Response to: SHORT COMMENT - GIOVANNI MONEGATO

We are grateful for the useful comments provided by Giovanni Monegato. He raises some specific comments to which we answered point by point. In the following, we will repeat the Monegato's statements and our reply to it (in bold font).

Dear Authors of the manuscript "New insights into active tectonics and seismogenic potential of the Italian Southern Alps from vertical geodetic velocities". This article is interesting in providing new geodetic data about deformations in this important sector of the Southern Alps. My remarks are related to the general approach that, here and in many similar works, the chronology and Quaternary stratigraphy are used for deformation rates assessment without using updated information about the landscape and sedimentary evolution of the study area. This happens because no geomorphologists or Quaternary stratigraphers are normally involved in such kind of studies. However, because of the importance of the age assessment is a key for the conclusions of these works, a more careful attention has to be paid. In the present work, many chronological references sound obsolete for the innovative scope of the research.

I listed the specific concerns for this work as follow:

Line 48: the "last deglaciation" is meant after the Last Glacial Maximum I would include the time span (19-11 ka BP according to Clark et al., 2012), for the Alps see also Ivy-Ochs (2015).

We agree with this comment and the text has been changed accordingly, the timing for global estimation of the age of the last deglaciation is set in the time window 19-11 Ka BP following Clark a et al., 2012 and references therein.

Line 52: Spada et al. (2009) is referred to the "last deglaciation" but not to the "present deglaciation" that refers to the ice waning after the Little Ice Age.

Thanks, we removed the reference from the text.

Lines 345-350: the use of old and updated terminology (Mindel-Riss-Würm) from old literature shows how the authors have not updated their knowledge about the Pleistocene stratigraphy of the study area. This was update in a review article by Carton et al. (2009), who provided a long list of radiocarbon data for the Piave catchment.

Even if the terminology is a bit old, a possible update would not provide further information on the considerations derived in this part of the manuscript.

Lines 353-354: the LGM is not at 20-18 ka but at 26-21 ka. I suggest to use Clark et al. (2009) for a global LGM or Monegato et al. (2017) for the Alpine LGM or Rossato et al. (2018) that gave the most updated chronology for the Veneto Prealps and piedmont plain. Also Pellegrini et al. (2005) included a useful chronology for the Belluno and Cesen-Col Visentin sector.

We agree with this comment and the text has been changed accordingly, the timing for LGM at global scale in terms of global ice-sheet and mountain-glacier extent is now set at 26-19 Ka BP following Clark et al., 2009, while the regional alpine LGM is set at 25-23

Ka BP with a second large advance of the ice at 23-21 Ka BP, following Monegato et al. (2017) and reference therein.

Line 366: maybe the Geological and geomorphological data appears thus not fully consistent just because the Authors need to use the proper updated dataset.

We have used all the available datasets of our knowledge.

Lines 368-369: Benedetti et al. (2000) rates for the Montello are affected by the wrong age estimation of the Montebelluna megafan, whose age was already given as pre-LGM by Fontana et al. (2008, 2014). I suggest to use these references for this discussion.

We agree with this comment and the text has been modified taking into account that the Montebelluna megafan can tentatively be considered older than 30,000 BP, thus of pre-LGM age, but probably still within the Upper Pleistocene (125 Ka BP), following Mozzi, 2005 and Fontana et al., 2014.

Lines 394-395: Benedetti et al. (2000) cannot be used for assessing the thickness of the Piave glacier in Belluno, because the work is not about Pleistocene glaciations. Pellegrini et al. (2005) and Carton et al. (2009) have to be considered instead. The Piave glacier was not an ice-sheet, which has to be used for the Alps (i.e., Alpine Ice Sheet).

We agree with this comment and we modified the text accordingly taking into account that during the LGM the Belluno valley hosted the Piave glacier about 800 m thick up to an elevation of about 1150 m

Line 401: this is age is unreliable, the deglaciation in the Piave catchment occur after 18-17 ka, see Pellegrini et al. (2005) and Carton et al. (2009). At 10 ka valley glaciers were already waned. The collapse of the Alpine glaciers was fast but it occurred at 18-17 ka as reported also by Ravazzi et al. (2014) and Rossato and Mozzi (2016).

