

1. General remarks

The paper treats a very actual problem: ensembles technique choice for decadal simulations. The work frame is well defined for the purpose of the paper, considering non-initialised simulations in order to directly compare ensemble spread when using two initial perturbation methods:

lagged initial conditions and bred vectors.

The paper is original, as it treats the problem at decadal scale, extending techniques already tested for seasonal predictions. The conclusions are very useful for decadal prediction field.

I do recommend the paper to be published (minor revisions are suggested bellow).

2. Specific comments

The text is very clear and the methods and conclusions fairly presented and targeted to the main aim of the paper. Figures are clear and support the results and conclusions.

3. Technical comments

General

*) knowing that the error growth is a function of the perturbation size, it would be interesting for the conclusions, to see if the comparison here, compares indeed same initial perturbation size:
Here are compared 1-day lag perturbations against normalized monthly, so are they, after normalization comparable as to make more clear the comparison ?

*) also would be interesting to mention if there is impact known (tests) of using different norms for temperature and salinity ? may improve regions of Eckman convergence?

*) par20,page6: "here we allow for a period of 2 years with monthly normalization" : how has been chosen this period? is it a model error growth feature ?

*) the integration length during the breeding cycles iterations is function of new perturbation size ? (after the first normalization): the saturation time may be a function of it, hence accounting that could provide a better approach for the growth slope.

Core text

- *) par25, page6: "size of the rescaling norm"
while the norm definition is clear for a vector space, I would suggest to define what is here termed by "the size of the norm"
- *) how do EOF for other levels (deeper ocean) compare ?
- *) par10, page11: "The spread error ratio is then the ratio of this spread and the difference .." : possibly you used "absolute difference" not "difference" ?
- *) par20, page11 typing error " After four months ...lagged initialized ensemble " 2 times.
- *) par5,page13 typing error "comparable .. for the ocean temperature case"
- *) par15,page 14 and conclusion 2: not clear if there was any sensitivity to rescaling norm experiment conducted here.
