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ESA's STSE North Hydrology Project: Overview and early results

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Lake and river ice play a key 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 hinders the use of river and lake ice data into numerical weather prediction, climate and hydrologic models. In this context, Earth Observation (EO) represents a unique 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 new 24-month initiative called North Hydrology. The overall goal of North Hydrology is to support the international efforts coordinated by the Climate and Cryosphere (CliC) project of the World Climate Research Programme (WCRP) to exploit the use 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. To this end, 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 addition, as an additional support to the CliC efforts, a North Hydrology Science Data Portal is being developed by the project team. This data portal will not only provide valuable data and information to the current CliC community and the general user community, but in the longer term is expected to contribute to the Global Cryosphere Watch (GCW) - currently under development by the World Meteorological Organization (WMO). In this paper, we will present an overview of the North Hydrology project, its status, and provide examples of EO-based products being generated during the development and validation phase of the project.