**NASA DEVELOP National Program**

NASA Jet Propulsion Laboratory

**Summer 2015**

**Los Angeles Health and Air Quality**

**Identifying Urban Emission Patterns in Los Angeles**

**VPS Title:** Identifying Urban Emission Patterns in the Los Angeles Megacity

**Project Team & Partners**

**Project Team:**

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**Past or Other Contributors:**

Los Angeles Health and Air Quality: Detecting Policy Relevant Greenhouse Gas Emission

Reduction Scenarios for Los Angeles Utilizing Current and Future Remote Sensing

Capabilities - Summer 2012 (JPL*)*

**Partner Organizations**

California Air Resources Board (CARB), End-User/Collaborator, POC: Abhilash Vijayan (Manager:

Greenhouse Gas Technology & Field Testing Section)

**Project Details**

**Applied Sciences National Applications Addressed:**

Health and Air Quality

**Study Area:**

Greater Los Angeles Area: South Coast Air Basin (Los Angeles County, Orange County, Riverside County, and San Bernardino County)

**Study Period:** 2012 – Present

**Earth Observations & Parameters**

* Mt. Wilson Observatory, CLARS – CH4, CO, and CO2 “slant” column observation
* Los Angeles *In Situ* measurement network
* TCCON sites in Pasadena and Edwards, CA
* GOSAT – Methane and CO2 total column retrievals

**Ancillary Datasets Utilized**

* California Air Resources Board (CARB) emission inventories
* California Greenhouse Gas Emissions Measurements Project (CALGEM)
* Emissions Database for Global Atmospheric Research (EDGAR4.2)
* Publically available spatial datasets of methane emission sources
  + U.S. Energy Information Administration (EIA)
  + Southern California Association of Governments (SCAG)
  + United States Geologic Survey (USGS)

**Models Utilized**

* Models include: Buildings, energy use, traffic emissions, etc. Part of this work will involve determining the most appropriate models for each GHG emissions sector and will be described in the documentation of this work.

**Software Utilized**

* ArcGIS - data visualization, data processing, data analysis, developing cartographic products
* QGIS & Open GeoServer - publishing and consuming vector, raster, and tabular data online
* R Software or Excel - statistical analysis of data
* Matlab or Python - statistical analysis of data and data visualization
* Google Earth - data reference

**Project Overview**

**80-100 Word Objectives Overview**

The end-goal is to develop a spatial representation of methane emissions in the South Coast Air Basin (SCB). To accomplish this, different sources of GIS spatial layers that symbolize methane emission sources will be collect, process, standardize, and analyzed. Using the expertise from the JPL climate & science advisors and CARB partners, we will add estimated emission factors for each methane related spatial layer appropriately. Finally, this data will be used to create raster-based maps of the spatial distribution of methane emissions in the SCB. The GHG inventory created in this work will be used as a prior for future simulations like the Weather Research and Forecasting (WRF) Model for GHG emissions and the Large Eddy Simulation (LES) simulation for quantifying CH4 emissions in the South Coast Air Basin.

**Abstract**

Combining greenhouse gas (GHG) datasets with GIS spatial modeling is a viable method for analyzing the distribution of GHG emissions. Understanding the spatial dynamics of GHG emissions is very important in the realm of global climate modeling and forecasting, especially as it relates to predicting the effects of global warming and the development of state and federal policies. This research presents a spatial model of methane emissions in the Southern California Air Basin. Point sources of methane emissions are established through the development of a geospatial database. These spatial datasets are combined with the estimated emissions factors as rated and inventoried by the California Air Resources Board (CARB). The raster-based spatial map of methane emissions illustrates the potential of spatial modeling for accurately depicting GHG emissions in a megacity, such as greater Los Angeles. This data provides a baseline against which measurements collected by NASA Jet Propulsion Laboratory’s Climate Science Department, chiefly the Megacities Carbon Project, can be evaluated.

**Community Concerns**

* Understanding the environmental impacts of anthropogenic activities is crucial for long-term climate modeling and policy making
* Atmospheric CH4 is a prevalent GHG that significantly contributes to elevated surface ozone concentrations across the world (1), and is also a public health concern in urban areas due to contributions to ozone production and explosion hazard
* Current atmospheric CH4 concentrations exceed pre-industrial levels by 2.5 times as a result of both biological and fossil fuel anthropogenic sources (2)
* Policies that aim to reduce CH4 emissions, such as the US Climate Action Plan, require the identification and quantification of dominant source types and locations (2,3)

**Current Management Practices & Policies**

This project will serve as a starting point for similar collaborations between the Megacities project and CARB, and will benefit both parties by demonstrating how emissions factors that they collect and study can be combined with spatial data for higher level analysis. This project will also attempt to prove that these spatial maps can be a viable and accurate solution to their existing methods of analysis.

**Decision Support Tools & Benefits**

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| --- | --- | --- |
| **End-Product** | **Earth Observations Used** | **Benefit & Impact** |
| Emissions Map Series for South Coast Air Basin | Location of CH4 emissions will be determined using the spatial patterns of emissions (some of which are mapped by airborne observation). Total regional CH4 emissions, as measured by CLARS, will be allocated amongst these sectors. | A visual of CH4 emissions distribution can help assess the changes across the SCB region |
| Emissions Data Assessment | (1) How the spatial distribution compares to other CH4 emission datasets  (2) How the new CH4 emission product compares with measurements within the study region | Can potentially offer a viable higher accuracy solution |

**Project Imagery**

**[Insert image here]**

**Caption:** Map of the South Coast Air Basin with the relevant methane emission sources

Image Credit: Megacities Carbon Project | Team: Talha, Isis, Valerie

**Image:** File Name (Please submit your image as a separate .jpeg as well as inserting it in this document)

**Notes:**

References

1. Fiore, A. Linking Ozone Pollution And Climate Change: The Case For Controlling Methane. *Geophysical Research Letters* 2002, *29*.
2. McKain, K.; Down, A.; Raciti, S.; Budney, J.; Hutyra, L.; Floerchinger, C.; Herndon, S.; Nehrkorn, T.; Zahniser, M.; Jackson, R. et al. Methane Emissions From Natural Gas Infrastructure And Use In The Urban Region Of Boston, Massachusetts. *Proc Natl Acad Sci USA* 2015, *112*, 1941-1946.
3. The White House (2014) Climate Action Plan: Strategy to Reduce Methane Emissions. Available at www.whitehouse.gov/sites/default/files/strategy\_to\_reduce\_methane\_emissions\_2014-03-28\_final.pdf. Accessed June 16, 2015.