

# OceanSITES

Taking the pulse of the global ocean

## Varieties of time series data (OceanSITES)

Makio Honda

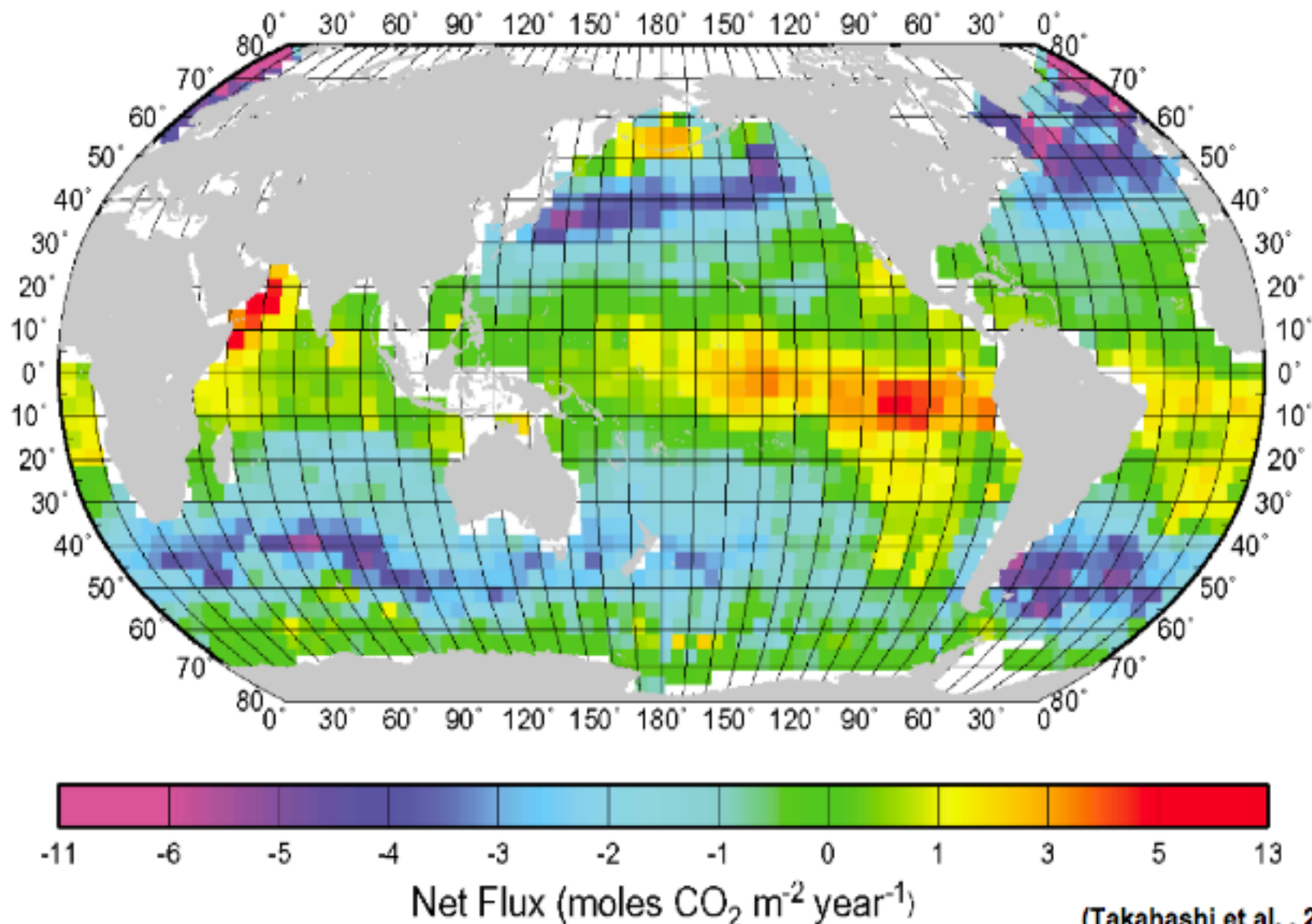
Japan Agency for Marine-Science and Technology  
(JAMSTEC)

(Executed committee member of OceanSITES)



# Spatial variation in CO<sub>2</sub> flux

Mean Annual Air-Sea Flux for 1995 (NCEP 41-Yr Wind, 940K, W-92)

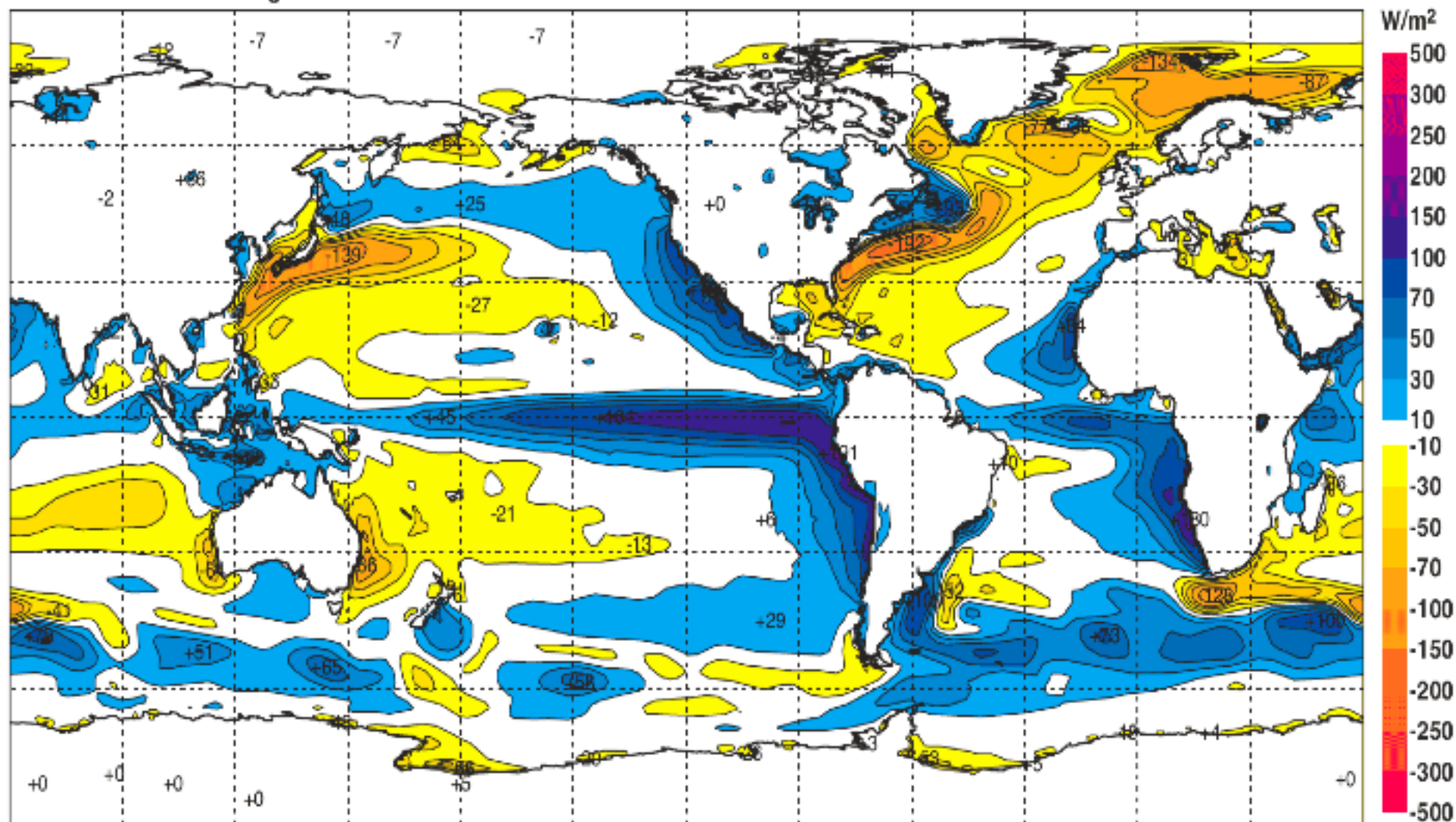




# Spatial variation in Heat flux

Net surface heat exchange

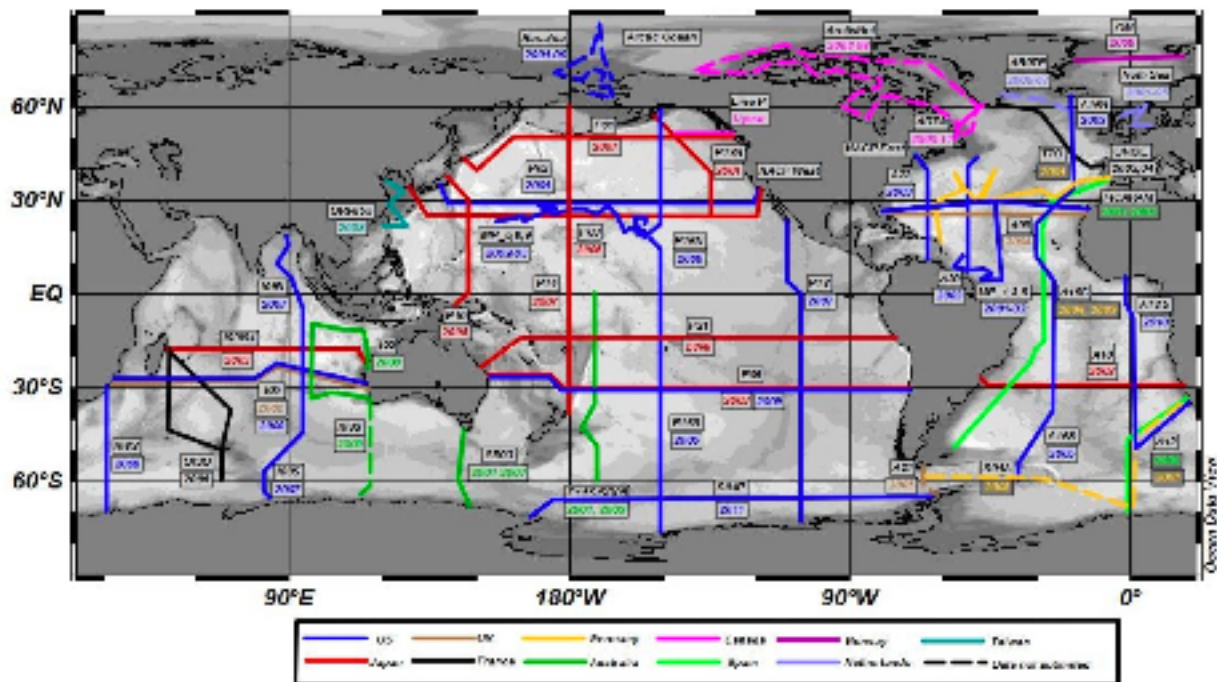
Annual mean



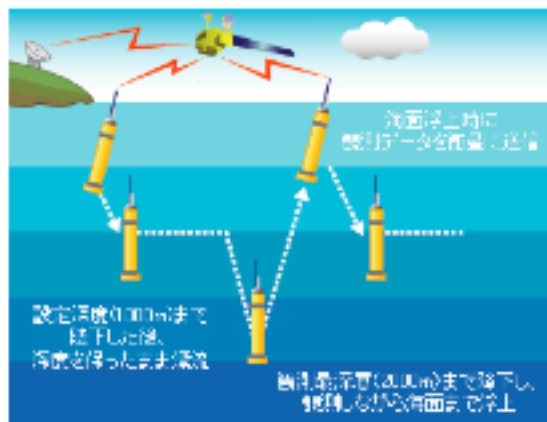
(Kallberg et al. , 2005)

