Geophysical Research Abstracts
Vol. 12, EGU2010-2880, 2010
EGU General Assembly 2010

Grid infrastructure for automatic processing of SAR data for flood applications

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More and more geosciences applications are being put on to the Grids. Due to the complexity of geosciences applications that is caused by complex workflow, the use of computationally intensive environmental models, the need of management and integration of heterogeneous data sets, Grid offers solutions to tackle these problems.
Many geosciences applications, especially those related to the disaster management and mitigations require the geospatial services to be delivered in proper time. For example, information on flooded areas should be provided to corresponding organizations (local authorities, civil protection agencies, UN agencies etc.) no more than in 24 h to be able to effectively allocate resources required to mitigate the disaster. Therefore, providing infrastructure and services that will enable automatic generation of products based on the integration of heterogeneous data represents the tasks of great importance.
In this paper we present Grid infrastructure for automatic processing of synthetic-aperture radar (SAR) satellite images to derive flood products. In particular, we use SAR data acquired by ESA's ENVSAT satellite, and neural networks to derive flood extent. The data are provided in operational mode from ESA rolling archive (within ESA Category-1 grant). We developed a portal that is based on OpenLayers frameworks and provides access point to the developed services. Through the portal the user can define geographical region and search for the required data. Upon selection of data sets a workflow is automatically generated and executed on the resources of Grid infrastructure. For workflow execution and management we use Karajan language. The workflow of SAR data processing consists of the following steps: image calibration, image orthorectification, image processing with neural networks, topographic effects removal, geocoding and transformation to lat/long projection, and visualisation. These steps are executed by different software, and can be executed by different resources of the Grid system. The resulting geospatial services are available in various OGC standards such as KML and WMS.
Currently, the Grid infrastructure integrates the resources of several geographically distributed organizations, in particular: Space Research Institute NASU-NSAU (Ukraine) with deployed computational and storage nodes based on Globus Toolkit 4 (htpp://www.globus.org) and gLite 3
(http://glite.web.cern.ch) middleware, access to geospatial data and a Grid portal; Institute of Cybernetics of NASU (Ukraine) with deployed computational and storage nodes (SCIT-1/2/3 clusters) based on Globus Toolkit 4 middleware and access to computational resources (approximately 500 processors); Center of Earth Observation and Digital Earth Chinese Academy of Sciences (CEODE-CAS, China) with deployed computational nodes based on Globus Toolkit 4 middleware and access to geospatial data (approximately 16 processors).
We are currently adding new geospatial services based on optical satellite data, namely MODIS. This work is carried out jointly with the CEODE-CAS. Using workflow patterns that were developed for SAR data processing we are building new workflows for optical data processing.