NASA Unidata Update

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YEARS

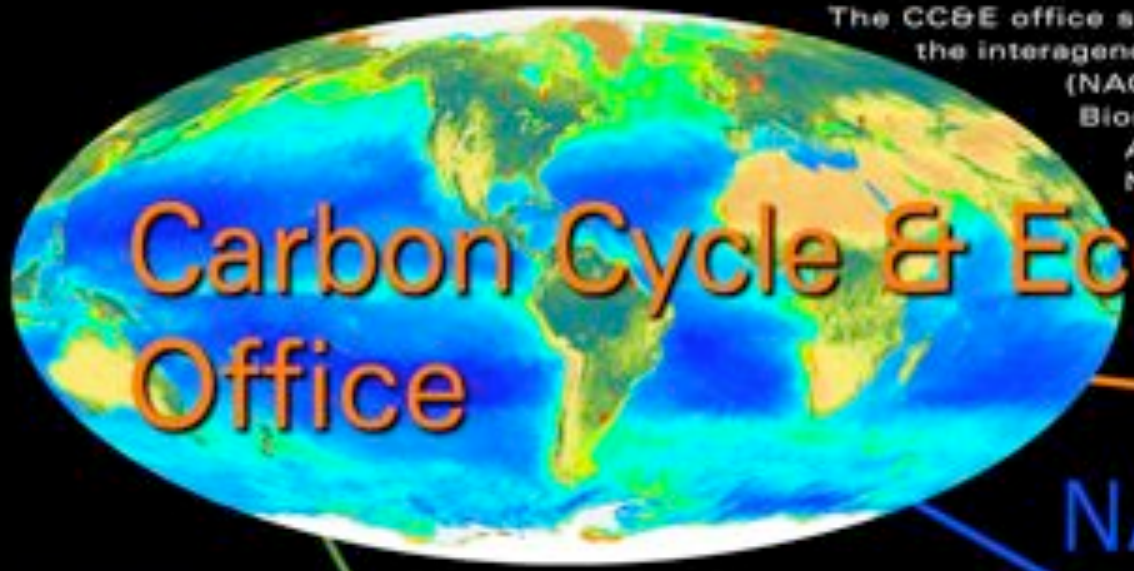
Mission Directorate:	Science
Theme:	Earth Science

FY 2010 Budget Request

http://www.nasa.gov/news/budget/index.html

Budget Authority ($ millions)	FY 2008 Actual	FY 2009 Enacted	FY 2010	FY 2011	FY 2012	FY 2013	FY 2014
FY 2010 President's Budget Request	**1,237.4**	**1,704.6**	**1,405.0**	**1,500.0**	**1,550.0**	**1,600.0**	**1,650.0**
Earth Science Research	358.3	437.4	397.5	407.5	404.2	416.8	412.1
Earth Systematic Missions	546.1	898.9	715.5	725.4	786.4	818.8	867.6
Earth System Science Pathfinder	106.8	118.3	63.9	128.8	114.2	121.4	119.1
Earth Science Multi-Mission Operations	143.0	148.1	149.9	160.3	165.4	161.3	165.5
Earth Science Technology	43.0	54.1	45.9	47.2	48.2	49.5	52.7
Applied Sciences	40.2	47.8	32.2	30.7	31.5	32.2	33.1
FY 2009 President's Budget Request	**1,280.3**	**1,367.5**	**1,350.7**	**1,250.9**	**1,264.4**	**1,290.3**	**--**
Earth Science Research	375.8	380.6	388.2	390.6	400.7	409.3	--
Earth Systematic Missions	530.1	677.9	661.5	583.2	563.6	569.6	--
Earth System Science Pathfinder	113.8	88.6	58.8	37.4	50.0	54.9	--
Earth Science Multi-Mission Operations	167.8	140.5	159.1	157.9	166.5	170.9	--
Earth Science Technology	47.3	46.1	49.2	50.6	51.6	52.8	--
Applied Sciences	45.4	33.8	33.8	31.3	32.1	32.8	--
Total Change from FY 2009 Request	**-42.9**	**337.0**	**54.3**	**249.1**	**285.6**	**309.7**	**--**

Note: Includes $325M of Recovery Act funding in FY09. Starting in FY 10, the NEOO project is in the Planetary theme.



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.

