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Effect of initial conditions on mixing within a turbulent channel flow EMMANUEL GERMAINE, LAURENT MYDLARSKI, LUCA CORTELEZZI, McGill University — We analyze the mixing of a passive scalar (temperature) in a turbulent channel flow for different initial conditions by means of numerical simulations. The numerical domain is a channel delimited by two parallel and infinite flat walls, simulated using periodic boundary conditions in the streamwise and spanwise directions. We consider three initial distributions of temperature, where hot and cold fluids are separated by a sharp but continuous interface that subdivides the computational domain into two identical halves. The interface is taken parallel to the walls or perpendicular to them, oriented in the streamwise or spanwise directions. We perform a direct numerical simulation of the temperature field at $Re_\tau = 190$ when the flow is fully turbulent. The numerical scheme combines an advection diffusion solver, i.e, a third-order flux integral method based on UTOPIA (Leonard *et al.*, Appl. Math. Modeling, 1995), with a Navier-Stokes solver, i.e, spectral code released by Prof. John Gibson, http://www.channelflow.org). We quantify the time-evolution of the mixing performance of the turbulent flow using different measures of the mixing, including a negative Sobolev norm – a diagnostic currently used to asses the mixing performance of laminar flows. Finally, we discuss the influence of the initial conditions on the turbulent mixing. Funding was provided by NSERC (grants RGPIN217169 and RGPIN217184).

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