Driving mechanisms of coastal cliff retreat in flysch deposits on the eastern Adriatic coast

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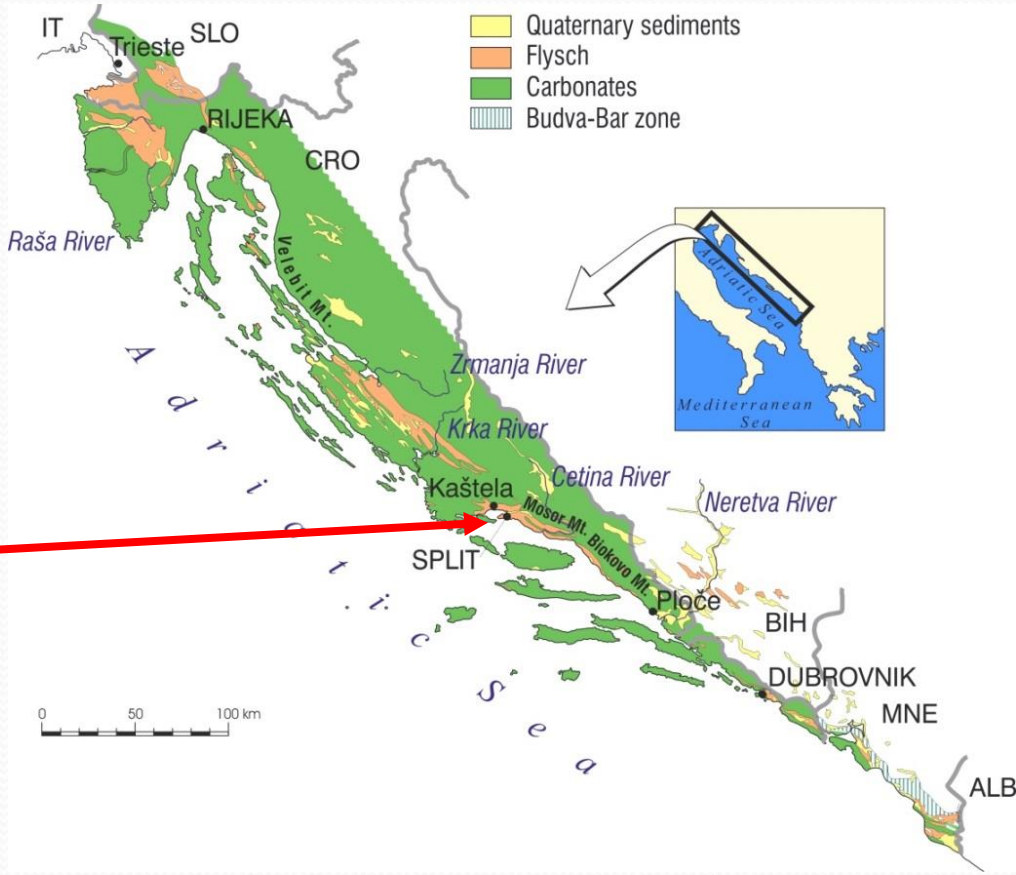
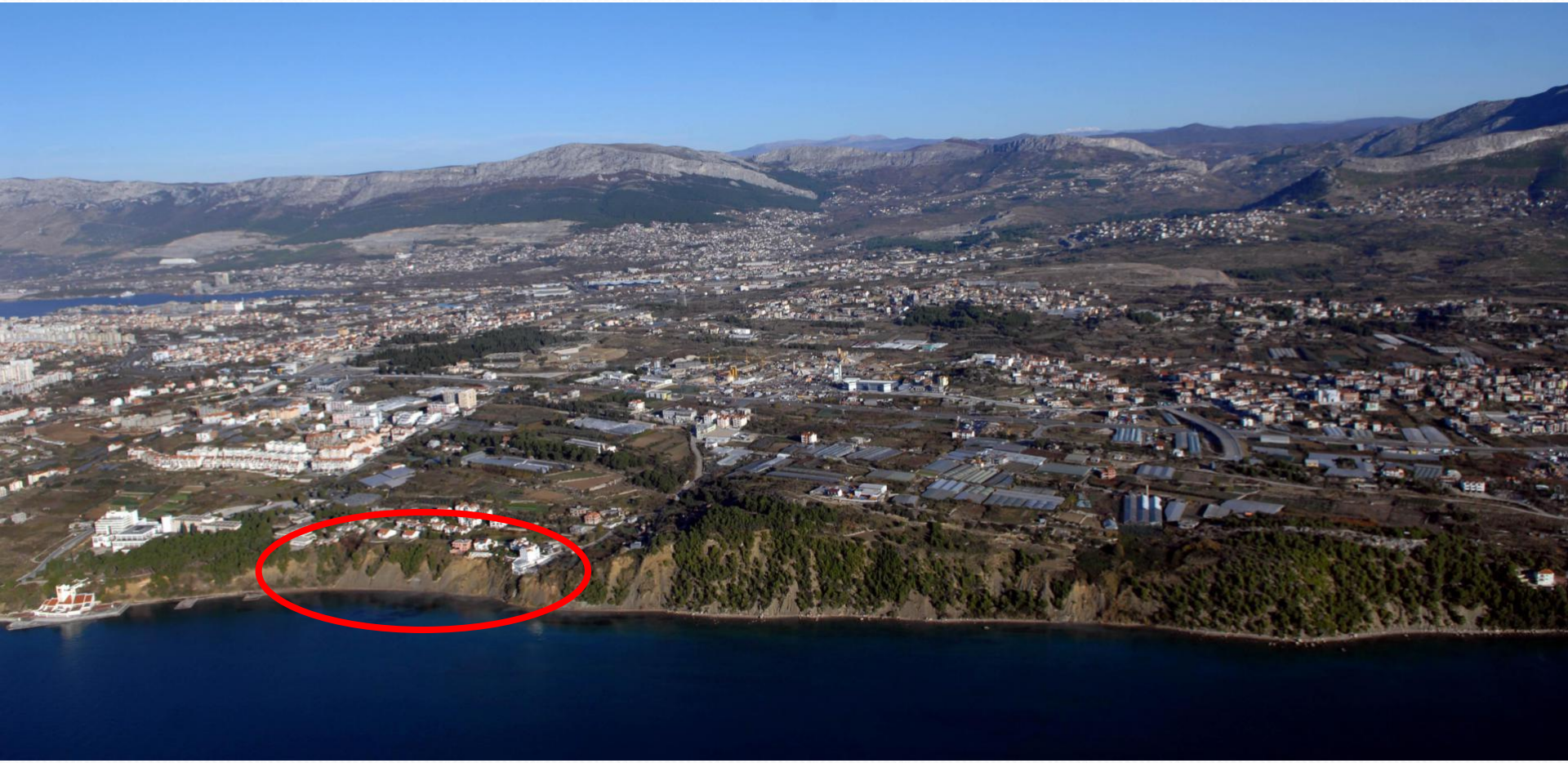
Rationale