Carbon Cycle & Ecosystems Office

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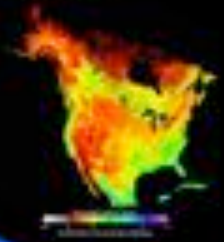
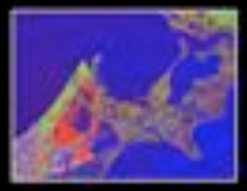
NACP

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

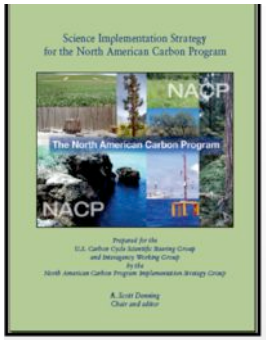
NASA's ecological component of LBA, a cooperative international project led by Brazil, seeks to create a predictive understanding of the relationships between deforestation in Amazonia and changes in regional and global climate. www.lbaeco.org

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/

What is the NACP?

- Carbon Cycle Science Plan- Sarmiento & Wofsy, 1999
- Climate Change Science Program (née U.S. GCRP)
- Carbon Cycle Interagency Working Group (CCIWG)

- NACP Science Implementation Strategy- Denning et al 2005
- NACP Office & Coordinator- since 2006 at NASA GSFC Carbon Cycle & Ecosystems Office
- NACP is a kissing cousin to OCCC / OCB
- OCB and NACP overlap in the coastal oceans of North America



NACP Goals

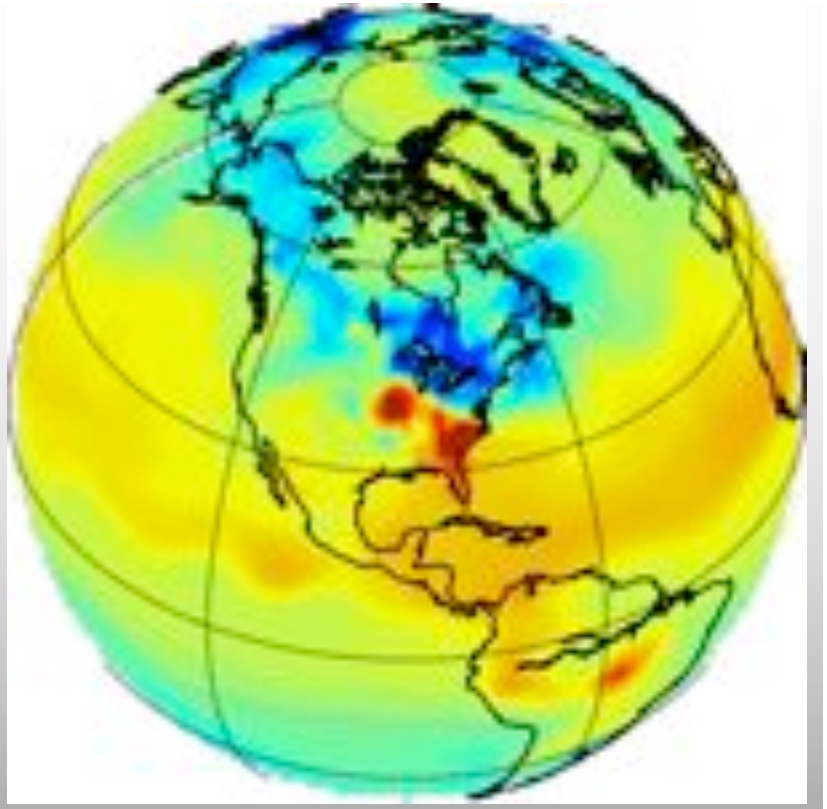
- Develop quantitative scientific knowledge, robust observations, and models to determine the emissions and uptake of CO2, CH4, and CO, changes in carbon stocks, and the factors regulating these processes for North America and adjacent ocean basins.
- Develop the scientific basis to implement full carbon accounting on regional and continental scales. This is the knowledge base needed to design monitoring programs for natural and managed CO2 sinks and emissions of CH4.
- Support long-term quantitative measurements of fluxes, sources, and sinks of atmospheric CO2 and CH4, and develop forecasts for future trends.

