Predictability analysis and skillful scale verification of the Lightning Potential Index (LPI) in the COSMO-D2 high resolution ensemble system

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During the last decade, the constant improvement in computational capacity led to the development of the first limited-area, kilometer-scale ensemble prediction systems (L-EPS). The COSMO-D2 EPS (now ICON-D2) is the operational L-EPS at the German weather service (DWD) and has a spatial resolution of around 2km. This grid resolution allows large scale, deep convective processes such as thunderstorms or heavy showers to be handled explicitly, without any physical parametrization necessary. Special parameters involving both clouds (micro-)physics and large scale lifting – such as the Lightning Potential Index, or LPI – have also been developed in order to try and bring the forecasting of deep convection and therefore also of lightning activity to a new level of spatial accuracy. With such high-precision forecasts comes however also a much higher error potential, at least for gridpoint-verification. The use of this high resolution setup in an ensemble prediction system might however bring huge benefits in terms of skill and predictability. This work is a preliminary attempt to apply innovative verification approaches such as the dispersion Fractions Skill Score (dFSS) or the ensemble-SAL (eSAL) to the LPI in the COSMO-D2 EPS. Aim of this work is to assess the relationship between the ensemble error and the ensemble dispersion at different spatial scales. For the summer months 2019 the COSMO-D2 EPS shows a general tendency to underestimate the unpredictability of the lightning events, though the spread-error relationship varies greatly for different forecast lead times. With the help of the dFSS, one can also express this relationship in terms of skillful scales. On average, the system produces a useful forecast during the afternoon hours for horizontal scales of around 200 km. However, the ensemble members show an average horizontal dispersion that lies around half of that value, at more or less 100 km.