

ACCORD

A Consortium for COnvection-scale modelling
Research and Development

Side meeting on stable PBL modeling

Outcome summary (Martina, Jeanette, Eric, Patrick, Claude, Katya)
Fri 8 April 2022

Motivation

- **During periods of stable BL in winter T2m error can reach +20K**
- **Large errors in wind and temperature profiles during these periods**

- **Too much or too little turbulence in (very) stable PBL (SBL) with temperature inversion and low wind**
- **Errors in the land surface scheme (snow)**

Issues & lessons from experience

- **Turbulence schemes were built using assumptions of stationarity and horizontal homogeneity**
 - These assumptions may not be valid in stable BL
 - Turbulence is transient and affected by horizontal heterogeneity in temperature (due to heterogeneity both in land cover and orography)
 - Monin-Obukhov profiles not really valid for intermittent turbulence
- **U^* is classically computed using scalar wind**
 - however in low wind conditions changes in both direction & intensity contribute to scalar transport (in intermittent mode)
- **Numerical and computational issues**
 - Resolution, accuracy
 - Dirty fixes

Ways forward

- **From talks of Dmitrii:**
 - DNS and LES studies to understand the essential physics
 - Employ the new turbulence scheme TKESV (Turbulence Kinetic Energy - Scalar Variance) developed by D. Mironov and E. Machulskaya and implemented in ICON
- **From the talk of Daniel:**
 - Introduce additional term to scalar-flux formulations
- **Learning from relevant observations:**
 - to understand horizontal and temporal variability of wind and temperature
 - to understand energy balances and profiles in the atmosphere and surface in stable BL conditions
- **Studying atmospheric modelling results:**
 - Can horizontal heterogeneity be reproduced/described on the grid and by using tiles and patches (subgrid)?

Short-mid term actions proposed in ACCORD

- **Form a task team, to contact BL academic experts**
 - discuss which relevant observational data sets they know, which ones they can make available
 - get details on the characteristics of these data sets, any useful info how they can be used for diagnosing space-time variability in SBL
 - suggestions: Sodankylä, specific instrumented sites (France?), contact Daniel Belusic, contact Larry Mährt (US)
- **We want to be ready to test ideas from academic studies, on how to improve parametrizations. Currently, we have no plans to do DNS or LES ourselves**
- **Cooperation with COSMO: we want to keep the door open (continue scientific exchange and keep updated on plans and progress about SBL activity)**