

Ocean Observation as IPCC related activity

Masao Fukasawa * 1
Christopher Sabine * 2

* 1 Research Institute for Global Change,
JAMSTEC

* 2 Pacific Marine Environment Laboratory
NOAA

IPCC : Intergovernmental Panel on Climate Change



World Meteorological Organization
Working together in weather, climate and water



United Nations Environment Programme
environment for development

**IPCC reviews
and assesses;**

...the most recent scientific, technical
and socio-economic information
produced worldwide relevant to the
understanding of climate change....

**It does not conduct any research nor
does it monitor climate related data or
parameters.**

Scientific information??



Projection of future climate

Description of the state of climate

Ocean observation;

AR4(2007)

Chapter5: Ocean Climate Change and Sea level (47pp)

5-1 Changes in Global-Scale Temperature and Salinity

5-2 Regional Changes in Ocean Circulation and Water Masses

5-3 Ocean Biogeochemical Changes

5-4 Changes in Sea Level

5-5 Synthesis

196 ocean observational research papers were cited

AR5(2013?)

First order draft was reviewed already

(inhibited to cite, quote or distribute yet).

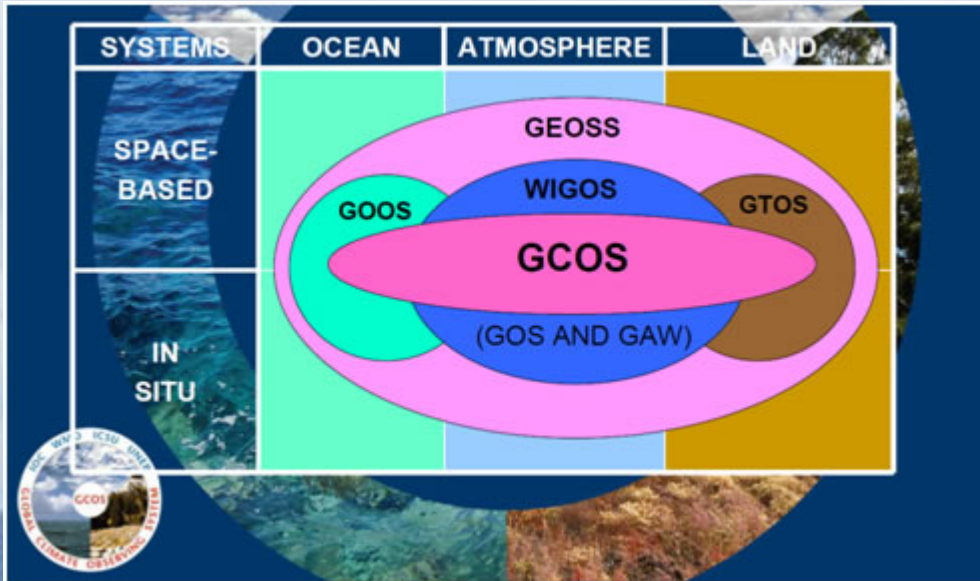
>Chapter for Ocean Observations(~60pp)

>Number of section will be larger than that of AR4

>300 ocean observational research papers will be cited

Almost all of observational data for those papers in IPCC reports are supplied from GCOS ocean part and/or GOOS (climate part).

GCOS: Global Climate Observing System organized under WMO, IOC/UNESCO, UNEP and ICSU



WIGOS: WMO Integrated Global Observing System

GOS : Global Observing System

GAW : Global Atmosphere Watch

GCOS: Global Climate Observing system
WMO, IOC/UNESCO, UNEP, ICSU

GOOS: Global Ocean Observing System
IOC/UNESCO, WMO, UNEP, ICSU

GTOS: Global Terrestrial Observing System
FAO, ICSU, UNEP, IOC/UNESCO,

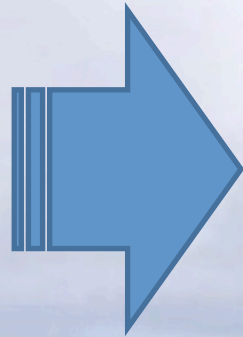
WMO

From GOSIC web

GOOS/GCOS Joint Programs

Essential Climate Variables (ECV) of ocean obs. by GCOS and GOOS

OCEANIC
Surface [6]
Carbon Dioxide Partial Pressure
Current
Ocean Acidity *
Ocean Color (for Biological Activity)
Phytoplankton *
Sea Ice
Sea Level ***
Sea State
Sea Surface Salinity (SSS)
Sea Surface Temperature (SST)
Sub-Surface
Carbon
Current
Nutrients
Ocean Acidity *
Oxygen *
Salinity
Temperature
Tracers
Global Ocean Heat Content **/***