# Global ocean observation network

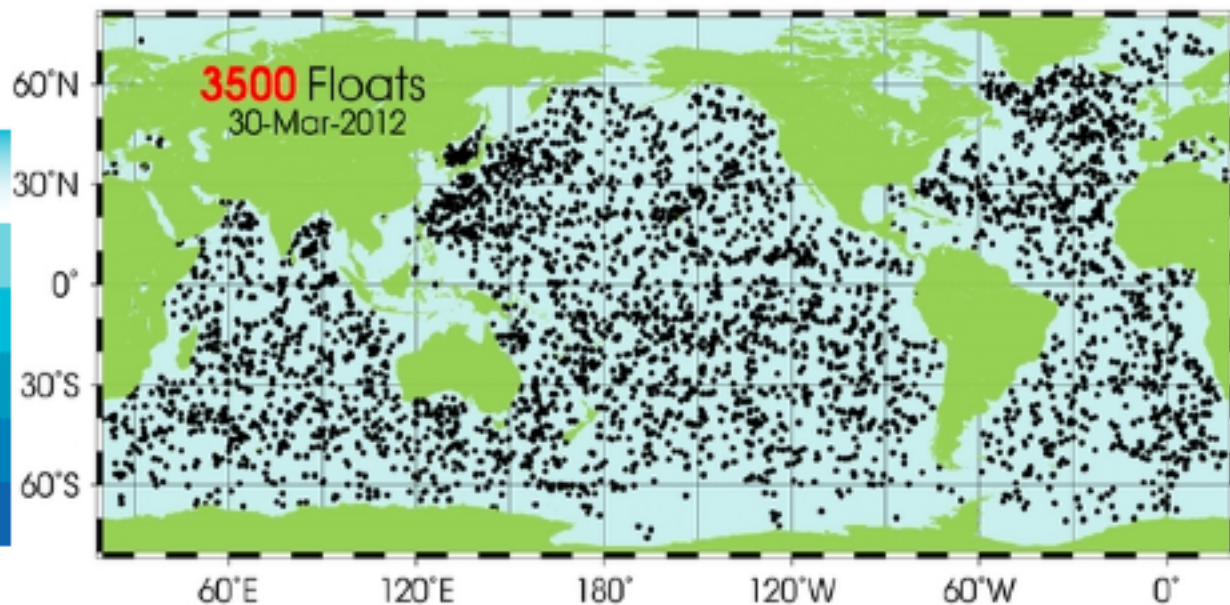
## Repeat Hydrography



## ARGO



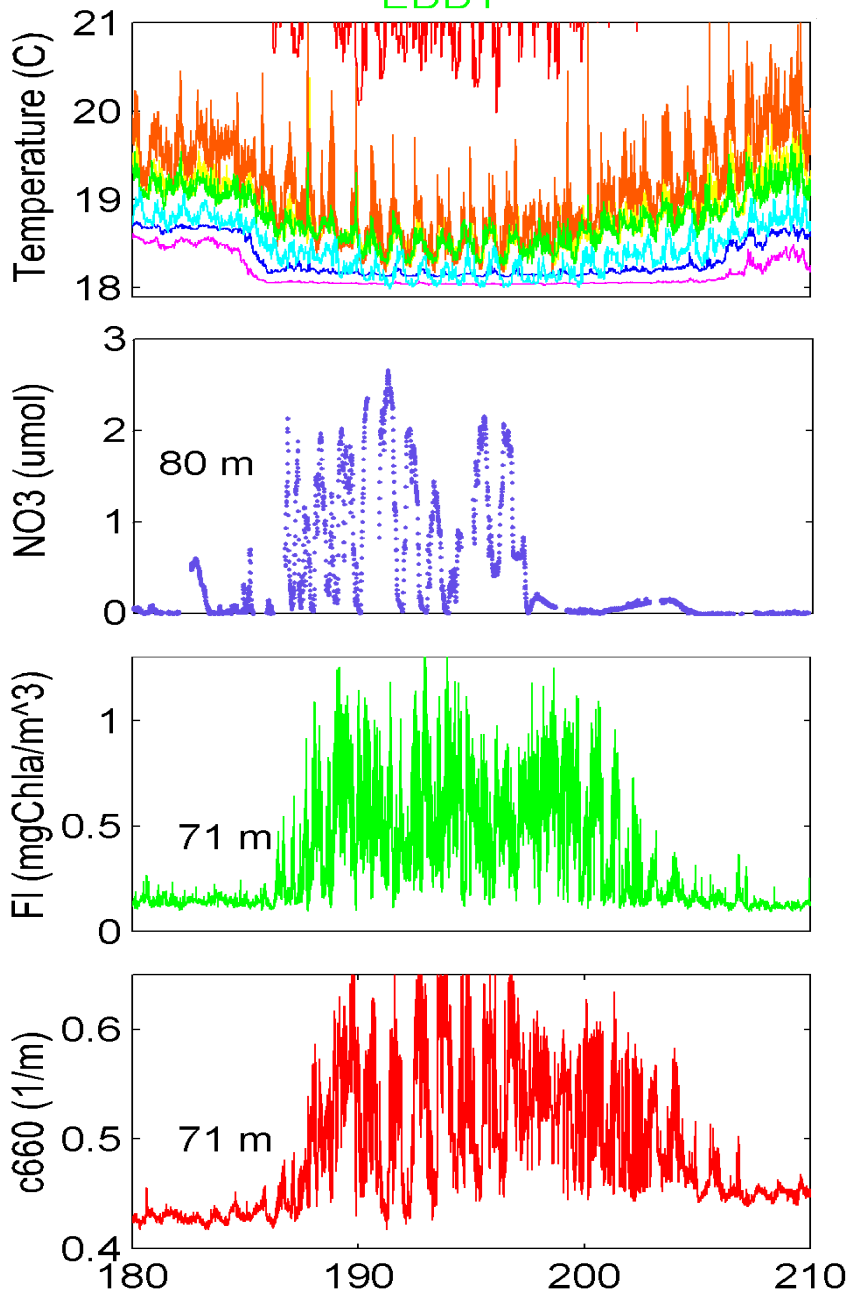
アルゴフロートの観測サイクル概念図



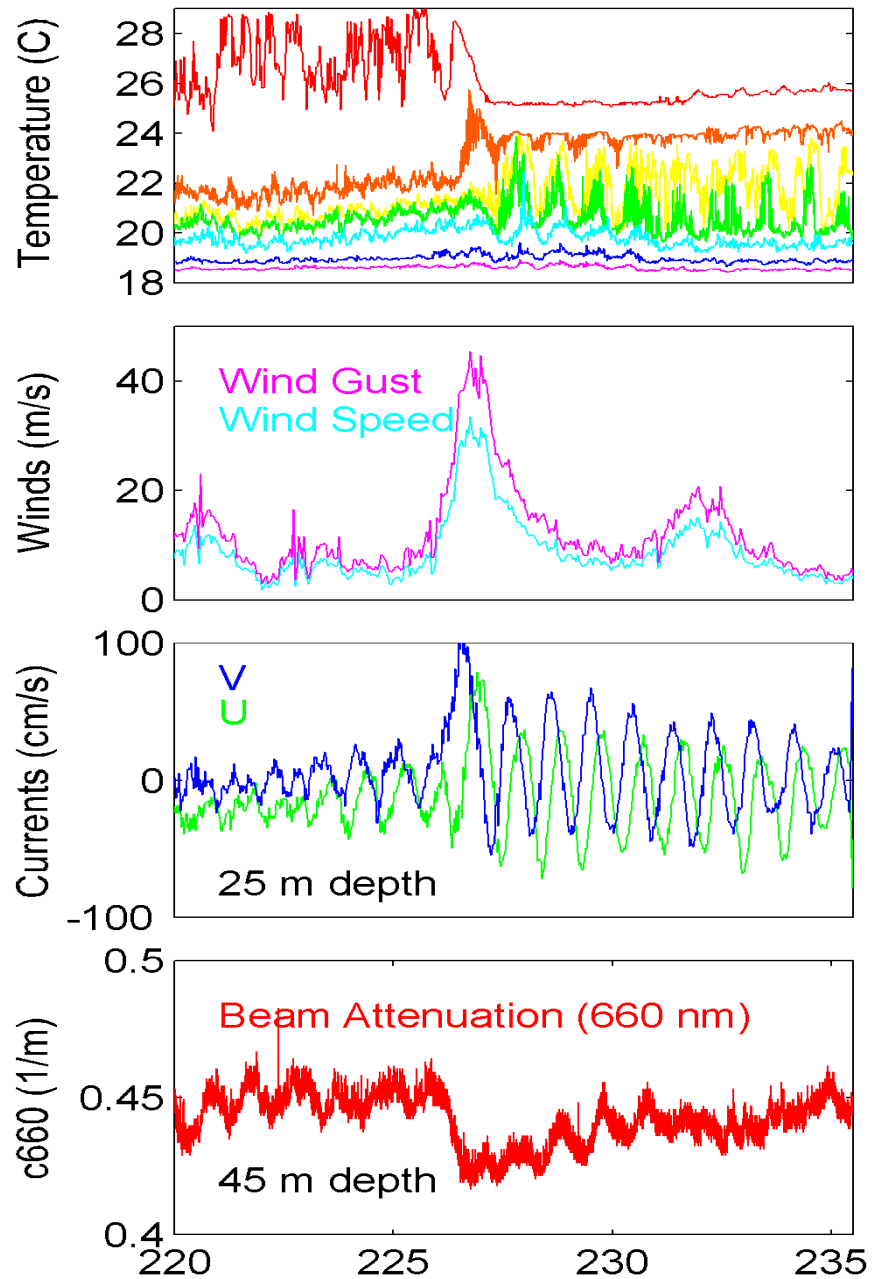


# Extemporary event in the ocean

EDDY



HURRICANE FELIX



# OceanSITES

Taking the pulse of the global ocean

Continuous measurements from  
the deep ocean in real time

[www.oceansites.org](http://www.oceansites.org)

