Anthropogenic sources of carbon dioxide (CO$_2$) represent a significant portion of the global carbon budget, but partitioning CO$_2$ measurements into their biogenic and anthropogenic sources has been difficult using only measurements of CO$_2$ abundances and those of a small number of additional tracers. An intensive field campaign was conducted in Fall 2010 at the Atmospheric Radiation Measurement-Southern Great Plains (ARM-SGP) Central facility near Lamont, OK to measure CO$_2$ and several tracers for its sources using a new mobile laboratory. Two trucks carrying over fifteen instruments for gases and particles were deployed along with a gas-calibration system. Air was drawn into both trucks from a 10-m tall mast. All measurements were made either from a common inlet or closely located inlets. Instruments were selected to provide measurements of tracers of both biogenic and anthropogenic sources. High-frequency measurements of abundances of CO$_2$ and its stable isotopologues ($^{13}$CO$_2$ and C$^{18}$O) were made simultaneously with measurements of CO, SO$_2$, NO$_x$, O$_3$, CH$_4$, water vapor isotopologues (H$_2$O, HD, and H$_2$O$_2$), volatile organic compounds, black and organic carbon aerosol, and particle count. Automated flask samplers collected whole air samples for off-line $^{14}$C analysis using accelerator mass spectrometry. Redundancy between CO$_2$, CH$_4$, and H$_2$O measurements provided a valuable crosscheck for the calibrations and the measurements. Good agreement between CO$_2$ measurements from four different instruments was attained following careful post-processing and calibrations. Similarly good agreement was demonstrated between four instruments that measured water vapor and two instruments that measured CH$_4$. The agricultural region that surrounds the ARM-SGP site had experienced little rainfall prior to the campaign, and land cover and crop growth were minimal during the period in which measurements were made (3 October - 9 November 2010). Correlations between various tracers and CO$_2$ provide insight into the different sources, including the anthropogenic component, which includes biomass and fossil fuel combustion.

Figure 1. Time series of $^{13}$C-CO$_2$, $^{14}$C-CO$_2$, $^{18}$D-H$_2$O, H$_2$O, and CO measured during the campaign. High $^{13}$C and $^{14}$C are associated with low CO, $^{18}$D -H$_2$O, and H$_2$O and air from high altitudes. Low $^{13}$C and $^{14}$C and high CO, $^{18}$D-H$_2$O, and H$_2$O are associated with air from low altitudes within the past few days.