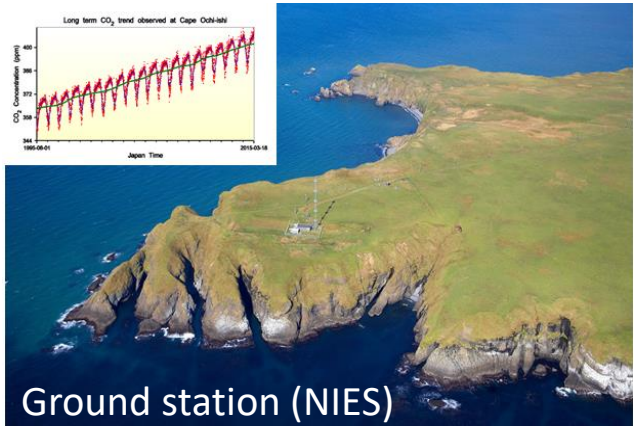
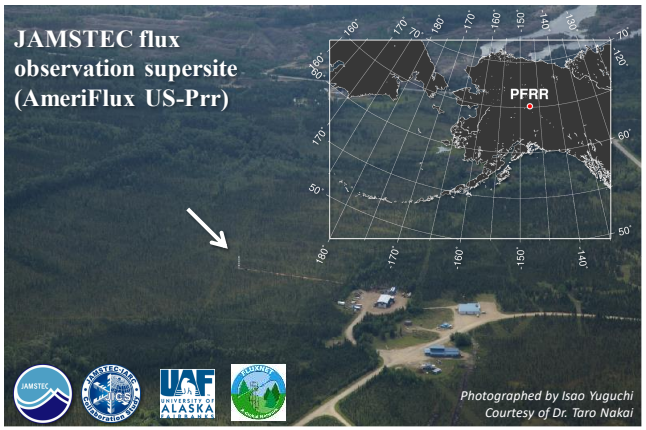
Earth Observation Platforms for Monitoring GHGs by Multi-Agency Coordinated with Japanese Alliance for Climate Change Observation





Nobuko SAIGUSA [1], Mikio UENO [2], Hideki KOBAYASHI [3]

[1] National Institute for Environmental Studies

[2] Japan Meteorological Agency

[3] Japan Agency for Marine-Earth Science and Technology

National Institute for Environmental Studies, Japan

CGER

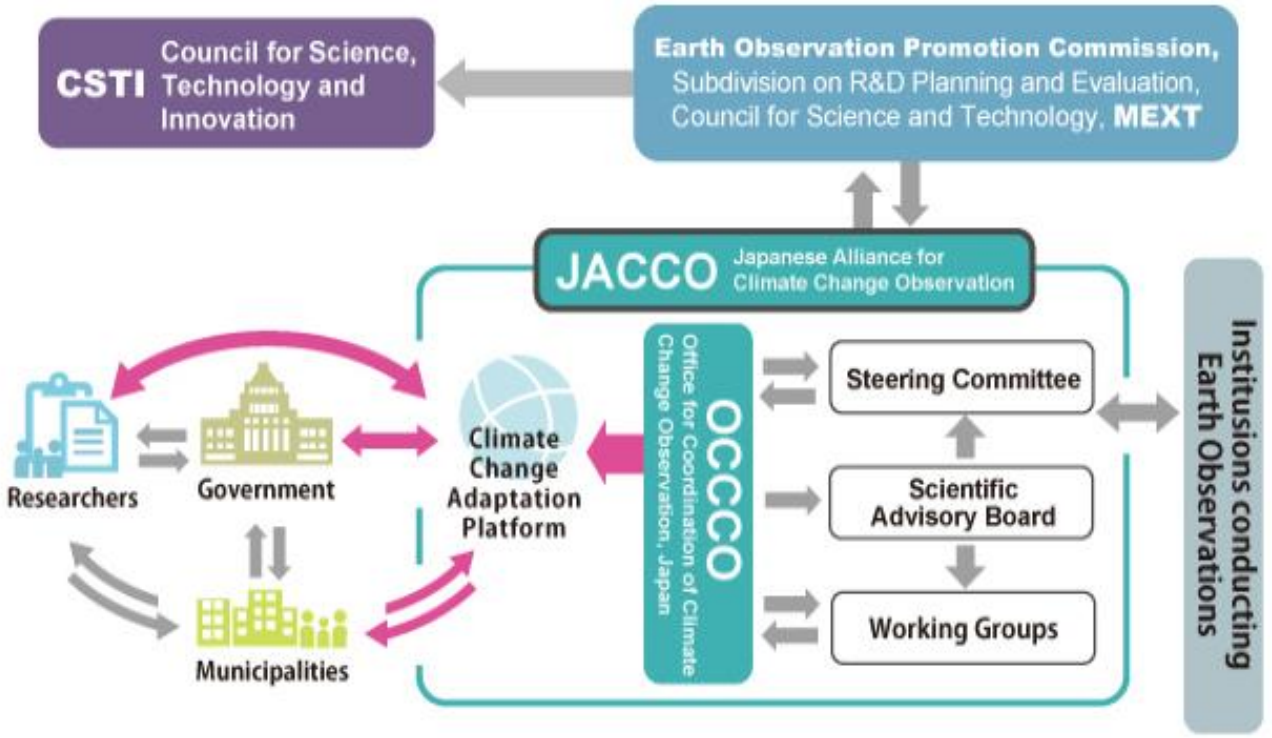
気象庁 Japan Meteorological Agency

JAMSTEC

Japanese Alliance for Climate Change Observation (JACCO)

Structure of JACCO for promoting EO in Japan

Office for Coordination of Climate Change Observation



2003~2005: 1st, 2nd, and 3rd Earth Observation Summit (USA, Japan, Belgium)

2006: JACCO established under Earth Observation Promotion Commission

2016: Climate Change Adaptation Platform (A-Plat) established in JACCO

Japanese Alliance for Climate Change Observation (JACCO)

Working group activities of JACCO

Office for Coordination of Climate Change Observation

- Reporting status and needs of EO in Japan
- Climate change statistics
- Standardization of atmospheric GHG observation
- Calibration of the radiation observation instruments
- Establishment of climate change adaptation platform
- Promotion of international initiatives on climate change and GHG

MoE (NIES), MEXT(JAXA, JAMSTEC), JMA(MRI), …

http://occco.nies.go.jp/e_index.html

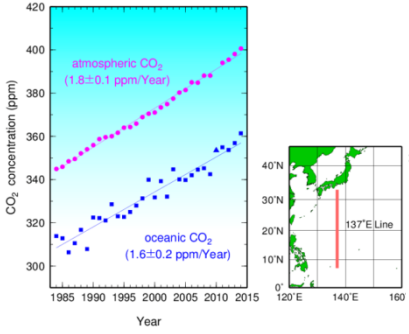
http://www.adaptation-platform.nies.go.jp/en/index.html

