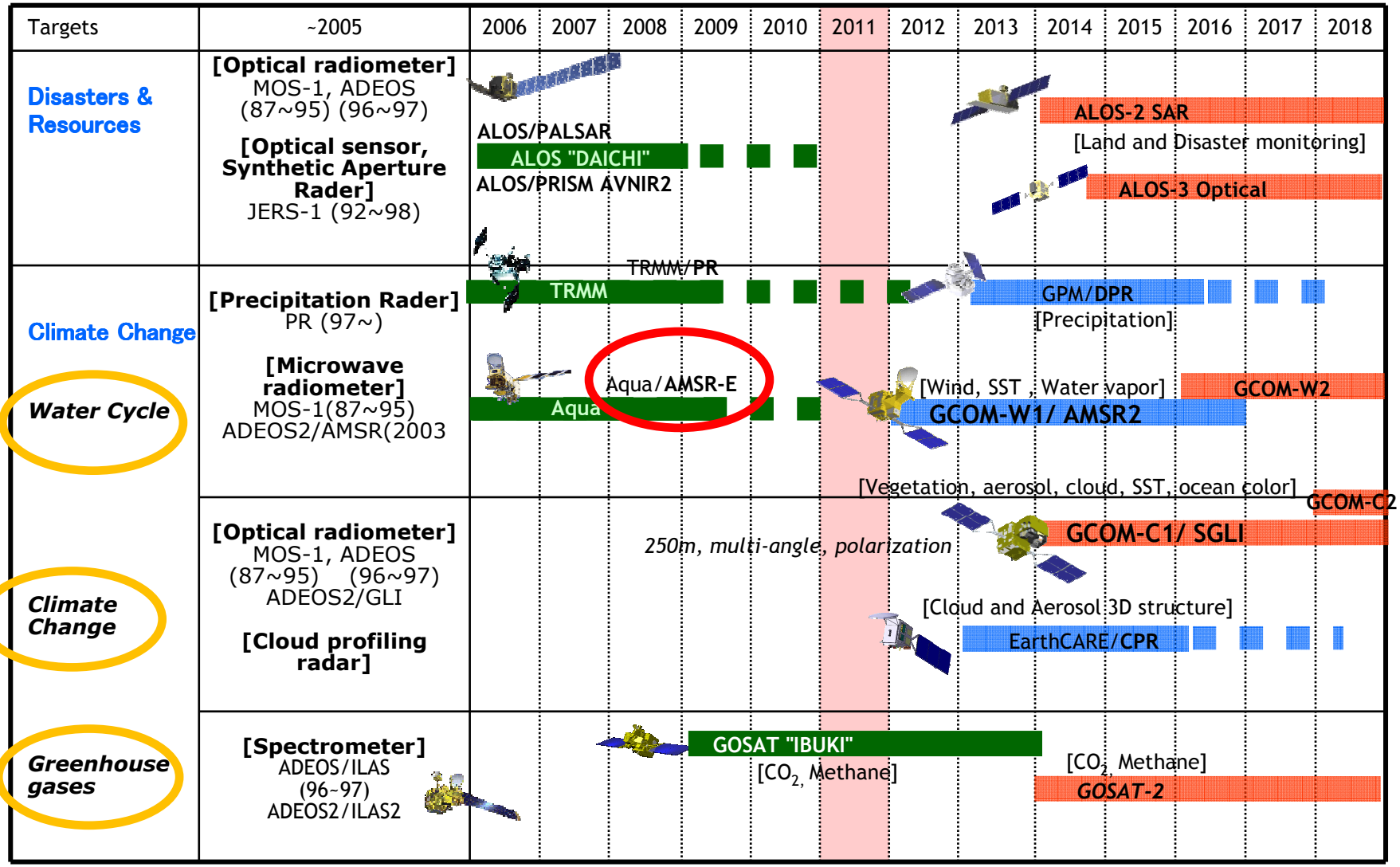
JAXA's contribution to AWCI

Toru Fukuda, Director
JAXA/EORC

06-09 October 2011, Seoul, South Korea
8th Asian Water Cycle Initiative, International Coordination Group Meeting

Long-Term Plan of Earth Observation by JAXA



AMSR-E observation completion

- At 3:58 p.m. on October 4, 2011 (Japan Standard Time,) the AMSR-E reached its limit(*1) to maintain the rotation speed necessary for regular observations (40 rotations per minute), and the radiometer automatically halted its observations and rotation.
- The AMSR-E is a microwave scanning radiometer with the world's highest performance. It can observe global-scale water, including ocean ice, surface temperatures, vapors, precipitation and soil water, regardless of weather conditions or if it is day or night by measuring faint radio waves emitted from the Earth.

