



Contribution ID: 4

Type: **Poster presentation**

Global precipitation hindcast quality assessment of the Subseasonal to Seasonal (S2S) prediction project models

This study assessed subseasonal global precipitation hindcast quality from all Subseasonal to Seasonal (S2S) prediction project models. The deterministic forecast quality of weekly accumulated precipitation was verified using different metrics and hindcasts considering lead times up to 4 weeks. The correlation scores were found to be higher during the first week and dropped as lead time increased, confining meaningful signals in the tropics mostly due to El Niño-Southern Oscillation and Madden-Julian Oscillation-related effects. The contribution of these two phenomena to hindcast quality was assessed by removing their regressed precipitation patterns from predicted fields. The model's rank showed ECMWF, UKMO, and KMA as the top scoring models even when using a single control member instead of the mean of all ensemble members. The lowest correlation was shared by CMA, ISAC, and HMCR for most weeks. Models with larger ensemble sizes presented noticeable reduction in correlation when subsampled to fewer perturbed members, showing the value of ensemble prediction. Systematic errors were measured through bias and variance ratio revealing larger positive (negative) biases and variance overestimation (underestimation) over the tropical oceans (continents and extratropics). The subseasonal atmospheric circulation hindcast quality was also examined and results suggest the importance of using a relatively finer spatial resolution and a coupled model for resolving the tropical circulation dynamics, particularly for simulating tropical precipitation variability. The extratropical circulation hindcast quality was found to be low after the second week likely due to the inherent unpredictability of the extratropical variability and errors associated with model deficiencies in representing teleconnections.

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Track Classification: Workshop on Predictability, dynamics and applications research using the TIGGE and S2S ensembles