AmeriFlux Network Aids Global Synthesis

PAGE 286

The carbon cycle science community has called for demonstrable progress in streamlining terrestrial-atmosphere observations into a global network to enable syntheses and regional to global modeling of the role of terrestrial ecosystems in climate change. The AmeriFlux network of about 100 research sites is the primary research group and data provider for large syntheses on terrestrial carbon cycling in the Americas. To broaden the value of the network, AmeriFlux has developed a database design and new guidelines for the submission of micrometeorological, meteorological, and biological data to the archive.

The database, which includes atmospheric, plant, and soils data, was designed with significant input from Microsoft and the Berkeley Water Center (California). AmeriFlux is also working with international organizations such as CarboEurope and the Global Terrestrial Observing System to standardize terrestrial observations and data products for global analyses.

The AmeriFlux network aims to quantify and explain the influences of climate and disturbances such as wildfire and land use on carbon, water, and energy exchange between terrestrial ecosystems and the atmosphere. An essential component that enables large-scale analyses is the consistency of the data. AmeriFlux guidelines for data submission reflect input from data providers and users as well as recommendations from database designers and data managers to improve the efficiency of access and automation, especially for global syntheses and spatial modeling activities that include data assimilation techniques. One of the fundamental requirements of network participants to maintain membership in the network is to submit micrometeorological and meteorological data within 1 year of collection, and biological data within about 2 years of collection to the AmeriFlux data repository at the Carbon Dioxide Information Analysis Center (CDIAC), at the Oak Ridge National Laboratory in Tennessee.

Biological observations represent a particular challenge in that they are collected at disparate scales, such as, for example, fast processes (photosynthesis, soil respiration) and slow processes (carbon pools, nitrogen content). The data submission requirements address this challenge by requesting variables in time and space scales that are most likely to be useful to a broad group of users. Controlled vocabularies are used for metadata and site characteristics such as disturbance histories. The system has checks on expected ranges of variation, controlled vocabularies, and formats. The specified formats are being used to standardize existing data in the collection and new observations by investigators in AmeriFlux and the North American Carbon Program (NACP), in which AmeriFlux plays a major role.

The NACP research strategy recommends an integrated data and information management system that will enable researchers to access, understand, use, visualize, and analyze large volumes of diverse data at multiple thematic, temporal, and spatial scales. Managing and integrating data for NACP requires an overarching data policy to ensure that participants have full, open, and timely access to data in order to promote the exchange of quality-controlled and quality-assured data. This is needed to protect intellectual property rights and to ensure that proper credit is given to data originators through authorship, citation, or acknowledgment. The development of the AmeriFlux data and information system will be an important asset to the NACP. Additional information on the NACP is located at http://www.nacarbon.org.

In an effort to make data broadly available and yet allow data providers time to conduct original analyses within and among similar networks, AmeriFlux requests that users follow the Data Fair Use Policy posted on the AmeriFlux Web site. The AmeriFlux database is located at http://public.ornl.gov/ameriflux.

—BEVERLY E. LAW, AmeriFlux Network, Oregon State University, Corvallis; E-mail: bev.law@oregonstate.edu

GEOPHYSICISTS

In Memoriam

PAGE 286

George A. Guy, 92, 23 February 2007; Atmospheric Sciences, 1948

Takeo Kosugi, 57, 26 November 2006; Solar and Heliospheric Physics, 1994

Elizabeth Sulzman, 40, 10 June 2007; Biogeosciences, 2000

MEETINGS

Global Changes in Ocean Carbon: Variability and Vulnerability

Surface Ocean CO_2 Variability and Vulnerability Workshop, Paris, France, 11–14 April 2007

PAGE 287

The oceans have taken up approximately half of the anthropogenic CO_2 emissions. This uptake reduces climate change but also lowers ocean pH, with the potential to disrupt ecosystems. Climate change affects ocean biology and physics and could lead to reduced efficiency of the carbon sinks, a process that atmospheric data and ocean models indicate is already occurring in the Southern Ocean. Attempts to set a baseline stabilization target for the atmospheric CO_2 concentration will ultimately depend on our understanding and prediction of oceanic CO_2 sinks. While we are now close to monitoring oceanic CO_2 uptake on decadal and regional scales, meaningful predictions of its future behavior are difficult. There is a critical and urgent need to better understand the ocean processes regulating CO_2 uptake and to identify research and observational priorities for the future.

On 11–14 April 2007, over 100 scientists from 20 countries gathered at the United Nations Educational, Scientific, and Cultural Organization (UNESCO), in Paris, to review current knowledge on the magnitude, variability, and processes governing ocean sources and sinks of carbon. The discussions covered observations, process-based models, and atmospheric and oceanic inversions. This workshop was cosponsored by the International Ocean Carbon Coordination Project (IOCCP), the Surface Ocean Lower Atmosphere Study (SOLAS), the Integrated Marine Biogeochemistry and Ecosystem Research (IMBER), and the Global Carbon Project (GCP) programs.