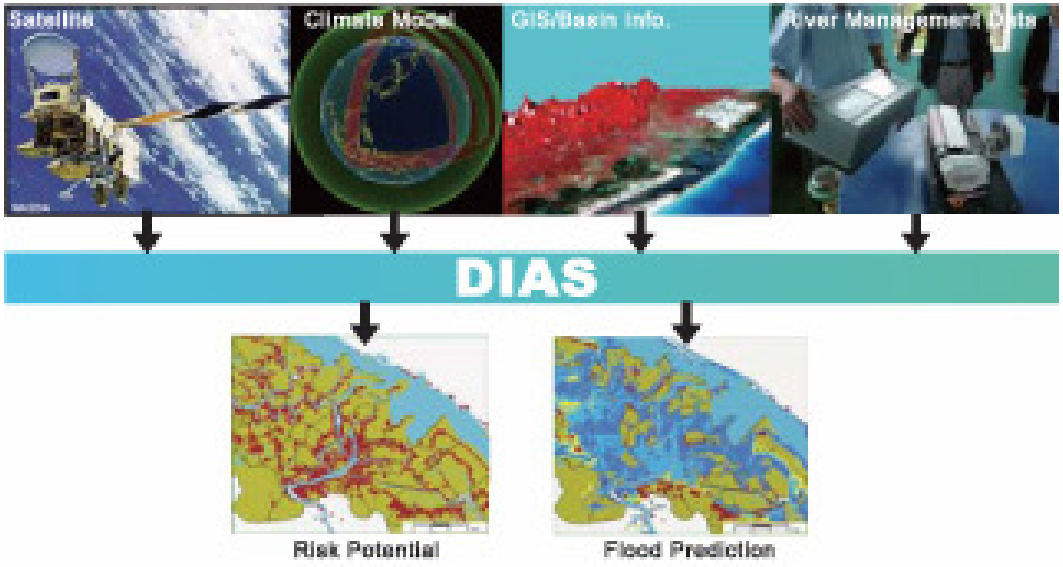
CONTRIBUTION TO AWCI THROUGH CEOP AND DIAS

Data Provision to DIAS and CEOP

- The **Coordinated Energy and water cycle Observations Project (CEOP)** is now the international focal point for **WCRP/GEWEX** Global Hydroclimatological Research.

- **Data Integration and Analysis System (DIAS)** was launched in 2006 to integrate data from earth observation satellites and in-situ networks with other types of data.

- JAXA is providing satellite datasets to DIAS to contribute to CEOP activities, which is to be a main science user group of DIAS.



JAXA Satellite Datasets on DIAS

http://www.editoria.u-tokyo.ac.jp/dias/link/portal/english_index.html

Three Scales

- 250km rectangular covering each Reference Sites,
- Monsoon Regional
- Global Area

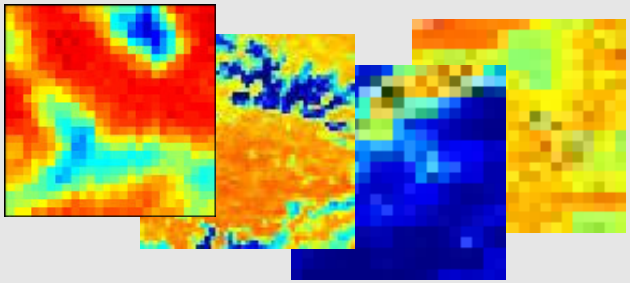
Product Levels

- **Level-1b**: Radiance product with full resolution at reference sites.
- **Level-2**: Geophysical product at the same resolution at reference sites and monsoon regions.
- **Level-3**: Statistical geophysical product in space and/or time at reference sites, monsoon regions and global. (example: Monthly mean rain rate at reference sites, etc.)

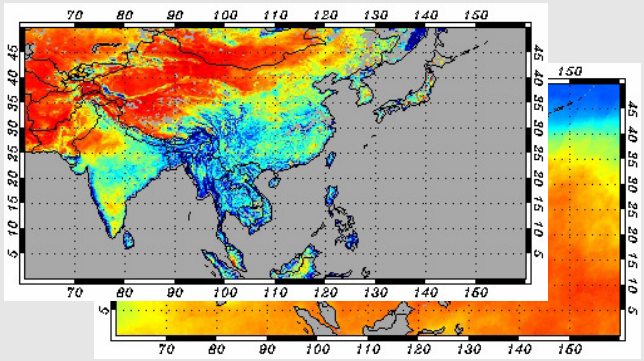
Metadata

- Consist of an image element and a metadata part element that is compliant with the ISO-19115 metadata standard.

