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Stochastic parametrization of boundary layer processes in ENS

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Ensemble prediction systems tend to be under-dispersive when only initial state uncertainty is considered. Additional ensemble spread is typically generated by representing the model uncertainty. In the ECMWF Ensemble Prediction System (ENS) the model uncertainty is partly represented by perturbing the tendencies of the physical processes using so-called SPPT scheme (Stochastically Perturbed Parametrization Tendencies). However, applying this scheme in the boundary layer results in numerically unstable system. Thus the current SPPT scheme does not perturb the boundary layer. We propose a novel scheme that enhances the model uncertainty representation by introducing a stochastic representation of uncertainties in boundary layer processes. This is achieved by using spatially and temporally varying parameter values in the parametrizations instead of a global constant value. The parameter perturbations are drawn from a distribution, which converges to the unperturbed parameter value in the limit of small variance. Here we focus on four parameters from the vertical mixing and surface drag parametrizations of the ECMWF Integrated Forecasting System. The stochastic parameter perturbations are tested in the ENS at TL399 resolution with initial state perturbations, and SPPT and SPBS (Spectral stochastic backscatter) stochastic physics schemes enabled as well. The results are discussed in terms of ensemble spread and probabilistic skill.