

# Subsidence activity maps derived from DInSAR data: Orihuela case study

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First at all we will like to thanks referee # 1 for accepting to review our paper and for his valuable comments. We have performed a detailed review of the article according to reviewer's comments. In this document, referee's comments are in italic bold font whereas authors' answers are in blue font.

***Comment 1- Page 5368, line 11: I suppose PS means Permanent Scatterers, but here a complete spelling is needed since it is the first appearance.***

Answer 1- The whole paper has been reorganized and line 11 has been eliminated. Now the first appearance of Persistent Scatterer, with a complete spelling, is in paragraph 3 in which the products of the SPN technique are described.

***Comment 2- Page 5368, line 18: what dose “normalized” mean? Do you mean that the LOS displacements have been projected along the vertical direction?***

Answer 2- In our paper “normalized” is not related with the projection of displacements along LOS. Normalization is here related with the transformation of the histograms of the different PS populations. In order to perform the Conditional Sequential Gaussian Simulation (SGS) we needed to transform the histogram of each population of PS into a Gaussian histogram or normalized histogram. This transformation was performed by the software SGeMS which is the same software used to perform the SGS.

In order to clarify the meaning of the term “normalized”, in the revised version of the paper a new sentence explaining this previous step has been introduced.

***Comment 3- Page 5369, line2: I am a little bit confused by “unsampled pixel (PS)”. Did you use two sets of known points (PS) to extend the information to unmeasured location (unsampled pixel), is it right? If I am correct they cannot coincide. Please clarify.***

Answer 3- In this case the word “unsample” refers to a portion of land without PS. The two periods were analysed separately and to extend the information to unmeasured locations the interpolation was performed. To avoid confusion this sentence has been rewritten.

***Comment 4- Page 5371, line 6: Specify acquisition geometries***

Answer 4- A new table (Table 2) specifying the main characteristic of the processed data stacks has been added.

***Comment 5- Page 5371, line 20: Many PS points show positive velocities: within the basin it means ground uplift (recharge), but there are some PS points with positive velocities also along the southern mountain range. How the authors explain this?***

Answer 5- PSs showing positive cumulative displacement are located in the southern west boundary of the processed area, outside the area of interest and within the mountain range. This result is probably due to a processing error typical related with the boundaries of the processed crop from the original images.

***Comment 6- Page 5372, line 7: I would suggest the authors to briefly describe (without going into detail) how the R software employed in the spatial analysis works to distinguish different components.***

Answer 6- Next new sentence, explaining the used method and how it works, has been included in the text: “The probability of every PS to belong to the first or second component was computed through the Expectation-Maximization (EM) Algorithm for Mixtures of Univariate Normal function from the mixtools R package (Benaglia et al., 2009). This is an iterative process implemented in R software (R Development Core Team, 2010) which allows distinguishing the presence of sub-populations that follow a Gaussian distribution (components) within a global population.”

***Comment 7- Page 5375, line 8: I couldn't understand if the subsidence activity maps have been generated interpolating the LOS velocity or its projected vertical component. If LOS velocity has been used, why not considering the elevation angle of ERS and ENVISAT satellites? I agree velocity doesn't change very much (the increment variation may be around 10%), but since it is easy to do, it may lead to more representative calculation of differential settlements and angular distortions***

Answer 7- The variogram analysis and the interpolation (Sequential Gaussian Simulation) were performed with the cumulated displacement values along the LOS. Therefore the subsidence activity maps represent the cumulated displacement along the LOS and the differential settlements and angular distortions, calculated for each building, are derived from the subsidence activity maps and, therefore, they are calculated along the LOS. In order to enable a direct comparison between the limits set by the literature for the SLS (computed from vertical displacements) and the parameters computed from the subsidence activity maps (along LOS), the allowable values differential settlements and angular distortions have been projected along the LOS. The explanation of these transformations has been introduced in the text and the new results explained in the results section.

***Comment 8- Page 5379, line 21: paragraph 8 is currently an exhaustive summary of the performed work and of the obtained results. Discussions are weak. I would suggest to add some more words about potentials, limits, advantages, drawbacks and usefulness of the proposed approach.***

Answers 8- In the new version of the paper, discussion and conclusions have been divided into different sections. According to the reviewer's comments, the main potentials, limits, advantages, drawbacks and usefulness of the proposed approach can be found in section 5.1 and 5.2 and also they have been summarized in section 6.