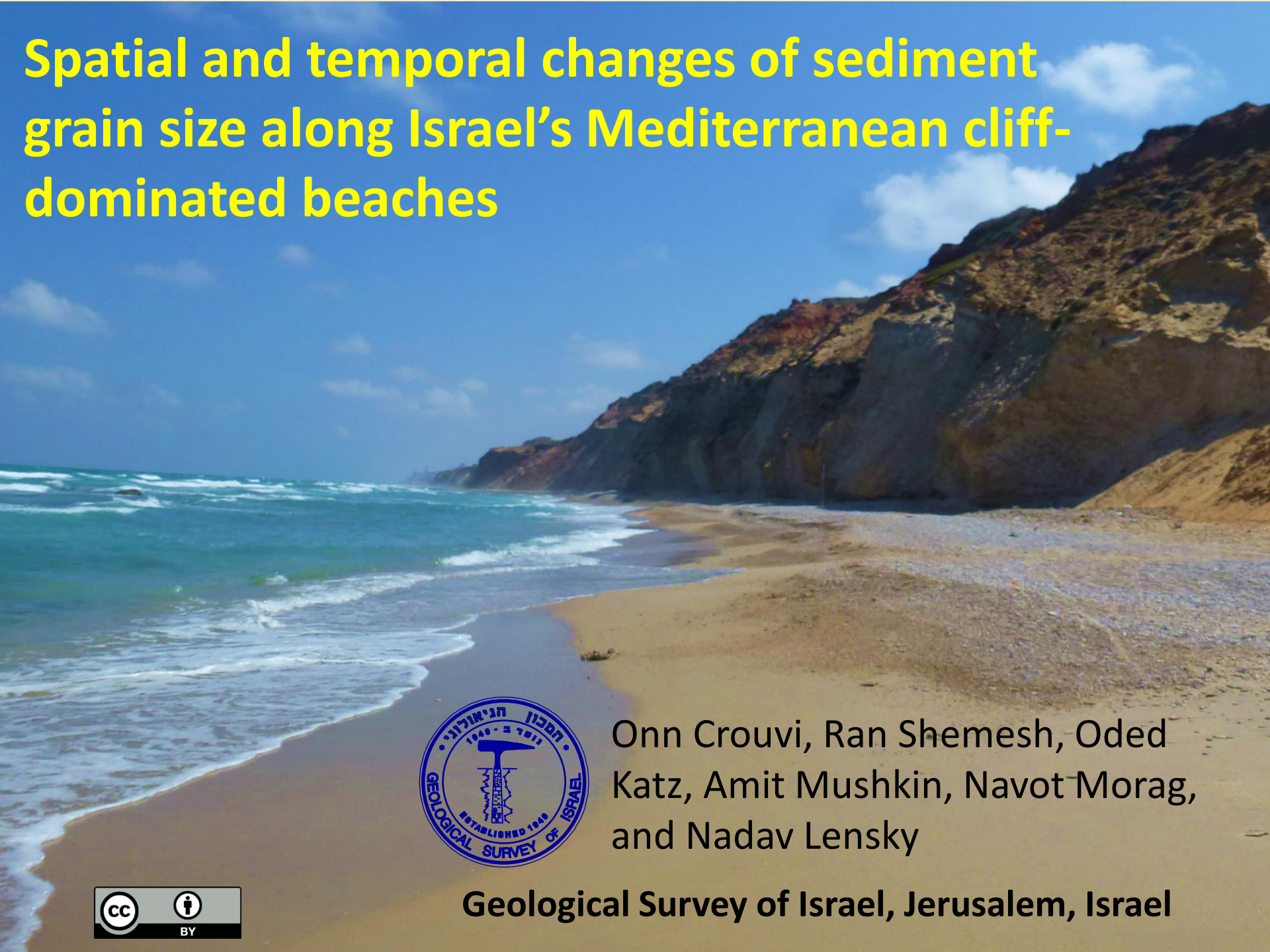
Spatial and temporal changes of sediment grain size along Israel's Mediterranean cliff-dominated beaches



