

An introduction of GCOM-C1 and its Biomass product

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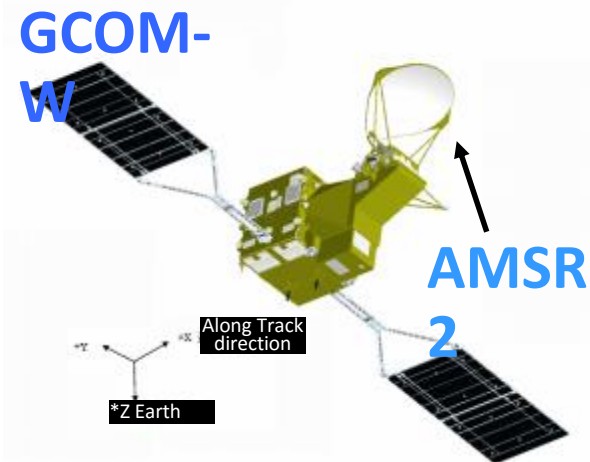
Japan Aerospace Exploration Agency (JAXA) has made a new plan of Global Change Observation Mission (GCOM) for monitoring of global environmental change.

GCOM

is follow-on satellite observation mission of ADEOS-II. will consist of two series of medium-sized satellites: GCOM-C (Climate) and GCOM-W (Water).



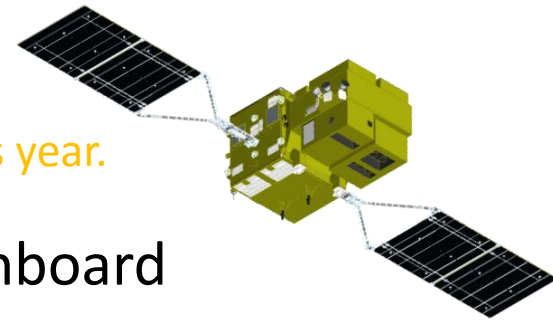
GCOM-C satellite will carry the instrument of SGLI (Second generation GLocal Imager).



GCOM-W satellite will carry the instrument of AMSR2 (Advanced Microwave Scanning Radiometer).

GCOM-C1 will be launched later this year.

◆ 2. Specification of GCOM-C1/SGLI

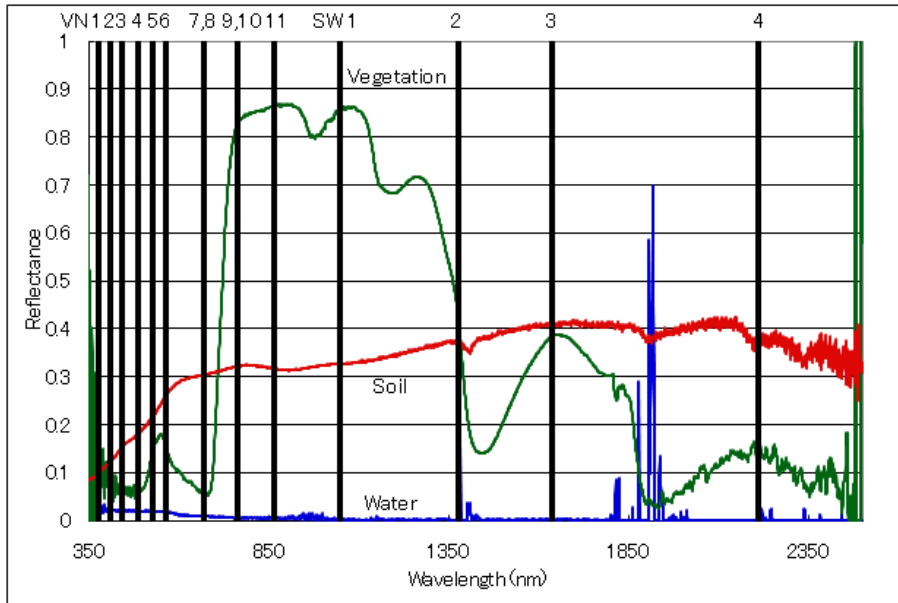


GCOM-C1 will be launched later this year.

GCOM-C1/SGLI

SGLI (Second generation GLocal Imager) is an onboard GCOM-C satellite, and provides GLI follow-on sensors.

◇ SGLI channel specifications



CH	λ	$\Delta\lambda$	L_{std}	L_{max}	SNR at L_{std}	IFOV
	VN, P, SW: nm T: μm		VN, P: W/m ² /sr/ μm T: Kelvin		VN, P, SW: - T: NE Δ T	m
VN1	380	10	60	210	250	250
VN2	412	10	75	250	400	250
VN3	443	10	64	400	300	250
VN4	490	10	53	120	400	250
VN5	530	20	41	350	250	250
VN6	565	20	33	90	400	250
VN7	670	10	23	62	400	250
VN8	670	20	25	210	250	250
VN9	763	8	40	350	400	1000
VN10	865	20	8	30	400	250
VN11	865	20	30	300	200	250
P1	670	20	25	250	250	1000
P2	865	20	30	300	250	1000
SW1	1050	20	57	248	500	1000
SW2	1380	20	9	103	150	1000
SW3	1630	200	3	50	57	250
SW4	2210	50	1.9	20	211(TBD)	1000
T1	10.8	0.7	300	340	0.2	500(opt. 250)
T2	12.0	0.7	300	340	0.2	500(opt. 250)

