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Urban Greenhouse Gas Emissions Monitoring in Davos, Switzerland, Before, During and After the World Economic Forum Annual Meeting 2012

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Efforts to reduce anthropogenic greenhouse gas emissions require validation. Atmospheric measurements capture all emissions, and provide a unique and powerful means of continuous validation and feedback. To demonstrate the utility of real time greenhouse gas measurements, in-situ GHG mixing ratio instruments were deployed in Davos, Switzerland to measure emissions from the city before, during and after the World Economic Forum (WEF). Three Instruments were deployed at two separate locations over 3 months (late December 2011 to February 2012). One site was located in the middle of the Davos urban area and a second site was located out of the valley in the surrounding mountains. Carbon Dioxide (CO_2), Methane (CH_4), Carbon Monoxide (CO) and water vapor (H_2O) were measured continuously by Picarro G2401 instruments at both sites. Additionally, a Picarro flux analyzer was deployed in the city to evaluate the inverse fluxes. The mesoscale atmospheric model, WRF nudged to meteorological observations (WRF-FDDA), was used to simulate the transport of GHG over the valley of Davos at 1.3km resolution. A Mini Micro Pulse LiDAR (MiniMPL) from Sigma Space was deployed to evaluate the simulated planetary boundary layer depth from the WRF-FDDA model. The initial flux estimates for CO_2 were constructed based on inventories reported for 2005. CO_2 mixing ratio measurements prior to WEF suggest the difference between modeled (real-time) and inventory (annual) emissions to be on the order of +40%. The enhancement is likely due to the increased use of heating fuel in the winter. We present here the temporal variability in the inverse fluxes, which are correlated with a cold wave severely affecting Western Europe during the past winter, as well as changes in anthropogenic activities during the week of the WEF meeting. Also presented are new analyses of composite diurnal cycles of hourly CO/CO_2 ratios, which provide additional information on the contributions of traffic relative to heating fuel. The absence of traffic peaks during the WEF meeting, indicate a change in road emissions potentially responsible for the observed decrease in the city emissions during the meeting.

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