

# SEMINAR NOTICE

*Department of Physics and Engineering Physics  
University of Saskatchewan*

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**SPEAKER:** Professor Ronald B. Smith,  
Department of Geology & Geophysics  
Yale University

**TOPIC:** *Momentum transport and deposition by gravity waves into the stratosphere:  
The DEEPWAVE field experiment in New Zealand in 2014*

**DATE:** November 21st, 2017

**TIME:** 3:30-4:30 p.m.

**PLACE:** Physics 103

## **ABSTRACT:**

The general circulation of the earth's atmosphere is significantly influenced by the transport of momentum by small scale buoyancy oscillations (i.e. gravity waves) from the earth's surface to the stratosphere and higher. An important aspect of the problem is the growth of wave amplitude by a factor of 100 or more as they propagate into the less-dense upper layers (i.e. the "bull-whip effect"). In spite of five decades of analysis, key questions remain concerning wave generation, wave breakdown and the response of the atmosphere to localized momentum deposition. To advance our knowledge, a large field campaign (DEEPWAVE) took place in 2014 over mountainous New Zealand using research aircraft, ground and aircraft based lidars and satellite detection of gravity waves.

In this presentation, we first review the physical properties of atmospheric gravity waves and the direct observations of waves by research aircraft in the low stratosphere during DEEPWAVE. Using high resolution numerical simulation, we show how winds across the mountains modulate wave generation. We examine the role of a low wind layer in the stratosphere (i.e. the "valve layer") in triggering wave breaking and controlling deeper propagation. Finally, we describe how the atmosphere responds to local momentum deposition, especially the pressure field and the violation of Potential Vorticity conservation.

### References:

- Fritts, D, R.B. Smith, et al., 2015: The Deep Propagating Gravity Wave Experiment (DEEPWAVE): An Airborne and Ground-Based Exploration of Gravity Wave Propagation and Effects from their Sources throughout the Lower and Middle Atmosphere, *Bulletin of the American Meteorological Society*, 97, 425-453  
Ronald B. Smith, Alison D. Nugent, Christopher G. Kruse, David C. Fritts, James D. Doyle, Steven D. Eckermann, Michael J. Taylor, Andreas. Doernbrack, M. Uddstrom, William Cooper, Pavel Romashkin, Jorgen Jensen, Stuart Beaton. 2016: Stratospheric Gravity Wave Fluxes and Scales during DEEPWAVE, *J. Atmos. Sci.*, 73, 2851-2869  
Kruse C. G., R.B. Smith and S. D. Eckermann., 2016: The Mid-Latitude Lower-Stratospheric Mountain Wave "Valve Layer", *J. Atmos. Sci.*, 73, 5081-5100  
Ronald. B. Smith and Christopher G. Kruse, 2017: Broad Spectrum Mountain Waves, *J. Atmos. Sci.*, 74, 1381-1402

*Coffee and Cookies will be served in Physics lounge at 3:00 p.m. for those attending the seminar.*