Greenhouse Gas Observation Network of JMA

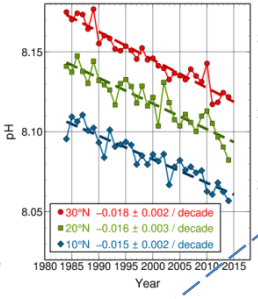
気象庁 Japan Meteorological Agency

Ocean

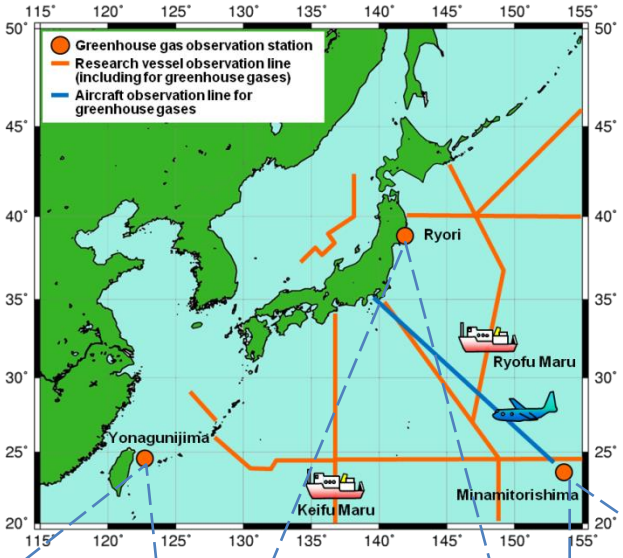
JMA has observed GHG and its related substances in the sea and over the sea surface in the western North Pacific using two research vessels.



CO_2 in and over the sea

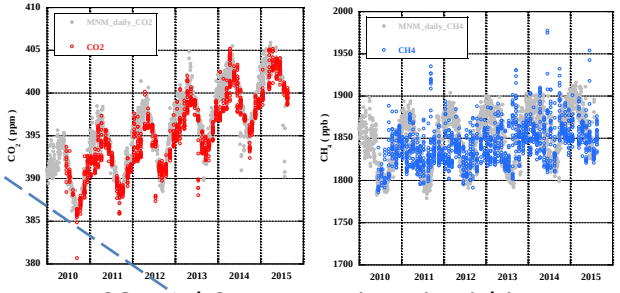


Ocean acidification



Aircraft

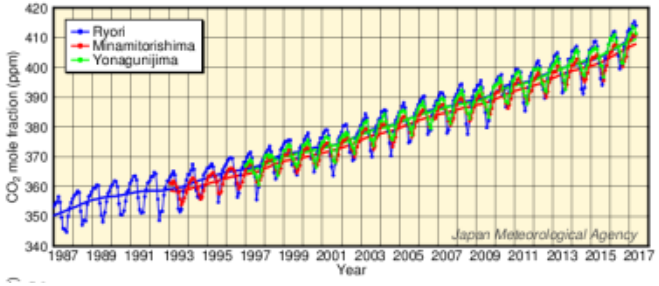
JMA has started an operational aircraft observation in the mid-troposphere at an altitude of about 6 km since 2011.

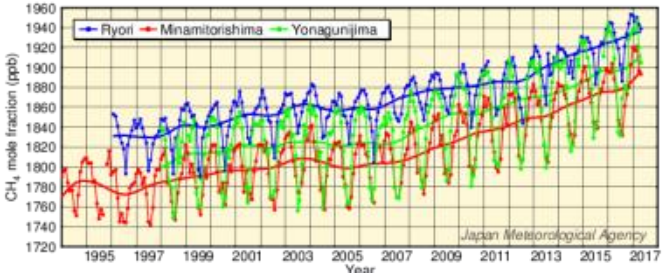


CO_2 and CH_4 over Minamitorishima

Ground-based

JMA has operated long-term observations of greenhouse gases almost for 30 years at three ground- based stations.



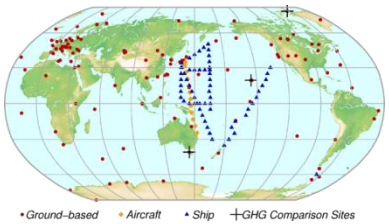


WMO World Data Centre for Greenhouse Gases

The World Data Centre for Greenhouse Gases (WDCGG) under WMO's Global Atmosphere Watch (GAW) programme has been operating since October 1990 at the Japan Meteorological Agency (JMA).

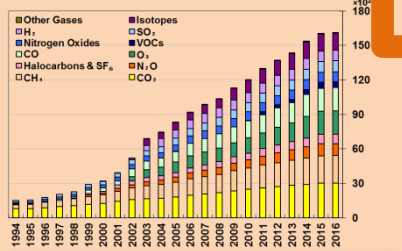
Data Submission

Observation Stations



WDCGG

Data validation & reformatting



Number of Archived Data

Archive

Dataset & Metadata

Analysis

Products

WDCGG Website

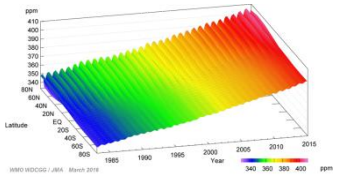
http://ds.data.jma.go.jp/gmd/wdcgg/wdcgg.html

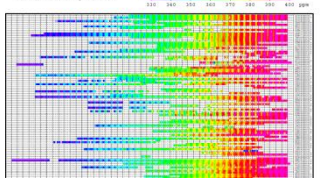
Users

- Scientists
- Related Organizations
- Policy makers

WDCGG Data Summary

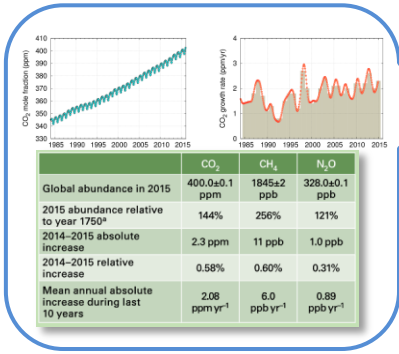
The WDCGG provides diagnostic analyses in the Data Summary.



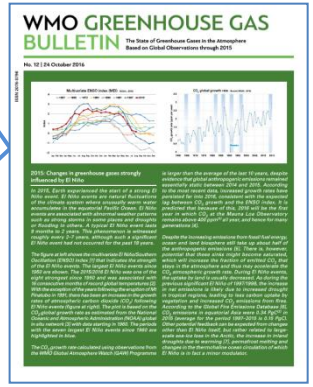


WMO Greenhouse Gas Bulletin

The WDCGG has contributed to the Greenhouse Gas Bulletin by providing global analyses for major greenhouse gases.



