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# A new GRID-based system to assist users in ASAR data handling and analysis

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The increasing availability of remote sensing images acquired periodically on a given geographical area has proven to be valuable to face real world Earth Observation (EO) applications of fundamental importance for a wide range of end-users. In this context, Synthetic Aperture Radar (SAR) sensors are becoming more and more important thanks to their ability to acquire measures that are almost completely independent of atmospheric conditions and illuminations. For this reasons SAR data can play an important role in several applications including risk assessment and management (e.g., landslides, floods), environmental monitoring (e.g., monitoring of coast erosion, wetland surveying, forest surveying), etc.

From a methodological point of view, the analysis of remote-sensing images (both in the optical and in the SAR cases) is a very challenging task, which involves different aspects and techniques of both image processing and pattern recognition. The main difficulties in analyzing remote-sensing images mainly arise from i) the peculiarities of remote sensing data that are characterized by a high dimensionality (i.e., multispectral images, multipolarimetric images, hyperspectral images, multitemporal images), and ii) the characteristics of the related applications (i.e., the lack of a priori information about the shapes of observed areas, sensor calibration, problems of alignment of multitemporal images). This complexity is further increased when Synthetic Aperture Radar (SAR) data are considered. Different factors render the analysis of SAR data a challenging task, such as the special SAR imaging geometry (e.g., presence of shadow, layover and foreshortening phenomena), the complicated scatter process and the presence of speckle noise. For these reasons, the use of SAR data is still limited in comparison to their potentialities. Finally, it is worth noting that, real applications usually require the analysis of data collected over wide area during extended period of time and involve considerable coordination and interaction between a large number of

players in the scientific, operational and commercial sectors.

Recently, European Space Agency (ESA) has demonstrated how GRID can respond to the complexity and constraints imposed by applications in EO domain and has identified the benefits of this technology and how it can improve the work of EO technical and scientific users. A GRID can facilitate interactions between different actors by providing a standard infrastructure and a collaborative framework to share data, storage and processing resources, algorithms and data products. Furthermore, ESA proposed to make GRID resources and services accessible through a user-friendly application portal (EOGRID-On-Demand web portal, http://giserver.esrin.esa.int/), thus facilitating the access to remote-sensing products from different sensors to non-technical end users.

This paper presents a new system that is under-development at ESRIN-ESA and that allows users to access, handle and analyze SAR data archived at ESA through a friendly webportal. Users can browse for the required products specifying the geographical area of interest as well as the acquisition time, and, if required, limiting the search for a given mode or pass. Afterward, they can specify the service of interest (e.g., coregistration of multitemporal images, image despeckling, multitemporal filtering, or even generation of background map, change detection map or classification map). The system automatically retrieves data stored on different storage elements (i.e., distributed archive), identifies the jobs needed for accomplishing the task required by the user and distributes them on different computing nodes of the GRID. This system provides valuable tools for both expert and non-expert users, as detailed in the following.

Concerning expert users, they can mainly take advantage of the underlying GRID technology that results in both a transparent access to the huge distributed data archive and a significant decrease of the time required by data processing. The system can bring noticeable advantages to actors involved in Data User Element (DUE) or Global Monitoring for Environment and Security (GMES) projects where access to distributed archives and fast reactive services are required (e.g., Crisis Mapping and Management). Furthermore, universities, research centers and private companies can integrate their proprietary tools on the system and exploit its peculiarities for a fast validation of the algorithms on large amount of data.

Concerning non-expert users, it is worth noting that, up to now, in general only expert users could analyze SAR data as distributed by Ground Segment. Thanks to this system also non-expert users can take advantage of the benefits derived from the use of SAR data. In practice, non-expert users can utilize it as an intermediate layer between the Ground Segment and them to order pre-processed (e.g., filtered, calibrated, coreg-

istered) data. More in details, a generic SAR processing environment was created on GRID. Different SAR toolboxes have been already integrated on EO-GRID allowing image despeckling, backscattering computation, multitemporal series co-registration, multitemporal filtering for speckle reduction, ellipsoid geocorrection for medium resolution images, mosaicing, multitemporal classification. Based on these tools, higher level functionalities oriented at the analysis of multitemporal images have been developed and are now available through GRID-On-Demand Web portal. Other toolboxes are at the present under consideration in order to increase the number of high level functionalities to be offered to the users.