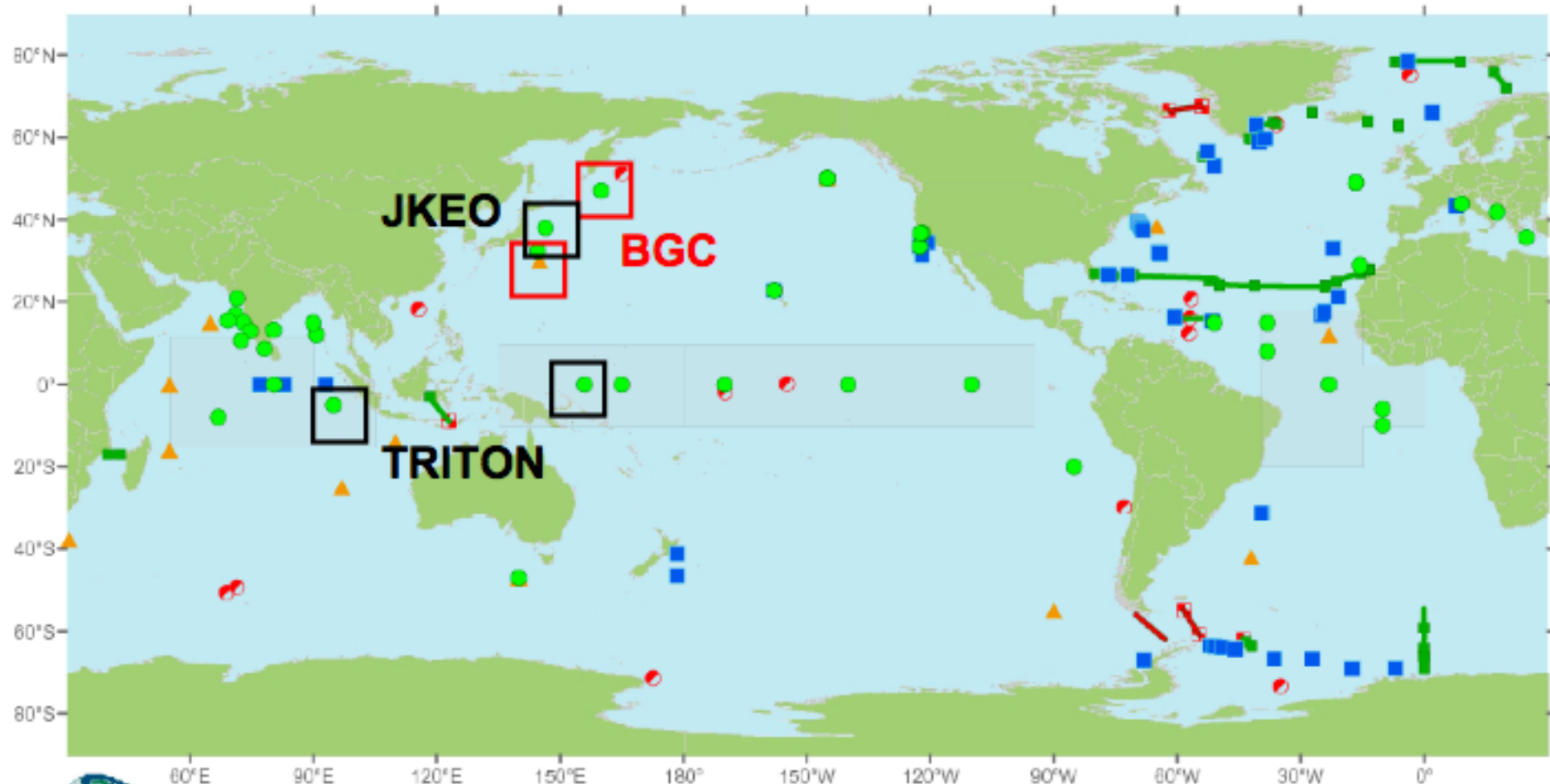
International Observation Network  
**OceanSITES** (Sustained Interdisciplinary  
Time-series Environment observation  
System)

- **GOOS/CLIVAR/POGO** sponsored activity and deeply related to **JCOMM** and **IOCCP**
- Goal is to make the **data publicly available** as soon as received and quality-controlled by the owner/operator
- The system is collecting **multidisciplinary time-series data in the open ocean**: physical, meteorological, chemical, biological and geophysical timeseries observations.
- only **Eulerian data**, i.e. data from time-series fixed points, no ship sections or underway data, no surveys with vessels or gliders around a site.
- **Interface** with other programs
- **Coordination** of methods, standards and logistics with other programs
- **Provides** resources, platforms, expertise and station information (e.g. cruise plan)

- An International Steering Team provides **guidance, coordination, outreach**, and oversight for the implementation, data management and capacity building
- **Participation of 20 countries** (at 2010) (Australia / Bermuda / Canada / Cape Verde / Chile / Faroe Island / France / Germany / Greece / Iceland / India / Italy / Japan / Netherland / New Zealand / Norway / Spain / Taiwan China / UK / US)



# Mooring systems form backbone of the OceanSITES global network



**OceanSITES Vision Map 2009 - All Planned Sites**



- |   |                                     |                             |                             |
|---|-------------------------------------|-----------------------------|-----------------------------|
| <b>OceanSITES Moorings and Observatories (91)</b> | <b>Planned or Discontinued (32)</b> | <b>Transport sites (19)</b> | <b>■ Transport Stations</b> |
| ● OPERATING Real time data (44)                   | ▲ PLANNED Real time data (15)       | — OPERATING (16)            | ⊠ Discontinued              |
| ■ OPERATING Delayed Mode data (47)                | ▲ PLANNED Delayed Mode data (0)     | — DISCONTINUED (3)          |                             |
|   | ● DISCONTINUED (17)                 |                             |                             |

Note: This status was based on information provided in 2009.

# JKEO

*meso and sub-meso scale phenomena*

*Air-sea interaction: heat flux*

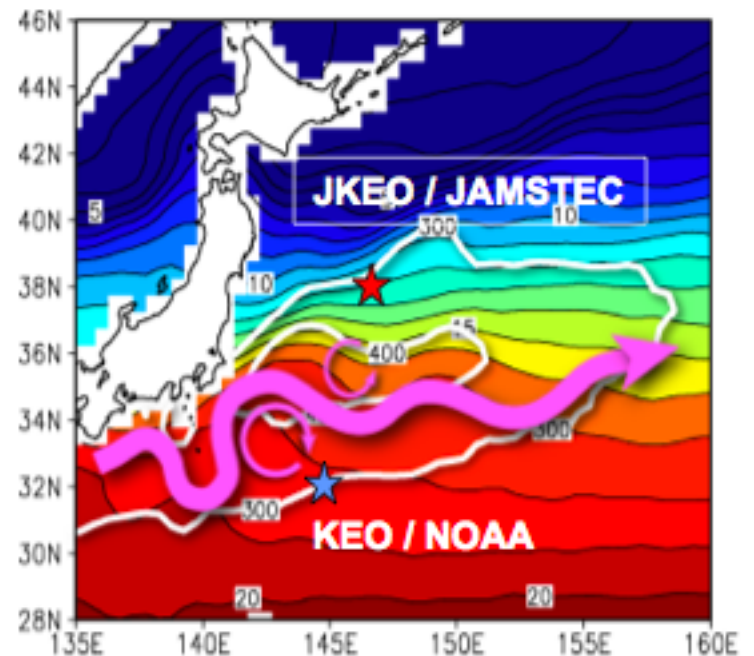
One is **JKEO** project. As the Kuroshio Extension region is the one of the **largest heat flux regions** in the world, the high quality surface heat flux data is necessary for better understanding of **global climate system**. Using the in-situ data observed by a surface flux buoy at JKEO-site in the mixed water region between two SST fronts, **the Oyashio and the Kuroshio Extension**, together with that from **KEO-site** at the south of the Kuroshio Extension operated by **NOAA-PMEL**, we will develop the method estimating high quality sea surface heat flux in the Kuroshio Extension region from the satellite remote sensing data. **A surface buoy (K-TRIRON)** in the Kuroshio region acquires atmospheric and oceanographic data and supplies a part of these data to OceanSITES.

**JKEO project:**

<http://www.jamstec.go.jp/iorgc/ocorp/ktsfg/dataset/jkeo/index.html>

**Data:**

[http://www.jamstec.go.jp/iorgc/ocorp/ktsfg/dataset/jkeo/JKEOocean\\_site.htm](http://www.jamstec.go.jp/iorgc/ocorp/ktsfg/dataset/jkeo/JKEOocean_site.htm)





# TRITON

*ENSO events*

*Dipole phenomena*

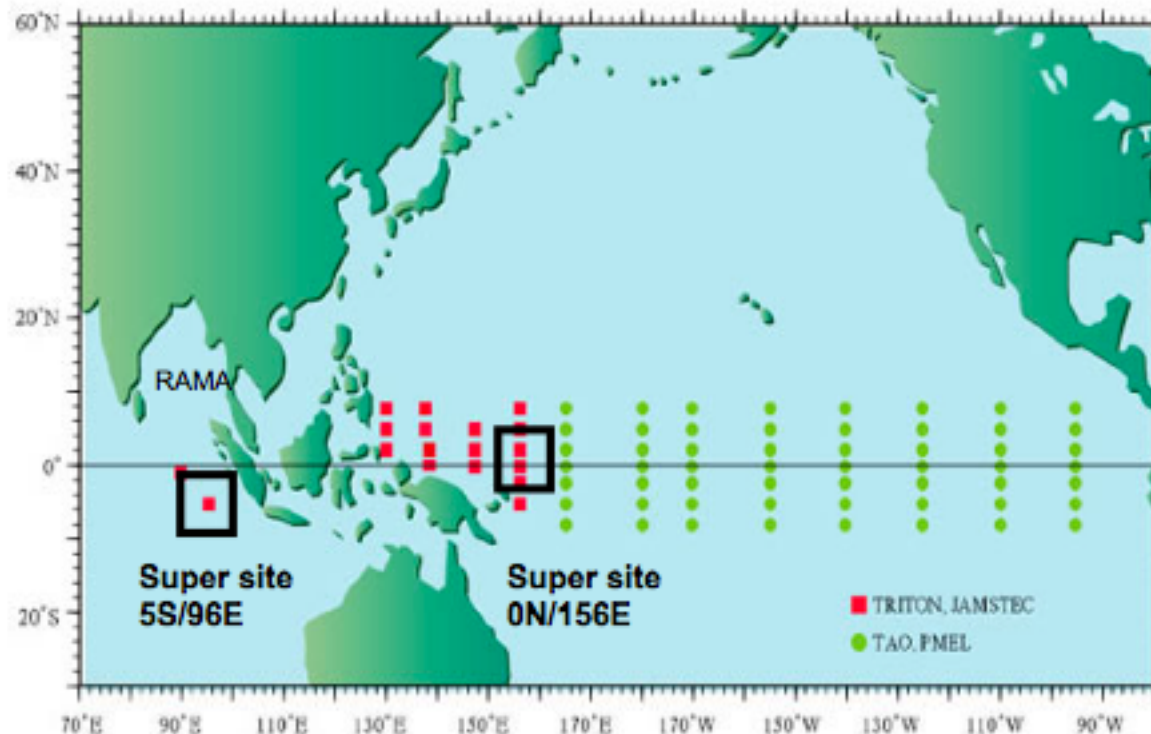
The other is **TRITON** project. The scientific objectives are to elucidate the processes of **heat and fresh water flux** in the center of western Pacific warm water pool. It consists of **ENSO** monitoring **TAO/TRITON** array operated with **NOAA-PMEL**. The buoy at this site will be used for high precision measurement of SST to validate the satellite products. Some buoys are also utilized for measuring **CO<sub>2</sub>** in the water for a study of carbon flux. TRITON buoys also acquire atmospheric and oceanographic data in the western equatorial Pacific and supply these data (two **Super sites**) to OceanSITES.

