

# Global change Observation Mission (GCOM)

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# GCOM Mission

- **Continuation of ADEOSII**
- **Contribution to GEOSS**
- **Climate, Weather, Water, Ecosystem, Agriculture, etc. in GEOSS 9 areas**
- **Focus on Climate change / Global warming and Water cycle committed in Summit**
- **Contribution to operational fields like weather forecast, fisheries, etc.**
- **Long term continuous measurements**

# Scientific Targets

- **Accurate estimation of aerosol radiative forcing**
- **Validation of climate models**
- **Accurate estimation of primary production**
- **Better understanding of coastal phenomena**
- **Better understanding of sea ice trend**

# GCOM Observation Targets

## Radiation budget

Cloud/aerosol changes  
and Radiative forcing

Ice-albedo  
feedback

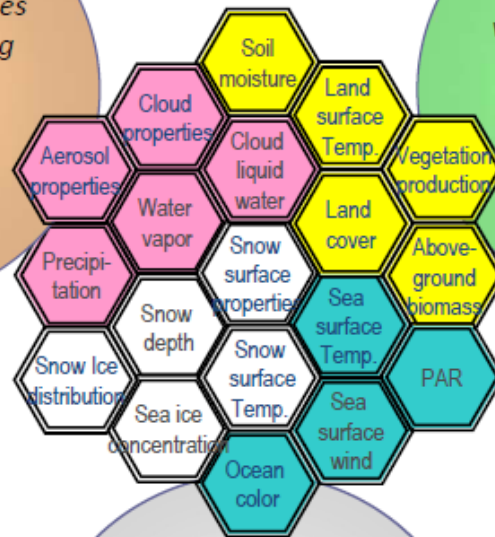
Major unknown factor  
in climate modeling

## Carbon cycle

Carbon cycle and  
vegetation production

Carbon and heat pool  
and coastal  
environment

Sink and pool of CO<sub>2</sub>  
(major greenhouse gas)



Water and energy  
cycle in global scale

Water cycle changes  
by global warming

Direct effect to  
human activities  
(severe weather, flood,  
water resources)

## Water/Energy cycle

# Operational Applications

- **Input to NWP**
- **Extreme weather forecasting**
- **Fisheries**
- **Navigation**
- **Coastal management**
- **Crop yield estimation**
- **Monitoring forest decrease**
- **Monitoring volcano eruptions**
- **Monitoring forest fire**

# GCOM satellites

- **GCOM-W1**
  - AMSR2 (Advanced Microwave Scanning Radiometer 2)
  - Launched on 18, May., 2012
- **GCOM-C1**
  - SGLI (Second generation Global Imager)
  - Launched on 23, Dec. 2017
- **Plan for the 2<sup>nd</sup> and 3<sup>rd</sup> generations**
  - GCOM-W2 (in 2022),  
GCOM-W3 (in 2029)
  - GCOM-C2 (in 2024),  
GCOM-C3 (in 2031)

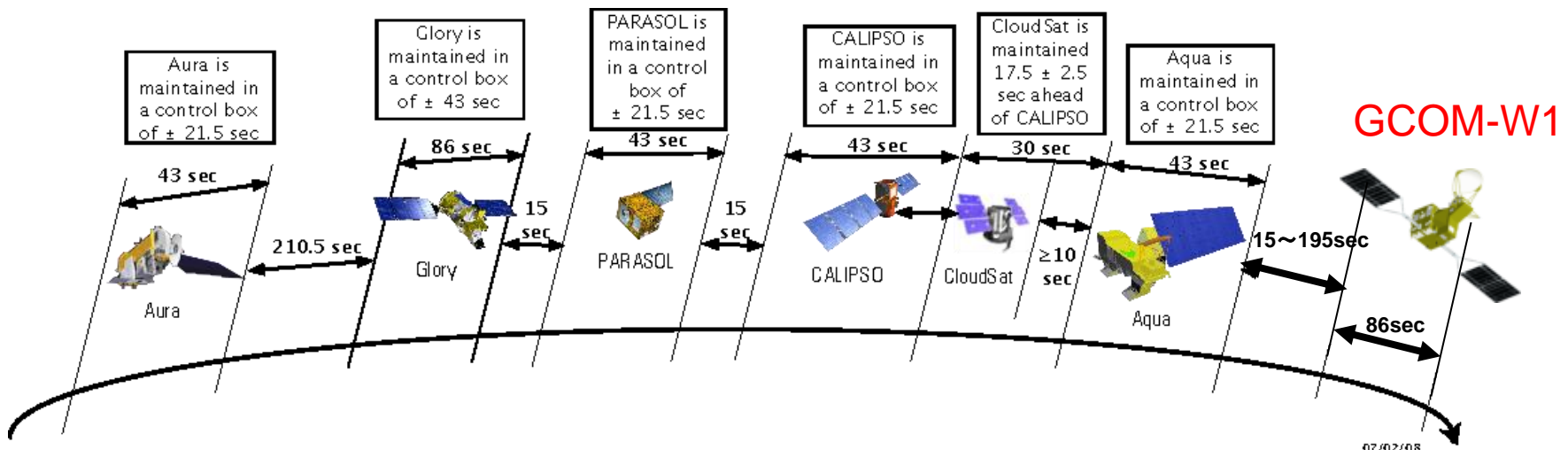


# GCOM-W1

- Orbit
  - Sun synchronous orbit
  - Height: about 700km
  - Local time of ascending node: 13:30
- Weight: about 1.99t
- Power : about 3.9kW
- Lifetime: 5 years
- Data transmission
  - Global observation data are stored and transmitted every orbit period
  - Observed data are transmitted to ground stations in real time

# A-Train and GCOM-W1

- After invitation to A-Train constellation from NASA, JAXA and A-Train members studied the possibility of participation of GCOM-W1 to A-Train.
- Participation of GCOM-W1 to A-Train was approved by A-Train members last October. The position of GCOM-W1 is ahead of Aqua.
- Benefits of joining the A-train are:
  - Precise inter-calibration between AMSR-E and AMSR2; and
  - Synergy with A-Train instruments for new Earth science research.



# GCOM-W1 Status

- GCOM-W1 & AMSR2 are operating well.
- Sufficient fuel for more than 10 years.
- Rotation torque level is still very low.

