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Preliminary global paleogeographic maps through the Greenhouse-Icehouse transition: forcing of the Drake Passage and Asian Monsoons.

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Paleogeographic maps are essential for understanding Earth dynamics. They provide the necessary boundary conditions for climate and geodynamic modeling, surface processes and biotic interactions. In particular, the opening and closing of ocean gateways and the growth of major mountain belts are major drivers of climate changes and biotic interchange. However, the timing and spatial extent of such events are highly controversial and regularly questioned by new data. As part of the ERC "MAGIC" project focusing on Asian Monsoons during the Icehouse to Greenhouse transition we thus produced a set of worldwide Cenozoic paleogeographic maps in the period time between 60 to 20 Ma, with a set of boundary conditions specific to the India-Asia collision zone and the Drake Passage.

The creation of a paleogeographic map followed a rigorous and reproductively methodology that integrates paleo-bathymetric, paleoshoreline and paleotopographic data into a coherent plate tectonic model using the open source software GPlates. (1) We use the model provided by Seton et al. (2012) as a first order tectonic model modified to integrate the full restoration of five regions: the Andes, the Scotia Arc, Africa, The Mediterranean Sea and the Tibet-Himalayan collision zone. (2) The paleobathymetry was provided by Müller et al. (2008) using age-depth relationships and assuming symmetric ridge spreading. (3) Paleoshoreline maps were modified according to the fossil database from fossilworks.org and the geological record and were used to represent the boundary between terrestrial and marine paleo-environments. (4) To reconstruct paleoelevations, the most controversial task, we compiled a wide range of data including stable isotope, leaf physiognomy, and thermochronology combined with regional fossil and geological records (tectonic setting) and geomorphological data. Finally, we use the open source GMT software and a set of masks to modify the current Earth relief model (ETOPO) according to the estimated paleoelevation for specific region at each period of time.

Our approach specifically takes into account the evolution of continental margins. Paleotopographic evolution is coupled with the evolving shape of continents. Considering the constant addition of new data and models, the value of this method is to generate a progressive paleorelief model of the Earth that can be easily compared and updated with new data.