Benefits of Doppler wind lidars to improve short-term low-level wind forecasts

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PROBE COST ACTION

Experimental setup

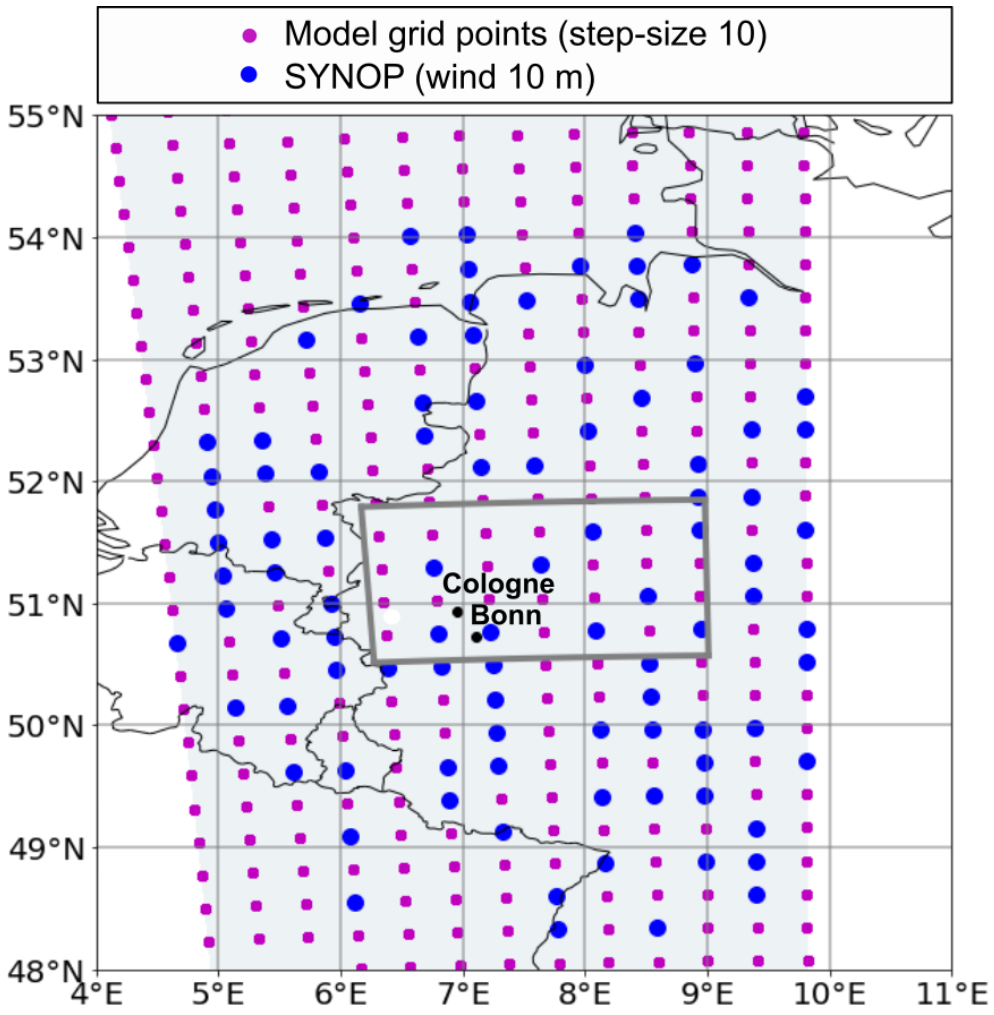

Figure adopted from Nomokonova et al., (2022)

Methodology is based on the ESA (Ancell and Hakim (2007), Torn (2014)) to estimate relative variance change.