◆ 3. GCOM-C1/SGLI products

Common

Land
14
products

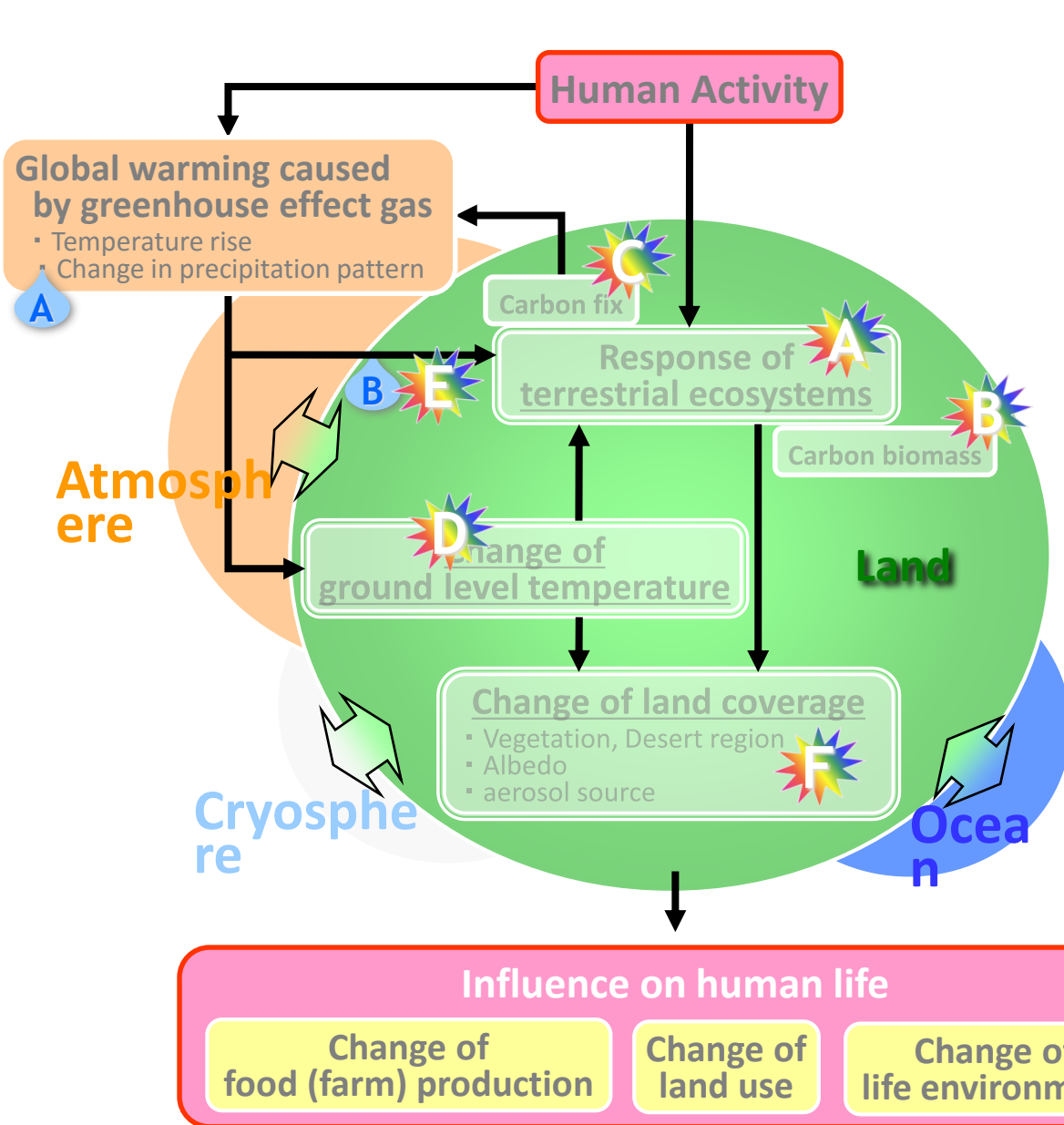
Atmosphere
10
products

Ocean
14
products

Cryosphere
12
products

Area	Group	Product	Category	Production unit	Grid size
Land	Radiance	TOA radiance (including system geometric correction)	Standard	Scene	VNR, SWI Land/coast: 250m, offshore: 1km, polarimetry: 1km TIR Land/coast: 500m, offshore: 1km
		Surface reflectance	Standard	Scene, Global (mosaic 1, 16 days, month)	250m
	Vegetation and carbon cycle	Precise geometric correction			
		Atmospheric corrected reflectance (incl. cloud detection)			
		Vegetation index			
		FAPAR			
		Leaf area index			
	Temperature	Above-ground biomass	Research	Global (month, year)	1km
		Vegetation roughness index			
		Shadow index			
	Application	Surface temperature	Research	Scene, Global (1, 16 days, month)	500m
		Land net primary production			
		Water stress trend			
		Fire detection index			
		Land cover type			
Atmosphere	Cloud	Land surface albedo	Standard	Global (month, season)	250m
		Cloud flag/Classification			
		Classified cloud fraction			
		Cloud top temp/height			
		Water cloud OT/effective radius			
	Aerosol	Ice cloud optical thickness	Research	Scene, Global (1, 16 days, month)	1km
		Water cloud geometrical thickness			
		Aerosol over the ocean			
	Radiation budget	Land aerosol by near UV	Standard	Global (1 day, month)	1km
		Aerosol by Polarization			
Ocean	Ocean color	Long-wave radiation flux	Research	Scene, Global (1 day, month)	1km (scene), 0.1deg (global)
		Normalized water-leaving radiance (incl. cloud detection)			
		Atmospheric correction parameter			
	In-water	Photosynthetically available radiation	Standard	Scene, Global (1, 8 days, month)	Coast: 250m Offshore: 1km Global: 4-9km
