



## **TG3: The GEO Carbon and GHG Initiative**

*Toward policy-relevant global carbon cycle observation  
and analysis*

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## The three challenges for GHG monitoring

- A technological challenge
  - Do we have the right instrumentation, models, satellites...?
- An integration challenge
  - Do we know how to integrate ocean, land and atmosphere, observations and models?
- A communication challenge
  - Do we respond rightly to the demand of policymakers, stakeholders? Do we provide the correct data and information?

# TG3: The GEO Carbon and GHG Initiative

- Satellite observation of GHGs is enlarged in the past 10 years and became indispensable instrumentation for source/sink evaluation by improving data coverage.

Satellites for Greenhouse Gases Observation  
(Column observation only)

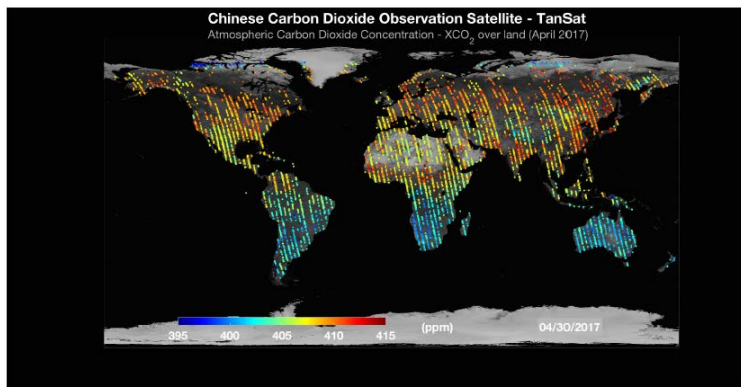
Mission	Country / Organization	Period	GHGs	Comments
ENVISAT / SCIAMACHY	ESA	2002 -2012	CO <sub>2</sub> , CH <sub>4</sub>	
GOSAT	Japan	2009 -	CO <sub>2</sub> , CH <sub>4</sub>	FTS
OCO-2	US	2014 -	CO <sub>2</sub>	Grating
GHGSat-D/CLAIRE	GHGSat (Canada)	2016 -	CO <sub>2</sub> , CH <sub>4</sub>	Fabry-Pérot
TanSat	China	2016 -	CO <sub>2</sub>	Grating
Sentinel-5p / TROPOMI	EC	2017 -	CH <sub>4</sub>	
FY-3D / GAS	China	2017 -	CO <sub>2</sub> , CH <sub>4</sub>	
GF-5 / GMI	China	2018 -	CO <sub>2</sub> , CH <sub>4</sub>	Spatial Heterodyne
GOSAT-2	Japan	2018 -	CO <sub>2</sub> , CH <sub>4</sub>	FTS
ISS / OCO-3	US	2019 -	CO <sub>2</sub>	Grating
MicroCarb	France	2021 -	CO <sub>2</sub>	
MERLIN	France/ Germany	2021 -	CH <sub>4</sub>	Laser
GeoCARB	US	2022 -	CO <sub>2</sub> , CH <sub>4</sub>	Geostationary, Grating
GOSAT-3	Japan	2022 -	?	?
Sentinel 7	(EC)	2025 -	CO <sub>2</sub>	Constellation



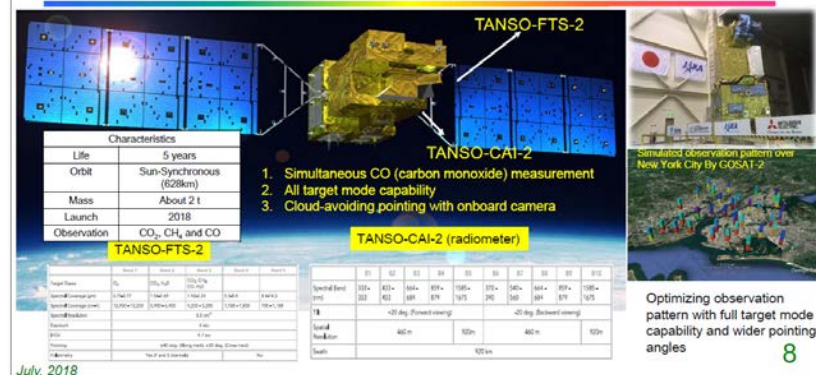
Tsuneo Matsunaga (matsunaga@nies.go.jp), National Institute for Environmental Studies (NIES), Japan, 11<sup>th</sup> GEOSS Asia Pacific Symposium, Kyoto, Japan, October 24-26, 2018

