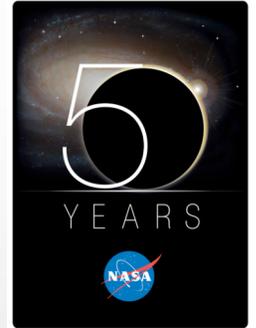


NASA Unidata Update

21 October 2008



Peter Griffith (SSAI)

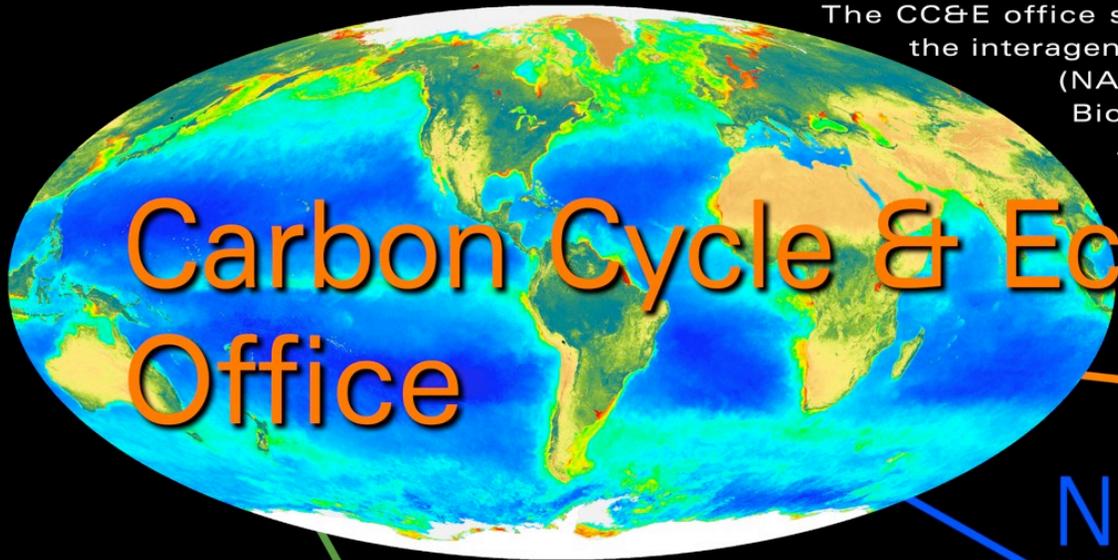
Lead Scientist

Carbon Cycle & Ecosystems Office

NASA Goddard Space Flight Center

Code 614.4

peter.c.griffith@nasa.gov



Carbon Cycle & Ecosystems Office

The CC&E office supports the research activities of the interagency North American Carbon Program (NACP), the NASA-funded Large Scale Biosphere-Atmosphere Experiment in Amazonia-Ecology (LBA-ECO), and NASA-funded carbon cycle research.

contact: Dr. Peter Griffith
peter.c.griffith@nasa.gov

NACP

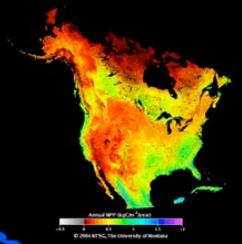
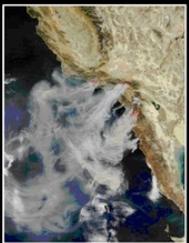
NACP, a component of the U.S. Climate Change Science Program, is designed to quantify continental-scale carbon sources and sinks in North America and adjacent ocean regions. www.nacarbon.org

Carbon Cycle & Ecosystems Research



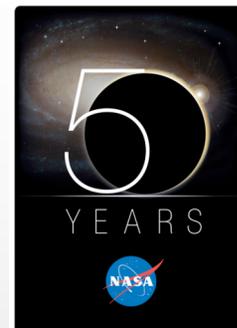
LBA-ECO

NASA's ecological component of LBA, a cooperative international project led by Brazil, seeks to create a predictive understanding of the relationships between deforestation in Amazonia and changes in regional and global climate. www.lbaeco.org



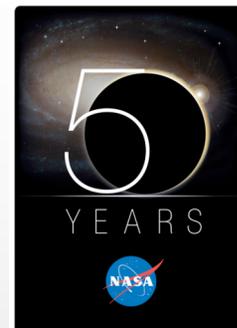
NASA's CC&E research provides knowledge of the interactions of global biogeochemical cycles and terrestrial and aquatic ecosystems with global environmental change and the implications for Earth's climate, productivity, and natural resources. <http://cce.nasa.gov/>