- **cliffs in soft rocks** – rare coastal forms in Croatia
- Croatian Adriatic coast is **mostly built in carbonates** (> 90%)
- **flysch*** is less present coastal rock (~6%)
- flysch cliff in Split urban zone
- occupied since 1980-ies
- tourism, urbanization
- cliff stability? cliff erosion?
- ***flysch** → marl - siltstone - sandstone - breccia assemblage



Political and simplified lithological map of the Eastern Adriatic coast (modified after Pikelj & Juračić, 2013)

Study area and aims

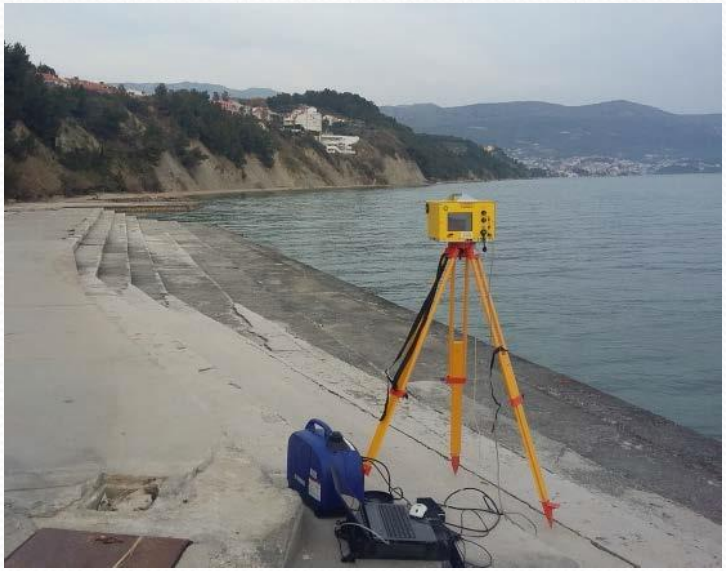


- to recognize cliff erosion driving mechanisms
- to assess the erosional rate

Split cliff developed in flysch (slobodnadalmacija.hr)