TRITON project:

[http://www.jamstec.go.jp/jamstec/TRITON/real\\_time/overview.php/po.php](http://www.jamstec.go.jp/jamstec/TRITON/real_time/overview.php/po.php)

Data:

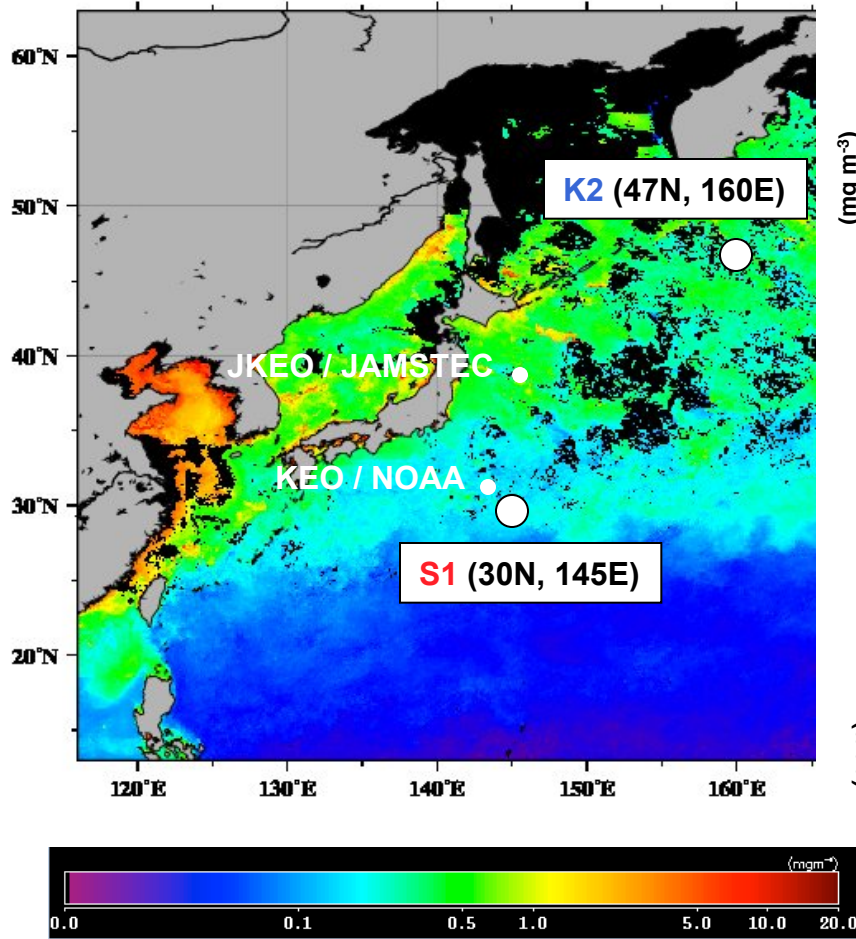
[http://www.jamstec.go.jp/OceanSITE/S/data\\_j.html](http://www.jamstec.go.jp/OceanSITE/S/data_j.html)



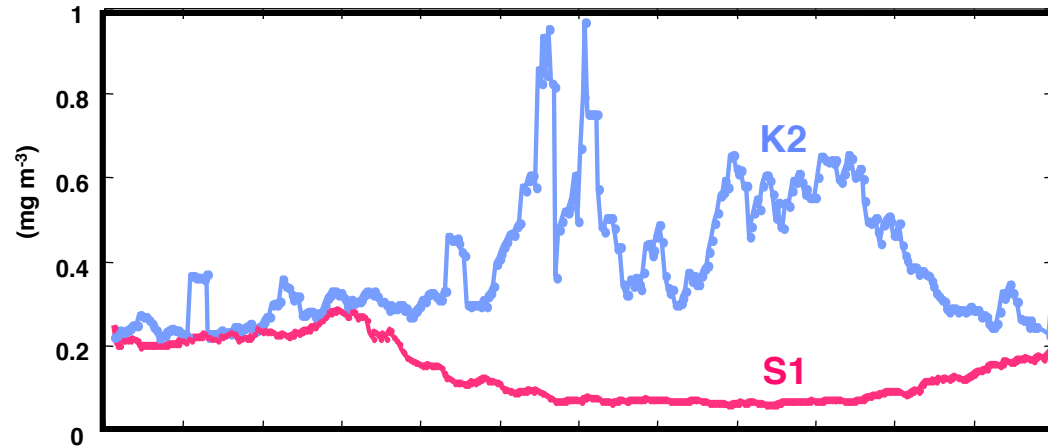
# BGC

## Change in material cycles and ecosystem by the climate change and its feedback

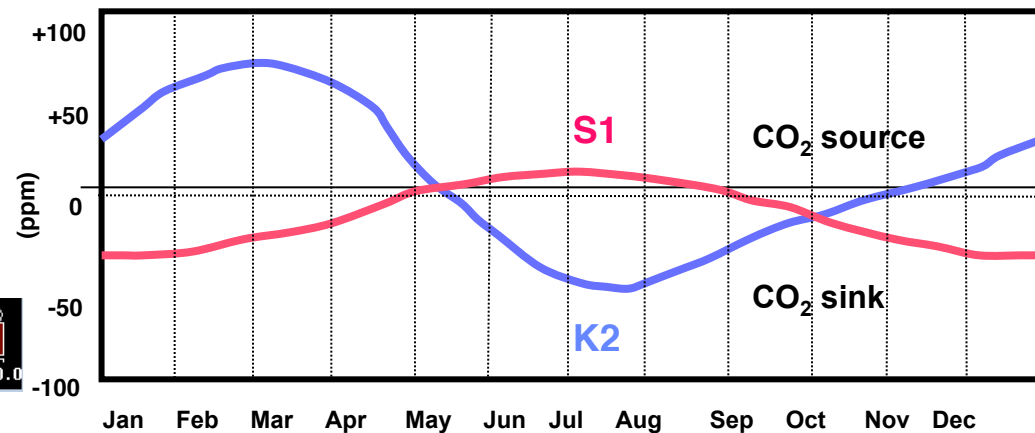
### Chl-a



Climatological seasonal variability in Chlorophyll *a* (Chl-a) in sub-arctic (K2) and sub-tropical (S1) gyres observed by satellite



Climatological seasonal variability in  $\Delta p\text{CO}_2$  in sub-arctic (K2) and sub-tropical (S1) gyres observed by VOS

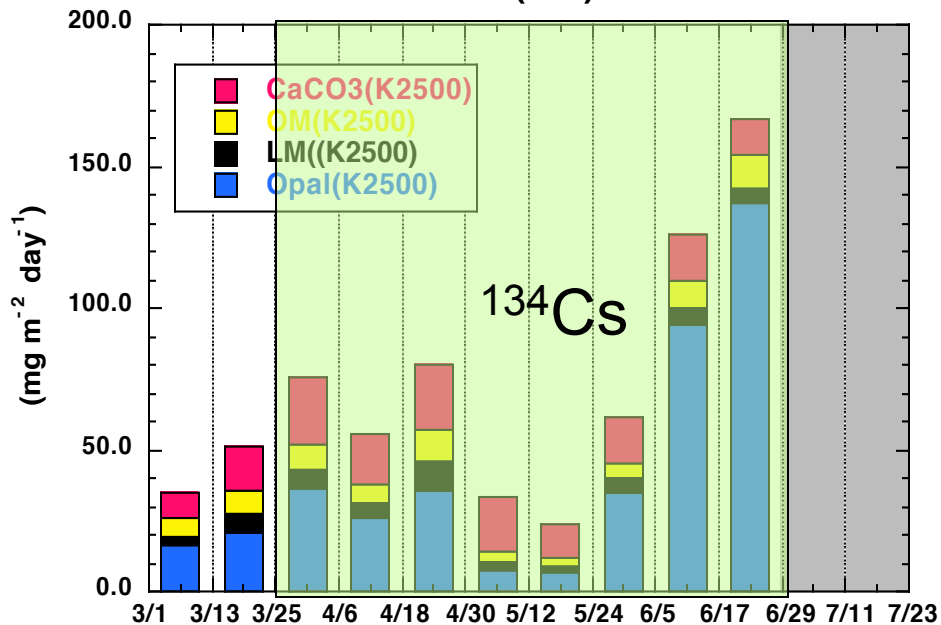




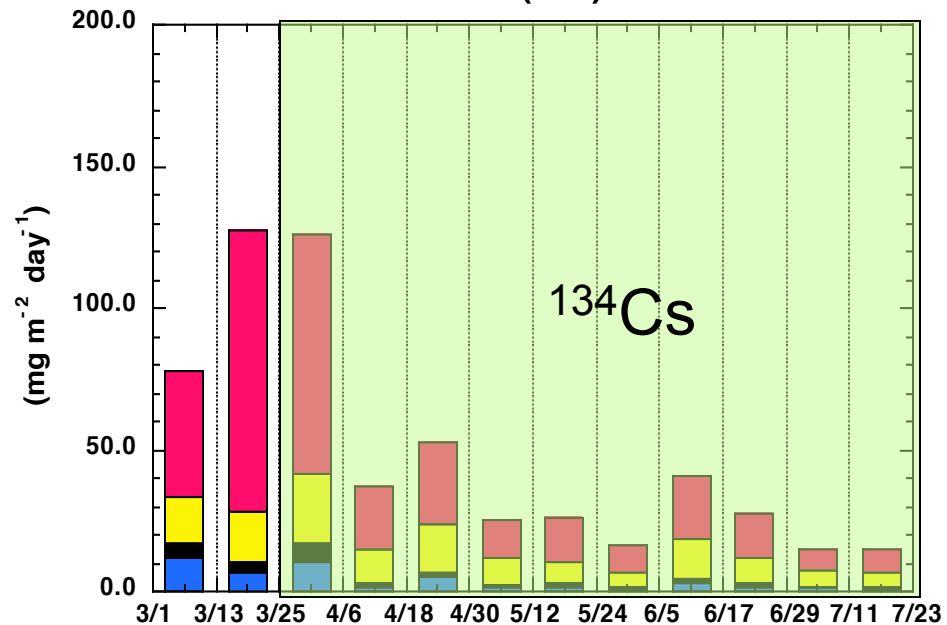
# multidisciplinary time-series observation with mooring systems