		Euphotic zone depth			
		Chlorophyll-a concentration			
		Suspended solid concentration			
		Colored dissolved organic matter			
	Temperature	Inherent optical properties	Research	Coast: 500m Others: Same as above	
		Sea-surface temperature			
	Application	Ocean net primary productivity	Research	Coast: 250m Others: Same as above	
		Phytoplankton functional type			
		Red tide			
		multi sensor merged ocean color			
Cryosphere	Area/ distribution	multi sensor merged SST	Standard	Scene, Global (1, 16 days, month)	250m (scene), 1km (global)
		Snow and ice covered area (incl. cloud detection)			
		Okhotsk sea-ice distribution			
		Snow and ice classification			
	Surface properties	Snow covered area in forests and mountains	Research	Global (16 days, month)	250m
		Snow grain size of shallow layer			
		Snow grain size of subsurface layer			
		Snow grain size of top layer			
		Snow and ice albedo			
	Surface properties	Snow impurity	Research	Scene, Global (1, 16 days, month)	250m (scene), 1km (global)
		Ice sheet surface roughness			
		Ice sheet boundary monitoring			
Boundary			Area (Season)	1km	

Land : In the future, how will the balance of carbon cycle and the food (plant) production become ?



Category

Standard Research

SGLI Land Products

Group	Product 14
Surface reflectance	Precise geometric correction
	Atmospheric corrected reflectance (incl. cloud detection)
Vegetation and carbon cycle	Vegetation index
	fAPAR
	Leaf area index
	Above-ground biomass
	Vegetation roughness index
Temperature	Shadow index
	Surface temperature
Application	Land net primary production
	Water stress trend
	Fire detection index
	Land cover type
	Land surface albedo

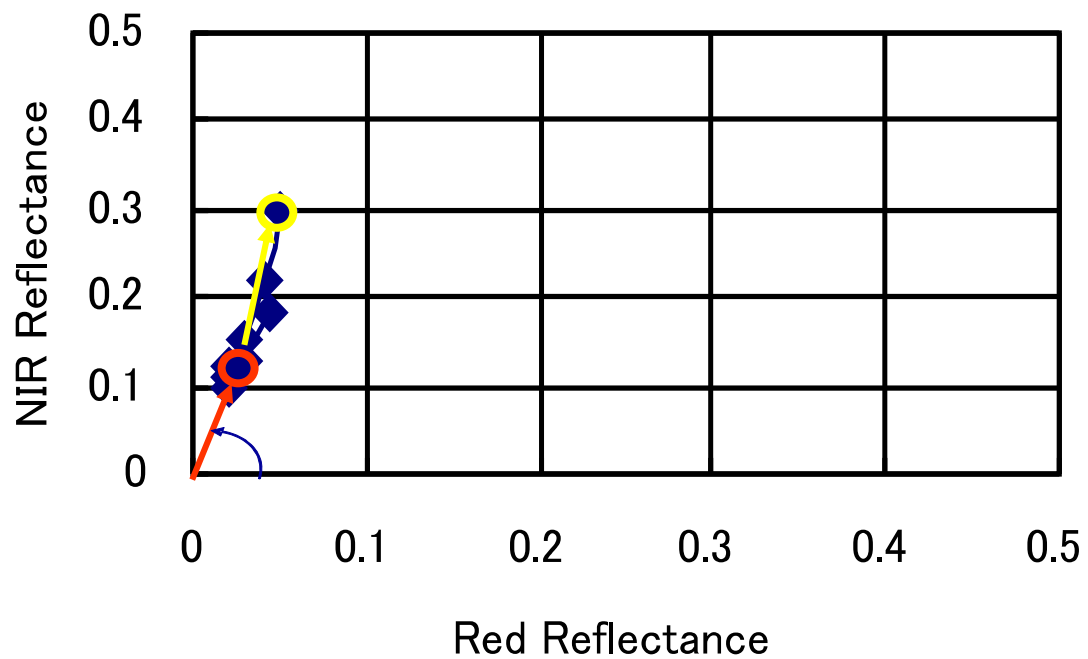
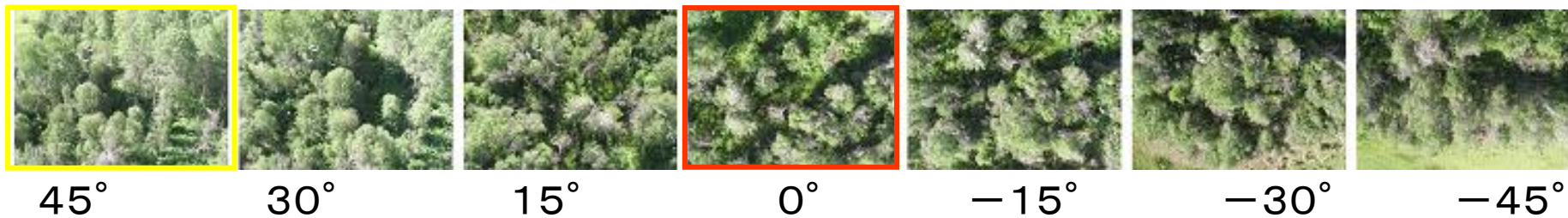
AMSR-2 Products

