Application of a Stochastic Parameterisation of Deep Convection in a Regional Ensemble Prediction System

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State-of-the-art ensemble prediction systems (EPS) typically use deterministic physical parameterisations and ad hoc techniques for sampling uncertainties originating from the subgrid-scale processes, truncation and diffusion. Although the ad hoc techniques, such as, in particular, stochastic perturbations of physics tendencies (SPPT; Charron et al. 2010), are relatively simple to apply and typically yield large improvements in the EPS performance they are rather unsatisfactory from a more fundamental point of view. In the long term, development of inherently stochastic physics parameterisations appears to be a more appropriate approach to representing model error originating from the unresolved physical processes.

For this purpose, a stochastic parameterisation of deep convection based on equilibrium statistics is being developed at RPN-A to be used for regional ensemble prediction. The new parameterisation is based on Plant-Craig (PC) theory applied to the Bechtold deep convection scheme. In order to introduce stochasticity, the deep convection scheme is modified to allow for plumes of different characteristics, such as the lifetime and radius at the cloud base, whereas the plume sampling distribution is obtained from theoretical considerations following the PC approach.

In this presentation we will examine in detail the results of the application of the new stochastic deep convection scheme in the ECCC's operational regional EPS. The preliminary results show that, when used along with the SPPT, the scheme has potential for improvements at shorter lead times and in situations with weak synoptic forcing and convection driven with the diurnal cycle (Fig. 1).

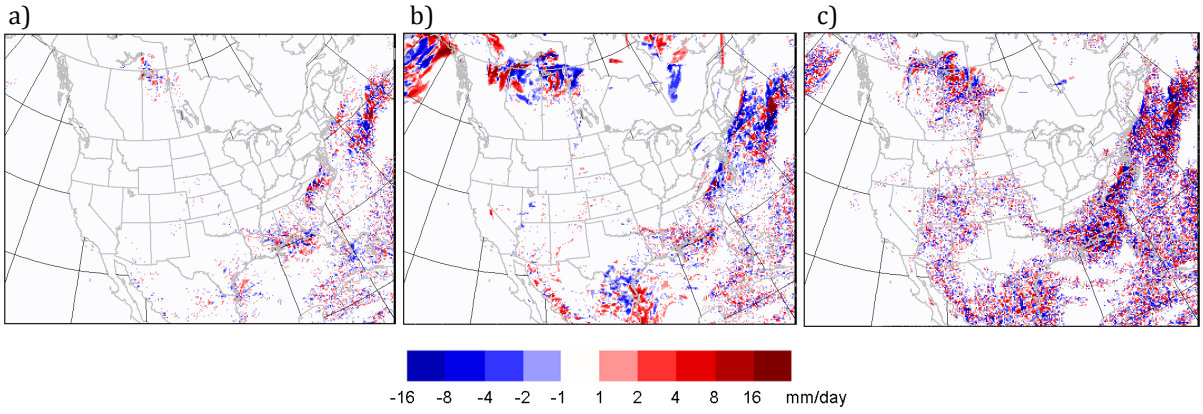

Figure 1. The response of 0-24-hour precipitation accumulation forecast for July 10, 2014 at 00 UTC to: (a) bit pattern perturbation, (b) stochastic perturbation of physics tendencies (SPPT) and (c) stochastic perturbation in the deep convection scheme.

References:

Charron, M., G. Pellerin, L. Spacek, P. L. Houtekammer, N. Gagnou, H. L. Mitchell, and L. Michelin, 2010: Toward random sampling of model error in the Canadian ensemble prediction system. Mon. Wea. Rev., 138, 1877–1901.