Kussul N.N., Shelestov A.Yu., Skakun S.V.
Space Research Institute NASU-NSAU, Kyiv, Ukraine

InterGrid Infrastructure for Natural Disaster Monitoring

In this report we introduce InterGrid infrastructure for environmental and natural disaster monitoring, in particular flood monitoring. We developed new intelligent method for flood extent estimation based on neural networks – self-organizing Kohonen's maps (SOMs) [1]. The developed method has been successfully tested for different case-study areas, in particular for flooding on Tisza river (Ukraine, Hungary) in 2001, on Huaihe river (China) in 2007 and Zambezi river (Mozambique) in 2008. For Ukrainian case-study we use ERS-2/SAR data, for Chinese case-study we use Envisat/ASAR and Radarsat data, and for Mozambique case-study we use Envisat/ASAR. Additional information on flood events was also acquired from MODIS instrument for cloudless days in order to analyze dynamics of flooding.

Taking into account heterogeneous nature of the data used and resource consuming computations required for data processing it makes sense to use Grid environment for implementation of flood extent mapping service. Moreover, some components of workflow are implemented on the basis of Grid, for example in ESA G-POD environment and Ukrainian Earth Observation Grid-system. Multi-source data for the problem solving, as a rule, are stored at different distributed archives, most of which are also running in Grid environments. Hence, to provide flood monitoring service for any region of the world, for example within the International Charter "Space and Major Disasters", it is necessary to use InterGrid system. Such kind of InterGrid environment is being developed in the framework of ESA Category-1 project "Wide Area Grid Testbed for Flood Monitoring using Spaceborne SAR and Optical Data"(no. 4181).

Parallel version of neural network method for flood extent extraction has been developed and tested in the InterGrid testbed integrating Grid systems of ESA, National Space Agency of Ukraine (NSAU) (Ukraine), and RSGS (China). GridFTP was chosen to provide data transfer between Grid systems. In order to submit jobs in InterGrid environment two possible approaches have been evaluated: (1) Grid portal solution supporting different middleware; (2) High-level Grid scheduler that supports different middleware and provides some standard interface. Grid portal solution is easy to deploy and maintain, but it does not provide application interface and scheduling capabilities. In turn, metascheduler approach is much more difficult to maintain comparing with portal, however, it provides APIs with advanced scheduling and load-balancing capabilities.

Currently, we use high-level Grid portal (that have been deployed using GridSphere framework) in order to provide access to resources of InterGrid environment. In order to visualize results of image processing in InterGrid environment, we use OpenLayers framework and UNM Mapserver v5. UNM Mapserver supports Open Geospatial Consortium (OGC) Web Map Service (WMS) that enables creation and display of registered and superimposed maplike views of information that come simultaneously from multiple remote and heterogeneous sources. Developed services for flood monitoring are accessible via Internet by address http://floods.ikd.kiev.ua/.

Developed testbed could be considered as a pilot version of Wide Area Grid (WAG), initiated by CNES within CEOS (WGISS). Further work should be focused on creation of user friendly interface and InterGrid productivity investigation.

Bibliography

1. Kussul N.N., Lupian E.A., Shelestov A.Yu., Skakun S.V., Tishchenko Y.G., Hluchy L. Determination of Inundated Territories on the Basis of Integration of Heterogeneous Data // Journal of Automation and Information Sciences. – 2007. – Volume39, Issue 12. – P. 42–51.