ADDENDUM

doi:10.1038/nature14954

Addendum: Plio-Pleistocene climate sensitivity evaluated using high-resolution CO₂ records

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Nature **518**, 49–54 (2015); doi:10.1038/nature14145

We have been invited to elaborate on the approach used in this Article to determine equilibrium climate sensitivity (ECS) for the Plio-Pleistocene epoch. We opted to use a regression-based method drawing on many determinations of climate forcing and temperature within a restricted geological interval, to yield the most statistically robust estimate of ECS. By its very nature, our method yields an average (but well determined) ECS for the time interval in question. Our method does not preclude the possibility that shorter-term variations to higher or lower values may have existed around the one-million-year mean that we determined, but such shorter-term variations cannot yet be robustly inferred, mainly owing to issues of chronological synchronization and uncertainties relating to our original temporal resolution. Until the Pliocene atmospheric carbon dioxide levels are known in fine detail, the only feasible approach is the one we chose. In addition, that approach is especially relevant when comparing time intervals of similar length (such as the Pliocene and the late Pleistocene) with a focus on establishing the longer-term (10^5 to 10^6 years) response of climate to forcing. Thus, we were able to establish the one-million-year mean ECS robustly, but robust assessment of any potential extreme values during the Pliocene will require additional carbon dioxide and climate data (of the type we presented in the Article), as well as important chronological improvements. If any short-term ECS values above or below the million-year mean were to be robustly identified, they would need to be carefully assessed in relation to the context of the (past) climate state in which such extremes occurred, and there could be important implications for climate sensitivity projections into our warming future. However, significant improvements in the geological data are needed before such an exercise can be reliably undertaken. We thank Dana Royer (Wesleyan University) for bringing this issue to our attention.

In addition, owing to a drafting error, Fig. 5g was slightly misaligned with its corresponding x -axis. Figure 1 of this Addendum shows the corrected panel. This correction does not affect our conclusions, and we thank Peter Kohler for bringing it to our attention.

Figure 1 | This figure shows the corrected Fig. 5g of the original Article.