Sub-mesoscale evolution of spatial wind gust patterns measured with 3 Doppler lidars in a triangle configuration

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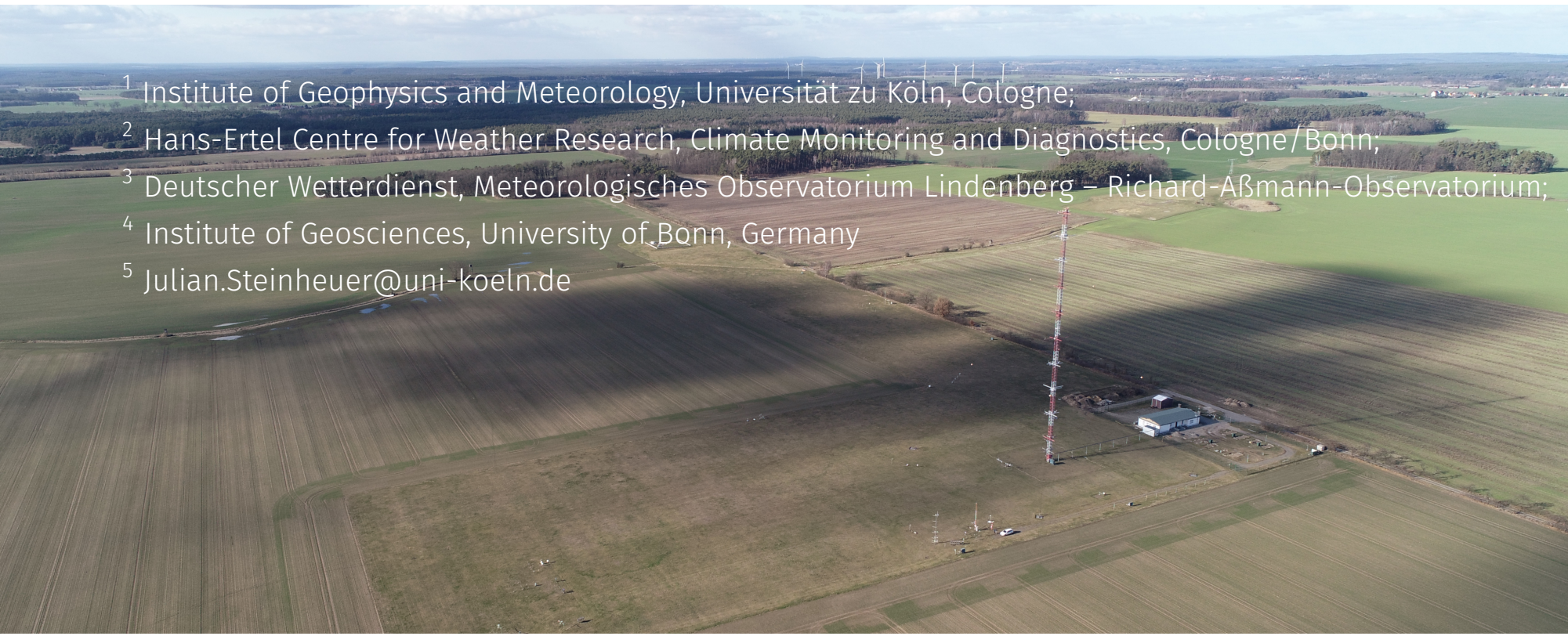

EGU General Assembly May 27, 2022

Lidar gust mode: Quick continuos conical scanning mode (CSM)

