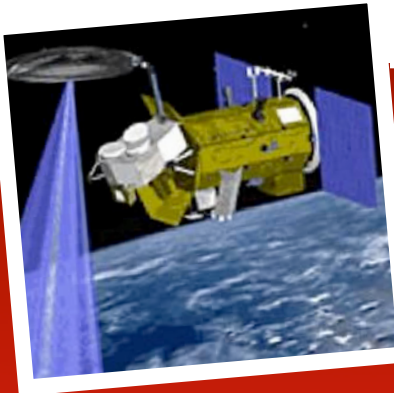


Role of Ocean Salinity in Climate

U.S. CLIVAR - CLIMATE VARIABILITY AND PREDICTABILITY

In order to better understand the role of salinity in the World's Oceans, scientists must be able to 1) describe the role of ocean salinity in the global water cycle, global ocean circulation, and climate variability (including trends); and 2) identify the requirements and challenges for analyzing, observing, and monitoring salinity, as well as simulate processes critical for determining the ocean's role in transport and storage of salinity. By doing these two, scientists will be able to provide guidance to NASA (and the international community) on observational and scientific activities that should be considered in advance of and during the Aquarius mission.

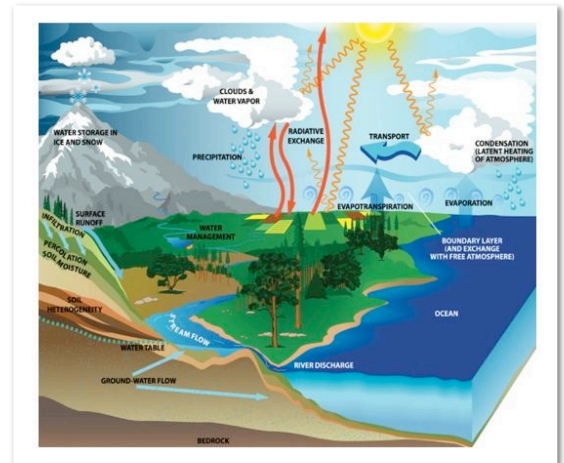


Aquarius Mission

Aquarius is a focused satellite mission that will measure sea surface salinity. It will resolve missing physical processes that link the water cycle, the climate, and the ocean. Aquarius is planning to launch in 2009.

THE GLOBAL WATER CYCLE

The oceanic salinity distribution and its variations are attracting increasing attention due to their relationship to the global water cycle and its influence on ocean circulation, mixing and climate processes. Little is currently known about ocean freshwater fluxes because previous “water cycle” research has focused on land and atmospheric processes. But, salinity is directly linked to the ocean dynamics through the distribution of mass, and plays an important part in the climate system due to its impact on seawater density. Archival data show that in the last 50 years high latitude oceans are freshening while the subtropical oceans are becoming saltier. This change is slowly spreading into the subsurface ocean layers, and may be affecting the strength of the ocean's thermohaline overturning circulation. Moreover, ocean salinity is an important indicator of the global water cycle as it reflects precipitation, runoff, and evaporation over 75% of the earth.



Recommendations from the U.S. CLIVAR Salinity Working Group

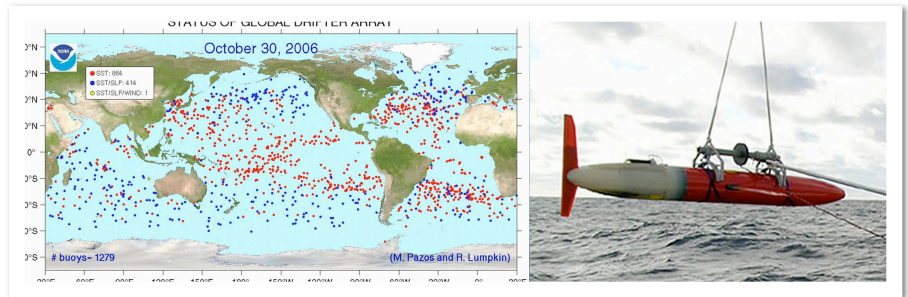
1. Encourage additional measurements to exploit a developing monitoring system;
2. Concentrated efforts to examine aspects of the oceanic freshwater cycle that play a role in climate variability, such as the development of barrier layers and subarctic Atlantic

salinity and its connection to the meridional overturning of the Atlantic;

3. Encourage Assimilation approaches that allow improvement of net surface flux such as the four dimensional variational approaches and coupled assimilation.

OBSERVATION OPPORTUNITIES

A network is currently in place for global ocean salinity monitoring, (surface and subsurface) in the form of Argo profiling floats and thermosalinograph programs. It is important to maintain this network



and to take steps to ensure high quality data emerge. Opportunities exist for equipping existing observation networks, such as the Global Drifter Program (above left), with salinity sensors, and enhancing the scope of salinity monitoring on the TAO/TRITON and PIRATA moored buoy arrays. Emerging technologies, such as gliders (above right) can expand the spatial and temporal coverage of salinity observations where necessary. The continued deployment of CTDs during oceanographic cruises will be vital for monitoring salinity from the surface to the ocean bottom along previously occupied cruise tracks.

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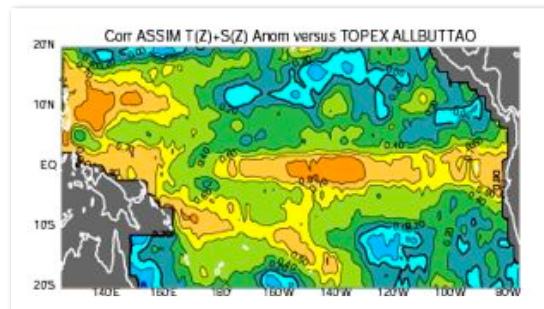
FOR ADDITIONAL INFORMATION:
WWW.USCLIVAR.ORG

FUTURE PAYOFFS AND RELEVANCE

SALINITY ASSIMILATION

Direct observations of salinity, although improving in quality and quantity, are still limited. Data assimilation in ocean-only and coupled models offers exciting potential to allow observations of sea surface salinity together with a host of other surface and subsurface observations to infer important aspects of the oceanic freshwater cycle, including net freshwater flux. In addition, data impact studies indicate the as

simulation of salinity improves the fields of subsurface thermal structure, and by extension may be expected to improve forecast model initialization. The figure below shows the correlation of assimi-



lated temperature and salinity anomalies versus TOPEX sea surface height data.

FRESHWATER FLUXES

Once assimilation of accurate salinity into

models with proper physics is achieved, one can expect to better monitor the changing state of the global water cycle. The water cycle is fundamental to the maintenance of civilization, yet since most of it

occurs over the oceans, our quantitative understanding remains poor. Expanded salinity observations

will let us use the oceans as the largest possible rain gauge.

