PanGeo FP7 Project: Ground motion study for Salzburg based on Radar SAR PSI (Persistent Scatterer Interferometry) – Analysis and Interpretation

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Introduction

The ground motion study for the federal province of Salzburg and surrounding was carried out during the course of the PanGeo FP7 European Union project which was primarily based on the analysis of satellite Persistent Scatterers (PS) ground motion data for 1992–2010, derived by ALTAMIRA by processing ERS-1/2 SAR and ENVISAT ASAR imagery with the SPN software.

In this study the combined use of geological and other geospatial layers available at the Geological Survey of Austria (GBA), together with PS dataset allow for the identification of homogeneous polygons or "Ground Stability Layers" (GSL) which corresponded to a certain type of geohazard.

The area covered by the GSL corresponds to an administrative area of roughly 1,070 km^2 and the geohazards observed through the PS data analysis included both natural processes (shrink-swell clays) and anthropogenic instability like buildings built on filled or made ground.

Data and methods

On the whole, the PS dataset used consisted in a first PS campaign based on the processing of 58 ERS SAR images with date range of analysis between 10/05/1992 and 13/12/2000 (30,000 points measured) and of a second campaign based on the processing of 62 ENVISAT and ERS SAR images with date range of analysis between 24/10/2001 and 29/08/2007 (4,000 points measured).

A series of geologic datasets composed primarily of in-house recent vector geological maps together with information concerning mass movements stored into the in-house geo-database GEORIOS (Koçiu et al., 2007) and point data information concerning gravitational mass movements and boreholes gathered into the SAGIS web GIS application were adopted for the analysis.

The decision to consider as a threshold for stable areas a PSI range between -2.1 mmy$_{-1}$ and 2.1 mmy$_{-1}$ is due to the results of the Bundesamt für Eich- und Vermessungswesen (BEV) levelling campaigns undertaken between 1968 and 1990 showing for the studied area an average difference in height varying between -0.3 and -0.5 mmy$_{-1}$ (Höggerl, 2001).

Results

The most widespread phenomenon recognised to be potentially responsible for shallow compaction is connected to waterlogging which cover an area of 25.53 km^2. A lithology very prone to shrink swell clay instead is the lake clay (Salzburger Seeton) which has an extension of 14.3 km^2.

The PSI observed geohazards cover an area of 0.822 km^2 and among them natural process leading to peat oxidation, due to the presence of moor sediment, are dominant. Furthermore, episodes of subsidence related to the shrinking and swelling of superficial and buried lake clay were mapped. More in detail in the municipality of Seekirchen am Wallersee the phenomenon which affected the local buildings, related to the lake clay sediment that undergoes a process of shrink in summer and swelling in winter (Text-Fig. 1), is very well known since 20 years as the "schiefen Häuser" in Seekirchen (*http://web.utanet.at/tothladi/daten/21.htm*).

Finally, sporadic anthropogenic ground instability due to made ground consolidation were also observed. Another task carried out was the collection of ground truth data as validations proof of evidence of the reliability of the PS method. The validation was made directly in the field where it was possible to observe several signs of instabilities like cracks in buildings, found as well as in fences and pavements, rolling roads, residential houses facade provided with prisms for precision monitoring and tilted geodesic pole installed on the ground. The one landslide and the two soil creep observed from PSI in the area investigated were also validated in the field (Vecchiotti & Koçiu, 2013).

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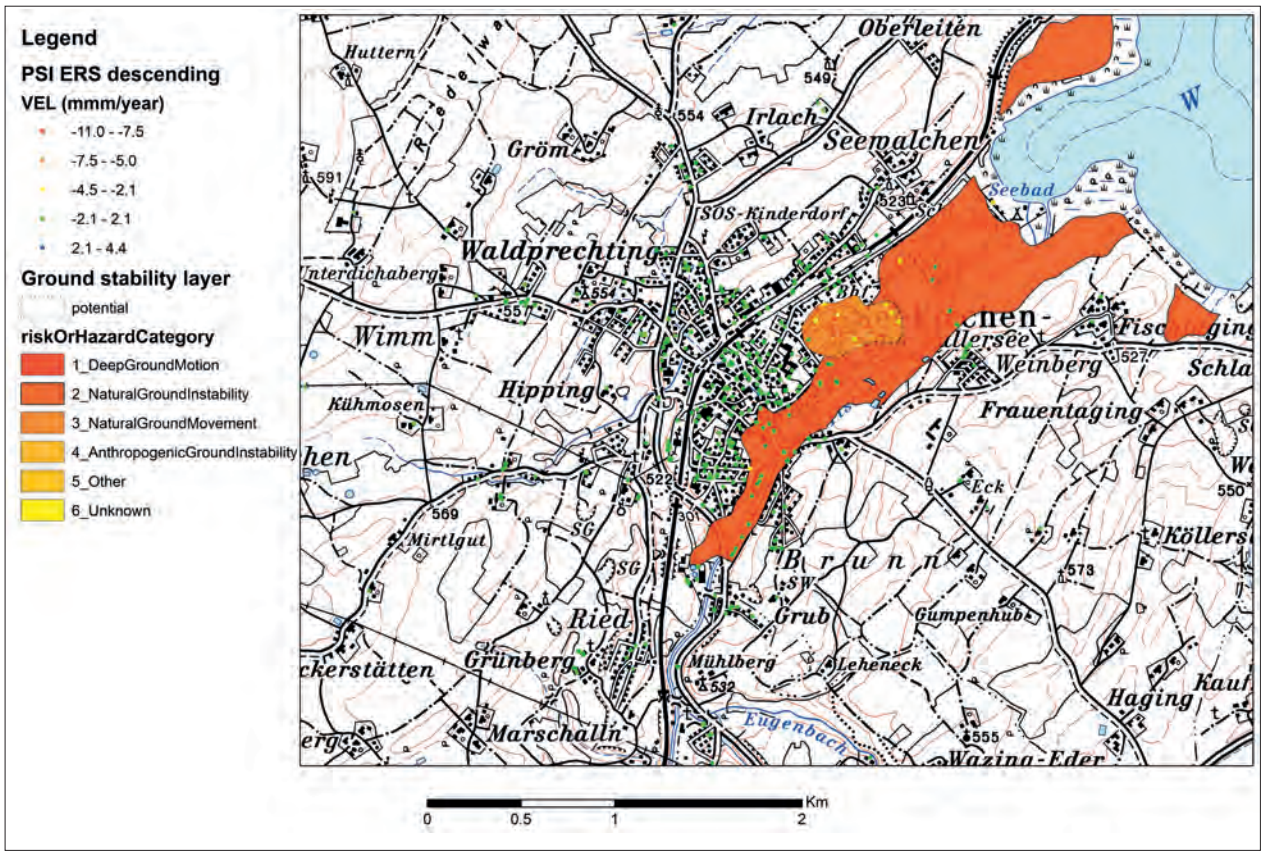

Text-Fig. 1.
PanGeo Ground Stability layer overlaid to PSI ERS ascending velocity map over Seekirchen am Wallersee, Salzburg.

Those results are published on the website of the PanGeo project (www.pangeoproject.eu) where the report for the province of Salzburg can be downloaded together with the Ground Stability layer (as a shape file). Furthermore, this GLS layer which respects the European geo-information INSPIRE conformity compliances, published under the OneGeology portal (*http://portal.onegeology.org*), can be viewed and imported as a web-service on a local GIS software.

References

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