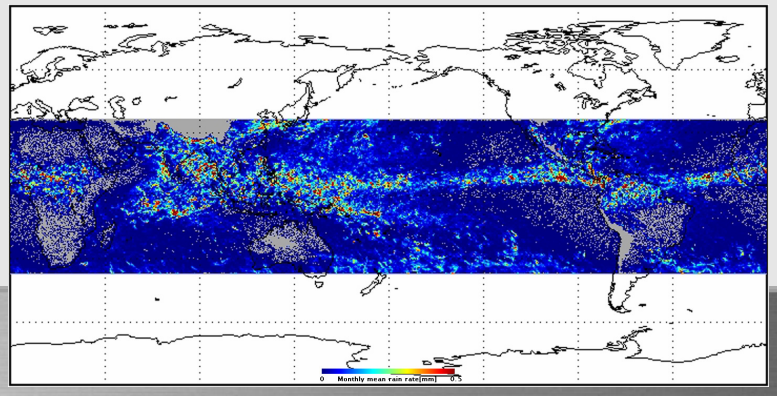
Reference Sites



Monsoon Regional

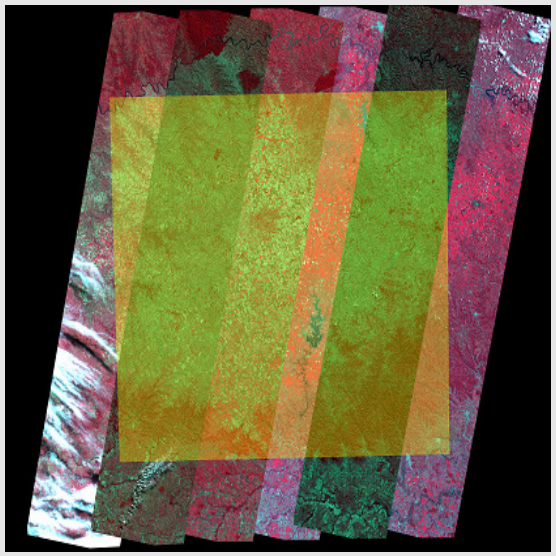


Global Area



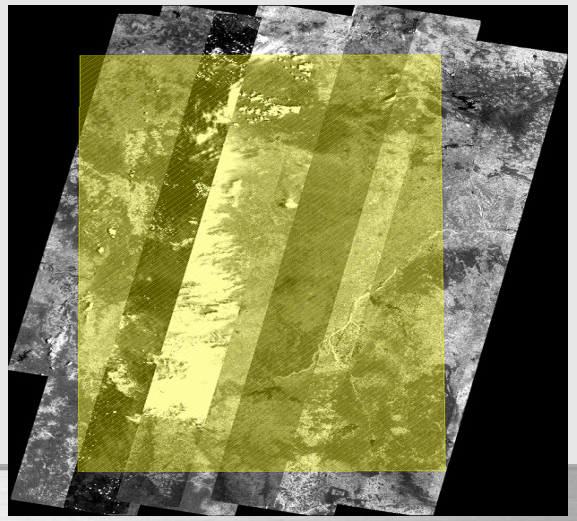
Daichi (ALOS) Path-Mosaics for CEOP

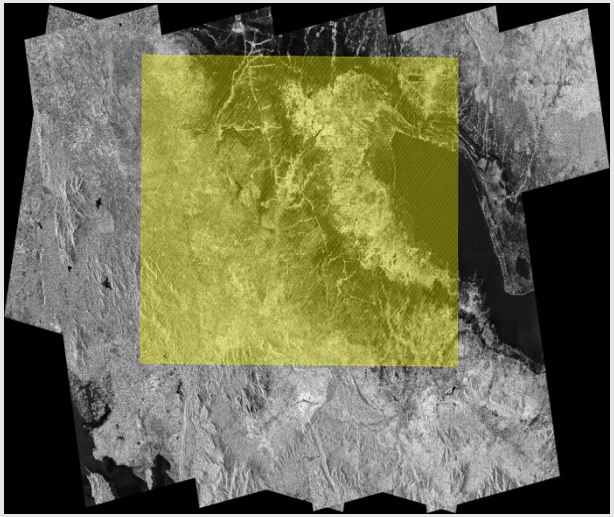
- Produced with Level 1 products of three sensors: PRISM, AVNIR-2 and PALSAR
- Associate with CEOP Reference Sites and AWCI River Basins
- Path-mosaiced instead of subsets because of the original small scene size and the large data volumes