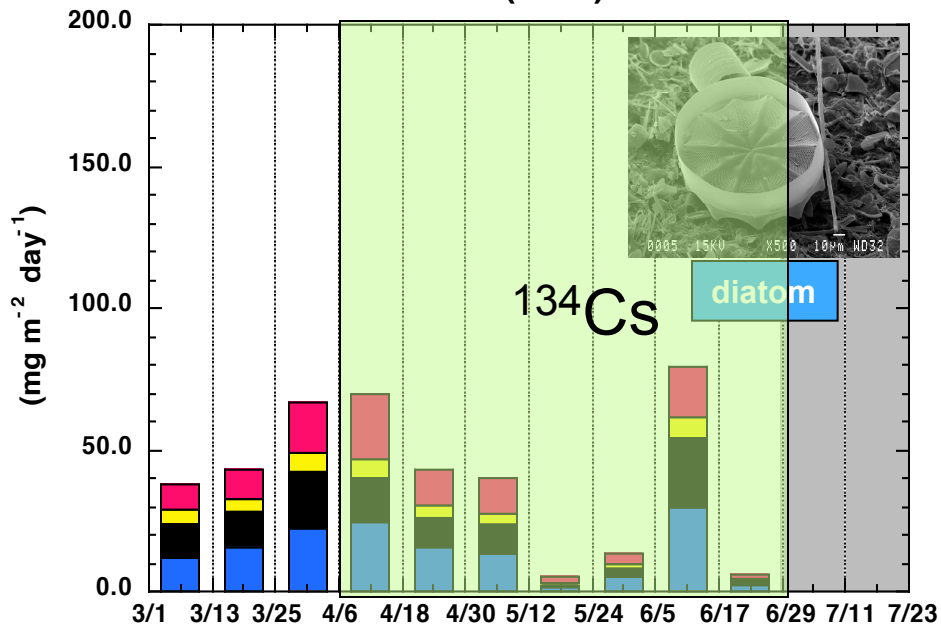
K2 (500)



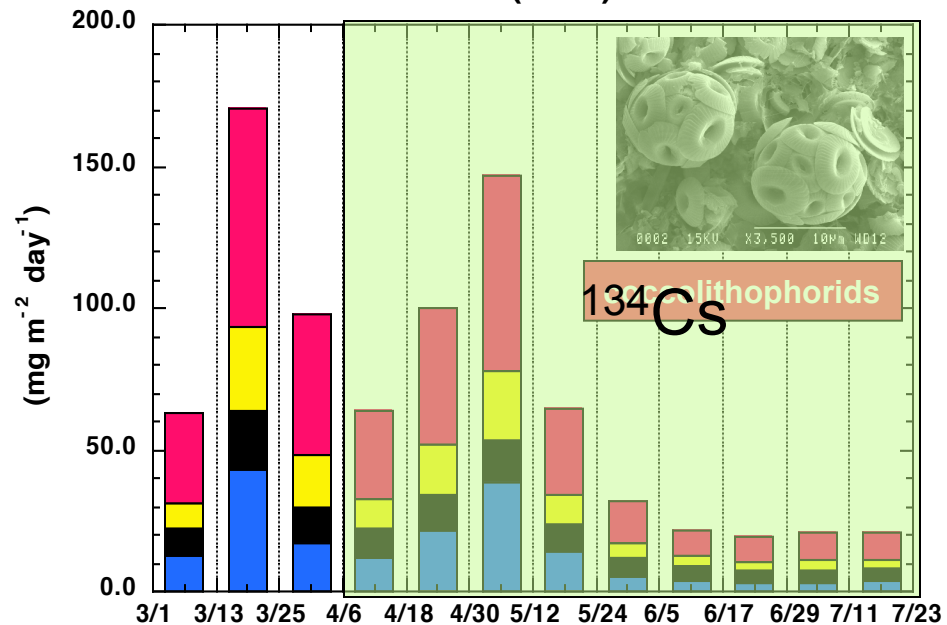
S1 (500)



K2 (4810)



S1 (4810)





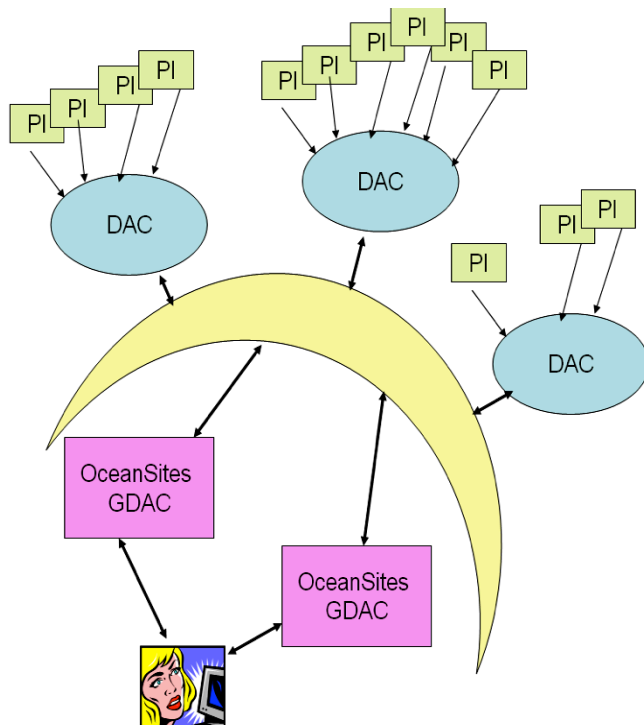
# OceanSITES data management structure and data access

The data flow within OceanSITES is carried out through three organizational units: **PIs**, **DACs**, **GDACs**.

The Principal Investigator (**PI**), typically a scientist at a research institution, maintains the observing platform and the sensors that deliver the data. He or she is responsible for providing the data and all auxiliary information to a **Data Assembly Center (DAC)**.

The **DAC** assembles OceanSITES-compliant files from this information and delivers these to the two **Global Data Assembly Centers (GDACs)**, where they are made publicly available.

The **GDAC** distributes the best copy of the data files. When a higher quality data file (e.g. calibrated data) is available, it replaces the previous version of the data file.



## **GDAC**

**NDBC:** National Data Buoy Center, USA

**Coriolis:** IFREMER Coriolis, France

## **DAC (potential)**

**BERGEN:** University of Bergen Geophysical Institute, Norway

**CCHDO:** CLIVAR and Carbon Hydrographic Office, USA

**CDIAC:** Carbon Dioxide Information Analysis Center, USA

**IMOS:** Australian Integrated marine Observing System, Australia

**INCOIS:** Indian National Center for Marine Observation Services, India

**JAMSTEC:** Japan Agency for Marine-Earth Science and Technology, Japan

**MBARI:** Monterey Bay Aquarium Research Institute, USA

**MEDS:** MEDS, Canada

**NIOZ:** Royal Netherlands Institute for Sea Research, Netherlands

**NOCS:** National Oceanographic Center, Southampton, UK

**PMEL:** NOAA Pacific Marine Environmental Laboratory, USA

**SIO:** Scripps Institute for Oceanography, USA

**WHOI:** Woods Hole Oceanographic Institution, USA

## User Obligations

A user of OceanSITES data is expected to read and understand OceanSITES user's manual and the documentation about the data as contained in the “attributes” of the **NetCDF** data files, as these contain essential information about data quality and accuracy.

A user of OceanSITES data must comply with the requirements set forth in the attributes “distribution\_statement” and “citation” of the **NetCDF** data files.

### **NetCDF: network Common Data Form**

<http://www.unidata.ucar.edu/software/netcdf/docs/BestPractices.html>





# OceanSITES

Taking the pulse of  
the global ocean



A worldwide system of deepwater reference stations providing:  
*The full depth of the ocean*

[Home](#)

[Global Network](#)

[Data](#)

[Global Team](#)

[Meetings](#)

[Documents](#)

[Links](#)

[Contact](#)



## Putting eyes and ears in the deep ocean

OceanSITES is a worldwide system of long-term, deepwater reference stations measuring dozens of variables and monitoring the full depth of the ocean from air-sea interactions down to 5,000 meters.

Since 1999, the international OceanSITES science team has shared both data and costs in order to capitalize on the enormous potential of these moorings. The growing network now consists of about 30 surface and 30 subsurface arrays. Satellite telemetry enables near real-time access to OceanSITES data by scientists and the public.

OceanSITES moorings are an integral part of the Global Ocean Observing System. They complement satellite imagery and ARGO float data by adding the dimensions of time and depth.

