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Interactive comment on "Imprint of chaotic ocean variability on transports in the Southwest Pacific at interannual timescales" *by* Sophie Cravatte et al.

Anonymous Referee #2

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This paper described results from an ensemble of model simulations for the Southwest Pacific Ocean. The experiment design is very sensible, and clearly described. Readers might appreciate a few more details of how the ensemble was set up, but this is easily addressed. The authors analyse results from their ensemble to estimate how much interannual variability can be attributed to chaotic processes. They find that this can be 40-60% in some regions. This is higher than I expected. I wonder if there is a subtlety to their ensemble that needs to be considered. Specifically, I wonder whether there is a phase difference of interannual signals could be introduced between ensemble members – owing to the different initial conditions – that could explain some of the differences they attribute to chaotic processes. The authors go some way to look at

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this with their analysis, but I think it would be worth looking at this before the paper is finalised. I expect that even if this is a factor, this study will be well worth publishing. It's very thought-provoking, and helps me think a bit differently about the circulation of this region. Some specific comments follow.

Re: ensemble perturbations

Perhaps the readers would be grateful for a bit more information on the perturbations to the initial ensemble.

Re: separation of interannual and chaotic variability

According to equations (1), all deviations from the time-varying ensemble mean are considered part of the chaotic ocean variability. But I wonder whether there could be some phase differences between members that are deterministic and unrelated to chaotic signals. Perhaps the different initial conditions could have some influence on the timing of interannual changes. Perhaps that interannual variability is equivalent, but just offset by some phase. Using the calculations outlined in section 2.2, I suspect these would be wrongly associated with chaotic variability.

I wonder if this could be checked by calculating the auto-correlation of transports, for example, at a few key locations to see if there is simply a phase-lag. Calculation of the coherence-squared and phase of the spectra may also help see whether this is a factor.

The EOF analysis (Figure 9 and 10) could perhaps be extended to look at this. Maybe you could look closely at the PCs of modes that are analogous between members. Does this show any offset in phase?

Maybe the authors would regard a shift in phase of an interannual signal as evidence of a chaotic process. If that's the case, I'm not sure I fully agree. Perhaps this could be more fully discussed in the paper.

Re: definition of transports

The term, “transport” is used to describe the “0-1000m integrated zonal and meridional transports . . . computed from monthly mean velocities”. I presume the velocities are integrated over depth, yielding units of m^2/s. This is consistent with the units in Figure 1 (m^2/s). I would be happy to see this stated explicitly.

This is a slightly unusual variable. It means that for the same “transport” value, points in coarser regions (eg at lower latitudes – at least for meridional transports) the volume transport is greater.

Is there a reason why the volume transports are not used? These would simply require the multiplication of the zonal or meridional grid spacing, yielding units of m^3/s.

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