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Tectonics vs. Climate efficiency in triggering detrital input in sedimentary basins: the Po Plain-Venetian-Adriatic Foreland Basin (Northern Italy)

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The relative efficiency of tectonics respect to climate in triggering erosion of mountain belts is a classical but still open debate in geosciences. The fact that data both from tectonically active and inactive mountain regions in different latitudes, record a worldwide increase of sediment input to sedimentary basins during the last million years concomitantly with the cooling of global climate and its evolution toward the modern high amplitude oscillating conditions pushed some authors to conclude that Pliocene-Pleistocene climate has been more efficient than tectonics in triggering mountain erosion.
Po Plain-Venetian-Adriatic Foreland System, made by the relatively independent Po Plain-Northern Adriatic Basin and Venetian-Friulian Basin, provides an ideal case of study to test this hypothesis and possibly quantify the difference between the efficiency of the two. In fact it is a relatively closed basin (i.e. without significant sediment escape) with a fairly continuous sedimentation (i.e. with a quite continuous sedimentary record) completely surrounded by collisional belts (Alps, Northern Apennines and Dinarides) that experienced only very weak tectonic activity since Calabrian time, i.e. when climate cooling and cyclicity increased the most.
We present a quantitative reconstruction of the sediment flow delivered from the surrounding mountain belts to the different part of the basin during Pliocene-Pleistocene time. This flow was obtained through the 3D reconstruction of the Venetian-Friulian and Po Plain Northern Adriatic Basins architecture, performed by means of the seismic-based interpretation and time-to-depth conversion of six chronologically constrained surfaces (seismic and well log data from courtesy of ENI); moreover, a 3D decompaction of the sediment volume bounded by each couple of surfaces has been included in the workflow, in order to avoid compaction-related bias.
The obtained results show in both Basins a rapid four-folds increase of the sediment input occurred since mid-Pleistocene time respect to Pliocene-Gelasian times. Even if the absolute amount of sediment arriving in the two basins is quite different, reflecting the different extension of their source regions, this increase occurred concomitantly with both the strong decrease of tectonic activity in the surrounding belts and the onset of major glaciations in the Alpine range.
Therefore we argue that a cool, highly oscillating climate, causing glacial-interglacial cycles is approximately 4 times more efficient than tectonics in promoting the erosion of mountain belts and the related detrital input in the surrounding sedimentary basins.