Methodology

- cliff-face morphology was scanned 11 times over 6 years (2012-2018) by terestrial laser scanner
- overlapped point clouds
- 4 representative profiles were chosen and compared
- cliff-top, cliff face and shore platform were examined 15 times during various various seasons/weather conditions



Cliff face during scanning process (above) and examination during cold season (below)

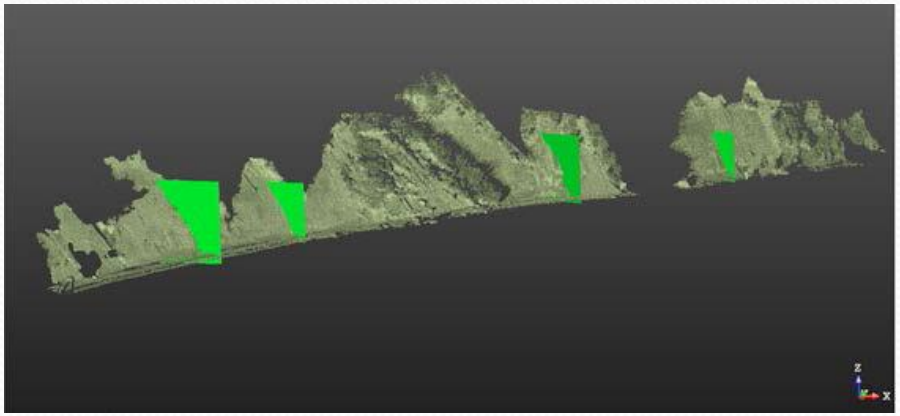
Results

- **cliff retreat rates:** 3-18 cm/y
- **extreme erosion (up to 34 cm/y)** during 2014/2015 and 2017/2018 – higher precipitation

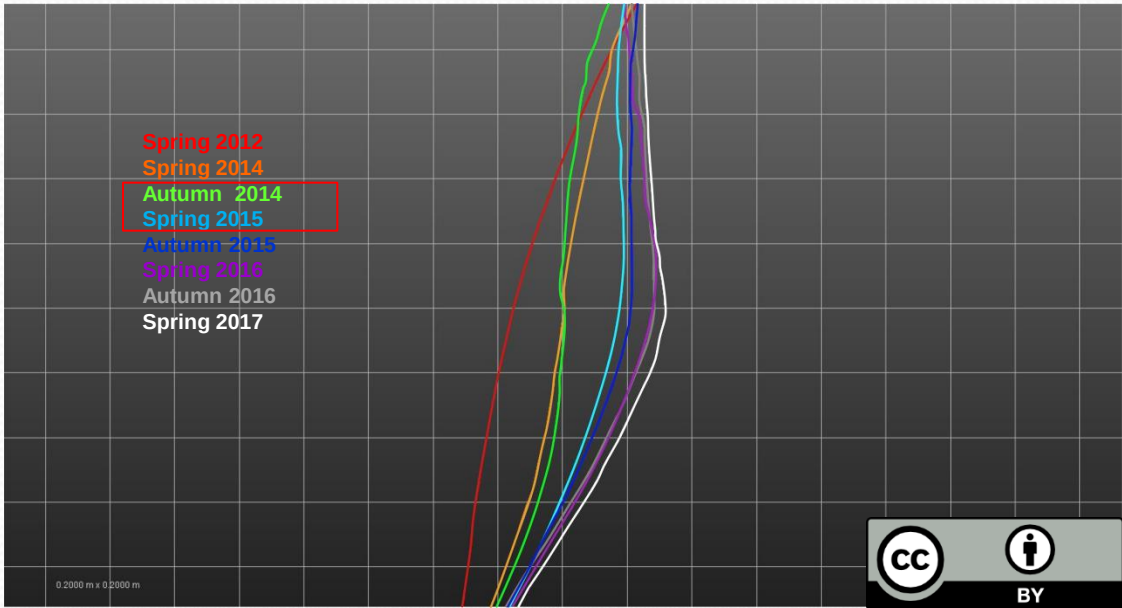
- occurence of landslides 2018 – due to intensive rain

- **water related denudation processes:**
- gullies formation,
- groundwater seepage
- sapping
- slaking

- removal of material by waves



Position of chosen profiles (above) and example of compared profiles on the steepest part of the cliff



Results

- Initial landslide in 2010

- Re-occurence in 2018 – due to intensive rain

Conclusions

- **erosion of soft flysch cliff in the urban zone**

- stronger erosion occurs during cold/wet season - slaking
- denudational processes related to intensive rain and higher precipitation rates
- flysch lithology – the main precondition of the enhanced weathering

- highly needed management of erosion

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