A	Precipitation
B	Soil Moisture

MOLI will help SGLI Land Products

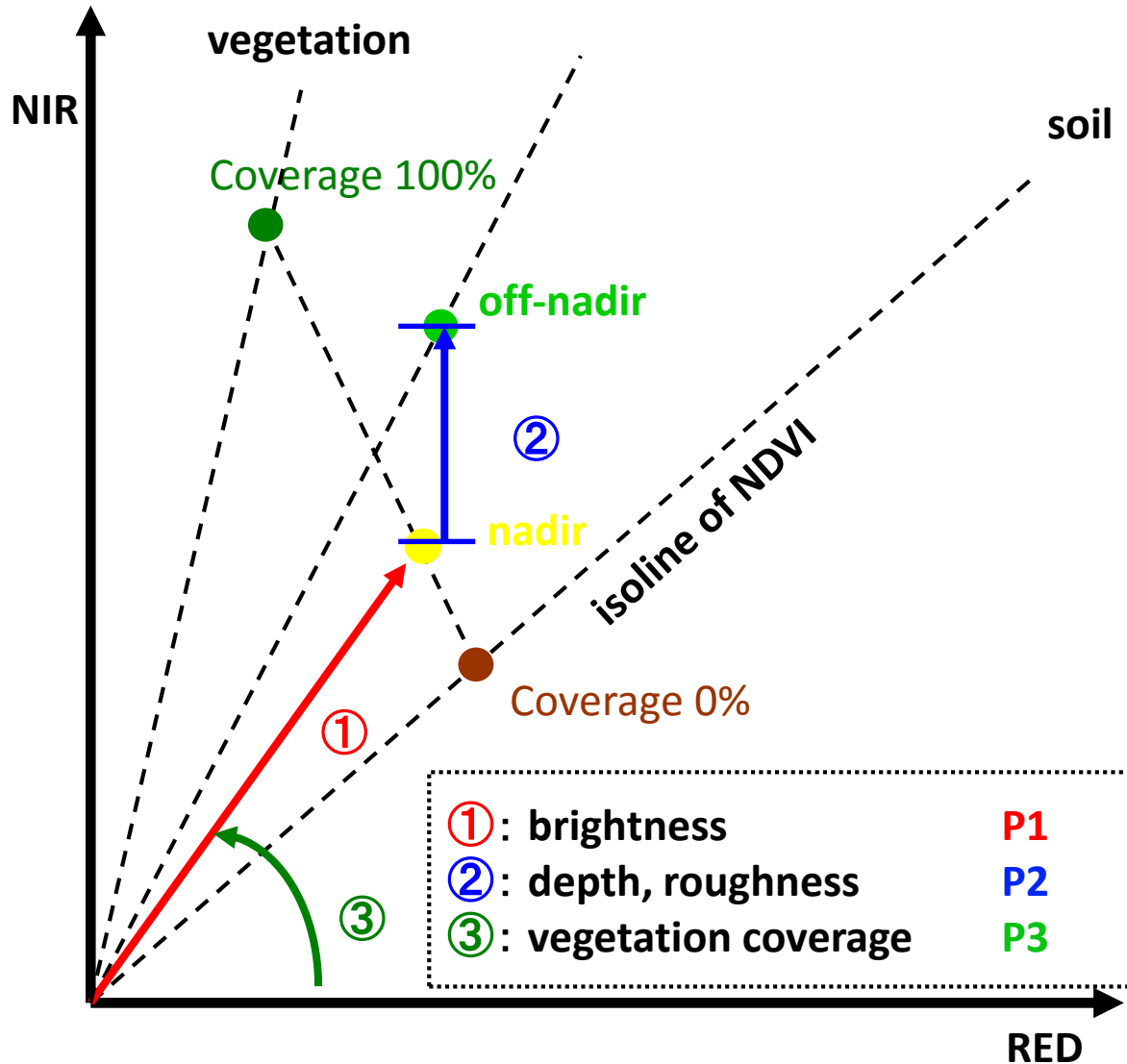
- Useful auxiliary information for the following SGLI products from MOLI
 - **Above-ground biomass**
 - as an Initial condition
 - Vegetation roughness index
 - as Validation
 - Land cover
 - as Validation

