Monitoring of the Water Cycle and Climate Variation by the Earth Observation Satellites

Misako KACHI
Manager for GCOM-W Research/GPM Applications
Earth Observation Research Center (EORC)
Japan Aerospace Exploration Agency (JAXA)

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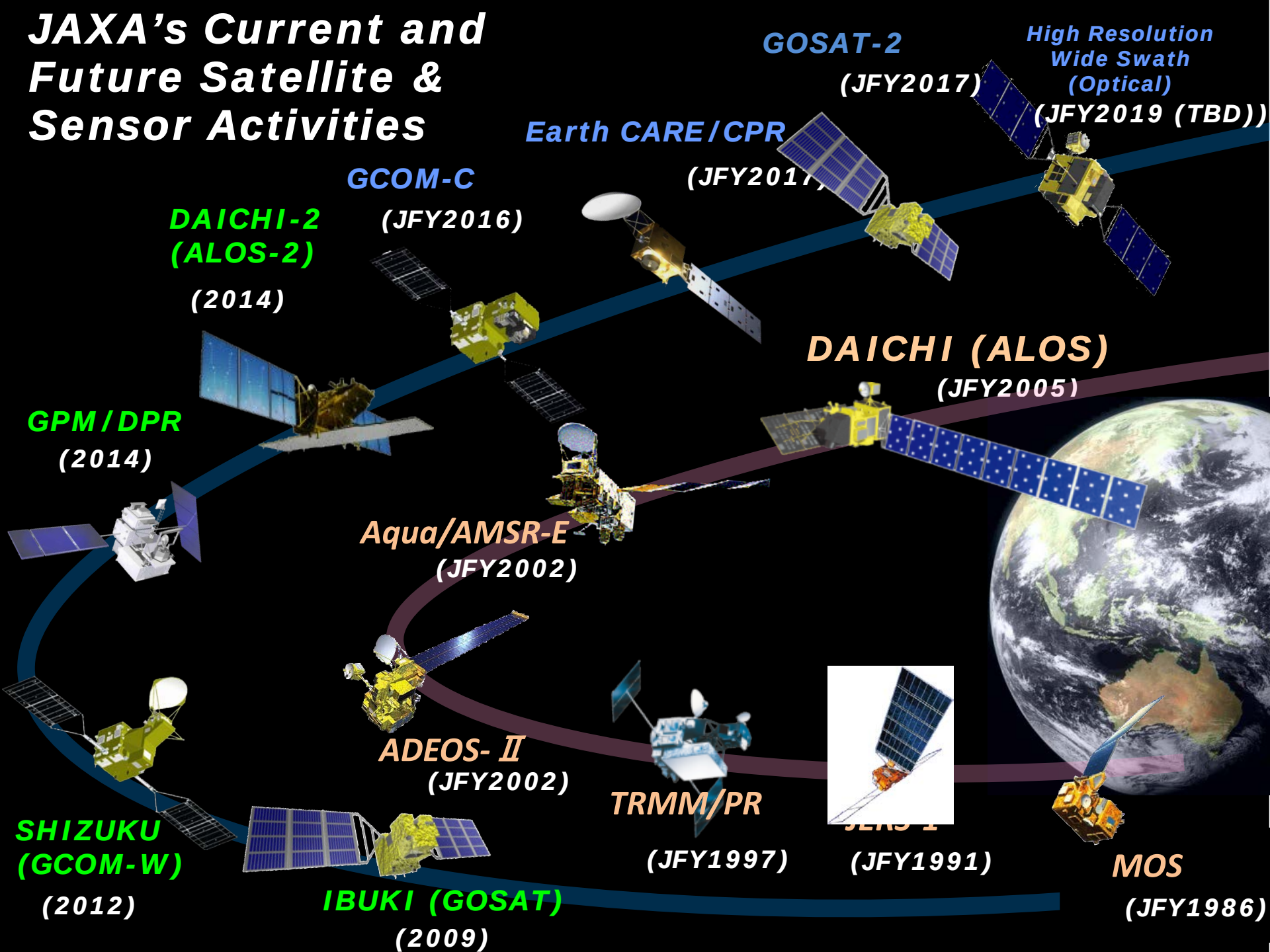
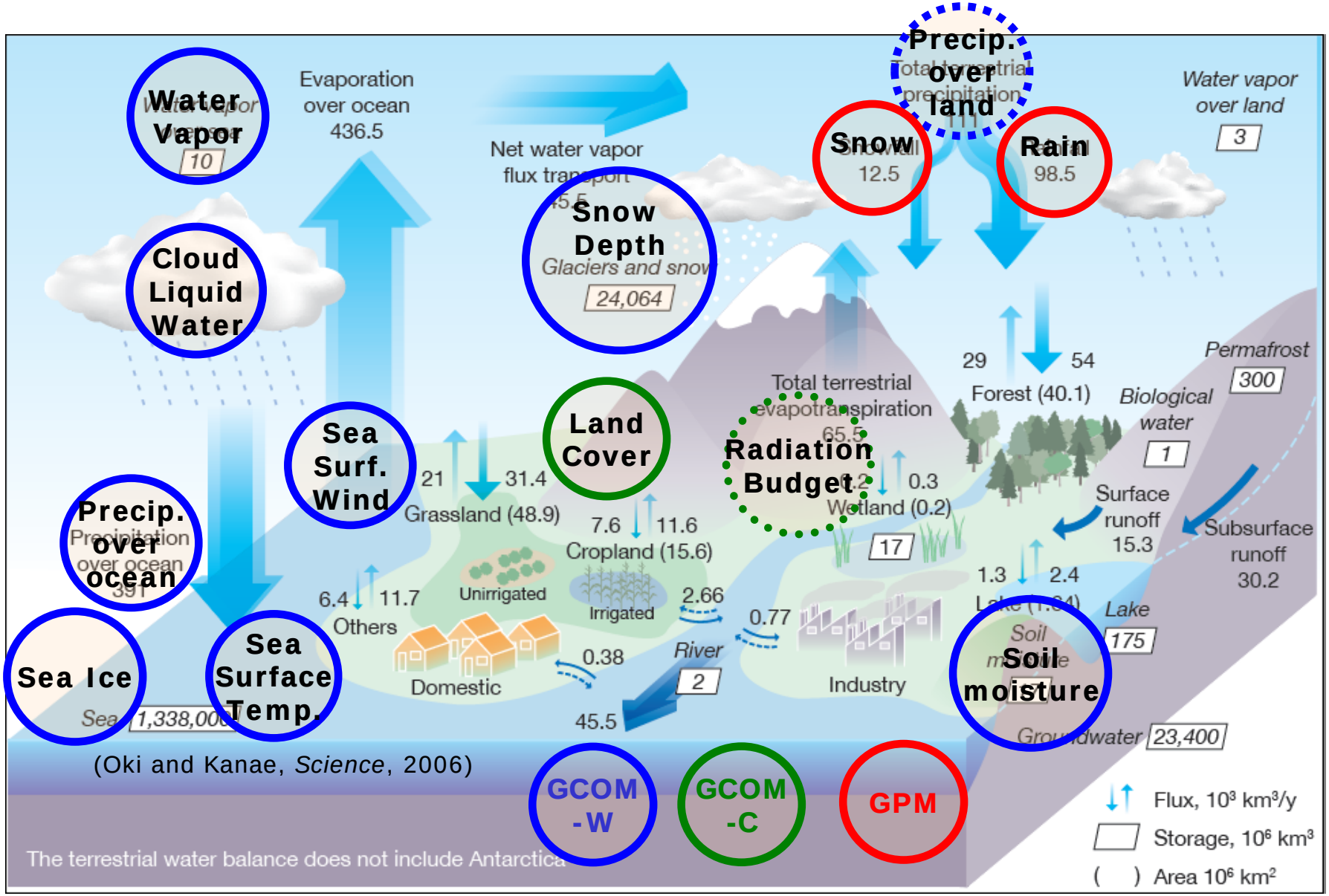
Role of Observation from "Space"

