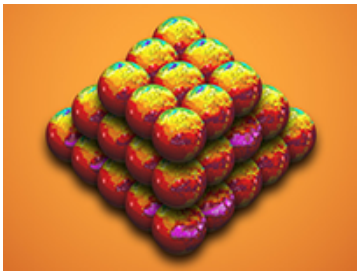

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Challenges and Limits in Ensemble Weather Prediction

Wednesday, 5 June 2019 15:45 (30 minutes)

Some days, the atmosphere is less predictable than on average. This is partly because the rate of growth of certainty (the result of Chaos) is dependent on the atmospheric flow itself. For example, moist processes are almost always implicated during investigations of very poor forecasts for Europe (so-called "forecast busts"). These moist processes might be associated with, for example, warm conveyor-belts along the cold-fronts of a cyclonic systems, meso-scale convective situations, or the extra-tropical transition of tropical cyclones.

Such moist situations also present a particular challenge for data assimilation. For example, satellite observation operators are highly non-linear in cloudy situations. The result is that the ensemble distribution of initial conditions is less constrained by the available observations.

Furthermore, these moist situations present challenges for the model. For example, the model's parametrized "deterministic physics" is very active in these situations, and biases are likely to have a large impact on the forecast. In order to maintain the "spread-error" relationship of the ensemble, additional "stochastic physics" is required to adequately represent the effects of sub-grid-scale uncertainty associated with these moist processes.

Hence such moist and unstable situations represent, almost literally, a "perfect storm" for forecasting. Progress can be made on some aspects, but the inherent large uncertainty growth-rates will remain.

This talk will focus on how diagnostics can help improve our understanding of these challenges and limits.

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