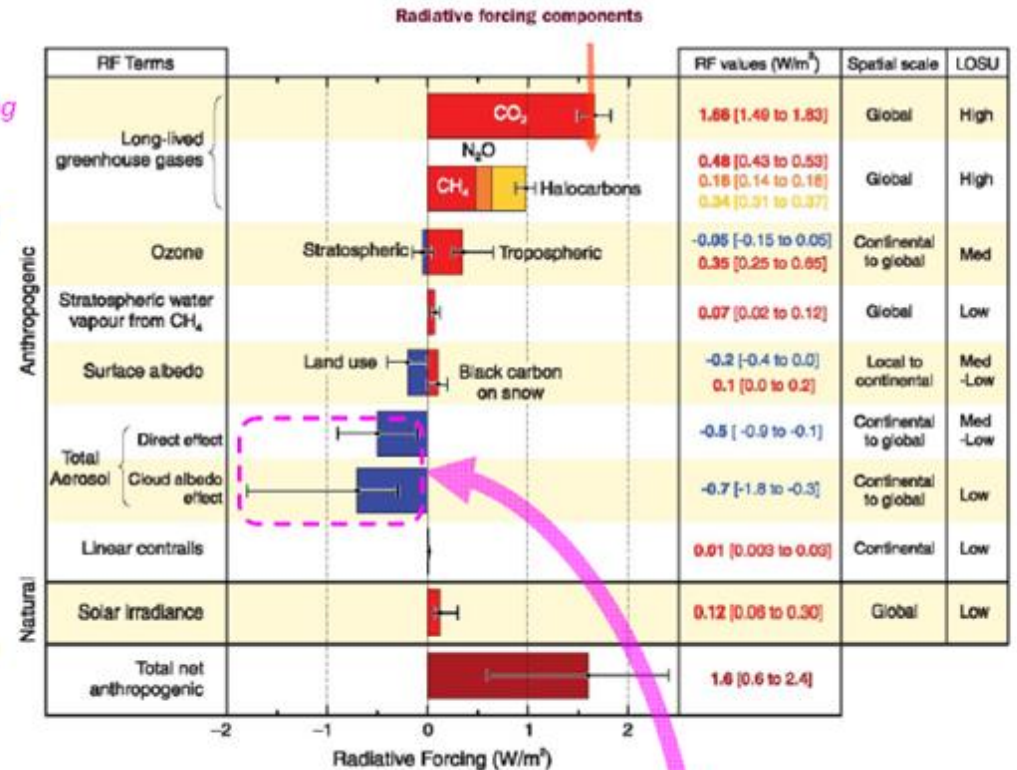
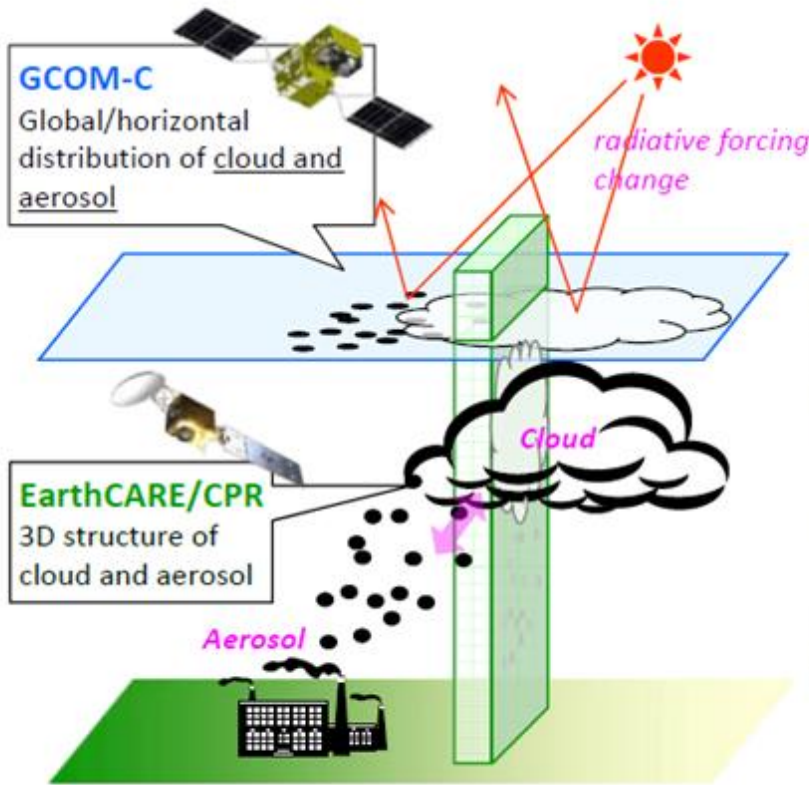
# GCOM-C1 Launch

- GCOM-C1 was launched by H2-A from Tanegashima Space Center on 23<sup>rd</sup>, Dec. 2017.
- Launch was successful and bus as well as SGLI are operating well.
- GCOM-C1 got into steady state operation from 28, March, 2018.

# GCOM-C Science Targets

## Radiation budget of the atmosphere-surface system

Today's the most significant factor: atmospheric CO<sub>2</sub>



Monitoring and process investigation about cloud and aerosol by GCOM-C & EarthCARE

Figure 2.4. Global average radiative forcing (RF) in 2005 (best estimates and 5 to 95% uncertainty ranges) with respect to 1750 for CO<sub>2</sub>, CH<sub>4</sub>, N<sub>2</sub>O and other important agents and mechanisms, together with the typical geographical extent (spatial scale) of the forcing and the assessed level of scientific understanding (LOSU). Aerosols from explosive volcanic eruptions contribute an additional episodic cooling term for a few years following an eruption. The range for linear contrails does not include other possible effects of aviation on cloudiness. (WGI Figure SPM.2)



# CGOM-C1

- Orbit
  - Sun synchronous orbit
  - Height: about 800km
  - Local time of descending node: 10:30
- Weight: about 2.1t
- Power : about 4kW
- Lifetime: 5 years
- Data transmission
  - Global observation data are stored and transmitted every orbit period
  - Observed data over Japanese islands are transmitted to JAXA ground station in real time

# SGLI

- Wide spectrum coverage
- Near UV, VIS, NIR, SWIR, TIR
- Polarization measurements
- Multiple angle observation
- Multiple telescopes

# VNR- non polarization

- Composed of 3 telescopes to cover the total swath
- Each telescope covers 24 degree achieving 70 degree in total