- "Observations" have played important role in addressing climate change issues
  - Capturing current status of the Earth and monitoring its variations
  - Contributing to climate models
    - Satellite will provide reference to evaluate climate models and their forecasts/predictions
    - It also improve precipitation process in the model
- Why from space?
  - Global (wide-area), repetitive, and uniform observation
  - Information can be shared simultaneously by broadcasting.
  - Robust against disasters (stable), and homogeneous all over the world .

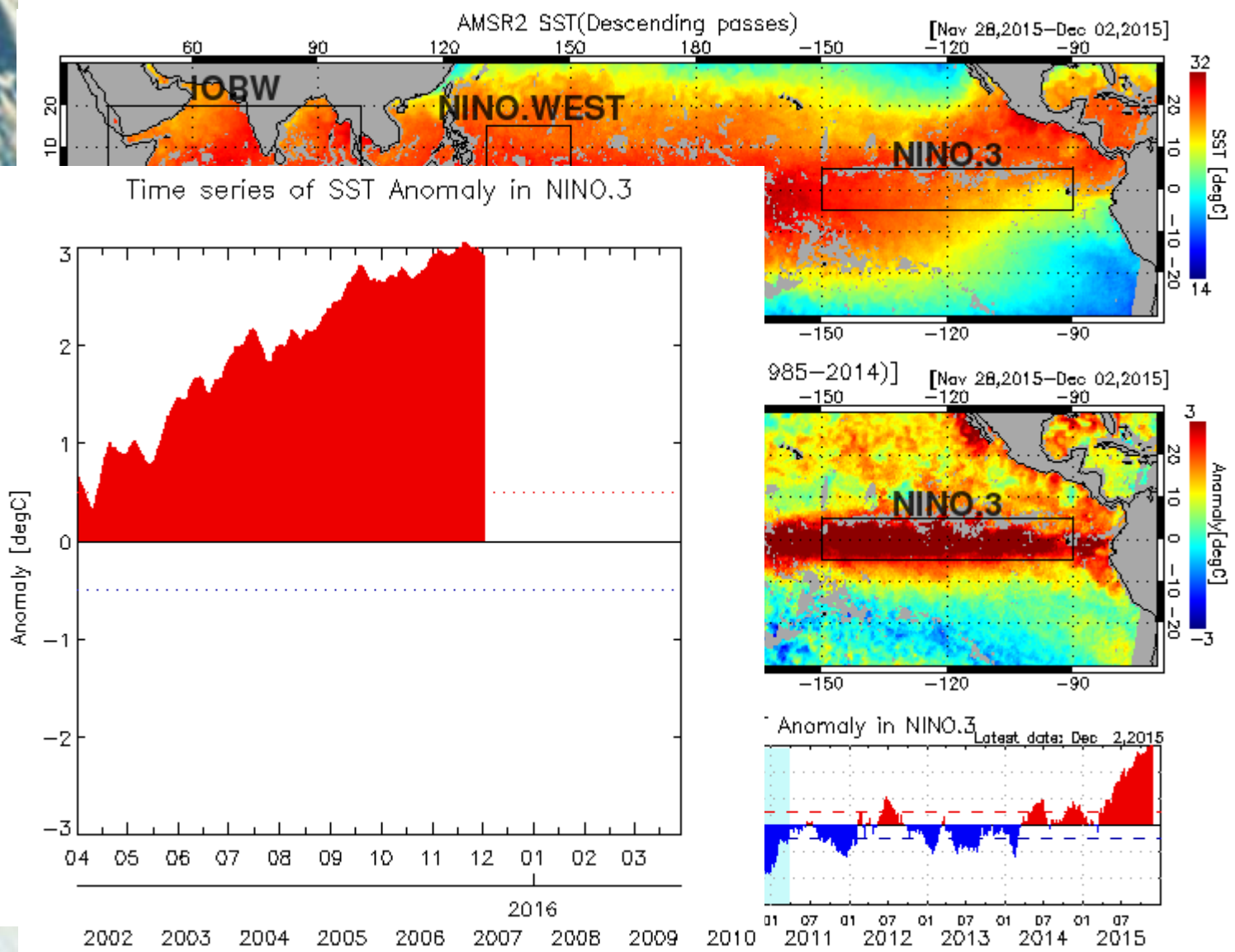
JAXA's Current and Future Satellite & Sensor Activities