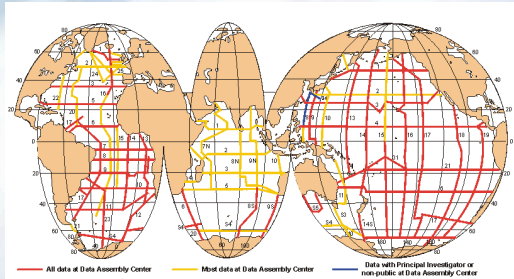


Program Name	Data Access	Program Information	Coordinating Bodies	Essential Climate Variables (ECV)	Other Links
Global Sea Level Obs. Sys. (GLOSS)	✓	✓	<ul style="list-style-type: none"> JCOMM GLOSS 	<ul style="list-style-type: none"> Sea Level 	
Data Buoy Cooperation Panel (DBCP)	✓	✓	<ul style="list-style-type: none"> JCOMM ICOADS 	<ul style="list-style-type: none"> Sea Surface Temperature Current Sea Surface Salinity 	
Predic. & Res. Moored Array in the Atlantic (PIRATA)	✓	✓	<ul style="list-style-type: none"> NOAA/PMEL France/IFREMER Brazil/INPE 	<ul style="list-style-type: none"> Sea Surface Temperature Current Sea Surface Salinity Wind Speed and Direction Air Temperature Precipitation 	
Tropic. Atmos. Ocean Project (TAO)	✓	✓	<ul style="list-style-type: none"> NOAA/PMEL JAMSTEC IRD 	<ul style="list-style-type: none"> Sea Surface Temperature Current Sea Surface Salinity Wind Speed and Direction Air Temperature Precipitation 	
Mooring Array in Tropic. West. Pacific and East. Indian Ocean (TRITON)	✓	✓	<ul style="list-style-type: none"> JAMSTEC 	<ul style="list-style-type: none"> Sea Surface Temperature Current Sea Surface Salinity Wind Speed and Direction Air Temperature Precipitation 	
Global Ref. Mooring Network(OceanSITE)	✓	✓	<ul style="list-style-type: none"> JCOMM OceanSITES 		OceanSITES web site
Argo	✓	✓	<ul style="list-style-type: none"> Argo Steering Team 	<ul style="list-style-type: none"> Sea Surface Salinity Current Sub-surface Temperature Sub-surface Salinity 	
Voluntary Observing Ship (VOS)	✓	✓	<ul style="list-style-type: none"> JCOMM ICOADS VOSCIim 	<ul style="list-style-type: none"> Sea Surface Temperature Sea Surface Salinity Current Sea Level Sea State Sea Ice Ocean Color Carbon Dioxide Partial Pressure 	VOS data flow

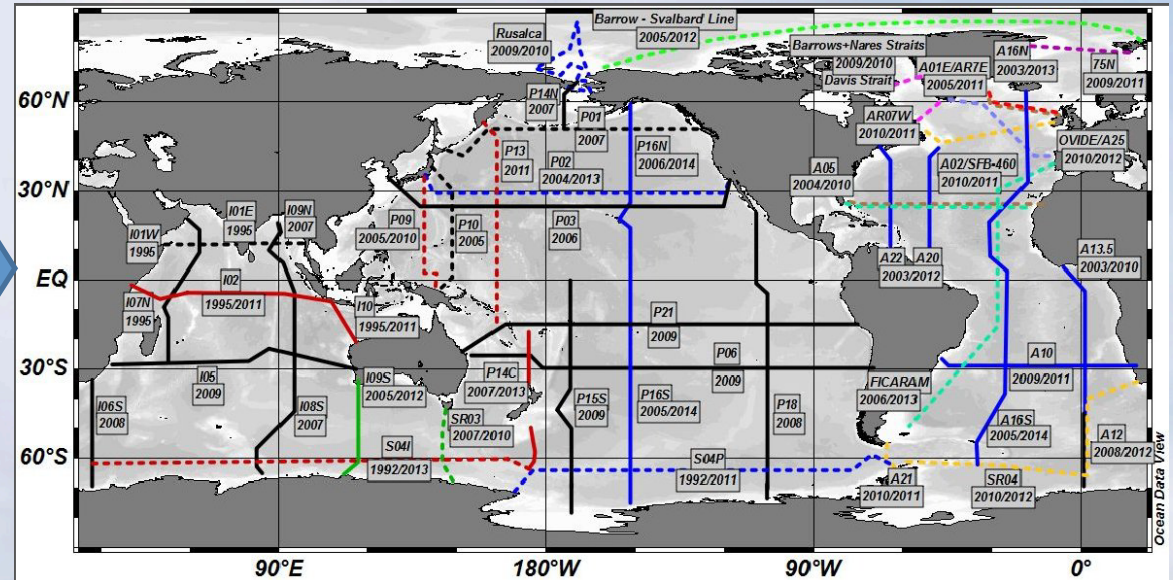
Each coordinating body is responsible for data collection, quality control and dissemination. Program information is also publicized by the body.