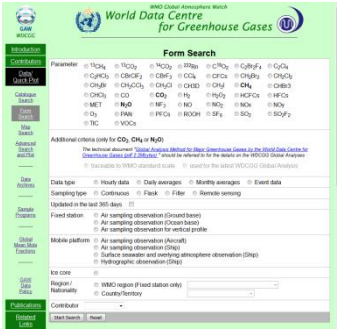
	CO_2	CH_4	N_2O
Global abundance in 2015	400.0±0.1 ppm	1845±2 ppb	328.0±0.1 ppb
2015 abundance relative to year 1750*	144%	256%	121%
2014–2015 absolute increase	2.3 ppm	11 ppb	1.0 ppb
2014–2015 relative increase	0.58%	0.60%	0.31%
Mean annual absolute increase during last 10 years	2.08 ppm yr^{-1}	6.0 ppb yr^{-1}	0.89 ppb yr^{-1}

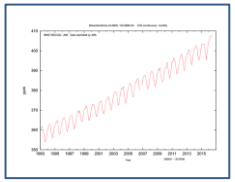


Supporting Tools

The WDCGG website provides following tools;

- **Data search** form/map
- **Quick plots of data**



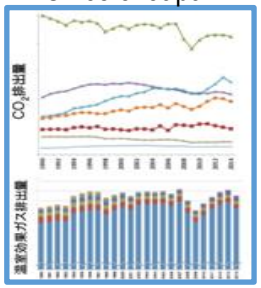


NIES Earth Observations (Climate Change and GHGs)

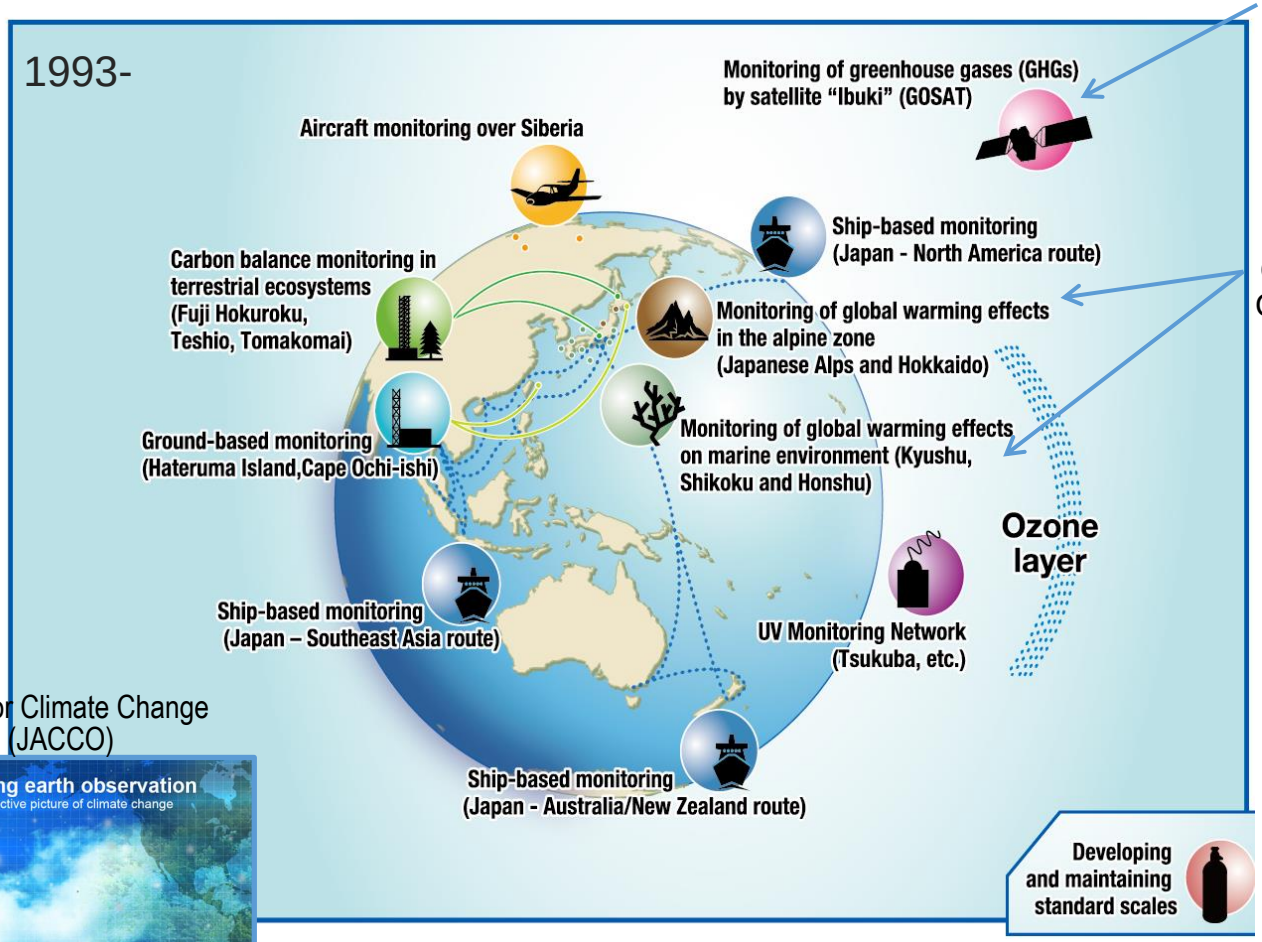
Strategic Monitoring of the Global Environment

Global Carbon Project Tsukuba Office

The GHG Inventory Office of Japan



Japanese Alliance for Climate Change Observation (JACCO)



