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The influence of tectonic grain to the Neogene evolution of the Mesopotamian basin: 3D tectonic–surface processes modeling

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The Mesopotamian basin is a plate-scale foreland basin commonly linked to the tectonic load of the Zagros mountain belt. Its current drainage pattern shows the two main river systems (Tigris and Euphrates) draining the basin longitudinally from NW to SE, likely to be influenced by other large-scale geodynamic events, such as the uplift of the Anatolian Plateau (Middle Miocene) to the NW and/or the Arabian plate flank tilting to the W (from early Miocene). By using an integrated modeling of surface processes, lithospheric flexure and kinematic fault deformation, we test the influences of each main tectonic units on the basin evolution. The numerical model is particularly designed to study the 3D foreland basin evolution and to identify large-scale relationships between tectonic movements and sediment transport and deposition. We specifically aim at reproducing the drainage conditions in the basin, the flexural profile and the sediment thicknesses and geometry of deposition, by investigating the basin history at the scale of the Arabian plate (3000 km x 1200 km), over a long period of time (i.e. since 35 Ma to present day), and with integrating realistic climatic conditions. The main results reveal 1) the need for an external load in addition to the Zagros to reproduce the flexural profile of the basin and 2) the important contributions of both Arabian plate flank tilting and Anatolian plateau uplift to the drainage system, all of them suggesting a significant contribution from deep geodynamic events occurring in early to middle Miocene times in shaping the present day Mesopotamian basin.