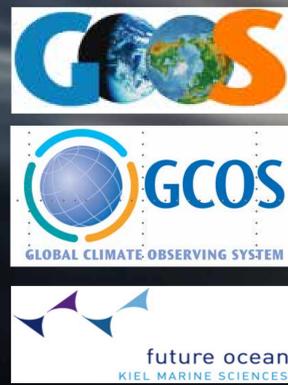
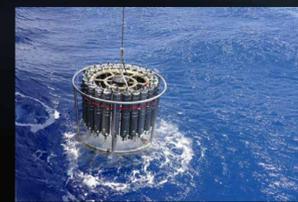
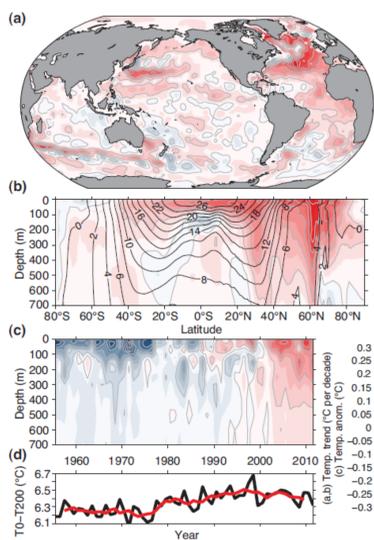


# Ocean aspects of the GCOS Implementation Plan 2016: Connection to Climate Information and Services for Adaptation, Mitigation and the SDGs.

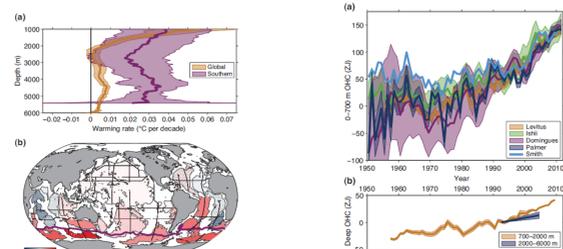
Toste Tanhua  
GEOMAR Helmholtz Center for Ocean Research Kiel  
UNESCO-IOC



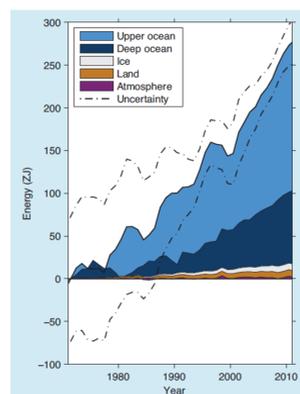
## Why Observe the Ocean for Climate?



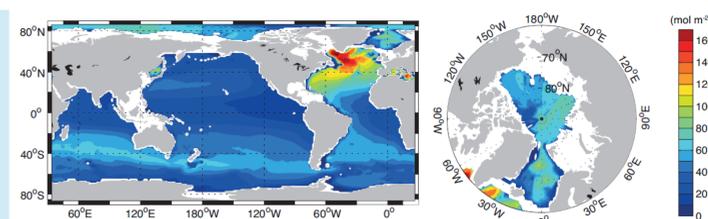
The ocean is warming and absorbing  
~93% of excess heat to the climate system



Far left: Temperature increase over time in upper ocean  
Mid left: Temperature increase over time in abyssal ocean  
Mid right: Increase of ocean heat content  
Far right: Change in heat content of the climate system



The ocean stores ~30% of  
anthropogenic CO<sub>2</sub>



Column inventory of anthropogenic CO<sub>2</sub> in the world ocean as  
estimated from transient tracer observations.

## Needs and Opportunities for Ocean Observations

“Attaining and sustaining global coverage is the most significant challenge of the oceanic climate observing system.”

This challenge will only be met through national commitments to the global implementation and maintenance effort and with international coordination. This Plan encourages the ocean observing community to adopt the Framework for Ocean Observing that was developed after the OceanObs09 conference with additional input provided from the ocean observing community, as a framework for planning implementing evaluating sustained multidisciplinary ocean observing.

The Global Ocean Observing System is organised by user-driven requirements for :

- Ø • Monitoring the climate system;
- Ø • Detecting and attributing climate change;
- Ø • Assessing impacts of, and supporting adaptation to, climate variability and change;
- Ø • Application to national economic development;
- Ø • Research to improve understanding, modelling and prediction of the climate system.

An observing system based on Essential Climate Variables (ECVs)

### Physics:

Temperature, Sea Surface Temperature, Salinity, Sea Surface Salinity, Currents, Surface Currents, Sea Level, Sea State, Sea Ice, Ocean Surface Stress, Ocean Surface Heat Flux

### Biogeochemistry:

Inorganic Carbon, Oxygen, Inorganic Nutrients, Transient Tracers, Nitrous Oxide, Ocean Colour

### Biology / Ecosystems:

Plankton, Marine Habitat Properties

Ø To meet the ECV requirement and to provide the greatest resilience of the observing system, the ocean observing system is coordinated through global networks which are organised around a particular platform or observing approach and with defined missions and implementation targets.

Ø The composite observing networks monitor ocean ECVs globally, but do this at different temporal and spatial scales depending on requirements and feasibility.

Ø There is a pressing need to expand the monitoring capabilities by obtaining global coverage using proven technologies and to continue to develop novel observing technologies, to establish communications and data management infrastructure, and to enhance ocean analysis and reanalysis capacity.

Ø The composite global ocean observing system makes best use of a mix of proven satellite and in situ technologies and optimizes the contributions from existing observing assets and deployment opportunities for both global surface and subsurface variables.