Cruz Alta, Brazil
AVNIR-2 R:G:B=4:3:2band
6 paths of mosaic images

Seonath-river, India
PRISM
10 paths of Mosaic images





Sangker, Cambodia
PALSAR FBD(HH)
8 paths of mosaic images

Number of Processed Scenes for CEOP

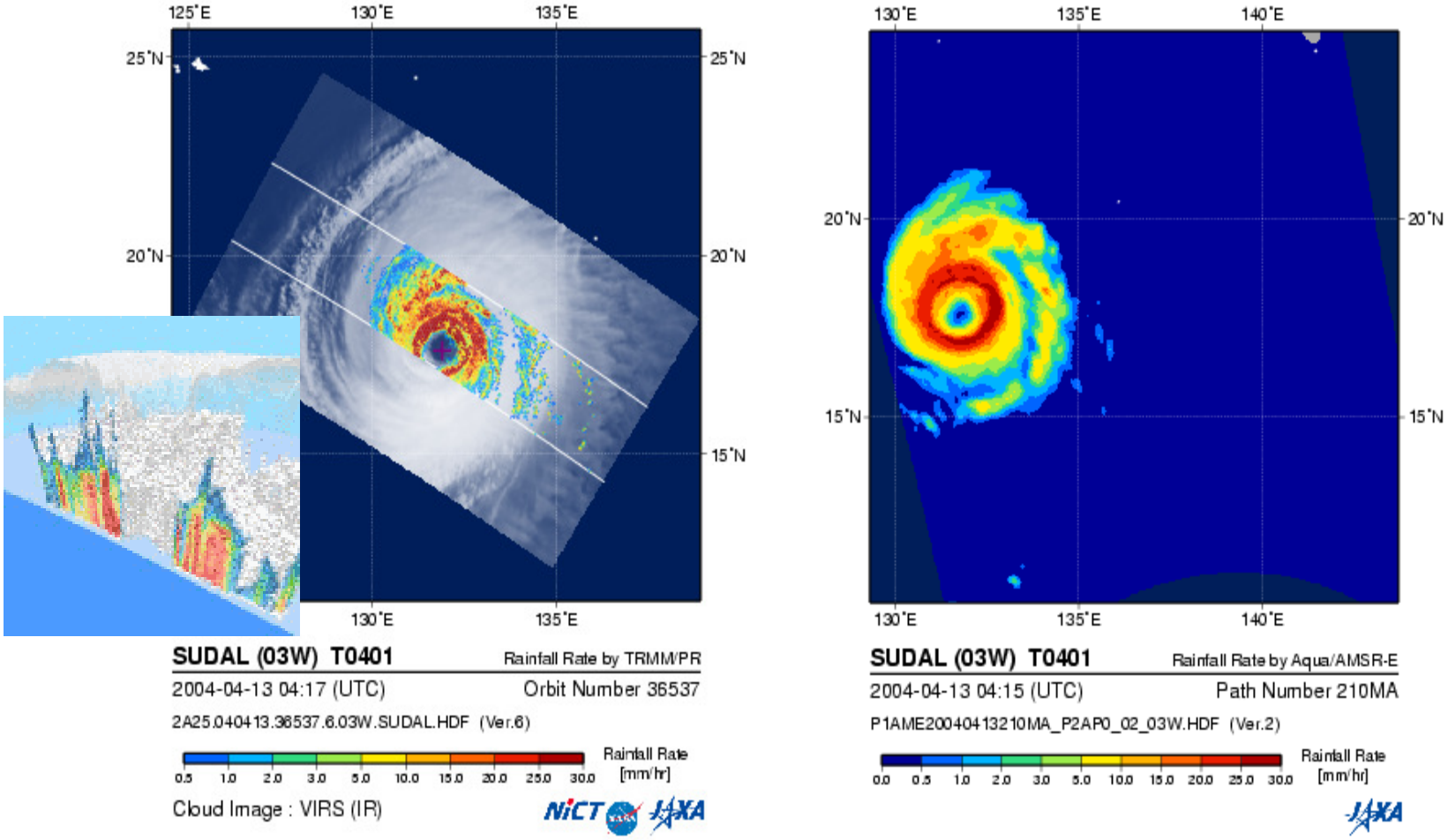
S/C	Sensor	EOP-3※1	EOP-4※2	2007	2008	2009	2010	Total
DMSP	SSMI	53,780	66,885	76,303	65,492	45,000	26,371	333,831
Midori-II (ADEOS-II)	AMSR	103,590	-	-	-	-	-	103,590
	GLI	114,550	-	-	-	-	-	114,550
TRMM	PR	22,291	27,851	18,685	23,478	22,066	23,316	137,687
	TMI	49,793	62,385	49,503	58,575	58,414	58,452	337,122
Aqua	AMSR-E	230,607	282,784	172,348	232,592	231,956	232,618	1,382,905
	MODIS	-	792,880	-	-	-	-	792,880
	AIRS	72,972	88,240	-	-	-	-	161,212
Daichi (ALOS)	PRISM	-	-	504	1410	1,636	1,454	5,004
	AVNIR-2	-	-	276	644	442	522	1,884
	PALSAR	-	-	698	1,437	1,120	1,082	4,337
Terra	MODIS	614,407	791,403	-	-	-	-	1,405,810

