
Towards Improved Representation of Stably Stratified Boundary Layers in NWP Models (a few points to stir up discussion)

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What is the Problem?

- Very large forecast errors in SBLs, e.g.
 - T2m forecast errors can be up to 20 degrees off (winter, night time)
 - large errors in wind and temperature structure of the boundary layer
- Problem exists in most (if not all) NWP and climate models
- Problem remain unresolved for several decades
- A lot of tuning-type efforts, but little progress

Can we do better?

Some Key Issues

- Horizontal thermal heterogeneity effects (talk by Dmitrii Mironov), surface-layer flux-profile relationships for heterogeneous surfaces
- Sub-grid scale orography effect on scalar transfer (e.g., sub-grid scale katabatic winds)
- Weak-wind boundary layer maintenance (talk by Danijel Belušić)
- Underlying soil/water and turbulence interaction: positive feedback; role of radiation
- Interaction between various parameterization schemes, e.g., momentum transfer by turbulence and SSO effects
- Numerical aspects: vertical and horizontal resolution, time step, coupling methods of different schemes

Proposed Co-operation

- A small-scale project focused on a few salient SBL features, incl. horizontal heterogeneity, SBL – soil/water coupling, numerical aspects and complex interplay of various parameterization schemes within NWP models
- Careful reconsideration of physical ideas behind existing parameterization schemes (limits of applicability!)
- Extensive use of LES and DNS for process studies (understand essential physics)
- High-quality measurements
- Well-targeted numerical experiments, incl. single-column runs
- Both component testing and system testing (holistic approach)

What Should Be Avoided

- Project blow up
- Attempt to study all conceivable SBL regimes
- Yet another intercomparison-type modelling study
(run model for a few cases, produce lots of nice plots, write words, full stop)
- “High-resolution eddy-resolving” SBL simulations (“LES”) with the horizontal mesh size of order 100 m
(fashionable nowadays, but pretty useless)