GES DISC Greenhouse Gas Data Sets and Associated Services

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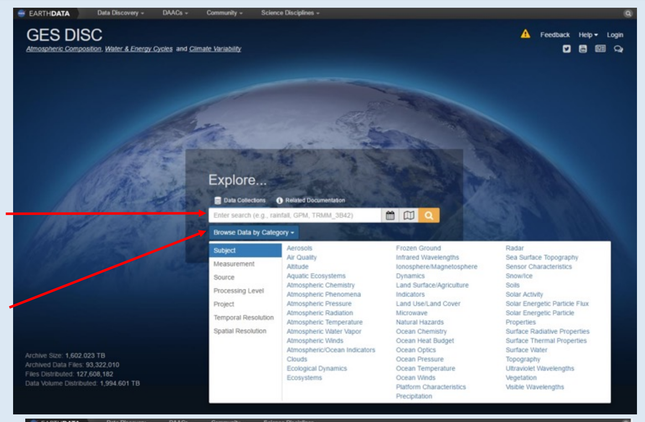
Abstract

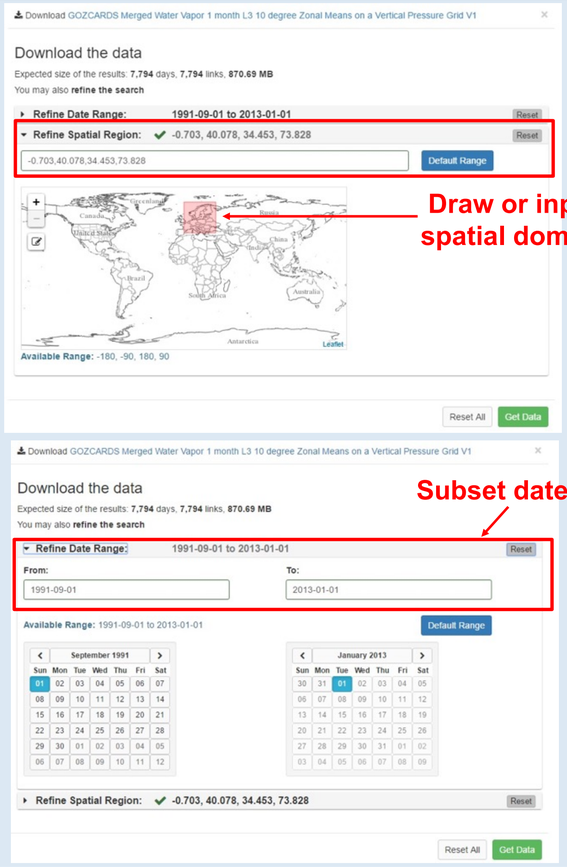
NASA Goddard Earth Sciences (GES) Data and Information Services Center (DISC) archives and distributes rich collections of data on atmospheric greenhouse gases from multiple missions. Hosted data include those from the Atmospheric Infrared Sounder (AIRS) mission (which has observed CO_2, CH_4, ozone, and water vapor since 2002); legacy water vapor and ozone retrievals from TIROS Operational Vertical Sounder (TOVS); and Upper Atmosphere Research Satellite (UARS) going back to the early 1980's. GES DISC also archives and supports data from seven projects of the Making Earth System Data Records for Use in Research Environments (MEaSUREs) program that have ozone and water vapor records. Greenhouse gases data from the A-Train satellite constellation is also available: (1) Aura-Ozone Monitoring Instrument (OMI) and Microwave Limb Sounder (MLS) ozone, nitrous oxide, and water vapor since 2004; (2) Greenhouse Gases Observing Satellite (GOSAT) CO_2 observations since 2009 from the Atmospheric CO2 Observations from Space (ACOS) task; and (3) Orbiting Carbon Observatory-2 (OCO-2) CO_2 data since 2014. The most recent related data set that the GES DISC archives is methane flux for North America, as part of NASA's Carbon Monitoring System (CMS) project. This data set contains estimates of methane emission in North America based on an inversion of the GEOS-Chem chemical transport model constrained by GOSAT observations (Turner et al., 2015).

