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An identification of coherent structures in an inhomogeneous turbulence RYUICHI NAGAOSA, RISS, AIST — This study proposes a proper scaling of a vortex indicator for practical identification of coherent structures (CS) from an inhomogeneous wall turbulence at the Reynolds numbers of $Re_\tau = 180$ and 400. The Laplacian of the pressure, Θ, is scaled by its time-space average Θ_{ave} and root-mean-square value Θ_{rms} to obtain a proper scaling for effective identification of CS, $\hat{\Theta} = (\Theta - \Theta_{ave})/\Theta_{rms}$. Numerical turbulent flow realizations with a wall and a gas-liquid interface obtained by a direct numerical simulation technique are employed to confirm suitability of the proposed scaling. The results of this study exhibit that the probability density function (PDF) of $\hat{\Theta}$ is very similar without respect to the distance from the wall, unlike PDF of unscaled Θ. Because of this statistical similarity, identification of CS based on $\hat{\Theta}$ is shown advantageous to separate all the essential CS from disorganized turbulent background using a unique threshold level, especially in the region adjacent to the wall and the gas-liquid interface. Several turbulent flow signatures at the gas-liquid interface suggest that a threshold of $1 \leq \Theta \leq 2$ is preferable to identify all the essential CS in the whole of the turbulent flow domain, without "contamination" caused by misidentification of meaningless structures.

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