For more information or to coordinate your research with the OceanSITES community, contact the NOAA

### News:



**OceanSITES Brochure**

**Spring 2006**

[Order Copies Here!](#)

[QARTOD IV Workshop](#)

**June 21 - 23, 2006**

**Quality Assurance of**



OceanSITES

Taking the pulse of the global ocean



NWPACIFIC

SITE: JAMSTEC-K2  
PLATFORM: JAMSTEC-K2

Network:

Array:

GDAC:

WMO\_ID:

ORIG\_DESC\_: 0

PI\_EMAIL:

tsaino@jamstec.go.jp;

hondam@jamstec.go.jp

UPDATE\_DAT: 0

SITE\_DESCR: Northwest  
Pacific K2

LAT: 47

LON: 160

TYPE: observatory

OCEAN: Pacific

STATUS: OPERATING

DATA\_TYPE: Real Time &  
Delayed Mode Data;

Accessible

PHYS: 0

MET: 0

GEOPHYS: 0

BGCHEM: 1

CO2: 0

FLUX: 1

AirSeaFlux: 0

COUNTRY: JAPAN

AGENCY: JAPAN-

JAMSTEC

JCOMMOPS\_P:

INFOURL:

DATAURL:

MetadataUR:

PI: Saino

EMAIL:

Data SIO, NOAA, U.S. Navy, NGA, GEBCO

© 2012 Google

US Dept of State Geographer

© 2012 MapLink/Tele Atlas

18°33'35.89" N 100°43'01.86" E 標高 473 m

©2010 Google

14°00.60 km



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**Thank you very much for  
your kind attention**

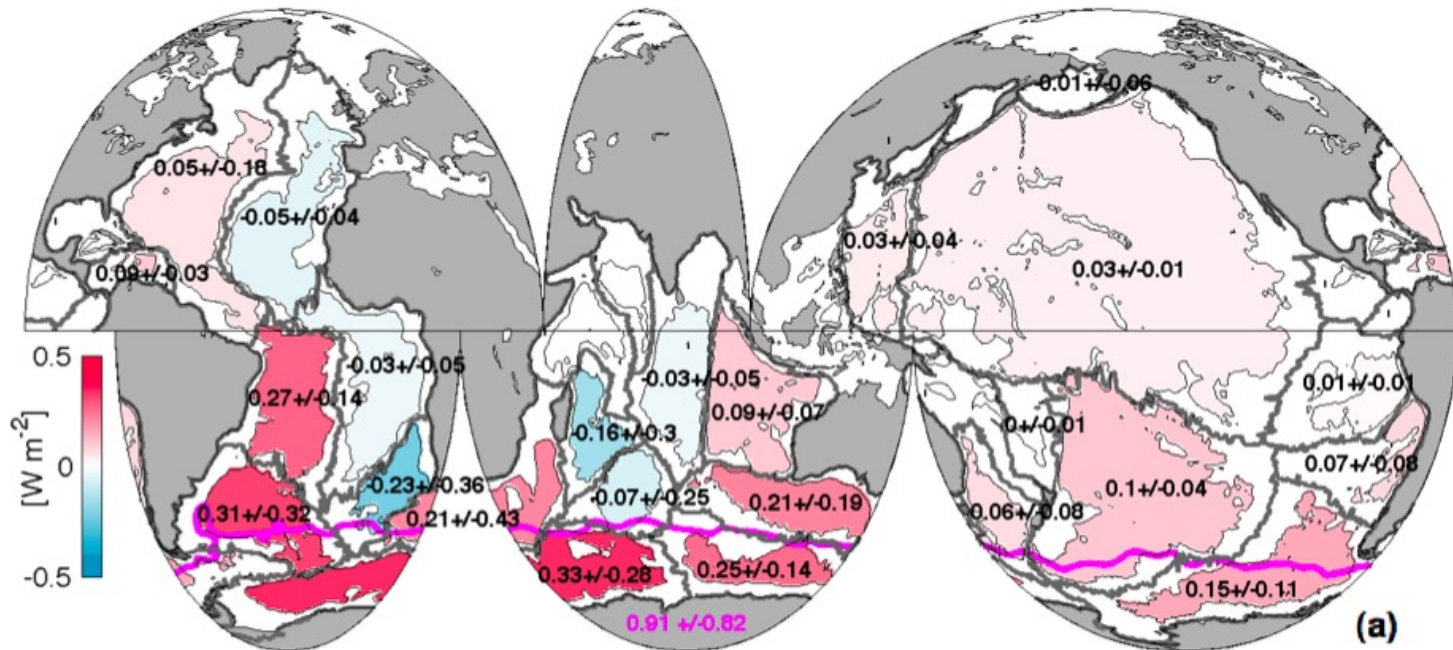


## Deep Ocean Observing

### Rationale for DOO

## Abyssal & Deep Heat Content Changes

(Purkey & Johnson, 2010)

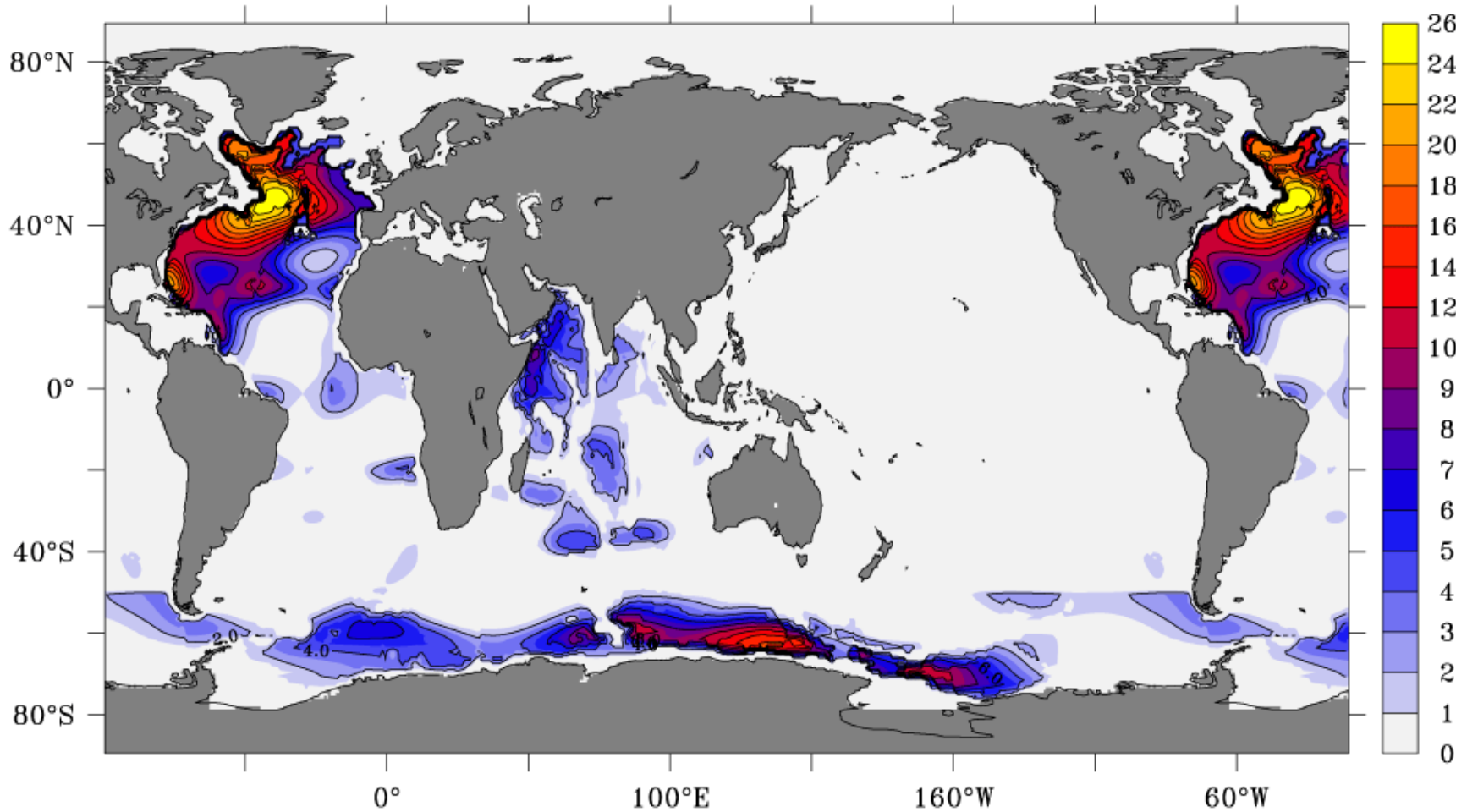


Region	Global Heat Gain ( $\text{W m}^{-2}$ )
Abyssal Ocean ( $z > 4 \text{ km}$ )	0.027 ( $\pm 0.009$ )
Southern Ocean ( $1 > z > 4 \text{ km}$ )	0.068 ( $\pm 0.062$ )
Total (Abyssal + Southern)	0.095 ( $\pm 0.062$ )



# Rationale for DOO

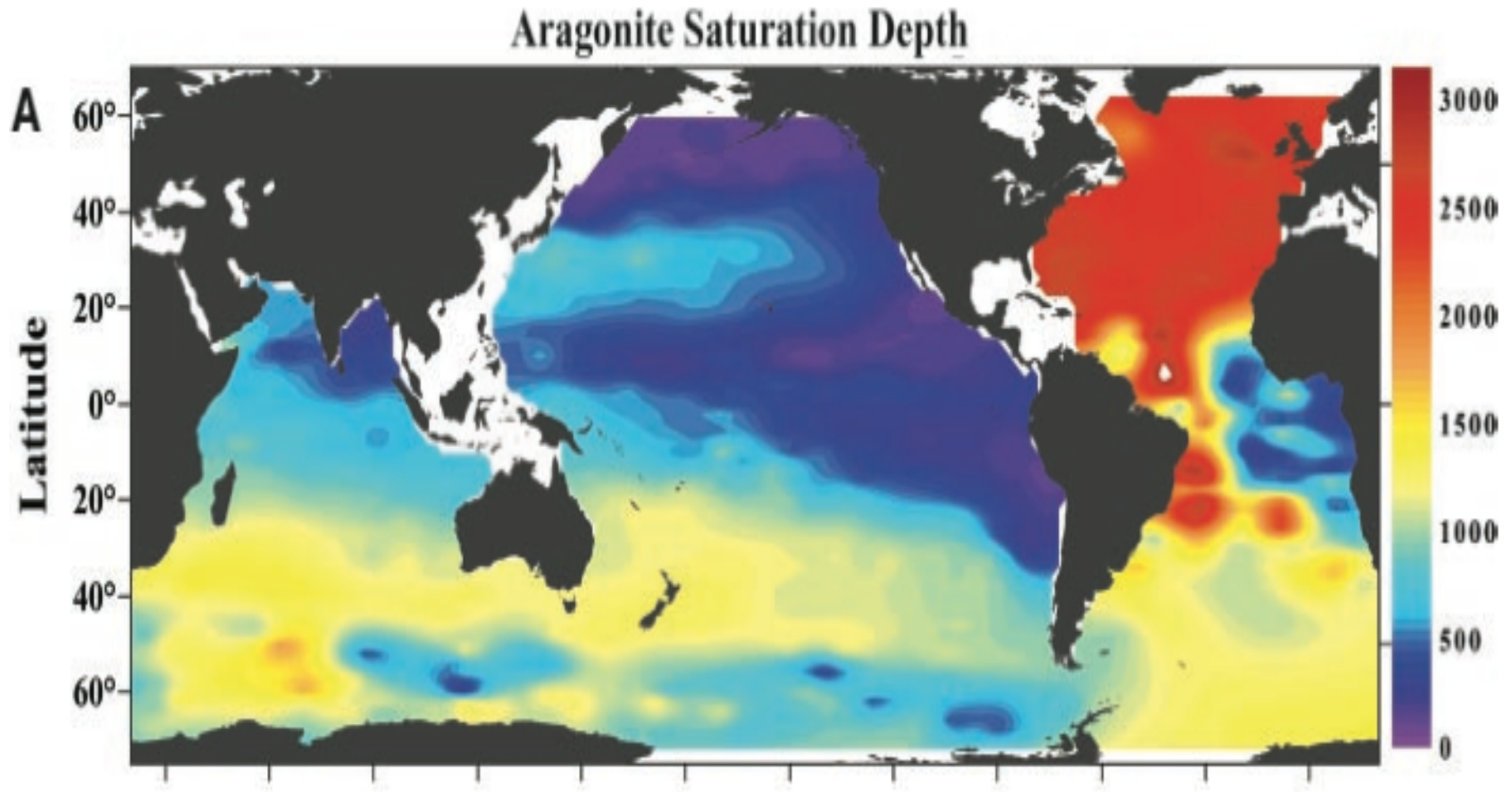
Column inventory of anthropogenic CO<sub>2</sub> below 2000 m (mol m<sup>-2</sup>)



based on Sabine et al. (2004)