Along with data stewardship, an important focus area of the GES DISC is to enhance the usability of its data and broaden its user base. Users have unrestricted access to a new user-friendly search interface, which includes many services such as variable subsetting, format conversion, quality screening, and quick browse. The majority of the GES DISC data sets are also accessible through Open-source Project for a Network Data Access Protocol (OPeNDAP) and Web Coverage Service (WCS). The latter two services provide more options for specialized subsetting, format conversion, and image viewing. Additional data exploration, data preview, and preliminary analysis capabilities are available via NASA Giovanni, which obviates the need for users to download the data (Acker and Leptoukh, 2007). Giovanni provides a bridge between the data and science and has been very successful in extending GES DISC data to educational users and to users with limited resources.

Browse and download data with new interface

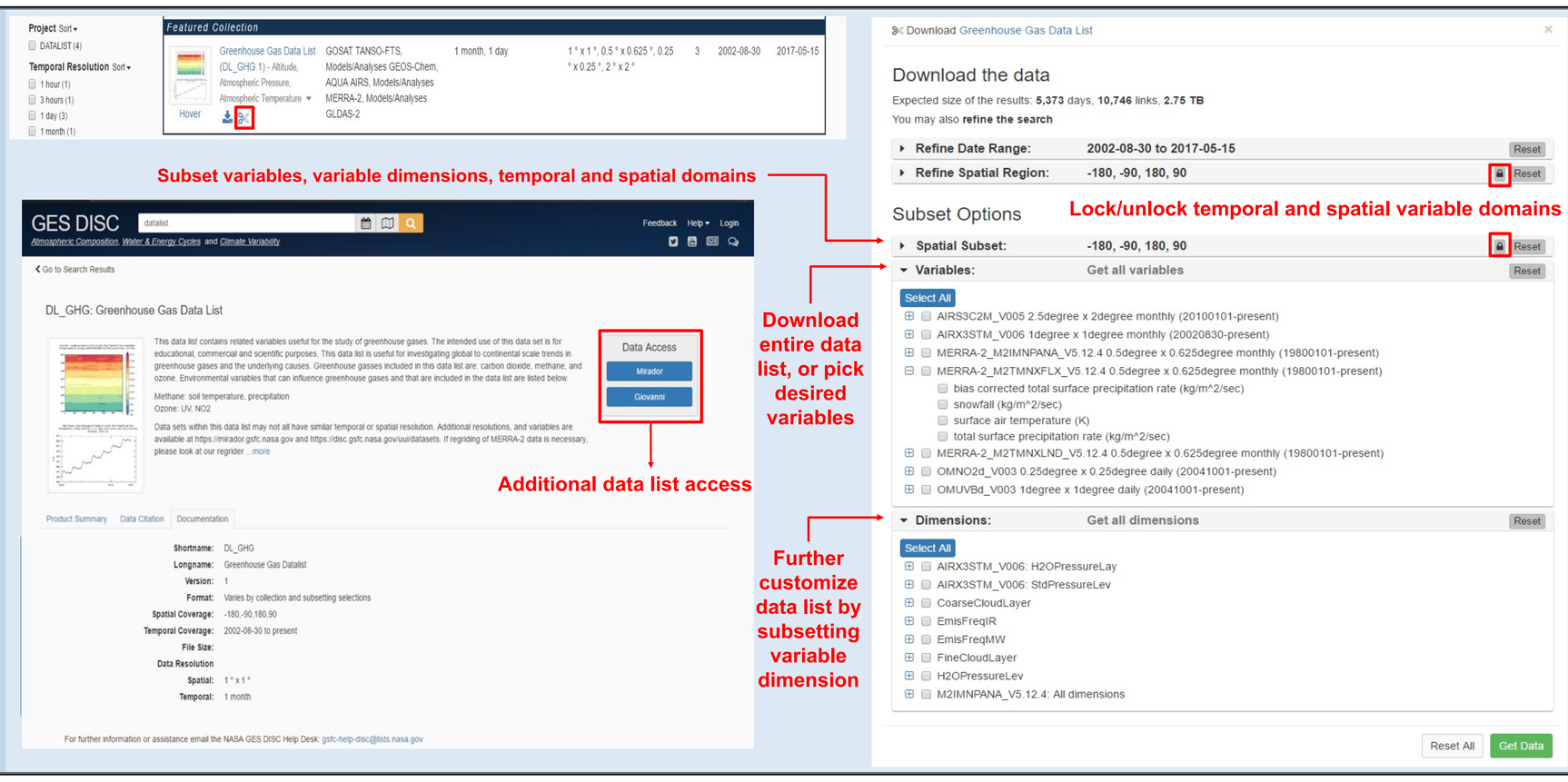
- Easily browse data and refine searches
- Directly download data
- Subset spatial and temporal dimensions of data before download
- Access over 1,600 TB of satellite and model data
- Utilize GES DISC tools and how-to guides