Importance of Water Cycle



Example(1) El Niño/La Niña Monitor



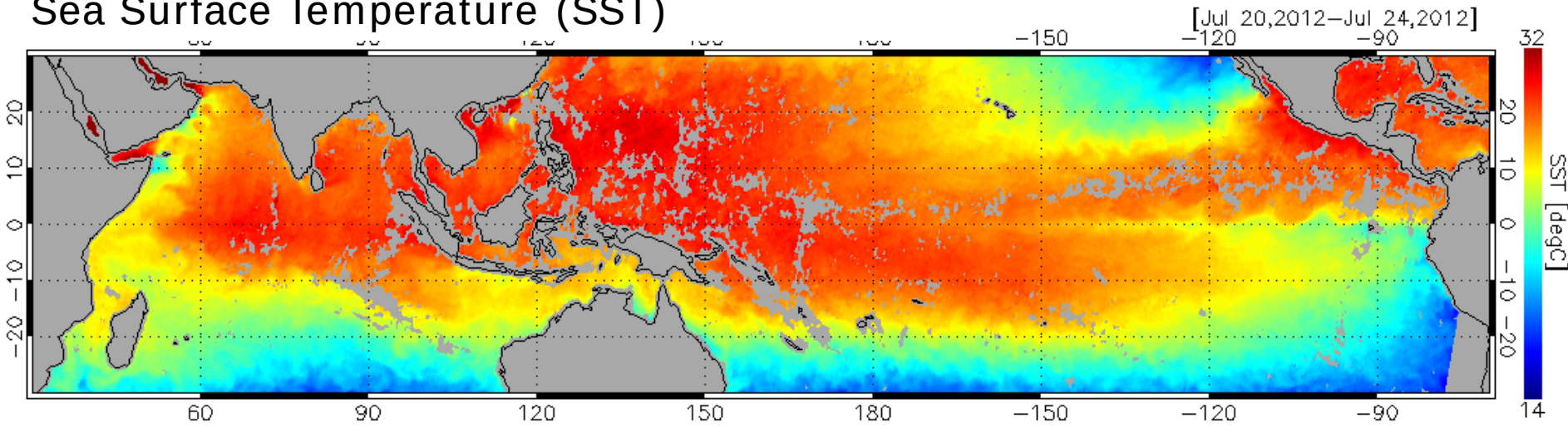
Sea Surface Temperature (SST)

SST differences from Climatology (anomaly)

Variation of SST anomaly of NINO.3

How El Niño Developed?

Sea Surface Temperature (SST)



