

TG3: AO-GHG (Asia-Oceania Greenhouse Gases)

Toward policy-relevant global carbon cycle observation and analysis



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(Chinese Academy of Science, China)

TG3: Asia-Oceania Greenhouse Gases (AO-GHG)

Paris Agreement (UNFCCC) in 2015

Article 4:

... to undertake rapid reductions thereafter (peak emissions) in accordance with best available science, so as to achieve a **balance between anthropogenic emissions by sources and removals by sinks** of greenhouse gases in the second half of this century...

Global Stocktake (every 5 years: 2023, 2028...)

track regions **towards zero net emissions**, anthropogenic and natural fluxes (Paris Agreement)

TG3: Asia-Oceania Greenhouse Gases (AO-GHG)

TG-3 AO-GHG Task Group Meeting Agenda				
		Date: Sep 4, 10:00-13:00		
		Room: Conference Room #2		
		https://us02web.zoom.us/j/85361896886?pwd=XaSimXvb7UJH2GltHjPuEyJE3yeDRZ.1		
		meeting ID: 853 6189 6886 passcode: aogeo16		
Time	Name	Affiliation	Country	Title
10:00-10:05	Kazuhito Ichii	Chiba University	Japan	Setup Goals, Introduction
10:05-10:20	Osamu Ochiai	JAXA	Japan	CEOS priority initiative for Climate Policy Impact and GHG Observation
10:20-10:35	Yang Dongxu	Chinese Academy of Science	China	TanSat and TanSat-2 mission achievements
10:35-10:50	Hibiki Noda	NIES	Japan	Overview of GHGs Observation Mission with GOSAT Series
10:50-11:05	Shuai Shao	Chiba University	Japan	Development of Global Primary Production and Evapotranspiration Products derived from Enhanced BESS Model and GCOM-C SGLI Datasets
		Photo and Break		
11:15-11:30	Liu Yi	Chinese Academy of Science	China	The Achievement and Challenge of Top-down method to calculate Carbon emission
11:30-11:45	Naveen Chandra	JAMSTEC	Japan	Verification of sub-continental scale fluxes with natural and anthropogenic sector separation
11:45-12:00	Jiang Fei	Chinese Academy of Science	China	Satellite data application in emission estimation
12:00-12:15	Deepshikha	IIT-Delhi	India	Refining Methane Emission Estimates for USA, China, and India Using GOSAT XCH4 Data and Atmospheric Modeling
12:15-12:30	Dan Henri	Chiba University	Japan	The effect of different MODIS versions on a data-driven estimation of CO2 Fluxes in Asia
12:30-13:00		Discussion Statement Preparation		
				※ Each presentation has 12 min talk + 3min QA

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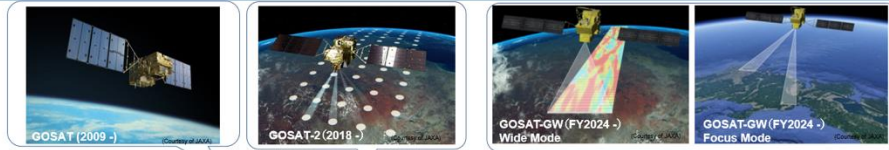
Achievement:

History/Future of GHG Satellites (AO region: GOSAT (Japan), Tansat (China), GF-5, FY-3 (China))

