Institut für Geophysik

Geophysikalisches Kolloquium

Wintersemester 2026/2027

Montag, 16.11.2026

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Emergent large-scale dynamics in stably and unstably stratified flows

Gravity, the weakest of the four fundamental interactions in physics, pervades the whole universe while being inescapable by acting as a body force. Depending on the mass density stratification of a configuration, gravity may thus either stabilise or destabilise a fluid and affect geophysical and astrophysical flows. This talk will cover simplified yet meaningful configurations which correspond to either one of these cases and are accessible to direct numerical simulations.

In the first part of this talk, we will focus on unstably stratified Rayleigh-Bénard convection as the paradigm of thermal convection. We will cover some recent results from studying the impact of thermal (and mechanical) boundary conditions on large-scale flow structures. It will be shown that thermal boundary conditions are crucial to the formation of long-living large-scale (turbulent) flow structures. In particular, a slow transient aggregation process — that only stops once the horizontal extent of the domain is reached — can be found once the fluid layer is subjected to Neumann-type constant heat flux boundary conditions. We trace this mechanism of self-organisation of flow structures back to secondary instabilities as well as an inverse cascade in spectral space.

In the second part of this talk, we will focus on stably stratified shear-driven turbulence that exhibits a Kelvin-Helmholtz instability. In this set-up, two layers of fluid interact only due to an imposed shear profile which inevitably renders the flow anisotropic even in the horizontal directions. Traditionally, this configuration has been studied by means of initial value problems where the ensuing turbulence decays eventually due to dissipation. Here, in contrast, we consider the presence of a forcing that enables entering a statistically stationary state. It will be shown that an analysis of characteristic length and time scales reveals highly anisotropic dynamics associated with the self-organising flow.

Das Kolloquium findet um 11:15 Uhr im Seminarraum GEO 315, Corrensstr. 24, 48149 Münster statt. Alle an dem Thema Interessierten sind hierzu herzlich eingeladen.

Die Dozenten des Instituts für Geophysik