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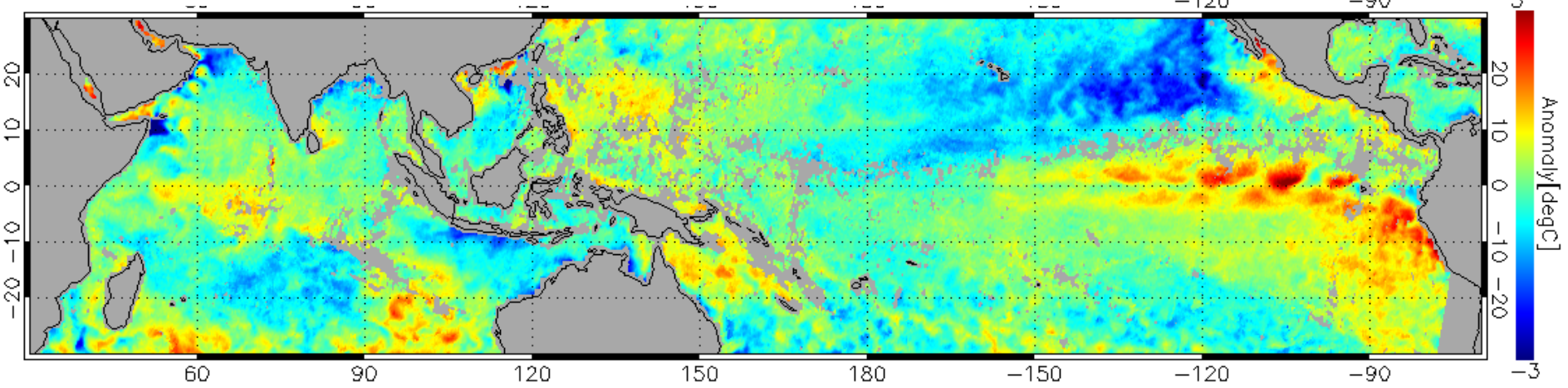
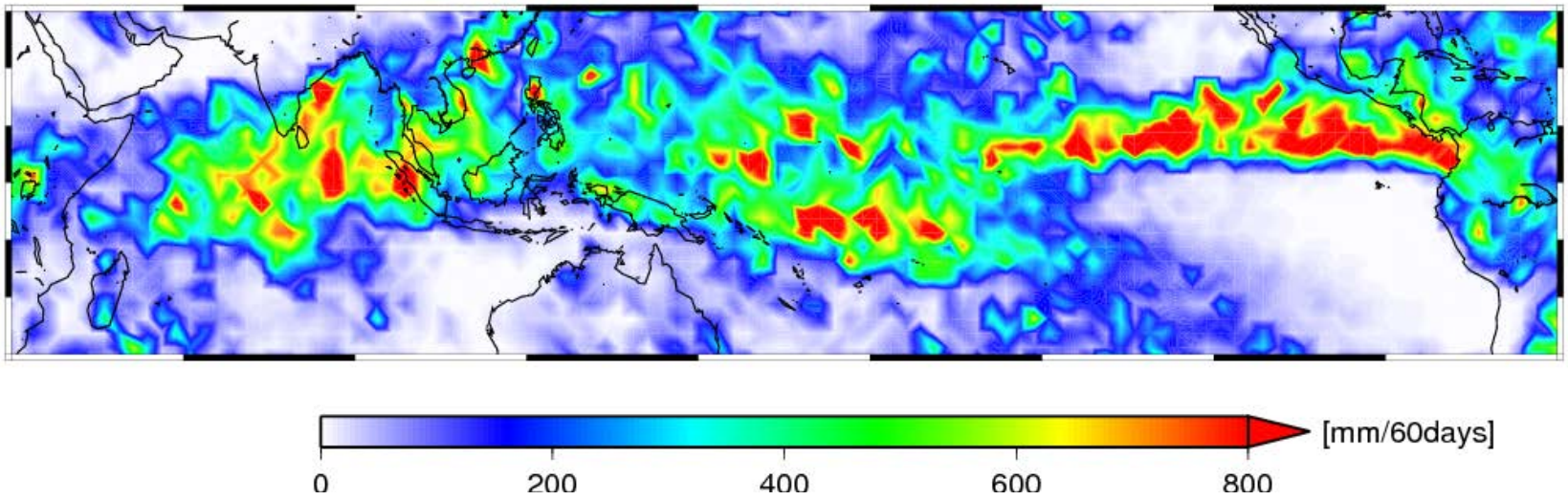


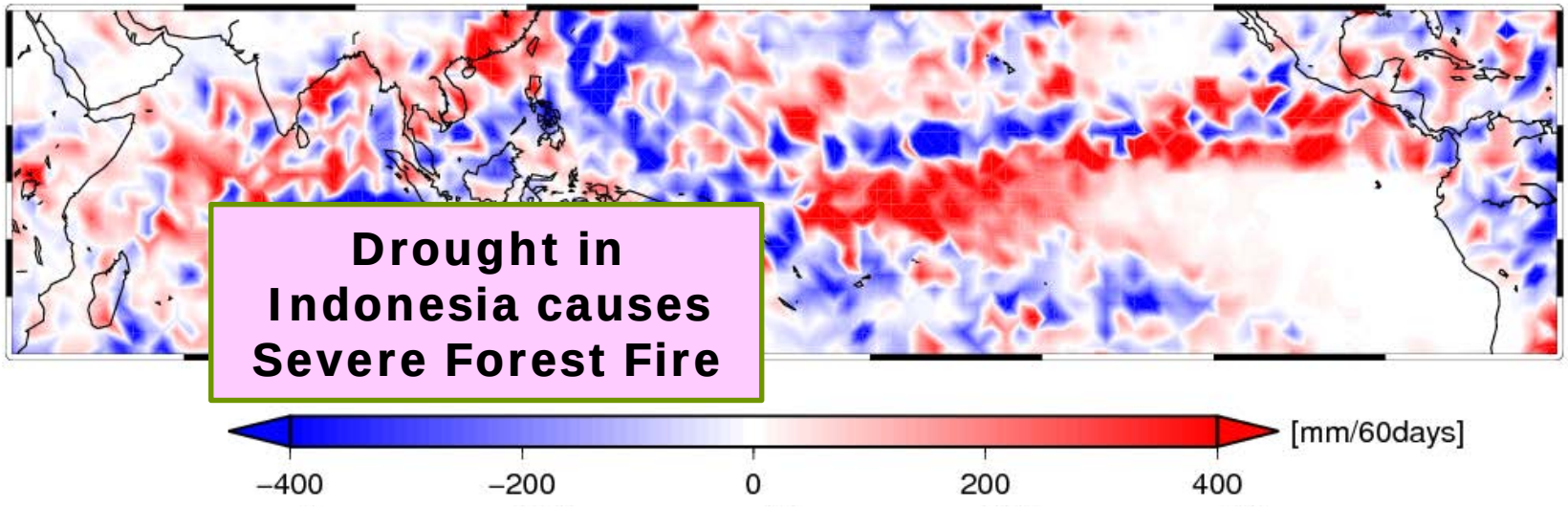
AMSR2 SST animation from Jul, 2012 to Nov. 2015

El Niño Changes Rainfall Distribution

GPMcore DPR surfacePrecipitation (2015/10/01–2015/11/28)



