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Quantitative comparison of methods and sensors for monitoring land subsidence based on SAR interferometric stacking

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Interferometric stacking techniques emerged in the last decade as methods to obtain very precise measurements of terrain displacements, and in particular subsidence phenomena. In particular, the so-called Persistent Scatterers (Ferretti et al. 2001) and Small BASeline (Berardino et al. 2002) methods can be considered as the two most representative stacking approaches. In both cases, the exploitation of 20 or more satellite Synthetic Aperture Radar (SAR) acquisitions obtained from the same satellite sensor with similar geometries on the interest area allows to measure displacements with an accuracy in the order of few mm / year, and to derive the full location history of good pixels with an accuracy of 1cm or better for every available date.

A main difference between the two approaches is the type of objects and land cover that are favoured in the analysis: the PS technique focuses on so-called Point Targets, i.e. objects possibly of small size and with a very well characterized geometry like corner reflectors (e.g. buildings, rocks) and with a high temporal stability of the backscattered signal; the SBAS technique vice-versa is concentrating the analysis on so-called distributed targets, like open fields and not very geometrically characterized objects.

The PS approach is then not making any assumption on spatial correlation of the displacement to be measured, but more on its linearity; the SBAS approach vice-versa is more robust in case of spatially correlated displacements, and allows in this case to monitor larger displacement rates. This paper is performing an extensive analysis and comparison of the results that have been obtained with the two approaches in a same geographical area in Japan, characterized by subsidence due to water and natural gas extraction.

The analysis is based on data acquired from the ALOS PALSAR (L-band), ENVISAT ASAR (C-band) and COSMO-Skymed (X-band) satellite instruments, and the validation of the results is based on GPS and leveling measurements. The analysis allows to draw conclusions on pros and cons of the different approaches and sensors for deriving the displacement measures for monitoring subsidence phenomena. The feasibility of exploiting the same approach in different geographical areas is also discussed. Finally, comments are given on the outcomes of this analysis in view of the exploitation of the data to be available from the forthcoming Sentinel-1 (C-Band) and ALOS-2 (L-Band) missions.

REFERENCES

Ferretti, A., Prati, C., & Rocca, F. 2001: Permanent scatterers in SAR interferometry, IEEE Transactions on Geoscience and Remote Sensing, 39, 8-20.

Berardino, P., Fornaro, G., Lanari, R., & Sansosti, E. 2002: A new algorithm for surface deformation monitoring based on small baseline differential SAR interferograms, , IEEE Transactions on Geoscience and Remote Sensing, 40, 2375- 2383.

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