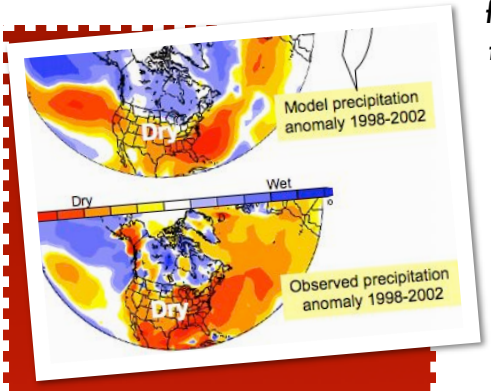
Climate Phenomenology, Observations and Synthesis

U.S. CLIVAR - CLIMATE VARIABILITY AND PREDICTABILITY

Three essential elements in understanding and predicting the climate system are the 1)identification and characterization of climate variability phenomena (e.g. ENSO, NAO, PDO, drought), 2) observation systems that enable scientists to monitor and detect changes in the climate system as well as describe important processes (e.g. mixing in the ocean, climate feedbacks) and 3) the synthesis of data with models to provide a four-dimensional depiction of the climate system for prediction, observation system design, and understanding. Within U.S. CLIVAR the Phenomena, Observations and Synthesis panel has the grand challenge of improving the understanding of climate variations in the past, present and future and to develop syntheses of critical climate parameters while sustaining and improving the global climate observing system.

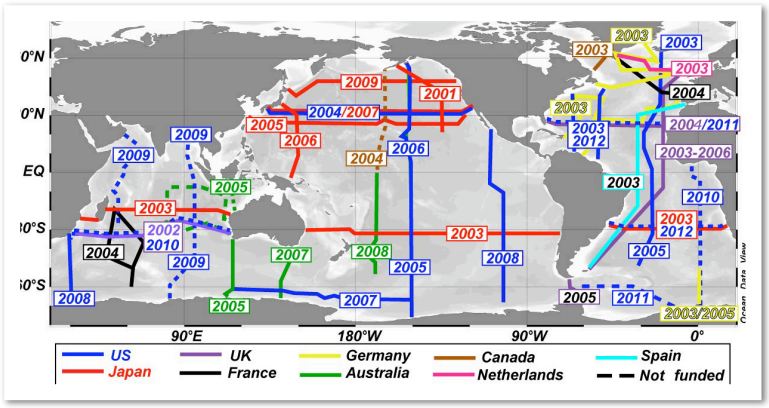


DROUGHT

A new U.S. CLIVAR Working Group on drought will focus attention on the mechanisms that maintain drought across the seasonal cycle and from one year to the next. What is the role of the land (e.g., deep soil moisture, snow, vegetation)? What is the role of the different ocean basins, including the impact of ENSO, the PDO, the AMO, and warming trends in the global oceans? This Working Group will address these questions and identify mechanisms leading to improved characterization of predicability.

Repeat Hydrography

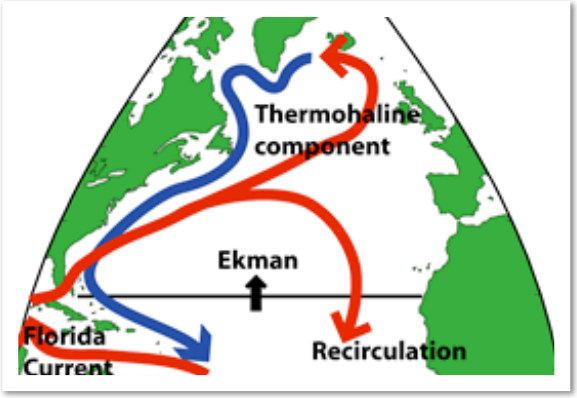
Scientists in the U.S. and abroad have been carrying out a systematic, global re-occupation of select hydrographic sections (U.S. Global Ocean Carbon and Repeat Hydrography program).



(http://ushydro.ucsd.edu/index.html). Their aim is to quantify changes in storage and transport of heat, fresh water, carbon, and related parameters for model calibration and validation, carbon system studies, heat and freshwater storage and flux studies, deep and shallow water mass and ventilation studies, and calibration of autonomous sensors. Data from these cruises are assembled and processed at the CLIVAR/Carbon Hydrographic Data Office (CCHDO - cchdo.ucsd.edu).

Opportunities

Increased hurricane activity, persistent droughts, images of enhanced ice stream melting along the margins of Greenland and Antarctic ice sheets, increased rates of sea level rise, and the prospects of an ice free Arctic by the mid-21st Century, have heightened our awareness of the importance and fickleness of climate. Changes in the Atlantic multi-decadal oscillation (AMO) and meridional overturning circulation (MOC) are linked with surface temperature changes throughout the Atlantic and the current generation of models shows that these temperature changes play a role in decadal Atlantic hurricane variability and global temperature and precipitation changes. Atlantic SST is affected by numerous variability mechanisms including ENSO, the NAO, monsoon systems, Arctic oscillation and more. Decadal variability in the Atlantic will likely provide the basis for the first successful decadal forecasts.



Leadership

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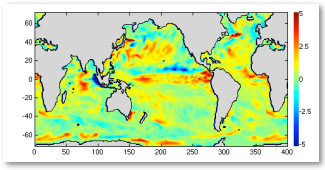
For additional information:
www.usclivar.org

Future Payoffs and Relevance

Estimating the Circulation and Climate of the Ocean (ECCO) is a consortium formed by a group of scientists at the Jet Propulsion Laboratory, Massachusetts Institute of Technology and the Scripps Institution of Oceanography. The main task is to bring together a global GCM with existing global data streams - including TOPEX/ POSEIDON and JASON altimeter observations and in situ hydrographic and flow measurements such as what will be available from the ARGO program - to obtain the best possible estimate of the time evolving ocean circulation and related uncertainties. These serve as critical initial conditions for climate predictions. Estimated ocean temperature is shown (above) at 50 meters for 27 October 2006.



SATELLITE DATA

One of the fundamental problems faced by oceanographers is the sheer size of the oceans. Oceans cover 70 per cent of the Earth's surface. Remote sensing allows measurements to be made of vast areas of ocean repeated at intervals in time. The figure above shows the distribution of ocean surface winds over the Atlantic Ocean, based on September 1999 data from NASA's SeaWinds instrument on the Quikscat satellite, shows wind direction (white streamlines) at a resolution of 25 kilometers (15.5 miles), superimposed on the color image indicating wind speed.