Geophysical Research Abstracts
Vol. 15, EGU2013-1735-2, 2013
EGU General Assembly 2013

Implementation of the CUAHSI information system for regional hydrological research and workflow

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Environmental research and education have become increasingly data-intensive as a result of the proliferation of digital technologies, instrumentation, and pervasive networks through which data are collected, generated, shared, and analyzed. Over the next decade, it is likely that science and engineering research will produce more scientific data than has been created over the whole of human history (Cox et al., 2006). Successful using these data to achieve new scientific breakthroughs depends on the ability to access, organize, integrate, and analyze these large datasets. The new project of PGI FEB RAS (http://tig.dvo.ru), FERHRI (www.ferhri.org) and Primgidromet (www.primgidromet.ru) is focused on creation of an open unified hydrological information system according to the international standards to support hydrological investigation, water management and forecasts systems.
Within the hydrologic science community, the Consortium of Universities for the Advancement of Hydrologic Science, Inc. (http://his.cuahsi.org) has been developing a distributed network of data sources and functions that are integrated using web services and that provide access to data, tools, and models that enable synthesis, visualization, and evaluation of hydrologic system behavior.
Based on the top of CUAHSI technologies two first template databases were developed for primary datasets of special observations on experimental basins in the Far East Region of Russia. The first database contains data of special observation performed on the former (1957-1994) Primorskaya Water-Balance Station (1500 km2). Measurements were carried out on 20 hydrological and 40 rain gauging station and were published as special series but only as hardcopy books. Database provides raw data from loggers with hourly and daily time support. The second database called «FarEastHydro» provides published standard daily measurement performed at Roshydromet observation network (200 hydrological and meteorological stations) for the period beginning 1930 through 1990. Both of the data resources are maintained in a test mode at the project site http://gis.dvo.ru:81/, which is permanently updated.
After first success, the decision was made to use the CUAHSI technology as a basis for development of hydrological information system to support data publishing and workflow of Primgidromet, the regional office of Federal State Hydrometeorological Agency. At the moment, Primgidromet observation network is equipped with 34 automatic SEBA hydrological pressure sensor pneumatic gauges PS-Light-2 and 36 automatic SEBA weather stations. Large datasets generated by sensor networks are organized and stored within a central ODM database which allows to unambiguously interpret the data with sufficient metadata and provides traceable heritage from raw measurements to useable information.
Organization of the data within a central CUAHSI ODM database was the most critical step, with several important implications. This technology is widespread and well documented, and it ensures that all datasets are publicly available and readily used by other investigators and developers to support additional analyses and hydrological modeling. Implementation of ODM within a Relational Database Management System eliminates the potential data manipulation errors and intermediate the data processing steps. Wrapping CUAHSI WaterOneFlow web-service into OpenMI 2.0 linkable component (www.openmi.org) allows a seamless integration with well-known hydrological modeling systems.