Evaluation of ICON over complex terrain on the hectometric range

Conference Poster

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ICON at the hectometric range over mountainous terrain

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1 Introduction

- Model performance evaluation for ICON over truly complex terrain
- Case study: A typical valley wind day, where mountain boundary layer (MoBL) processes dominate.

2 Data

Model setup

- Limited-area set-up, four domains (see Fig.1)
- BC: IFS; IC: COSMO-1 analysis (MCH); one-way nesting
- init 14 Sept 2019, runtime 24 hours
- Turbulence scheme: 1D TKE scheme (Raschendorfer)

Observations

- CROSSINN measurement campaign (detailed MoBL obs.)
- Turbulence flux towers, LIDARs, Radiosondes, etc.

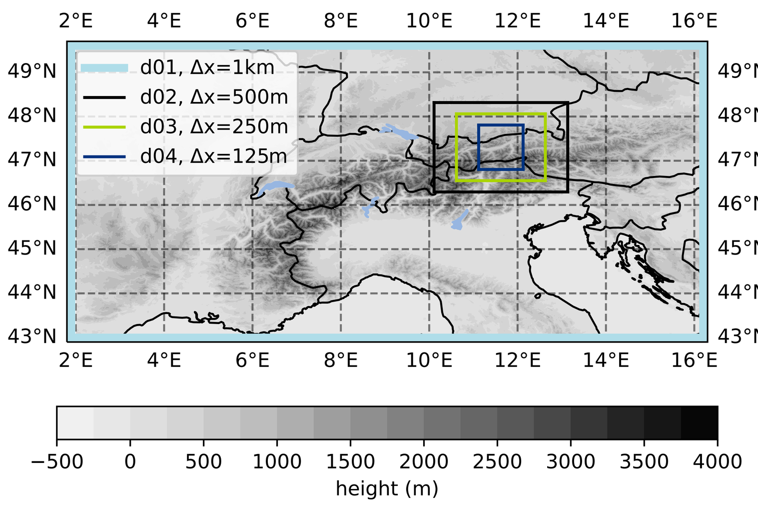

Fig. 1: Limited-area setup of ICON over the Alps.

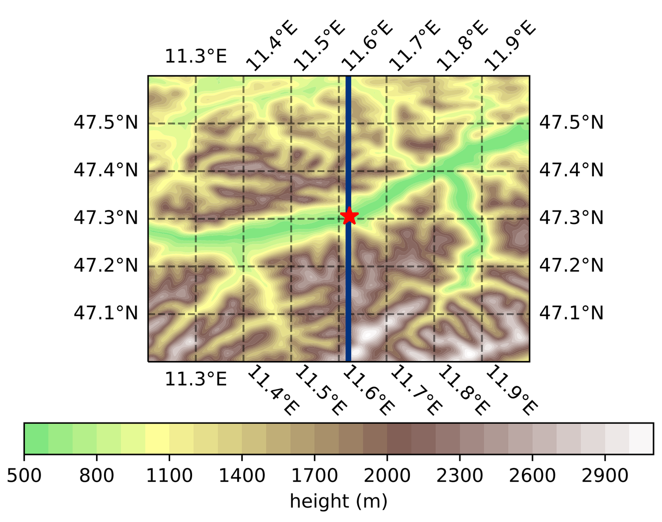

Fig. 2: Topography with the valley floor flux tower ⋆

3 Vertical cross-sections (15 UTC)

- Improved topography representation → more detailed boundary layer structure, weaker plain-to-mountain circulation