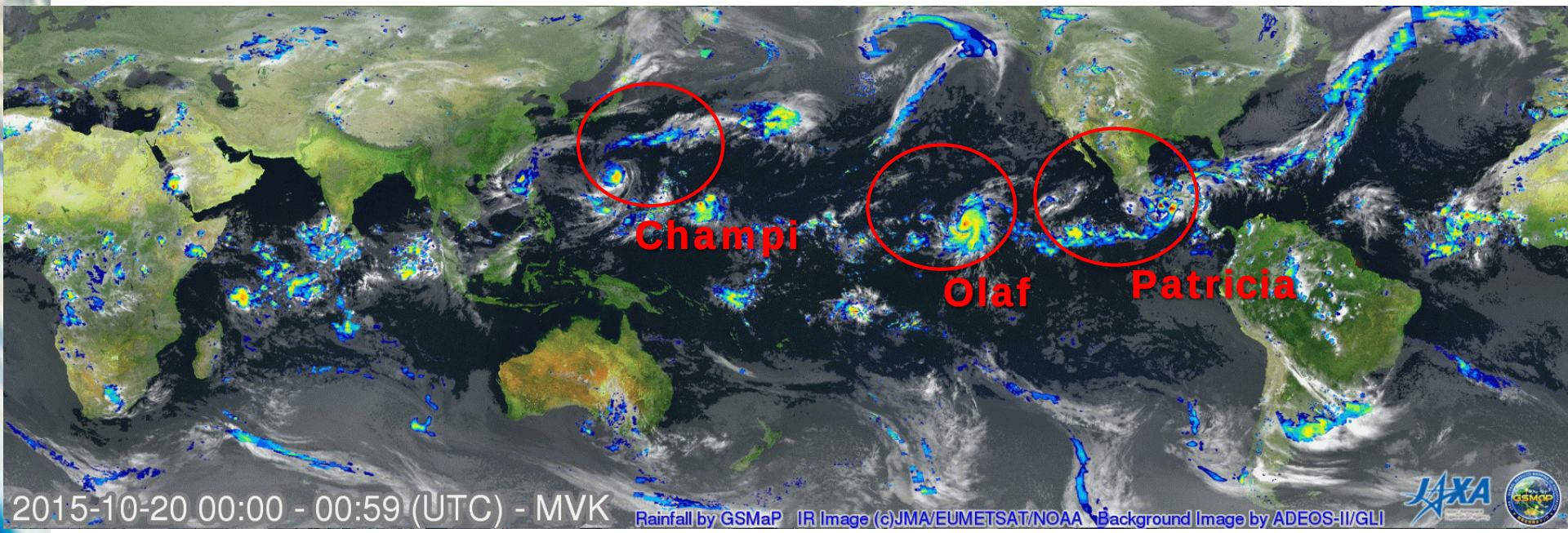
(2015) – (2014)



Drought in Indonesia causes Severe Forest Fire

Example(2) Global Rainfall Monitor

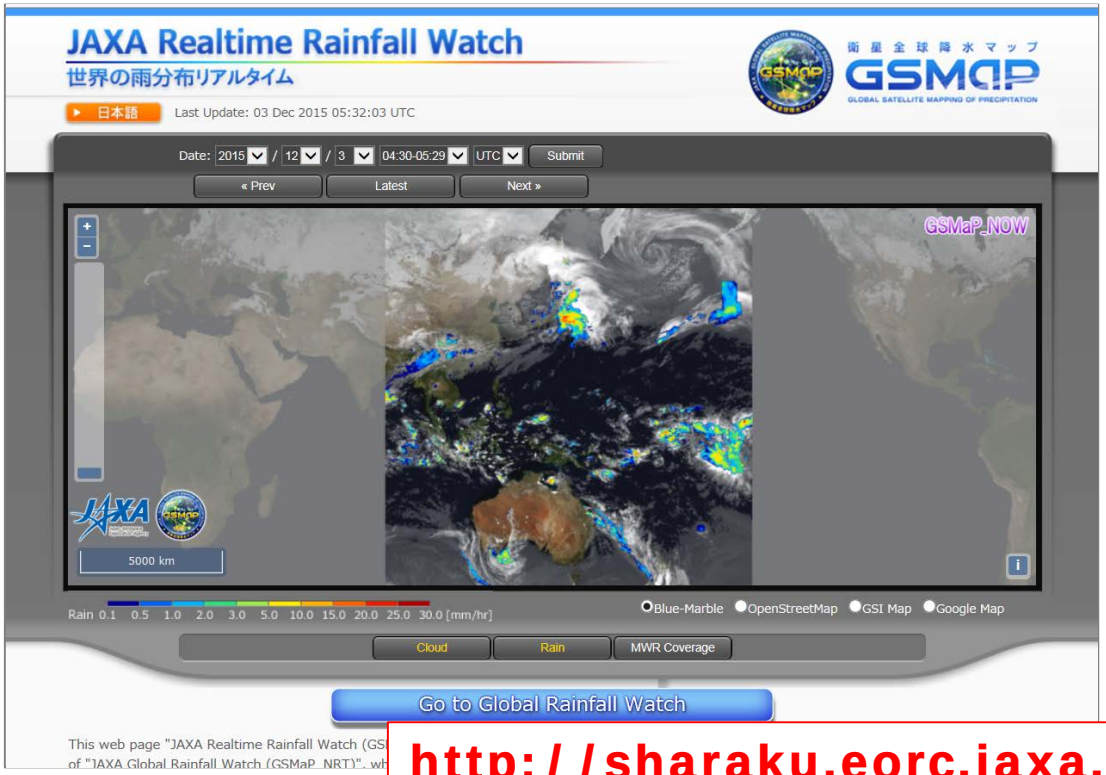
- Rapidly changing precipitation phenomena need frequent observations
  - JAXA provides hourly rainfall product in 0.1x0.1deg lat/lon grid in global (60N-60S) by merging multi-satellites' microwave radiometers and geostationary infrared cloud moving vector information
  - Processed and distributed in near real time basis (about 4-hour after observations)
- Example of application will be shown by Mr. Konami.



http://sharaku.eorc.jaxa.jp/GSMaP

From 4-hour Delay to Realtime

- To reduce latency of GSMaP to respond users
  - Using data that is available within 0.5-hour (GMI, AMSR2 direct receiving data, AMSU direct receiving data and MTSAT) to produce GSMaP at 0.5-hr before.
  - Applying 0.5-hour forward extrapolation (future direction) by cloud moving vector to produce GSMaP at current hour (GSMaP_NOW).



