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Mid-Pliocene mesic subtropical hydroclimate over continents driven by land surface changes

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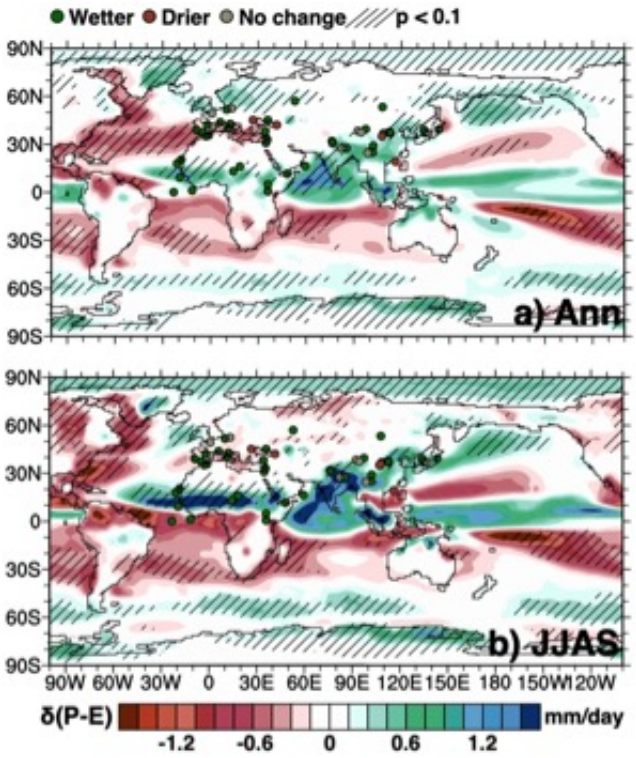
Earth System Models (ESMs) project drying of the northern subtropics by the end of the 21st century. However, geologic evidence from intervals with elevated concentrations of atmospheric carbon dioxide (pCO_2), like the mid-Pliocene, suggest mesic subtropical conditions. Several hypotheses, including an El Niño-like SST pattern and weaker Hadley circulation, have been proposed to explain this mismatch. Here, we show that PlioMIP2 ensemble broadly capture the pattern of proxy reconstructed Pliocene hydroclimate, notably a wetter Sahel and southeast Asia. Sensitivity simulations reveal that this pattern is driven by summertime rainfall increases as a result of lowered albedo and a distinct surface warming pattern, generated by prescribed vegetation and ice sheet changes. The resultant tropospheric moistening and stationary wave pattern enhance moisture convergence into the northern subtropics. Our results suggest that mid-Pliocene hydroclimate is part of the Earth system feedback to sustained CO_2 concentrations similar to today.



PlioMIP2: A. Haywood, J. Tindall, S. Hunter, A. Abe-ouchi, W. L. Chan, C. Contoux, Chuncheng Guo, Xiangyu Li, G. Lohmann, C. Stepanek, N. Tan, Q. Zhang, Z. Zhang, Charles Williams