Ship Based Hydrography

WOCE → CLIVAR



GO-SHIP



GO-SHIP reference line

GO-SHIP

The Global Ocean Ship-Based Hydrographic Investigation Program established in 2007 under IOCCP and CLIVAR in collaboration with IMBER, SOLAS, Argo and OceanSITES

Core Variables

CTD;

Temperature, Salinity, Pressure, O₂, Current

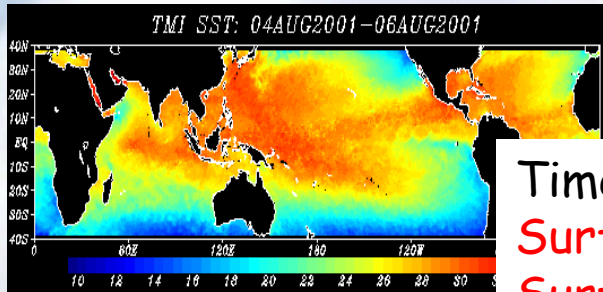
Water Samples;

Salinity, O₂, NO₃, NO₂, PO₄, SiO₃, DIC, Alk, (pCO₂), pH, 13C, 14C, CFC-11/12, SF₆, 3H, 3He, POC, DOC

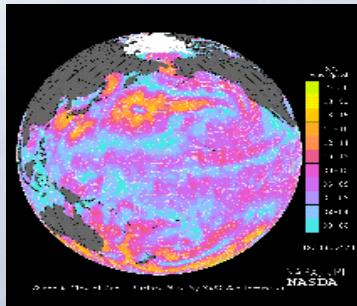
Underway including pCO₂

Information ; GO-SHIP office
Data ; CCHDO(Scripps)
and CDIAC(USDOE)

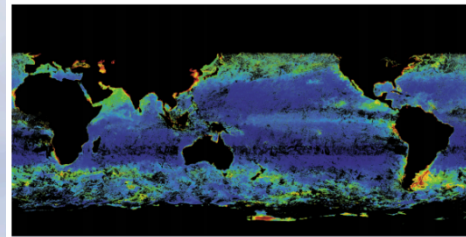
Satellite ocean observation



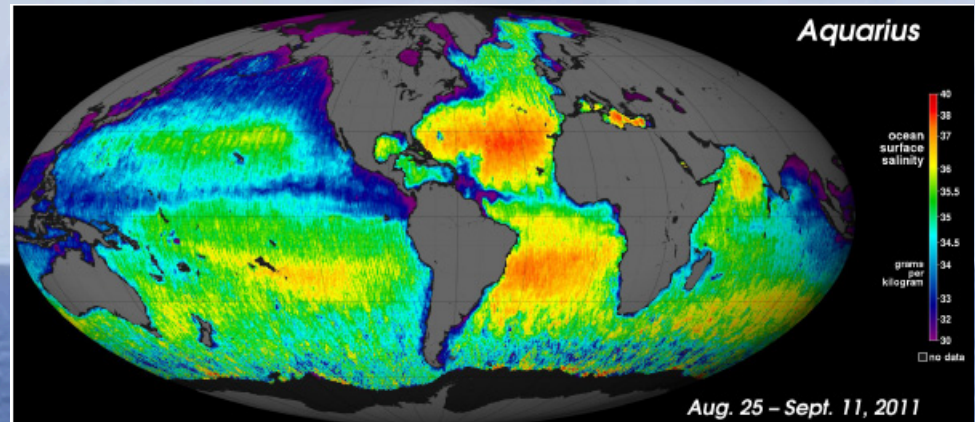
Time series of world wide distribution of **Sea Surface Height, Sea Surface Temperature, Sea Surface Wind, Chlorophyll-a and Sea Ice** have been monitored and distributed to the society with minimum cost.



