Geophysical Research Abstracts
Vol. 21, EGU2019-13840, 2019
EGU General Assembly 2019

Inverse analysis of Pearl River source-to-sink system, South China Sea: Implications for SE Tibetan uplift and monsoon intensification

Xiaoping Yuan (1), Jean Braun (1), Michael Nirrengarten (2), Sascha Brune (1), Geoffroy Mohn (2), and Laure Guerit (3)

(1) GFZ, Potsdam, Potsdam, Germany (xyuan@gfz-potsdam.de), (2) Laboratoire Géosciences et Environnement Cergy, Université de Cergy-Pontoise, Cergy-Pontoise, France, (3) Géosciences Environnement Toulouse, UMR5563 CNRS-IRD-Université de Toulouse, France

The uplift history of the SE Tibetan Plateau has been a highly debated topic in Earth sciences for decades. Yet, it is of great importance to understand the crustal deformation in continental collisions, as well as the interaction between solid Earth and climate. In particular, two contrasting models of crustal deformation have been proposed for SE Tibet uplift, namely the “rigid-block uplift” (Tapponnier et al., 2001), which regards the lithosphere as a series of interacting but non-deforming blocks, and the “crustal-flow uplift” (Clark and Royden, 2000), which postulates horizontal flow of a partially molten lower crust. This uplift has resulted in the formation of the large Pearl River catchment running from SE Tibet to the South China Sea. Asian monsoon rains feed this catchment, modulate sediment transport to the marginal sea, and affect the modern topography of SE Tibet. The sedimentary sequences preserved in the Pearl River Mouth Basin (PRMB) on the northern margin of the South China Sea represent an ideal natural laboratory to understand how tectonic deformation, river erosion and climate interact in this source-to-sink system.

Here, we use a new efficient landscape evolution model to undertake an inverse analysis of the Pearl River source-to-sink system since the Middle Eocene (45 Ma), in an attempt to unravel the history of river erosion, catchment geometry, climate (monsoon intensification), and tectonics (SE Tibetan uplift) that is compatible with the observed geometry of the PRMB. For this, we use a Bayesian inversion scheme in which the misfit function is constructed by comparing the observed sedimentation rate, sediment thickness, sediment surface slope, and shelf length to those predicted by the model.

Using the crustal-flow uplift model, our preliminary simulations show that the produced sediment flux is larger than the observed sedimentation rate. In addition, we do not capture the geological and geomorphic features of the SE Tibetan Plateau. On the contrary, the rigid-block uplift model can reproduce the observed topographic signature of the plateau. We find that the best-fitting values of oceanic sediment transport coefficients are in the range of $\sim$200$-$800 m2/yr. Our preliminary simulations, consistent with previous interpretations based on geochemical isotopic data (Gao et al., 2018), show that small drainage system dominated the coastal south China in the Early Oligocene (33 Ma). Then, the Pearl River expanded towards the near-modern continental-scale drainage configuration in the Early Miocene (23 Ma). We also infer that, in order to fit the observed sedimentation rate of the Peal River system (Clift, 2006), the monsoon intensity, simulated here by the precipitation rate, must have decreased by a factor of $\sim$2$-$3 since $\sim$13 Ma.