# VNR-Polarization

- Composed of 1 telescope for each channel
- IFOV is 55 degree
- Looking fore, nadir & aft
- One camera with tilt (45 degree)

# VNR-NP

central wavelength [nm]	IFOV [m]	$\Delta\lambda$ [nm]	$L\lambda$ [W/m <sup>2</sup> /st r/ $\mu$ m]	$L_{\max}$ [W/m <sup>2</sup> /st r/ $\mu$ m]	S/N spec	S/N PFT
380	250	10	60	210	250	613<
412	250	10	75	250	400	703<
443	250	10	64	400	300	474<
490	250	10	53	120	400	815<
530	250	20	41	350	250	410<
565	250	20	33	90	400	936<
673.5	250	20	23	62	400	1010<
673.5	250	20	25	210	250	473<
868.5	250	20	8	30	400	1580<
763	1000	12	40	350	400	460<
868.5	250	20	30	300	200	1580<

# Polarization channels (3

IS)	directions)				
IFOV [m]	$\Delta\lambda$ [nm]	$L\lambda$ [W/m <sup>2</sup> /str/ $\mu\text{m}$ ]	$L_{\text{max}}$ [W/m <sup>2</sup> /str/ $\mu\text{m}$ ]	S/N spec	S/N PFT
1000	20	25	250	250	712
1000	20	25	250	250	727
1000	20	25	250	250	586
1000	20	30	300	250	719
1000	20	30	300	250	693
1000	20	30	300	250	580

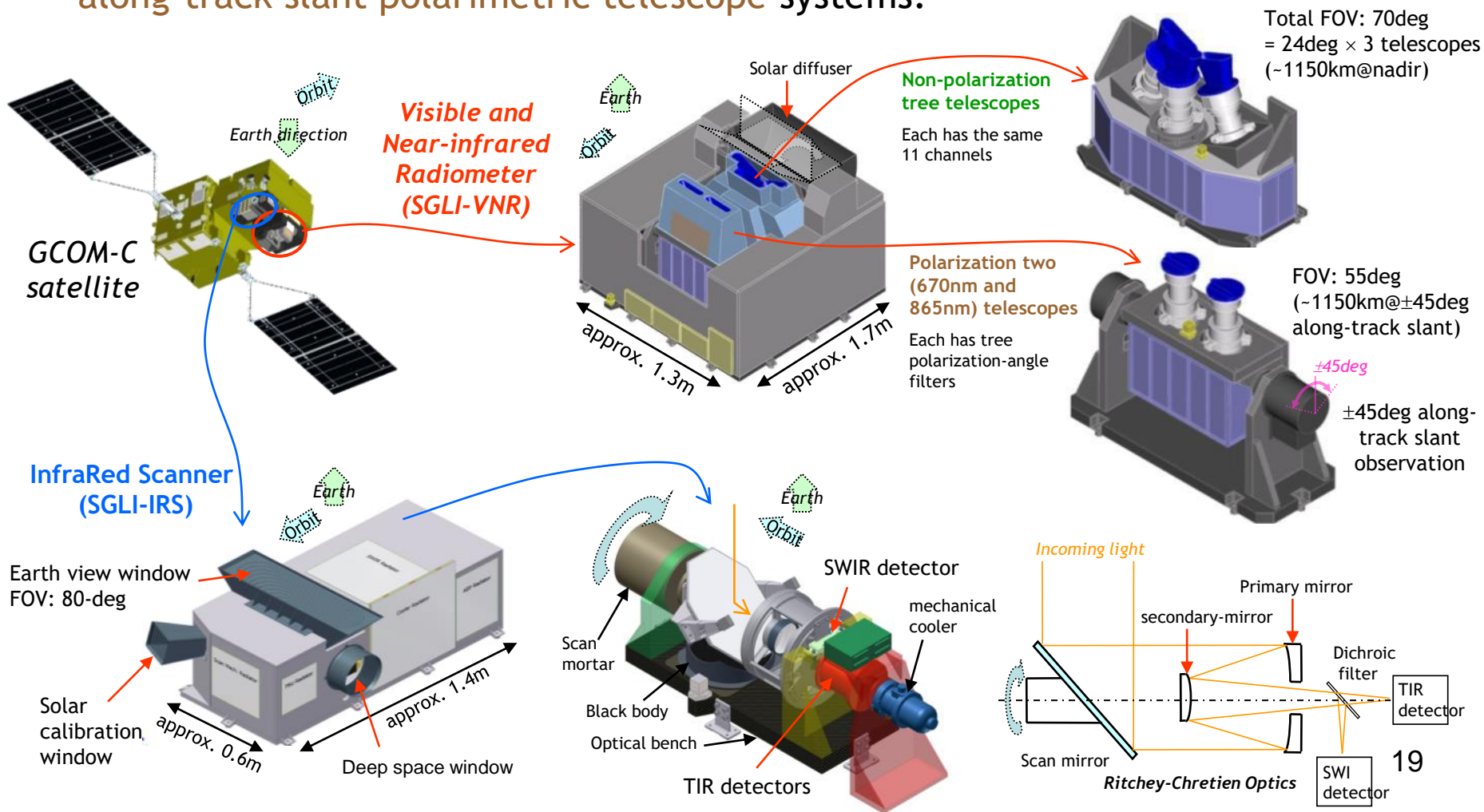
# IRS

<b>Ch.</b>	<b>Central wavele ngth [<math>\mu\text{m}</math>]</b>	<b>IFO V [m]</b>	<b><math>\Delta\lambda</math> [<math>\mu\text{m}</math> ]</b>	<b><math>L_\lambda</math> [<math>\text{W}/\text{m}^2</math> /str/<math>\mu\text{m}</math>] or <math>T_{\text{std}}</math> [K]</b>	<b><math>L_{\text{max}}</math> [<math>\text{W}/\text{m}^2</math> /str/<math>\mu\text{m}</math>] or <math>T_{\text{max}}</math> [K]</b>	<b>S/N or NEdT@ 300K spec</b>	<b>S/N or NEdT@ 300K PFT</b>
<b>SW I-1</b>	<b>1.05</b>	<b>1000</b>	<b>0.02</b>	<b>57</b>	<b>248</b>	<b>500</b>	<b>942</b>
<b>SW I-2</b>	<b>1.38</b>	<b>1000</b>	<b>0.02</b>	<b>8</b>	<b>103</b>	<b>150</b>	<b>329</b>
<b>SW I-3</b>	<b>1.64</b>	<b>250</b>	<b>0.2</b>	<b>3</b>	<b>50</b>	<b>57</b>	<b>100</b>
<b>SW I-4</b>	<b>2.21</b>	<b>1000</b>	<b>0.05</b>	<b>1.9</b>	<b>20</b>	<b>211</b>	<b>368</b>
<b>TIR -1</b>	<b>10.8</b>	<b>500</b>	<b>0.7</b>	<b>300</b>	<b>340</b>	<b>0.2</b>	<b>0.07</b>
<b>TIR</b>	<b>12.0</b>	<b>500</b>	<b>0.7</b>	<b>300</b>	<b>340</b>	<b>0.2</b>	<b>0.13</b>