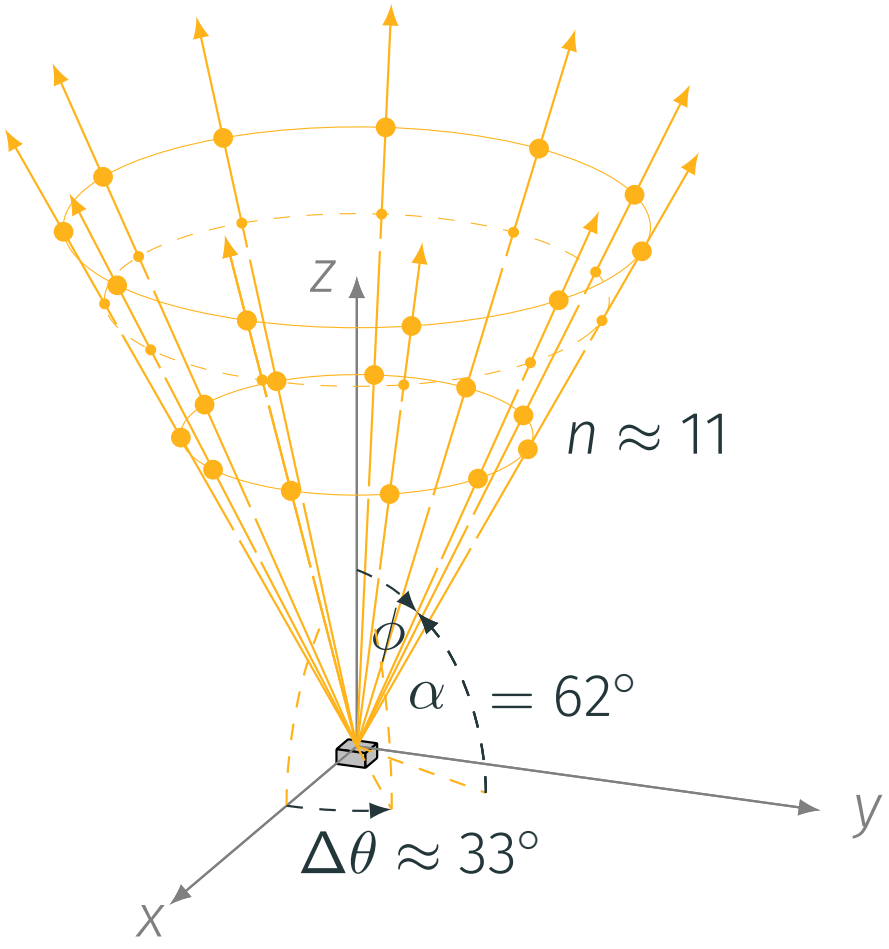

Figure 1: Observation principle of CSM with 11 measurements in 3.4 s and 3000 pulses/beam. See Steinheuer et al. 2022 for the gust retrieval.

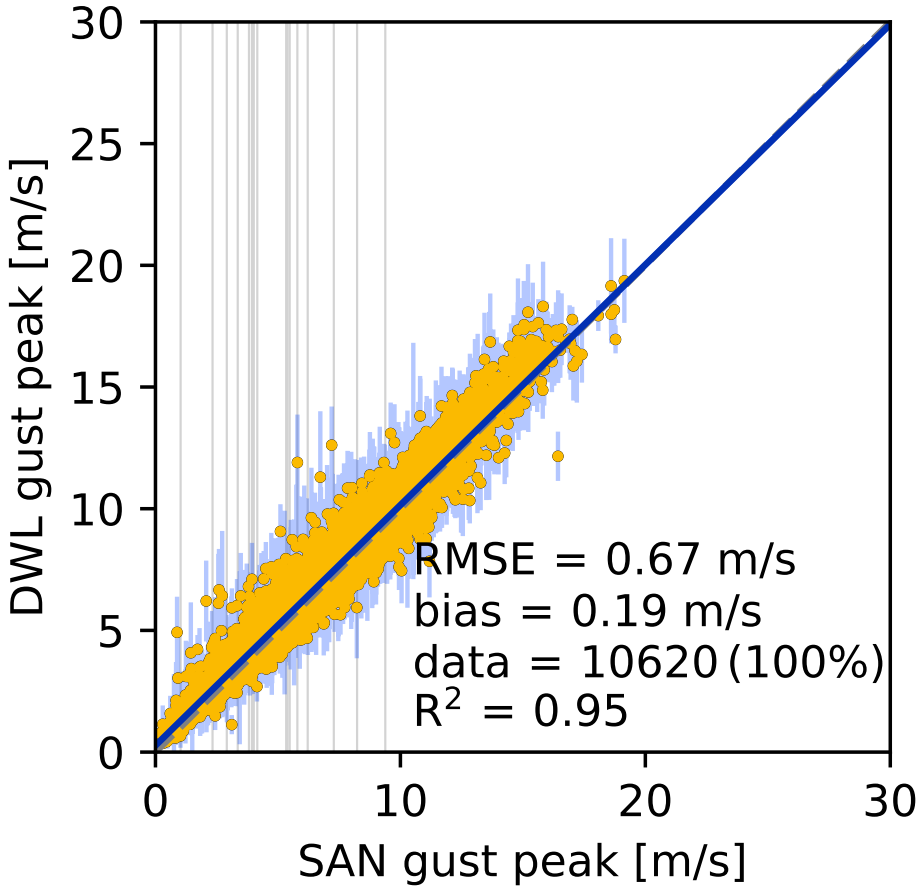

Figure 2: Sonic anemometer (SAN) gust (3 s in 10 min) vs. Doppler wind lidar (DWL) gust (3.4 s in 10 min) at 90.3 m in Falkenberg (18.5.21 - 31.8.21).

