Response to reviewer #2

We are thankful to the reviewer for their comments and we respond point by point in the following.

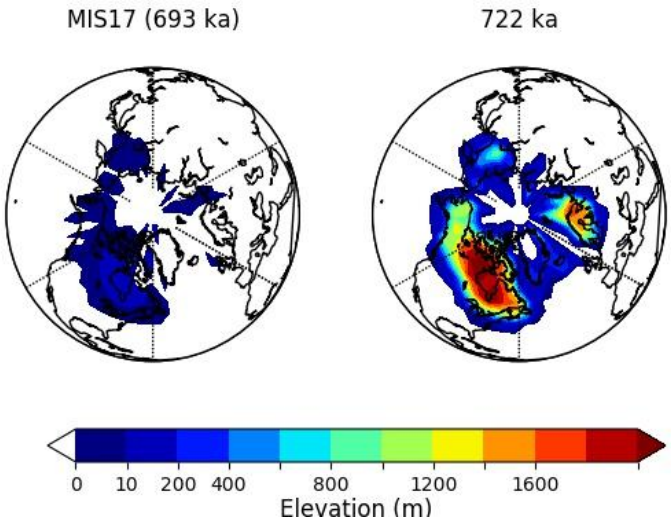
Anonymous Referee #2

Bouttes et al did an excellent job running a coupled EMIC model with carbon cycles to study the model's response to the different climate conditions of the last 9 interglacials. Unfortunately, even though the data show about 35ppm changes among the 9 interglacials, the model can only produce about 4 ppm changes, and the authors conclude that the fail of reproducing the 35 ppm is due to "mis-representation of some key processes in the model".

1. First, I suggest that the title needs to be changed to something like below to better represent the major topic of this paper.
"Response of the carbon cycle in an intermediate complexity model to the different climate configuration of the last 9 interglacials".
So the readers know that it's a model's carbon cycle response and doesn't imply that the response is derived from the data. Also since this study did simulations with the different orbital, vegetation and ice sheets, so it's better to use climate configuration other than orbital configuration in the title.
We agree and have modified the title to the suggested title: "Response of the carbon cycle in an intermediate complexity model to the different climate configurations of the last 9 interglacials"

2. Second, the authors need to explain how the increase of vegetation on land can produce HUGE global ocean warming (Figure 8).
As seen on Figure 8, including an interactive vegetation model leads to warming of the SSTs in most of the ocean. This warming is of a few tenths of a degree, which is relatively modest compared to the glacial-interglacial change of temperature of a few degrees. The change of vegetation modifies the local albedo and evapo-transpiration, in particular in the high NH latitudes where more tree cover leads to reduced albedo and larger transpiration, hence warming. Yet a more detailed analysis with sensitivity experiments taking into account the effect of changing vegetation on only one variables at a time (albedo, evaporation…) and at one region at a time, as well as possible retroactions, would be necessary to pinpoint the exact reasons of the warming, which is beyond the scope of this study.

3. Third, MIS17 in Figure 2 looks more like glacial instead of interglacial.
The figure below shows the ice sheet elevation for MIS17 and the preceding glacial maxima from the model simulations as comparison. While at 693 kaBP the ice sheet covers part of North America, its elevation is very low (a few tens of meters) compared to a glacial period such as at 722 kaBP when most of the ice sheet is higher than 1000 meters.



Even though MIS17 is different from a glacial, it highlights the need to better constrain the ice sheets. While more data and ice sheet simulations can help, it would also be useful to run sensitivity experiments with different prescribed ice sheet configurations in the carbon-climate model to evaluate the impact of those different ice sheets.

4. Fourth, P10L22, Change "Using a fully coupled climate model" to "Using a fully coupled climate model with an intermediate complexity"
We have modified to: “Using a fully coupled climate model of intermediate complexity”.

Additional modification:
In addition, due to recent measurements, we have modified pollen values in table 4 for MIS17 for the Iberian margin, which increases the tree cover there and gives better agreement between model and data (Figure 12), and for MIS15 which do not modify the qualitative results.