

## ***Interactive comment on “Analysis of sea cliff slope stability integrating traditional geomechanical surveys and remote sensing” by S. Martino and P. Mazzanti***

**Anonymous Referee #2**

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General comments:

The paper is quite interesting. Nevertheless, some changes are necessary to reach the standard for a journal like NHESS. In particular, the discussion about remote sensing results must be significantly improved. The specific case of a sea cliff is studied, but analogies and differences between observation of a sea cliff and observation of mountain cliff are not enough discussed. Please see the specific comments.

I have evaluated and annotated the manuscript before a look to the Reviewer 1 comments and the corresponding authors' response. In this report I have omitted all those

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comments that are unnecessary because the authors have already promised changes according to the Reviewer 1 comments. I don't agree with the opinion of reviewer 1 about the language. The paper is easy to read.

List of specific comments:

1) The abstract is too long. Please reduce the abstract length to 60-70% of the present one. Moreover, please taken into account the note 12) below, related to a mistake about a numerical value.

2) 3692/11. The acronym TInSAR is uncommon. Please use GB-InSAR instead. Moreover, since GB-InSAR is very long, I suggest this change: “Terrestrial SAR Interferometry” -> “Ground Based Synthetic Aperture Radar Interferometry (GB-InSAR, later on simply SAR)”. The simplest acronym SAR can therefore be used all along the paper.

3) 3692/13-14. The acronym TIR is uncommon. In particular, infrared thermography (typical acronym: IRT) or thermal imaging are commonly used instead.

4) 3693/6. Please delete the term “non-conventional”. The joint use of SAR and TLS is a standard approach in slope stability-based remote sensing. The TLS-based geomechanical survey is also a standard approach (for example, I use TLS and SAR since 2004, and IRT since 2006). The observed rock cliff is a rock cliff, even if it is a sea cliff (please see the general comments and the specific comments 7, 6 and 22).

5) 3697/2 and all along the paper. There is no universally accepted symbol for the year as a unit of time. Nevertheless, a common abbreviation in international use is “a” (latin annus), and “y” is also commonly used. Therefore, I suggest the use of “a” or “y” instead of “yr”.

6) 3699/15. 45M points cannot be used. Please use 45 million points instead (this is like the alternative use of MW or megawatt, but Mwatt or megaW cannot be used).

7) 3699/16. Please add details about acquisition distance, accuracy, expected distortions due to the relative position of TLS viewpoints and targets. In particular, please

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discuss the effects of constraints on viewpoints related to the observation of a cliff, taking into account the shape and position of the features that should be studied. The important topic of observation of an object from highly constrained viewpoints is already discussed in literature (please add some references). I think that the paper can be improved if an adequate discussion about this fact is added because of peculiarities of a sea cliff. In particular, analogies and differences between observation of a sea cliff and a mountain cliff should be discussed.

8) 3670/14. In some parts of the paper, the term "formation" is used. In other parts, "Fm." is used instead. Please use the same notation. I suggest the definition of "Fm." at the first occurrence of the word "formation" (3696/14) and the use of "Fm" all along the paper. All the acronyms and abbreviations must be defined. The abbreviation "Fm" is undefined in the submitted paper.

9) 3702/8. Please define the acronym SF (it was defined in the abstract, but it must be redefined at the first occurrence in the main text).

10) 3704/14-15. Please change "sen" to "sin" ("sen" is used in Italian only). Please also see note 24), related to Fig. 8.

11) 3704/16. Please change "W= weight . . ." to "W is the weight. . ." and make all the corresponding changes all along the paper (e.g. 3703/14).

12) 3704/26-27. 0.169g? 0.316g? I think that these quantities are estimations whose significant digits are no more than 2 (please note that in the abstract the range 0.16-0.3g is cited instead. 0.169g becomes 0.17g, not 0.16g. Moreover, please write 0.17g-0.3g instead than 0.17-0.3g).

13) 3706/1. Please remove the brackets of "(TIR)"; please also note that TIR should be changed to IRT.

14) 3706/8. Please add the range resolution (only the cross-range one is provided).

15) 3706/12. Please use the above defined acronym (why always different terms?)

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Thermal infrared camera, IR thermographic, . . .).

16) 3706/21. Please better discuss the results. What is the significance of a permanent displacement greater than 1 mm? Translation? Seasonal change? Since the available data do not allow any conclusion about this fact, I think that a comment must be added (I think that this result could be related to seasonal motions. Nevertheless, I don't know the specific case study and leave to the authors the interpretation of the results). Moreover, please explicitly declare that SAR only provides data about the motions along the line of sight (LOS). Please discuss this fact taking into account of the peculiarities of the specific case study (in particular, the uncertainties due to the fact that the dominant motion component could be unaligned to the TLS). These discussions could be placed in the chapter 8. Please also see note 25), about Fig. 9.

17) 3706/15-30. The part about thermal imaging is not enough developed. No references are provided (several articles about IRT in geosciences have been published). Please improve this part, or remove it. Please also see note 26), about Fig. 10.

18) Section 7.2. I think that an article should propose new facts, or new techniques, or new theoretical/numerical approaches, or new methods of data integration/fusion, or new interpretations. In particular, an article is not a research project. Future perspectives can be mentioned, but cannot cover an entire section. Please significantly shorten the Section 7.2 (no more than 10-15 words) and move it at Chapter 2 or Chapter 9.

19) 3709/11. Please define the acronym. I suggest the introduction of such an acronym at 3704/25-30.

20) 3709/3710. Please add a discussion about the use of pseudo-static forces. Is such a simplification always reasonable? Are the corresponding hypotheses satisfied in the specific case study? Please justify! In general, the authors should provide information that make the reader able to discriminate between the cases where such a simplification is reasonable, and the cases where other kinds of analysis should be used instead.

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21) 3709/3710. According to notes 15 and 16, please significantly improve the discussion about SAR. Moreover, please improve the discussion about IRT or remove it.

22) 3711. The term “tsunamis”, which was used in Chapters 1 and 2, disappeared later on. Please add a sentence in the Conclusion (or remove the emphasis on the term. I agree with the use of “tsunamis” in Chapter 1 or Chapter 2. I don’t agree with the emphasis on a term that disappears in the remaining part of the paper. The authors should choose the most representative sentence about tsunamis in these chapters and delete the others).

23) 3726 – Figure caption 2. The term “remote sensing” is not suitable (mistake?). Please use an appropriate term (SAR position?)

24) 3732 – Fig. 8. Please use “sin” instead of “sen”.

25) 3733 – Figure caption 9. Please insert “along the line of sight” (or “along the LOS” if the acronym has been defined in the text) between “displacements” and “projected”.

26) 3734 – Fig. 10. I think that the map in (b) is unable to provide interesting information. In general, I recommend either a complete development of the part related to IRT, or its complete deletion. If the authors choose the first option, Fig. 10 should be changed. In particular, a plot of the time evolution of the temperature difference (or, which is a better solution, a plot of the time evolution of the thermal contrast) in some selected, interesting points should be added. Some examples of such an approach can be found in IRT Literature.

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