Meas.	Org.	Sat	2002	2004	2006	2008	2010	2012	2014	2016	2018	2020	2022	2024	2026	
Passive		Envisat	Envisat-Sciamachy					[CO ₂ etc.]								
		Aqua	Aqua-AIRS										[CO ₂ , CH ₄ etc.]			
		Aura	Aura-TES										[CO, CO ₂ , CH ₄ etc.]			
		GOSAT	[CO ₂ , CH ₄ etc.]		GOSAT-1					GOSAT-2		GOSAT-2				
		OCO	OCO-1		[CO ₂]		OCO-2		OCO-3		OCO-3					
		TanSat	[CO ₂]		TanSat		TanSat		TanSat		TanSat					
		GF-5	[CO ₂ , CH ₄ etc.]		GF-5		GF-5		GF-5		GF-5		GF-5			
		FY-3	[CO ₂ , CH ₄ , CO etc.]		FY-3		FY-3		FY-3		FY-3		FY-3G			
		Sentinel-5p	[CO ₂ , CH ₄]		Sentinel-5p		Sentinel-5p		Sentinel-5p		Sentinel-5p		Sentinel-5p			
		GeoCarb	[CO ₂]		GeoCarb		GeoCarb		GeoCarb		GeoCarb		GeoCarb			

Specifications of GOSAT, GOSAT-2, and GOSAT-GW

[Slide by Prof. Yi Liu]



	GOSAT	GOSAT-2	GOSAT-GW
Launch / lifetime	2009 / 5 years	2018 / 5 years	FY2024 / 7 years
Satellite mass / power	1.75 t / 3770 W	1.8 t / 5000 W	2.9 t / 5200 W
Orbit	666 km, 3 days, 13:00, descending	613 km, 6 days, 13:00, descending	666 km, 3 days, 13:30, ascending
Spectrometer	FTS	FTS-2	TANSO-3 (Grating)
Major targets	CO ₂ , CH ₄	CO ₂ , CH ₄ , CO, SIF	CO ₂ , CH ₄ , NO ₂ , SIF
Spectral bands	0.7 / 1.6 / 2 μm + TIR	0.7 / 1.6 / 2 μm + TIR	0.45 / 0.7 / 1.6 μm
Spectral Resolution (Sampling Interval)	0.2 cm ⁻¹ (= 0.01 nm @ 0.7 μm, = 0.05 nm @ 1.6 μm)		< 0.5 nm @ 0.45 μm, < 0.05 nm @ 0.7 μm, < 0.2 nm @ 1.6 μm
Swath	Discrete, 1 – 9 points	Discrete, 5 points	Selectable, 911 km (Wide Mode) or 90 km (Focus Mode)
Footprint size, nadir	10.5 km	9.7 km	Selectable, 10 km (Wide Mode) or 1 – 3 km (Focus Mode)
Pointing	± 20 / ± 35 deg (AT/CT)	± 40 / ± 35 deg (AT/CT)	± 40 / ± 34.4 deg (AT/CT) for Focus Mode
Other instruments	CAI (Cloud and Aerosol Imager)	CAI-2 (Cloud and Aerosol Imager 2)	AMSR3 (Advanced Microwave Scanning Radiometer 3)

Challenges

- ✓ Accuracy improvement with more observation data is expected.
- ✓ More collaboration (within Asia-Oceania) is expected.

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Achievement: Bottom-up Carbon Products using various sensors

Global Biomass Datasets

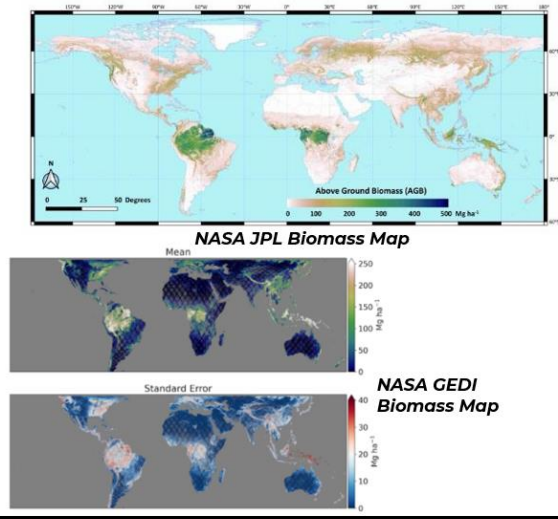


CEOS Committee on Earth Observation Satellites
<https://ceos.org/gst/biomass.html>

