Authors' Responses to Reviewer 2 (RC2, anonymous)

Title: **Deadly disasters in Southeastern South America: Flash floods and landslides of February 2022 in Petrópolis, Rio de Janeiro**

Authors: Enner Alcântara *et al.*

Dear Reviewer,

Thank you for your time and effort in reviewing our manuscript and providing us with constructive feedback and comments that will help improve the quality of the manuscript.

Reviewer #2:

The manuscript is an interesting case study, but still presents many deficiencies in its present state. It needs therefore some reworking, as I will try to detail in the following. Further, several comments and minor corrections are included in the attached file. First, in many places the English language is not clear, making it very difficult to follow the reasonings. Further, many sentences need some language reworking.

Authors: The English was revised by a native speaker. All the minor corrections/suggestion along the attached PDF were corrected/implemented in the revised version.

Reviewer #2:

The geological description is quite poor, with only minor essential information provided. Some additional space should be dedicated to let the readers understand the geological setting. This is also important to understand (later on) why the area was affected by flash floods. For instance, it is unclear if flash floods are frequent in the area, or occurred only in this event, and if they are related to topography (high mountain ridges close to the sea), to the presence of karst terrains (where flash floods are quite typical), or to other reasons. This part should be clarified, too.

Authors: We agree. We included the following paragraph in the revised version.

Petropolis is geologically located in the Rio Negro Complex, of paleoproterozoic origin, formed mainly by migmatites and granitoids. This part of Rio de Janeiro state suffered the effects of several regional metamorphic phases, resulting in highly foliated rocks cut by large ductile shear zones. These rocks are severely sectioned by fractures and faults of regional extension, with a strong reflection on topography since the entire region was submitted to tectonic events during the Precambrian period (Penha et al 1981; Fonseca et al 1998; Goncalves et al 1998, IBGE 2018; Rosi et al 2019). The drainage network of the region is strongly influenced by brittle regional structures, which play an essential role in its organization and the relief pattern and modeling. This set of geological characteristics, such as highly foliated and fractured rocks, trigger mass movements, mainly shallow landslides,

and debris flow. Processes of folding, faults reactivation and blocks remobilization resulted in Petropolis's terrain (Gonçalves et al. 1998), which produced braided drainage pattern, with elongated hills which separates valleys. The soil is mostly occupied by clay with low fertility, well drained and high aluminium saturation (Carvalho-Filho et al. 2000).

Gonçalves, L.F.H. Avaliação e Diagnóstico da Distribuição Espacial e Temporal dos Movimentos de Massa com a Expansão da Área Urbana em Petrópolis-RJ. Ph.D. Thesis, Universidade Federal do Rio de Janeiro-UFRJ, Rio de Janeiro, Brazil, 1998.

Carvalho-Filho, A.; Lumbreras, J.F.; Santos, R.D. Os Solos do Estado do Rio de Janeiro; CPRM: Brasília, Brazil, 2000; 36p

Reviewer #2:

As regards the landslides, too, not much is presented about typology and distribution of the phenomena. I understand the focus of the article is not that, but at the same time I believe some additional information must be provided in order to clarify the overall setting and the hazards occurred therein.

Authors: We agree. We included the following paragraph:

According to Avelar et al. (2013) the most frequently landslides in Petrópolis are translational of layers, with varying thickness from 0.5 to 2 m.

Avelar AS, Netto ALC, Lacerda WA, Becker LB, Mendonça MB (2013) Mechanisms of the recent catastrophic landslides in the mountainous range of Rio de Janeiro, Brazil. In: Landslide science and practice. Springer, Berlin Heidelberg, pp 265–270.

Reviewer #2:

When quoting more than one reference, these must be listed in chronological order. This is not followed in the article at many points. Authors are kindly invited to strictly refer to the journal guidelines at this regard, and to follow them accordingly. Also in the reference list there are many problems with the alphabetical order in which the references should be listed. Authors should carefully revise this aspect, strictly following the journal guidelines.

Authors: We revised the references as advised.

Reviewer #2:

Some new references have been suggested at several places in the manuscript. In particular, I encourage Authors to check the paper by Martinotti et al. (2017), since it presents a similar meteorological analysis of the causes at the origin of several natural hazards (Reviewer #2: Page 20, line 450).

Authors: We appreciate the reference suggestion, which was cited in the revised version.

Reviewer #2: Page 22, line 482:

Are flash floods typical of this area?

Authors: Flash floods in Petrópolis occurs mostly after a heavy rainfall associated with poor land uses and unplanned land (Fernandes et al. 2020).

Fernandes, M.C., Heesom, D., Fullen, M.A., Antunes, F.S. Flood dynamics: A geoecological approach using historical cartography and giscience in the city of Petrópolis (Brazil). European Journal of Geography, 11, 73-92. 2020.