Reply on RC3

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Community comment on "A range of outcomes: the combined effects of internal variability and anthropogenic forcing on regional climate trends over Europe" by Clara Deser and Adam S. Phillips, Nonlin. Processes Geophys. Discuss., https://doi.org/10.5194/npg-2022-15-CC3, 2022

I am sorry that I perhaps made a mistake by clicking on the wrong reply link. No harm intended.

What's also interesting is that *"random internal variability"* is cited to Lorenz. But Lorenz really left this aspect as open and unresolved when applied to climate variability and predictability.

Edward N. Lorenz ——— When we predict the oceanic tides, for example, which we can do rather well years in advance, we do not start from the observed present state of the ocean and extrapolate forward; we base our prediction on known periodicities, or on established relations between the tides and the computable motions of the sun, earth, and moon.

Perhaps the feature most often cited as falling into this category is the sea-surface temperature (SST), which, because of the ocean's high heat capacity, sometimes varies rather sluggishly. Along with the atmospheric features most strongly under its influence, the SST may therefore be expected to be somewhat predictable at a range when migratory synoptic systems are not. A slow final approach to saturation may thus be anticipated, particularly if the "total error" includes errors in predicting the SST itself.

A perennial feature in which the SST plays a vital role is the El Niño-Southern Oscillation (ENSO) phenomenon. Phases of the ENSO cycle persist long enough for predictions of the associated conditions a few months ahead to be much better than guesswork, while some models of ENSO (e.g., Zebiak and Cane, 1987) suggest that the onsets of coming phases may also possess some predictability. Again, the phenomenon should lead to an ebbing of the late-stage growth rate.

Perhaps less important but almost certainly more predictable than the ENSO-related features are the winds in the equatorial middle-level stratosphere, dominated by the quasi-biennial oscillation (QBO). Even though one cannot be certain just when the easterlies will change to westerlies, or vice versa, nor how the easterlies or westerlies will vary from day to day within a phase, one can make a forecast with a fairly low expected mean-square error, for a particular day, a year or even several years in advance, simply by subjectively extrapolating the cycle, and predicting the average conditions for the anticipated phase. Any measure of the total error that gives appreciable weighting to these winds is forced to approach saturation very slowly in the latest stages.

Looking at still longer ranges, we come to the question, "Is climate predictable?" Whether or not it is possible to predict climate changes, aside from those that result from periodic or otherwise predictable external activity, may depend on what is considered to be a climate change.

Consider again, for example, the ENSO phenomenon. To some climatologists, the climate changes when El Niño sets in. It changes again, possibly to what it had previously been, when El Niño subsides. We have already suggested that climatic changes, so defined, possess some predictability.