Nat. Hazards Earth Syst. Sci. Discuss., 1, C814–C817, 2013
www.nat-hazards-earth-syst-sci-discuss.net/1/C814/2013/

Natural Hazards and Earth System Sciences
Discussions

Interactive comment on "Advanced interpretation of land subsidence by validating multi-interferometric SAR data: the case study of the Anthemountas basin (northern Greece)" *by* F. Raspini et al.

F. Raspini et al.

federico.raspini@unifi.it

Received and published: 12 August 2013

The Authors wish to thank Dr. ATHANASSIOS GANAS for his interest to the paper, for his revision and for the useful suggestions. Our replies to the four specific comments are:

1) Figure 1 has been corrected according to the reviewer's suggestion. A new version of figure 1 will be included in the reviewed version of the manuscript. Moreover, as mentioned by both referees the results referring to the activity of the NW-SE striking

fault (Thermi fault in the manuscript), bordering the northern part of the Anthemountas plain, are not well founded. Both referees report that there is not a clear correspondence between the ground deformations and the fault. As mentioned in the manuscript "Density and distribution of PS targets offer a synoptic view of the linear deformation patter along the NE side of the Anthemountas basin, indicating that a possible tectonic component might be included at this deformation". So, we also have our doubts about the potential activity of this fault. As a result, following the instructions of the referees we decided to remove all references to the activity of the Thermi fault and we are planning to collect more data and evidences to support this interpretation and in order to better found this result in a future publication.

2) Suggested references were added at the revised version of the manuscript.

3) The reference point used during the processing of this dataset of ERS images was chosen in the southeast urban fabric of downtown Thessaloniki. More precisely, it seems to correspond to the 30x15 m roof of a residential building in the district of Nea Krini, south of Kalamaria, 500m away from the coastline. According to the Thessaloniki sheet of the geological Map of Greece (Scale 1:50.000), provided by IGME, the reference point is located on rigid over consolidated formations of Upper Miocene-Lower Pliocene age, mainly compact sandstones and conglomerates and marls horizons. A proper selection of the reference point is of fundamental importance within the PSI processing chain: besides the phase coherence throughout the dataset, the selected point has to be chosen within area unaffected by ground motions in order to avoid the retrieval of an unreal pattern of deformation. Concluding, the associated geology (rock to hard soil formations) can be safely considered as stable, unable to be affected by local scale deformation processes related to hydrogeological factors.

4) Accurate identification of the radar target by using medium resolution SAR sensors (i.e., ERS1/2 satellite with a range and azimuth resolution of 25m and 5m, respectively) is often a challenge. Due to this low spatial resolution and to the fair georeferencing accuracy (ca. +/-10 m in both X and Y direction), it is often difficult not only to iden-

tify exactly what object is acting as the “persistent scatterer”, but, even if the scattering object is identified, it is then difficult to detect which part of the object is actually scattering. This happens because a PS, which corresponds to resolution element containing a single dominant scatterer, is usually smaller than the pixel itself. Moreover, it is worth to notice that some pixels behave like PS on the runways, while their neighbors, which are probably physically similar, do not. This may be related to: - Change of reflectivity in the asphalt of the runway area following maintenance and/or repairs, since several fractures have been noted (and fixed) along the runaway areas by the management of the airport. - Threshold value used during selection of PS candidates.

Identify the nature of the PS surfaces inside the Macedonia airport is, as a matter of fact, quite difficult. The text at page 1233 means that, when dealing with linear infrastructures, the successful application of PSI technique depends on many factors: besides the radar look direction and amount of data acquisitions available, we have to consider the orientation of the feature itself. Linear features with south-north orientation are imaged better in the ERS1/2 SAR images, because their orientation is relatively parallel with the azimuth direction, whose resolution is finer than the range (perpendicular to the flight) one.

Here our replies to the specific technical corrections: 1)Yellow curves and labels have been replaced with red color. 2)Required information has been added. 3)The selection of the correct range of variation of the velocity field of radar targets can be facilitated by the analysis of histogram, showing the frequency distribution of values of deformation recorded in the dataset of interest. Analysis of the variability of recorded deformation values can support the identification of proper class intervals. The extremes of the scale of color should not be excessively large (compared to the distribution of the values of deformation), to prevent that most of the points fall within the central class. On the other hand, the extremes of the scale should not be excessively narrow. Indeed, while the reduction of the extremes of the scale facilitates the identification of more detailed spatial variation of the phenomenon, we have to keep in mind that we

cannot create intervals smaller than the sensitivity of the used technique. Generally, the deformation rates that delimit the “central” class corresponding to the points to be considered stable, are chosen equal to $\pm$ 1.5 or $\pm$ 2 mm/year. The amplitude of the other classes depends on the frequency distribution of the dataset, showed by the histogram. For this reason we prefer to maintain the current sequence of appearance of the figures in the paper, with Figure 6 showing the spatial distribution of PS points classified according the subdivision in classes of figure 5, employing a semaphoric color code (e.g. green, yellow, red).

Interactive comment on Nat. Hazards Earth Syst. Sci. Discuss., 1, 1213, 2013.