Response to Referee #2, Gregory Retallack. Many thanks to Dr. Retallack for his insightful review. His comments are greatly appreciated.

Reviewer comment: This paper is well written and relatively free of errors, and presumably has been reviewed before.

Author response: It had not been reviewed before and we appreciate compliment.

Reviewer comment: Earth System Sensitivity (l.242) is a very slippery concept in this context, because the temperature increase with CO2 doubling in any one part of the world will depend on where it is. There are already numerous studies showing that midlatitude continental sites show little temperature change and thus muted sensitivity, but tropical and polar sites show marked changes in temperature. New Zealand is a temperate, site but also globally unusual in having a strongly marine-influenced climate now, and even more so in the Miocene when there was little land and few mountains. It is not clear how this even becomes relevant later (l.374) where elevated CO2 estimated is thought to relate to ESS of 4-7oC, because Miocene paleotemperature for New Zealand is not offered.

Author response: Perhaps this wasn't clear enough in our discussion. We agree that local temperatures are not particularly instructive when considering ESS. The temperature change we considered was an estimate of the global average based on data and the transfer function approach presented in Hansen et al. (2013). We have updated the text to clarify this. While this approach itself has its limitations (which we also discuss in the manuscript), we believe that it is a reasonable basis for the ESS discussion and that this discussion is valuable.

Reviewer comment: I fail to see the relevance of C4 grassland expansion (l. 388) because it postdated the age of these New Zealand leaves by some 10 million years.

Author response: We updated the text to better explain the relevance of C4 grassland expansion in the late Miocene in the context of our results.

Reviewer comment: Errors in estimated paleoatmospheric CO2 are asymmetric and very large (l. 307-8). Perhaps this is due to inadequate numbers of stomates counted: it should be hundreds in each image. Furthermore, Gaussian error propagation can be used to calculate symmetrical errors. Both issues are addressed in the following paper too recent to be included - Retallack, G.J. and Conde, G.D., 2020. Deep time perspective on rising atmospheric CO2. Global and Planetary Change, p.103177.

Author response: The reviewer raises an interesting point about the numbers of stomata per image counted resulting in larger error bars. We have now added text to further clarify how we avoided systematic error propagation and we now have referenced the reviewer's suggested study to highlight the importance of the number of counts per image.

The asymmetrical error propagation is the result of the gas-exchange model iteratively solving for conductance, assimilation rate and carbon dioxide, centered around a representative assimilation rate (A_0) measured under modern day atmospheric carbon dioxide. Because of this approach, the model returns a greater number of divergent solutions for fossil conductance, assimilation rate, and carbon dioxide for high CO_2 estimates, and fewer for low CO_2 estimates.