

Interactive comment on “The implications of initial model drift for decadal climate predictability using EC-Earth” by Andreas Sterl

Anonymous Referee #2

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This paper is on the drifts in the EC-Earth model hindcasts after full field initialisation with ERA-Interim atmosphere and ORAS4 ocean. The drifts are interesting to see although they are not presented in enough detail or with focussed enough diagnostics to really learn a lot about the causes of drift. Where these are discussed the paper appears very speculative and the results shown do not really justify the conclusions. I therefore think that the claim of the paper to have explained why decadal hindcasts appear to fail with this model (and by implication to the same deficiencies in other models) cannot really be justified. I cannot therefore recommend publication in the full journal. The presentation is rather superficial level at times. Page 3 L2 full field initialisation the ocean state is not simply “constructed from Observations”. L6-7 the drift occurring in full-field assimilation is exactly the same as in seasonal forecasting approaches which have accepted forecasting skill. If the drift is to obscure forecast skill the system must

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become very non-linear. L16 One might expect drift to at least have a seasonally dependent component (which is stated later top of page 4). Section 3.3 Using the AMOC to assess drift relative to an observation based reanalysis truth is rather hazardous I would say. There is not a lot of evidence that the AMOC is not really robustly reproducible in these reanalysis products yet (as Karspeck et al note) so using it as a forecast target is insecure. Page 5 The low natural variability in EC-Earth cannot be a surprise given this is such a low resolution model that has not really been tuned against low frequency variability signals. Indeed this whole section 3.3 seems to end with the conclusion that a higher resolution version of the model might be better for the AMOC but there is no evidence presented for this apart from noting another model has found this. Section 3.4 discussed vertical structure of drift in AMOC and Lab sea. The lack of predictability as well as the drift in the AMOC is then suggested to be related to the rapid decorrelation and drift of surface heat fluxes and upper ocean properties in the Lab sea in different model members. But the hypothesis is not really proved. In addition there is no discussion of the way the Lab sea / SPG water gets out and at what depths it propagates down to influence the AMOC. I would argue this is an aspect which will be greatly affected by model resolution. Section 3.5 is very brief and discusses the obvious result that the atmosphere is unpredictable on short timescales. The discussion section 4 then presents some speculative Lagrangian argument for the pathways of air from a colder SPG towards Europe. But none of the diagnostics are Lagrangian and no attempt is made at budgeting the movement of heat content anomalies. The section concludes that this argument does not agree with the model results anyway and that therefore “obviously the mechanism does not work”

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