

JAXA's Plans for Health Applications using EO Data

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Session 1: Advances in Environmental Monitoring for Health

Advances in Geospatial Technologies for Health

ISPRS Commission VIII/WG-2

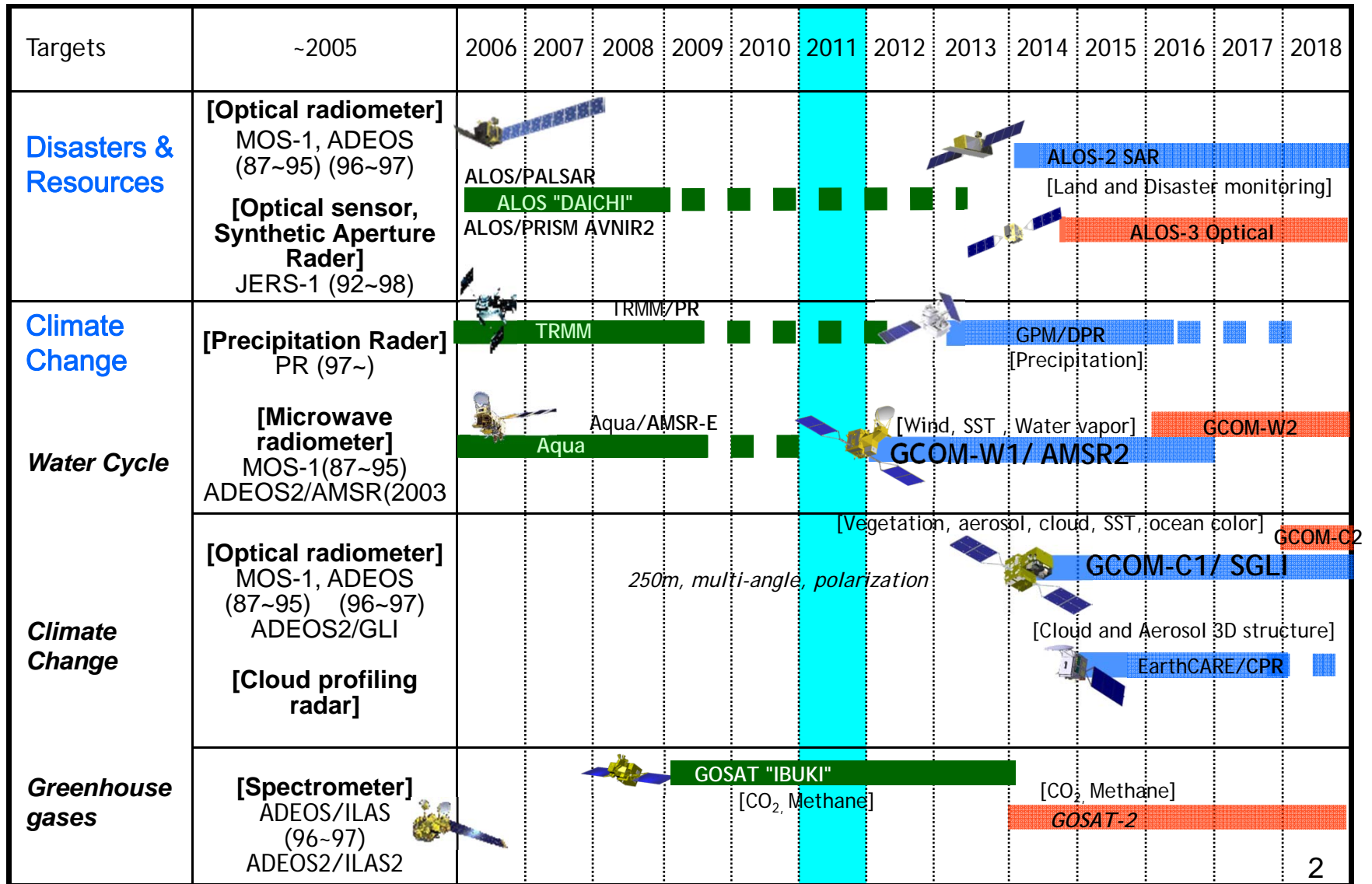
Remote Sensing Applications & Policy: Health

