Answer to Public Comment of Matthew Huber

We thank Matthew Huber for the encouraging comment on our manuscript and the discussion point risen:

"As a minor point, while I think the discussion of the Pliocene is relevant, some brief discussion of the Eocene, Oligocene, and Miocene might also be relevant. Not as a general, anodyne statement, but as a specific recommendations. If the LGM is a weak candidate for constraining ECS, are there realistic combinations of paleogeographic boundary conditions and climate data/ patterns that would make an excellent candidate? If so, could you speculate a bit about which ones might be better than LGM? The warming signal for example in the Miocene is at least twice as big as in the Pliocene, but with only moderately higher CO2 (https://cp.copernicus.org/articles/ 10/523/2014/ https://agupubs.onlinelibrary.wiley.com/doi/abs/10.1029/2020PA004037) and paleoclimate model ensembles exist (https://agupubs.onlinelibrary.wiley.com/doi/abs/ 10.1029/2020PA004054). Would that have a higher signal to (non-CO2)-noise ratio? What are the properties of the ideal ECS emergent constraint paleo configuration?"

This comment is an interesting point that we often came across when discussing with other members of the paleoclimate community in conferences. Therefore, we decided to expand the manuscript with the last section entitled "Recommendations on paleo-emergent constraints on ECS", which answers the questions of Matthew Huber. We believe this section fits well with the rest of the manuscript, which, despite being centered on the LGM, also aims to open more on the use of past climates as emergent constraints on ECS.
To summarise this new section, we believe the ideal past climate to be used as emergent constraint on ECS is

1) Warm, with limited ice sheets, considering the substantial noise arising from intermodel differences in ice sheet forcing at the LGM. The climate needs to be warm enough to have a large signal-to-noise ratio, but most likely not as warm as in the Eocene, where non-linearities in feedback might appear.
2) with small changes in paleo-geography due to the issues arising from changes in ocean circulation and how feedbacks behave with varying topographies.
3) with abundant and high-quality proxy data.

We conclude that the Pliocene is likely to be one of the best candidates, but the Miocene is also promising. Oligocene and Eocene are most likely more challenging to use as they are located further in time and therefore have scarce and uncertain data and major changes in paleogeography.