

Vita

Candidate's name: Dustin Roy Douglas Fraser

Universities
Attended: University of New Brunswick (2018)
Bachelors of Science
Major in Physics & Mathematics

University of New Brunswick (2021)
Masters of Science
Physics

Presentations/Conferences/Publications:

Dustin Fraser, William Ward, Sam Kristoffersen, and Dustin Gamblin (2019), Analysis of bore observed in the MLT region over Eureka, Probing the Atmosphere of the High Arctic (PAHA) Workshop, Toronto, Canada

Dustin Fraser, William Ward, Sam Kristoffersen, Dustin Gamblin, and David Themens (2019), Study of bores observed in the Canadian High Arctic mesopause region, International Union of Geodesy and Geophysics (IUGG) General Assembly, Montreal, Canada

Dustin Fraser, William Ward, Sam Kristoffersen, Dustin Gamblin and David Themens (2019), Observation of mesospheric bores over Eureka, NU, Division of Atmospheric and Space Physics (DASP) Workshop, Saskatoon, Canada

Dustin Fraser, William Ward, Peter Preusse, Cornelia Strube, Samuel Kristoffersen, and Dustin Gamblin (2021), Ray tracing of gravity waves in the Northern Polar MLT, DASP Workshop, Calgary, Canada (Virtual)

Dustin Fraser, William Ward, Peter Preusse, Cornelia Strube, Samuel Kristoffersen, and Dustin Gamblin (2021), Detection and ray tracing of gravity waves in the Arctic upper atmosphere, Canadian Meteorological and Oceanographic Society (CMOS) Congress, Victoria, Canada (Virtual)

Gravity Wave Ray Tracing in the Northern Polar Atmosphere

UNIVERSITY OF NEW BRUNSWICK

THESIS DEFENCE AND EXAMINATION

in Partial Fulfillment

of the Requirement for the Degree of
Master of Science

by

Dustin R. D. Fraser

in the Department of Physics

U.N.B., Fredericton, N.B.

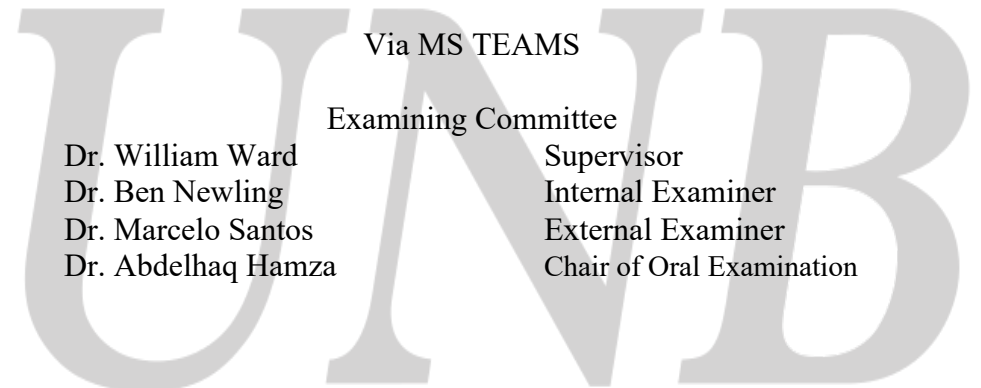
**Thursday, September 23rd, 2021
1:00 p.m.**

Via MS TEAMS

Examining Committee

Dr. William Ward
Dr. Ben Newling
Dr. Marcelo Santos
Dr. Abdelhaq Hamza

Supervisor
Internal Examiner
External Examiner
Chair of Oral Examination



Abstract

Gravity waves (GWs) are ubiquitous throughout Earth's atmosphere. Yet, their inadequate representation in global models is a source of uncertainty in accurately evolving the state of the atmosphere. It is therefore imperative to improve our understanding of their spectra and origins. In this study, GWs are observed in the mesosphere and lower thermosphere (MLT) via their perturbations to airglow layers above Eureka, Canada (80N, 86W). GW observations from all-sky imaging and high-precision wind measurements with the E-Region Wind Interferometer (ERWIN) are conducted at the Polar Environmental and Atmospheric Research Laboratory (PEARL) to allow extraction of wave parameters. Ray tracing is performed on observed waves to diagnose potential sources using the Gravity Wave Regional or Global Ray Tracer (GROGRAT), developed by Marks and Eckermann. Background atmosphere datasets are retrieved from the extended Canadian Middle Atmosphere Model (CMAM) for tracing the waves. Topography is identified as a likely leading mechanism for small-scale

secondary wave (horizontal wavelength < 100 km) generation above Ellesmere Island during the 2008-2009 winter times. A case study of a large-scale GW on Nov. 20, 2008 revealed probable origins linked to a strong low-pressure system and jet stream over Eastern Canada. The paper concludes with an analysis exploring the sensitivity of GROGRAT derived ray trajectories to launch parameters and contrasting backgrounds.