# Observing and forecasting wind gusts in winter storms over Germany

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Wind gusts are responsible for most of the damages in cyclonic winter storms, the most destructive natural hazards over central Europe. Their forecast is challenging, because they involve multiple scales from the track and intensity of the storms down to turbulent momentum transport. Observations and forecasts are investigated here to gain an insight into the dynamics and predictability of gusts at subsynoptic scales.

The field campaign WASTEX (Wind And STorms EXperiment) was conducted during the winter 2016/17 near the city of Karlsruhe located in south-western Germany. A Doppler wind lidar provided high-resolution observations in space and time within a range of several km during the passage of low-pressure systems. This allows sampling the mixing of high momentum in the boundary layer, which results in the strongest gusts near the surface. The observations cover several types of storms, including a case of severe convection embedded in the cold front and a rare case possibly involving a sting jet. A challenge in exploring the data gathered is the low aerosol concentration during the passage of frontal systems, which results in a low signal-to-noise ratio for the backscattered laser light.

The observational work is complemented by predictability studies based on the convection-permitting ensemble prediction system COSMO-DE-EPS, which has been run operationally since 2012 at the German Weather Service (DWD). The focus is on storms involving mesoscale structures that are not well represented by global models, such as sting jets (e.g. in storm Christian in October 2013) and frontal convection (e.g. in storm Niklas in March 2015). First results suggest that the ensemble is underdispersive at the mesoscale and the ensemble spread at the synoptic scale is mostly inherited from the global multi-model forecast the ensemble is downscaled from. The link between wind gusts and mesoscale structures in the storms is analysed using a novel 3D visualization software designed for ensemble forecasts. In addition, statistical post-processing methods are tested to improve the forecast deficits mentioned above.