Geophysical Research Abstracts
Vol. 19, EGU2017-6977, 2017
EGU General Assembly 2017

Global sea level fluctuations and uncertainties through a Wilson cycle based on ocean basin volume reconstructions

Nicky Wright, Maria Seton, Simon E. Williams, and R. Dietmar Müller
The University of Sydney, School of Geosciences, Australia

Variations in the volume of ocean basins is the main driving force for (long-wavelength) changes in eustatic sea level in an ice-free world, i.e. most of the Mesozoic and Cenozoic. The volume of ocean basins is largely dependent on changes in the seafloor spreading history, which can be reconstructed based on an age-depth relationship for oceanic crust and an underlying global plate kinematic model. Ocean basin volume reconstructions need to include: (1) a predicted history of back-arc basin formation, including where geological evidence exists for the opening and closing of back-arc basins within a single Wilson cycle, (2) the emplacement and subsidence of oceanic plateaus (LIPs), (3) variations in sediment thickness through time, and (4) a reconstruction of the depth of continental margins and fragments. Unfortunately, due to subduction of oceanic crust, we must rely on synthetically modelled ocean crust for much of Earth's history, for which it is impossible to ground truth the history of LIPs and sediment thickness.

In order to improve reconstructions of sea level on geologic time scales and assess the uncertainty in deriving the volume of ocean basins based on a global plate kinematic model, we investigate the influence of these poorly constrained features (e.g. LIPs, back-arc basins, sediment thickness, passive margins) on ocean basin volume since 230 Ma (i.e. throughout an entire Wilson cycle). We assess the characteristics for each feature at present-day and during well-constrained times during the Cenozoic, and create suites of alternative paleobathymetry grids which incorporate varying degrees of each feature's influence. Further, we derive a global sea level curve based only on the reconstruction of ocean basin volume (i.e. excluding effects such as dynamic topography and glaciation), and present the influence of each component and their uncertainties through time. We find that by incorporating reasonable predictions for these components during times where ocean basins are predominantly synthetic reconstructions, the mean depth of ocean basins shallow by over 150 m. Such investigations are important for exploring Earth's evolutionary cycles including transitions from Greenhouse to Icehouse worlds, continental inundation and emergence, as well as continental amalgamation and dispersal. The paleobathymetric models derived in this study can be used as first-order boundary constraints for paleoclimate models.