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Implementation of stochastic parameterization of surface variables in ensemble forecasts

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To represent uncertainties in the numerical weather prediction, various ensemble forecasting systems have been recently developed by different weather services around the world. Most ensemble systems account for uncertainties in the initial conditions and for limited area ensemble systems also errors in the lateral boundary conditions are considered by using one or more global ensemble systems as coupling model. To account for uncertainties in the model a stochastic physic scheme is one possibility which is in use in some ensemble systems. In forecast models surface processes are typically treated by parameterizations to represent physical processes at the interface between surface and atmosphere. Especially for the forecast quality of near surface fields these processes can play a crucial role but also for the formation of precipitation in the atmosphere.
However, uncertainties in the forecast due to errors in the representation of surface processes, which can feed back to atmospheric processes are not yet considered in any operational ensemble system.

The aim of the work is to investigate whether the representation of uncertainties in the surface scheme of an ensemble system can improve the probabilistic forecast. Therefore a stochastic physics scheme for surface processes, similar to the stochastic physics scheme that has been used for several years in the ECMWF-EPS, is implemented in ALADIN-LAEF, the operational limited area ensemble model of the Austrian Weather service. The stochastic physic method is used to randomly perturb tendencies of surface variables, for example soil moisture and surface temperature in the surface scheme, during the forecast.

In the presentation the implementation in ALADIN-LAEF is introduced and simulations of high impact weather situations as well as a verification over 3 months against forecasts without perturbing surface fields will be presented. To verify the importance of the representation of uncertainties due to surface processes during a short-range forecast a simplified version of the operational ALADIN-LAEF, with 16 perturbed member, a horizontal resolution of 11km and driven by ECMWF-EPS member is compared with ALADIN-LAEF forecasts where the stochastic physics method is applied on surface fields.
In addition, it will be shown whether the combination of perturbed surface fields and a multi-physics approach for the representation of uncertainties in the atmospheric processes will perform superior to the aforementioned ensemble experiments.