North American Carbon KML

Using Google Earth for Exploring Atmospheric Observations of Carbon Dioxide for Understanding the North American Carbon Budget

This work was selected as a winner of Google's KML in Research Competition.

Atmospheric concentrations of carbon dioxide (CO2) have increased from approximately 280 ppm (parts per million) to 380 ppm since the beginning of the industrial era. We know that this increase contributes to global climate change. Carbon cycle scientists are trying to understand why plants and oceans are taking up as much carbon as they are, so that they can better predict how these carbon sinks will change in the future. One important way in which scientists gain this understanding is by using atmospheric CO2 concentration measurements, together with information about wind and weather patterns from atmospheric models, to trace back where the releases and uptakes of CO2 are occurring. This information is used together with existing computer models of how plants take up carbon to improve the understanding of what controls variability, in space and time, of carbon sinks.

To understand the carbon cycle, scientists must work with large volumes of data that vary in space and time. This work formats several of these carbon cycle datasets in KML, a descriptive language for geospatial data, so that that data be explored using Google Earth. Google Earth provides a user-friendly interface for viewing spatial and temporal data that be used by a wide range of user groups, including researchers, teachers, and the general public.

This project was led by Dr. Tyler A. Erickson of the Michigan Tech Research Institute (MTRI), a research institute of Michigan Technological University. The visualization was made possible by the ongoing work of many organizations and researchers working in the area of carbon cycle science. In particular, the CO2 concentration measurements were obtained from NOAA's Tall Tower Network of observing sites and the model results were produced through an ongoing NASA-funded project led by Dr. Anna M. Michalak at the University of Michigan, with several members of her PUORG research group contributing data directly for this application. Additional details on models and datasets are described within the KML file itself.

The KML file is an output from an internet-based information system designed for storing, analyzing, and communicating geospatial and temporal data. MTRI researchers build similar systems, based on open-source geospatial software components, to manage data for a wide variety of government clients. The following open source geospatial packages were used to generate the final KML file:

GeoDjango	Python-based geographic web framework
GEOS	2-dimensional geometry modeling and manipulation library
proj.4	cartographic projections library
GDAL/OGR	raster/vector translation and processing libraries
libkml	KML object generation library
numpy / scipy	Python scientific computing libraries
PostgreSQL / PostGIS	open source relational database with geometric object support

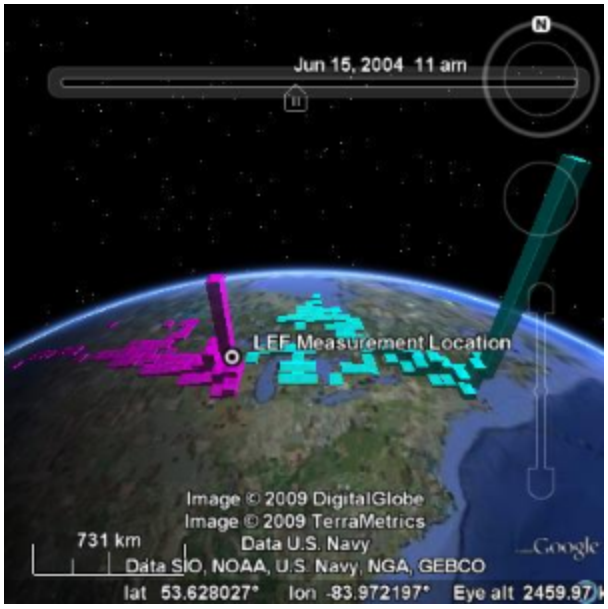
To learn more about this project, contact Dr. Tyler A. Erickson at tyler.erickson@mtu.edu.

Download Dataset

Click on the following icon to access the dataset, which can be viewed in Google Earth.


Jun 4, 2004 10 pm
LEF Measurement Location
Image NOAA
Image © 2009 DigitalGlobe
213 m
Imagery Dates: 2005 - Apr 18, 2006 lat 45.948473° lon -90.268


Jun 30, 2004 3 am
LEF Measurement Location
Image © 2009 DigitalGlobe
Image © 2009 TerraMetrics
1147 km
Data SIO, NOAA, U.S. Navy, NGA, GEBCO
lat 51.433574° lon -90.483029° Eye alt 3810.54


Jun 15, 2004 11 am
LEF Measurement Location
Image © 2009 DigitalGlobe
Image © 2009 TerraMetrics
Data U.S. Navy
731 km
Data SIO, NOAA, U.S. Navy, NGA, GEBCO
lat 53.628027° lon -83.972197° Eye alt 2459.97

(click to enlarge screenshots)