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T. Fukuda and M. Onoda


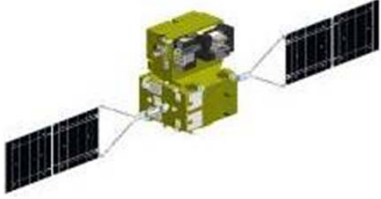
JAXA

Long-Term Plan of Earth Observation by JAXA



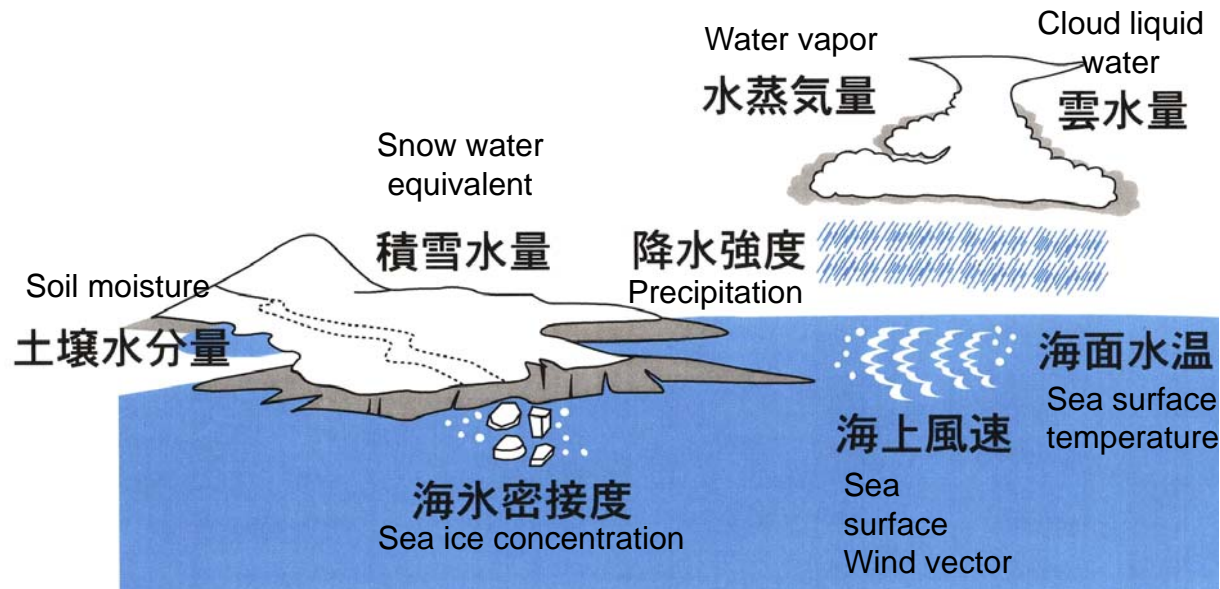
Mission status ■ On orbit ■ Phase B- ■ Phase A ■ Extension

