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Wildfire monitoring via the integration of remote sensing with innovative information technologies

C. Kontoes (1), I. Papoutsis (1), D. Michail (2), Th. Herekakis (1), M. Koubarakis (3), K. Kyzirakos (3), M. Karpathiotakis (3), C. Nikolaou (3), M. Sioutis (3), G. Garbis (3), S. Vassos (3), I. Keramitsoglou (1), M. Kersten (4), S. Manegold (4), and H. Pirk (4)

(1) National Observatory of Athens, Institute for Space Applications and Remote Sensing, Athens, Greece (kontoes@noa.gr), (2) Dept. Informatics and Telematics, Harokopio University of Athens, Athens, Greece, (3) Dept. of Informatics and Telecommunications, National and Kapodistrian University of Athens, Athens, Greece, (4) Centrum Wiskunde & Informatica, Information Systems - Database Architectures, Amsterdam, The Netherlands

In the Institute for Space Applications and Remote Sensing of the National Observatory of Athens (ISARS/NOA) volumes of Earth Observation images of different spectral and spatial resolutions are being processed on a systematic basis to derive thematic products that cover a wide spectrum of applications during and after wildfire crisis, from fire detection and fire-front propagation monitoring, to damage assessment in the inflicted areas. The processed satellite imagery is combined with auxiliary geo-information layers, including land use/land cover, administrative boundaries, road and rail network, points of interest, and meteorological data to generate and validate added-value fire-related products. The service portfolio has become available to institutional End Users with a mandate to act on natural disasters and that have activated Emergency Support Services at a European level in the framework of the operational GMES projects SAFER and LinkER. Towards the goal of delivering integrated services for fire monitoring and management, ISARS/NOA employs observational capacities which include the operation of MSG/SEVIRI and NOAA/AVHRR receiving stations, NOA's in-situ monitoring networks for capturing meteorological parameters to generate weather forecasts, and datasets originating from the European Space Agency and third party satellite operators.

The qualified operational activity of ISARS/NOA in the domain of wildfires management is highly enhanced by the integration of state-of-the-art Information Technologies that have become available in the framework of the TELEIOS (EC/ICT) project. TELEIOS aims at the development of fully automatic processing chains reliant on a) the effective storing and management of the large amount of EO and GIS data, b) the post-processing refinement of the fire products using semantics, and c) the creation of thematic maps and added-value services. The first objective is achieved with the use of advanced Array Database technologies, such as MonetDB, to enable efficiency in accessing large archives of image data and metadata in a fully transparent way, without worrying for their format, size, and location, as well as efficiency in processing such data using state-of-the-art implementations of image processing algorithms expressed in a high-level Scientific Query Language (SciQL). The product refinement is realized through the application of update operations that incorporate human evidence and human logic, with semantic content extracted from thematic information coming from auxiliary geo-information layers and sources, for reducing considerably the number of false alarms in fire detection, and improving the credibility of the burnt area assessment. The third objective is approached via the combination of the derived fire-products with Linked Geospatial Data, structured accordingly and freely available in the web, using Semantic Web technologies.

These technologies are built on top of a robust and modular computational environment, to facilitate several wildfire applications to run efficiently, such as real-time fire detection, fire-front propagation monitoring, rapid burnt area mapping, after crisis detailed burnt scar mapping, and time series analysis of burnt areas. The approach adopted allows ISARS/NOA to routinely serve requests from the end-user community, irrespective of the area of interest and its extent, the observation time period, or the data volume involved, granting the opportunity to combine innovative IT solutions with remote sensing techniques and algorithms for wildfire monitoring and management.