※1 EOP-3: 2002/10/1 - 2003/9/30
※2 EOP-4: 2003/10/1 - 2004/12/31

Total 4,780,812

Global Rainfall Map

Precipitation Radar and Microwave Radiometer



Typhoon “SUDAL”, April 13th 2004 (UTC)

Precipitation Distribution

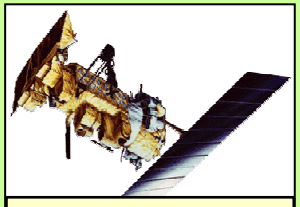
TRMM/PR and VIRS (Left), Aqua/AMSR-E (Right)

Satellite Combined Product
Global Precipitation Map


TRMM
TMI


Aqua
AMSR-E


DMSP
SSM/I, SSMIS


NOAA
AMSU

Precipitaton Physical Model from Radar Observation

Precipitation data estimated by each Microwave Imager/sounder

Combining multiple data retrivals for hourly Precipitation Map


Geostational Meteorological Satellite

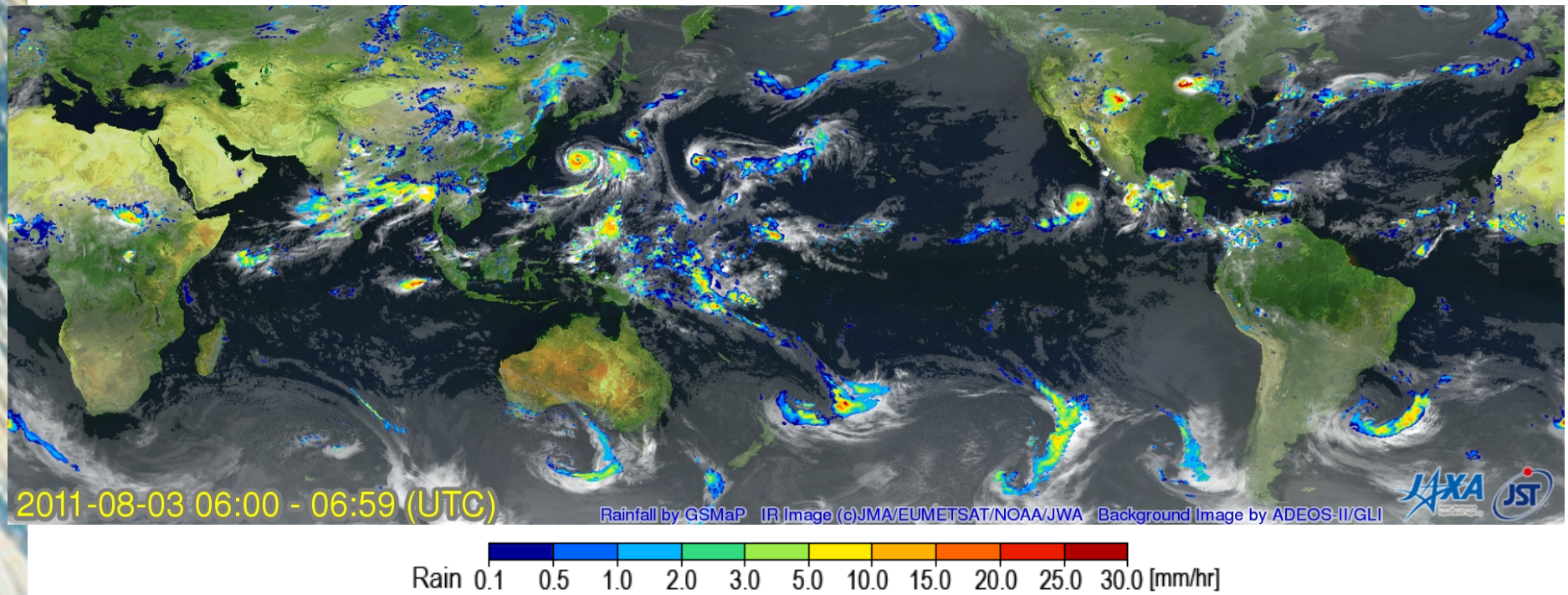
Cloud Moving Vector

Global Precipitation Map

Hourly 0.1 degree grid

JAXA/ EORC Global Rainfall Watch
GSMaP (Global Satellite Mapping for Precipitation)

