Geophysical Research Abstracts
Vol. 19, EGU2017-9955, 2017
EGU General Assembly 2017

Do Higher 20th Century Sea-cliff Retreat Rates Necessarily Imply Recent Acceleration in Sea-cliff Retreat?

Amit Mushkin (1,2), Oded Katz (1), and Naomi Porat (1)

(1) Geological Survey of Israel, Jerusalem, Israel (mushkin@gsi.gov.il), (2) University of Washington, Seattle, WA, USA

Inland retreat of sea cliffs in response to post LGM (last glacial maximum) sea-level rise is an ongoing process that affects coastal environments and communities worldwide. Here, we examine a globally recurring pattern where reported sea-cliff retreat rates since the 20th century often appear to exceed longer-term millennial-scale (‘background’) rates that rarely exceed ∼0.1 m/yr. Focusing on Israel’s 30-km-long Mediterranean ‘Sharon’ sea-cliff as a case study we demonstrate that such apparent increase in rates may also reflect a widely acknowledged sampling bias in geologic rate estimates inferred from observation time windows (‘OTW’) shorter than process episodicity. We show that this possible bias leads to an ambiguity in conventional rate estimates obtained by averaging observed retreat distances over OTW, and that as a result despite ubiquitous and robust observations of cliff retreat since the 20th century (e.g., aerial photographs) recent/current retreat rates for many of the world’s episodically retreating sea cliffs remain essentially unknown. To address this present limitation in our ability to detect and quantify recent changes in sea-cliff retreat rates we use airborne LiDAR to measure the continuous wave-driven volumetric erosion of collapsed material from the cliff base as an effective upper-bound constraint for the m/yr rate of episodic retreat of the cliff itself. We find that while conventional retreat rate estimates since the 20th century along the Sharon sea cliff artefactually increase up to several m/yr as an inverse function of OTW, the LiDAR-constrained retreat rates are not susceptible to this sampling bias, are comparable to the cliff’s background retreat rate of 0.03-0.07 m/yr since the mid Holocene and thus indicate no recent acceleration in retreat. This ability to unambiguously constrain sea-cliff retreat rates with annual to decadal-scale observations directly impacts the global-scale push to quantify, better understand and ultimately predict the response of sea cliff erosion and retreat to recent/projected changes in environmental conditions such as sea-level, climate, near-shore ocean dynamics and anthropogenic influences.