Above Ground Biomass

Above ground biomass products: NCEO Africa Biomass, IceSat-2 Boreal Biomass, JPL Global Biomass, GEDI Biomass, ESA CCI Biomass

ESA CCI Biomass



(4) GCOM-C SGLI

Carbon Stock (Biomass) Products

Substantial investment (\$4.5Bn) in biomass-related mission launches 2018-2025: ICESat-2, GEDI, MOLI, SAOCOM-1A/B, ALOS-4, NISAR, BIOMASS

[Ochial]

Carbon Flux Products

[Shao]

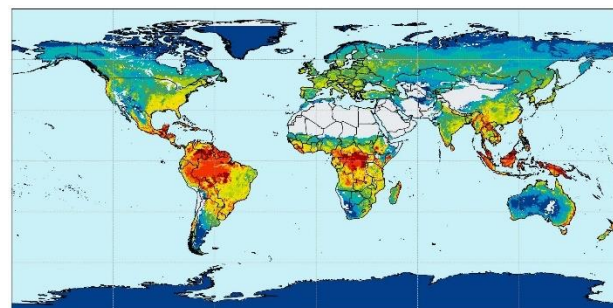


Table.1 Details of different medium-resolution satellites

Satellite	Launch Date	Expected End Date	Temporal Resolution	Spatial Resolution	Coverage Band	Agency
GCOM-C SGLI	2017	TBD	1 day	250 m to 1 km	Visible to Infrared	JAXA
MODIS (Terra)	1999	In coming years	1-2 days	250 m to 1 km	Visible to Infrared	NASA
VIIRS (NPP)	2011	TBD	1 day	375 m to 750 m	Visible to Infrared	NASA/NOAA

Challenges

- ✓ High Spatial Resolution
- ✓ Improvement of Accuracy
- ✓ International collaboration



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Achievement:;

Assessment of anthropogenic CO₂ emissions, Separation of natural and anthropogenic estimates

REFINING METHANE EMISSION ESTIMATES USING GOSAT XCH₄ DATA AND ATMOSPHERIC MODELING

... for USA, China, and India



Indian Institute of
Technology, Delhi

Presenter : Deepshikha

16th AOGEO Symposium



04 September 2024

Mentors

Prof. Sagnik Dey
Dr. Prabir K. Patra

[Chandra]

[Deepshikha]

Challenges

- ✓ Revise Inventory
(Anthropogenic emission)
- ✓ (better obs converge, modeling)

Verification of sub-continental scale CO₂ fluxes with natural and anthropogenic sector separation

Naveen Chandra and Prabir. K. Patra

¹Research Institute for Global Change (RIGC) / Institute of Arctic Climate and Environment
Research (IACE), JAMSTEC, Yokohama