Typhoon “MUIFA” 2011/08/03 06Z



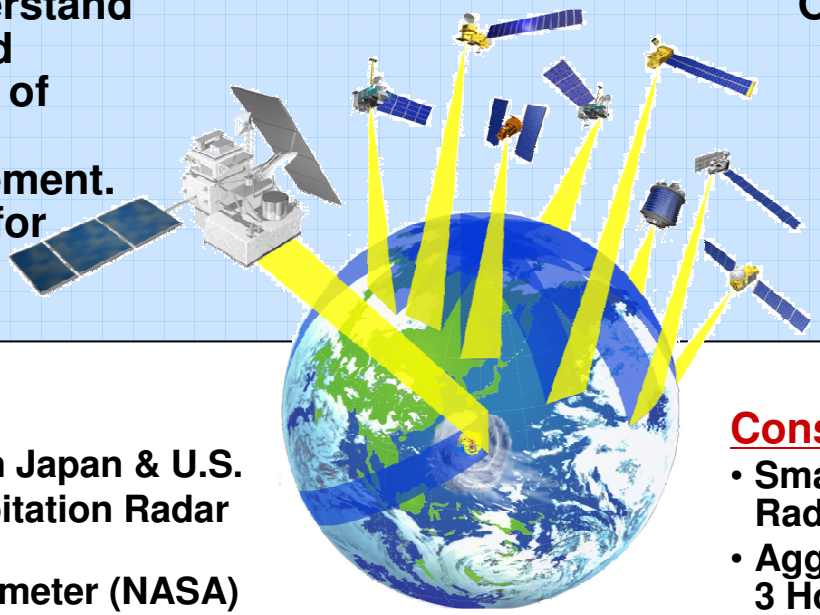
- Hourly mean, 0.1 degree grid, available on-line 4hours after observation
- Browse image, Google Earth(KMZ), 24hours movie are available
- Binary data for research use
- Application testbeds for Flood forecast, weather service, crop yeild forecast

Global Rainfall Map in near-real-time -- http://sharaku.eorc.jaxa.jp/GSMaP/

FUTURE EARTH OBSERVATION PROGRAMS

Global Precipitation Measurement (GPM)

OBJECTIVE: Understand the Horizontal and Vertical Structure of Rainfall and Its Microphysical Element. Provide Training for Constellation Radiometers.



OBJECTIVE: Provide Enough Sampling to Reduce Uncertainty in Short-term Rainfall Accumulations. Extend Scientific and Societal Applications.

Core Satellite

- Joint mission between Japan & U.S.
- Dual-frequency Precipitation Radar (JAXA and NICT)
- Multi-frequency Radiometer (NASA)
- July 2013, H2-A Launch
- Non-Sun Synchronous Orbit
- ~65° Inclination
- ~407 km Altitude

Constellation Satellites

- Small Satellites with Microwave Radiometers
- Aggregate Revisit Time, 3 Hour goal
- Sun-Synchronous/Non-sun-synchronous orbit
- 500~900 km Altitude
- International Partners; NOAA, NASA, JAXA, CNES/ISRO, etc.

