Monitoring climate-driven ice regime shifts of Pan-Arctic lakes with long-term satellite observations

Cristina Surdu (1), Diego Fernandez Prieto (1), and Claude Duguay (2)

(1) European Space Agency, Science, Applications and Future Technologies, Frascati, Italy (cristina.surdu@esa.int), (2) University of Waterloo, Department of Geography & Environmental Management and Interdisciplinary Centre on Climate Change, Waterloo, Canada

Arctic lakes represent an important part of the global cryosphere and the timing of the seasonal freeze-thaw cycle, and the fraction of lakes freezing to the bed in winter, are a useful tool for monitoring the impacts on the cryosphere from global climate change and warming Arctic temperatures. Lake ice-cover both forces and responds to climate variability. Freeze-up and break-up timing of the lake ice cover affects ecological processes and land-atmosphere energy exchanges. Trends in the phenology and thickness of the ice tend to be related to climatic and meteorological conditions, such as variations in air temperature and snow cover.

To date, records of ice phenology and winter maximum ice thickness for shallow Arctic lakes are relatively sparse and vary in length thus limiting detection of longer-term trends at a regional scale.

In this study, break-up timing and winter maximum ice thickness was observed for over 900, mainly small and medium size lakes, of various depths, many of which are shallow, across the Arctic, from 1992 to 2016, using satellite imagery. To evaluate the extent of changes that lake ice has undergone in recent climate conditions, three key, lake-rich Arctic regions were selected: the North Slope of Alaska (with the longest observational record), the Canadian Arctic Archipelago and the Lena Della in northern Siberia. This research provides a detailed spatial analysis of changes in ice break-up, winter maximum ice thickness and summer ice minimum for High Arctic lakes, investigating regional trends and regional comparison, and climatic drivers for each region.