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High resolution ensemble forecasting using CAPE singular vectors

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We study the feasibility of using the singular vector technique to create initial condition perturbations for short range ensemble prediction systems focussing on predictability of severe local storms and in particular deep convection. For this a new final time semi-norm based on the convective available potential energy (CAPE) is introduced. We compare singular vectors using the CAPE-norm with SVs using the more common total energy norm for a two week summer period in 2007, which includes a case of mesoscale extreme rainfall in the south west of Finland.

The CAPE singular vectors perturb the CAPE field by increasing the specific humidity and temperature of the parcel and increase the lapse rate above the parcel in the lower troposphere consistent with physical considerations. The CAPE-SVs are situated in the lower troposphere. This in contrast to TE-SVs with short optimization times which predominantly remain in the high troposphere. By examining the time evolution of the CAPE singular values we observe that the convective event in the south west of Finland is clearly associated with high CAPE singular values.