2011 Workshop: New Lidar Observations and Studies

Long title
New results of lidar observations and studies from high to low latitudes
Conveners
Xinzhao Chu
Gary Swenson
Description

Starting in year 2010, several new scientific lidar campaigns are being conducted worldwide, including two Fe lidar installations at McMurdo and Davis stations in Antarctica, and a Na lidar campaign in Cerro Pachon, Chile. Plus the re-location of CSU Na lidar to USU, the ongoing lidar campaigns at Andoya, Norway with multiple instruments, and many other lidar observations being continued by CEDAR researchers, the resonance and Rayleigh lidars are providing new and exciting data to the CEDAR science community. One of the goals of this workshop is to provide a platform for the newest results to be presented, stimulating new science collaborations among observations, data analysis and modeling.

We encourage presentations on various topics related to CEDAR lidar research, including but not limited to the layered phenomena in mesosphere and thermosphere, neutral and ion chemistry, MLT wave dynamics including flux measurements, and coupling in the atmospheric region.

Agenda

The meeting agenda as of June 27, 2011 is as follows:

1. Xinzhao Chu -- First and Newest Results from McMurdo Lidar Campaign (20 min)

2. Rich Collins -- Estimates of vertical eddy diffusivity and energy dissipation in the upper mesosphere in the presence of a mesospheric inversion layer (15 min)

3. Chet Gardner -- Wave-induced Vertical Constituent Transport in the Mesopause Region (30 min)

4. Titus Yuan -- Monthly-mean Tidal Perturbations of Na Density and Vertical Wind based on Full-Diurnal Cycle Na Lidar Observations at Fort Collins, CO (2002-2008) (15 min)

5. Jonathan Friedman/Jonathan Fentzke -- Sporadic metal atom and ion layers and their connection to chemistry and thermal structure in the mesopause region at Arecibo (10 min)

6. Wentao Huang -- Simultaneous Observations of Na and Fe Layers at Boulder in 2010 (5 min)

7. Dave Fritts -- Simulations of Multi-Scale Dynamics and Implications for Lidar Measurements in the MLT (10 min)

8. Gary Swenson -- Chile Campaign and its current status (10 min)

Justification

This session is relevant to the active lidar campaigns and studies being conducted by numerous groups in US and in the world.

Summary

The lidar workshop was held from 1:30 to 3:50pm on Thursday, June 30, 2011 at the Santa Fe Conventional Center's O'Keefe+Milagro. There were about 60 people attending the workshop, including students. Xinzhao Chu from the University of Colorado and Gary Swenson from the University of Illinois co-chaired the session. In the opening statements, Chu pointed out that CEDAR lidars had achieved the pole-to-pole measurements of middle and upper atmosphere with resonance and Rayleigh lidars, and made significant contributions to the CEDAR science. This workshop provided a stage to present the newest results from lidar observations, data analyses, and model simulations.

There were a total of eight presentations, starting with the newest results on polar mesospheric clouds, temperatures, Fe layers, and gravity waves by an Fe Boltzmann temperature lidar from McMurdo, Antarctica, and ending with updates on the lidar campaign in Cerro Pachon, Chile and the development of Helium resonance lidar. Three talks were focused on the middle atmosphere dynamics, including the estimates of vertical eddy diffusivity, wave-induced vertical constituent transport, and tide-induced perturbation of vertical wind and Na density, based on the lidar

measurements at Poker Flat, Starfire Optical Range, and Ft. Collins. Gardner provided a comprehensive summary of four mechanisms (advection, turbulent mixing, dynamical and chemical transport) contributing to gravity-wave-induced vertical constituent transport that is characterized by vertical flux. The following two talks were about the chemistry of meteoric K, Na, and Fe layers measured from Arecibo and Boulder. Fritts provided numerical simulations of middle atmosphere influenced by multi-scale dynamics.

The new data and simulations presented at this workshop are intriguing to the CEDAR middle and upper atmosphere community. In particular, the first-ever observations of thermospheric Fe layers may have opened a new field for the study of thermosphere. Apparently, the 2-hour workshop was too short to allow extensive discussion. The active lidar campaigns and lidar developments currently pursued by CEDAR researchers call for a longer workshop for next CEDAR.

Below is a list of the speakers and presentation titles:

1. Xinzhao Chu (Univ. of Colorado): First and Newest Results from McMurdo Lidar Campaign

2. Rich Collins (Univ. of Alaska): Estimates of vertical eddy diffusivity and energy dissipation in the upper mesosphere in the presence of a mesospheric inversion layer

3. Chet Gardner (Univ. of Illinois): Wave-induced Vertical Constituent Transport in the Mesopause Region

4. Titus Yuan (Utah State Univ.): Monthly-mean Tidal Perturbations of Na Density and Vertical Wind based on Full-Diurnal Cycle Na Lidar Observations at Fort Collins, CO

5. Jonathan Friedman (Arecibo Observatory): Sporadic metal atom and ion layers and their connection to chemistry and thermal structure in the mesopause region at Arecibo

6. Wentao Huang (Univ. of Colorado): Simultaneous Observations of Na and Fe Layers at Boulder in 2010

7. Dave Fritts (CoRA): Simulations of Multi-Scale Dynamics and Implications for Lidar Measurements in the MLT

8. Gary Swenson (Univ. of Illinois): Status reports of Chile campaign and He resonance lidar

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