New results were presented for a global air-sea CO_2 flux climatology and detection of decadal variations in oceanic partial pressures of CO_2 (pCO_2). Observations conducted over more than 20 years show the long-term pCO_2 increase of surface waters is

generally close to the atmospheric CO_2 increase, indicating relatively constant sinks. In recent years, significant decadal changes in pCO_2 have been observed in some parts of the ocean, e.g., in the North Atlantic and the equatorial Pacific; however, for many regions there are still no routine observations. Quantification of the decadal changes of the air-sea CO_2 fluxes has been improved using atmospheric data, especially for the vulnerable Southern Ocean, where oceanic data are sparse. Presentations, posters, working group reports, and maps and tables of the ocean carbon observation network are available on the meeting Web page: http://www.ioc.unesco.org/ioccp/pCO2_2007.htm.

A major outcome of the workshop was the widespread recognition and strong support for sustained funding and further development of the global observing system for surface pCO_2. The workshop resulted in actions for developing joint synthesis papers, establishing a standard and well-documented global surface pCO_2 data set, and producing a regular atlas of surface ocean pCO_2. Regional synthesis groups were formed to analyze the underlying causes for variability and vulnerability in the system and to develop plans for a sustained observing system.

—NICOLAS METZL, Institute Pierre Simon Laplace, Paris; BRONTE TILBROOK, CSIRO Marine and Atmospheric Research, Hobart, Tasmania, Australia; DOROTHEE BAKKER, University of East Anglia (UEA), Norwich, UK; CORINNE LE QUÉRÉ, UEA and British Antarctic Survey, Cambridge, UK; SCOTT DONEY, Woods Hole Oceanographic Institute, Woods Hole, Mass.; RICHARD FEELY, NOAA Pacific Marine Environmental Laboratory, Seattle, Wash.; MARIA HOOD and ROGER DARGAVILLE, United Nations Educational, Scientific, and Cultural Organization (UNESCO), Paris.

Past, Present, and Future: A Science Program for the Arctic Ocean Linking Ancient and Contemporary Observations of Change Through Modeling

A follow-up to the 2nd International Conference on Arctic Research Planning, 19–21 November 2007, Potsdam, Germany

PAGE 287

The Arctic Ocean is the missing piece for any global model. Records of processes at both long and short timescales will be necessary to predict the future evolution of the Arctic Ocean through what appears to be a period of rapid climate change. Ocean monitoring is impoverished without the long-timescale records available from paleoceanography and the boundary conditions that can be obtained from marine geology and geophysics. The past and the present are the key to our ability to predict the future.

The 2nd International Conference on Arctic Research Planning (ICARP II) was organized around preparation of science plans by 12 working groups (WG) that spanned the full range of Arctic studies. The reports from these working groups are available at http://www.icarp.dk. To build on the ICARP II effort, chairs and young scientists from the working groups, representatives of the sponsoring agencies, and members of the steering group met in Potsdam, Germany, from 19 to 21 November 2006 to use the rationale laid out in the working group reports to focus future science activity in the post International Polar Year environment.

The original marine working groups were divided into shelf, margins and gateways, and deep basin regions. Their connectivity and overlapping concerns were reflected in redundancies between the WG reports. At the same time, gaps were evident between the WG reports. In Potsdam, these three groups, Deep Basin (WG 4), Margins and Gateways (WG 5), and Shelves (WG 6), came together to prepare a unified science plan. Our unified science plan has two primary objectives.

Improved monitoring of the Arctic Ocean through autonomous data acquisition and time-series studies is the first component of our proposed program. Understanding of the active processes in the Arctic Ocean is being built on monitoring at sea and on land at strategic sites. Synoptic observations collected through varied means will document change at seasonal, annual, and, eventually, decadal scales.

The second focus is on scientific drilling to reconstruct the tectonic history of the Arctic Ocean and recover paleoceanographic records. The tectonic history of the Arctic Ocean is critical to setting the physical boundary conditions that restrict and enable oceanographic processes and shape ocean circulation.

Understanding contemporary processes and variations at the days to decades scale at dispersed sites across the Arctic Ocean margins and basin is the highest priority for the oceanography, biology, and sea ice communities. Consistently monitoring key locales and circulation choke points (e.g., gateways) with autonomous instruments will establish how climate change is advancing through various systems in the Arctic.

While a well-structured monitoring program could expose the synoptic changes, study of the basin at timescales of hundreds to tens of millions of years can only be accomplished through a systematic program of scientific drilling. These records would also span the time of the last high-pCO_2 environment, which would provide a critical analog for the present anthropogenically driven climate changes.

The full text of this meeting report can be found in the electronic supplement to this *Eos* edition (http://www.agu.org/eos_elec/).

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