Conductive Heat Flow through Temperate Region Lake Ice

LAURA ALVAREZ SALINAS[1] AND LAURA BROWN[1]

ABSTRACT

Understanding the conductive heat flow through lake ice is important to understanding the future of lake ice in a changing climate. Temperate lake ice has a different composition compared to arctic lake ice due to the warmer and wetter climate experienced in more southern latitudes. With limited research, there is a need to study how conductive heat flow travels through the ice layers in temperate regions. Consequently, this research focuses on expanding research in temperate lake ice by providing the first in-depth look at heat flux through the predominantly white ice layers found in the temperate region. This research investigates the temperature gradients within both black and white ice, and the snowpack on top of the ice, while also looking at lake ice thickness over the span of six years from 2017 to 2022. The area of study consists of two lakes in Central Ontario: Macdonald Lake and Clear Lake. Snow and ice measurements have been collected along 4 sampling transects (snow depth, density, temperature, grain type, albedo, ice thickness, ice type) while heat flow was measured through the ice using thermistors at a single location. Data collected has shown climate variability throughout the collection period, with thicker white ice in the most recent years compared to earlier years. Moreover, the data collected from the thermistors allows an insight on how conductive heat flow occurs through both the black and white ice. Furthermore, snowpack data also reflects climate variability by exhibiting different patterns in the temperature profile which has reflected variations in degrees of annual slushing. This research aids to show how heat transfers through the ice layers and allow for a more thorough understanding of the effect that heat flow has on temperate region lake ice, greatly expanding the field.

[1] Department of Geography, Geomatics and Environment, University of Toronto Mississauga, Mississauga, ON, Canada