Precipitation Validation Sites

- Global Ground Based Rain Measurement

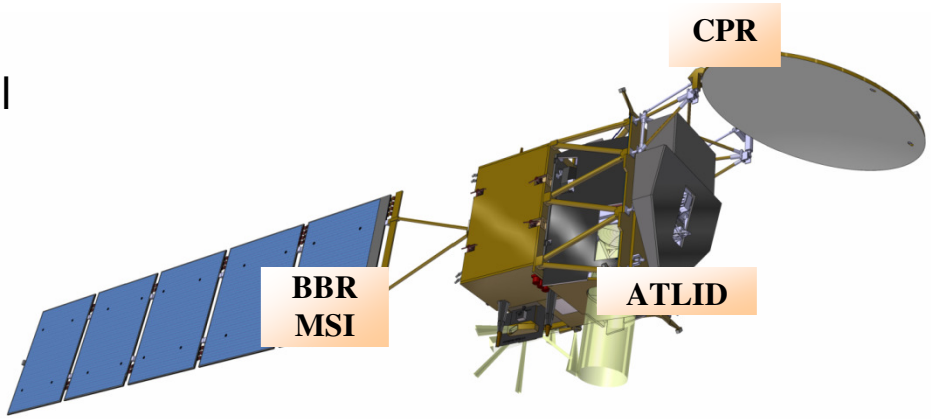
Global Precipitation Processing Centers

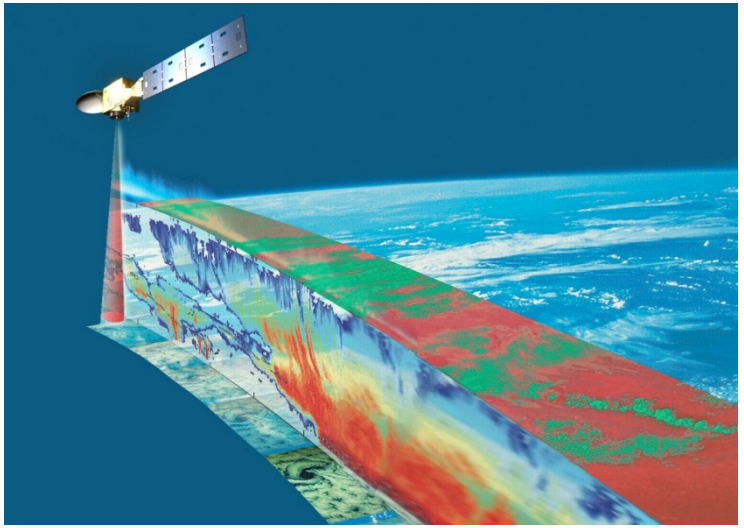
- Capable of Producing Global Precipitation Data Products as Defined by GPM Partners

EarthCARE/CPR

Climate monitoring of earth radiation, cloud and aerosol
Cooperation between ESA and Japan (JAXA/NICT)

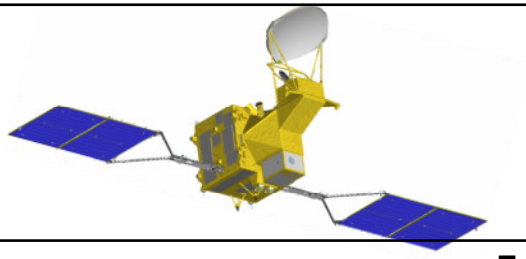
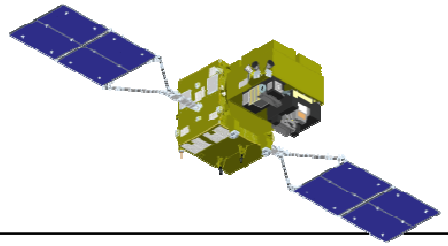
- **Mission**
  - Vertical profile of clouds, aerosol
  - Interaction between clouds and aerosol
  - Cloud stability and precipitation
- **Orbit**
  - Sun synchronous
  - Equator crossing time 13:45
  - Altitude 400km
- **Instrument**
  - CPR (Cloud Profile Radar)
  - ATLID (Atmospheric LIDAR)
  - MSI (Multi-Spectral Imager)
  - BBR (Broad Band Radiometer)
- **Task sharing**
  - JAXA/NICT（CPR）
  - ESA（LIDAR, MSI, BBR, Spacecraft)
- **Launch target**
  - JFY2013





Concept of the Global Change Observation Mission (GCOM)

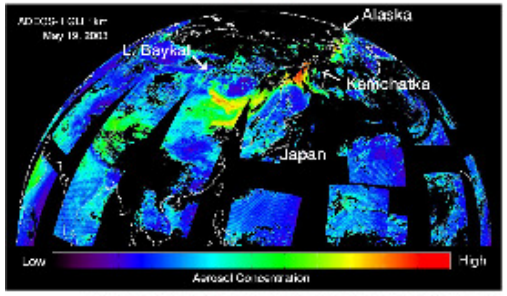
- GCOM aims to construct, use, and verify systems that enable continuous global-scale observations of effective geophysical parameters for elucidating global climate change and water circulation mechanisms.
- GCOM will consist of 2 satellite series (GCOM-W and C) spanning 3 generations in order to perform uniform and stable global observations for 13 years.

	GCOM-W	GCOM-C
Orbit	**Type : Sun-synchronous, sub-recurrent Altitude : Approx. 700 km Inclination : 98.19 degrees Local time of ascending node : 13:30 (Join in the "A-Train")**	**Type : Sun-synchronous, sub-recurrent Altitude : Approx. 800 km Inclination : 98.6 degrees Local time of descending node : 10:30**
Satellite overview		
Mission life	**5 years**	
Launch vehicle	**H2A launch vehicle**	
Instrument	**Advanced Microwave Scanning Radiometer 2 (AMSR2)**	**Second Generation Global Imager (SGLI)**
Launch (target)	**Japanese Fiscal Year (JFY) 2011**	**JFY 2014 (TBD)**

GCOM Observation Parameters

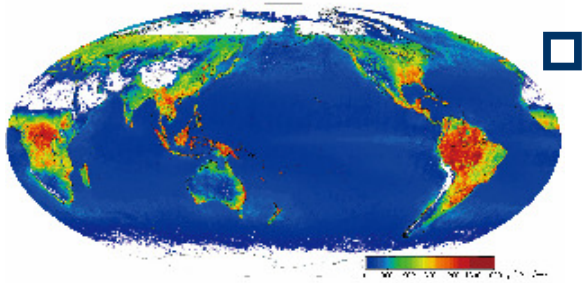
GCOM - Climate (GCOM-C)

