2021 Workshop: Gravity waves

Long title
Gravity wave multi-step vertical coupling from the troposphere to the thermosphere/ionosphere
Conveners
S. Vadas
E. Becker
Description

In this workshop, we explore gravity wave excitation, propagation, dissipation, and re-excitation (following dissipation) at all altitudes from the lower to upper atmosphere and ionosphere. Studies can be at low, middle or high latitudes, and can be based on models, observationss, or a combination of both. For example, fishbone structures showing evidence of secondary GWs in z-t plots can be analyzed and studied. Examples of the GWs from primary sources we include here are the generation of GWs from 1) orographic forcing, moist convection, fronts, and jets in the troposphere, and 2) the polar vortex in the stratosphere. We emphasize the effects of these sources on the thermosphere/ionosphere (TI) via the generation of secondary and higher-order GWs (multi-step vertical coupling).

Agenda

Dave Fritts: ``Impacts of Decreasing Model Resolution on Mountain Wave Dynamics, Propagation, and Secondary Gravity Wave and Acoustic Wave Generation in the Mesosphere and Thermosphere (Dave Fritts, Erich Becker, Tom Lund, and Adam Lund)

Chris Heale: ``Primary Versus Non-primary Gravity Wave Response at F-region Heights Generated by a Convective Plume

Neil Hindley: ``What's wrong with the wintertime winds in the WACCM polar mesosphere?

Erich Becker: ``Generation of gravity waves by the polar vortex in a high-resolution GCM nudged to reanalysis

Sharon Vadas: ``Generation of primary, secondary and higher-order gravity waves from the polar vortex, and MSTIDs in the F region (S.L. Vadas, E. Becker, K. Bossert, G. Baumgarten, L. Hoffmann)

Steve Smith: ``Momentum Flux Estimates During Winter at Several Global Sites

Ian Geraghty: ``GW properties at McMurdo point toward secondary wave generation in the MLT

11:43-11:11:48 Jia Yue: ``Mesosphere gravity waves from La Soufriere volcano eruption in April 2021

11:50-11:58 Pavel Inchin: ``Modeling of tsunamigenic acoustic-gravity waves and their transients in mesospheric airglow (Inchin P.A., Heale C.J., Snively J.B.)

Justification

One of the challenges the aeronomy community has encountered recently is that it has become apparent that to accurately describe and model F region gravity waves, multi step vertical coupling needs to be included. This is true in both the winter and summer hemispheres, but especially in the winter hemisphere. For the physical process of multi step vertical coupling, gravity wave dissipation leads to the creation of local body forces (i.e., horizontal accelerations) and heatings, both of which excite secondary GWs. Where the secondary GWs dissipate, another set of GWs is excited (tertiary GWs), and so on to higher orders. Recent modeling has shown that this is the reason for the TAD hotspot in GOCE and CHAMP satellite density perturbations over the Southern Andes.

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