

Interactive comment on “Surface-circulation change in the Southern Ocean across the Middle Eocene Climatic Optimum: inferences from dinoflagellate cysts and biomarker paleothermometry” by Margot J. Cramwinckel et al.

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Cramwinckel et al. present a study of the surface-circulation change in the Southern Ocean during the Middle Eocene Climatic Optimum based on dinoflagellate cysts and biomarker paleothermometry. The manuscript submitted by Cramwinckel et al. is of good quality. This manuscript is within the scope of ‘Climate of the Past’ and is well written and structured. This will be a very useful paper on the MECO period in the

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Southern Ocean that is not well known. This study will certainly help climate modelers who can introduce consistent boundary conditions into the models for this part of the globe. I recommend publication of their paper in *Climate of the Past* with however some revisions.

Main comments: - Authors should give, in supplementary data, a detailed description of the pollen morphology (apertures, ornamentation of the exine surface. . .) and some photos of the main palynomorphs (dinocysts and pollen grains). This period in this region is not well known and it could help for further studies. - The fossil pollen and spores should be identify, by comparing them to modern pollen grains, following current taxonomy of recent taxa, instead of using morphotaxa names. By applying such approach, pollen and spores may be assigned to family, genus, and sometimes, but rarely, even to species levels. Once they are botanically identified, their paleoecological requirements may be defined based on the modern taxa. This botanical approach allows reliable paleoenvironmental reconstructions, as described and done by Suan et al. (*Geology*, 2017) for the Early Eocene of the Arctic Siberia. - Biostratigraphy: A table with the regional occurrences of the dinocysts could be interesting. - A simplified diagram with the stratigraphic log and the percentages of the main terrestrial palynological data of Latrobe-1 borehole is lacking.

Minor (technical) comments: - p5, L1: add a S to metre; L10: call figure 2a; L11: remove one "was not". - p6, L8: How many samples have been studied for this site?; L25: add "concentration" for the dinocyst content. - p10, L32: add a reference for the ages given by *Lophocysta* spp . - p14, L19: remove the "cf" in front of the reference Bijl et al.. - Figure 5, L17: add a "c" in the word dinocyst. - Figure 2, L21: in (a), it is not the bathymetry that is illustrated as there is no mention of the depth of the ocean.

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