We understand the point, but we set up this simple model just to estimate a first order of possible uplift rate due to the melting of this glacier. Since the more recent time estimates are older than the age we choose, at most, the true uplift rates would be lower than those estimated by the model, that already predicts modest glacial isostatic uplift rates. In light of your comment we add this sentence in the manuscript: "This is an upper bound estimate since recent studies (Pellegrini et al., 2005; Carton et al., 2009) evaluate the complete disappearance of the glacier occurred likely before 15 ka BP."

References, **in bold those used and to be added in our list**

Benedetti, L., Tapponnier, P., King, G. C., Meyer, B., & Manighetti, I. (2000). Growth folding and active thrusting in the Montello region, Veneto, northern Italy. Journal of Geophysical Research, 105(B1), 739–766.

Carton, A., Bondesan, A., Fontana, A., Meneghel, M., Miola, A., Mozzi, P., Primon, S. & Surian, N. (2009). Geomorphological evolution and sediment transfer in the Piave River

watershed (north-eastern Italy) since the LGM. Géomorphologié: Relief. Process. Environ. 3, 37–58.

Clark, P. U., Dyke, A. S., Shakun, J. D., Carlson, A. E., Clark, J., Wohlfarth, B., Mitrovica, J. X., Hostetler, S. W. & McCabe, A. M. (2009). The Last Glacial Maximum. Science 325, 710–714.

Clark, P.U., Shakun, J.D., Baker, P.A., Bartlein, P.J., Brewer, S., Brook, E., Carlson, A.E., Cheng, H., Kaufman, D.S., Liu, Z., Marchitto, T.M., Mix, A.C., Morrill, C., Otto- Bliesner, B.L., Pahnke, K., Russell, J.M., Whitlock, C., Adkins, J.F., Blois, J.L., Clark, J., Colman, S.M., Curry, W.B., Flower, B.P., He, F., Johnson, T.C., Lynch-Stieglitz, J., Markgraf, V., McManus, J., Mitrovica, J.X., Moreno, P.I. & Williams, J.W. (2012). Global climate evolution during the last deglaciation. Proc. Natl. Acad. Sci. 109 (19), E1134–E1142.

Fontana, A., Mozzi, P., & Bondesan, A. (2008). Alluvial megafans in the Veneto-Friuli Plain: Evidence of aggrading and erosive phases during Late Pleistocene and Holocene. Quaternary International, 189(1), 71–90.

Fontana, A., Mozzi, P., & Marchetti, M. (2014). Alluvial fans and megafans along the southern side of the Alps. Sedimentary Geology, 301, 150–171.

Ivy-Ochs, S. (2015). Glacier variations in the European Alps at the end of the last glaciation. Cuadernos de Investigación Geográfica 41, 295– 315.

Monegato, G., Scardia, G., Hajdas, I., Rizzini, F. & Piccin, A. (2017). The Alpine LGM in the boreal ice-sheets game. Sci. Rep. 7, 2078.

Mozzi, P., 2005. Alluvial plain formation during the Late Quaternary between the southern Alpine margin and the Lagoon of Venice (northern Italy). Geografia Fisica e Dinamica Quaternaria (Suppl. 7), 219–230.

Pellegrini, G.B., Albanese, D., Bertoldi, R. & Surian, N. (2005). La deglaciazione alpina nel Vallone Bellunese, Alpi meridionali orientali. Geografia Fisica e Dinamica Quaternaria. Supplemento 7, 271–280.

Ravazzi, C., Pini, R., Badino, F., De Amicis, M., Londeix, L. & Reimer, P. (2014). The latest LGM culmination of the Garda Glacier (Italian Alps) and the onset of glacial termination. Age of glacial collapse and vegetation chronosequence. Quat. Sci. Rev. 105, 26–47.

Rossato, S. & Mozzi, P. (2016). Inferring LGM sedimentary and climatic changes in the southern Eastern Alps foreland through the analysis of a 14C ages database (Brenta megafan, Italy). Quaternary Science Reviews, 148, 115-127.

Rossato, S., Carraro, A., Monegato, G., Mozzi, P., & Tateo, F. (2018). Glacial dynamics in pre-Alpine narrow valleys during the Last Glacial Maximum inferred by lowland fluvial records (northeast Italy). Earth Surface Dynamics, 6, 809-828.

Best Wishes Giovanni Monegato