Conducted by Satellite Observation Center

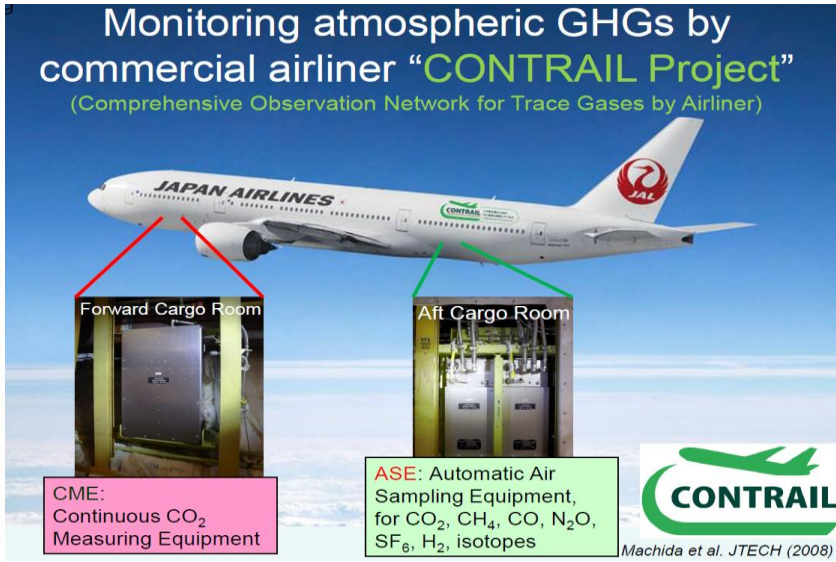
GOSAT Project

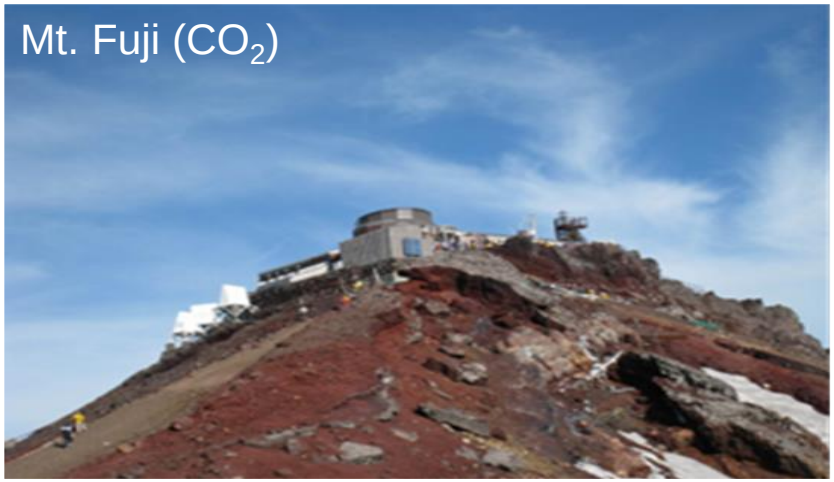
Conducted together with Center for Environmental Biology and Ecosystem Studies

Global Environment Database

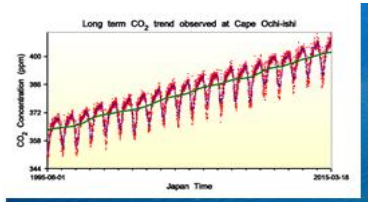
Fuji-Hokuroku Flux Site

Tall towers in West Siberia (GHGs)





Mt. Fuji (CO_2)



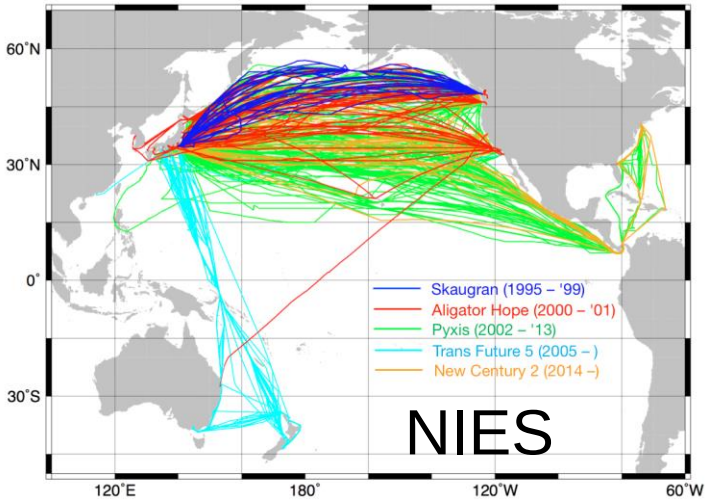
Cape Ochi-Ishi (GHGs)

Teshio Flux Site

Cargo Ships for monitoring Oceanic pCO_2

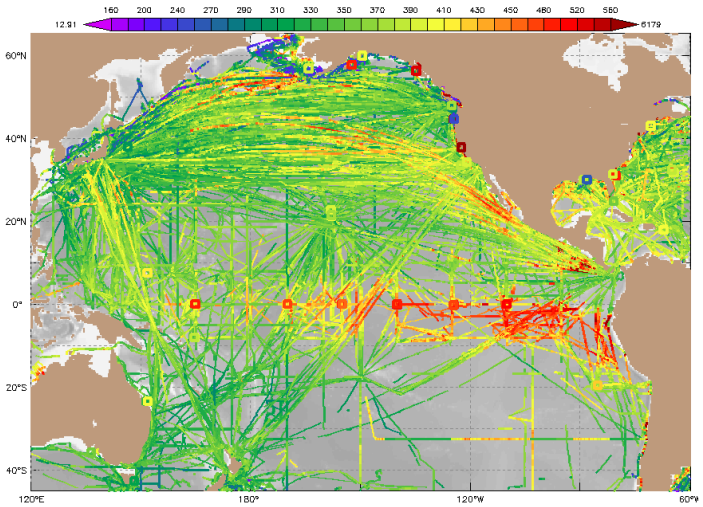
Significant Contributions of NIES pCO_2 Data to SOCAT

pCO_2 measurements since 1995



Cruise tracks of Volunteer Observing Ships (VOS)
> 20 times a year

SOCAT version 5



Surface Ocean CO_2 Atlas (SOCAT)

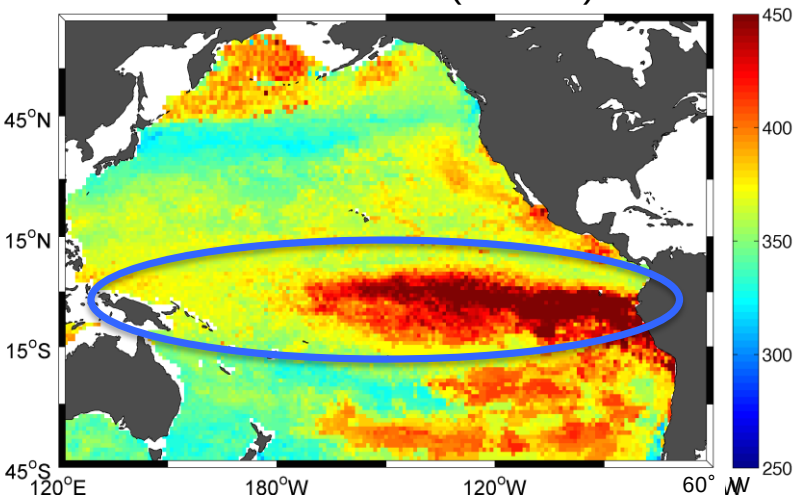
PI: Nakaoka S.

- Data contributions with 20 % of the SOCAT V5 database in the Pacific Ocean.
- Responsible quality controller of the North Pacific.
- Contribution to the synthesis efforts of Global Carbon Project .

Global Carbon Budget 2016, 2015, 2014

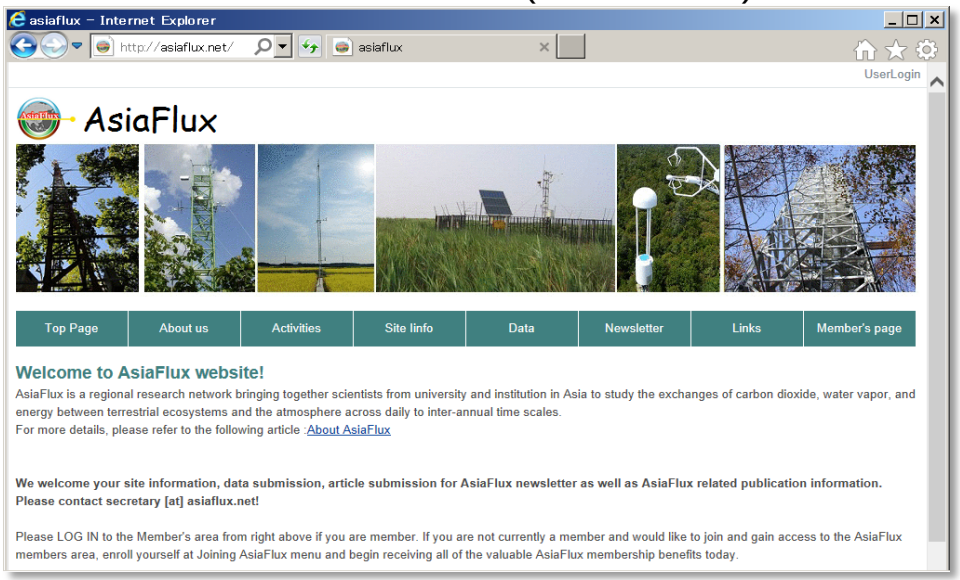
Monthly pCO_2 distribution

Oct. – Dec. 2009 (El Niño)



