

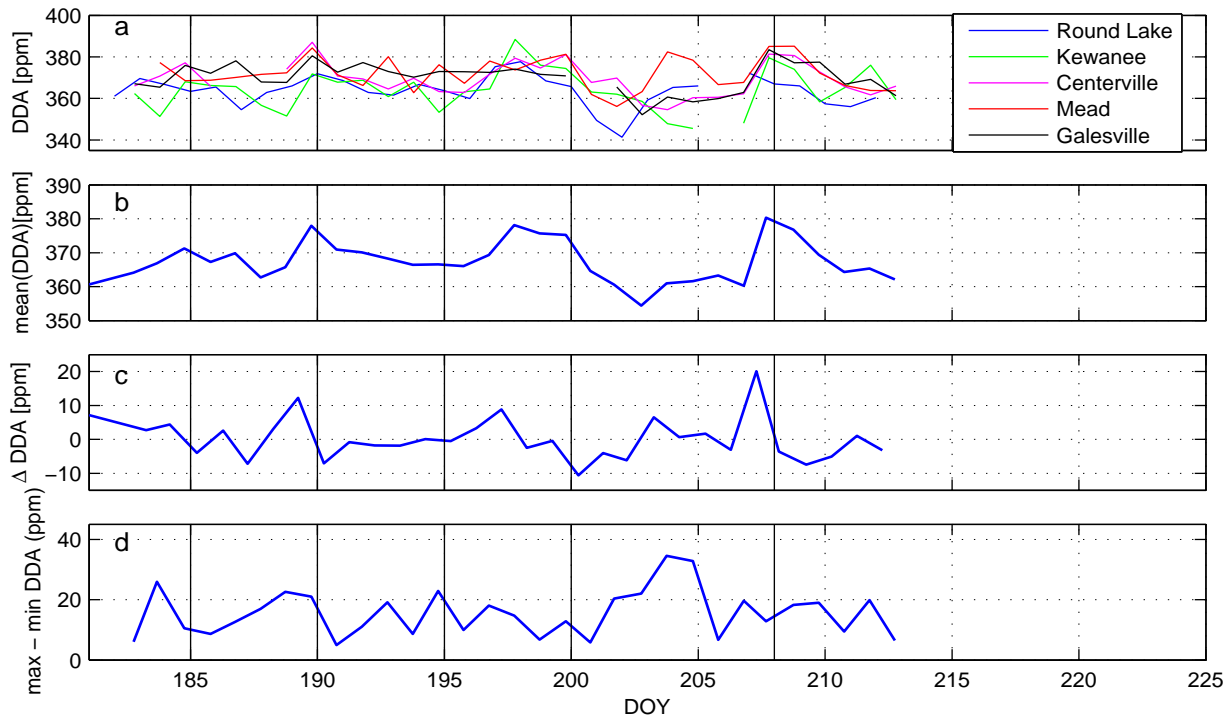
# Temporal and Spatial Patterns in Regional and Continental-Scale CO<sub>2</sub> Mixing Ratio Measurements

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The study of the terrestrial carbon cycle is currently data limited, but the number of well-calibrated tower-based CO<sub>2</sub> mixing ratio measurements has increased dramatically within the last five years. We present results from two such datasets: a campaign-based group of five sites for the North American Carbon Program’s (NACP) Mid Continent Intensive (MCI) and a long-term group of four sites at Ameriflux towers. The MCI CO<sub>2</sub> measurement systems (“Ring 2”) are based on cavity ring-down spectroscopy, and the locations are regional in scale (surrounding the state of Iowa). If the measurements are shown to be spatially dense enough to over sample the CO<sub>2</sub> mixing ratio, the experiment will provide an upper bounds on the density of measurements required to produce the most accurate flux calculations possible with current atmospheric inversions; thus we are particularly interested in the spatial gradients between the sites. In Figure 1, the synoptic scale pattern in the daily daytime mean CO<sub>2</sub> mixing ratio (b) (the average of the sites shown in (a)) is associated with the passage of fronts through the region. For the month of July 2007, there are eight local extrema; these are correlated with the frontal passages. The change in site-averaged DDA per day is shown in (c). The variability amongst the sites (d) changes throughout the month as well, with some days having less than 5 ppm difference between the sites, whereas others having more than 20 ppm difference. The other dataset, the Ameriflux CO<sub>2</sub> measurement systems, are based on non-dispersive infrared sensors, and the locations are continental in scale. With the continental scale data, and incorporating the regional scale MCI data, we can also investigate seasonal patterns in the weekly mean data.



**Figure 1.** (a) Daily daytime average (DDA) CO<sub>2</sub> mixing ratio at the five “Ring 2” MCI sites for the month of July 2007. Vertical lines indicate approximate times of frontal passages through the region. (b) DDA averaged over the five sites. (c) Change in site-averaged DDA per day. (d) Difference between maximum and minimum DDA amongst the five sites.