## Rationale for DOO

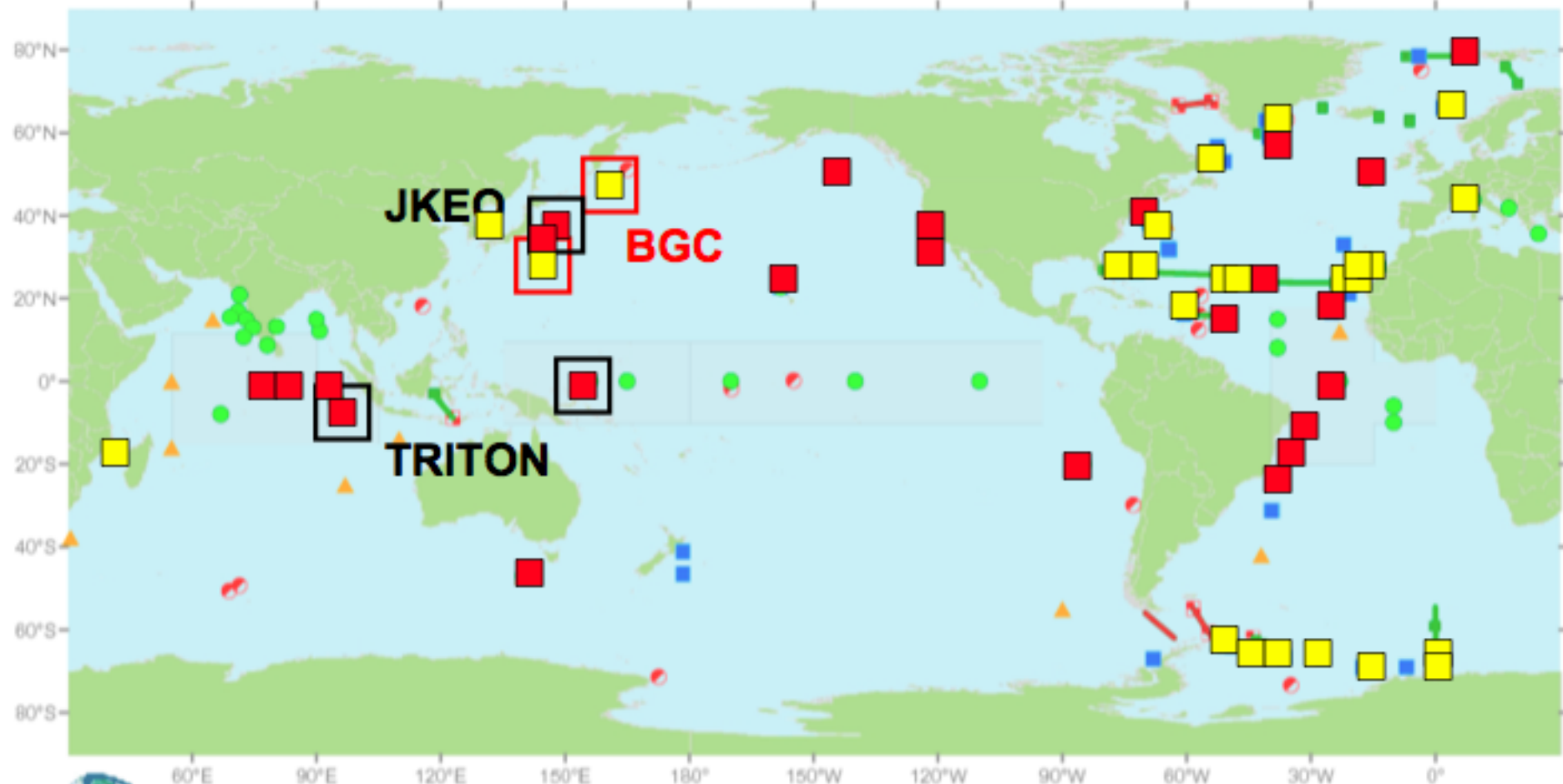
Naturally low saturation state at depth requires only little  $C_{\text{anthro}}$  to reach the “tipping point”



# “Small pain for each moorings, huge impact as network”

Existing Deep Microcats (79)

New/Pledged Deep Microcats (23)



OceanSITES Vision Map 2009 - All Planned Sites



OceanSITES Moorings and Observatories (91)

Planned or Discontinued (32)

Transport sites (19)

Transport Stations

● OPERATING Real time data (44)

▲ PLANNED Real time data (15)

— OPERATING (16)

⊗ Discontinued

■ OPERATING Delayed Mode data (47)

■ PLANNED Delayed Mode data (0)

— DISCONTINUED (3)

⊗ DISCONTINUED (17)

Note: This status was based on information provided in 2009.

(after Send and Weller, 2012)



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**Thank you very much for  
your kind attention**

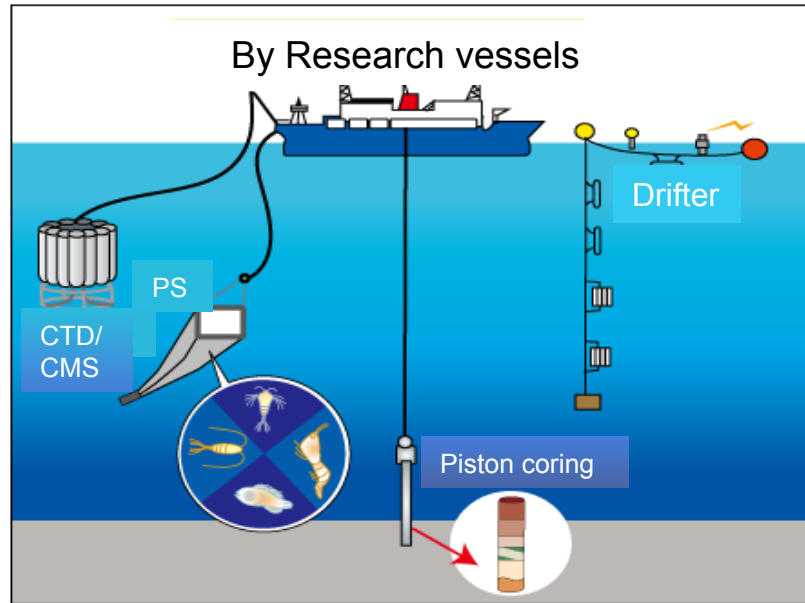
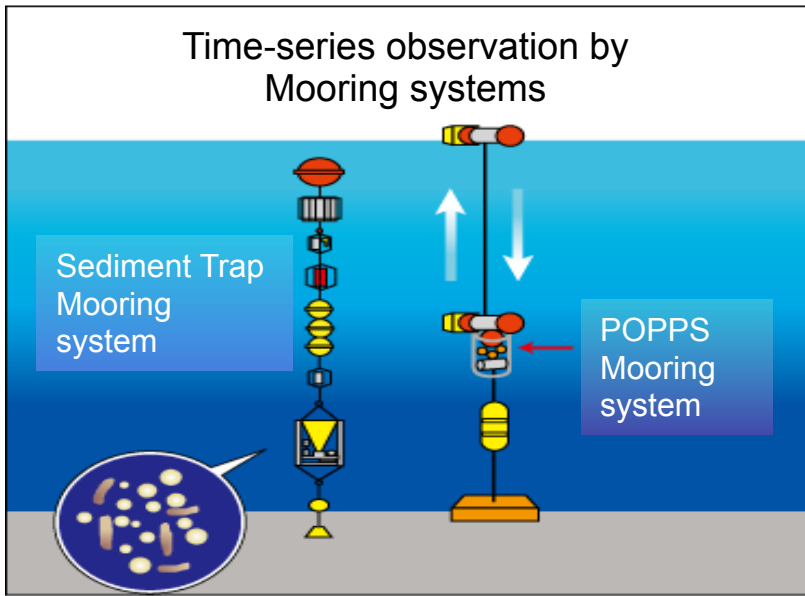