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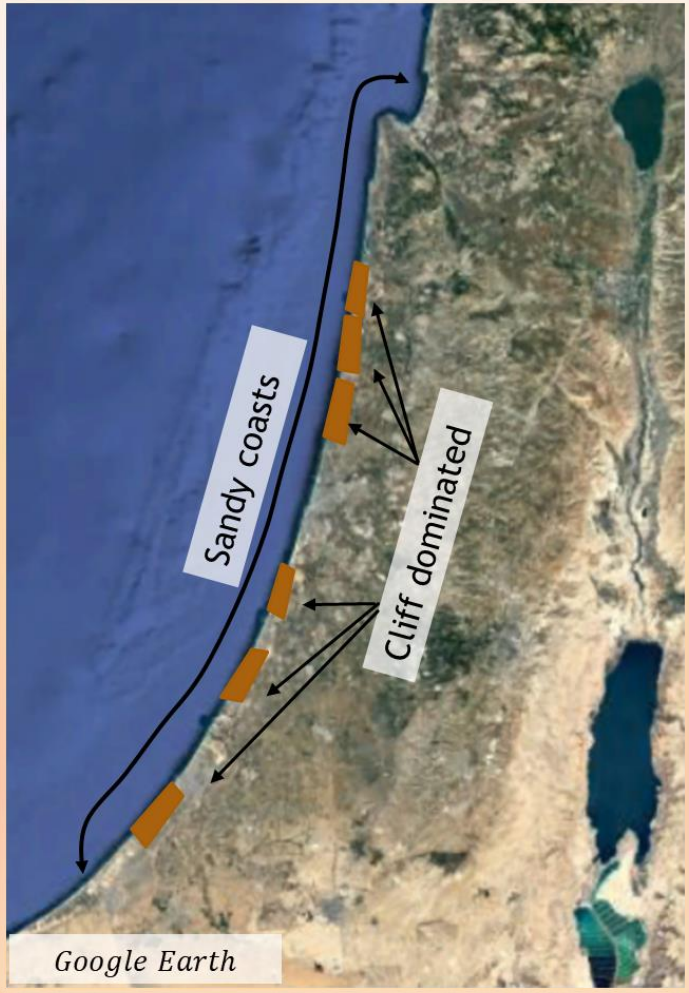
Motivation

- 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:

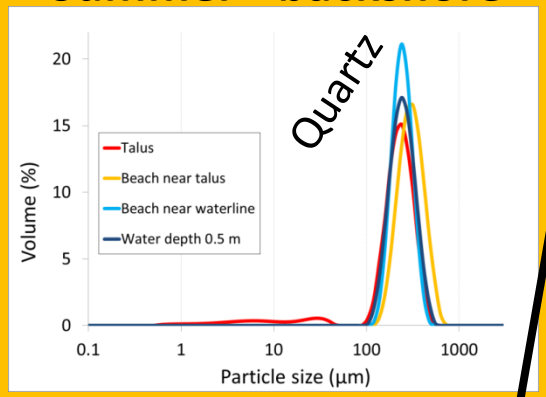
    1) Sieving over the range 0.5 mm to 12.5 mm using 12 sieves,

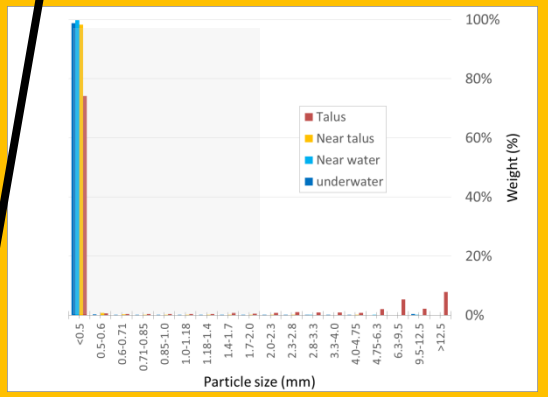
    2) Laser diffraction analysis over the range of 0.02 µm to 2 mm.

Results

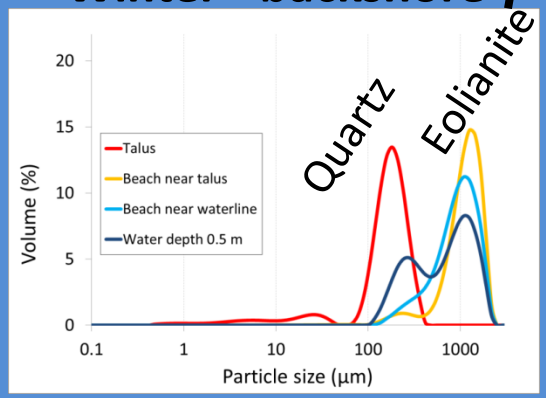
- Most samples exhibit **unimodal PSD**, with a mode either at the fine sand fraction (**180-220 µm,** quartz), or at the very coarse sand fraction (**1-2 mm,** eolianite rock).
- The 1-2 mm mode dominants the PSD mostly during winter, whereas at summer it is usually absent.