Promotion of Regional Networking in Asia

AsiaFlux Tsukuba Office (CGER/NIES) 1999-



Supporting 13th AsiaFlux Workshop, Pune, India (Nov 2015)

Supporting 14th AsiaFlux WS & Training Course, Beijing, China (Aug 2017)

Asia-Pacific Monitoring Sites

Atmosphere

Project Groups: NIES Lidar network, AD-Net, SKYNET

Observation parameters:

- ☑ All
- ☑ CO_2 ☑ CH_4 ☑ N_2O ☑ O_3 ☑ CO/H_2 ☑ NO
- ☑ NO_2 ☑ SO_2 ☑ Aerosol ☑ Cloud ☑ Radiation ☑ Gas
- ☑ Atmospheric sampling ☑ Chlorofluoro carbons ☑ CO_2 Zonde
- ☑ Forest MRV ☑ Meteorology

Ecosystem

Project Groups: AsiaFlux

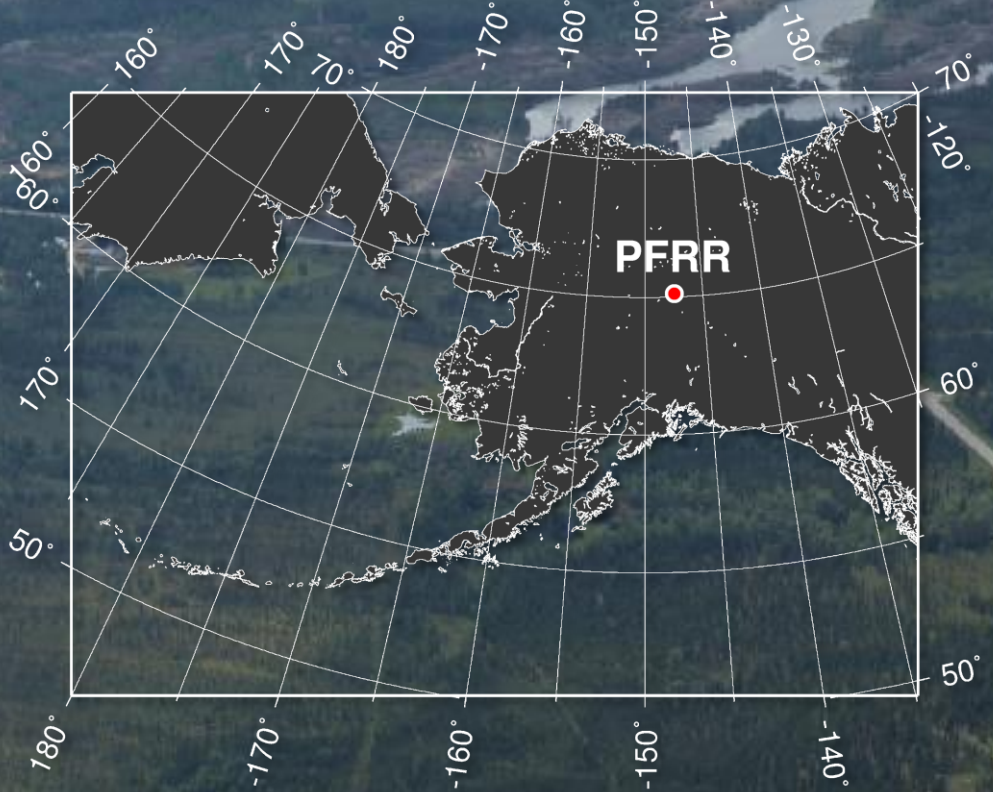
Observation parameters:

- ☑ All
- ☑ CO_2 flux ☑ CH_4 flux ☑ H_2O flux ☑ N_2O flux ☑ Soil respiration
- ☑ Phenology ☑ Photosynthesis ☑ Ecological investigation ☑ Meteorology

JAMSTEC flux observation supersite (AmeriFlux US-Prr)
Poker Flat Research Range, University of Alaska

To understand the terrestrial carbon response to the rapid warming in the sub-Arctic region, a 17-m tall eddy flux tower was deployed in a boreal forest
(AmeriFlux: US-Prr)

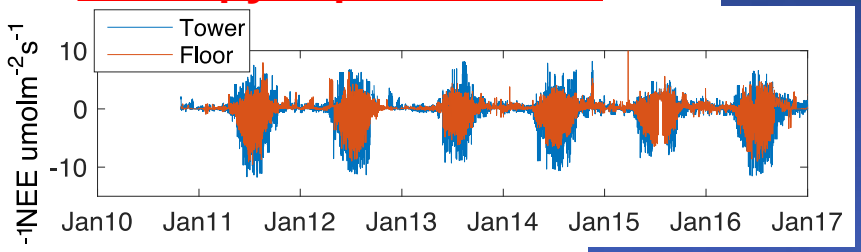
Latitude: 65.1234N
Longitude:147.4874W



Photographed by Isao Yuguchi
Courtesy of Dr. Taro Nakai

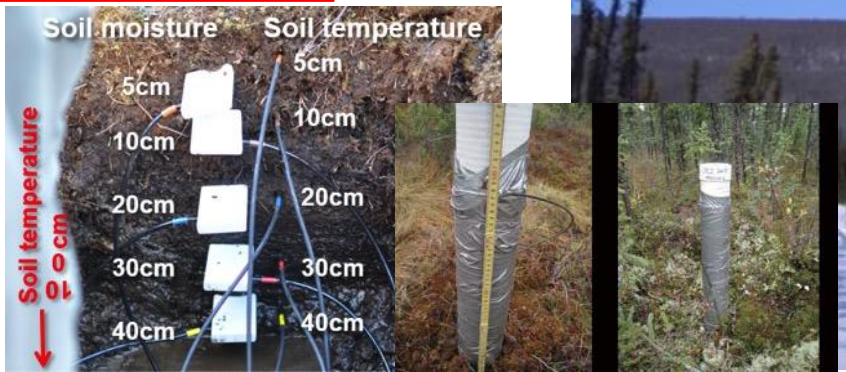
JAMSTEC flux observation supersite
On-going observation systems

