Nat. Hazards Earth Syst. Sci. Discuss.,
https://doi.org/10.5194/nhess-2020-84-RC1, 2020

Natural Hazards and Earth System Sciences
Discussions

Interactive comment on "Evolution of surface deformation related to salt extraction-caused sinkholes in Solotvyno (Ukraine) revealed by Sentinel-1 radar interferometry" *by* Eszter Szűcs et al.

Anonymous Referee #1

Received and published: 23 April 2020

General comments: The paper uses InSAR to analyse surface deformation in an area of sinkholes formed due to salt mining in Solotvyno (Ukraine). The major results of the paper are: 1. two velocity maps and time series of LOS displacements, one in the ascending and the other in the descending Sentinel-1 tracks, for the years 2014-2019, with maximum LOS velocities of 5 cm/y. 2. Decomposition of the LOS displacements to vertical and E-W horizontal components. 3. Recognition of linear trends of deformation (no acceleration nor deceleration). The paper is local and mostly technical, showing some interesting results, however, it does not make any attempt to discuss

these results, their implications, or their contribution to our general understanding of sinkhole-related processes.

Specific comments 1. The geographical and geological background is far too long and detailed and is mostly irrelevant to the scope of the paper. The background sentences in the introduction are sufficient to understand the setting. 2. Materials and methods: lines 153-169 and 190-199 are introductory and background descriptions and should not appear in this section. Only lines 170-187 and 200-229 are relevant and should be combined with lines 53-62 to one section. 3. The authors present ascending and descending data and claim (line 254) that the "average (descending) deformation rate shows similar pattern as for the ascending pass. This suggests that the deformation consists mostly of vertical component.". This declaration has not been proved in any way, for example, by a graph comparing all ascending vs descending LOS velocities. Furthermore, similar patterns are not enough to prove that claim, the values should also be close (albeit moderated by the incidence angle). This should be shown. 4. The equation relating LOS to vertical and horizontal components should also include the heading angle between the track and the north. 5. The vertical velocities are about twice in magnitude (max $\sim$40 mm/y) compared to the horizontal velocities (max $\sim$20 mm/y). This means that deformation does not consist mostly of vertical deformation and that the horizontal movements should be considered and explained. Furthermore, Fig. 14 and lines 291-292 show that "The northern part of the deforming area clearly shows a westward displacement, whereas its southern part shows displacement towards the east". This means horizontal movements away from the subsidence centre (the sinkhole), which is counterintuitive, and should be explained and/or discussed. 6. Figures 10 shows a cross sections over an area that is highly incoherent, while the lines are continuous from side to side. The authors should explain how this section was made and make it clear where are the true points and where are the lines based on interpolation. 7. Line 183-184: "separation of total line-of-sight (LOS) deformation into east-west and vertical components which can help to understand the mechanism of sinkhole collapse and the progress of underground processes". The authors do not

show anywhere later in the paper any insight or discussion regarding the mechanism of sinkhole collapse and progress of underground processes. So what is the motivation for this separation to vertical and horizontal components? 8. Lines 257-259: can the authors please explain the large difference between the ascending and descending velocities in the “landslide” area? 9. Lines 261-264: The description of the two sides of the bowl is poorly supported by the figure. 10. Lines 305-306: “guaranties to maintain coherence” – coherence is definitely not maintained in the central area.

Technical corrections 1. The paper requires Language and grammar editing. Lots of sentences lack commas (,) to separate between parts of the sentence. Citation of previous studies should not be in brackets when they are the subject of the sentence. For example, line 143: (Gaidin, 2008) has already drew attention to. . ..., should be: Gaidin (2008) has already. . ... This type of error appears many times in the paper. 2. Line 115: change horizontal extension to areal extent 3. Line 256: what is MT-InSAR? Fig. 7 is like 6 but descending

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