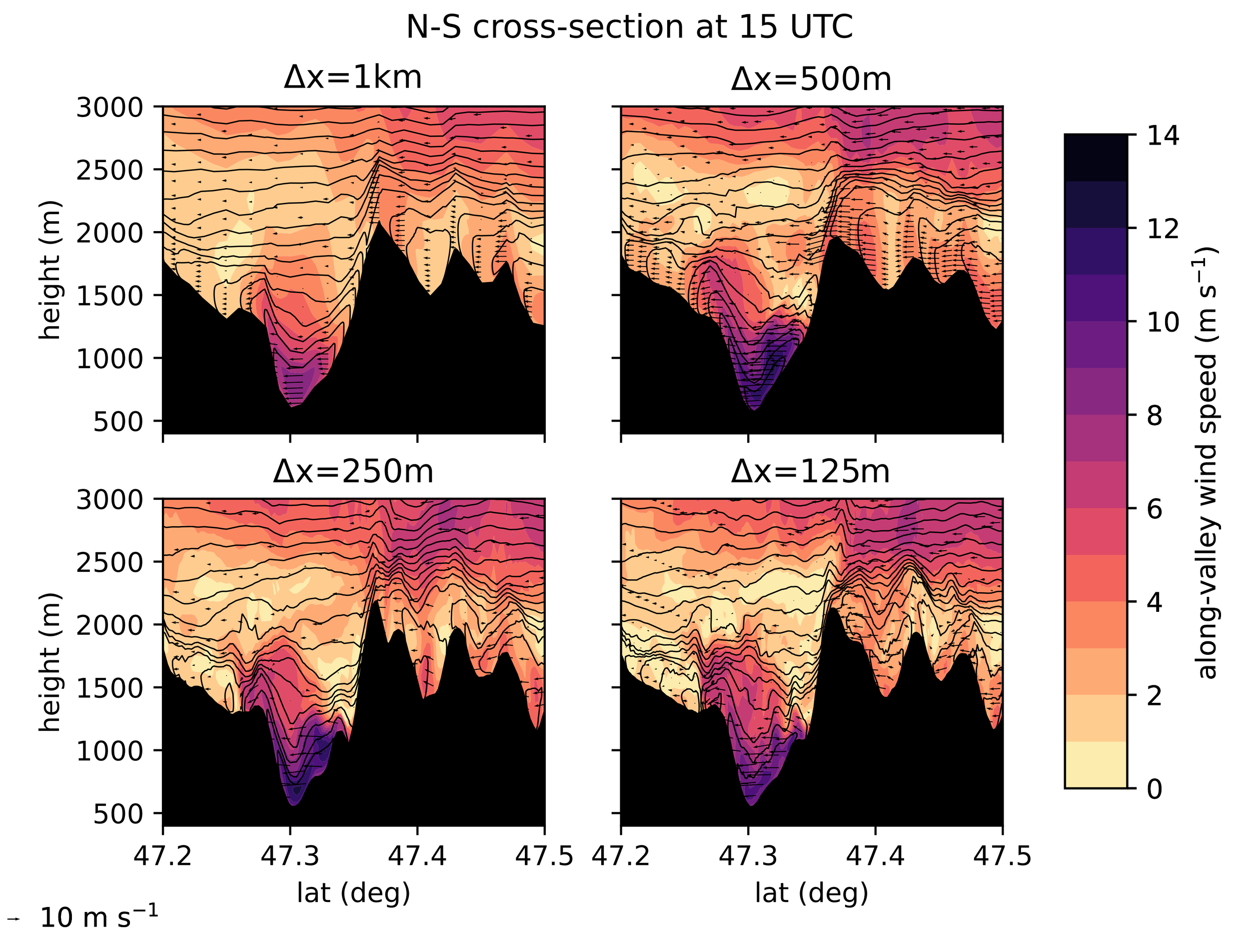

Fig. 3: North-South cross-sections of along-valley wind speed (colors), cross-valley wind speed (arrows), and potential temperature (contours) along the blue line in Fig. 2.

6 Conclusions / To-do

- Check on the driving processes: Radiation, SEB, TKE budget
- Sensitivity runs: Topographic shading, CORINE land use, different vertical coordinates

