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Forecasting the weather
- ensemble techniques
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Spatial variance spectra in the convection-permitting limited area NWP model COSMO-DE

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The spectral variance of variables such as the kinetic energy as a function of horizontal scale is fundamental in many theoretical studies of geophysical fluids and in turbulence theory. A general observation when analyzing atmospheric horizontal kinetic energy spectra is a k^{-3} slope on larger scales and a $k^{-5/3}$ slope on the mesoscale, where k is the wave number.

The $k^{-5/3}$ slope on the mesoscale has significant implications for the predictability when using high-resolution mesoscale numerical weather prediction (NWP) models, since error growth on small scales may be much faster for mesoscale dynamics compared to synoptic scale motions.

In this study, spectral analysis is applied to evaluate the mesoscale ensemble prediction system using the convection-permitting NWP model COSMO-DE. We present the spatial characteristics of mesoscale fields, particularly during high-impact weather conditions. One-dimensional wave number spectra of the kinetic energy are derived from zonal and meridional as well as from vertical wind velocities. The spectra not only represent the spatial characteristics of mesoscale fields in COSMO-DE, but also give information about the scale of the dynamics that are effectively resolved by the model. Spin up effects and the development of mesoscale disturbances during the forecast as well as the effects of data assimilation are investigated.