Project Vulcan

- Interactive maps let scientists and citizens examine carbon dioxide emissions from fossil fuel combustion using the popular Google Earth platform. The maps, funded by NASA and the U.S. Department of Energy through the joint North American Carbon Program, can display fossil fuel emissions by the hour, geographic region, and fuel type. The science team integrated seven primary data sets, including imagery of Earth's surface captured by the NASA/USGS Landsat 5 satellite, fossil-fuel carbon dioxide emissions data from the U.S. Environmental Protection Agency and U.S. Department of Energy, and population data from the U.S. Census Bureau. A second phase is underway to create similar inventories of carbon dioxide emissions for Canada and Mexico.
- http://www.purdue.edu/eas/carbon/vulcan/index.php
- http://www.purdue.edu/eas/carbon/vulcan/GEarth/index.html

CarbonTracker
carbon “weather” for scientists, citizens, and decision-makers

- What does CarbonTracker tell us? North America is a source of CO2 to the atmosphere. The natural uptake of CO2 that occurs mostly East of the Rocky Mountains removes only ~30% of the CO2 released by the use of fossil fuels.
- CarbonTracker is NOAA contribution to the North American Carbon Program: http://www.esrl.noaa.gov/gmd/ccgg/carbontracker/summary.html
- Peters et al PNAS 2007



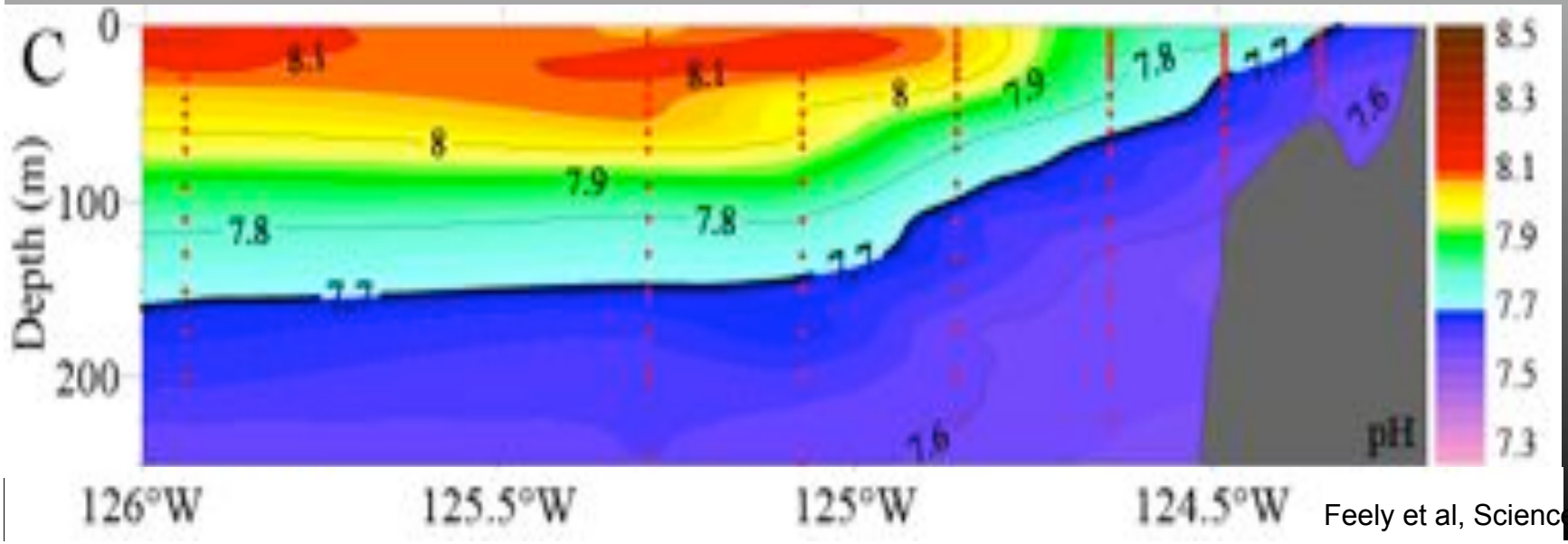
CO2 weather for the week of July 3-10, 2004. The colors show CO2 concentrations as simulated by CarbonTracker, averaged from the surface up to about 15 km. Uptake of CO2 by forests and crops acts to reduce atmospheric CO2 concentrations, whereas fossil fuel burning increases CO2 concentrations. These high- and low-concentration CO2 air masses (red for high, blue for low) are then moved around by weather systems to form the patterns shown here.

