

Earth Surf. Dynam. Discuss., referee comment RC2  
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## Comment on esurf-2022-28

Anne Duperret (Referee)

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Referee comment on "Constraints on long-term cliff retreat and intertidal weathering at weak rock coasts using cosmogenic  $^{10}\text{Be}$ , nearshore topography and numerical modelling" by Jennifer R. Shadrack et al., Earth Surf. Dynam. Discuss., <https://doi.org/10.5194/esurf-2022-28-RC2>, 2022

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### General comments

- Does the paper address relevant scientific questions within the scope of ESurf?
  - Does the paper present novel concepts, ideas, tools, or data?
  - Are substantial conclusions reached?
  - Are the scientific methods and assumptions valid and clearly outlined?
  - Are the results sufficient to support the interpretations and conclusions?
  - Is the description of experiments and calculations sufficiently complete and precise to allow their reproduction by fellow scientists (traceability of results)?
  - Do the authors give proper credit to related work and clearly indicate their own new/original contribution?
  - Does the title clearly reflect the contents of the paper?
  - Does the abstract provide a concise and complete summary?
  - Is the overall presentation well structured and clear?
  - Is the language fluent and precise?
  - Are mathematical formulae, symbols, abbreviations, and units correctly defined and used?
  - Should any parts of the paper (text, formulae, figures, tables) be clarified, reduced, combined, or eliminated?
  - Are the number and quality of references appropriate?
  - Is the amount and quality of supplementary material appropriate?
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- This paper is relevant to the scope of ESurf. Modelling of rocky coast erosion. Interaction between lithosphere, hydrosphere, atmosphere (weathering ).
  - Yes. New Data (new CRE data on two coastal chalk cliffs sites in Sussex and Kent, UK).

The concept and modelling was already published by the same authors in Esurf in 2021. (Shadwick et al, 2021). It is useful to read this previous paper to understand the purpose of this one. Acronyms are not detailed in this paper. This needs, such as MCMC, DSAS, GIA, RPM....

- Yes. Substantial conclusions are given.
- see 2.) Assumptions during the discussion are clearly and precisely described.
- yes. Results are sufficient to support the interpretations and conclusions.
- Experiments and calculations used in the numeric modelling are explained in another paper (Shadrack et al, 2021)
- yes
- yes
- yes
- yes
- yes
- see 2)
- no
- yes.

15. yes. There is link to conduct to the code and data availability and 2 tables S1 and S2 with brut RCE data on Seven Sisters and St Margaret's sites

### **Details comments**

Line 30-195 : Introduction and background on south coast chalk cliffs is very well explained.

Line 80 : Change : Duguet, 2021 by Duguet et al, 2021

Line 94 and in some other places of the text. Shadwick et al, in revision. Are you sure that this paper will be published ? Please, no citation in this paper because it is not possible to read it.

Line 137 : Add : Mortimore et al, 2001

Line 139 : I am not sure that some paleo-sand barriers are located offshore the Sussex coast.

Line 285-290 : Cross-shore topographic profiles cover mainly the aerial part of the shore platform ? Elevation scales extend from zero (equivalent to cliff platform junction) to about -6 m (as shown on Fig. 5).

Table 3 : A data presentation as a function of the cliff distance could be more easier to follow.

Line 402 : Change Fig. 4 by Fig 5

Figure 5 : It appears that samples cover only the intertidal shore platform and they do not reach the main steps at the end of the shore platform except at Hope Gap. Unfortunately,  $^{10}\text{Be}$  content do not seems to be perturbed around this step.

If a proposed explanation is given line 740, please make a link with the  $^{10}\text{Be}$  content.

How the authors explain the very localised high  $^{10}\text{Be}$  contents at St Margarets and Beachy Head ?

Line 412 to 415 and Fig. 5 : Could the higher elevation of the shore platform topography versus the model uncertainty resulting from a thick shingle berm on the beach ? It is a typical accumulation at the top of the shore platform, occulting cosmogenic signal.

Line 440 to 450 : It is not so clear how long-term cliff retreat rate are calculated.

Line 567 to 570 : The Beachy Head inshore low concentrations could not be due to the debris of the large cliff collapse covering a large part of the inshore platform at this site, since 1999 at least?

## **Conclusions**

Line 760-774 : On the UK chalky coast, the comparisons between long-term erosion rates (between 5300 and 6800 years) and historical rates (about 150 years)

Models gives cliff retreat rates ranging between 15 to 55 cm/year at 7000 years BP at Hope Gap, Beachy Head and St Margaret's and 110 cm/year at Seven Sister's at 7000 years BP. Where comes from this discrepancy, taking into account the SLR was about the same on these sites at this period (2.6 mm/year) ?

When compared with historical rates calculated on about 130 years, cliff retreat rates vary between 22-32 cm/year. Are the authors conclude to a recent acceleration of the cliff retreat rates on Sussex chalky coast (at Hope Gap and Beachy Head) but not at Seven Sisters ?

Line 776-785 : It is not surprising to conclude that weathering is more intense on chalk coast than on sandstone rock coast. Authors give an order of magnitude and it is great.

Finally, recent work conducted on chalk rock coast in Normandy, France (Duguet et al, 2021) conclude also to an acceleration of cliff retreat rates during the Holocene, using static model of erosion, based on a detailed submarine bathymetry analysis offshore the studied sites. A continuous submarine step is observed underwater and the  $^{10}\text{Be}$  content of some underwater samples has been analysed.

Some comparison of results could be discussed between chalk cliff retreat rates in Sussex and Normandy. It is roughly the same cliffs! A comparative discussion of results could be very interesting to complete our knowledge of chalk cliff retreat rates on each side of the Channel, through various periods of the past.

The question is : Do you think that a similar work in UK with underwater complementary bathymetry and CRE analysis, may help to better define erosive mechanisms and erosion rates versus SLR rates along chalky coast ? Pre-Holocene periods of inheritance needs also to be better defined along these coast-types, because even if the intertidal shore platform do not indicate re-occupation due to the low content of  $^{10}\text{Be}$ , it could be different off the shore.

I suggest minor revisions for this paper. It is an interesting piece of work. This needs, in my opinion, to be continued with some complementary work on these coasts, but it is another work! I suggest also to precise the conclusions, with less doubt.