# 2. GCOM-C products and SGLI design

## - 2.8 SGLI design (VNR and IRS)

- SGLI system consists of two components: **SGLI-VNR** and **SGLI-IRS** to optimize optics for each wavelength range
- SGLI-VNR consists of **11-channel non-polarimetric telescope** and **2-channel along-track slant polarimetric telescope** systems.



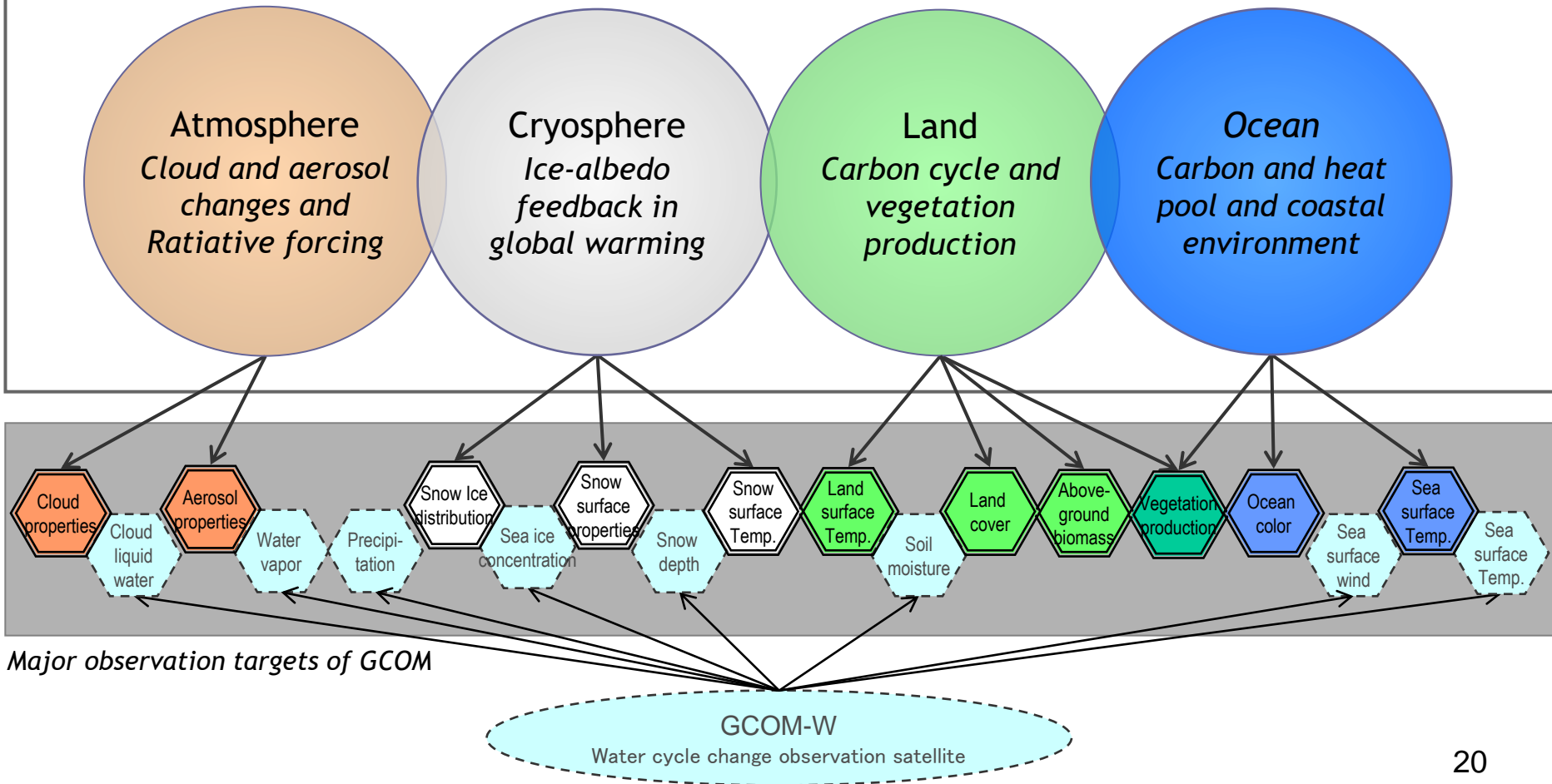
# 2. GCOM-C products and SGLI design

## - 2.1 mission target and product groups

### GCOM-C observation targets

#### Radiation budget

#### Carbon cycle



## Standard products (land)

products	GSD	accuracy
radiance	250/1000m	5%, 0.5K
geom. corr. rad.	250m	0.5pixel
land surface refl.	250m	5%/10%* <sup>1</sup>
veg. index	250m	20%/15%* <sup>2</sup>
veg. roughness. index	1km	20%/15%* <sup>2</sup>
shadow index	1km	20%/15%* <sup>2</sup>
land surf. temp	500m	2.5K
fAPAR	250m	30%/20%* <sup>2</sup>
LAI	250m	30%
above ground biomass	1km	30%

\*1 : >443nm / ≤443nm

\*2 : grass land / forest

# Research products (land)

products	GSD	accuracy
net primary prod.	1km	TBD
veg. water stress index	500m	TBD
fire	500m	TBD
land cover class.	250m	TBD
land surface albedo	1km	TBD

## Standard products (atmosphere)

products	GSD	accuracy
cloud flag/type	1km	
cloud type & amount	1km/0.1°	15%
cloud top temp/altitude	1km/0.1°	3k/2km
opt. thick. of water cloud	1km/0.1°	100%
opt. thick. of cirrus	1km/0.1°	70%
aerosol over ocean	1km/0.1°	0.1
aerosol over land UV	1km/0.1°	0.15
aerosol over land pol.	1km/0.1°	0.15

