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Questions regarding the uncertainty of trends in both historical and projected climate model simulations have been limited by uncertainty about the relative importance of internal variability and external forcing to trends over the relatively short observational record. At the same time, it is known that systematic operational seasonal forecast errors are dominated by model errors that develop rapidly, on the order of a few weeks to months following forecast initialisation.

Here, we suggest that climate model trend errors can be usefully investigated by examining their rapid development within seasonal hindcasts. We show that many apparent climate simulation trend discrepancies in SST, precipitation and sea level pressure are evident in trends computed from monthly seasonal hindcasts over the 1993-2016 period for a suite of operational initialised forecast models, and in many cases are well developed at short lead times. These hindcasts use models similar to CMIP-class models and include the same CMIP historical external forcings, but critically are initialised with observations, removing uncertainty related to internal variability.

We suggest that these hindcast trend errors reflect sensitivity of the model mean biases to the changing radiative forcing, rather than a forced response. That is, similarity between errors in free running simulations and hindcasts is a result of the seasonal forecast models quickly transitioning from nature's attractor to the climate model attractor. This suggests that we might be able to better diagnose the climate model trend errors by looking at the early development of the forecast trend error in the seasonal forecast models.
Presentation file
Beverley-Jonathan.pdf
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