SESSION: (A2) Modelling issues in S2S prediction

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The art and science in sub-seasonal forecast system design

Yuhei Takaya

Meteorological Research Institute, Japan Meteorological Agency

An operational forecast system requires a high level of forecast quality, timeliness and cost-efficiency under various competing resource requirements. As such, it is vitally important for operational modelling centres to design and configure forecast systems, including the sub-seasonal forecast system, so as to maximize the accuracy, forecast skill, and benefits of forecast information.

Apart from modelling issues in representing physical and dynamics processes, there are many unresolved issues in the forecast system design and configuration: initialization, model resolution, ensemble size, ensemble generation, hindcast and forecast configurations. The choice of these configurations demands careful consideration since each choice impacts cost and quality. Under the constraint of fixed resources, these choices compete against one other in the tradespace.

This presentation reviews current practices in sub-seasonal forecast system design at operational centres and discusses the pros and cons of several approaches. Existing issues regarding the optimal forecast system design for the sub-seasonal predictions include (1) benefits and deficiencies of burst and Lagged Average Forecasting (LAF) ensemble approaches for operational forecasts, (2) optimal configurations of real-time forecasts such as frequency and ensemble size, (3) optimal configurations of reforecasts in terms of ensemble size, length and frequency, (4) techniques of ensemble generation and data assimilation. The sub-project "ensemble generation" in the S2S Phase 2 focuses on some of these issues.

Initial shocks and model drifts are other important aspects in sub-seasonal forecast systems. In the big picture of the sub-seasonal forecast systems, global observations and analyses of past and present are essential in maintaining the operational sub-seasonal forecast service. Oceanic observations are necessary for systems employing atmosphere-ocean coupled models. With increases in the complexity of forecast systems, it is becoming difficult to make the system consistent in hindcasts and forecasts. In the sub-seasonal time-range, the initial shocks and gradual increase of model biases (model drifts) appear due to the imbalance and difference between model and analysis states. The inconsistency of analysis and model states causes initial shocks in different time scales, for example, initial shocks of the atmosphere may last about one week and those of the ocean and land may last several weeks and more. Therefore reducing these shocks and drifts is one of major foci of the sub-seasonal system development.

All of the above aspects affect the quality of forecasts and need to be properly configured to create an optimized system, a "masterpiece" of a sub-seasonal forecast system.