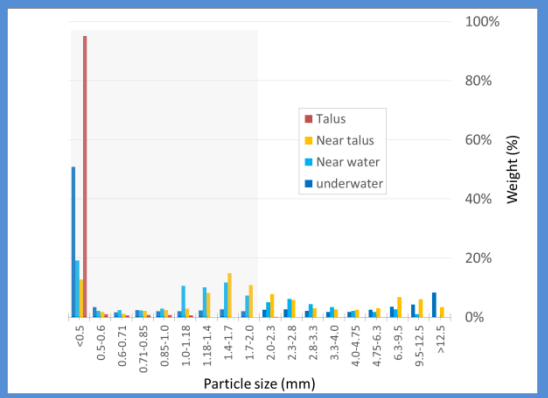
Summer - backshore





Winter - backshore

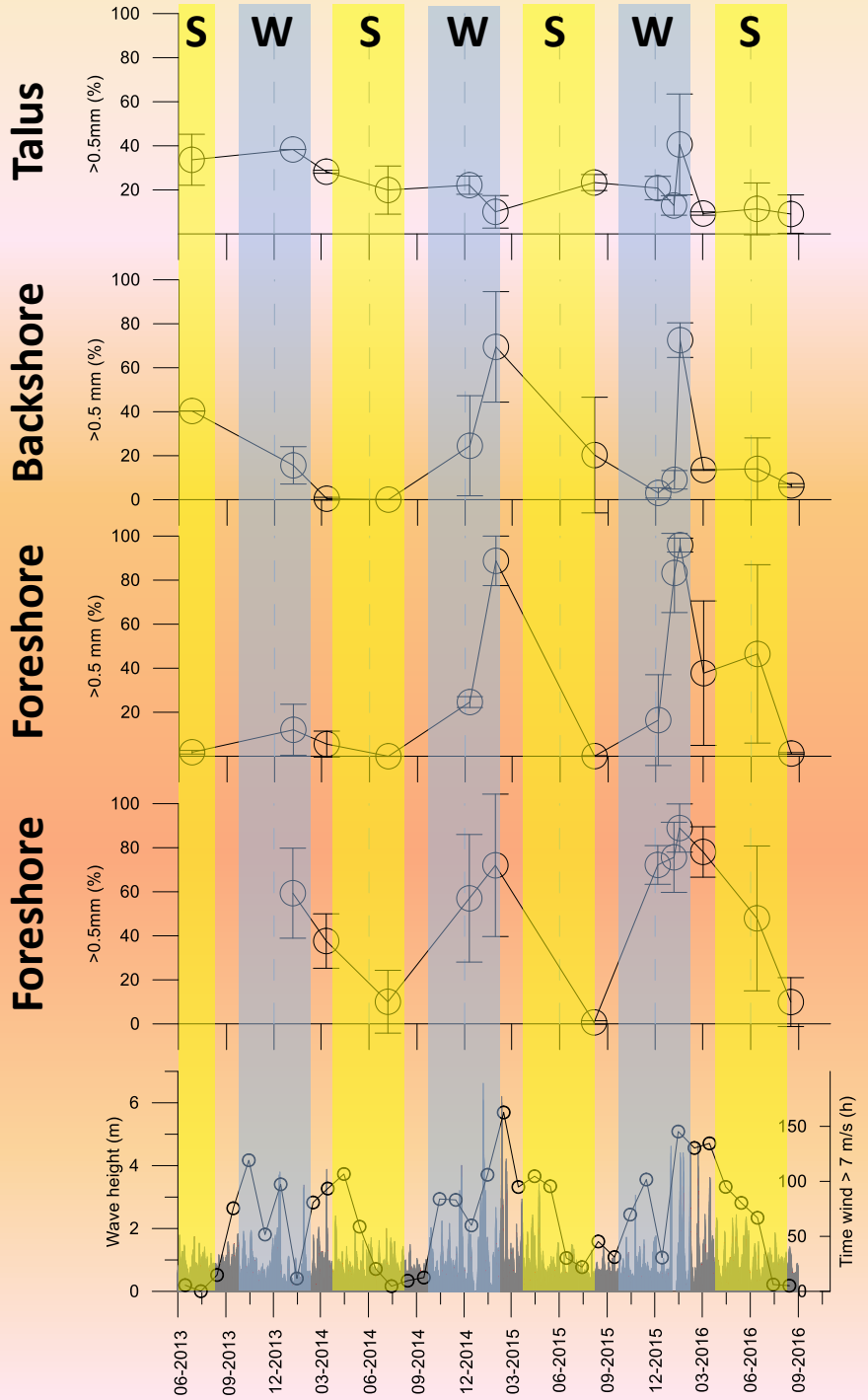




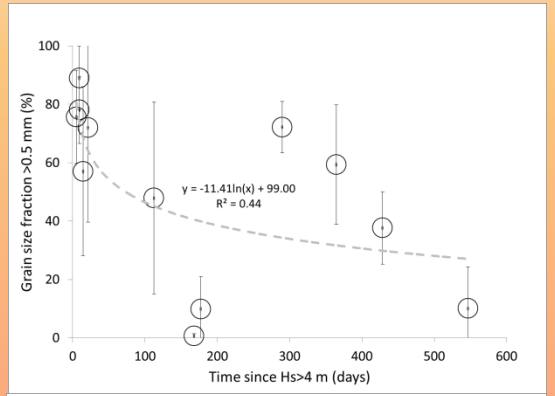
Interpretation of PSD seasonal cycle

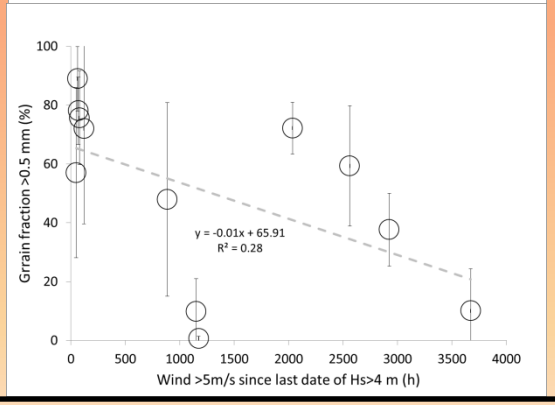
1. The **addition of the 1-2 mm mode** during winter is related to high-energy wave storms that mobilize and transport cliff-derived materials (taluses) along the beach.

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.



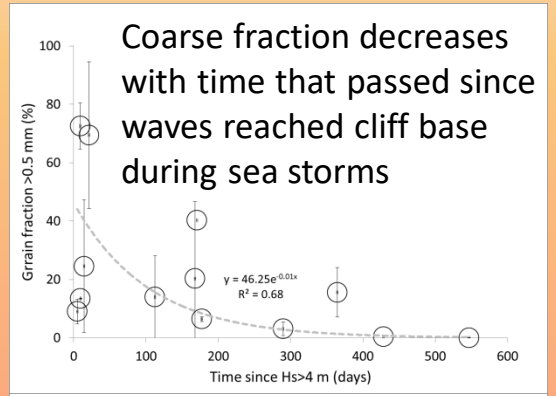
