

FINAL PROGRESS REPORT

Long-Term Assessment of Isotopic Exchange of Carbon Dioxide in a Subalpine Forest
(Niwot Ridge AmeriFlux Site)

Project ID: 0010768
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Major participants on this project:

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With funding from DOE-TCP through the joint NASA/DOE/USDA Carbon Cycle Science Program, in 2005 we began a long-term measurement program of CO₂ and its stable isotopes at the Niwot Ridge AmeriFlux site. Measurements are ongoing. The project design has been described in earlier project reports.

This final progress report follows a one-year no-cost extension. Apparently, DOE did not request a final progress report in 2008, and we did not submit one. This final report was requested by DOE in May 2014, and is being written in retrospect, but with a focus on the elements that were in progress during the one-year extension.

The long-term measurements of CO₂ isotopes that began with award DE-FG02-04ER63904 are ongoing in 2014 and have continued since 2005 uninterrupted.

Papers that resulted from this award (note that analyses continue and we are still publishing papers from this work many years later).

- Bowling, D. R., A. P. Ballantyne, J. B. Miller, S. P. Burns, T. J. Conway, O. Menzer, B. B. Stephens, and B. H. Vaughn. 2014. Ecological processes dominate the ¹³C land disequilibrium in a Rocky Mountain subalpine forest. *Global Biogeochemical Cycles*:2013GB004686.
- Bowling, D. R., and W. J. Massman. 2011. Persistent wind-induced enhancement of diffusive CO₂ transport in a mountain forest snowpack. *Journal of Geophysical Research* 116:15 PP.
- Bowling, D. R., W. J. Massman, S. M. Schaeffer, S. P. Burns, R. K. Monson, and M. W. Williams. 2009a. Biological and physical influences on the carbon isotope content of CO₂ in a subalpine forest snowpack, Niwot Ridge, Colorado. *Biogeochemistry* 95:37–59.
- Bowling, D. R., J. B. Miller, M. E. Rhodes, S. P. Burns, R. K. Monson, and D. Baer. 2009b. Soil, plant, and transport influences on methane in a subalpine forest under high ultraviolet irradiance. *Biogeosciences* 6:1311–1324.
- Bowling, D. R., D. E. Pataki, and J. T. Randerson. 2008. Carbon isotopes in terrestrial ecosystem pools and CO₂ fluxes. *New Phytologist* 178:24–40, doi: 10.1111/j.1469-8137.2007.02342.x.
- Moyes, A. B., A. J. Schauer, R. T. W. Siegwolf, and D. R. Bowling. 2010. An injection method for measuring the carbon isotope content of soil carbon dioxide and soil respiration with a tunable diode laser absorption spectrometer. *Rapid Communications in Mass Spectrometry* 24:894–900.

- Riveros-Iregui, D. A., J. Hu, B. S.P., D. R. Bowling, and R. K. Monson. 2011. An interannual assessment of the relationship between the stable carbon isotopic composition of ecosystem respiration and climate in a high-elevation subalpine forest. *Journal of Geophysical Research* 116, G02005:doi:10.1029/2010JG001556.
- Schaeffer, S. M., D. E. Anderson, S. P. Burns, R. K. Monson, J. Sun, and D. R. Bowling. 2008a. Canopy structure and atmospheric flows in relation to the $\delta^{13}\text{C}$ of respired CO_2 in a subalpine coniferous forest. *Agricultural and Forest Meteorology* 148:592–605.
- Schaeffer, S. M., J. B. Miller, B. H. Vaughn, J. W. C. White, and D. R. Bowling. 2008b. Long-term field performance of a tunable diode laser absorption spectrometer for analysis of carbon isotopes of CO_2 in forest air. *Atmospheric Chemistry and Physics* 8:5263–5277.
- Zobitz, J. M., S. P. Burns, J. Ogée, M. Reichstein, and D. R. Bowling. 2007. Partitioning net ecosystem exchange of CO_2 : A comparison of a Bayesian/isotope approach to environmental regression methods. *Journal of Geophysical Research* 112:G03013, doi:10.1029/2006JG000282.
- Zobitz, J. M., S. P. Burns, M. Reichstein, and D. R. Bowling. 2008a. Partitioning net ecosystem carbon exchange and the carbon isotopic disequilibrium in a subalpine forest. *Global Change Biology* 14:1785–1800.
- Zobitz, J. M., J. P. Keener, H. Schnyder, and D. R. Bowling. 2006. Sensitivity analysis and quantification of uncertainty for isotopic mixing relationships in carbon cycle research. *Agricultural and Forest Meteorology* 136:56–75.
- Zobitz, J. M., D. J. P. Moore, W. J. Sacks, R. K. Monson, D. R. Bowling, and D. S. Schimel. 2008b. Integration of process-based soil respiration models with whole-ecosystem CO_2 measurements. *Ecosystems* 11:250–269.

Public datasets available from this award:

Tunable diode laser data from this project (2003-present) are publicly available via the project website:

(http://biologylabs.utah.edu/bowling/niwot_data.html)

Data from the forest, tundra, and aircraft sites (site codes NWF, NWR, CAR, respectively) are publicly available via the NOAA/GMD website:

(<http://www.cmdl.noaa.gov/ccgg/iadv/>).