Overview: The Rocky Mountain Regional Atmospheric Continuous CO2 Network (Rocky RACCOON) includes four high-alpine sites and two valley sites instrumented for continuous measurements beginning in August of 2005. We are utilizing these growing records to provide information on regional carbon exchange in the U.S. Central Rocky Mountains and Southwest, as well as to monitor the impact of disturbance on local valley-scales, with a goal of resolving key drivers of variability and trends in the carbon fluxes of mountain and semi-arid ecosystems, including drought, fire, and insect outbreak. Our data are available to the public on the internet in near real time to support quality control, local science, and larger scale synthesis efforts (http://raccoon.ucar.edu).

Panel 1. Existing Sites
The mountain-top RACCOON sites were selected to capture regionally representative air samples during well-mixed daytime or descending nighttime conditions. These include:
- Niwot Ridge (NWR) at 3523 m just west of Ward, Colorado
- Storm Peak Laboratory (SPL) at 3200 m near Steamboat Springs, Colorado
- Hidden Peak (HDP) at 3351 feet elevation near Snowbird, Utah
- Roof Butte (RBA) at 2982 m within the Navajo Nation in northeastern Arizona

An additional valley-bottom site was selected to observe the nighttime build-up of respired CO2, but also produces daytime values similar to the other sites:
- Fraser Experimental Forest (FEF) at 2743 m in the St. Louis Creek Valley near Fraser, Colorado

While another site intended to capture regional signals has turned out to also be sensitive to valley pooling:
- Entrada Field Station (EFS) at 1280 m northwest of Moab, Utah

Panel 2. Diurnal Variations
During summer, all sites show the influence of nighttime respiration and the onset of mixing and photosynthesis in the morning, however with important differences. NWR, HDP, and RBA show increasing CO2 during the afternoon while CO2 at SPL decreases. In winter the mountain-top sites show varying influences from the daytime lifting of valley CO2 pools.

Panel 3. Comparisons to Background Concentrations
After filtering afternoon (1200-1600 LST) data for hourly standard-deviations < 1.0 ppm and local vertical gradients < 0.5 ppm, we compare to the GlobalView marine boundary-layer reference curve. These comparisons show consistent regional-scale flux signals that increase to the east, with a narrow upturn peak in spring and broad emission in fall and winter.

Panel 4. CarbonTracker Data Assimilation
Since 2007, data from NWR and SPL have been included in the NOAA CarbonTracker modeling effort. Inclusion of these sites led to decreased model uptake in coniferous forests and grasslands and increased model uptake in croplands in North America. However, coarse model topography combined with ingesting data at height above sea-level results in the sites being 1000 m above ground, and having unrealistic diurnal cycles. We are collaborating with the CarbonTracker team to improve the treatment of these mountain-top sites.

Panel 5. Pine Bark Beetle Effects
The FEF measurements have spanned almost complete mortality of the local lodgepole-pine dominated forest due to beetle infestation. Nighttime valley CO2 has in fact decreased over this period, indicating that the reduction in autotrophic respiration from formerly living trees has been greater than any increased heterotrophic respiration of dead organic matter.