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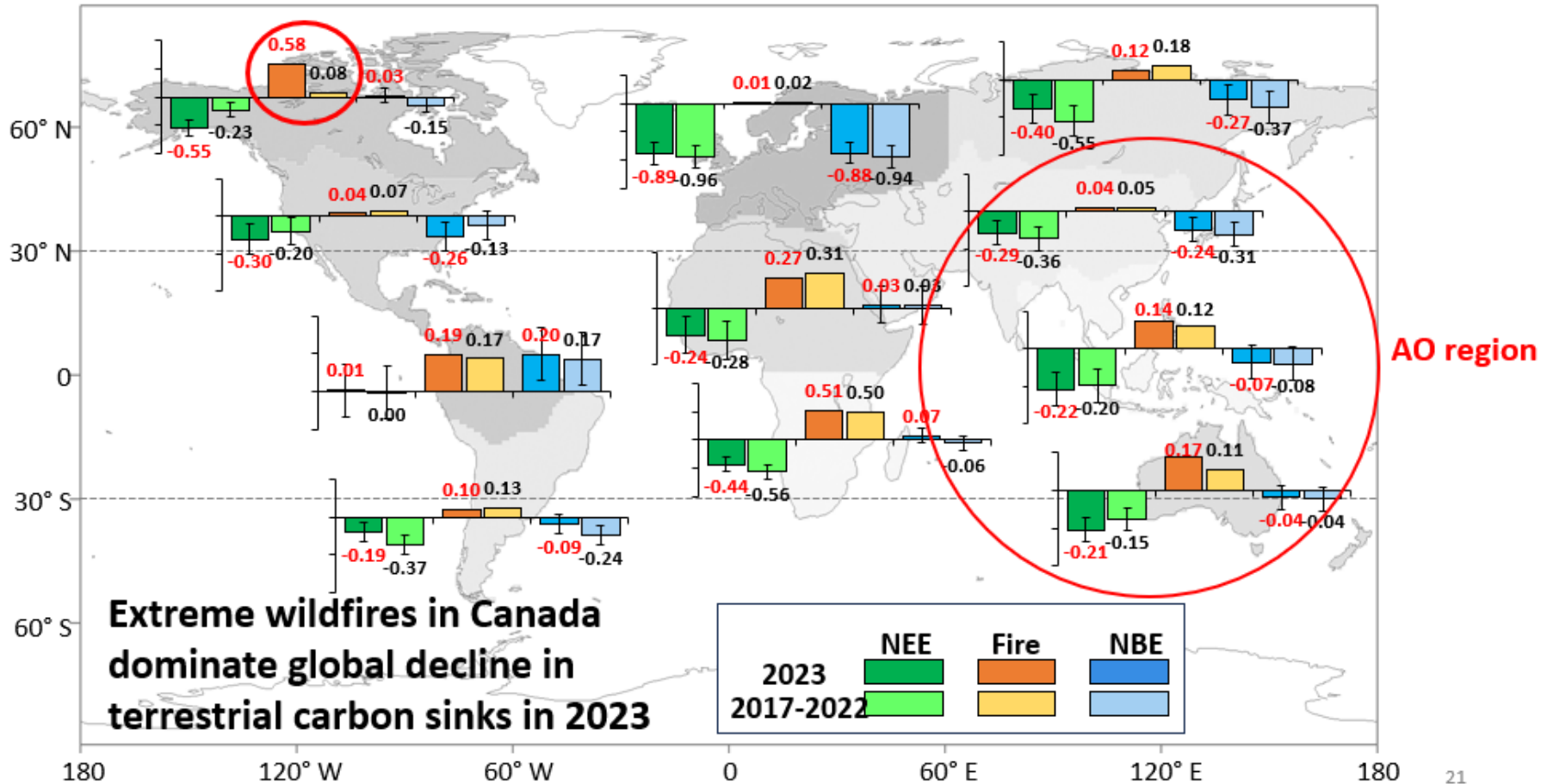
Asia-Oceania Greenhouse Gases Symposium TG-3
AO-GHG (Asia-Oceania Greenhouse Gases)
04 September 2024



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Achievement: Carbon Assessment – yearly (speedy) update

3.3 2023 Global extreme Heatwave



Challenge: toward low latency (near-real time & take action) (in-situ obs data)

[Jiang]

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Challenge; Potential Collaboration with Global Frameworks for GHG



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Global Greenhouse Gas Watch
(G3W)



(Committee on
Earth Observation Satellites)



TG-3: AO-GHG

☑ where to put energy in AOGEO regions,
identify key regions. Gap areas



Ongoing Issues & Way forward

- ✓ Accuracy and data availability of measurements of GHG
- ✓ Low-latency (e.g. other in-situ takes long term)
- ✓ High spatial and temporal resolution
- ✓ Point sources, Hotspot of emission
- ✓ Separation of anthropogenic and natural carbon cycle processes
- ✓ integration system refinement
- ✓ Coordination among agencies
- ✓ Where to put energy in AOGEO regions, identify key regions. Gap areas.
- ✓ Collaboration among international frameworks.