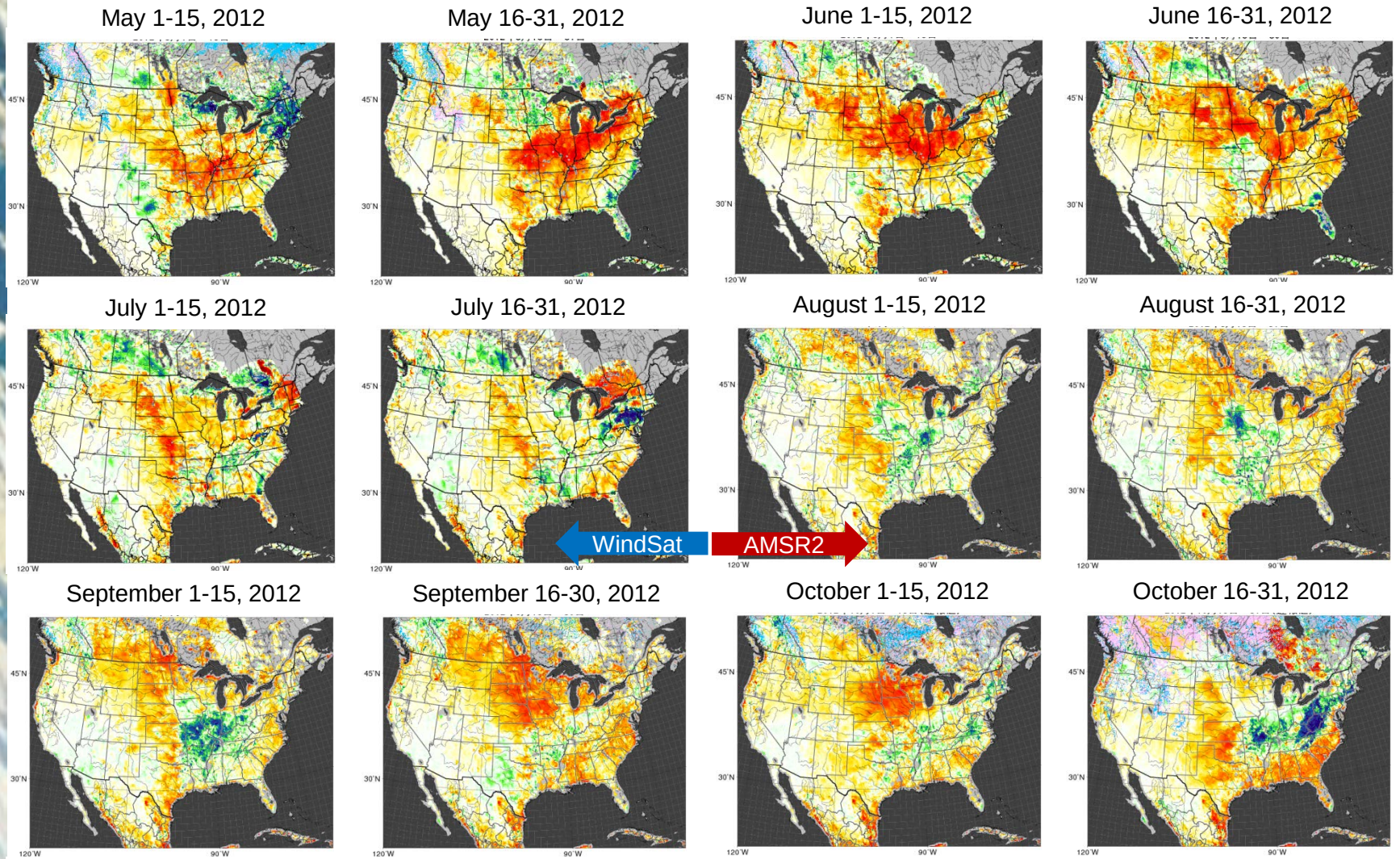
Area: Geostationary satellite Himawari area