Measuring cold pool Jogi on 29.6.21 (day)

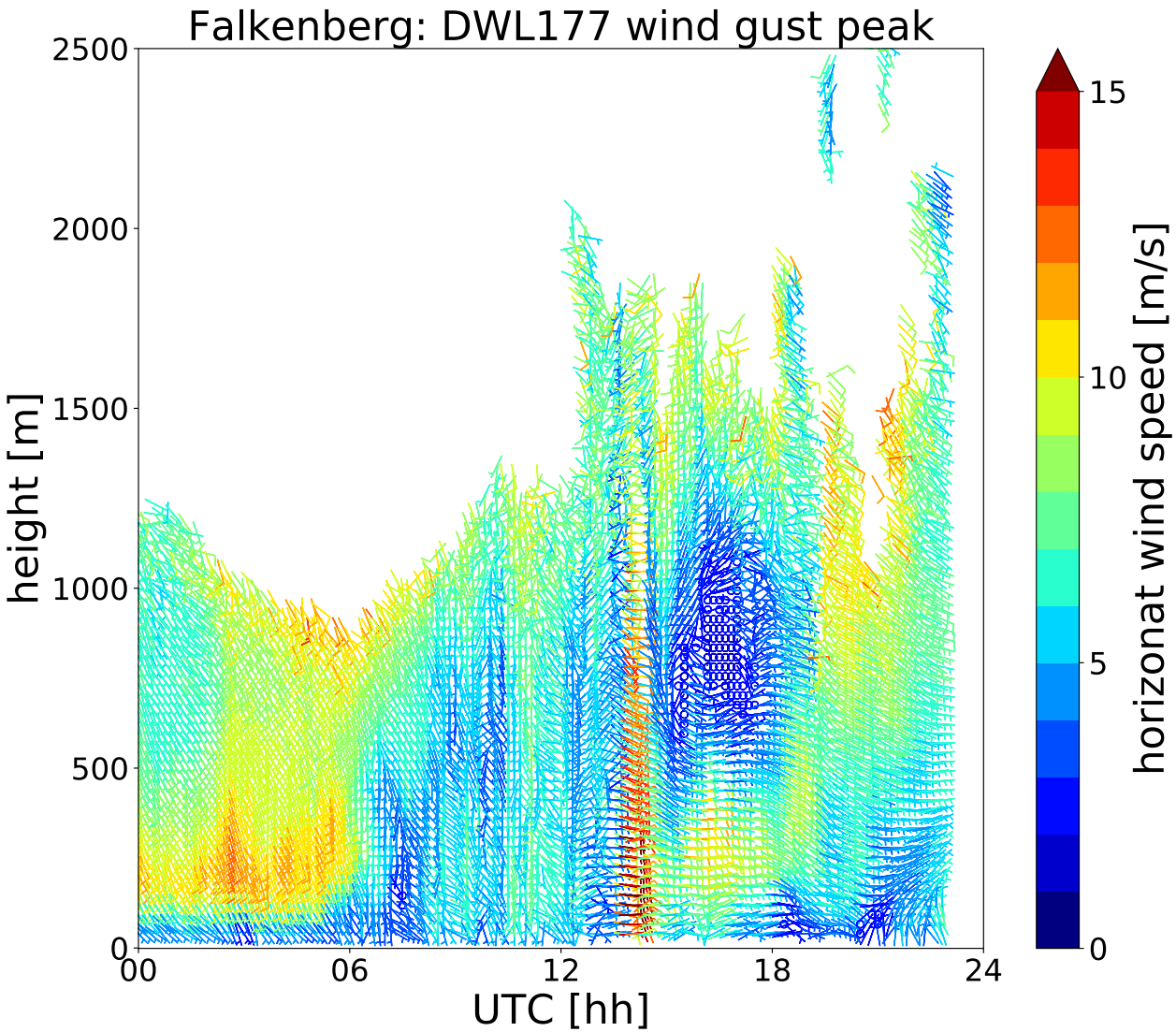

Figure 3: Wind barbs of the 10-minute gust peaks measured by the DWL at Falkenberg on June 29, 2021.