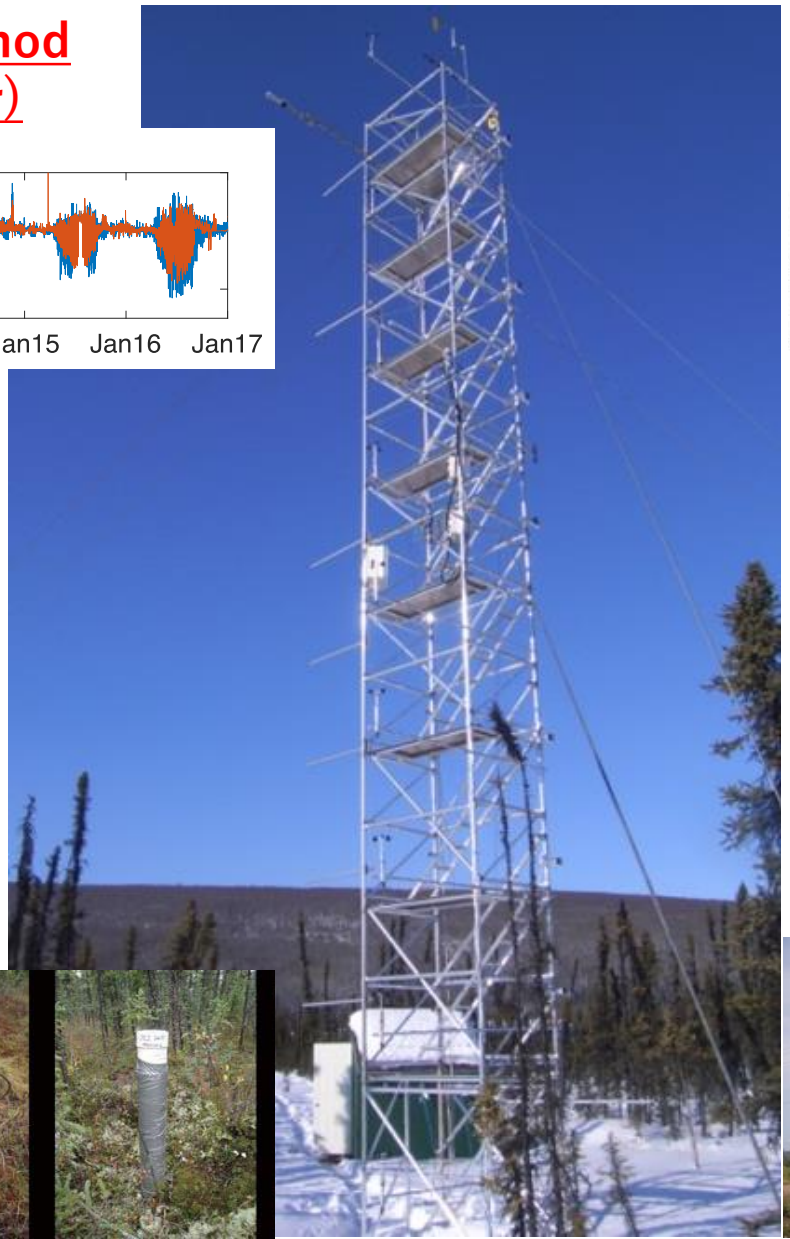
1. Eddy covariance method (Canopy top and floor)



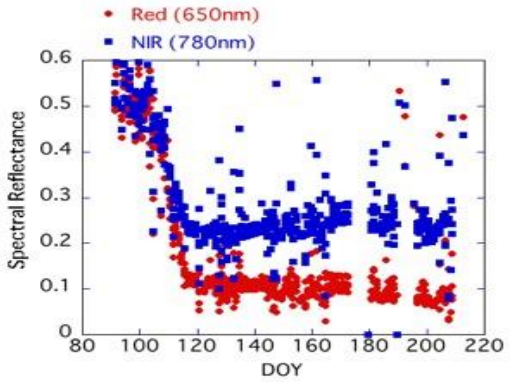
2. Automated soil chambers for CO2 flux

3. Soil and permafrost measurements

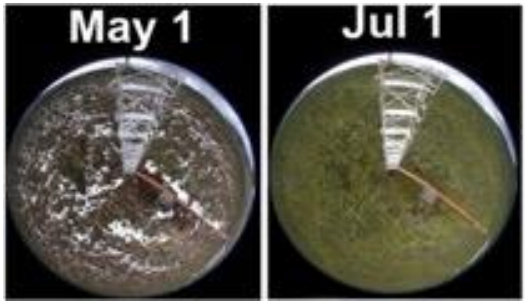




4. Spectral reflectance



5. Time-lapse cameras (PEN network)



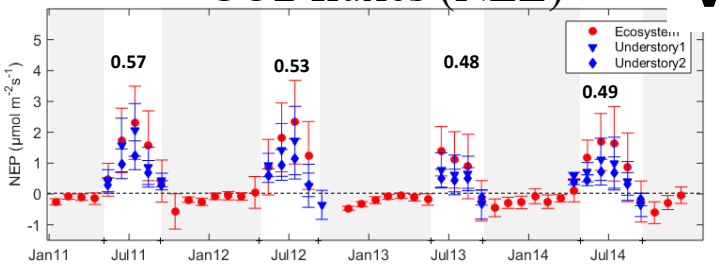
6. Black Carbon & CO

Satellite observation & validation of terrestrial productivity

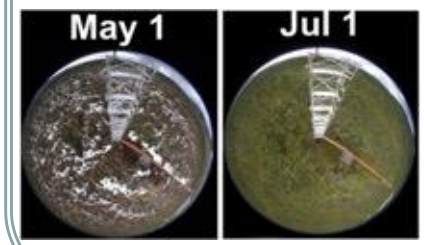
The ground observation by JAMSTEC and collaborative institutions serve as validation platforms for the Japan-flagship Earth Observing (EO) satellites such as GCOM and GOSAT.

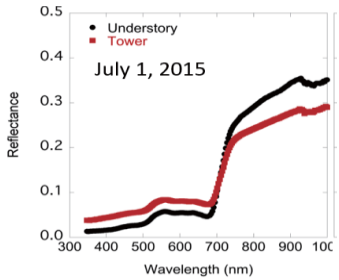
Ground observation

CO2 fluxes (NEE)



Camera phenology and spectral reflectance

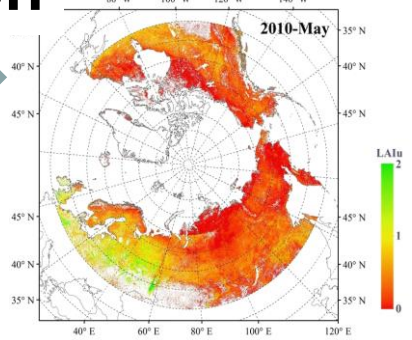




Validation

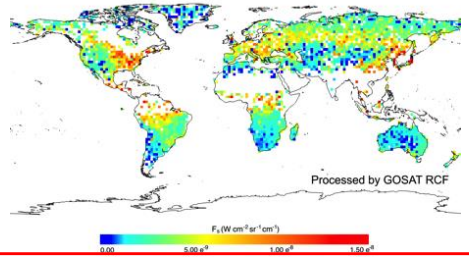
Satellite observation

JAXA GCOM-C observation



Terrestrial vegetation parameters such as leaf area index, above ground biomass, GPP, NPP, NEE