GCOM 1st Generation

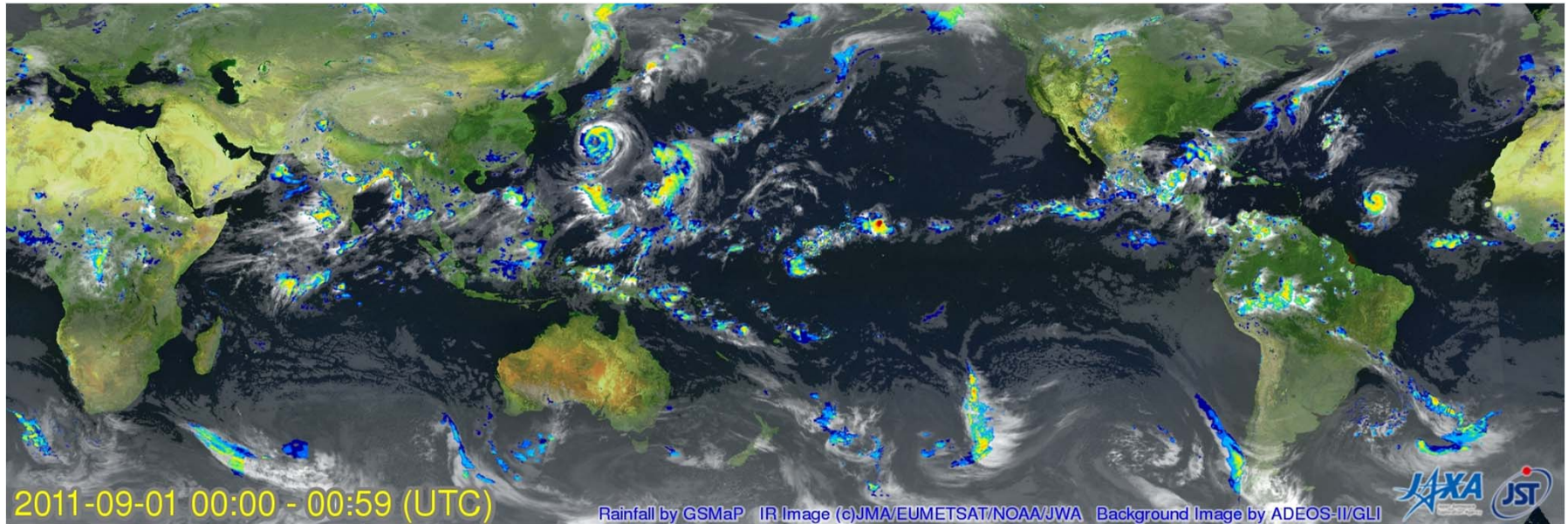
	GCOM-W1	GCOM-C1
Orbit	Type : Sun-synchronous, sub-recurrent Altitude : 699.6 km Inclination : 98.19 degrees Local time of ascending node : 13:30	Type : Sun-synchronous, sub-recurrent Altitude : 798 km Inclination : 98.6 degrees Local time of ascending node : 10:30
Satellite overview		
Mission life	5 years	
Launch vehicle	H2A launch vehicle	
Mass	1940kg (AMSR2 404 kg)	2020 kg (SGLI 480 kg included)
Instrument	AMSR 2 (improved AMSR-E)	Second Generation Global Imager (SGLI, improved GLI)
Launch (target)	JFY2011	JFY2014

AMSR-E Geophysical Parameters

Geophysical products	Comments
AMSR follow-on instrument	
Integrated water vapor	Over global ocean [*] , columnar integrated value
Integrated cloud liquid water	Over global ocean [*] , columnar integrated value
Precipitation	Global (except over ice and snow), surface rain rate
Sea surface temperature	Global ocean [*]
Sea surface wind speed	Global ocean [*]
Sea ice concentration	High latitude ocean areas
Snow depth	Land surface (except dense forest regions)
Soil moisture	Land surface (except ice sheet and dense forest regions)



Global Rainfall Map - NRT



Sep. 1, 2011

Rain 0.1 0.5 1.0 2.0 3.0 5.0 10.0 15.0 20.0 25.0 30.0 [mm/hr]

- Global rainfall map merging TRMM, AMSR-E and other satellite information
- Available 4-hour after observation, hourly update
- 0.1-degree latitude/longitude grid