## Research products (atmosphere)

products	GSD	accuracy
geom. thickness of water clouds	1km/0.1°	N/A
land surface long wave radiant flux	1km/0.1°	N/A
land surface short wave radiant flux	1km/0.1°	N/A

## Standard products (ocean)

products	GSD	accuracy
normalized water leav. rad.	250m/1km/4-9km *1	50%
atm. corr. parameter	250m/1km/4-9km	50%
PAR	250m/1km/4-9km	15%
chlorophyll-a	250m/1km/4-9km	-60-+150%
SS	250m/1km/4-9km	-60-+150%
CDOM	250m/1km/4-9km	-60-+150%
SST	500m/1km/4-9km	0.8K

**\*1 : 250m:coastal, 1km : open ocean, 4-9km : global**

## Research products (ocean)

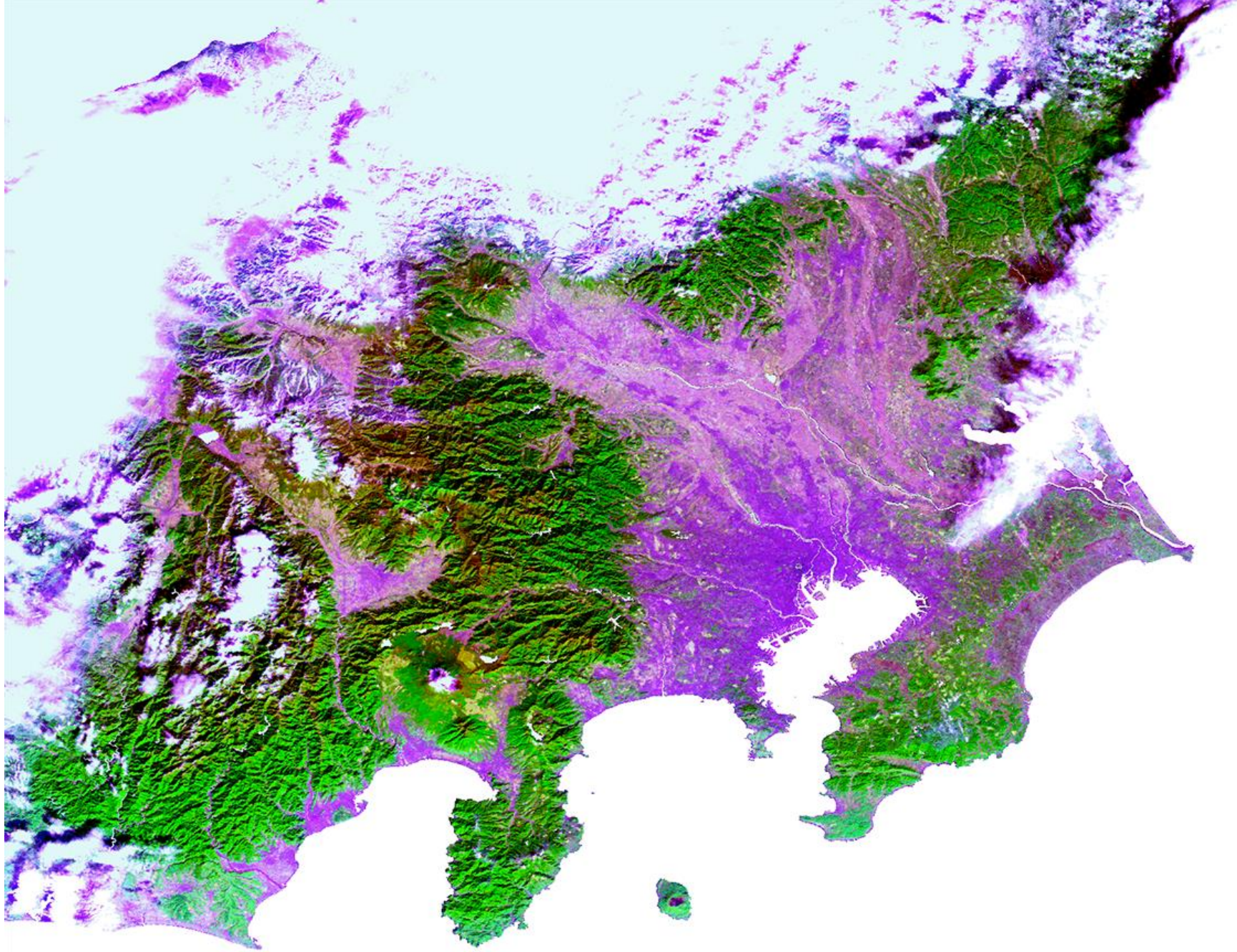
products	GSD	accuracy
euphotic zone depth	250m/1km/4-9km	N/A
intrinsic opt. char. of seawater	250m/1km/4-9km	N/A
primary production	500m/1km/4-9km	N/A
phytoplankton type	250m/1km/4-9km	N/A
red tide	250m/1km/4-9km	N/A
sensor fusion ocean color	250m/1km	N/A
sensor fusion SST	500m/1km	N/A