JAXA

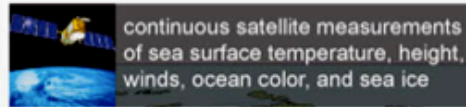


Recently, even **Sea Surface Salinity** distribution are going to be measured by a satellite.

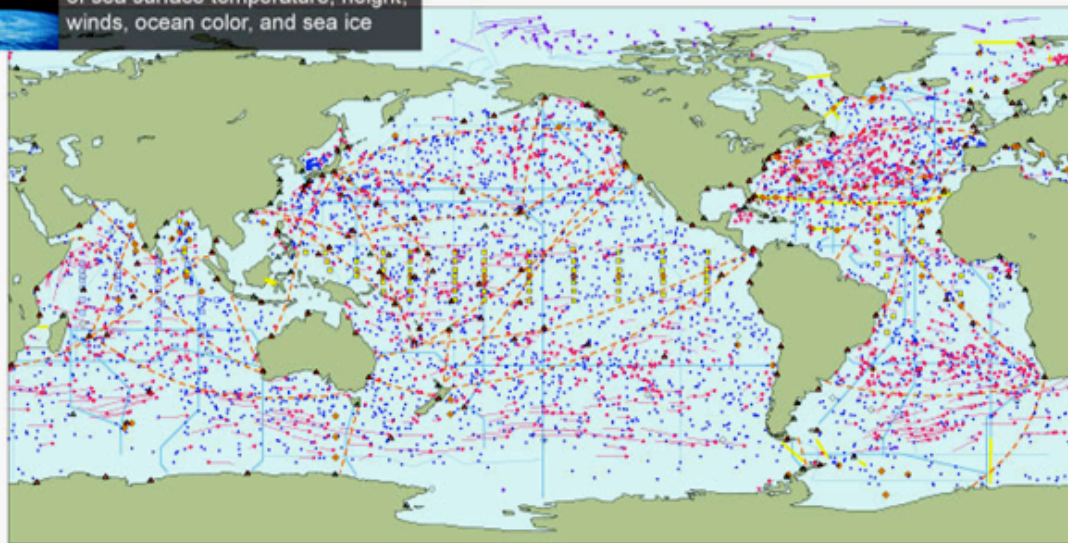


NOAA

Implementation of GCOS ocean in situ observing network or GOOS climate part



Total *in situ* networks **62%** April 2011

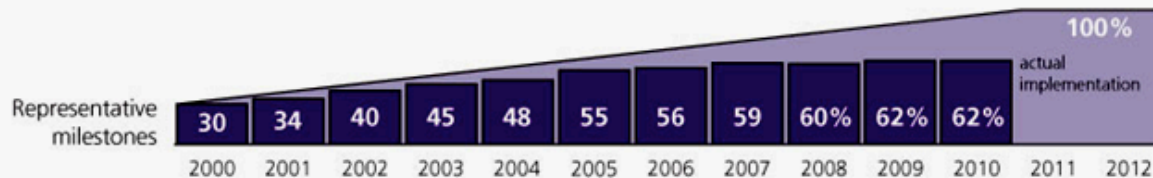


- 100%** Surface measurements from volunteer ships (VOS)
 - 250 ships in VOSclim pilot project
- 100%** Global drifting surface buoy array
 - 5° resolution array: 1250 floats
 - Ice buoys
- 59%** Tide gauge network (GCOS subset of GLOSS core network)
 - 170 real-time reporting gauges
- 80%** XBT sub-surface temperature section network
 - 51 lines occupied
- 100%** Argo profiling float network
 - 3° resolution array: 3000 floats
- 62%** Repeat hydrography and carbon inventory
 - Full ocean survey in 10 years

