Geophysical Research Abstracts
Vol. 13, EGU2011-3954-1, 2011
EGU General Assembly 2011

North Hydrology: An ESA-Sponsored Initiative in Support of the Climate and Cryosphere (CliC) Project

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Lake and river ice play a significant role in the physical, biological, and chemical processes of cold region freshwater. The frequency and size of lakes greatly influence the magnitude and timing of landscape-scale evaporative and sensible heat inputs to the atmosphere and are important to regional climatic and meteorological processes. Because lakes are such a major component of most northern atmospheric and hydrologic systems, the ability to determine their annual energy and water budgets is critical to our ability to forecast high latitude weather, climate, and river flow patterns. River-ice is also one of the major components of the terrestrial cryosphere. It affects an extensive portion of the global hydrologic system, particularly in the Northern Hemisphere where major ice covers develop on 29% of the total river length and seasonal ice affects 58%. River-ice duration and break-up exerts significant control on the timing and magnitude of extreme hydrologic events such as low flows and floods. There are long-term observations of lake and river ice for many northern countries. However, the observation networks have been declining dramatically in recent decades. This lack of data limits the use of river and lake ice data into numerical weather prediction, climate and hydrologic models. In this context, Earth Observation (EO) represents a viable tool to support the scientific and operational communities to characterize and monitor river and lake ice dynamics as a key component of the North Hydrology System.

The European Space Agency (ESA) through its Support To Science Element (STSE) Programme is funding a 24-month initiative, called North Hydrology, to support the international efforts coordinated by the Climate and Cryosphere (CliC) project of the World Climate Research Programme (WCRP). Emphasis is on the exploitation of EO technology, models and in situ data to improve the characterization of river and lake ice processes and their contribution to the Northern Hydrology system. North Hydrology aims to develop a portfolio of novel multi-mission geo-information products, maximizing the use of ESA satellite data, to respond to the scientific requirements of the CliC community and the operational requirements of the weather and climate operational agencies (regional to global scale), and the requirements of the operational user community to better characterize river-ice (and glacier temporary lakes) dynamics in flood forecasting models at the basin scale. In addition, the project aims to:

• Reinforce the long-term strategic partnerships of ESA with the WCRP and the CliC community.
• Foster the use of ESA data within the CliC community for northern hydrological processes studies.
• Foster the operational use of the ESA-based developed products.
• Foster the scientific return of ESA missions in terms of novel scientific results and publications.

In this paper, we will present an update on the status of the North Hydrology project and highlight some of products being derived from ESA satellite data during the second (development and validation) phase of the project.