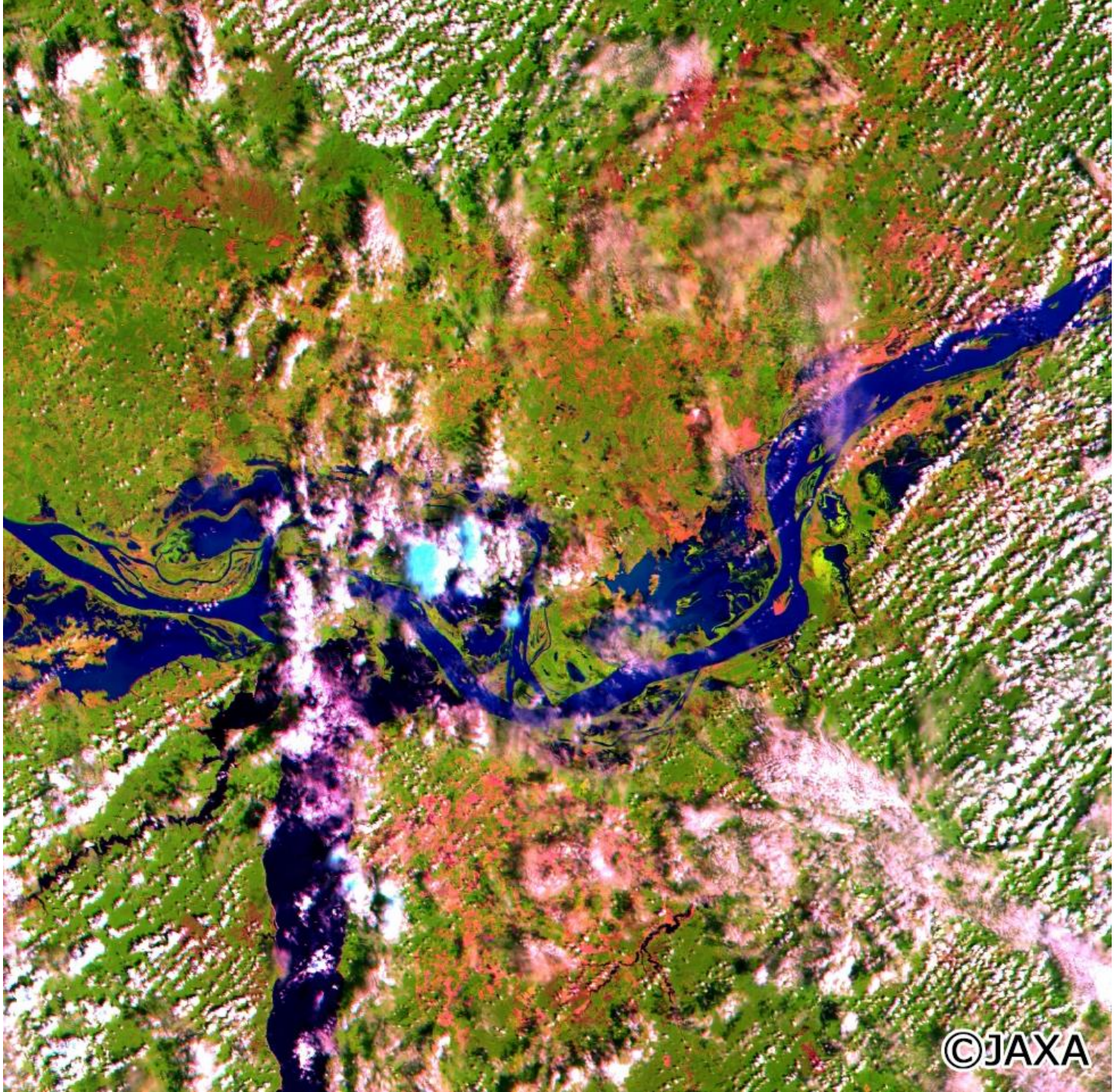
## Standard products (cryosphere)

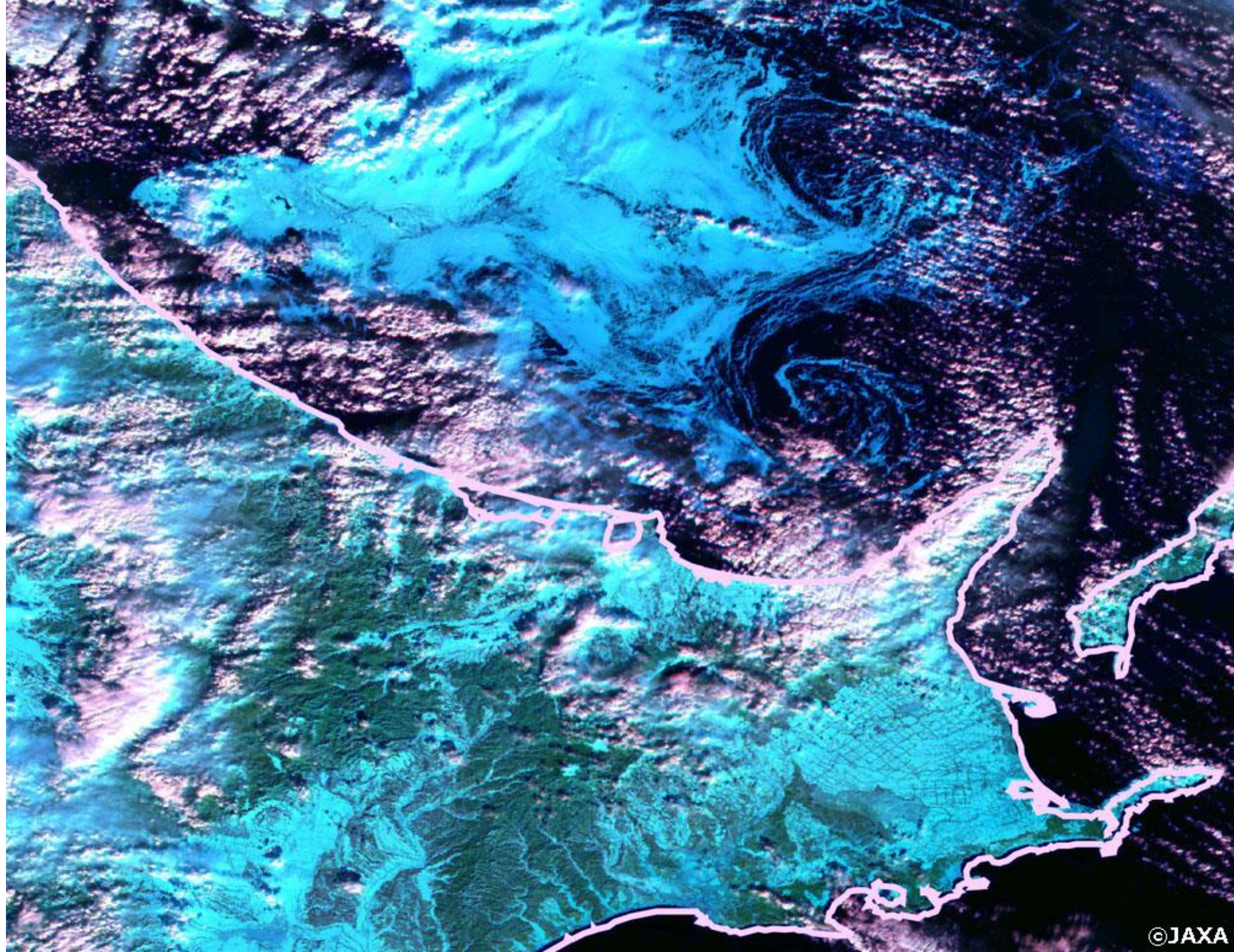
products	GSD	accuracy
snow & ice cover	250m/1km	7%
sea ice dist. in Okhotsk sea	250m	5%
snow/ice surface temp.	500m/1km	2K
snow particle size	250m/1km	50%

