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A regional approach for exploring the relation between sediment transport and coastal erosion in Sicily.

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To study on a regional basis, the relation between fluvial sediment delivery and coastal erosion, the historical record of coastline migration of Sicily was analyzed with respect to the estimated sediment delivery to the coast obtained from the spatially distributed sediment delivery WaTEM/SEDEM model. The latter was directly acquired from the ESDAC database as a 25 m pixel layers, being based on the combination between the RUSLE model and a transport capacity routing algorithm.

At the same time, the coastline-evolution (accretion/retreat) data for 1960/1994 and 1994/2012 intervals were processed. This dataset, provided by ISPRA (Italian Institute for Environmental Protection and Research), is made by vectorial polygons, corresponding to erosion or accretion areas obtained by the intersection between two coastlines. The dataset contains polygons related to the 1960-1994 and 1994-2012 periods.

Once a common baseline was extracted from 2019 satellite images, 22 Physiographic Units (PU) were identified. The PU was defined based on geomorphologic criteria and by assuming a null net sediment budget (null sediment transport between two PU neighboring). Each coastal PU was connected to its contributing fluvial basins, also assigning the expected sediment delivery at the coastline.

To perform the analysis, cross profiles along the coastline were generated and intersected with the polygons, calculating a response value, in terms of retreatment or accretion, to each of the cross-profile centroids. Finally, for each PU, the cumulated variations were computed.

PUs with significant cumulative variations (more than 2 km) in at least one of the two epochs were identified and three different patterns were detected: accretion/retreat, retreatment/accretion, and retreatment/retreatment. The response observed for the different PUs was then analyzed considering estimated sediment delivery, recognizing coherent (large sediment delivery = accretion) and incoherent (large sediment delivery = retreatment) behaviors, which have been interpreted as controlled by the history of soil/coastal erosion management practices.

In particular, in spite of a very high expected sediment delivery, more than three-quarters of the

Tyrrhenian coast resulted as affected by a marked retreat in 60-94 (same tens of meters) and a moderate accretion in 94-12, as the result of extensive coastal works which have been realized to mitigate coastal erosion.