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The effects of local blowing perturbations on thermal turbulent structures CAN LIU, GUILLERMO ARAYA, Texas Tech U., STEFANO LEONARDI, U. of Texas Dallas, LUCIANO CASTILLO, Texas Tech U. — Blowing is an active flow control technique with several industrial applications, particularly in film cooling of turbine blades. In the past, the effects of localized blowing have been mostly analyzed on the velocity field and its influence of the flow parameters and turbulence structures (Krogstad and Kourakine, 2000). However, little literature can be found on the effects of blowing on the coherent thermal structures. In the present study, an incompressible turbulent channel flow with given steady blowing at the wall is simulated via DNS by means of five spanwise holes. The Reynolds number based on the friction velocity and half channel height is approximately Re = 394 and the molecular Prandtl number is Pr = 0.71. Temperature is considered a passive scalar with isothermal conditions at the wall. Different blowing amplitudes and perturbing angles (with respect to the streamwise direction) are applied to find out their effects on the turbulent thermal structures by means of a two-point correlation analysis. In addition, local reduction and increase of drag are connected to vorticity. The corresponding influence of perturbing amplitudes and angles on the energy budget of thermal fluctuations and turbulent Prandtl numbers are also shown and discussed.

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