Triangle measuring at the Field Experiment on Sub-Mesoscale Spatio-Temporal Variability in Lindenberg (FESSTVaL)

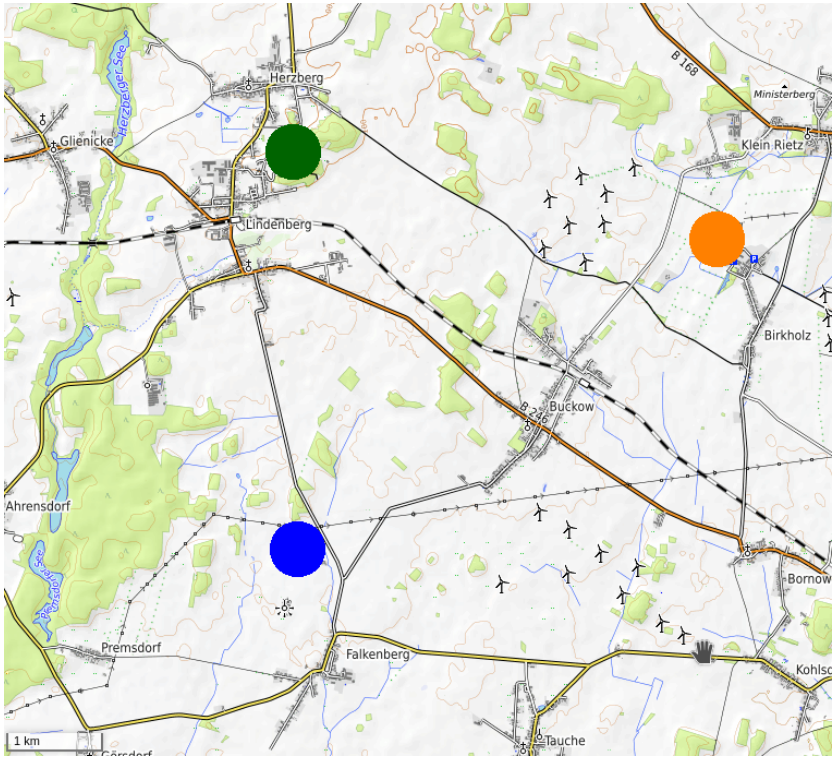

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Figure 4: Locations of the three supersites 6 km apart from each other: Lindenberg (L), Birkholz (B), and Falkenberg (F).

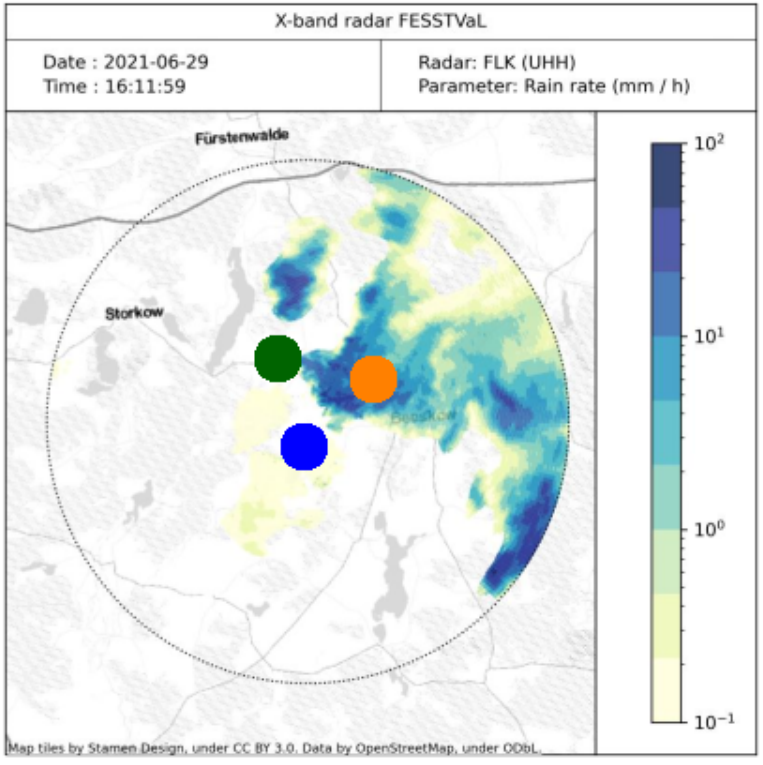

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Figure 5: Rain rate from the mobile X-band radar on June 29, 2021, 14 UTC (cold pool Jogi).

