PanGeo project and the future exploitation of the ESA Radar SAR archive in Austria

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1. What is PanGeo?

PanGeo is a collaborative project of the EC’s Seventh Framework Program aimed at mapping and cataloguing a vast GIS space natural and anthropogenic geo-hazard in Europe. The involvement of European geospatial survey, ESA qualified PSI (Permanent Scatterer Interferometry) providers, together with the geospatial software and GIS “Urban Atlas”, (in house state of the art contribution on hazard mapping and non-uniform environments, Salzburg (fig. 1) and Vienna are only two out of 52 sites investigated in PANAGEO. The Pangeo software allows to perform the realization of the ground stabilisation level. By combining such a layer with a hypertext, it will be possible to visualise natural and anthropogenic instabilities on the GIS PanGeo portal (fig. 2). This portal is meant to be a main reference for public authorities who deal with risk management and assessment.

2. The use of the ESA radar archive in Austria

The “Austrian landslide catalogue assessment through the use of radar interferometry application” is the title of the project proposed by the GBA which has been approved by the ESA in April 2012. The aim of the project is to improve the GEORIOS landslide cadaster of certain regions of Austria using Differential InSAR technique processing ERS and Envisat images provided free of charge from the ESA.

The cost effective strategy to exploit the ESA Radar SAR archive in Austria is based on the fact that in mountainous areas major processing ERS and Envisat images provided free of charge from the ESA.

Fig. 1: PanGeo project overview

3. Methods overview

By reviewing historical rainfall, snow, flood and landslide events it's possible to apply a kind of pre-seismic and post-seismic approach to the so-called “pre-triggering and post-triggering” method (fig. 2).

A PSI predictability model (fig. 5) was tested successfully on the PSI data delivered for PANAGEO. The ascending orbit gives the higher probability to find motion movements mapped as very slow on GEORIOS. Around 500 features with faster > 10 mm/year are exceptions to be detected in motion by using simple two pass DINSAR method. These two passes were compared with ENVISAT PSI data showing good coherence for mountainous areas (91%). The phase unwrapping in goes to be tested with SNAPHU and MATLAB algorithms. The future step in the analysis is to use GMTSAR software and perform the A-DINSAR focused on 2 sample sites.

4. Data availability

The data available (fig. 3) for PanGeo were:
- Various geoprocesses with 30,000 and 1.200,000 polygons;
- Various digital elevation models (ASTER DEM and barear den DAVI DEM);
- Urban Atlas (land cover map for cities > 100,000 inhabitants).

5. Software processing

The PSI predictability model (fig. 5) was tested successfully on the PSI data delivered for PANAGEO. The ascending orbit gives the higher probability to find mass movements mapped as very slow on GEORIOS. Around 500 features with faster > 10 mm/year are exceptions to be detected in motion by using simple two pass DINSAR method. These two passes were compared with ENVISAT PSI data showing good coherence for mountainous areas (91%). The phase unwrapping in goes to be tested with SNAPHU and MATLAB algorithms. The future step in the analysis is to use GMTSAR software and perform the A-DINSAR focused on 2 sample sites.

6. Preliminary results and their validation

After having visualised PSI data, geo hinted data and ancillary data together the main attention was draw where maximum rate of subsidence (in mm/year) in both series of descending orbit data were found (red and orange points). Two main areas affected by a pattern of subsidence driven displacement and these characteristics by punctual evidences were examined. The latter are positioned very close to landslide mapped in the 1/30,000 scale geological map and in GEORIOS. The former areas, at the first sight, showed any geological evidences supporting instability. Apart for the case of Saalfelden am Steinernen Meer in Salzburg urban area and surroundings, the survey revealed for the first time good evidence on landslide evidences in the middle of the urban area. The upper part of the landslide (fig. 9) was mapped on the “Central Ternsee Formation” (fig. 7). Whereas on the Nevada hill the subsidence was able to wait a minor movement of a metalling wall here, it was possible to map a rotational landslide imposed on “Rhenodorniense Formation” (fig. 8). Langruth, a central area of Salzburg instead three buildings showed cracks (fig. 6). Further surveys by combining homogeneous and leveling data will be attempted in order to clearly define the motion occurring in urban areas.

7. Conclusions

The PSI data available for Salzburg were very useful for the detection of subsidence and gravitational phenomena. This technique allows for the discovery of new phenomena and for the monitoring of known ones. Furthermore, the PSI data was used for the classification of mass movement based on their activity. The validation of the field showed a very good reliability of the data since on the main hot spots selected, with movement > 4 mm/year, it was possible to detect some indication of ground or building instability. Being the method robust and reliable it supposed to be more intensively adopted by municipalities which are concerned for infrastractures planning. The use of the ESA archive in Austria is an ongoing project which is supposed to achieve similar results.

8. Literature