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Current state and future directions in paleogeography reconstructions throughout the Cenozoic

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The reconstruction of paleogeography, that is, the reconstruction of Earth's surface elevation within a plate tectonic context, is crucial for understanding changes in past climate, sea level, as well as variations in biodiversity through deep time. Although often presented as picturesque maps in publications or even museums, paleogeography reconstructions can provide important geoscientific context and serve as a key boundary condition in many aspects of Earth science including, but not limited to, the simulation of past climates and landscape evolution modelling. However, despite the potential influence and impact of paleogeography on many aspects of Earth's history, there are very few published global reconstructions of paleogeography, and available reconstructions are often constrained to a single time slice (e.g., Middle Miocene, ~15 Ma), or are available in and represent longer (~5–10 Myr) increments. Additionally, there are major uncertainties in reconstructions of paleogeography, in part due to the poor temporal and/or spatial coverage of proxy data, but also uncertainties within the underlying workflows used to derive its key components. Here, I examine published paleogeography reconstructions throughout the Cenozoic, focusing on key time intervals. I compare the similarities and differences in reconstructions, including aspects of their workflows and sources of uncertainties within them. Finally, I present new approaches for generating paleogeography and quantified uncertainties in a more open and reproducible framework, allowing for future advances in proxy data and other constraints to be incorporated.