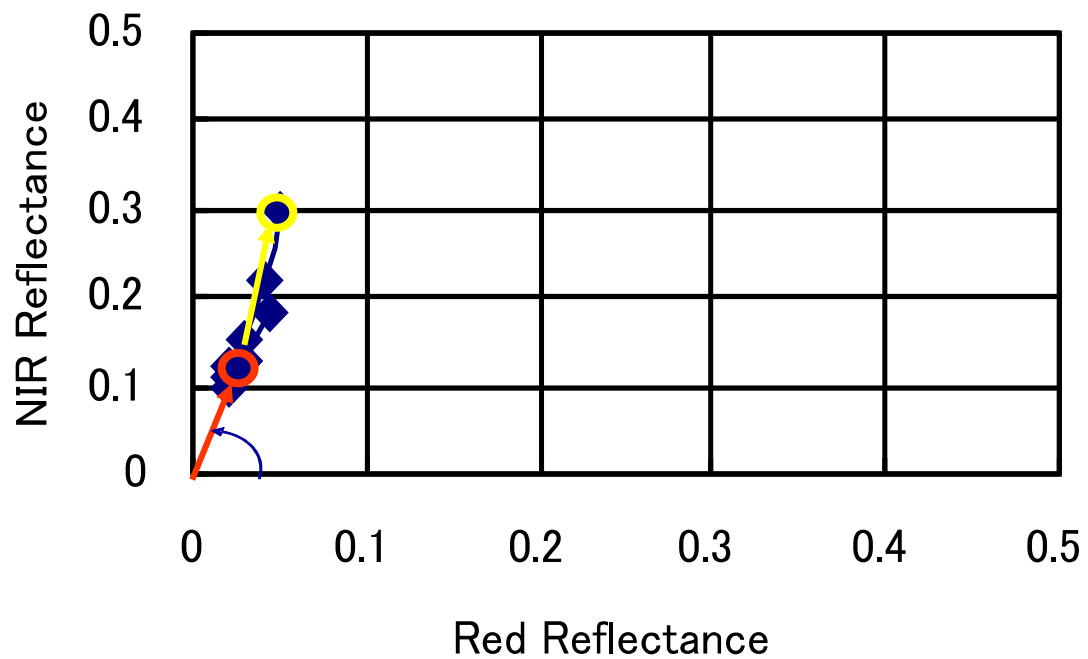
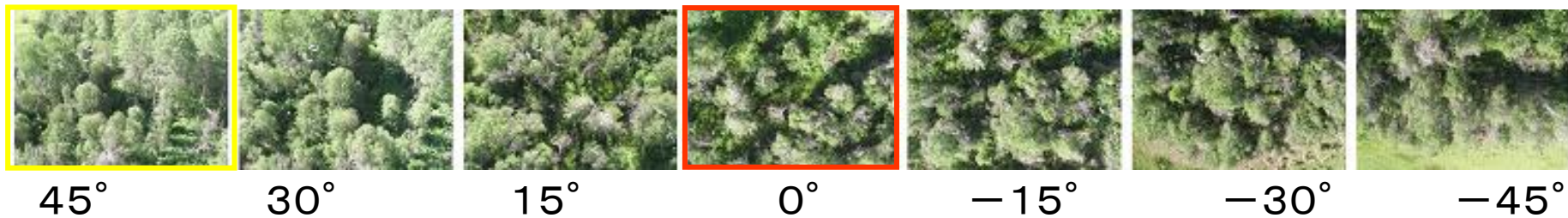
Algorithm development of Above Ground Biomass product



