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Reviewer: 3

Comments to the Author
If this paper is correct, it is a profoundly important paper. If this paper is flawed then to publish it would be profoundly misleading. The question is, which is it.

This paper shows that models cannot predict the weather years ahead of time, due to the accumulation of errors. This is already known, so the result is not novel. We have known this formally since Lorenz. Unfortunately the author misunderstands this result and claims that the models cannot predict climate. The equation that he has applied, eq. (2), does not however apply to climate which is the average state of the atmosphere not the instantaneous state. It might conceivably apply to weather – and he proves weather is not predictable on longer timescales but it is a mis-application of Equation 2 to apply it to climate.

I think it is actually very arguable whether Equation (2) does apply to the weather state. The equation assumes that successive errors are independent and additive, yielding a random walk. This is not how dynamical systems behave, because in the short term errors grow exponentially (in effect, are multiplicative) and must be characterised not by a linear growth parameter as assumed in this manuscript, but by an exponent (the Lyapunov exponent). Thus the situation is even worse than the author believes for weather, and instead of months of predictability, as implied by Fig. 5 with linear error growth, there are only a couple of weeks of actual predictability. Over the long term, the dissipative character of dynamical systems (including the climate system) causes the errors to be bounded by the dimensions of the attractor. The author is strongly urged to consult a textbook on dynamical systems theory since the application of (2) is a very basic error. If he does not want to read dynamical text books by climate scientist, read some by applied mathematicians.

The author's calculation is completely inapplicable to climate modeling. Indeed if we carry such error propagation out for millennia we find that the uncertainty will eventually be larger than the absolute temperature of the Earth, a clear absurdity. In reality climate models have been tested on multicentennial time scales against paleoclimate data (see the most recent PMIP intercomparisons) and do reasonably well at simulating small Holocene climate variations, and even glacial-interglacial transitions. This is completely incompatible with the claimed results.

In summary, the claims made in this paper are profoundly important if they are right. Unfortunately, they are wrong at several important levels and the paper has to be outright rejected.