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**A New Year's Day icebreaker: Icequakes on lakes in Alberta, Canada
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ABSTRACT

Any process that causes a sudden brittle failure of material has the potential to cause earthquake-like seismic events. Cryoseisms represent an underreported class of seismic event due to their (often) small magnitudes. We document the phenomenon of some of the largest magnitude lake-associated icequakes (ML 2.0) yet reported. These events occurred nearly simultaneously (within 2 h) on geographically separate lakes in Alberta, Canada, starting 1 January 2018. We conjecture that these events were caused by the sudden brittle failure of lake ice due to thermal expansion; the effects of the thermal expansion were compounded by the lack of insulating snow cover, high lake water levels, and a rapid onset of atmospheric warming. These factors also contributed to ice-jacking—a repeating process in which thermal contraction produces tensile cracks (leads) in lake ice that are then filled with water that is frozen during the cooling cycle. Thus, any subsequent thermal expansion must be accommodated by new deformation or brittle failure. This ice-jacking process caused creeping ground deformation after the initial brittle failure and again two weeks later following a second warming period. In many cases, the resulting ground deformation was significant enough to cause property damage.

Full paper: Kavanaugh, J., Schultz, R., Andriashek, L.D., Van der Baan, M., Ghofrani, H., Atkinson, G. and Utting, D.J. (2019) A New Year's Day Icebreaker: Icequakes on Lakes in Alberta, Canada. *Canadian Journal of Earth Sciences*, 56(2), 183-200. <https://www.nrcresearchpress.com/doi/10.1139/cjes-2018-0196>

BIOGRAPHY

Mirko van der Baan is a professor at the University of Alberta in the Department of Physics, specializing in Exploration Seismology. He graduated in 1996 from the University of Utrecht in the Netherlands, obtained a PhD with honors in 1999 from the Joseph Fourier University in Grenoble, France, and then joined the University of Leeds, UK, where he became the Reader of Exploration Seismology. He also holds an HDR (Habilitation) from University Denis Diderot, Paris, France.

Mirko was the 2017 Honorary Lecturer, North America, of the Society of Exploration Geophysicists: 'How widespread is human-induced seismicity in the USA and Canada?'. He is a co-Director of the Microseismic Industry Consortium, a collaborative venture with the University of Calgary, dedicated to research in microseismicity. In 2020, the Consortium received the NSERC Synergy Award for Innovation, in the category "Two or More Companies".