NASA use of Unidata tools

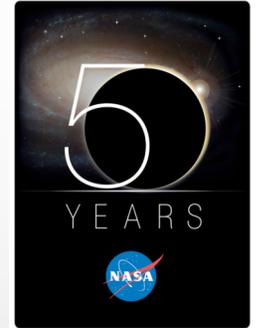
- Diverse scientific communities; hard to assess penetration of Unidata tools
- Used throughout atmospheric and climate sciences
 - GES DISC serves data from AIRS, TOMS, TRMM, MSU instruments
 - NASA GISS GCM and climate models submitted to WCRP CMIP3 multi-model dataset archive
 - Global Change Master Directory
- Need identified for advancing collaborative connections for earth system science (Frank Lindsay HQ Program Manager)



Carbon Cycle & Ecosystems Data

- LBA-ECO www.lbaeco.org
 - Biogeochemical data archive at ORNL DAAC
 - LBA-MIP Model Intercomparison Project
- North American Carbon Program www.nacp.org
 - Program Office encourages and facilitates use of Unidata tools
 - MAST-DC Modeling and Synthesis Thematic Data Center
 - BCO-DMO Biological and Chemical Oceanography Data Management Office (funded primarily by NSF)
 - Ameriflux at CDIAC (funded primarily by DOE)
 - Investigator instances still very limited in number

LBA-MIP



- The objective of the LBA-Model Intercomparison Project (LBA-MIP) is to bring together international biosphere-atmosphere modeling groups to understand how different models simulate the ecosystems and biogeophysical processes in the Amazon of South America. Forcing and validation data were provided by the [Large-Scale Biosphere-Atmosphere \(LBA\) Experiment in Amazonia](#). The LBA-MIP is the result of discussions held during the Carbon Synthesis Workshop and the 10th [LBA-ECO](#) Meeting held in Brasilia in early October 2006. This initiative is led by Luis Gustavo de Goncalves, Inez Fung, Humberto da Rocha and Scott Saleska. <http://www.climatemodeling.org/lba-mip/>
- Tried to follow protocols from other MIP activities but found great difficulty in knowing how to use tools. Inez Fung suggested using unidata tools and suggested getting Forrest Hoffman involved. The group hoped it would be easier to use and share and distribute with other groups. Gustavo is developing a tool (Windows + Visual Basic + Excel) to make an analysis of model results (range and consistency checks), and will include a netCDF writer, from comma delimited text data file. Existing examples not suitable for scientists who are not programmers and do not know netCDF. Such scientists found it hard to submit data. This slowed down the MIP and lost participants in (mostly unfunded) synthesis activity. Might have been easier to do analysis using flat ascii. Uncertain about long-term payoff for future comparisons. Bottom line: need tools useable by anyone, not just programmers. Needs to be portable and flexible. He would be happy to talk to Unidata support and show their prototypes.

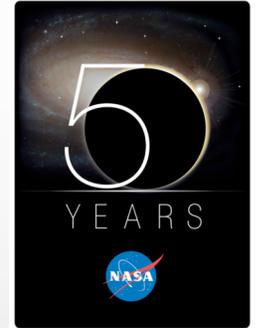
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10/21/08

Peter Griffith

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Ameriflux



- CDIAAC provides AmeriFlux data products in a netCDF format largely for the benefit of modelers. Modelers want all data from all sites and netCDF has proven to be, based on our surveys, the preferred format for them. CDIAAC adheres to the COARDS netCDF convention (Cooperative Ocean/Atmosphere Research Data Service), which has been embraced by the climate-change modeling community. CDIAAC also delivers AmeriFlux data in an OPeNDAP framework, along with NASA MODIS products, through the ORNL NASA DAAC data effort.
- To date it has proven to be nearly impossible to get observational scientists to provide tower flux, site, or biological data in netCDF format, despite an intense lobbying and technical support effort led by the Ameriflux lead scientist, Beverly Law.
- An FAO published guide document for carbon flux data interpretation, formatting and distribution should be published in early 2009.