Matsunaga

Global distribution of XCO<sub>2</sub> on April 2017 --TanSat



GOSAT-2 (2018-) will be launched on Oct. 29 (Mon)  
TANSO-FTS-2 and CAI-2



Kuze

Liu

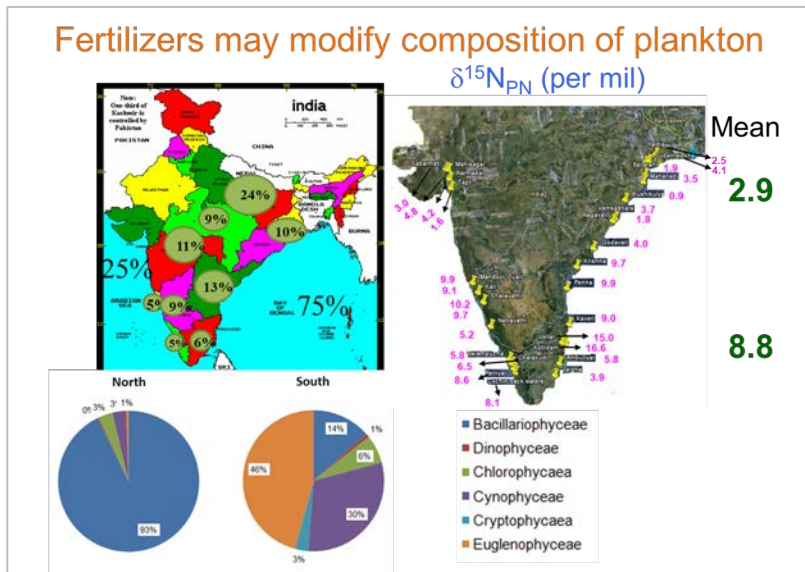


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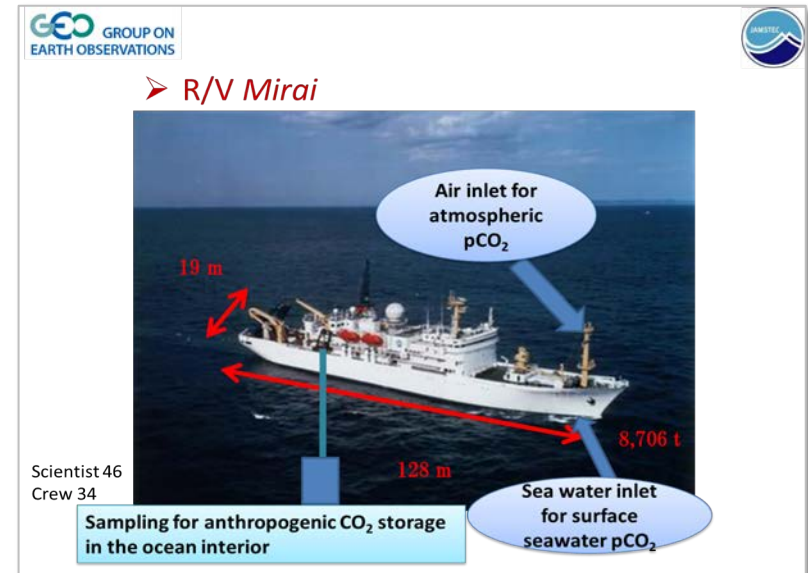
- Aircraft observation provides unique seasonal variations and vertical profiles, and improves inversion model results.
- International frameworks of research vessels (e.g., GO-SHIP) and seawater pCO<sub>2</sub> (e.g., SOCAT) are ongoing for open ocean.
- Coastal observations are required and established for a better estimation of CO<sub>2</sub> source/sink (e.g. India).