<http://sharaku.eorc.jaxa.jp/GSMaP/index.htm>

Soil Moisture and Precipitation

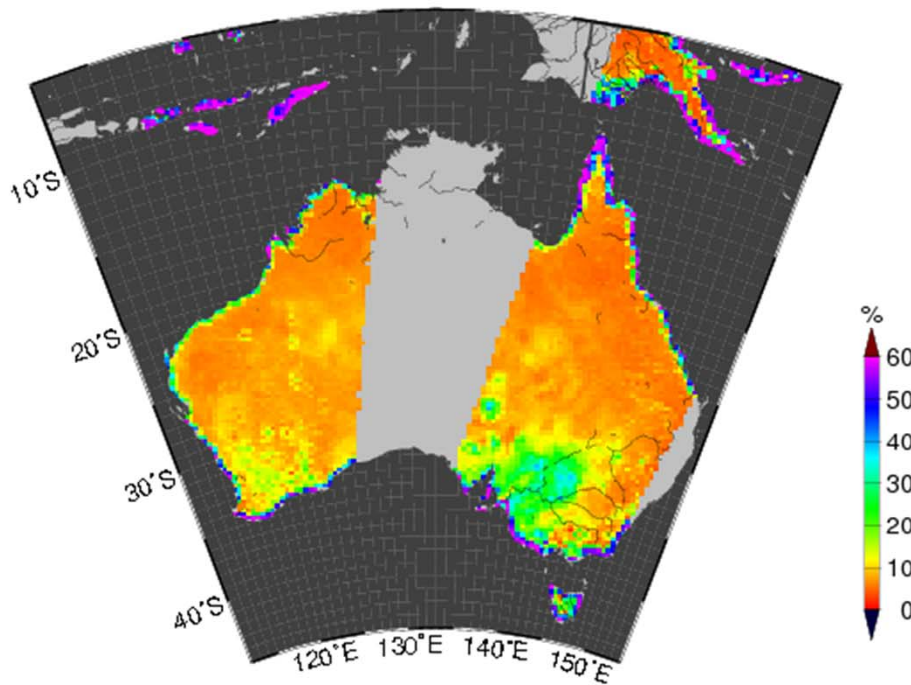
AMSR-E Soil Moisture

- L2, Descending
- Volumetric Soil Moisture [%]

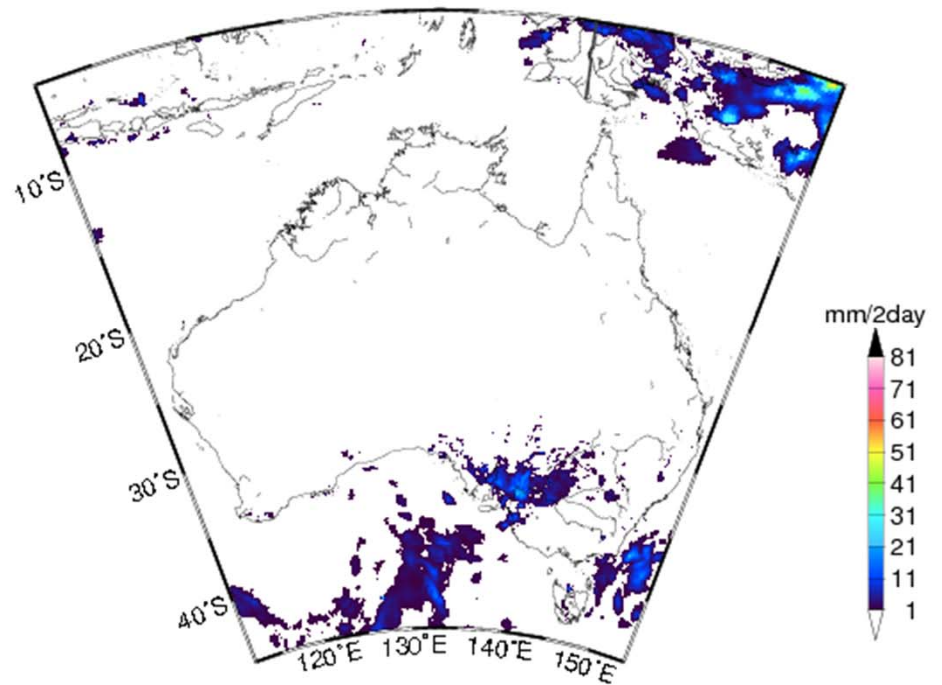
Precipitation :

- Total amount of precipitation for 48 hours before AMSR-E observation.
- Data source: GSMaP MVK hourly (JST-CREST/GSMaP)

AQUA/AMSR-E SM May. 23, 2003 DES



GSMaP MVK 2Days Precipitation May. 23 2003



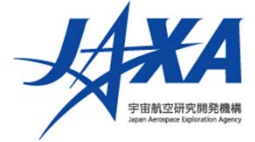
Provided by Dr. Fujii of JAXA/EORC.

