Ocean Science Discussions

Ocean Sci. Discuss., referee comment RC2
https://doi.org/10.5194/os-2021-97-RC2, 2021

Comment on os-2021-97

Anonymous Referee #2

Referee comment on "Interannual variability of sea level in the southern Indian Ocean: local vs. remote forcing mechanisms" by Marion Kersalé et al., Ocean Sci. Discuss., https://doi.org/10.5194/os-2021-97-RC2, 2021

The authors evaluate in detail the relative importance of local wind forcing and remote oceanic signals from Pacific to the sea level variability in the SIO by using the ECCO simulations and a 1.5-layer reduced-gravity model. The paper is well written and informative. However, there are still some issues that need further clarification. Specific comments are listed as follows.

1. I agree with reviewer #1 that the closure of ITF passages will create a new wave guide from equatorial Indian Ocean to the west Australian coast, which may lead to overestimation of the eastern boundary forcing in the ITF-off experiment. Furthermore, I have some additional concerns about eastern boundary signals in the ITF-off experiment:

(1) Researchers usually adopt free running ocean models to conduct numerical sensitivity experiments. However, as introduced in the section 2.1, the ECCO experiments used in this study are not “free-run” simulations, but constrained by a variety of ocean observations through the adjoint method. This method try to minimize the misfit between observations and simulations by iteratively optimizing the initial conditions, surface atmospheric state and internal parameters. Therefore, the differences between the ITF-on and ITF-off experiments will potentially be reduced by such a data assimilation scheme. As shown in Figure 4, the eastern boundary SLA variability in the ITF-off experiment highly resembles that in the ITF-on experiment, albeit of a relatively weaker amplitude. But these SLA signals are poorly explained by local wind forcing (Figures 6c and 6d). I wonder whether these results reflect the impact of data assimilation scheme applied in both experiments.

(2) Is the Torres Strait closed as well in the ITF-off experiment? As mentioned in Lines 227 & 291, the closure of the ITF leads to a weaker LC in the ITF-off experiment. It is known that the LC is a counter-wind flow driven by the poleward pressure gradient. When closing the Indonesian straits, the LC should reverse to an equatorward flowing coastal jet, similar to the Benguela Current in south Atlantic and the Peru Current in south Pacific.

Therefore, a southward LC in the ITF-off experiment, despite its weaker speed, may also be induced by the unrealistic adjustment of data assimilation processes in ECCO or by the potential wave transmissions from the Torres Strait. Please check the flowing direction of LC in the ITF-off experiment.

2. Line 8: South Indian Ocean (SIO); Line 26: Southern Indian Ocean (SIO). Please make them consistent.

3. The ticks of X axis in Figure 1a have equal spacing, but the time intervals between neighboring labels are not uniform.

4. Figure 8c: please explain the meaning of the dashed lines. The blue line and the black line show different varying phases during 2014-2016 but the explained variance reaches 61% (Line 336). Please explain how to calculate the explained variances.

5. Line 367: "the correlation between the west-east SLA differences" should be "the correlation between the MEI and the west-east SLA differences".

6. Line 421: "the observed decade-long heat accumulation is due to the ocean tunnel effect, linked to the ENSO variability." Does it reflect the impact of PDO variability during hiatus period?