Machida



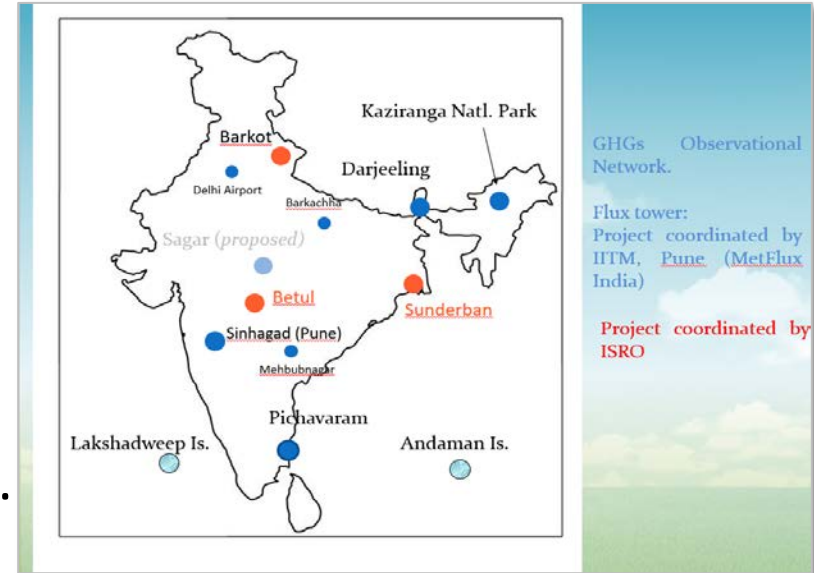
Sarma



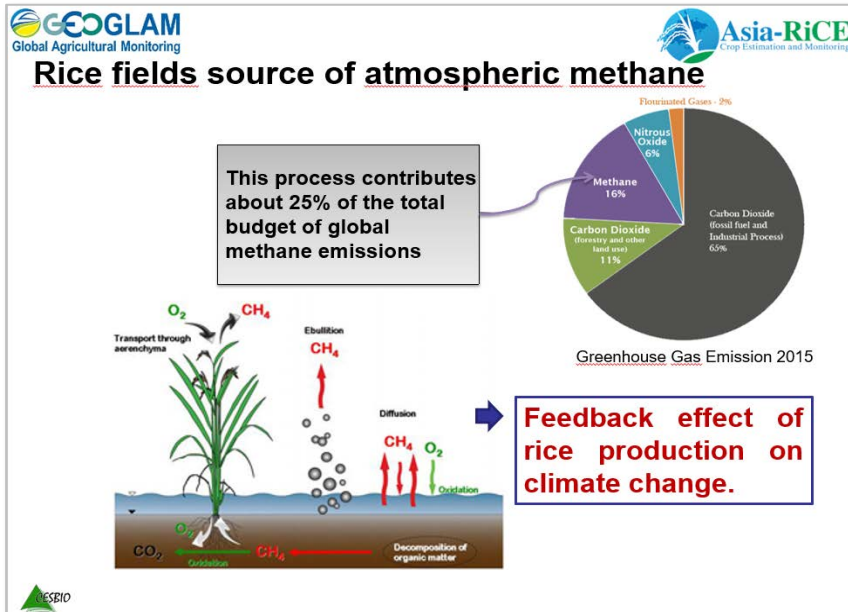
Murata

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- Great progress has been made in terrestrial flux monitoring in India.
- Peatland restoration in Indonesia is critically important for mitigation.
- EO is expected to provide timely and synoptic information of rice production and methane emission in Asian rice fields.