Satellite Remote Sensing Data Available from JAXA/EORC



- In Operation
 - ALOS: Forest Cover, Land Cover, Water-body, Soil Moisture
 - GOSAT: CO₂, CH₄, O₃, Aerosol
 - TRMM/PR: Precipitation
 - Aqua/AMSR-E: Water Cycle; Atmosphere, Soil Moisture, Earth Surface Temperature, etc.
 - Others: GSMaP; NRT Global Precipitation Mapping, JASMES (global environment mapping data sets)
- Future Plan
 - GCOM-W1/AMSR2 (JFY2011-): Improved Water Cycle Mapping
 - GPM/DPR (JFY2013-): Improved Precipitation Mapping
 - GCOM-C1/SGLI (JFY2014-): Aerosol, Vegetation Cover, Ocean Color, Earth Surface Temperature
 - EarthCARE/CPR, ATLID (JFY2015-): Aerosol

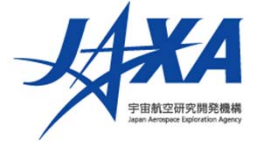
Topics in Discussion



- Infectious Diseases
 - Air-borne Diseases: In the cases on diseases; influenza, the correlation between the atmospheric temperature, humidity and the cases of diseases have indicated statistical significance in Kochi, Japan.
 - Water-borne Diseases: In Ariake Sea, *Vibrio vulnificus* cases had the correlation with SST and the turbidity (as the tracer of Sea Surface Salinity) from MODIS data,
 - Vector-borne Disease: In Japan, there is no case of Malaria, however there are reports on the north bound front movement of the carrier mosquito habitat.
- Pollinosis of cedar and other diseases of aerosols origin
 - Photosynthetically Available Radiation (PAR) in the past summer and the total Japanese cedar pollen has correlation. Also there seems to be effective environmental factors; tree species, surface wind, topography, DEP, urban environment, transboundary air pollution (Kosa Dust Storm, etc.)
- Heat stroke
 - Depend on the atmospheric temperature and humidity (derived from Land Surface Temperature, NDVI, Water surface, altitude, soil moisture, water stress trend, etc.)

Climate and Infectious Diseases

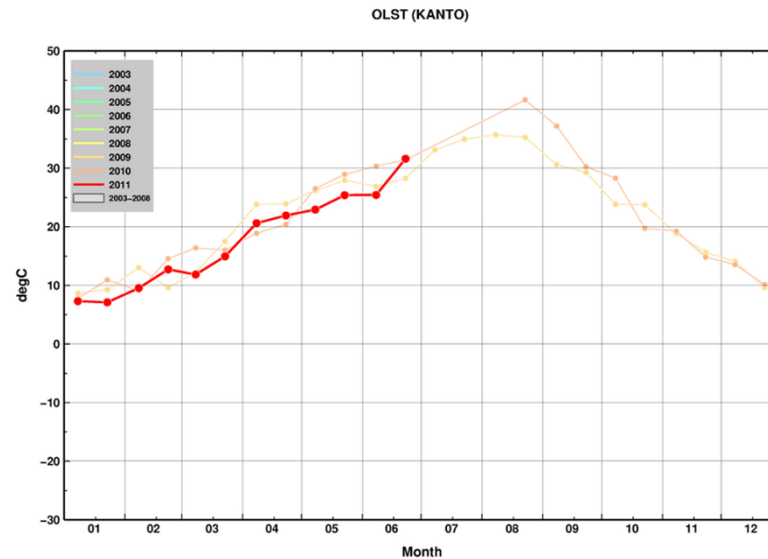
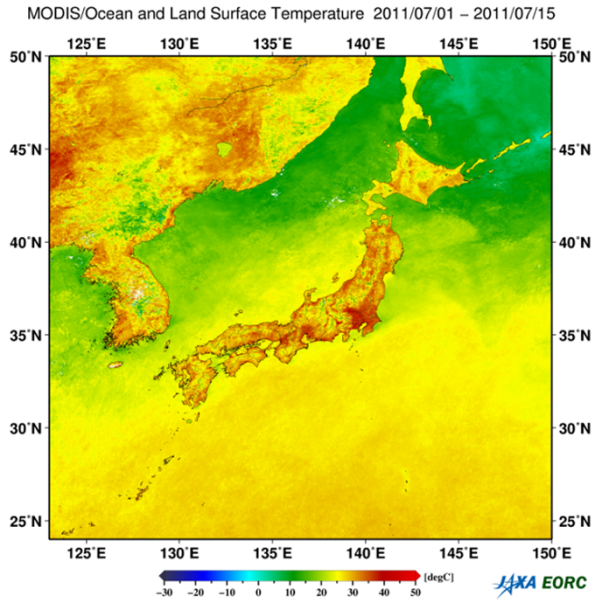
(Rep. Pub. Hlth. Kochi, 2004)