Dead mussels along Tatoosh Island in the Pacific Northwest, where seawater acidity has risen faster than expected. Wootton et al PNAS 2008.

Coastal Ocean Acidification

NACP West Coast Survey Cruise

Scientists found that 'ocean acidified' corrosive water was upwelled from depths of 150-200 m onto the shelf and outcropped at the surface near the coast. Although seasonal upwelling of the undersaturated waters onto the shelf is a natural phenomenon in this region, the ocean uptake of anthropogenic CO2 has increased the size of the affected area. Organisms including pteropods, copepods, fish larvae, clams and sea urchins may be affected. Some affected organisms are important as food for larger fish like salmon. Agencies : NOAA, NSF, NASA.



Feely et al, Science, 2008.

NACP Interim Syntheses

- Site Interim Synthesis –Synthesis of modeled and measured carbon, water, and energy fluxes across North America; regional to continental upscaling of AmeriFlux data
- Mid Continental Intensive (MCI) Interim Synthesis –Synthesis of Tower CO2 Flux observations, inventory-based CO2 budget, atmospheric inversions, through 2005.
- Non-CO2 Greenhouse Gases Interim Synthesis
- Regional Interim Synthesis –NACP spatial model-data comparisons, inverse modeling, West Coast analyses
- **NEW! Coastal Interim Synthesis –carbon budgets for the East Coast, Gulf of Mexico, Pacific Coast, Arctic Ocean, and Great Lakes**
- EVEN NEWER but moving fast! Continental-scale Disturbance Synthesis

A CORE ELEMENT OF THE U.S. CLIMATE CHANGE SCIENCE PROGRAM

North American Carbon Program

CONTINENTAL CARBON BUDGETS, DYNAMICS, PROCESSES, AND MANAGEMENT

Explore NACP Research Contributions
with Google Map
and Google Earth

Lohrenz-01 Project Profile

- Print/View Entire Report
- To make changes to your profile, see Updating Project Profiles.

Title: Satellite Assessments of Regional pCO2 Distributions and Air-Sea Fluxes of Carbon Dioxide in a River Dominated Margin

Leader: Steven Lohrenz, University of Southern Mississippi

Contribution	Available by: Feb 2009
Product Title: Regional surveys of surface distributions of pCO2 and air-sea flux of CO2 in north central Gulf of Mexico	
Description: Image-based maps of pCO2 and air-sea flux of CO2 for the study region.	
Expected Users: Investigators interested in modeling carbon budgets and relating carbon system properties to other processes and environmental variables.	
Metadata URL(s):	
Data Server URL(s): Not yet available.	
Site(s) of Data Collection: 31.00000,-91.00000; 28.00000,-88.00000	

Community Comments

- Biogeochemical Dynamics Data Center (NASA DAAC)

Bruce Wilson: From my perspective, we've got some plans on how this gets used, but there are still some challenges for really understanding the use model. I'd love to see some good case studies published (maybe they're there) on how the TDS and OPeNDAP tools are actually being used by scientists relevant to the ORNL DAAC's user community.

Jerry Yun: A recent experience we had speaks to the inflexibility of THREDDS. THREDDS (3.17) server out of box has a few clients (called viewers) links on a "Data Access Page". The client software code is hosted at UNIDATA website and is download when a user click on the links. There are no configuration options that can be used to turn these viewers off easily. Apparently, they recently changed their website and accidentally left out these required resources, and everyone's viewer links were consequently broken. I informed them of this and they were able to put these resources back quickly (if they had not, my only option would have been to edit source code to fix it). So, I wish the software were more configurable for these kind of things. The viewer programs should have options to turn them on or off. The other lesson I can draw from this incident is again I think the servlet code should be changed to use JSP or other view technology for its web GUI, so that various organization can easily customize the look and feel and change these kind of external links. I hope their upcoming new version of THREDDS is more flexible already.

Community Comments

- National Snow & Ice Data Center (NASA DAAC)

Kevin Schaefer: Improved netcdf/hdf Compatibility. My model and associated analysis tools all use netcdf, but a lot of the data from NASA comes in hdf. The netcdf library cannot read hdf files (although I do not know if the hdf library can read netcdf files). The netcdf library is not compatible with the hdf library such that you cannot compile a program with both. I cannot convert my model to hdf for a variety of practical reasons. For me, this has lead to complicated, convoluted efforts to read or convert hdf files or avoiding them altogether. The ability to read (or convert) hdf files with netcdf would be extremely useful.

