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Coastal erosion: an overlooked source of sediments to the ocean. Europe as an example

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The eroding rocky coasts export sediment to the ocean, the amount of which is poorly known. At the global scale it could amounts 0.15-0.4 Gt/a (1). Recent evaluations of large retreat rates on monitored sections of sea cliffs indicate it can be comparable to the sediment input from medium to large rivers. We quantify rocky coast input to the ocean sediment budget at the European scale, the continent characterized by the best dataset.

The sediment budget from European rocky coasts has been computed from cliff lengths, heights and retreat rates. For that, we first compiled a large number of well-documented retreat rates; the analysis of whom showed that the retreat rates are at first order explained by cliff lithology (GlobR2C2, 2). Median erosion rates are 2.9 cm/a for hard rocks, 10 cm/a for medium rocks and 23 cm/a for weak rocks. These retreat rates were then applied to the European coast classification (EMODnet), giving the relative coast length for cliffs of various lithology types. Finally the cliff height comes from the EU-DEM (https://ec.europa.eu/eurostat/web/gisco/geodata/reference-data/elevation).

Due to data availability, we only worked on ~70% of the whole Europe, corresponding to a 127,000 km-long coastline (65,000 km of rocky coast). We calculated it originates 111±65 Mt/a, corresponding to 0.38 times the sediment input from rivers from the equivalent area (3.56 10^6 km^2), calculated after Milliman and Farnsworth (3)'s database (290 Gt/a). A crude extrapolation to the 1.5 10^6 km-long Earth's coastline reaches an amount of 0.6-2.4 Gt/a, an order of magnitude less that the sediment discharge from rivers (11-21 Gt/a, e.g., 3).

This up-to-now overlooked sedimentary source must further be explored for: (i) its effects on the geochemical ocean budget; (ii) the rising sea level control on the cliff retreat rates; and (iii) the characteristics and location of sediment deposition on ocean margins.

References

(1) Mahowald NM, Baker AR, Bergametti G, Brooks N, Duce RA, Jickells TD, Kubilay N, Prospero JM, Tegen I (2005). Atmospheric global dust cycle and iron inputs to the ocean: ATMOSPHERIC IRON DEPOSITION. Global Biogeochemical Cycles 19. DOI: 10.1029/2004GB002402

(2) Prémaillon M, Regard V, Dewez TJB, Auda Y (2018). How to explain variations in sea cliff erosion rates? Insights from a literature synthesis. Earth Surface Dynamics Discussions:1–29. DOI: https://doi.org/10.5194/esurf-2018-12

(3) Milliman J, Farnsworth K (2011). River Discharge to the Coastal Ocean: A Global Synthesis. Cambridge University Press