- Study on climate change and trend of case of infectious diseases shows possibility of the strategic preventive medicine.
- Correlation between climate and infectious disease epidemicity, prediction using statistical technique of regression analysis, etc. shows the following results:
 - Positive correlation between diseases and pathogenic microbe and the factors; temperature and humidity.
 - Disease : Herpangina, hand foot and mouth disease (HFMD), pharyngoconjunctival fever (PCF), Exanthem subitum, epidemic keratoconjunctivitis (EKC), Infectious gastroenteritis, Influenza, Varicella
 - Pathogenic microbe: Entero71, Noro (SRSV), Rota
 - In the summer season, there is possibility of prediction of time and scale of epidemicity.

Land Surface Temperature (LST)

(JASMES MODIS Jul.1-15, 2011)

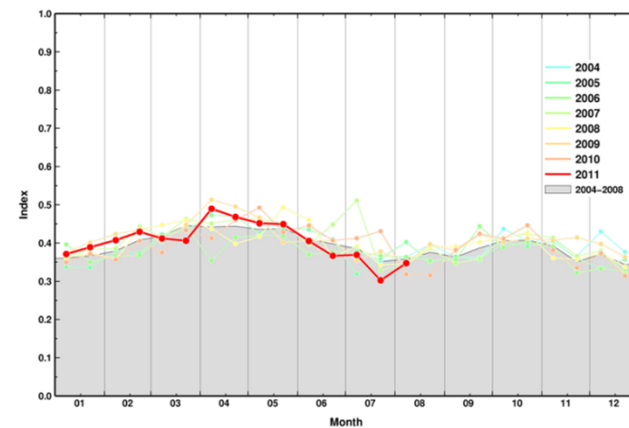
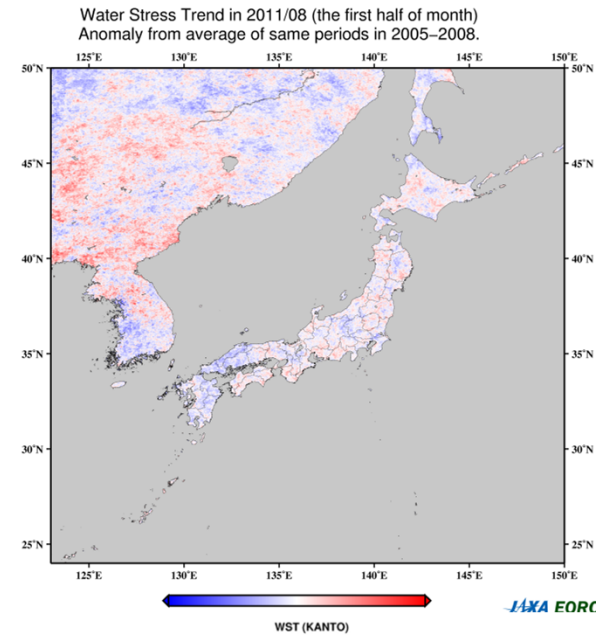
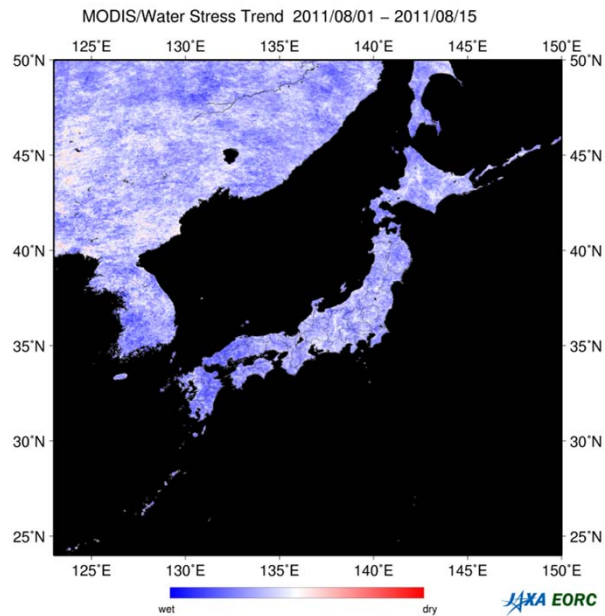


