH SIDDLE-MITCHELL, XIAOFENG LIU, San Diego State University, JOSEPH KATZ, Johns Hopkins University — The instantaneous pressure distribution in a turbulent flow field can be measured non-intrusively by integrating the measured material acceleration using particle image velocimetry (PIV). However, due to the finite spatial resolution of the measurement, the pressure reconstructed from PIV is actually subjected to the effect of spatial filtering. Consequently, the reconstructed pressure is effectively imbedded with the contribution of the sub-grid scale (SGS) stress, which is a term appearing in the filtered Navier-Stokes equation. To quantify the effect of the SGS stress on non-intrusive spatial pressure measurement, we use box filtering to filter three dimensional velocity components in a time-varying isotropic turbulence flow field available to public from the John Hopkins University Turbulence Database (JHTDB). Preliminary results show that the error in the reconstructed instantaneous pressure caused by the SGS stress is about 4.4% of the r.m.s. fluctuation of the filtered isotropic pressure. Correction using similarity SGS modeling reduces the error to 2.1%.

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