GOSAT observation (fluorescence)

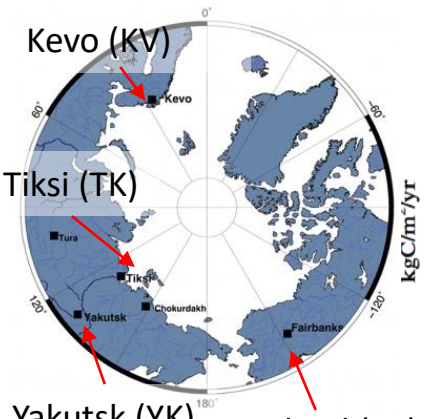


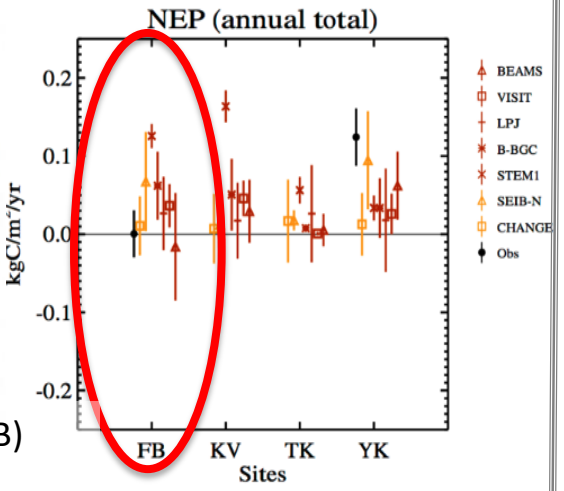
NIES GOSAT Team
Provided by Noda, Yoshida, Oshio

Jointly working with the JAXA GCOM-C team, Chiba University and others

Application: LSM/ESM validation and inverse modeling

1. Inter-comparisons of LSMs in cold climate regions (GTMIP)

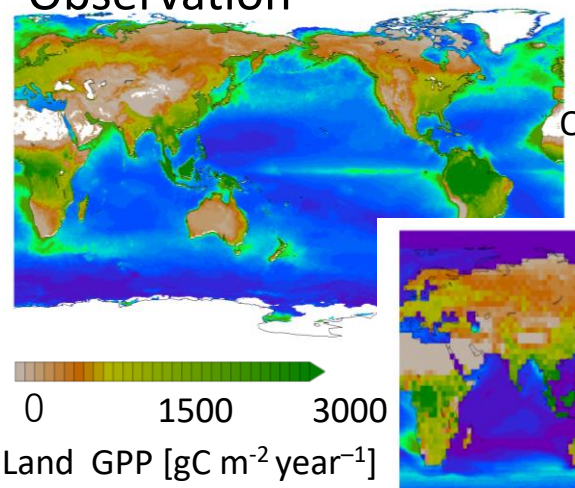


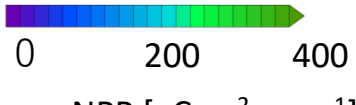


Sueyoshi, T., K. Saito, et al 2015

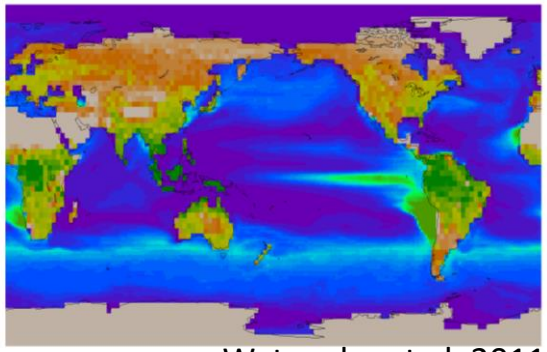
Miyazaki, S., K. Saito, et al 2015

2. Earth System Model validation with FLUXNET (GPP-MTE) and satellite data





MIROC-ESM

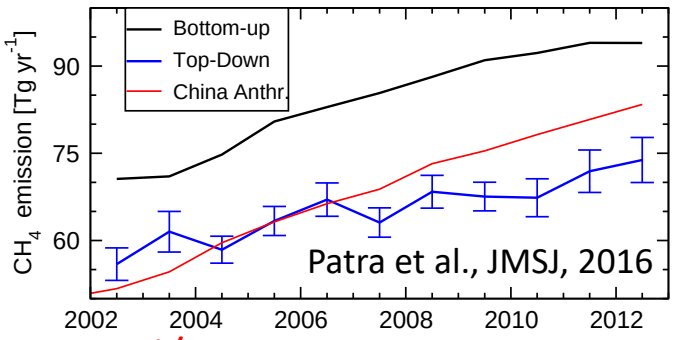


Watanabe et al, 2011

3. Regional CH_4 and CO_2 budget estimates using JAMSTEC's ACTM

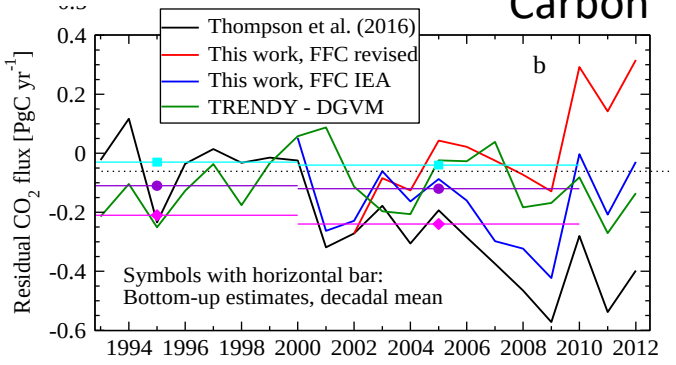
East Asia (China, Japan, Korea)