Upper image: Land Surface Temperature (LST)

Lower left image: Kanto Area, Lower right: LST half monthly change 10

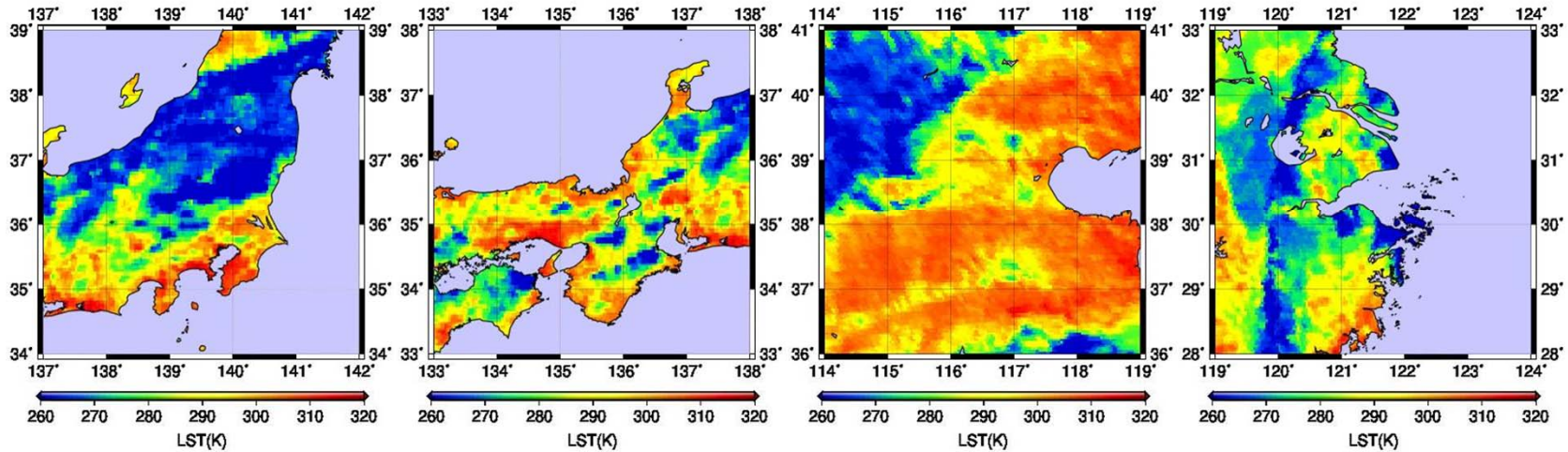
Water Stress Trend (WST)

(JASMES MODIS Aug. 1-15, 2011)