Grid size: 0.1-degree
Average: Hourly
Update: every 30-min

Data is freely available after simple registration

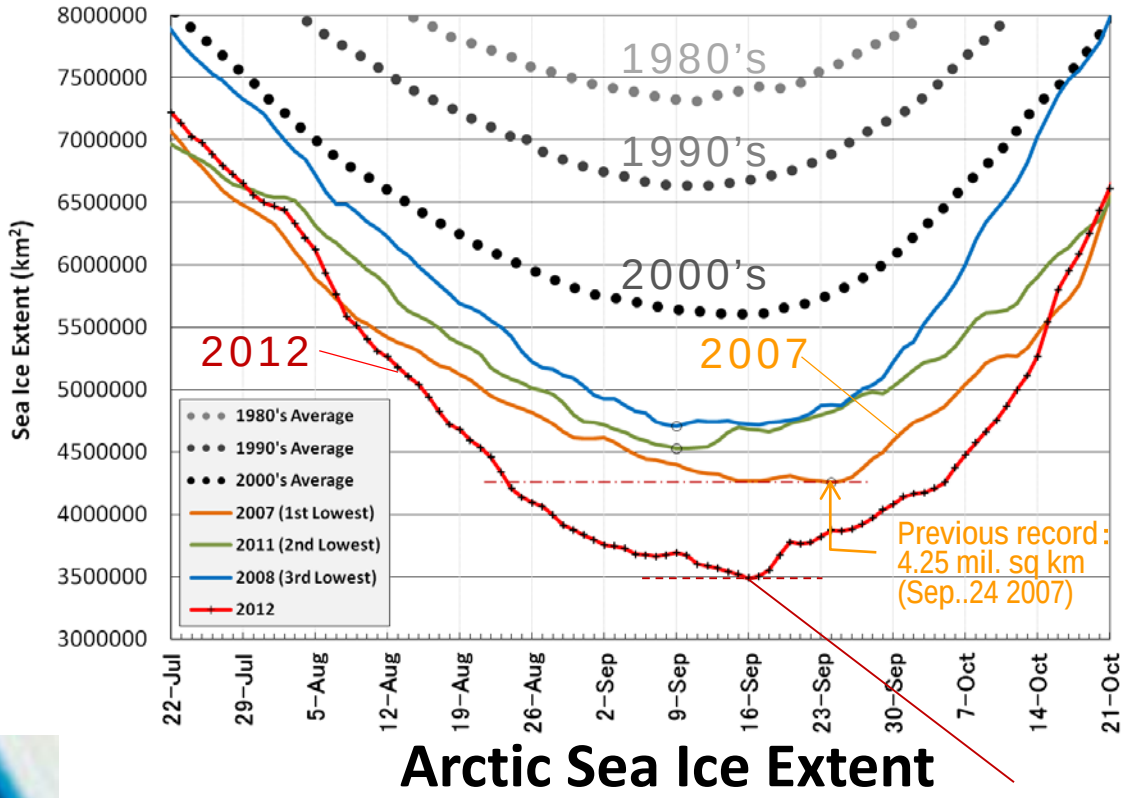
http://sharaku.eorc.jaxa.jp/GSMaP_NOW

Example (3) Drought Monitoring

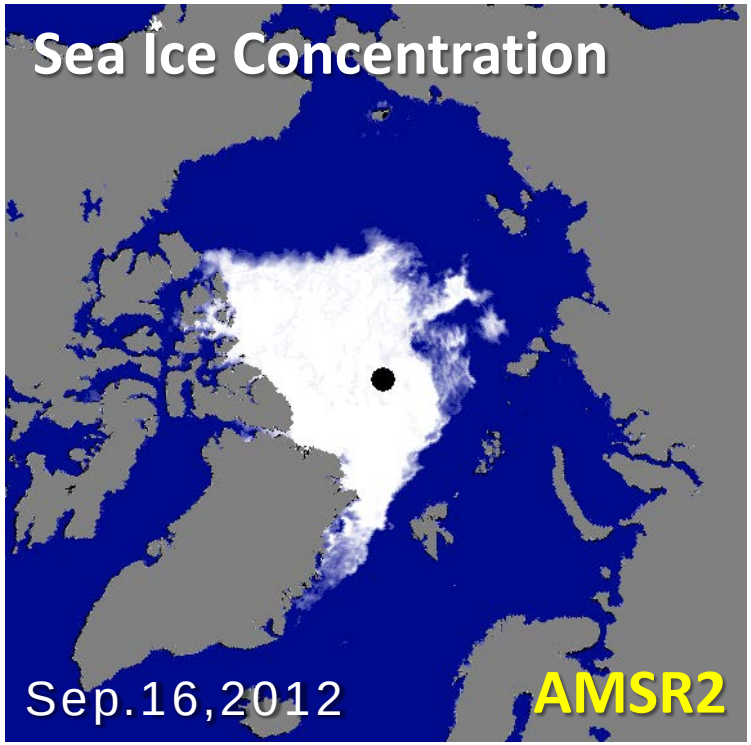


Example (4) Sea Ice Monitoring

- Sea Ice is one of indicator of climate status
- Shrinkage of sea ice extent in the Arctic is one of the major climate change issues