SIB3 Carbon Flux Daily
=>SIB3 Carbon Flux 1999-08

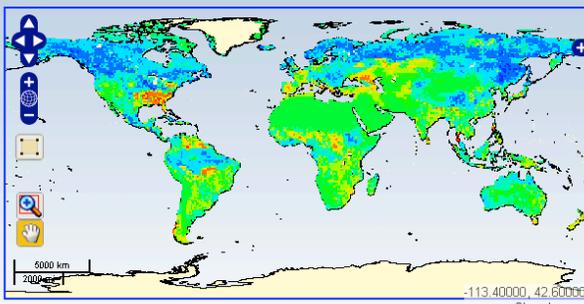
Global data set of carbon fluxes between the atmosphere and the terrestrial biosphere for the years 1998-2006, produced by the Simple Biosphere Model, version 3 (SiB3). These data represent the global net ecosystem exchange of carbon dioxide between the planetary boundary layer and the surface vegetation layer. Following atmospheric convention, flux is defined as positive into the atmosphere and negative into the surface vegetation.

Data Granules Information for SiB3 Carbon Flux 1999-08

- Collection: [SiB3 Carbon Flux Daily](#) (view full metadata in Mercury)
- Native Projection: 4326
- Spatial Extent: -180,-90,180,90
- Map Units: degrees
- Resolution: 1,1
- Start DateTime: 1999-08-01T00:00
- End DateTime: 1999-08-31T23:59
- Data Units: moles/m²/sec
- Scale Factor: 1
- Offset: 0
- Time Steps: 1999-08-01, 1999-08-02, 1999-08-03, 1999-08-04, 1999-08-05, 1999-08-06, 1999-08-07, 1999-08-08, 1999-08-09, 1999-08-10, 1999-08-11, 1999-08-12, 1999-08-13, 1999-08-14, 1999-08-15, 1999-08-16, 1999-08-17, 1999-08-18, 1999-08-19, 1999-08-20, 1999-08-21, 1999-08-22, 1999-08-23, 1999-08-24, 1999-08-25, 1999-08-26, 1999-08-27, 1999-08-28, 1999-08-29, 1999-08-30, 1999-08-31
- Number of Bands: 1

Data Customization and Download

Coverage: SIB3 Carbon Flux 1999-08



Projection: Spatial Extent:

Resolution: x y

Format:

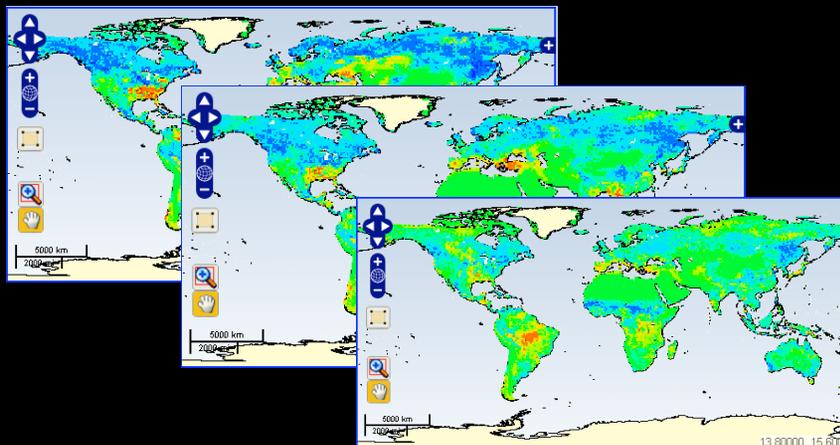
Time:

Bands:

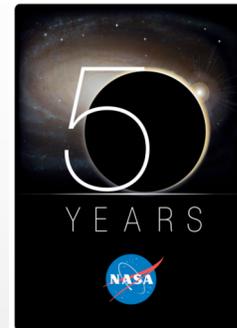
NetCDF files for use in OGC-Web Coverage Service

- Deliver NetCDF file through WCS download
- Deliver WMS images of NetCDF files
- Works great for time series based data

WMS Carbon Flux time series data



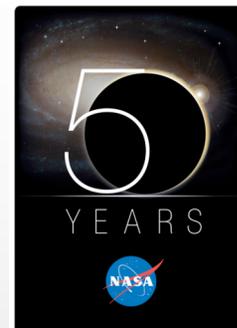
Screenshot of ORNL DAAC WCS delivering Carbon-Flux data for the globe in NetCDF format. The underlying files for this dataset came from NetCDF format but were converted into GeoTIFF because of limitations in WCS format to handle time parameter. Slide courtesy of Suresh Kumar.