Red-NIR Plot of Broadleaf Forest

Reflectance Shift in RED-NIR plane





Red-NIR Plot of Broadleaf Forest

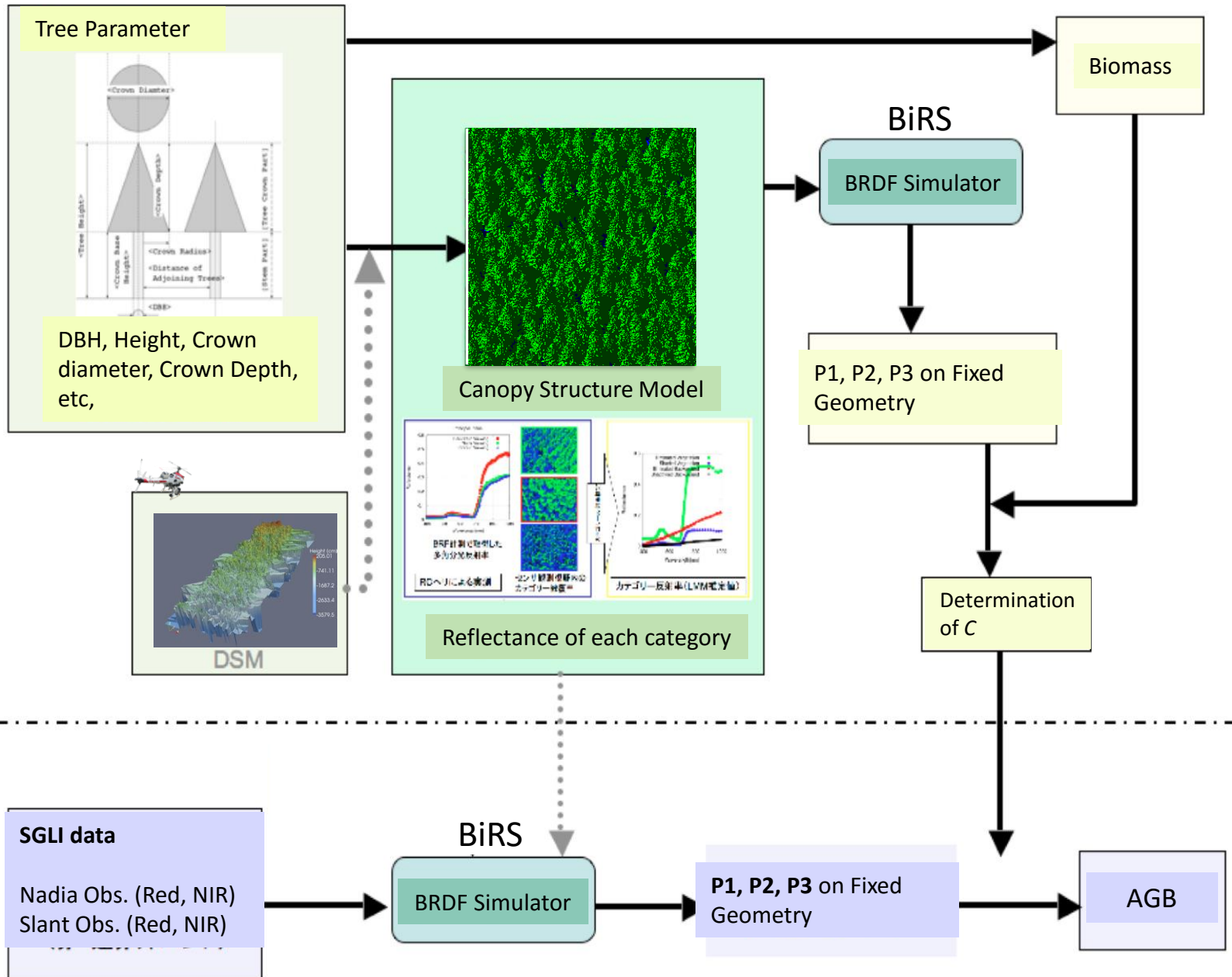
Biomass Estimation using P1,P2,P3

$$\text{Biomass} = C \times \left(\frac{P2}{P1} + 1 \right)^3 \times P3$$

Forest Type Dependent Coefficient	Volume related term	Vegetation Coverage
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- P1, P2, P3 should be used fixed geometry (normalized geometry).
- To obtain the P1, P2, P3 at fixed geometry, satellite observed reflectance has to simulate with BRDF model.