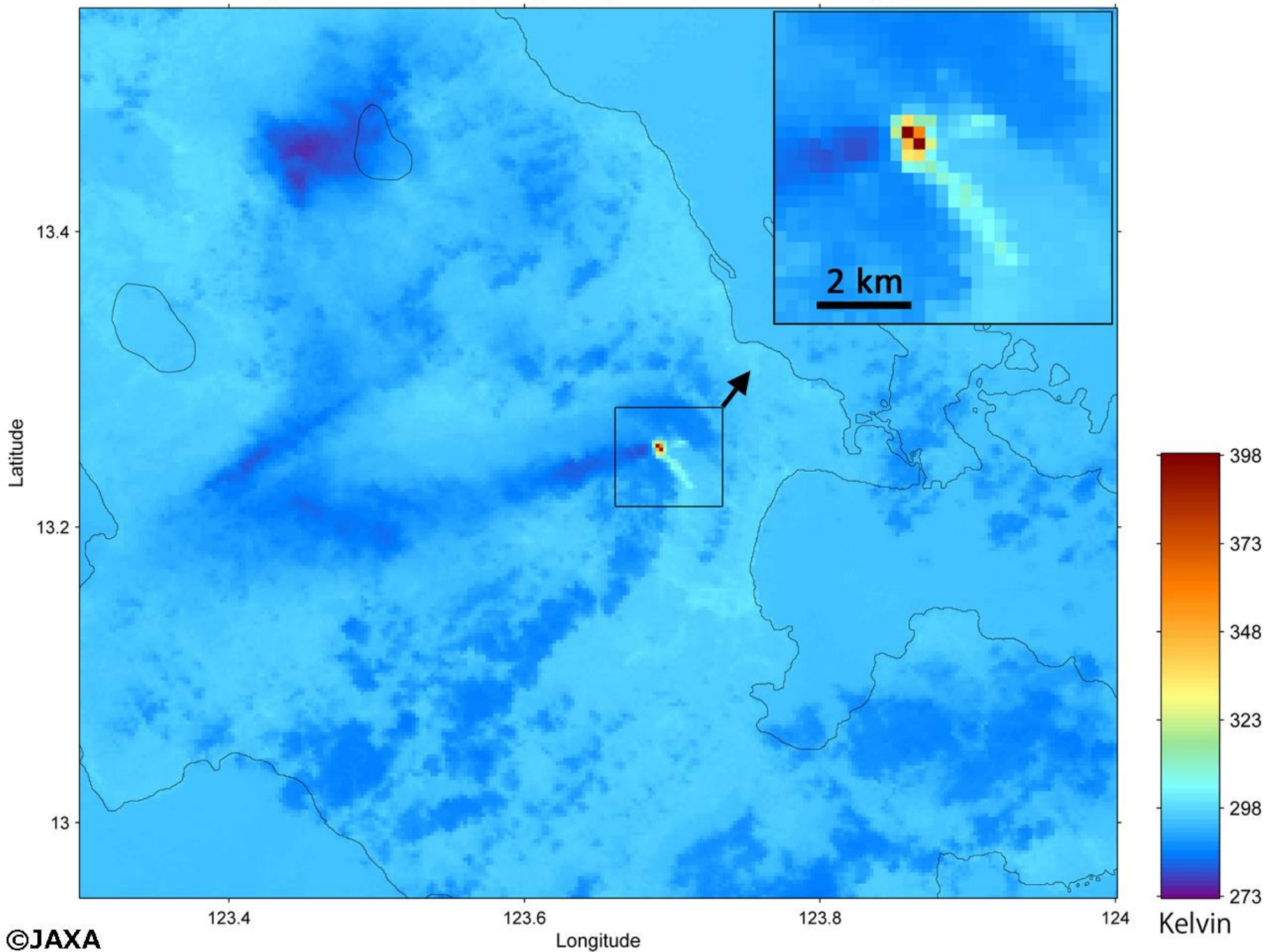
## Research products (cryosphere)

products	GSD	accuracy
snow/sea ice class.	1km	N/A
snow cover over mountains	250m	N/A
snow particle size of semi surface	1km	N/A
surface snow particle size	250m/1km	N/A
snow/ice surface albedo	1km	N/A
snow impurity	250m/1km	N/A
ice sheet roughness	1km	N/A
ice sheet edge monitor	250m	N/A





