

144-2 - ENCODING PERIODIC TECTONIC FORCINGS IN THE STRATIGRAPHY AND GEOMORPHOLOGY OF A FAULT-CONTROLLED LATE PLEISTOCENE SOURCE-TO-SINK SYSTEM

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We present results from time series analyses of environmental change proxies in natural and model-generated sedimentary and geomorphic archives aimed at exploring how exogenic tectonic forcings might be discerned from climatic forcings or autogenic processes. Our natural experiment for this exercise is the ~30 km² Pagliara basin and fan-delta located in the uplifting footwall of a normal fault in northeast Sicily. The analyzed sedimentary package consists of stacked, cyclical, distributary mouth channel and bar facies that have been geochronologically dated (IRSL) to constrain a long-term sediment accumulation rate (SAR) of ~1 cm/y. Power spectral analysis of a 24 m long (~2400 yr record) rock-magnetic time series reveals several peaks with a 99% probability of significance above a red noise model with periodicities of ~520 ~390, ~80, and ~45 yrs. Assuming ~2 m of geomorphic relief, we discount high-frequency peaks less than the 200 yr compensation time. Tuning the remaining periodicities to known sub-Milankovitch climatic cycles, reveals a SAR of ~0.8 cm/yr and an evolutionary spectrum that correlates well to the lithostratigraphy, consistent with the encoding of a climatic driver. In contrast, short-term time series analysis of medium- to high-magnitude (M=5-7.5) historical earthquakes within a radius of 130 km from Pagliara, have periodicities of ~125 yr and ~50 yr, below the compensation time, which probably indistinguishable in the sedimentary archive. Longer-term unsteadiness in earthquake activity is, however, expressed in the base level fall record for the Pagliara that we reconstruct using a linear inversion approach of the basin's channels revealing a periodicity of ~200 ka that matches the marine terrace record. These natural experiments are compared to a Landlab-based numerical model that evolves topography in response to periodic or aperiodic fluctuations of base level elevation and precipitation intensity. Time series analysis of the sediment flux at the basin outlet and long profile modeling of the synthetic channels in the basin are able to distinguish among periodic (exogenic forcing) vs aperiodic (autogenic processes) signals introduced into the model. These results both inform and will be further tested in the natural case with a longer stratigraphic section in the Pagliara delta.

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