The effect of precipitation on the surface energy budget, carbon dioxide, and environmental conditions at a Colorado subalpine forest site

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Changing meteorological and environmental conditions affect fluxes; model analysis has shown that environmental variability directly accounts for about half the interannual variability in net ecosystem exchange (NEE) of CO_2 whereas the other 50% is due to biotic responses to these changing variables (Richardson et al. 2007). In our study, thirteen years (1998-2011) of turbulent flux measurements of sensible heat, water vapor, and CO_2 at the Niwot Ridge AmeriFlux site (Monson et al. 2002) are examined with respect to meteorological conditions (atmospheric temperature, stability, precipitation, and cloudiness) as well as changes in environmental conditions, such as snow depth and soil moisture. The typical yearly cycle and an estimate of the magnitude of year-to-year variability in the diurnal fluxes and other variables for this high-elevation subalpine forest ecosystem are presented. Wintertime ecosystem respiration has an average NEE of 0.4 $\mu\mathrm{mol\,m^{-2}\,s^{-1}}$ with an interannual range between 0.2-0.6 $\mu\mathrm{mol\,m^{-2}\,s^{-1}}$. Uptake of CO_2 in late summer has an average NEE of -1.5 $\mu\mathrm{mol\,m^{-2}\,s^{-1}}$ with an interannual range between -1 to -2 $\mu\mathrm{mol\,m^{-2}\,s^{-1}}$.

Previous studies at the Niwot Ridge AmeriFlux site have described the importance of photosynthetic photon flux density (PPFD) (Monson et al. 2002) and also growing season length (Hu et al. 2009) on NEE. In this study we use multiple years of tower measurements to look at how precipitation modifies the diurnal cycle of the surface energy balance as well as NEE and vertical profiles of CO_2 mole fraction at the site.

References:

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