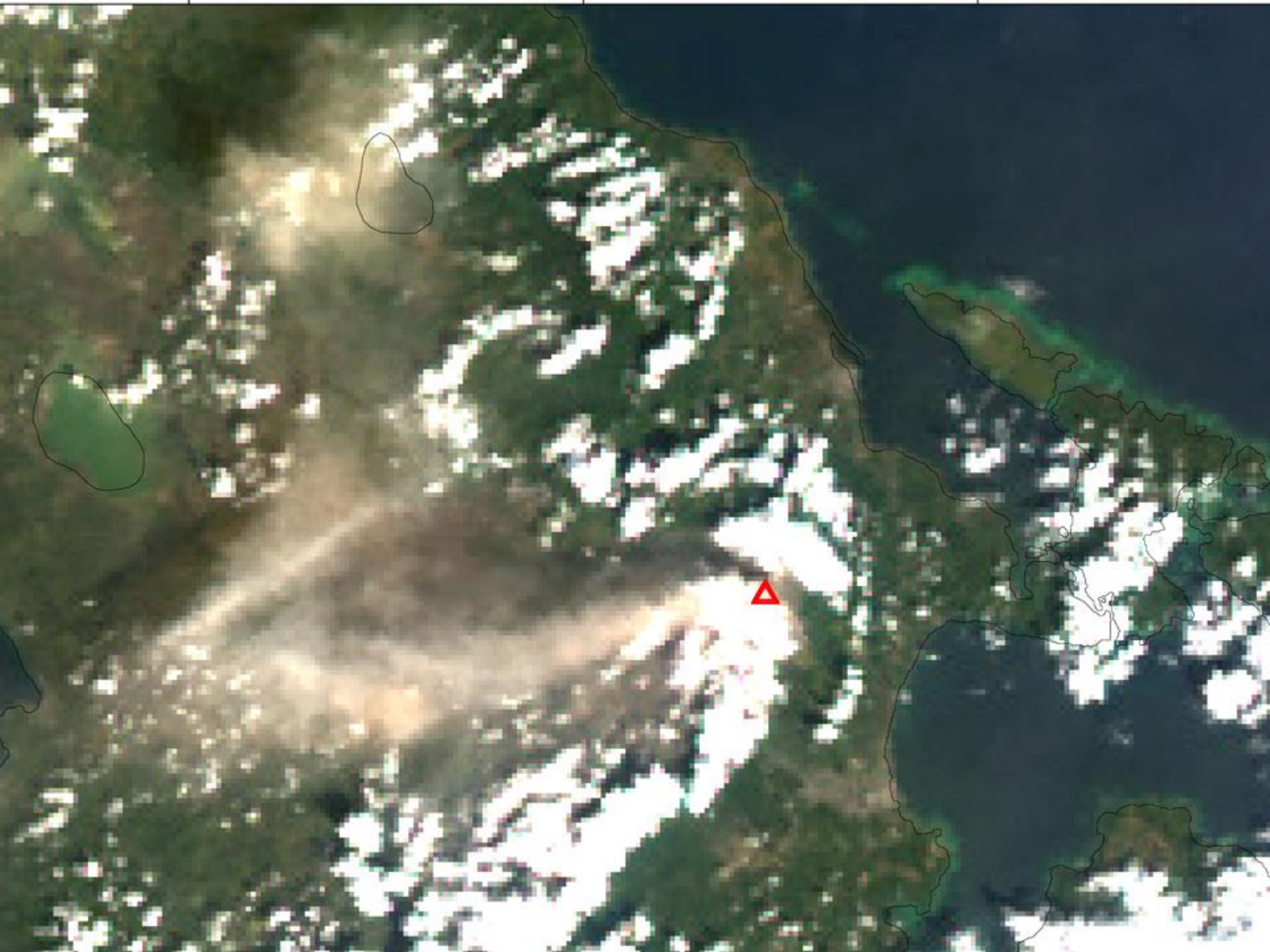


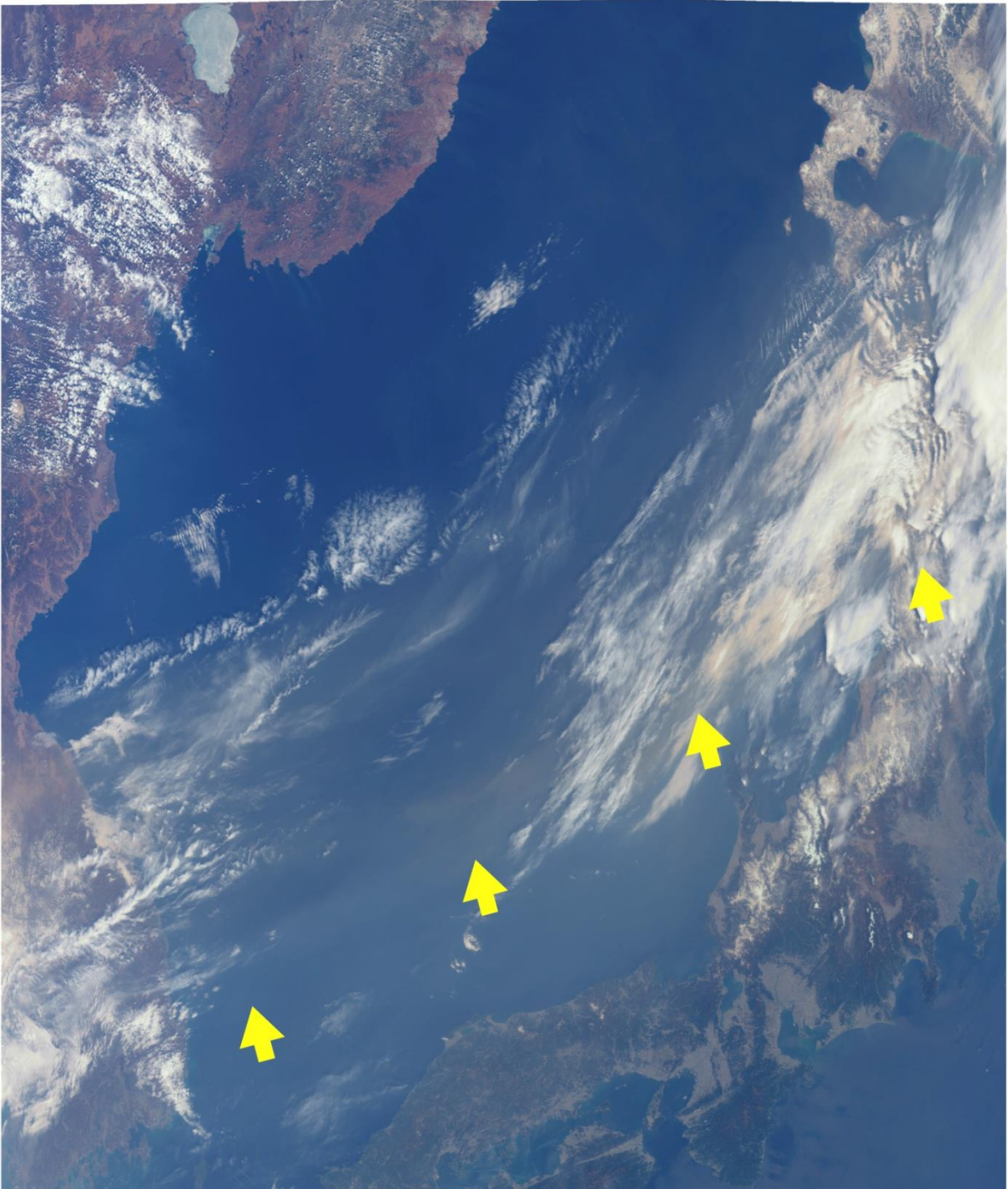


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# AMSR3

- AMSR-3 will be launched with GOSAT-3.
- Planned launch date is 2023.
- Resolution enhancement of C-band by super resolution is planned. Target is 20km.
- Possibility of addition of high frequency channels (150&190GHz) for solid precipitation and water vapor sounding
- Orbit is under discussion.
- AMSR3 MDR will be held on April or May.