



# Division of Atmospheric Sciences

*Science*

*Environment*

*Solutions*

A. Gannet Hallar  
Director  
gannet.hallar@dri.edu

Ian B. McCubbin  
ian.mccubbin@dri.edu

Division Atmospheric Sciences  
Desert Research Institute

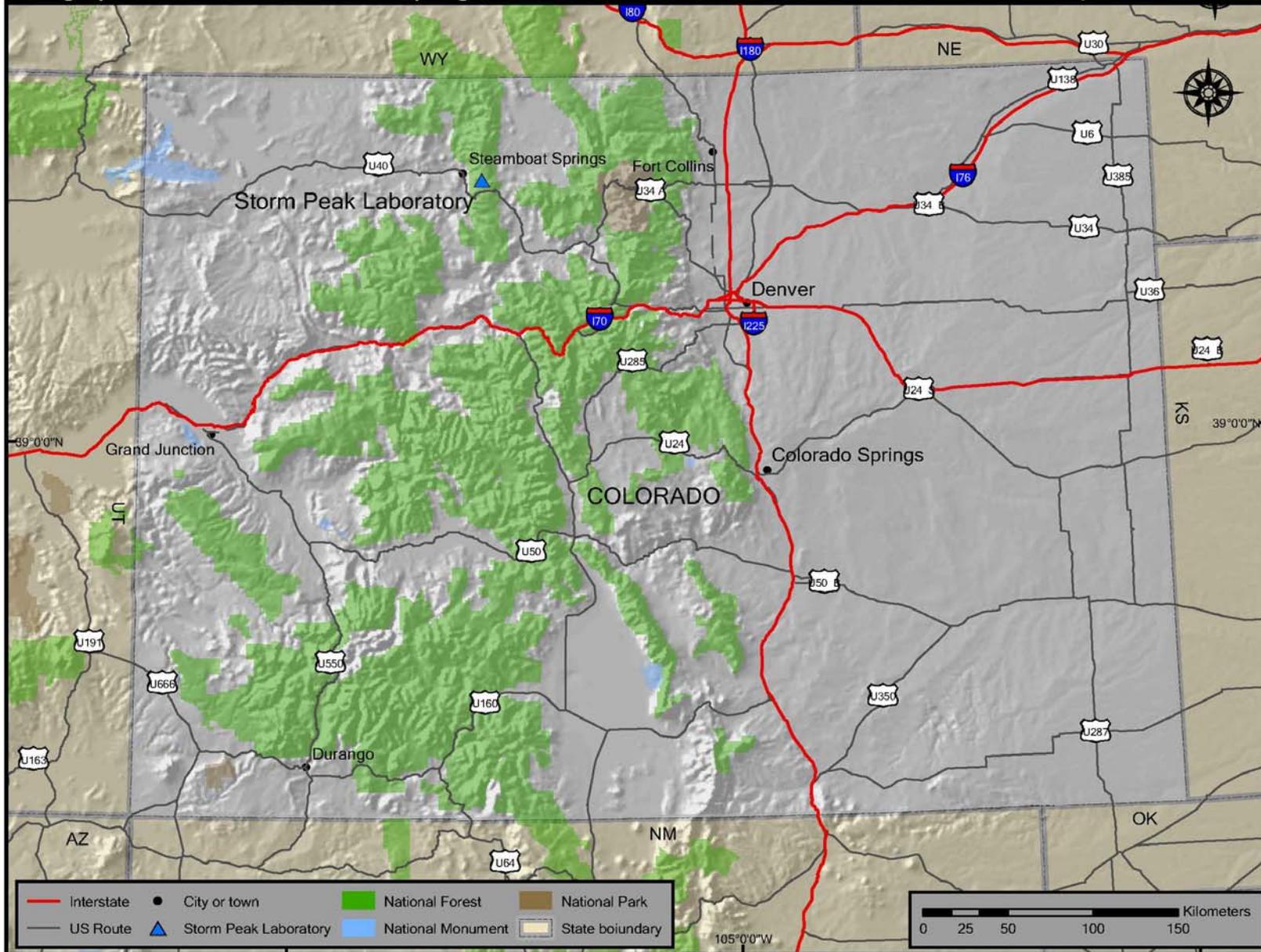
Storm Peak Laboratory  
P.O. Box 882530  
Steamboat Springs, CO 80488  
Cell Phone: 720-771-9490



***Unique, high elevation, mountain-top atmospheric research facility readily accessible under all weather conditions!!!***

Storm Peak Laboratory  
Geographic Location - Steamboat Springs, CO

Desert Research Institute  
Division of Atmospheric Sciences





**Mountain Trail Key:**

- Mountain Bike Trails
- Hiking Trails
- Gondola
- Other lifts (closed in summer)
- Trailhead
- Information
- Emergency phone
- Picnic
- Restrooms
- Handicapped access
- Dining

Control your speed. Ride designated trails only.



Recreation on this public land is provided by a unique partnership between the Steamboat Ski & Resort Corporation and the Medicine Bow/Rout National Forest. The Steamboat Ski & Resort Corporation is committed to the wise use of our natural resources, as well as the preservation and enhancement of the Medicine Bow/Rout National Forest. Our efforts in this area include the improvements of wildlife habitat, erosion control, water conservation and recycling of waste products, along with the use of recycled materials when possible. We hope you will join us in our commitment to preserve our environment by helping to keep your National Forest lands beautiful.

