Boulder Fluid and Thermal Sciences Seminar Series

Tuesday, May 24, 2016
3:45pm-4:45pm (refreshments at 3:30pm)
ECCR 155 in the Engineering Center
University of Colorado, Boulder

Top-Down Regional GHG Inversions and Uncertainty Quantification

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Urban emissions of Greenhouse Gases (GHG) represent about 70% of the global emissions. These emissions could increase rapidly as large metropolitan areas are projected to grow twice as fast as the world population in the coming 15 years. Monitoring these emissions will require the use of independent approaches to implement transparent regulation policies. As a first step toward a robust verification system, a high-resolution atmospheric inversion was developed to quantify carbon emissions from cities and larger metropolitan areas. The system is tested with in-situ measurements of CO_2 and CH_4 from the Indianapolis Flux Experiment (INFLUX), the largest and densest deployment of GHG in situ measurements within one metropolitan area. Uncertainties from the different components of the system are explored with sensitivity tests. The assimilation of meteorological data to improve the performance of atmospheric models is presented for various sources of observations such as surface stations, aircraft, rawinsondes, and ground-based Doppler Lidars. Large Eddy Simulations are compared to mesoscale plumes to better represent the local transport and identify potential biases in mesoscale simulations. Because fine-grained emission inventories (such as Hestia) are likely to be unavailable for every city, GHG emission products based on remotely-sensed data such as ODIAC are tested as an alternative to describe fine spatial emission structures across urban domains. Finally, column XCO2 observed from satellites (here OCO2) are compared to high-resolution model results to better understand how to utilize space-based information within urban GHG monitoring frameworks.

Biography: Thomas Lauvaux has developed atmospheric inversion systems to quantify sources and sinks of carbon at regional scales. He works on carbon cycle data assimilation systems for Earth sciences in support of climate policies over agricultural landscapes, natural ecosystems, and over centers of human activities such as large cities and natural gas shales. Among other projects, he is currently participating to a large research effort to quantify carbon emissions from urban centers (INFLUX project) in order to monitor and verify mitigation policy efforts in large metropolitan areas. He has implemented different greenhouse gas mesoscale inversion systems assimilating tower and aircraft in situ data, remote sensing data from satellite and ground-based sensors, and now combining meteorological assimilation systems with carbon inversions.