THE APPLICATION OF EARTH OBSERVATION SYSTEMS AND REAL-TIME WATER MONITORING FOR ENVIRONMENTAL SECURITY AND WATER RESOURCES MANAGEMENT

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The Department of Environment and Conservation (DOEC) of the Government of Newfoundland and Labrador in Canada first used Earth Observation (EO) on a near real time basis when it integrated satellite SAR imagery into operational flood forecasting of river ice on the Exploits River near the Town of Badger, Newfoundland and Labrador, Canada in 2003. The success of this river ice service, the first operational EO based river ice service in the world, encouraged DOEC to integrate EO into a wide range of operational Environmental Security and Water Resources Management applications.

The paper presents two case studies to illustrate the application of EO for environmental security and water resources management. It highlights the successes and the challenges encountered by DOEC in developing and implementing these services. The paper also outlines a path forward for further application of EO systems to complex water resources management issues like trans-boundary water resources management. The socio-economic benefits in terms of early warning of floods and water quality incidents associated with the adaptation of new technology as compared to traditional approach are highlighted.

The first case study provides an update on the river ice service that was presented at IGARSS 2004. In 2004 the river ice service was only in its first year of operation. Since then the river ice service has been improved and is now used on several rivers in Canada, United States of America and Russia. The river ice service was developed under Polar View and funded through the European Space Agency's Global Monitoring for Environment and Security (GMES) program.

The river ice service utilizes SAR imagery from Envisat, Radarsat 1 and Radarsat 2. The images are analyzed in near real-time, geometrically corrected to a base map in UTM coordinates and subjected to a visual interpretation. In addition to the location of the ice front, an ice classification product is produced by identifying and extracting three interpretative ice classes from the image data. A third change detection product compares images to highlight changes in the ice cover between consecutive images. This information is used to calibrate and augment a predictive ice progression model used to forecast the development of the ice cover and the progression of the ice front on the Exploits River in Canada. The paper outlines how the river ice service is now being used as a tool for climate change adaptation. It also discusses how its use is being extended to monitor the impact of a major hydro electric power project in Canada.

The second case study outlines how EO is being integrated with Real-Time Water Monitoring (RTWM) to monitor lake water quality. Since the 2005, DOEC and C-CORE have been working on a European Space Agency TIGER project to design, develop and implement an EO based capacity for the operational monitoring of lake water quality in Lake Manzalah, Egypt. In 2008 the scope of the project was extended to integrate EO with RTWM.

The prototype water quality service developed in the first phase of the TIGER project uses MERIS imagery as the primary data source and MODIS imagery as a secondary data source. Water quality products derived under the prototype service include turbidity (TUR), concentration of total suspended solids (TSS) and concentration of chlorophyll-a (CHL). Under the phase 2 of the TIGER project, RTWM will be used as a source of in-situ data, for calibration and validation, to generate quantitative water quality products in near real time.

The paper outlines the progress on the project. The paper outlines how DOEC would adapt the water quality service developed in the TIGER project to undertake operational monitoring of water quality of Newfoundland and Labrador lakes and rivers. DOEC has an extensive network of RTWN stations and it envisages the water quality service as a tool that will augment the data being collected by the RTWN stations. The paper also discusses how the project results can be used for trans-boundary water resources management.