# Rationale for DOO

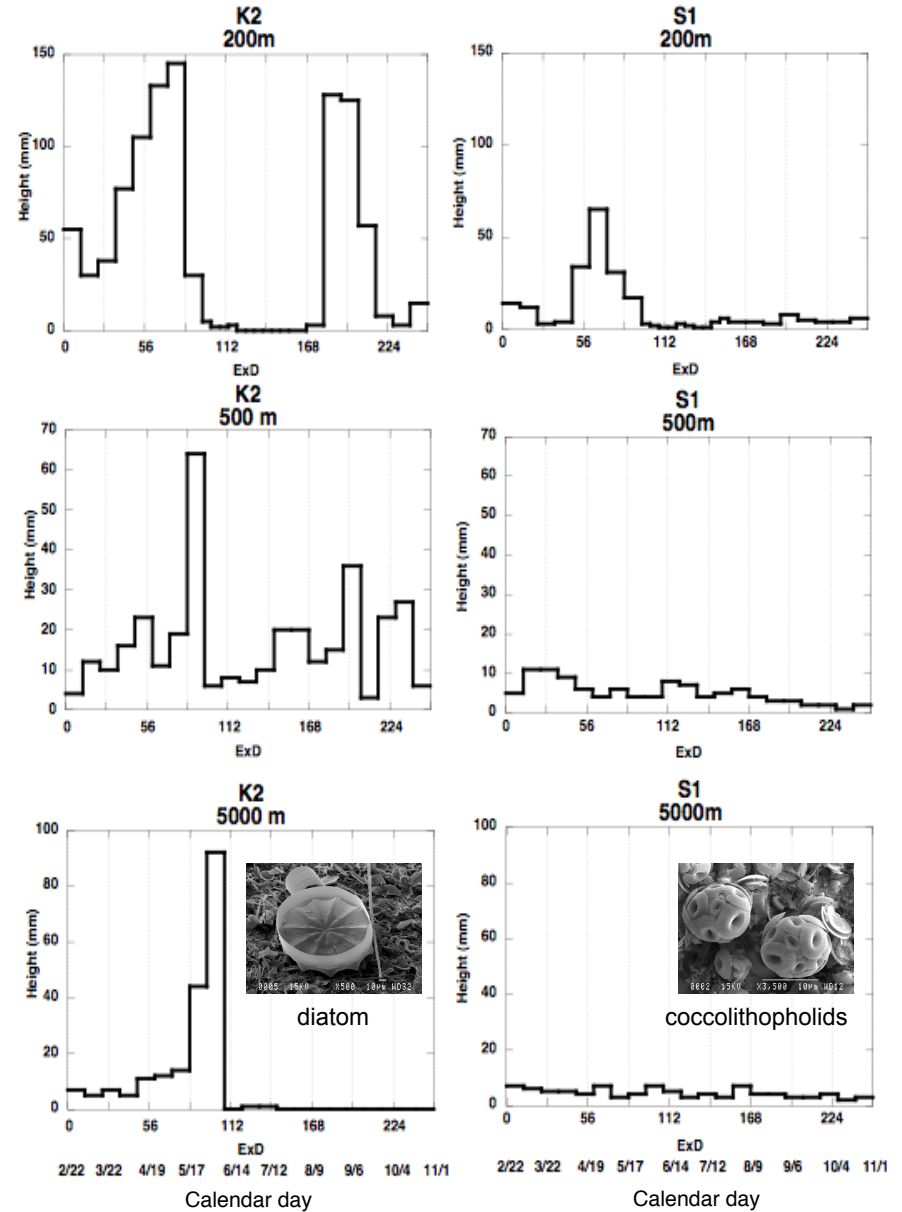
Over **180 new species**, **25 new genera** and **2 new families** have been described from deep-water chemosynthetic ecosystems since 2002







Seasonal variability in **material fluxes** at 200, 500 and 5000m at stations K2 and S1 observed by sediment trap

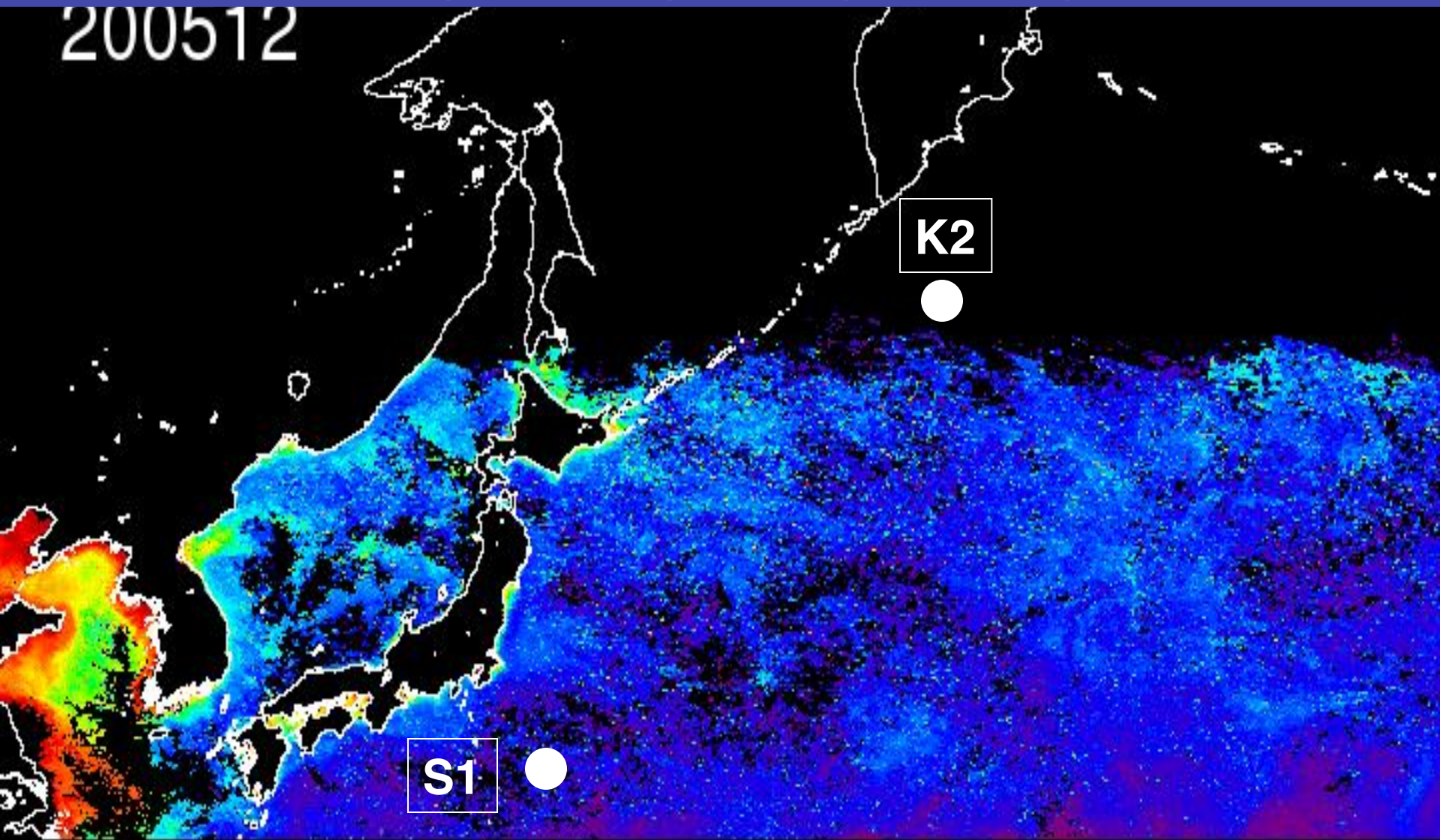


**Impact of oceanic change on marine ecosystem and material cycles**



# Temporal variation in biological activity

200512



K2

S1

(mg m<sup>-3</sup>)

0.10

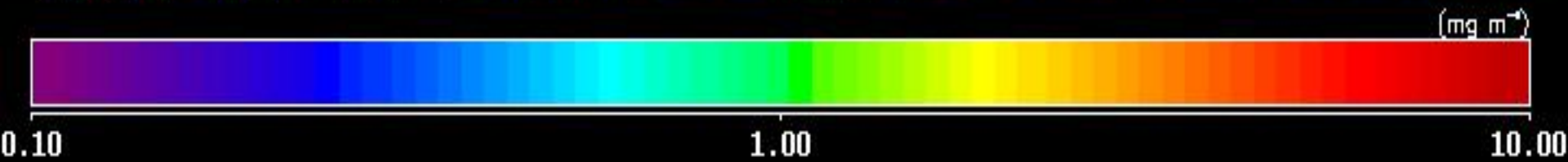
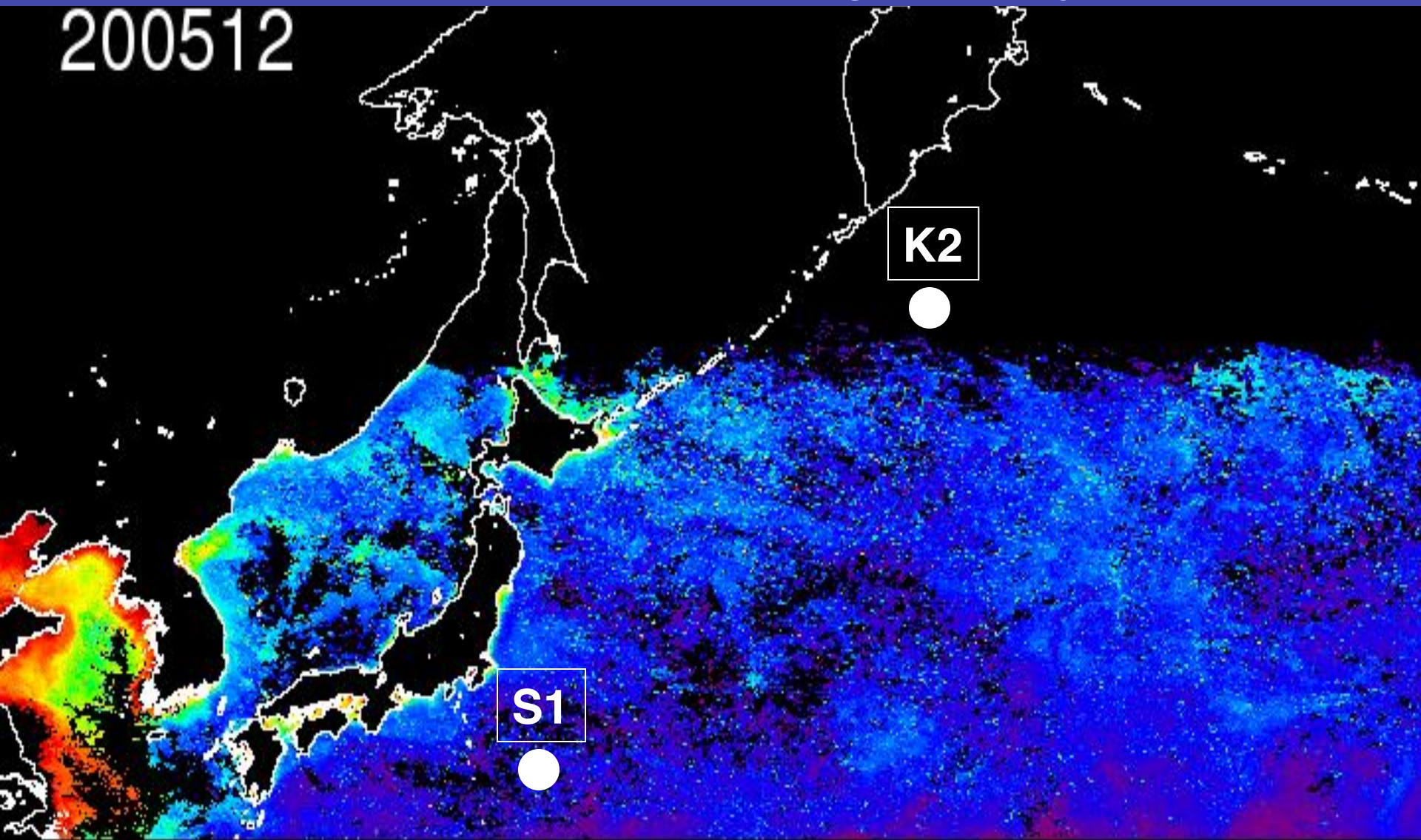
1.00

10.00



# Temporal variation in biological activity

200512





# Sediment trap mooring system

