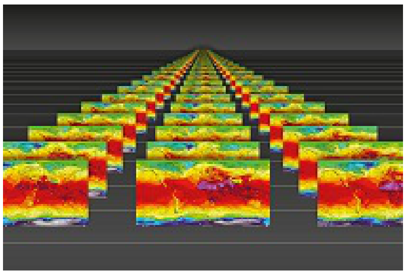

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Achieving seamless verification across sub-seasonal time scales from weather to climate

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Sub-seasonal time scales lie in the middle of the range of "seamless" prediction that spans from deterministic instantaneous weather prediction to the probabilistic time-averaged conditions of seasonal weather forecasts. However, attaining true seamlessness across these disparate types of forecasts is not easy. We propose a flexible approach to model validation that blends day-to-day weather forecast verification and time-averaged predictions for longer time scales in a truly seamless manor. The method combines two weighting methods to transition daily forecast data into multi-day time means whose averaging period increases with forecast lead.

The Poisson distribution is nearly ideally suited to be such a weighting function, as it is narrow and positively skewed for low parameter values, corresponding to short forecast lead times of one to a few days, becoming a Gaussian distribution approximating weekly or monthly means at progressively longer lead times. However, it cannot represent the character of a deterministic forecast, even at very short time scales. Deterministic forecasts are effectively time-weighted forecasts whose weighting function takes the form of a Kronecker delta. Applied to daily forecast model output, Poisson and Kronecker distributions along the time axis share two key characteristics: they both peak at the value of their sole parameter, and the sum of weights over all times is one. This allows a linear combination of the two functions to be well-behaved, so that a transition from Kronecker to Poisson weighting with increasing forecast lead time makes for a seamless transition. The 2-parameter Hill equation is used to define the transition, which can be tuned to specify the lead time at which the Poisson distribution becomes dominant as well as the steepness of the transition with lead time. This allows the approach to be tailored to specific applications, different forecast variables, locations, and seasons as appropriate. Examples will be shown and caveats discussed.

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