4 Wind speed & direction at valley floor

Flux tower time series

- Wind speeds overestimated with decreasing Δx

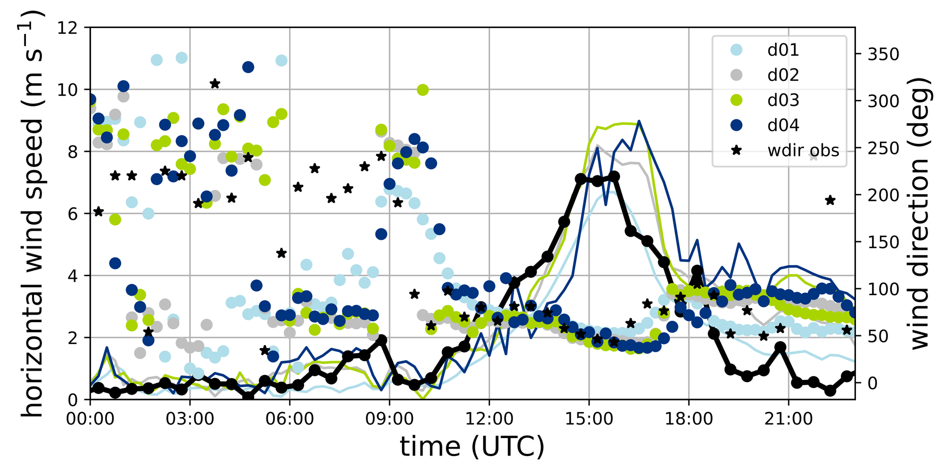

Fig. 4: Timeseries of wind speed and direction for all four domains from the lowest model level (lines/stars) together with observations (connected points) from the flux tower (measurement level at 17 m).