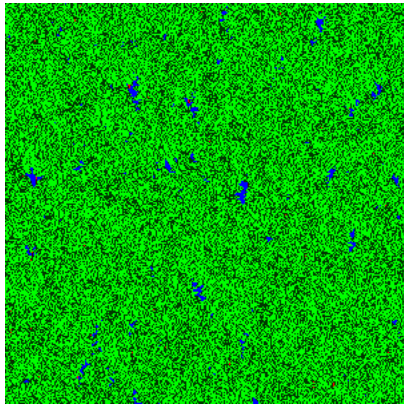
Schematic diagram for AGB estimation



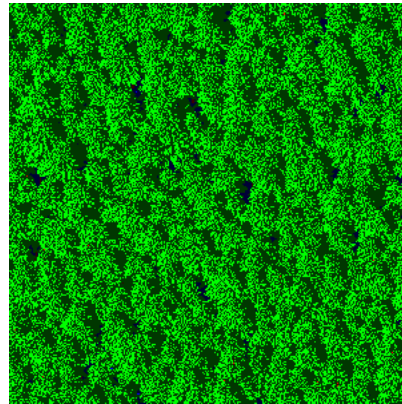
BRDF simulator output category images

Mean Adjacent Tree Distance = 3.87m, Mean Tree Height = 10m, Crown Depth = 5.0m

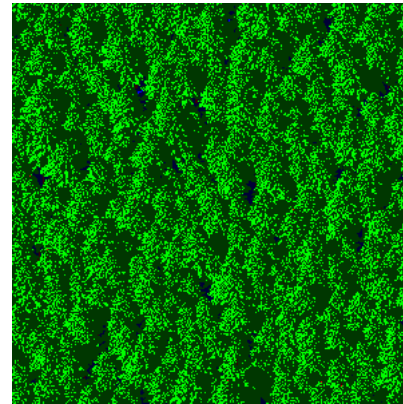
SOZ= 40deg, SEZ = 40deg



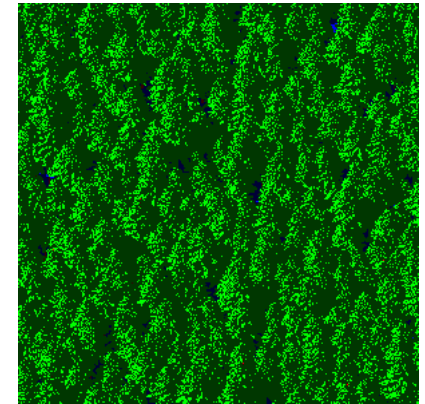
REA = 0



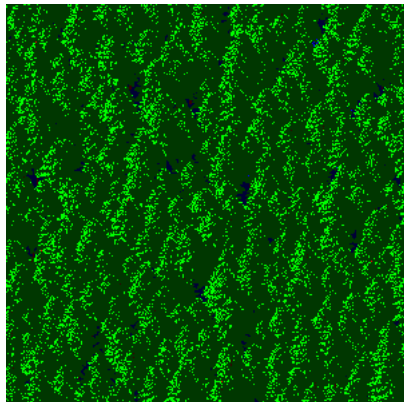
REA = 30



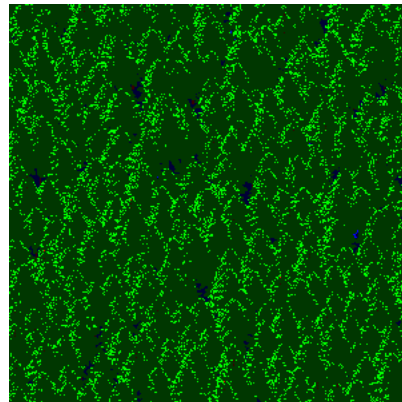
REA = 60



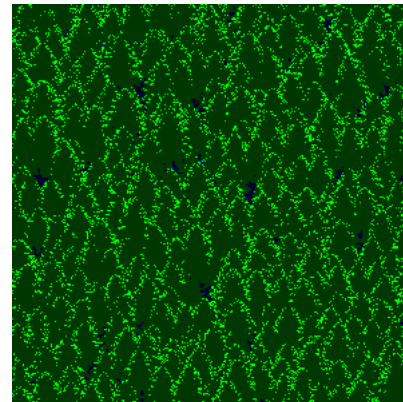
REA = 90



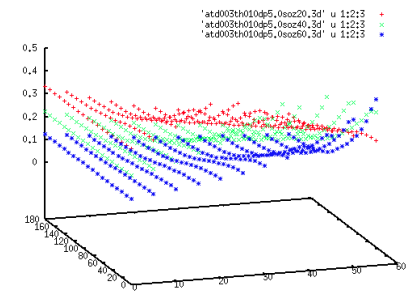
REA = 120



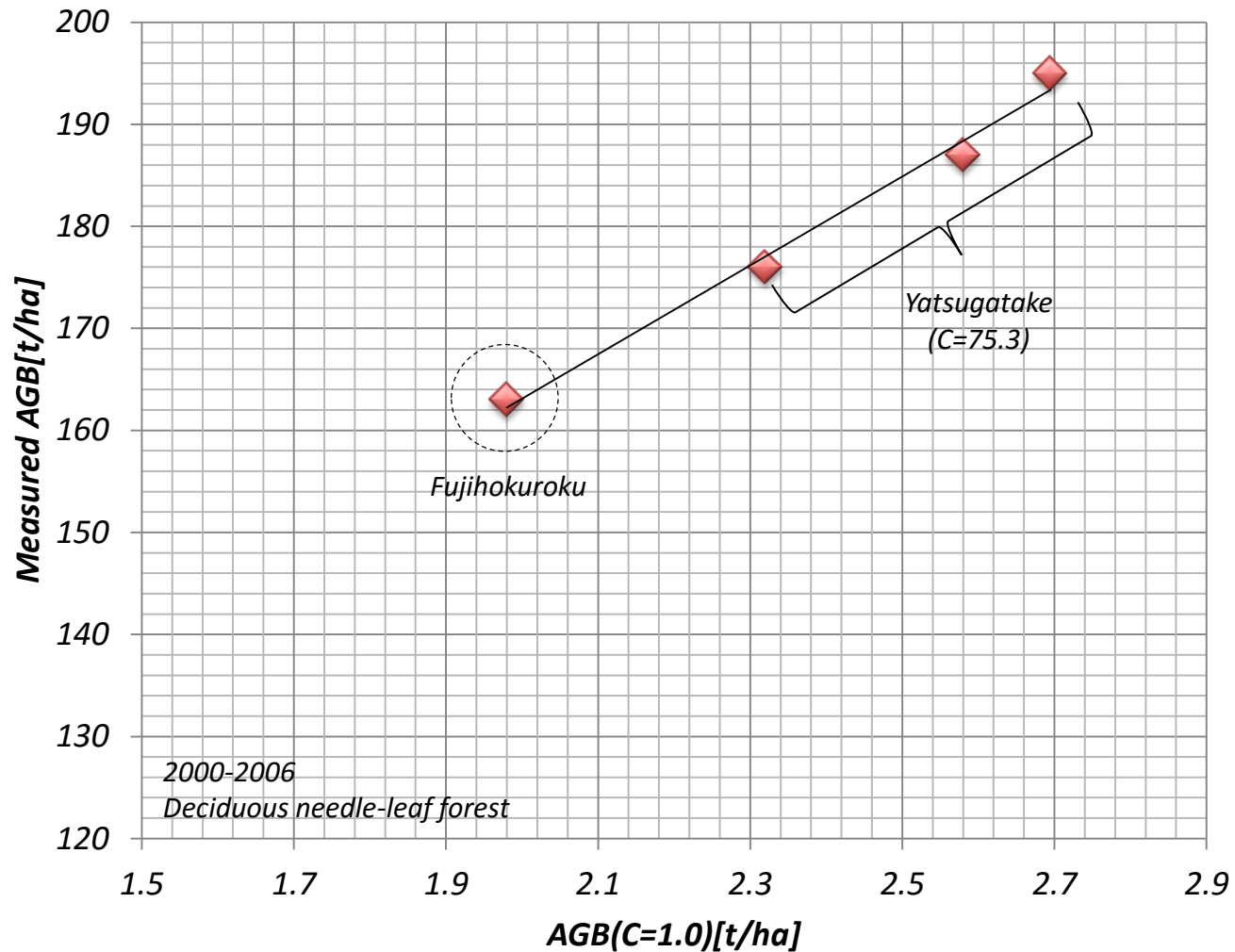
REA = 150



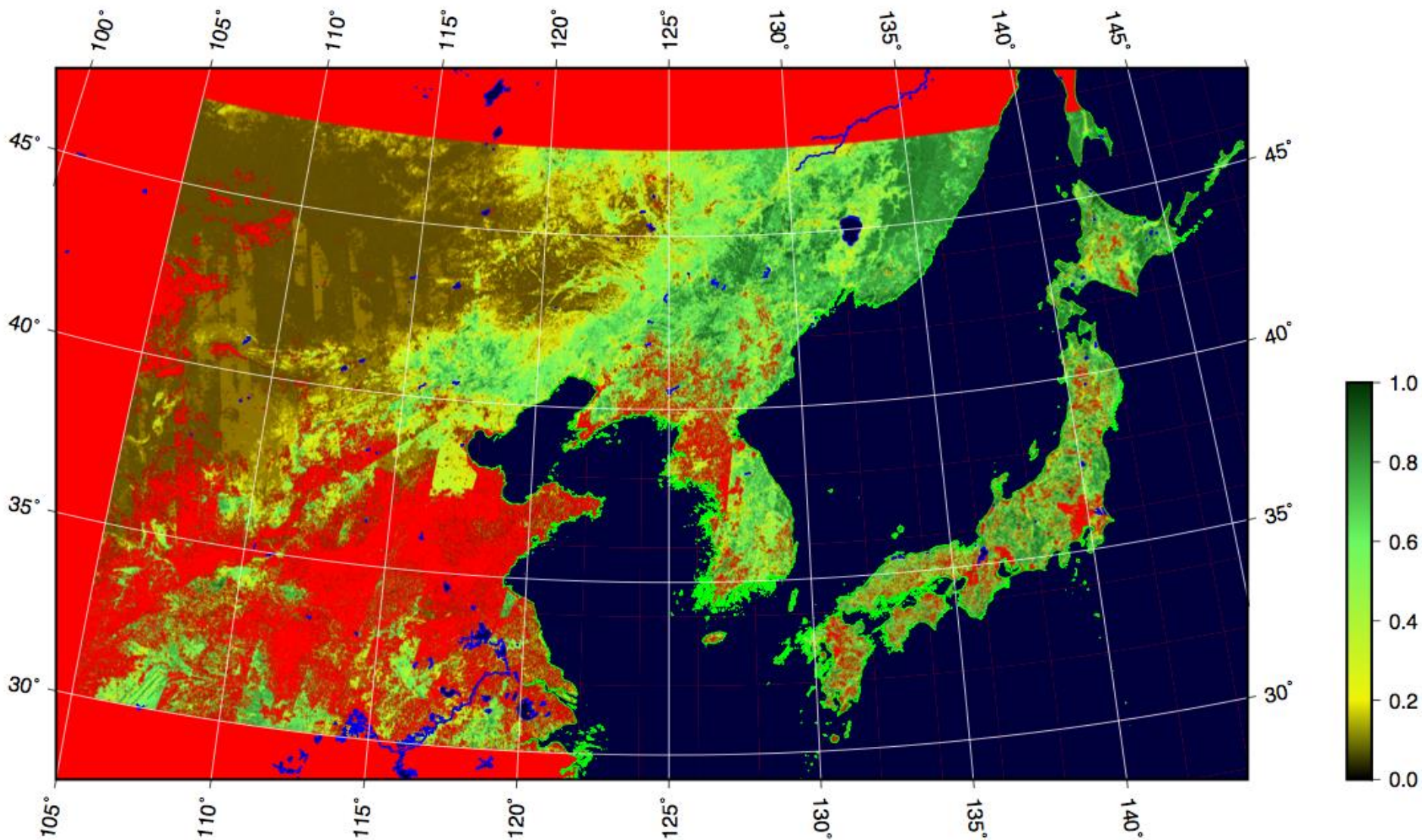
REA = 180



Algorithm Validation using in-situ measurement data



Processing result for 2010 summer on East Asia (AGB)



Red color indicates invalid STSG/reflectance combination found or nadir NDVI < 0 pixel

Used data: MOD09GA(Terra), MYD09GA(Aqua) 7/1 to 9/30 (92 days maximum composite)

8 tiles: h25v04, h26v04, h26v05, h27v04, h27v05, h28v04, h28v05, h29v05

MOLI will help SGLI Land Products

- Useful auxiliary information for the following SGLI products from MOLI
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 - as an Initial condition ← Determination of C
 - Vegetation roughness index
 - as Validation
 - Land cover
 - as Validation