The contribution of PSInSAR interferometry to landslide susceptibility assessment in weak rock-dominated areas

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In the Grande da Pipa river basin (north of Lisbon, Portugal), 64% of the landslides inventoried occur on a particular weak rock lithological unit composed by clay and with sandstone intercalations, that is present in 58% of the study (Oliveira et al., 2014). Deep-seated slow moving rotational slides occur essentially on this lithological unit and are responsible for the major damages verified along roads and buildings in the study area. Within this context, landslide hazard assessment, is limited by two major constrains: (i) the slope instability signs may not be sufficiently clear and observable and consequently may not be correctly identifiable through traditional geomorphologic survey techniques and (ii) the non-timely recognition of precursor signs of instability both in landslides activated for the first time and in previously landslide-affected areas (landslide reactivation). To encompass these limitations, the Persistent Scatterer synthetic aperture radar interferometry technique is applied to a data set of 16 TerraSAR-X SAR images, from April of 2010 to March of 2011, available for a small test site of 12.5 square kilometers (Laje-Salema) located on south-central part of the study area. This work's specific objectives are the following: (i) to evaluate the capacity of the Persistent Scatterer displacement maps in assessing landslide susceptibility at the regional scale, and (ii) to assess the capacity of landslide susceptibility maps based on historical landslide inventories to predict the location of actual terrain displacement measured by the Persistent Scatterers technique.
Landslide susceptibility was assessed for the test site using the Information Value bivariate statistical method and the susceptibility scores were exported to the Grande da Pipa river basin. The independent validation of the landslide susceptibility maps was made using the historical landslide inventory and the Persistent Scatterer displacement map. Results are compared by computing the respective Receiver Operator Characteristic curves and calculating the corresponding Area Under the Curve.

Reference:
Oliveira, S.C.; Zêzere, J.L.; Catalão, J.; Nico, G. (2014) – The contribution of PSInSAR interferometry to landslide hazard in weak rock-dominated areas. Landslides, DOI 10.1007/s10346-014-0522-9