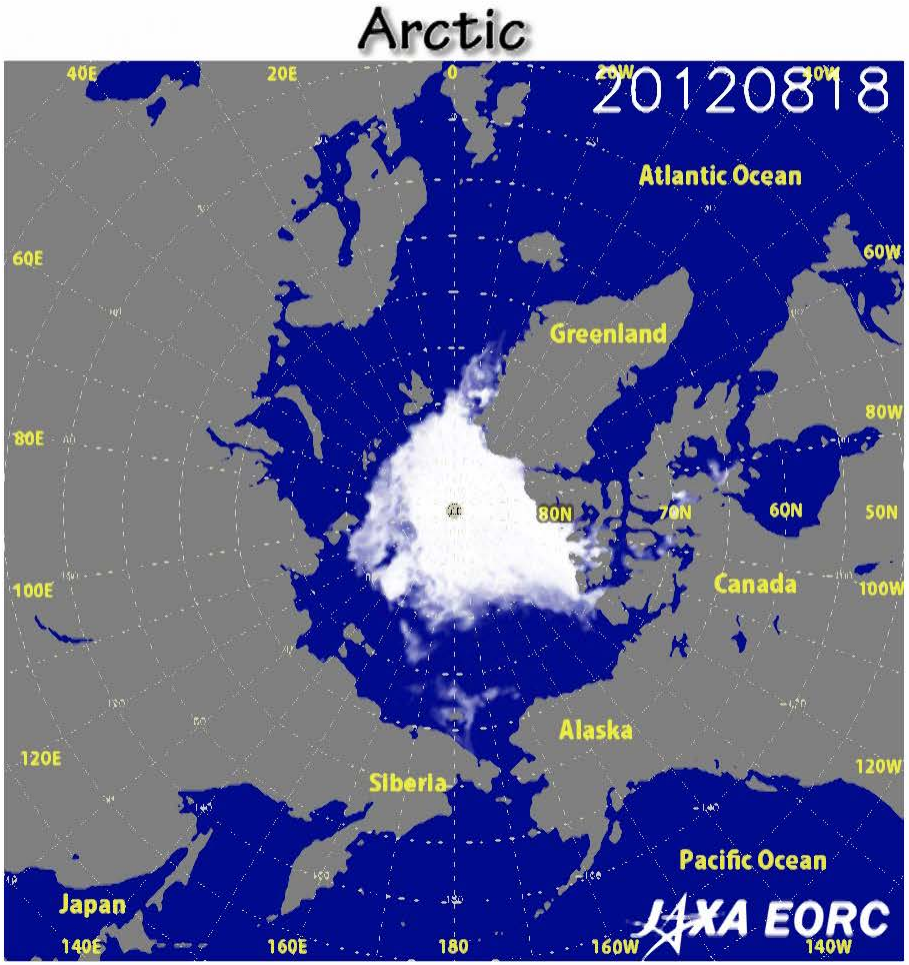


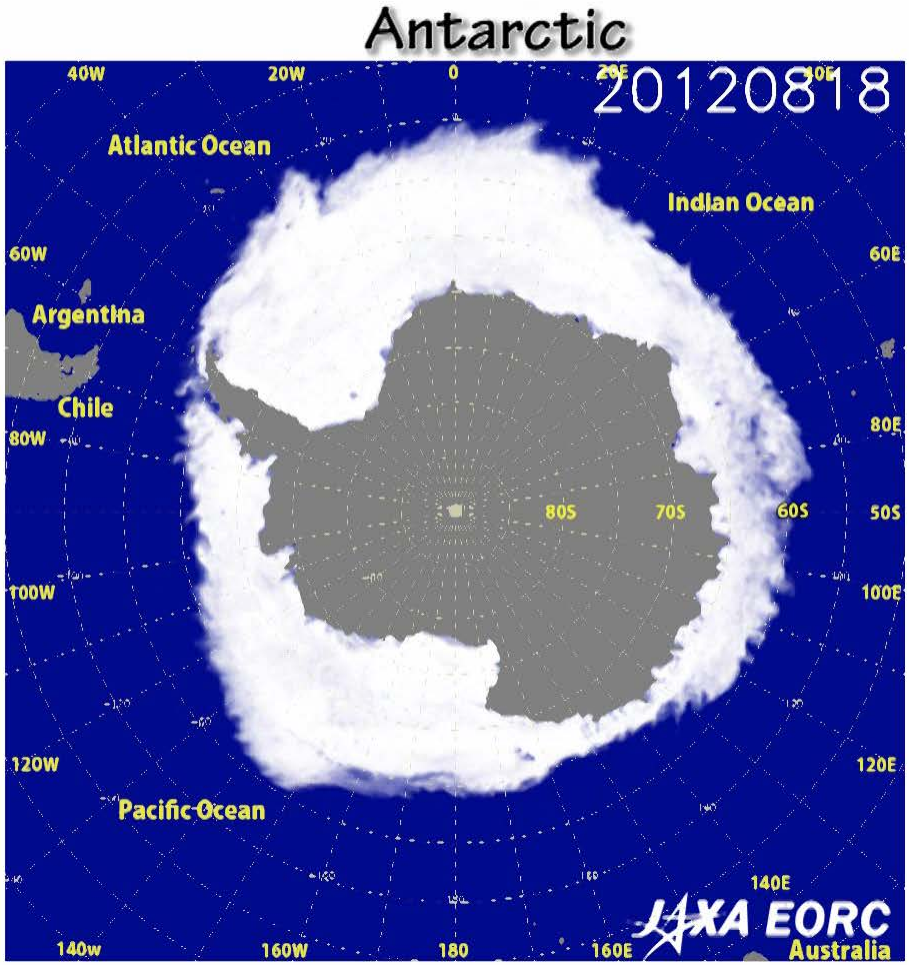
Arctic Sea Ice Extent



Minimum record SIE : 3.49 mil. km^2 (Sep. 16, 2012)

Sea Ice Distribution





More examples will be shown by Prof. Enomoto's presentation

Constrains and Conditions

- Satellite data is unique, but not enough
  - necessary to be combined with other data
  - necessary to be transformed into information easy to understand.

- Timely delivery and continuity of satellite data are not guaranteed
  - Just a single satellite can not provide timely delivery of data in response to disasters
  - Continuous observation is essential for climate monitoring

- In order to overcome these constraints
  - International collaborations between space agencies and various discipline
    - GEO, CEOS, UNESCO, ADB, JICA, local agencies, …
  - Combine the in-situ data with satellite data, and utilize numerical models and forecasts

Summary

- Combination of multi-satellite data, ground observation, and numerical models provides us more “information” than single observation.
- Assuring continuity of observations, both from space and ground, is essential to archive data for corresponding to climate change issues.
- To reduce impacts and risks of extreme weather events and related water hazards, more collaboration among different disciplines are needed.