First TEAMx Workshop

Session F: Mountain boundary layer flows

Themes: Three-dimensional structure of the mountain boundary layer (MoBL); Turbulent and advective exchange processes; Vertical extent and time scales of mountain-induced exchange; Convective and stable boundary layers

Participants

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15:00-15:15	Introduction (incl. short overview presentation).
15:15-16:00	Part 1: Discussion on physical processes. Four parallel panels.
16:00-16:30	Coffee break
16:30-17:00	Wrap-up of part 1. All session participants together
17:00-18:00	Part 2: Discussion on experimental and modelling aspects. Two parallel panels.
18:00-18:30	Wrap-up of part 2. All session participants together.

White paper: What is missing

Processes

- Interaction between mountain-induced circulations and other mesoscale motions (e.g., breeze systems at coastlines or lake shores).

Observations

- The use of airborne remote sensing platforms (e.g, Doppler and Raman lidar)
- Synergy between remotely sensed and in-situ measurements (both “traditional”, e.g. tethersondes, and “innovative” e.g., drones).

White paper: What is missing

Modelling

- LES case-studies (e.g., nested in mesoscale model runs: realistic terrain, land cover and ambient flow): an intermediate step between highly idealised process studies and state-of-the-art operational NWP. Better suited for:
  - Comparing with high-density observations.
  - Developing experimental strategies (e.g., instrument siting; evaluation of the uncertainty due to lidar scanning strategies).
  - Parameterization development (best possible model).
- Microphysics parameterizations. Probably not a “complex-terrain-specific” issue, but are key to the good modelling of several relevant processes (e.g., impact of aerosols on nucleation processes, convection initiation, etc.).

Working groups

- Protocols for processing data collected in complex terrain (esp. Doppler lidar data).
- Deployment of emerging or new technologies (e.g., sonic measurements on tethered balloons, swarms of drones, …)
- Intercomparison of idealized modelling experiments over complex terrain.

Process understanding: Priorities

- **Identification of relevant length/time scales**. Characterizing the MoBL with a single scale (e.g., its height/depth) does not seem feasible or useful. There can be many (e.g., horizontal vs. vertical; dictated by the orography vs. the dominant processes). The context (e.g., application, stable vs. convective MoBL) determines which ones are relevant. Which horizontal/vertical scales are not resolved by models? Which scales matter and need to be parameterized? What model resolution is 'good enough' to represent the observed structure and important processes?

- **Link with moisture transport**. e.g., convection intitiation studies.

Process understanding: Priorities

- **Characterization of turbulence sources**. Locally vs. non-locally generated turbulence. Presence of elevated (decoupled) layers. Role of tributary valleys, slopes, etc.

- **Role of entrainment over complex terrain**. Oftentimes no direct interface between CBL and free atmosphere due to, e.g. impact of slope and ridges heating, horizontal advection, etc.

Field experiment: priorities

- Possibilities to link PBL processes with **moisture transport processes** and convection. For example, enough moisture is available in the Alps unlike in the target areas of a few past experiments, e.g. T-REX or MATERHORN.
- Ability to explore different objectives with the same set of measurement (e.g., PBL processes and convective initiation).
- Ability to learn from previous experiments about the temporal and spatial scales of the processes we are targeting.
- Exploring a manageable “parameter space”, in terms of processes and topographical scales.

Modelling: Priorities

- Validation of models against a **broad(er) set of observed variables**. Not only temperature/humidity/wind, also quantities related to the surface forcing (e.g., SEB components, maybe time-integrated; TKE and budget terms).
- Focus on **object-based verification** (identifying features in time-series).
- Concentrate on case studies or processes that have **practical relevance** for forecasters or the public (e.g., fog, snowline).