- Located at Steamboat Ski Resort
- Elevation: 3.2 km (10,500 ft)
- In cloud ~30% of time
- Mix Phased Clouds
- Free Tropospheric Air
- Year-Round Access
- 9 Person Bunkhouse
- Full Kitchen
- Facility Instruments

# *STORM PEAK LABORATORY (SPL)*

## *MISSION STATEMENT:*

*To ensure that the Storm Peak laboratory will continue to integrate research and education by advancing discovery and understanding within the field of aerosol and cloud interactions.*



# Field Courses

- Atmospheric Science Winter Field Courses
  - Currently used by 5 Universities for atmospheric science field courses (Graduate and Undergraduate):
    - UNR, U of Wisc., Colo State, CCNY, U of Calagry
- Working on Developing Summer Field Courses
  - NSF Proposal for Undergraduate Courses promoting diversity in geosciences



# Current Equipment

- Particles are sampled from an insulated manifold - Temperature and RH measured
- Condensation nucleus (CN) concentrations
  - TSI 3025 and 3010 CN counters (CNC)
- Cloud droplet size distributions
  - DMT SPP-100 forward scattering spectrometer
  - DMT modified PMS-2DP precipitation probe

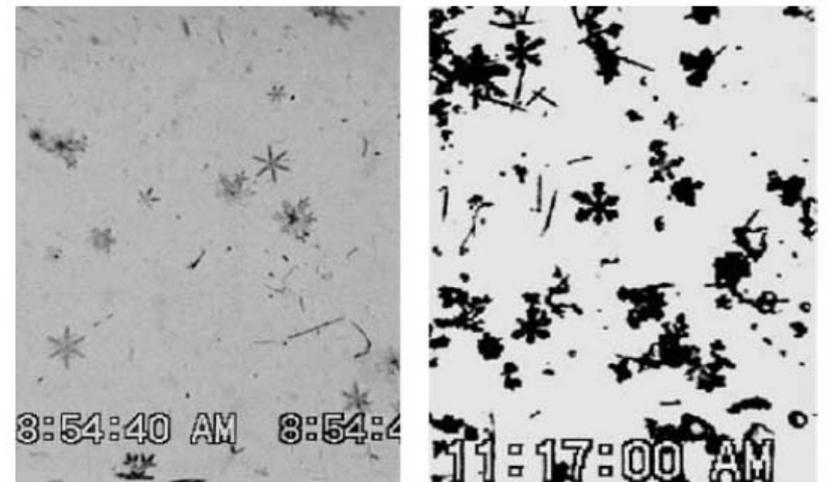


- CO<sub>2</sub> Measurement
- O<sub>3</sub> Measurement
- Shadowband Radiometer
- Pyranometer
- Snow Video Spectrometer
  - Cold Room with Microscopes
- Aerosol size distributions
  - TSI SMPS and APS 3320
- DMT Cloud Condensation Nuclei (CCN)
- Multiple On-Mountain Meteorological Stations

# Examples of Research of Cloud and Aerosol Interactions at SPL

- Investigate the second indirect aerosol effect
- Less accumulated snow water equivalent (SWE) will precipitate to the surface due to the reduction of ice particle growth by riming when anthropogenic aerosol is present
- Sulfate concentration for unrimed case was ~9 times higher than found in the rimed case

Citation: Borys, R.D., D. H. Lowenthal, S. A. Cohn, and W. O. J. Brown, 2003



**Figure 5.** Video images of snow particles on Feb. 15 (left) and Feb. 19 (right).

# Current Modeling Capabilities of SPL area

- Colorado State University- Regional Atmospheric Modeling System (RAMS) model has the capability of snow fall prediction in the area utilizing cloud microphysics
- Uses a bin-wise size approach
- Being utilized to perform high resolution mesoscale simulations (750m grid spacing) focused over the Storm Peak Lab

# Creating ARM IOP at Storm Peak

Jay Mace, University of Utah; Roj Machand, PNNL  
Gannet Hallar and Ian McCubbin, DRI/Storm Peak Lab

## Science Objective

Validation of millimeter wavelength (cloud) radar retrievals  
with in situ measurements



# ARM Proposal

Next Winter, Jan. - March 2008

## ■ Test Concept

- Have either (1 scanning) radar or 2 (one vertical, one pointing just above SPL) radars from the nearby valley floor
- Provide millimeter radar datasets that can be used to
  - Determine if the distribution of reflectivities directly above the radar are different from those near the *in situ* site
  - Provide a LONG time series of *in situ* observations and radar reflectivity measurements that can be used to test radar retrievals.

# Previous and Current Radar measurements at the Base

- NSF project titled “Inhibition of Snowfall by Pollution Aerosols” (ISPA), P.I. Randy Borys
  - **Measurements at Storm Peak in 2001 and again this winter**
- MAPR (Multiple Antenna Profiler Radar) is wind profiler radar at NCAR to make rapid measurements of the boundary layer (Cohn et al., 2001).
- MAPR is transported in trailer

Part of “Integrated Sound System”  
Includes radiosonde soundings, a meteorological tower, solar radiation and other sensors. (Parsons et al., 1994)



# Following Winter, Jan.-March 2009

- Intensive Operating Period
  - Using full ARM Mobile Facility
  - Could be an excellent opportunity for Aerosol Working Group



**You are invited to see the lab.**

**<http://stormpeak.dri.edu>**

**Expect Updates to the website soon!**

**Contact us with any questions or comments.**

**Gannet.hallar@dri.edu**

**Ian.mccubbin@dri.edu**