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Assessing data and model uncertainties in modelling Pliocene warm terrestrial climates

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Existing data-model comparisons (DMC) demonstrate that climate models are generally able to reproduce past warm climates of the last 65 million years. However, a regular data-model mismatch between high latitude temperature estimates and simulations suggests that models tend to systematically underestimate past polar amplification. This led to an ongoing controversy about the accuracy of DMC-studies which might have been biased by uncertainties in estimating temperatures from geological proxies. Here we assess the role of uncertainties and variability of proxy data and model outputs on the retrodictive capacities of Pliocene climate models. We will present DMC studies using a comprehensive global data set of palaeobotanical proxy-based temperature estimates and biome reconstructions to assess the ability of four fully coupled ocean-atmosphere climate models (CCSM4, GISS Model ER, HadCM3 and MIROC4m) to simulate the warm terrestrial climates of the mid Piacenzian warm period, 3.264-3.025 million years ago. Our data-model comparison considers intermodel variability and uncertainty ranges of palaeo-temperature estimates and biome reconstructions as well as model sensitivity to varying geological boundary conditions. The results show for all models a distinct Northern Hemisphere-wide cold bias (particularly north of 30 °N) and the contribution of each forcing to this data-model mismatch will be discussed.