Geophysical Research Abstracts
Vol. 20, EGU2018-11158-1, 2018
EGU General Assembly 2018

The role of mantle convection in driving the flooding and emergence of New Guinea since the Jurassic

Lauren Harrington (1), Sabin Zahirovic (1), Nicolas Flament (2), and R Dietmar Müller (1)

(1) EarthByte Group, School of Geosciences, University of Sydney, Australia, (2) School of Earth and Environmental Sciences, University of Wollongong, Australia

The paleogeographic reconstructions of New Guinea indicate fluctuating periods of long-term flooding and emergence since the Jurassic, some of which are inconsistent with estimates of tectonic and global sea level influences, especially since the Eocene. The role of deep Earth dynamics, namely vertical lithospheric motions in response to mantle convection, to explain these discrepancies has not been explored. We present work that investigates the role of subduction-driven mantle flow in controlling long-wavelength dynamic topography and its manifestation in the regional sedimentary record, within a tectonically complex region leading to orogeny. We couple regionally refined global plate reconstructions using GPlates (www.gplates.org) with forward numerical models of mantle flow using CitcomS (https://geodynamics.org/cig/software/citcoms/) to compare trends of dynamic topography to estimates of eustasy and regional paleogeography. Qualitative corroboration of modelled mantle structure with equivalent P- and S-wave tomographic profiles allows us to ground-truth the models. We show that predicted dynamic topography trends correlate with the paleogeographic record of New Guinea from the Jurassic to the present. We find that subduction at the East Gondwana margin locally enhanced the high eustatic sea levels from the Early Cretaceous ($\sim$145 Ma) to generate long-term regional flooding. During the Miocene, however, dynamic subsidence associated with south-dipping subduction to form the Maramuni Arc explains the long-term inundation of New Guinea during a period of global sea level fall. The results illustrate the need to evaluate the role of deep Earth processes when interpreting the stratigraphic record, and lay the foundation for future work that evaluates the relative contributions of sea level change, dynamic topography, flexural and tectonic topography, and surface processes in the long-term geographic evolution of tectonically complex continental margins.