- Atmospheric Sciences Data Center (NASA DAAC)

Allan Settel: Unidata is providing alternative data access and management tools to the user community. Since ASDC's data is in hdf4, hdf, and hdf-eos format, a tool to convert hdf and hdf-eos to netcdf would be ideal or IDV and GEMPAK to have the ability to read hdf and hdf-eos data.User questions commonly address the need for display and analysis tools. We do have a few users that are very pleased with McIDAS and use it on a regular basis. OPeNDAP is a quick mechanism for users to access data on the fly. However, the interface is not intuitive. Instructions for the different options would be helpful. To a large extent we are just getting started with OPeNDAP and THREDDS here ... so if you would want to come back and ask in a few months, we may have more to say.

Community Comments

- BCO-DMO- Biological and Chemical Oceanography Data Management Office-

Cyndy Chandler: I am very pleased with Unidata; netCDF and OPeNDAP in particular.in fact - I am working with OPeNDAP programmers today through Monday to develop JGOFS handler for Hyrax BES - so intense effort followed by the rest of the week of hopefully somewhat less intense effort!OPeNDAP allows me to serve all my data holdings (NetCDF and JGOFS format daat) in a way that is immediately useful to many in the community we serve.

- NACP Coastal Interim Synthesis modeler

Marjy Friedrichs: I've been using netCDF, OPeNDAP and THREDDS on a weekly - probably daily - basis for several years. These are critical to my modeling research. For our USECoS project, various individuals can post their model results (netCDF files) on one server using THREDDS/OPeNDAP, and then we can all access the output. It's fantastic!

Community Comments

- NACP Modeling & Synthesis Data Center (MAST-DC)

Yaxing Wei: Basically, what I'm doing are: process grid files including various variables (NEE, NPP, GPP, Rh, Ra, ...) of ecosystem models output, inversion models output, and observation measurements, convert and distribute them in CF compatible netCDF format, conduct certain comparison analysis across the models, and validate model outputs against observation measurements. So my experience with netCDF mainly focuses on: CF compatible netCDF files creation; netCDF files visualizatio; Data analysis based on netCDF files.netCDF file format is perfect for MAST-DC model output distribution. One reason is that it is able to represent grid data with multiple variables and multiple time steps. Another reason is there are lots of good tools to visualize netCDF files, like IDV, ncBrowse, and Panoply. I like IDV because I can choose several ways to display the data, like "Contour Plan View", "Color-Filled Contour Plan View", and even "Value Plots". I can also overlay multiple display for the same data together. I also like its animation function for data with multiple time steps.But I do have some trouble to create CF compatible netCDF files. As far as I know, there is no good tool for CF compatible netCDF files creation from other formats, like GeoTiff. ArcGIS can do some of the conversion, but its output is not fully CF-compatible and it does not work for data with multiple time steps. I have to use ArcMap and GDAL together to convert data from other formats to netCDF format, then use NetCDF Operator (NCO) to modify the converted netCDF files to make them CF compatible. Actually, I like some of the functions provided by NCO, like the creation, modification, and deletion for attributes and variables. I can also perform data analysis, like addition, subtraction, and statistics, on top of netCDF files using NCO. But I can't find such functions from IDV. I think it will be ideal if IDV can integrate those netCDF modification and analysis functions, so that I can take advantage of the visualization functions provided by IDV after some data analysis operations.

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 was recently funded by the NASA Terrestrial Ecology Program. This initiative is led by Luis Gustavo de Goncalves, Inez Fung, Humberto da Rocha and Scott Saleska. http://www.climatemodeling.org/lba-mip/
- Site-specific forcing data is available in NetCDF and ASCII formats at the LBA-MIP website. Forcing datasets include air temperature, specific humidity, module of wind speed, downward long wave radiation at the surface, surface pressure, precipitation, shortwave downward radiation at the surface.

CDIAC/ Ameriflux

- CDIAC 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. CDIAC adheres to the COARDS netCDF convention (Cooperative Ocean/Atmosphere Research Data Service), which has been embraced by the climate-change modeling community. CDIAC 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.