Aerosol properties



A first land and ocean aerosol distribution with ADEOS-II/GLI near-ultraviolet 1 km resolution band

Primary production

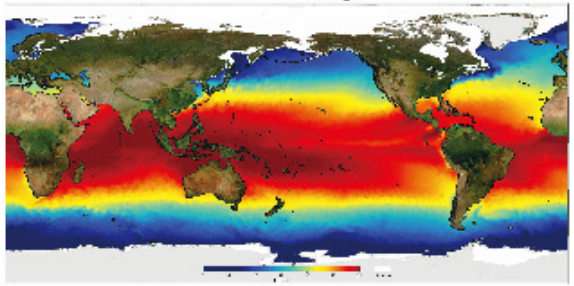


Global primary production derived from ADEOS-II/GLI in 2003

- Climate change observation will be performed by the SGLI on the GCOM-C satellite.
- GCOM-C sensors will observe clouds, aerosol, ocean color (marine organisms), vegetation, snow and ice.

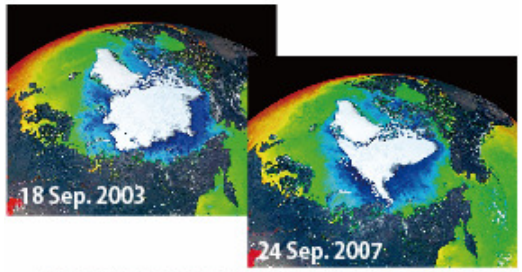
GCOM - Water (GCOM-W)

Sea surface temperature



Global sea surface temperature derived from Aqua/AMSR-E in March 2009

Sea-ice concentration



Sea ice: Sea ice concentration derived from Aqua/AMSR-E
Ocean: Clear-sky brightness temp. derived from Terra/MODIS
Land: Clear-sky reflectance derived from Terra/MODIS

- Water cycle variation will be observed by the AMSR2 on the GCOM-W satellite.
- GCOM-W will observe precipitation, water vapor, sea surface wind speed, sea water temperature, soil moisture, snow depth and etc…

ALOS to ALOS-2 and ALOS-3

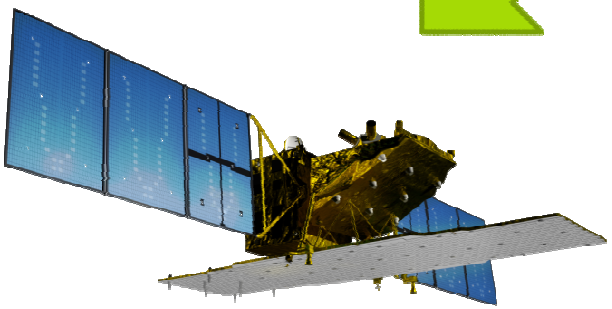
ALOS Jan. 2006-May 2011

Weight : 4 t

PALSAR

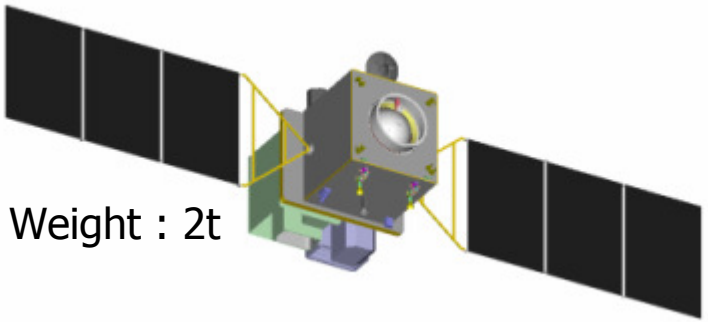
PRISM

AVNIR-2



Weight : 2t

ALOS-2 (SAR satellite)
Launch in 2013



Weight : 2t

ALOS-3 (Optical satellite)
Launch in 2015

Summary

- JAXA has been contributing to AWCI by providing dedicated satellite datasets through CEOP and DIAS.
  - Archived datasets are available via DIAS.
- Forthcoming satellite missions dedicated and/or contribute to monitor the global hydrological cycles are ahead.
  - GCOM-W1 will be launched in JFY 2011.
  - GPM/DPR, EarthCARE/CPR will be launched in JFY 2013.
  - ALOS-2 will be launced in JFY 2013.
  - GCOM-C1 will be launched in or later than JFY2014.
  - ALOS-3 will be launced in or later than JFY 2015.
- Further efforts are needed to avoid or minimize data gaps.