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Cloud-resolving ensemble simulations of the August 2005 Alpine flood

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Quantitative precipitation forecasting is a challenging task, which may be improved using higher-resolution numerical weather prediction models and/or ensemble prediction systems (EPS). This study explores the potential benefits of applying a cloud-resolving EPS over its driving limited-area EPS (LEPS) for the August 2005 Alpine flood. The cloud-resolving EPS is based on the LM model, includes an explicit treatment of deep convection (2.2-km grid spacing) and dynamically downscales the COSMO-LEPS information. A second cloud-resolving EPS is further constructed by perturbing only the LM initial fields.

Comparison of the cloud-resolving and of the driving lower-resolution LEPS pinpoints to the high skill of both ensembles in simulating the major phase of heavy precipitation. Ensemble means and spreads are roughly equivalent and the resolution-induced differences tend to be smaller than typical member-to-member variability. Larger discrepancies are found over regions of moist convective instability owing to the excessive production of rain by the LEPS convective parameterization. Comparison of the two cloud-resolving EPS further reveals that the domain-internal predictability is rather high for this particular case and that the induced precipitation spread is mainly dominated by uncertainties advected from the lateral boundary conditions into the high-resolution domain.