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The Role of Mantle Convection on the Landscape Evolution in Amazonia Since Oligocene

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The greatest drainage system in the world, the Amazon River system, drains an area of about six million square kilometers in Northern South America, including parts of the Central and Northern Andean Cordillera, the Amazonian Craton and lowlands. Based on evidences from the Foz do Amazonas basin, the establishment of this transcontinental river system flowing eastward occurred in Late-Miocene. However, the landscape evolution of Amazonia that culminated in this huge drainage system is a matter of debate, as well as the processes that guided this evolution. The orogeny of the Eastern Andean Cordillera played a major role in controlling the paleogeography in Amazonia, mainly since the Oligocene. Additionally, the topographic variations induced by mantle convection (i.e. dynamic topography) represents an important process controlling the sedimentary deposition, mainly in Western and Central Amazonia. Aiming to reconstruct the landscape evolution and to verify the role of dynamic topography in the evolution of the drainage and sedimentary pattern in Amazonia, in the present research, we incorporate different maps of dynamic topography in Amazonia through time in a numerical model that simulates the Andean orogeny, surface sedimentary processes and the flexural isostasy of the lithosphere. In the numerical experiments, we observed the formation of a transcontinental river system right after the disappearance of a great lacustrine environment that occupied the Western and Central Amazonia during the Early-Middle Miocene. In the simulations, the size and duration of this lacustrine environment and the age of the formation of the transcontinental river system depends on the shape and magnitude of the dynamic topography and also the sedimentary input in the basins of the region, so that in the simulations without dynamic topography this lacustrine environment was restricted to the foredeep of the foreland basin system. Based on the simulations, we conclude that the transcontinental river system would be formed even without the contribution of the dynamic topography. However, the negative dynamic topography (i.e. subsidence) in Western and Central Amazonia delays the filling of the sedimentary basins of the region and, consequently, retards the formation of the transcontinental river, while the dynamic subsidence in eastern Amazonia accelerates the river connection between the Andes, the Western Amazonia, and the Atlantic Ocean.