2015 Workshop: DEEPWAVE Gravity Wave Coupling

Long title
DEEPWAVE - Gravity Wave Coupling from Lower Atmosphere Sources Throughout the MLT
Conveners
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Description

The Deep Propagating Gravity Wave Experiment (DEEPWAVE) was performed over the New Zealand South Island, Tasmania, and the surrounding Southern Ocean and Tasman Sea centered during June and July 2014. DEEPWAVE employed the NSF/NCAR Gulfstream V (GV) research aircraft for 26 research flights using 183 flight hours based from Christchurch, New Zealand during a core 6-week flight program. The GV was joined by the German DLR Falcon aircraft that performed 13 research flights during the second half of the GV deployment.

To provide measurements spanning as large an altitude range as possible, two new lidars were built specifically for the GV and DEEPWAVE. A 7-W UV Rayleigh lidar was built to measure densities and infer temperatures from ~20 to 60 km, and a 10-W CW/pulsed sodium lidar was built to provide sodium densities and temperatures extending from ~75 to 105 km. An Advanced Mesosphere Temperature Mapper (AMTM) was built for the GV to image temperatures along and across the GV flight track. Additional side-viewing IR cameras extended the cross-track field of view (FOV) to ~900 km.

DEEPWAVE was also supported by extensive ground-based measurements, including another AMTM, Rayleigh lidars on South Island and Tasmania, an FPI, airglow imaging at two sites, a boundary layer radar, and several radiosonde sites.

Extensive forecasting and modeling resources were available for flight planning and are being used in support of DEEPWAVE data analyses.

Justification

Vertical coupling by gravity waves (GWs) from sources in the lower atmosphere into the stratosphere and MLT are key dynamics accounting for the circulation and structure of the atmosphere from the surface to very high altitudes. These links are challenging or impossible to quantify with measurements from fixed sites, as ground-based instruments cannot characterize all of the GW scales and their spatial and temporal variability and horizontal extent at a majority of altitudes.

DEEPWAVE has specific relevance to goals 2 and 4 in the recent Heliophysics Decadal Survey, Solar and Space Physics: A Science for a Technological Society: 2. Determine the dynamics and coupling of Earth’s magnetosphere, ionosphere, and atmosphere and their response to solar and terrestrial inputs, 4. Discover and characterize fundamental processes that occur both within the heliosphere and throughout the universe.

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