National Aeronautics and Space Administration Goddard Earth Science Data Information and Services Center (GES DISC)

README Document for the Carbon Monitoring System (CMS) data sets on Methane (CH4) Flux for Canadian and Mexican Oil/Gas Systems (CMS_CH4_FLX_CA, CMS_CH4_FLX_MX)

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Revision History

Revision Date	***Changes***	***Author***
6/29/2017	Original Document	Thomas Hearty
6/30/2017	Added science results and time dimension information	Thomas Hearty
3/13/2018	Added flux units	Thomas Hearty

Table of Contents

1.0 Introduction

This document provides basic information for using two Carbon Monitoring System (CMS) datasets:

1. Methane (CH4) Flux for Canadian Oil/Gas Systems L4 0.1 degree x 0.1 degree V1 (CMS_CH4_FLX_CA)
2. Methane (CH4) Flux for Mexican Oil/Gas Systems L4 0.1 degree x 0.1 degree V1 (CMS_CH4_FLX_MX)

1.1 Description of the Data Sets

These data sets contain yearly average methane (CH4) flux for Canadian and Mexican oil and gas systems based on a bottom up calculation of oil/gas emissions reported by ICF International for Canada in 2013 and the Mexican Petroleum Institute in Mexico for 2010. Canadian emissions are concentrated in Alberta (gas production and processing) and Mexican emissions are concentrated along the east coast (oil production). More details about the observations, algorithm, and scientific findings are described in Sheng et al. 2017.

1.2 Carbon Monitoring System (CMS) Description

The NASA Carbon Monitoring System (CMS) is designed to make significant contributions in characterizing, quantifying, understanding, and predicting the evolution of global carbon sources and sinks through improved monitoring of carbon stocks and fluxes. The System will use the full range of NASA satellite observations and modeling/analysis capabilities to establish the accuracy, quantitative uncertainties, and utility of products for supporting national and international policy, regulatory, and management activities. CMS will maintain a global emphasis while providing finer scale regional information, utilizing space-based and surface-based data and will rapidly initiate generation and distribution of products both for user evaluation and to inform near-term policy development and planning.

1.3 Data Disclaimer and Digital Object Identifier (DOI)

The data should not be used in publications without first contacting the investigators. The data sets may be acknowledged in publications using the following DOIs:

Dataset Title	**DOI**
Methane (CH4) Flux for Canadian Oil/Gas Systems L4 V1	10.5067/6K2DW26DXETZ
Methane (CH4) Flux for Mexican Oil/Gas Systems L4 V1	10.5067/RZAQB50RV3BS

2.0 Data Organization

These data are yearly average values provided on a 0.1 degree latitude x 0.1 degree longitude grid.

2.1 File Naming Convention

The Flux data for Canada are in a file named “CMS_CH4_FLX_CA_2013.nc” and the flux data for Mexico are in a file named “CMS_CH4_FLX_MX_2010.nc”.

2.2 File Format and Structure

The files are stored in NetCDF-4 format.

3.0 Data Contents

The dimensions of the flux data for Canada are time = 1 by lat = 300 by lon = 951. The dimensions of the flux data for Mexico are time = 1 by lon = 342 by lat = 210.

The units and long_name for each variable are given in variable attributes called “units”, “long_name”. The units of the methane flux are molec/cm2/s.

The data fields in each file are named as follows:

1. CH4_FLX_??_Gas_Distribution
2. CH4_FLX_??_Gas_Processing

3. CH4_FLX_??_Gas_Production
4. CH4_FLX_??_Gas_Transmission
5. CH4_FLX_??_Oil
6. CH4_FLX_??_TOT
7. lat
8. lon
9. time

where “??” is either “CA” or “MX” depending upon whether it is the dataset of Canada or Mexico emissions.

4.0 Options for Reading the Data

4.1 Programming Languages

The data can be read using major programming languages such as Fortran, C, Java, IDL, Matlab, and Python.

4.2 Command Line Utility

ncdump
The ncdump tool can be used as a simple browser for NetCDF and HDF data files, to display the dimension names and sizes; variable names, types, and shapes; attribute names and values; and optionally, the values of data for all variables or selected variables in a netCDF file. The most common use of ncdump is with the –h option, in which only the header information is displayed.

ncdump [-c|-h] [-v ...] [[-b|-f] [c|f]] [-l len] [-n name] [-d n[,n]] filename
Options/Arguments:
[-c] Coordinate variable data and header information
[-h] Header information only, no data
[-v var1[,...]] Data for variable(s) <var1>,... only data
[-f [c|f]] Full annotations for C or Fortran indices in data
[-l len] Line length maximum in data section (default 80)
[-n name] Name for netCDF (default derived from file name)
[-d n[,n]] Approximate floating-point values with less precision filename File name of input netCDF file

4.3 A tool for simple visualization

Panoply, developed at the Goddard Institute for Space Studies (GISS), is compliant with NetCDF Climate and Forecast (CF) Metadata Convention that is gaining popularity. A strength of the tool is that data can be previewed "remotely" over the network – i.e. user can preview file content of HDF files stored on a remote site, without downloading them. Panoply is available from GISS:

http://www.giss.nasa.gov/tools/panoply/

5.0 Data Services

Data services and access methods can be found on the dataset landing page for each product:

http://disc.sci.gsfc.nasa.gov/datacollection/CMS_CH4_FLX_CA_1.html

http://disc.sci.gsfc.nasa.gov/datacollection/CMS_CH4_FLX_MX_1.html

If you need assistance or wish to report a problem:
Email: gsfc-help-disc@lists.nasa.gov
Voice: 301-614-5224
Fax: 301-614-5268
Address:
Goddard Earth Sciences Data and Information Services Center NASA Goddard Space Flight Center Code 610.2 Greenbelt, MD 20771 USA

6.0 Acknowledgments

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7.0 References

Sheng, J.-X., Jacob, D. J., Maasakkers, J. D., Sulprizio, M. P., Zavala-Araiza, D., Hamburg, S. P. (2017). A high-resolution (0.1° × 0.1°) inventory of methane emissions from Canadian and Mexican oil and gas systems. *Atmospheric Environment*, 158, 211