Unidata Software usage

- netCDF used for some data sets in archive
- THREDDS used to serve some data
 - <http://daac.ornl.gov/thredds.shtml>
 - <http://thredds.daac.ornl.gov/thredds/catalog.html>
- Hyrax OPeNDAP sever used internally to send HDF-4 to THREDDS data server
- WCS Server delivers netCDF images
- netCDF Java library for DAP calls in internally developed tool for data comparisons
- Other netCDF utilities used for data conversions
- Working to include explicit recognition of DAP availability in metadata records for Mercury Toolset

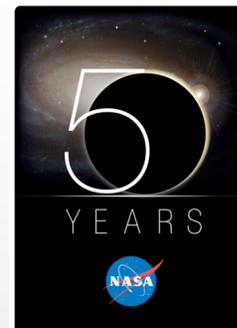
Slide courtesy of Bruce Wilson



Unidata Software Desires

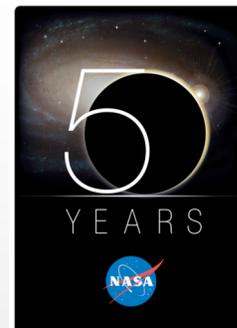
- Better viewer for data
- Improve generalization of netCDF service in TDS
- Improved interface for geospatial subsetting
- Default WCS client out of the box
- Enhance TDS catalog to extract global attributes of a dataset
- "My personal assessment is that we're making progress using it, but that it's also taken a fair amount of time, energy, and effort to get there. I like what the Unidata stack offers, and I think it's generally heading in the right direction...I'm not sure what would have made that process easier, but I do have this vague angst that it was more work than it should have been."

Slide courtesy of Bruce Wilson



THREEDS/NetCDF Usages: (Courtesy of Jerry Yun Pan)

- (1) We use Unidata THREDDDS server as a part of ORNL DAAC Web Site to serve a subset of ORNL biogeochemical datasets. The public linkage to THREDDDS server is via a URL embedded in an introductory page (<http://daac.ornl.gov/thredds.shtml>). This instance of THREDDDS is also linked to an internal OPeNDAP Hyrax OPeNDAP server in order to serve our HDF-4 datasets. The URL of this THREDDDS server is <http://thredds.daac.ornl.gov/thredds/catalog.html>.
- (2) In addition, we serve some partners' datasets from the same THREDDDS instance, e.g., AmeriFlux Level 2 flux tower measurements. We also use the NetCDF Java Library to make DAP calls to the OPeNDAP service for AmeriFlux dataset, for a data extraction tool (under development) that extracts and compares in-situ data with remote sensing data.
- (3) We also use the same THREDDDS instance to support the Modeling and Synthesis Thematic Data Center (MAST-DC) project, which is part of the NASA's North American Carbon Program.
- (4) We have used various Unidata NetCDF tools and libraries, including Java API, ncdump and ncgen with CDL, to prepare and convert a few datasets into the NetCDF (V.3) format in order for THREDDDS to read and serve these datasets.



DESIRES and NEEDS: (Courtesy of Jerry Yun Pan)

- (1) I think a better viewer, in addition to IDV and the JavaTool viewer, would help adoption of this data server technology. My experience there is that the current viewer sets might be complicated and lack of status indications to the end users, therefore undermine the power of THREDDS in some degree.
- (2) NetCDF Service of the THREDDS server is a good direction. I would like to see the generalization of this service for datasets with any types of dimensions, beyond geospatial dimensions. I also wish the interface for geospatial subsetting be enhanced, when the datasets do have lat/lon dimensions and can be read into the Common data model. Perhaps a map interface like google map would help.
- (3) I wish there is a default WCS client out of the box, either web-based or web-startabled, to make the WCS capability readily accessible by the end users. This way the data providers will not need to provide additional OGC-clients. It may already been implemented in IDV, but it appears to me IDV is already quite heavy, it would be nice to have a light-weighted WCS client by default.
- (4) If the THREDDS catalog service can automatically extract the global attributes of a dataset, it would add a lot of values I think. Otherwise, without manually adding an "enhanced" catalog, there is very limited metadata on the catalog even if the dataset contains rich metadata.