EGU22-4189
https://doi.org/10.5194/egusphere-egu22-4189
EGU General Assembly 2022

Scale-wise relaxation to isotropy in direct numerical simulations

Georgios Bagiatis[1], Alzbeta Medvedova[1], Ivana Stiperski[1], Mathias Rotach[1], and Alexander Kendl[2]
[1]Department of Atmospheric and Cryospheric Sciences (ACINN), University of Innsbruck, Innsbruck, Austria (georgios.bagiatis@uibk.ac.at)
[2]Institute for Ion Physics and Applied Physics, University of Innsbruck, Innsbruck, Austria (alexander.kendl@uibk.ac.at)

The Kolmogorov hypothesis of local isotropy is fundamental in stochastic models of turbulence and generally assumed to hold for atmospheric turbulence. According to Kolmogorov's second similarity hypothesis, there is a range of turbulent scales (inertial subrange) that are statistically isotropic and the statistics of these scales have a universal form that is uniquely determined by the TKE dissipation rate. Recent work based on atmospheric turbulence measurements has shown that the scale-wise route turbulence takes to reach isotropy at these smallest scales is uniquely determined by the anisotropy of the energy containing eddies.

In this study we explore the connection between large-scale anisotropy and the route to small-scale isotropy through direct numerical simulations (DNS). We perform simulations of neutral flow over flat and rough (wavy) surfaces at different Reynolds numbers, to investigate the scale-wise anisotropy as a function of height from the surface and surface-roughness. The resulting trajectories of relaxation to isotropy are compared to the experimental ones and the differences between the two are explored in light of the return-to-isotropy terms and Reynolds number.