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Global vegetation distribution and terrestrial climate evolution at the Eocene-Oligocene transition

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The Eocene – Oligocene transition (EOT; ca. 34–33.5 Ma) is widely considered to be the biggest step in Cenozoic climate evolution. Geochemical marine records show both surface and bottom water cooling, associated with the expansion of Antarctic glaciers and a reduction in the atmospheric CO_2 concentration. However, the global response of the terrestrial biosphere to the EOT is less well understood and not uniform when comparing different regions. We present new global vegetation and terrestrial climate reconstructions of the Priabonian (late Eocene; 38–33.9 Ma) and Rupelian (early Oligocene; 33.9–28.45 Ma) by synthesising 215 pollen and spore localities. Using presence/absence data of pollen and spores with multivariate statistics has allowed the reconstruction of palaeo-biomes without relying on modern analogues. The reconstructed palaeo-biomes do not show the equator-ward shift at the EOT, which would be expected from a global cooling. Reconstructions of mean annual temperature, cold month mean temperature and warm month mean temperature do not show a global cooling of terrestrial climate across the EOT. Our new reconstructions differ from previous global syntheses by being based on an internally consistent statistically defined classification of palaeo-biomes and our terrestrial based climate reconstructions are in stark contrast to some marine based climate estimates. Our results raise new questions on the nature and extent of terrestrial global climate change at the EOT.