LIDAR time series

- Vertical extent of valley wind is realistic for all domains

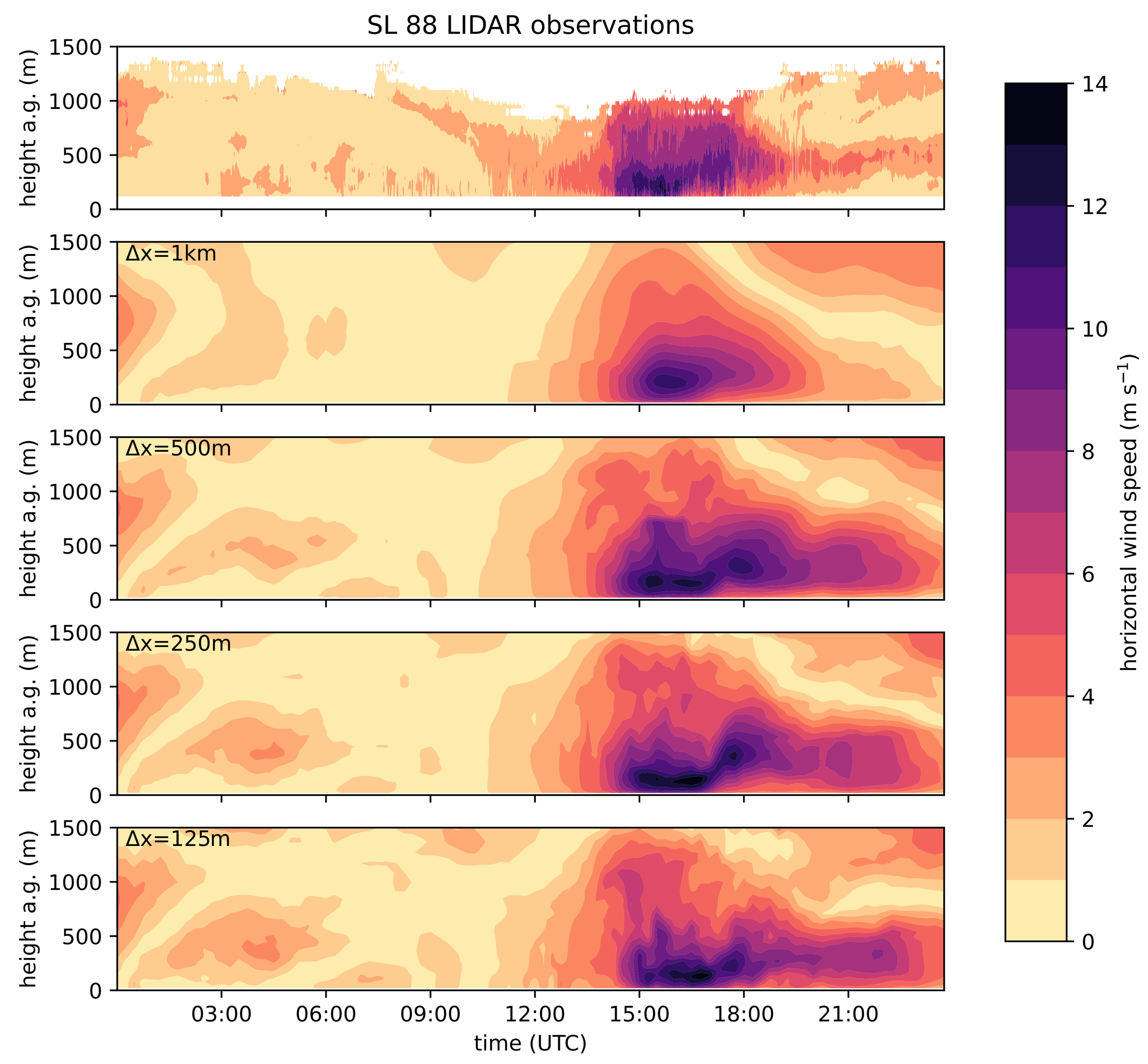

Fig. 5: LIDAR observations from the valley floor and ICON model output from the four domains.

5 Turbulence at valley floor

- TKE underestimation for all domains → TKE grey zone?

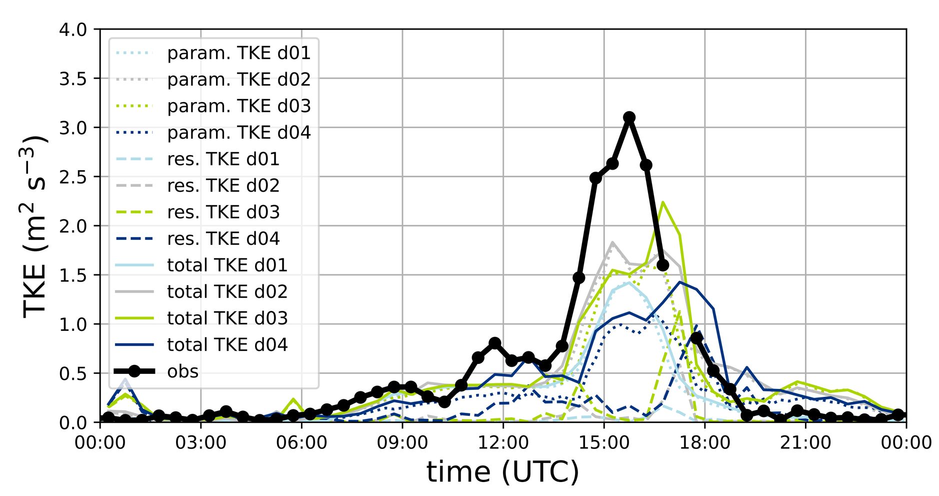

Fig. 6: Timeseries of turbulence kinetic energy (TKE) for all four domains from the lowest model level (lines) together with observations (connected points) from the flux tower. Resolved TKE is calculated from 30-min time averages.

- Resolved TKE becomes non-negligible at hectometric range (40% of total TKE at Δx = 125 m)

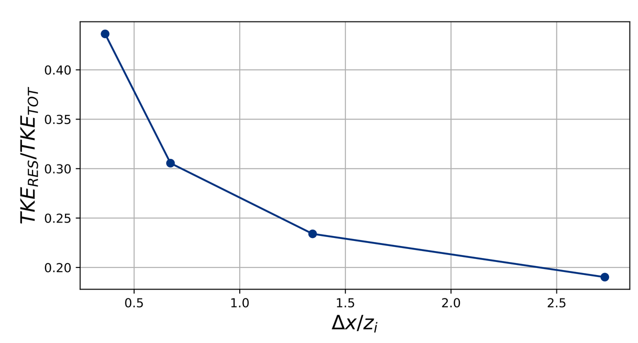

Fig. 7: Part of resolved TKE of total TKE as a function of Δx and ABL height (z_i), averaged over the simulation time.