Chakraborty



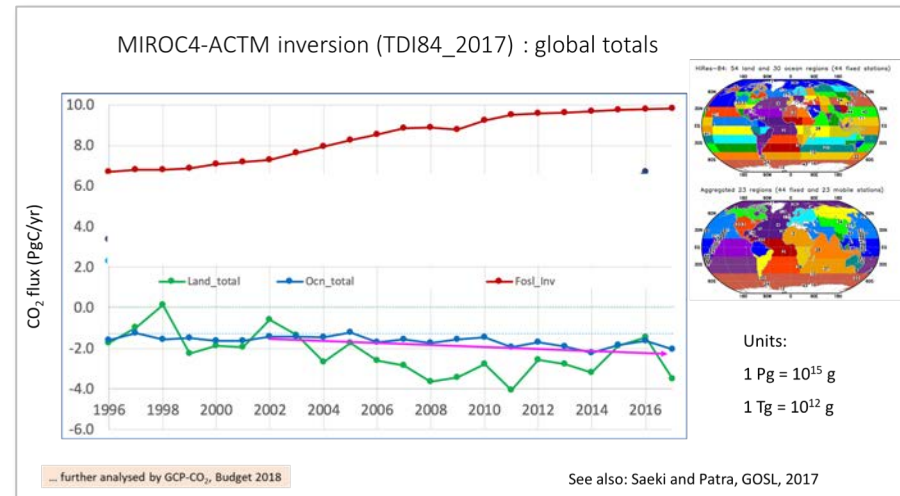
Toan



Gunawan

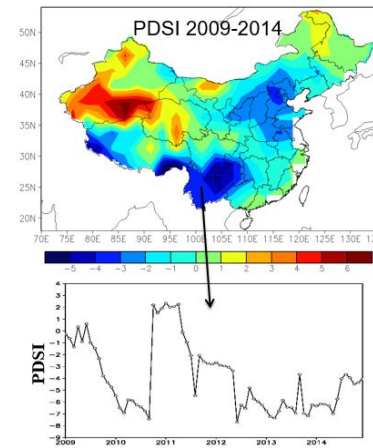
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- Needs of separating anthropogenic (fossil fuel) from natural source/sink are more recognized for supporting national GHG inventories.
- Top-down and flux-upscaling estimations of GHG give us essential insights to interpret long-term trends of sink/source distribution and FF emission.



Patra

## 3. A new Global Carbon Assimilation System

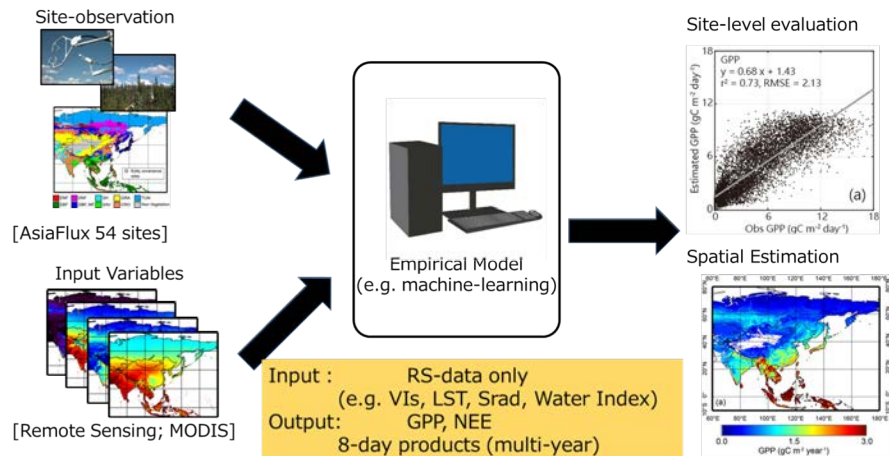


- From the autumn of 2009 to the spring of 2014, Southwest China (mainly Yunnan province) has occurred many years of extreme drought, which may lead to a carbon source in this area.
- After adding satellite XCO<sub>2</sub>, the inversion results show a significant increase of carbon source in this area, **indicating that the satellite XCO<sub>2</sub> data may help to understand the changes of regional carbon sinks caused by extreme climate events.**

