Spatial and temporal changes of sediment grain size along Israel’s Mediterranean cliff-dominated beaches

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Motivation

- Changes in sediment grain size, shape or density can lead to morphological changes of beach systems.
- Spatial variation of grain size along beach profiles has been well studied, temporal variation in beach grain size has received less attention.
- The fate of cliff-eroded sediments along sandy coasts was rarely studied as most studies focused on shingle beaches.

Goals

1. Quantify the temporal dynamics of beach sediments in cliff (eolianite) - dominated beaches along Israel’s Mediterranean coast.
2. Explore their relationship to cliff erosion and to sand abrasion.
Approach and methods

- Repetitive sampling of surficial sediments (0-2 cm) along two cross shore transects over 3 years. Sampling interval varied from 10 days to 3 months.
- Sampling at four locations along the profile: Talus, backshore and at foreshore.
- Particle size distribution (PSD) was evaluated using two complementary approaches:
  1) Sieving over the range 0.5 mm to 12.5 mm using 12 sieves,
  2) Laser diffraction analysis over the range of 0.02 μm to 2 mm.
Results

- Most samples exhibit **unimodal PSD**, with a mode either at the fine sand fraction (180-220 µm, quartz), or at the very coarse sand fraction (1-2 mm, eolianite rock).
- The 1-2 mm mode dominates the PSD mostly during winter, whereas at summer it is usually absent.
1. The **addition of the 1-2 mm mode** during winter is related to high-energy wave storms that mobilize and transport cliff-derived materials (taluses) along the beach.

2. The **disappearance of the 1-2 mm mode** towards summer is related to sand abrasion by wave and/or by wind action, i.e. breakage of the ~1-2 mm eolianite rocks into ~200 µm quartz grains.
Our findings emphasize the importance of cliff erosion and sand abrasion in controlling the temporal variation in PSD along cliff-dominated beaches.