

## ***Interactive comment on “Constraining atmospheric CO<sub>2</sub> content during the Middle Miocene Antarctic glaciation using an ice sheet-climate model” by P. M. Langebroek et al.***

**P. M. Langebroek et al.**

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We have changed the manuscript following suggestions of the two referees and the editor, which were very helpful for improving the manuscript and the ice sheet-climate model. The main changes in the manuscript are listed below. A more detailed discussion can be found in the responses to the reviewers.

1. The main focus of the manuscript remained the Antarctic ice-sheet expansion in the Middle Miocene. However, instead of perfectly constraining the atmospheric CO<sub>2</sub> for that specific period, we rather explored the potential influence of atmospheric CO<sub>2</sub> and insolation on the ice-sheet expansion. The title has therefore been changed to: 'Antarctic ice-sheet response to atmospheric CO<sub>2</sub> and insola-

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- tion in the Middle Miocene’.
2. The Introduction of the manuscript is expanded considerably in order to better present the context and background of the study. The Middle Miocene climate transition is discussed in more detail and illustrated by a figure showing a compilation of high-resolution benthic oxygen-isotope records. The specific aspects of the Middle Miocene (e.g. insolation, initial bedrock topography) which are used in the ice sheet-climate model can be found in the Methods section. This is also compared to the literature in the Discussion section.
  3. We discussed the experimental atmospheric CO<sub>2</sub> data available, and why we prefer to explore a large range of atmospheric CO<sub>2</sub> values.
  4. The climate sensitivity of the model was found to be too high and is now improved (see comments to the referees). The current model shows a climate sensitivity of 2.5C with a more realistic temperature increase of approximately 4C on Antarctica.
  5. Our results are discussed in more detail and compared to previous studies.

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