PDSI gridded data from Aiguo Dai, hosted at NCAR-RDA

Jiang

## Data-driven Spatial Upscaling

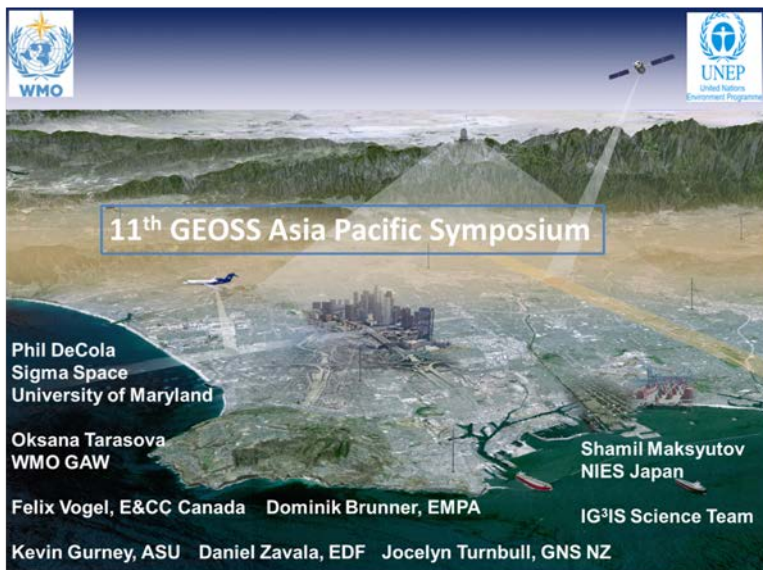
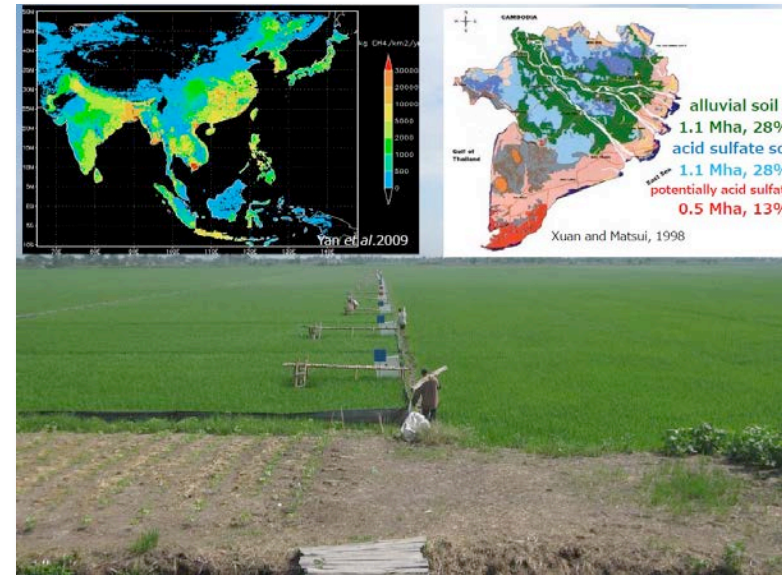


Ichii



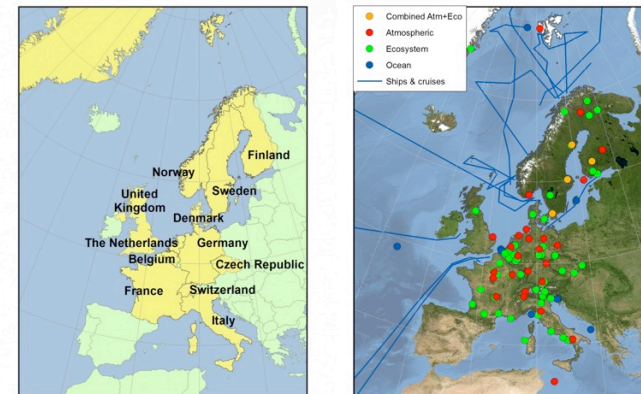
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- MRV system for monitoring CH<sub>4</sub> emission from rice fields is applicable for economic assessment of GHG mitigation.
- Needs of transformation to “infrastructure”: Keys to success are to build strong national consortia, and to get early commitment from the stakeholders.
- IG<sup>3</sup>IS will serve as an international coordinating mechanism and establish and propagate consistent methods and standards.



DeCola

## ICOS member countries and measurement stations 2017



ICOS

ICOS ERIC Head Office, Helsinki, Finland | [www.icos-ri.eu](http://www.icos-ri.eu)

Heiskanen

## AP region's response to the Paris Agreement

- Technological and integration challenge
  - ✓ Harmonizing data flows between different organizations
  - ✓ Acquiring datasets for separating anthropogenic and natural source/sink from different source factors
- Communication challenge
  - ✓ What questions we are trying to answer
  - ✓ How do we disseminate information (e.g., global stock take)
- Solutions
  - ✓ Establishing a system in each country/region in Asia to have infrastructure
  - ✓ Capacity building for data sharing and synthesis
  - ✓ Funding (ADB, government agencies, etc.)