Foreshore



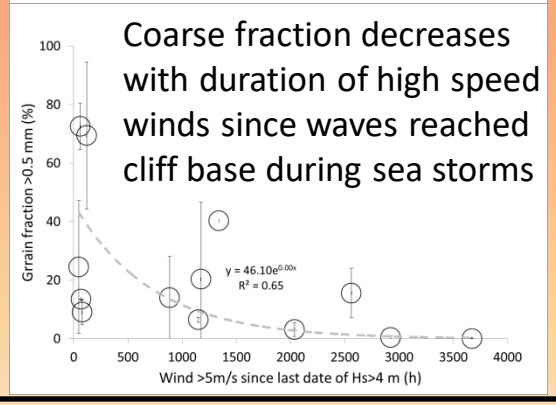


Backshore

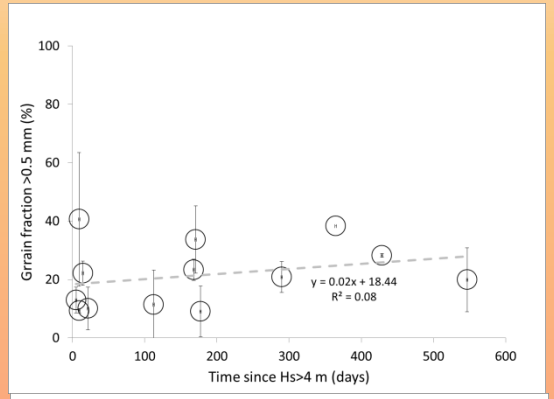
Coarse fraction decreases with time that passed since waves reached cliff base during sea storms

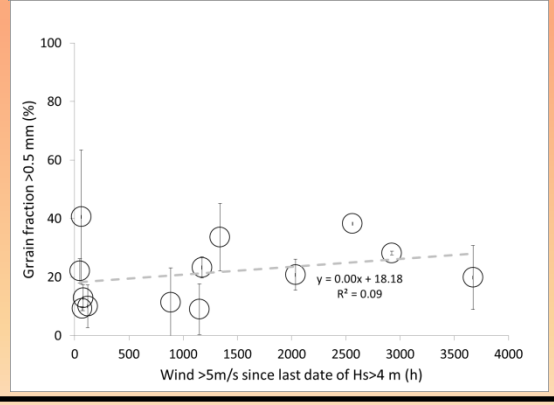


Coarse fraction decreases with duration of high speed winds since waves reached cliff base during sea storms



Talus





Our findings emphasize the importance of cliff erosion and sand abrasion in controlling the temporal variation in PSD along cliff-dominated beaches