Large scale skill of the Eta against its driver ECMWF 32-day ensemble

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Among the several options used in extended range NWP, subseasonal to seasonal prediction (S2S), and regional climate modeling, use of limited area models (LAMs) driven by lateral boundary conditions (LBCs) of global models remains popular. Among the issues faced in particular by the last group of users is that of applying one of the large scale nudging schemes or alternatively attempting to achieve added value in all scales within the domain used. This unavoidably will involve consideration of the trade-off between resolution and the domain size.

In that context, trying to identify a primary cause of the improvement in 250 hPa winds previously demonstrated in an Eta ensemble members over their 32-day ECMWF driver members, 10 of the Eta members were run switched to the sigma. At apparently a critical time of the experiment the Eta members in auto mode showed a tendency for the more accurate tilt of a 250 ha trough than the members run in sigma mode. The experiment was rerun for a more recent and higher resolution ECMWF ensemble. The advantage of the Eta over ECMWF is seen again, even though this time the Eta resolution during the first 10 days of the experiment was about the same as that of the driver members. Rerunning the Eta ensemble switched to sigma showed an advantage in the Eta/eta 250 hPa wind scores we used, visible in particular during an upper-air trough's movement across the Rockies.

The experiments made are consistent with the idea that four requirements need to be met if one is to achieve added value at all scales driving a LAM. First, one needs to run the LAM or regional climate model (RCM) on a relatively large domain. Second, one should use an LBC scheme that is not ignoring the basic mathematical properties of the problem at hand. That means enforcing the driver model values along the outside RCM boundary only, and not all of them at the outflow parts of the boundary. Third, one must not use large scale or spectral nudging. And fourth, one must use an RCM with dynamical core not of inferior quality to that of the driver global model.