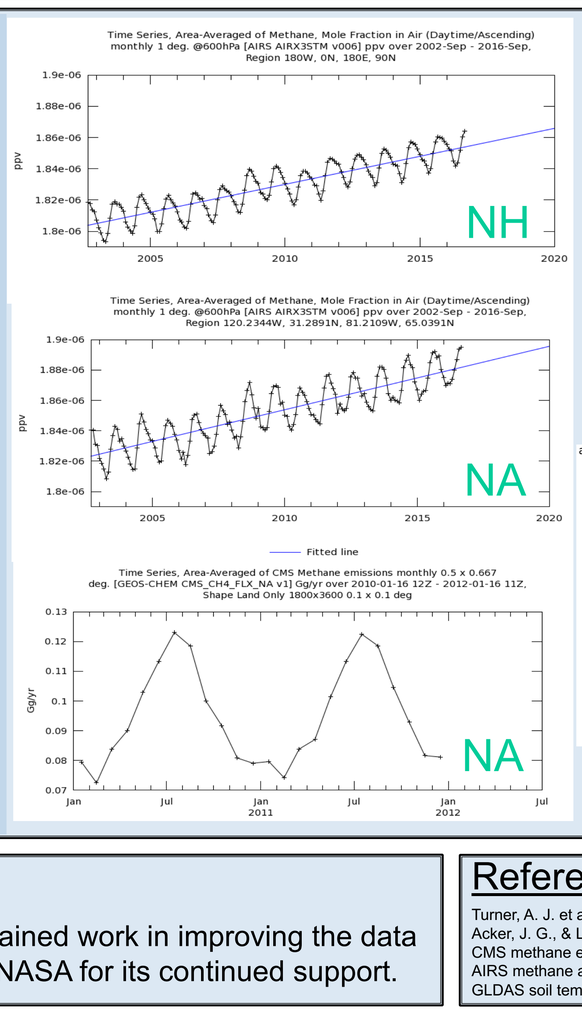
Directly access customized collections of variables

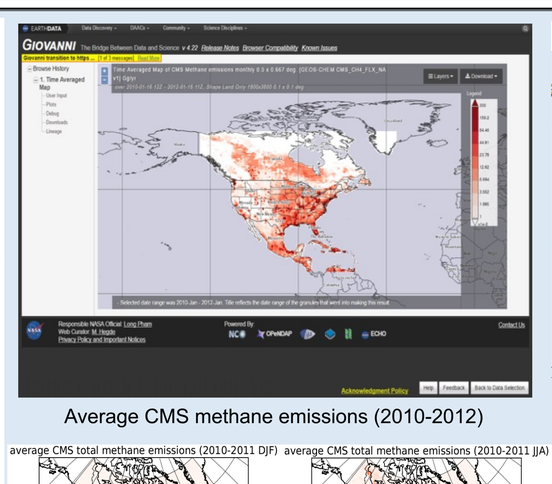
- Direct access to related variables from multiple data sets as preferred by users.
- Use the new data 'list' implementation to quickly find relevant data across multiple data sets.
- Users can download entire data list or part of a data list customized by variable, spatial, and temporal domains.
- Greenhouse gas data list (prototype) contains data for CO_2, CH_4, O_3, and ancillary variables.
  - useful for studying global to continental scale trends across seasonal to interannual timescales.
- Other prototyped lists include: Hurricane, Wind Energy, and A-Train Data Depot.