Methane



3-5%/yr increase in CH_4 emission

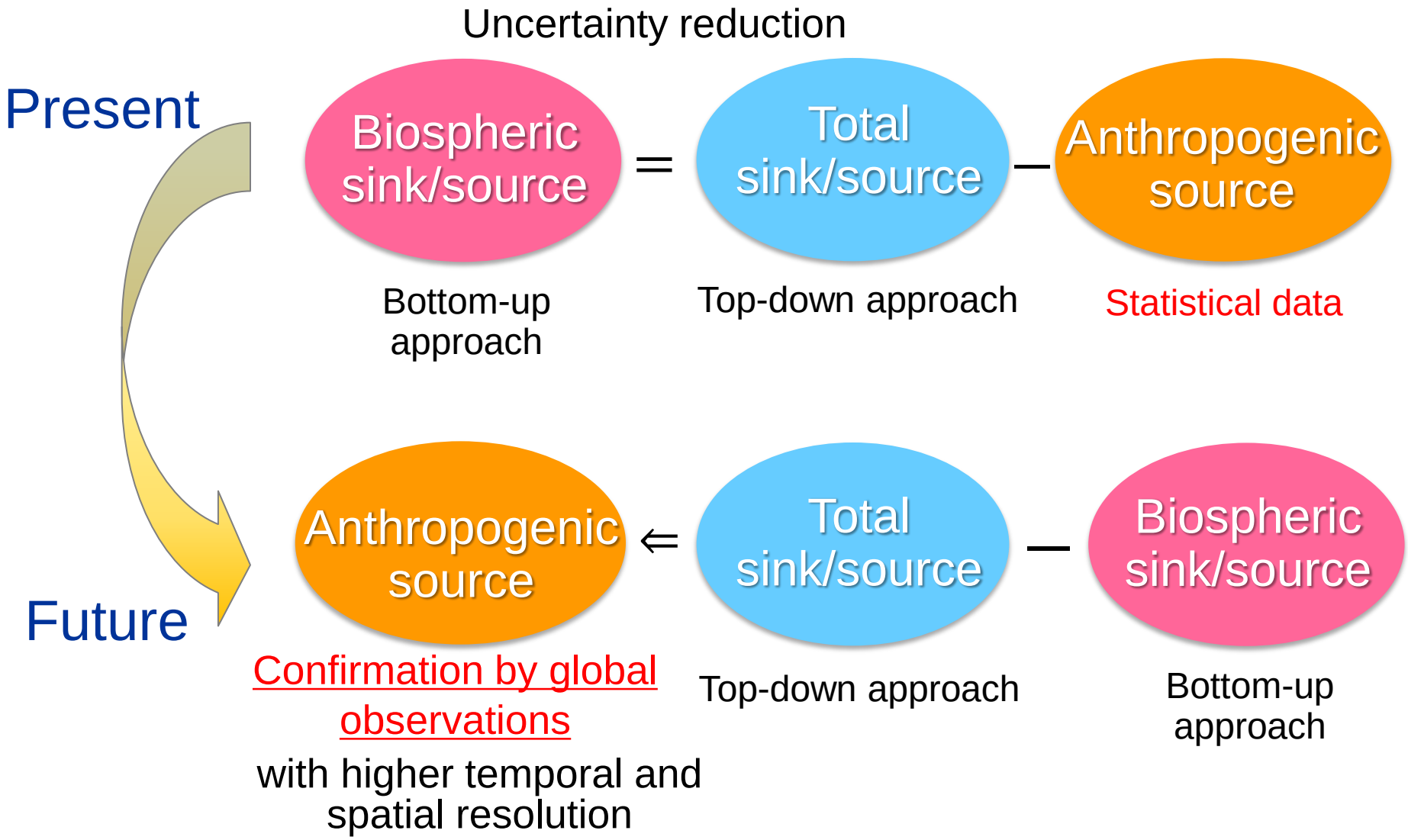
Carbon



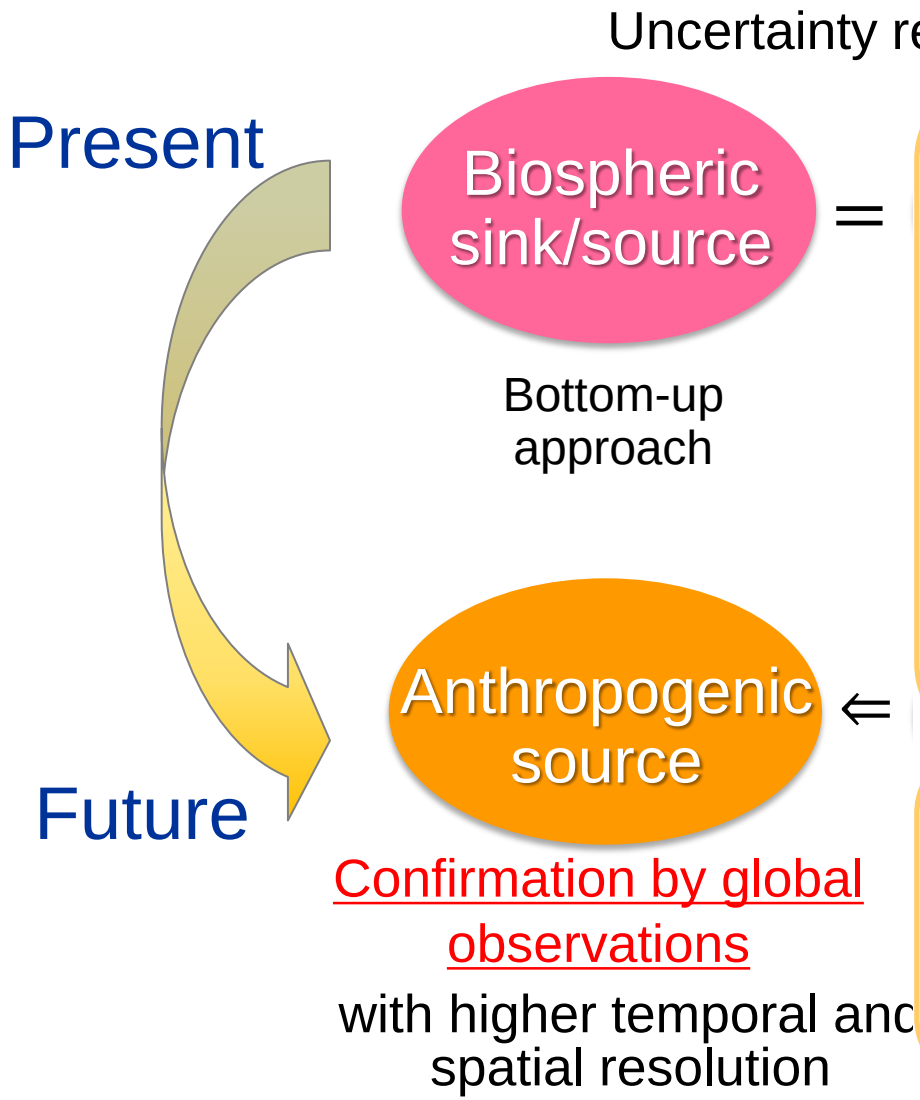
Saeki and Patra, GOSL, (2017)

The best estimated CO_2 inversion flux is between the red and blue lines

Summary and Future Challenge



Summary and Future Challenge



UNFCCC Paris Agreement <Article 4>

Undertake rapid reductions… so as to achieve a balance between anthropogenic emissions by sources and removals by sinks of GHGs in the 2nd half of this century.

Confirm the achievement independently from National GHG Inventory

Summary and Future Challenge

- Harmonized multi-platform observations of GHGs (concentrations, fluxes, C-stock, etc.)
- Improvement of data coverage in Asia-Oceania
- Integration of such observations into improved data analysis (assimilation) systems

are urgent tasks to

- Improve C source/sink estimates with enough accuracy
- Evaluate human impacts on the changes in C-cycle
- Provide additional sources of information that can complement the national inventories