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Object-oriented best member selection in a regional ensemble forecasting system

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A difficult problem for forecast evaluation and data assimilation is phase errors, where a weather system is displaced in space or time. This is especially true on smaller scales, e.g. for mesoscale convective systems, where the errors are large and not handled well by methods based on linear perturbations. Here we evaluate forecasts from the COSMO-LEPS limited-area ensemble prediction system using an image-matching method that attempts to quantify displacement differences between simulated and observed satellite images.

Synthetic infra-red satellite images are created from the model forecasts using a fast radiative transfer code (RTTOV). A field of displacement vectors is then computed which 'morphs' the simulated image into a best match to an observed image. The large-scale displacements are generated first by matching coarse-grained versions of the images, and are then successively refined using increasingly higher resolution image versions. The magnitude of the displacment vectors and the quality of the final match give objective measures of the quality of the simulation.

Using this method, the most recent satellite data can be used to obtain weighting factors to aid in interpretation of ensemble forecasts, or even to terminate ensemble members that are evolving contrary to obervations while spawning new members by perturbing the highly weighted members.