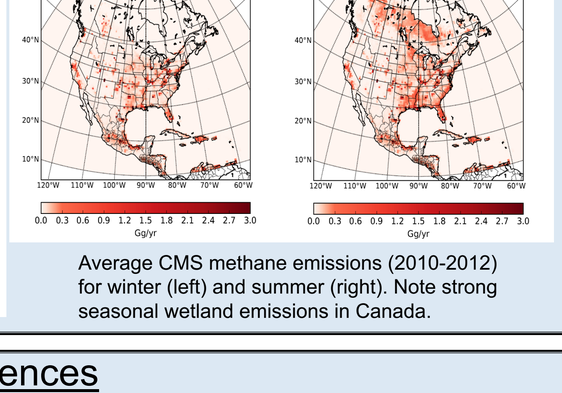
Explore and visualize greenhouse gas data

- Use Giovanni's mapping and analysis tools to explore numerous data sets online.
- Download plots and analyzed data directly from Giovanni.
- Subset temporal and spatial bounds.
- Access over 1,600 variables.
- 22 plotting and analysis tools are available.

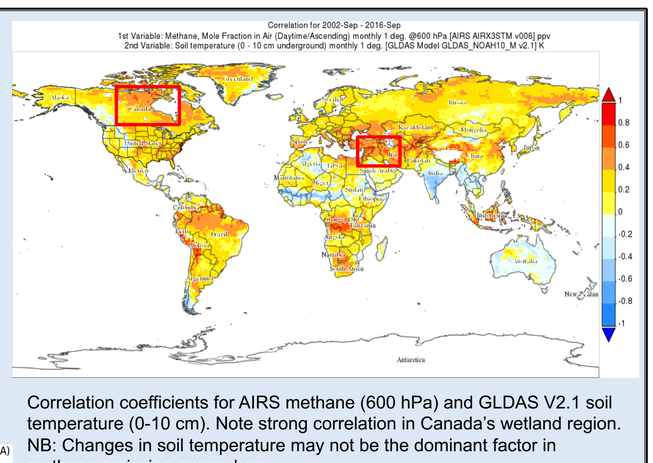




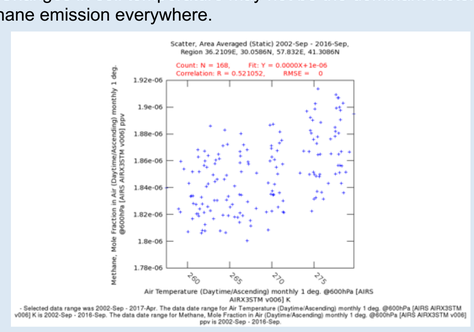
Average CMS methane emissions (2010-2012)



Average CMS methane emissions (2010-2012) for winter (left) and summer (right). Note strong seasonal wetland emissions in Canada.



Correlation coefficients for AIRS methane (600 hPa) and GLDAS V2.1 soil temperature (0-10 cm). Note strong correlation in Canada's wetland region. NB: Changes in soil temperature may not be the dominant factor in methane emission everywhere.



Scatter plot of AIRS methane (600 hPa) and air temperature (600 hPa) over the Middle East.

Acknowledgments

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References

Turner, A. J. et al. (2015). Estimating global and North American methane emissions with high spatial resolution using GOSAT satellite data. *Atmos. Chem. Phys*, *15*(12), 7049-7069.
Acker, J. G., & Leptoukh, G. (2007). Online analysis enhances use of NASA earth science data. *Eos, Transactions American Geophysical Union*, *88*(2), 14-17.
CMS methane emissions (DOI: 10.5067/RF3R3G9I3UVX)
AIRS methane and temperature (DOI: 10.5067/AQUA/AIRS/DATA319)
GLDAS soil temperature (DOI: 10.5067/LWTYSMP3VM5Z)