Transport monitoring **48%**
29 sites

34% Global time series network
58 moorings planned

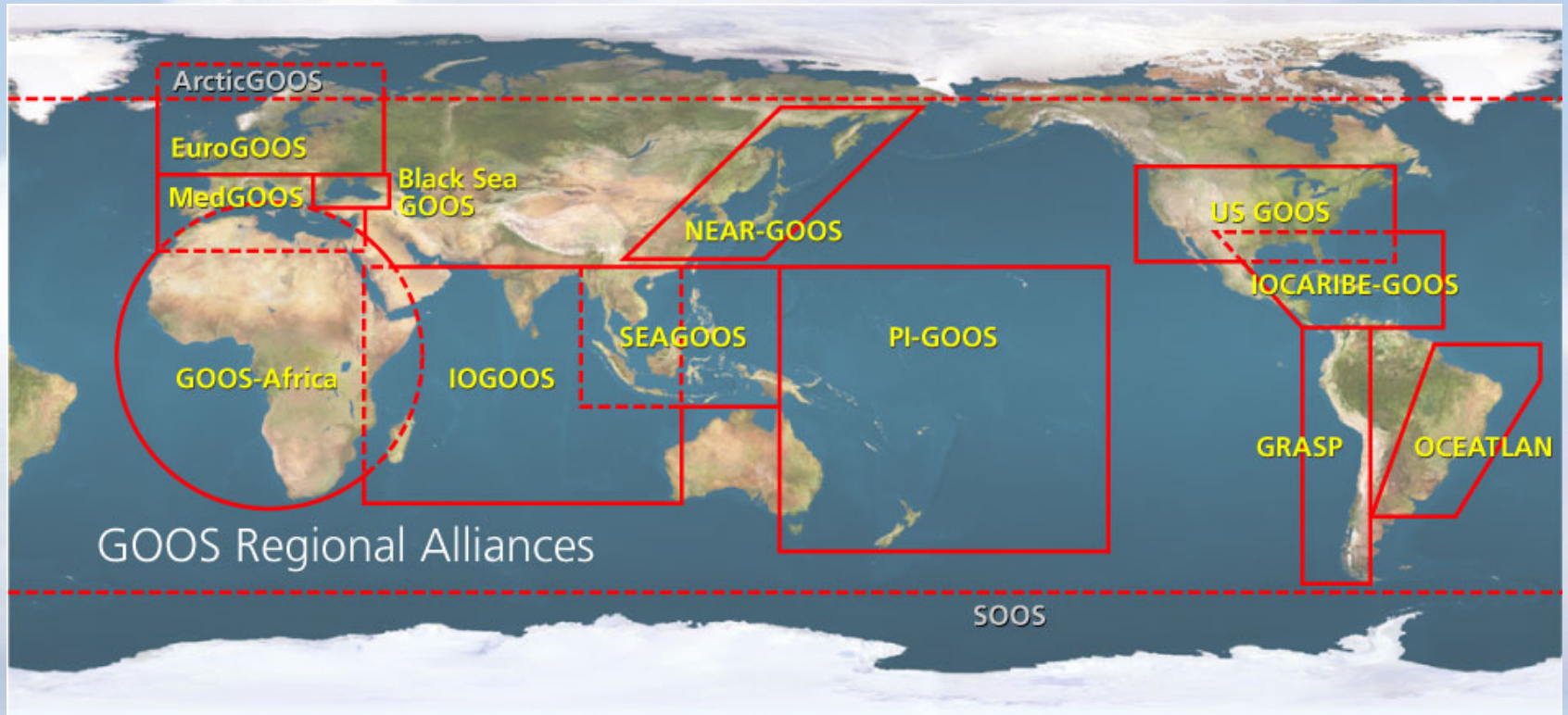
73% Global tropical moored buoy network
119 moorings planned



System % of initial goals

Implementation has been sustained since 2007 mainly because slow developments of OceanSITE and Transport monitoring.

GOOS Regional Alliances



GOOS Regional Alliances are intended to provide an operational demonstration of the usefulness of a regional ocean observing system in the achievement of its own specific goals and as a pilot project for other parts of the world.

GOOS Regional Alliances are located much closer to our society or to our daily life!!!

However, from the view point of "data user"

	Real time	Delayed mode
NEAR-GOOS	△	○
SEA-GOOS	x	x
PI-GOOS	x	x
IOGOOS	x	x

accessibility to data in each regional GOOS in Asian-Pacific

States of data collection and dissemination including project information in Asian-Pacific Regional GOOS are not sufficient.