DWL triangle measuring of cold pool Jogi on 29.6.21 (13^{40} – 15^{20})

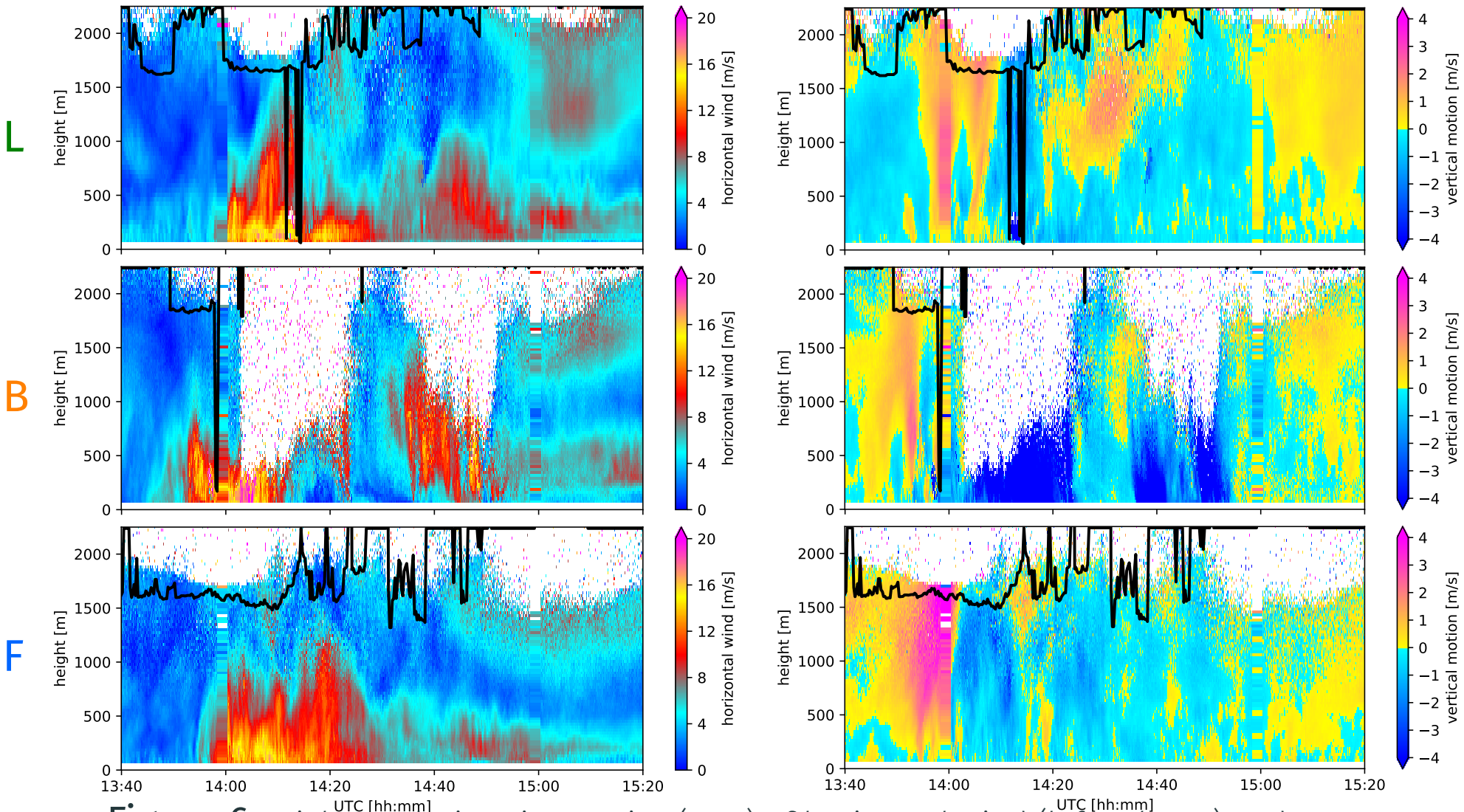

Figure 6: High-resolution time series (3.4 s) of horizontal wind (left column) and vertical air motion (right) around 14 UTC (top row for L, middle B, and bottom F) gives different signatures of cold pool Jogi. The black line indicates the height of the lowest cloud base measured by ceilometers.

Conclusion

→ quick continuous conical scanning mode (CSM) can measure wind gust peaks

→ triangle configuration has potential to see evolution of wind gust patterns

→ investigate further cases in synergy with other observations

Steinheuer, Julian et al. (Jan. 2022). “A new scanning scheme and flexible retrieval for mean winds and gusts from Doppler lidar measurements”. In: DOI: *10.5194/amt-2021-426*. URL: *https://doi.org/10.5194/amt-2021-426*.