Combining GLCC mapping and chamber based flux measurements (Figures 1 and 2) designed for field use provides a tool for both leak detection and quantification. The ability to perform GLCC mapping and chamber based flux measurements with a single instrument from soil. Accumulation chamber based measurements provide a means of directly quantifying fluxes of CO$_2$ relative to background level. Absolute CO$_2$ concentrations by taking advantage of its integrated power, data storage and sampling hardware. By integrating a global positioning system with the instrument, CO$_2$ concentration can be rapidly mapped over large spatial scales. By combining CO$_2$ mapping and chamber based flux measurements, the instrument can be used to rapidly screen large areas for potential leaks and measure leak rates at “hot spots” with accuracy.

Mapping ground level CO$_2$ concentrations (GLCC) in an urban environment (Figures 3, 4, and 5)

- GLCC was measured along a seven-mile transect in Lincoln, NE, on June 24, 2010.
- During the measurement period, wind speeds were low: <2 m s$^{-1}$.
- Intake tube height was between 10 and 15 cm above ground level.
- Spatial data paired with CO$_2$ concentration was imported into Google Earth as a .kml formatted file.
- The data demonstrates that the measurement technique is sensitive, with changes in GLCC reflecting changes in land cover along the transect.

Combining GLCC mapping and chamber based flux measurements (Figures 3, 4, and 5)

- Measurements of GLCC and soil CO$_2$ flux were made at the Zero Emissions Research Technology (ZERT) site in Bozeman, MT, during July 19 through 22, 2010.
- See Spangler et al., 2009, for a detailed site description of the ZERT facility.
- A subsurface CO$_2$ release was performed to generate an artificial “leak” for the testing of various leak monitoring technologies.
- GLCC mapping proved effective in rapidly identifying hot spots of CO$_2$ release.
- Soil CO$_2$ flux measurements were able to quantify CO$_2$ release at the hot spots with a high degree of accuracy (mean $r^2$ from curve fits of fluxes greater than 100 µmol m$^{-2}$ s$^{-1}$ = 0.997).
- Areas of maximum soil CO$_2$ flux overlaid areas where the maximum GLCC was measured (Figure 5B).

Conclusions

- GLCC mapping can be used as a rapid assessment tool for identifying alterations in CO$_2$ concentration relative to background conditions.
- Absolute CO$_2$ concentration measured by GLCC mapping is sensitive to both wind speed and direction, and intake tube height.
- Accumulation chamber based measurements provide a means of directly quantifying fluxes of CO$_2$ from soil.
- The ability to perform GLCC mapping and chamber based flux measurements with a single instrument designed for field use provides a tool for both leak detection and quantification.

References