It may be because any coastal ocean data have great concern with the security and benefits of each country.

However, it is almost impossible for a country to create good direction of coastal management without coastal ocean data from adjacent countries.



At least, **information of coastal ocean observation in Asian-Pacific area should be collected and disseminated even without measured data.** (APCOIC; Asian-Pacific Coastal Observation Information Center is desirable.)

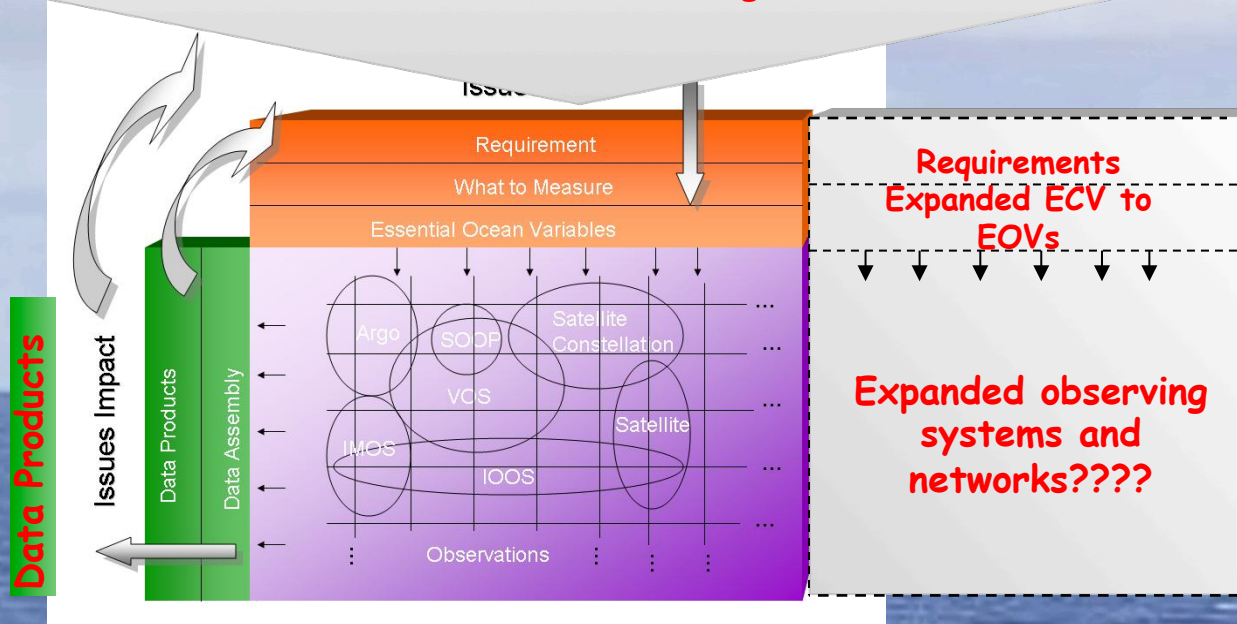
TOR of or expectation to IPCC in coming decade;
 "Assessment of climate change" to "Assessment of the way
 how we can mitigate against and adapt to climate change"

Definition of Societal Drivers of Ocean observation
 toward "Ocean and Society"

Fisheries
Ecosystem services/
Biology

Assessments of
Regional managements
Real-time services
 •Emergency support
 •Ocean forecasting

Weather & Climate
 •UNFCCC/IPCC
 •WCRP
 •WMO RRR
 •Climate services



Summary

- # 1: In the last decade, Ocean observing system has considerably developed and many outcomes are available as assessment of global climate change. Ocean observation is important parts within IPCC reports.
- # 2: GOOS has been a core of the ocean observation system. Global ocean data are collected and disseminated through GCOS/GOOS joint programs very smoothly.
- # 3 GOOS Regional Alliances are one of keys to "Ocean and Society", however, some **new framework of data flow, which does not violate each national security and benefit, is necessary to share information of coastal ocean observation among A-P countries.**
- # 4 Also, **new idea of "Essential Ocean Variable" is needed to secure the societal driver of ocean observation towards "Ocean and Society".**

A scenic view of a blue ocean under a bright blue sky with large, fluffy white clouds. The text "Thank you for your kind attention!!!" is centered in the middle of the image.

Thank you for your kind attention!!!









Weather & Climate

• UNFCCC/IPCC

• WCRP

• WMO RRR

