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IPL Project (IPL - 235) Annual Report Form 2019-2020

1. IPL-235 (2019) Title: EO4GEO – **Towards an innovative strategy for skills development and capacity building in the space geo-information sector supporting Copernicus User Uptake**.

2. Main Project Fields
   (1) Technology Development
   A. Monitoring and Early Warning, B. Hazard Mapping
   (2) Targeted Landslides: Mechanisms and Impacts
   B. Landslides Threatening Heritage Sites and Infrastructure
   (3) Capacity Building
   A. Enhancing Human and Institutional Capacities
   (4) Mitigation, Preparedness and Recovery
   A. Preparedness

3. Name of Project leader

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Core members of the Project, Names/Affiliations: (4 individuals maximum);

- **Dr. Giorgio Saio (General EO4GEO coordination)** GISIG – Geographical Information System International Group;

4. Objectives: (5 lines maximum)

EO4GEO is an Erasmus+ Project aiming at defining a long-term and sustainable strategy to fill the gap between supply of and demand for space/geospatial education and training in the Copernicus domain. ISPRA is contributing to the development of Integrated Applications, coordinating different scenarios fostering the uptake of EO data, services and methodologies of analysis, and conducting a series of training actions. More in detail ISPRA will implement technical scenario by the application of satellite PSInSAR techniques to monitor landslide hazard and subsidence affecting Cultural Heritage.

5. Study Area: (2 lines maximum)

The selected site is the Roman *Terme di Baia* (gulf of Naples), being part of the "Parco Archeologico dei Campi Flegrei", located close to active calderas and belonging to Campania Region.

6. Project Duration (1 line maximum)

The whole duration of the projects is 4 years from January the 1st, 2018

7. Report

1) Progress in the project: (30 lines maximum)

During the last two years, available EO data (e.g. Sentinel from Copernicus program, COSMO-Sky-Med from ASI) were tested to evaluate their effectiveness and efficiency in different fields (e.g. ground motion monitoring on Cultural Heritage, agro monitoring to support regional decision-making; land change detection, geohazard zoning, risk assessment, etc.). The selected area is characterized from geological point of view, by a sequence (from the bottom to the top) of volcanic breccia, pyroclastic deposits and surge deposits. Phlegrean Fields represent an

exceptional example of volcanic-related subsidence with unrest cycles characterized by intense ground uplift and lowering. The instability phenomena depend mainly on the acclivity of the top sector of the slope, with the activation of small collapse events, and on the lack of ordinary management and maintenance of the area (e.g. invasive vegetation, absence of drainage system). A preliminary InSAR analysis was performed exploiting ERS datasets (1993–2003), showing regional ground lowering, with deformation rates (5-10 mm/yr) that are consistent with the general down lift cycle affecting the whole area in that that period. Ongoing InSAR data processing are focused on SENTINEL-1 data (January 2016 - August 2020) allowing us to explore most recent evolution of instability phenomena. Data processing has been performed using the SeNtinel's Application Platform (SNAP-ESA) and the Stanford Method of Persistent Scatterers (StaMPS).
The dataset is composed by 79 descending and 81 ascending scenes, and the single master stack contains 76 interferograms from the descending and 80 from the ascending geometry. Additionally, SRTM DEM was used in the interferometric processing. Obtained results clearly show in the investigated period a dome-shaped uplift, centered around the town of Pozzuoli, with vertical displacement that reaches 40 mm/yr. At the Roman Thermae of Baia site, on the western side of the uplifting area, most of the displacement, a few millimeters per year, is toward west. Anyway no differential displacement has been observed on the exposed elements of the site.

2) Planned future activities or Statement of completion of the Project (15 lines maximum)

Fort the present year, a MOOC focused on this use case is under development, thus contributing to fill the gap between supply and demand in the Copernicus domain, main goal of the EO4GEO project. The definition of step-by-step methodology from EO data to final processing will be defined and connected to learning outcomes, sectorial and transversal skills contributing to finalize the main goal of the EO4GEO project.
The MOOC will be structured in different sections, starting from an introduction to the Copernicus Programme, then guiding the trainees to learn about the archaeological site, its geologic setting and geohazard assessment and showing how to use Copernicus services and data to perform a DInSAR analysis. Finally the results of the analysis will be validated and integrated with in-situ measurements to obtain a reliable model of the site's natural evolution to address proper mitigation measures.

3) Beneficiaries of Project for Science, Education and/or Society (15 lines maximum)

The project target groups and final beneficiaries are constituted by stakeholders from across knowledge triangle including academia (primarily High Education Institutions), enterprises (SMEs) and Public Bodies active both in the education/training and in the space/geospatial sectors applied to natural risk assessment. More in detail the international landslide communities will benefit of the risk scenarios as a standard methodology for the use of open and free satellite data (e.g. Copernicus, CSKmed) in the field of landslide hazard risk assessment, monitoring and mitigation.

4) Results: (15 line maximum, e.g. publications)

The main outcome of the project should be gap filling among earth science academia domains (mainly University and research institute) and the Earth Observation and Geographical Information domains. Knowledge sharing and capacity building among the two sectors are one of the main targets. The project will be disseminated in many international conferences and several articles and abstracts have already been published.

- Cipolloni C., Comerci V., Delfini C., Ferrigno F., Guerrieri L., Leoni G., Spizzichino D. & ventura R. 2020. Remote Sensing data for the investigation of geo-hazard: EO4GEOproject and the knowledge sharing challenges. IOP Conf. Ser.: Earth Environ. Sci. 509 012053;
- D. Spizzichino, C. Cipolloni, V. Comerci, M. Congi, C. Delfini, F. Ferrigno, G. Leoni, R. Ventura and L. Guerrieri. Integrated application of Remote sensing and Cultural heritage : the EO4GEO project scenarios. EGU2020-10914 https://doi.org/10.5194/egusphere-egu2020-10914 EGU General Assembly 2020