1) **SCALE-RM 1000-member ensemble** (Necker et al., 2020) over Germany (**3 km**)

2) **Every 10th grid point** of the model output

3) 16 initial times covering 8 days in May/June 2016

4) Target: domain averaged 80 m wind component over RRA

(typical hub-height of wind turbines)

5) Incorporated observations:

- **wind at 10 m** (SYNOP stations)
- **wind profiles:**

  1 to 5 levels included: **80, 429, 1062, 1853, 2845 m**
- **50 repetitions** (random choice of stations)

Results

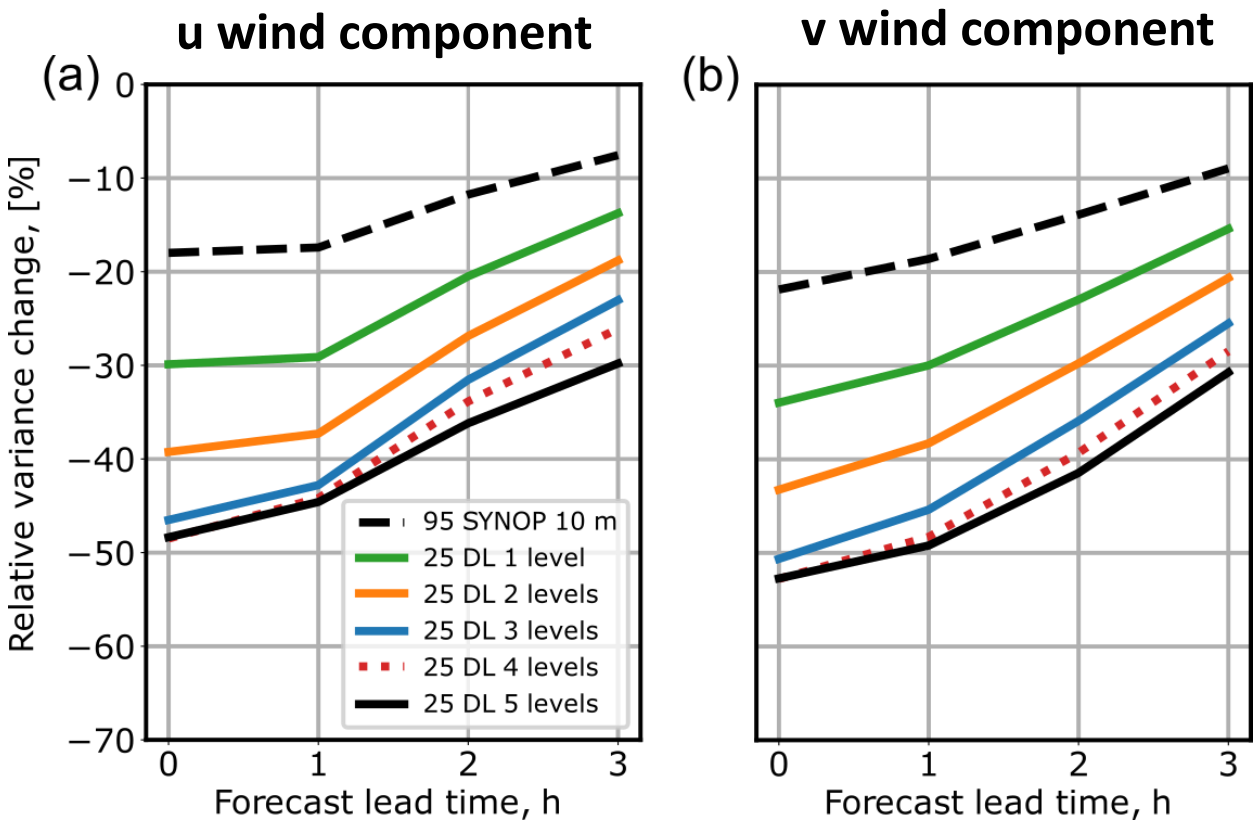

Figure adopted from Nomokonova et al., (2022)

- **25 wind lidars** (up to 1 km) → **1.6** - **3.3x** improvement
- The benefit depends on different wind lidar ranges, influenced by ABL conditions
- **1 layer** in DL wind profile:

  1.6x improvement for **1 h** lead time

  2x for the **3 h** lead time.
- **3 layers** in DL wind profile (up to 1 km):

  2.3x improvements for **1 h** lead time

  2.7-3.3x for the **3 h** lead time
- DL wind profiles are more beneficial than SYNOP with ↑ lead time
- The contribution from wind observations **>1 km** does not lead to considerable improvements

A network of Doppler lidars is beneficial for the short-term forecast of low-level wind