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Mapping greenhouse gas emissions in the Los Angeles basin by remote sensing using a Fourier Transform Spectrometer on Mt. Wilson

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Carbon dioxide (CO_2) and methane (CH_4) are long-lived greenhouse gases (GHGs) that play crucial roles in climate change. According to the 2007 IPCC report, anthropogenic CO_2 and CH_4 contribute 80% of the radiative forcing from all long-lived GHGs and more than two-thirds of the radiative forcing from all GHGs. Since megacities, such as Los Angeles, are significant sources of anthropogenic GHGs, it is critical to monitor their emissions. Currently, top-down estimates of GHGs are based on in-situ measurements, at the ground or by aircraft, and satellite data. However, these measurements have limitations – in-situ ground measurements are too sensitive to local emissions, aircraft measurements are too expensive for long-term observations and satellite measurements are usually not sensitive to emission variations in the boundary layer, where emissions are located. Here we present the estimations of greenhouse gases using ground-based remote sensing. A Fourier Transform Spectrometer (FTS), located on Mt Wilson at 1.7 km ASL, points downward at 29 different targets in the Los Angeles basin to measure the slant column abundances of CO_2, CH_4, N_2O and CO using reflected sunlight in the near- infrared region. This technique allows the spatial coverage of the Los Angeles basin at different times of the day. In addition, we measure GHG column abundances above Mt. Wilson using the direct solar beam. Here we present 1-year of data acquired during the period from August 2011 to August 2012. Using direct sun measurements, the contribution above Mt. Wilson is subtracted in order to calculate the basin contribution. The path-averaged dry-air mixing ratio, XCO_2, XCH_4 and XCO, in the Los Angeles basin showed significant spatial and temporal variability and covariance. Using morning XGAS values as background values, we computed the XGAS excess assigned to anthropogenic emissions. Here we present the maps of emission ratios of CH_4:CO_2, CH_4:CO and CO:CO_2 calculated using XGAS excess in the Los Angeles basin and comparisons between ratios calculated from in-situ and total column data.