Reconstruction Modeling Using Tectonics and Climate of Western North America

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As the Basin and Range province is one of the most biodiverse regions, advancements in reconstruction modeling of geologic-climate changes are necessary to investigate potential associations between landscape and biological evolution. The historic deformation of the western United States involved crustal extension and topographic collapse that developed the present-day landscape. During lithospheric transformation, exhumation of metamorphic core complexes (MCC) occurred, yet current models of the western U.S. fail to simulate MCC and deformation via synthetic continental and climate datasets. This study aimed to simulate an accurate Basin and Range region by integrating climate, Mohorovicic and external topography, and an initial thick crustal root to simulate deformation and formation of MCC. Utilizing Underworld Geodynamics and Badlands codes, the Geologic-Climate Model with new geologic-climate inputs was compared against reproduced simulations of the gold-standard geologic model by Rey et al., 2009. The Geologic-Climate Model reproduced sedimentary and elevation responses as well as internal and external topographic changes. Additionally, exhumation of MCC was simulated in the Geologic-Climate Model by the presence of a thick crustal root that flattens through time with strain localization in the upper crust below the highlands. Comparisons between the Geologic-Climate Model and Rey et al., 2009 supported the necessity of a thick crustal root and high elevation for successful simulation of MCC and supported disuse of linear or uniform precipitation trends and flat topography, which hinder representative modeling. Geologic-Climate Model simulations should be used to understand geologic, climate, and flora and fauna relationships in the past, present, and future.

Awards Won:

First Award of $5,000

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