

## ***Interactive comment on “Early westward flow across the Tasman Gateway” by W. P. Sijp et al.***

### **Anonymous Referee #2**

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This paper provides a good example of applying paleoclimate model simulations to evaluate a hypothesis based on empirical paleoclimate data, in this case that shallow opening of the Tasman Gateway in the early Eocene led to westward flow across the gateway. This study shows that under specific paleogeographic conditions such flow is consistent with ocean circulation models. While not especially groundbreaking, this study does add to our understanding of how the opening of southern hemisphere gateways influenced climate change in the Eocene.

Overall, I found the results and analysis to be sound and well described. However, section 3.2 (Temperature changes in response to gateway opening) is unsatisfying. In this section the authors point out that they observe no SST cooling during opening of the Tasman Gateway, in contradiction of the earlier findings of Bijl et al. The authors then discuss alternative model experiments where deep sinking in the Ross Sea is suppressed, where cooling is observed. However, these alternative model experiments

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are not discussed elsewhere in the manuscript, the results are not shown in any figure, and there are no citations to other work with similar studies. I think if the authors are going to include these alternative experiments they need to document them much more closely. They should be discussed in the methods (with more details on the model set up), the results should be shown in a figure, and previous studies with similar experiments should be cited. Otherwise, these alternative model experiments should be left out, and the authors should simply state that the model results are not consistent with the paleoceanographic data in terms of an SST response to gateway opening.

Otherwise, I have minor comments and suggestions outlined below. There are a number of instances where typos or grammatical issues complicate the understanding, so the authors should take care to proofread the article before publication.

Title: This title is very broad, and makes it sound like this paper provides empirical evidence for “early westward flow. . .”. I would suggest changing the title to more accurately reflecting the study, such as “Model simulations of early westward flow. . .”

P 5022 Line 21: add i.e. before “the ACC. . .”

P 5024 Line 8: add “and” between Kennett citations.

P 5025 L 8: “must have occurred south”- meaning unclear

L 12: This sentence is poorly constructed.

L 14: How are the Antarctic hinterland temperatures known? Is this based on MBT/CBT temperatures? If so it is fairly uncertain what location is reflected in those temperatures. More detail on this claim is needed. Also, error estimates on the temperature changes are needed.

P 5026 L22: How were the depths for the two gateways chosen? And why are they different? It seems like these depths could be quite important for the results of the study. More background on why they were chosen, and what evidence supports these choices, is needed.

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P 5030 L 17: Cut the word eventually.

P 5030: It would be better to be quantitative about the tracer studies in the text. What does enhanced mean quantitatively? What about limited?

P 5031 L 19: "none of that" is vague- it would be good to be more specific.

L 29: I think if the authors are confident in this result they should extend the analysis, and state that it provides evidence for a later opening of the Drake Passage.

P 5034 L 17: "Build" should be built

Figure 1: It should be made clear what negative and positive values indicate (i.e. westward or eastward flow). Also, I think it is confusing and misleading to have different scales on all of the color bars. I would strongly suggest making them uniform in this and other plots.

Figures 5 and 6: It would be helpful to have the two different sources have different color schemes to better differentiate them. Also, as above, the color bars should have the same scale in each panel (i.e. they should all go from 0 to 15).

Figure 7: I think the last sentence of the caption is mislabeled here. Based on both the text and the figure, I think it should say there is cooling to the east of Australia when the DP is open.

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Interactive comment on *Clim. Past Discuss.*, 11, 5021, 2015.