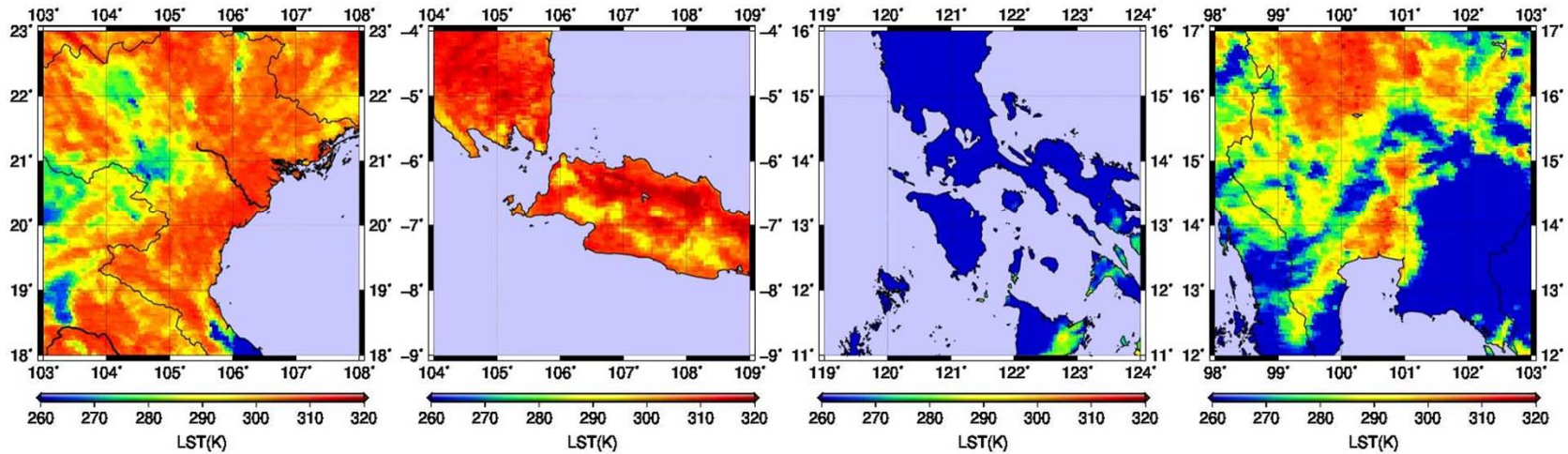


Upper left: water stress trend (WST), Upper right: anomaly
Lower left: Kanto Area, Lower right: WST half monthly change

MTSAT LST of Megacities with population >10 millions (Ohvoshi)

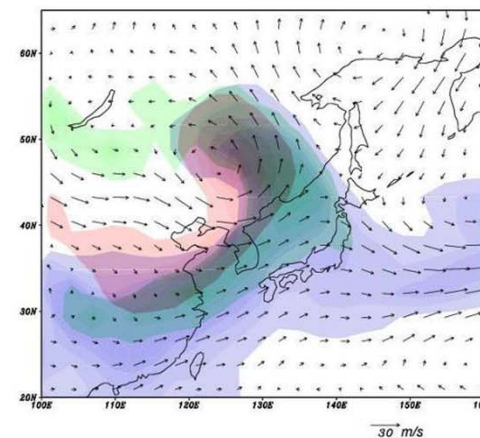
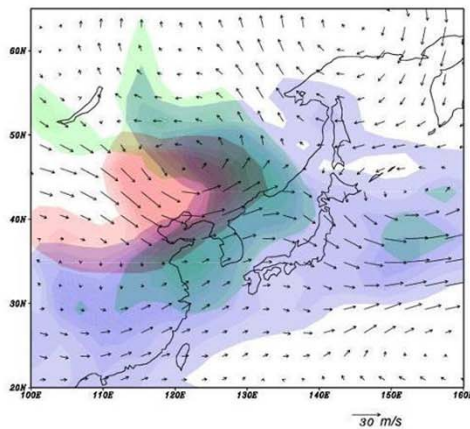
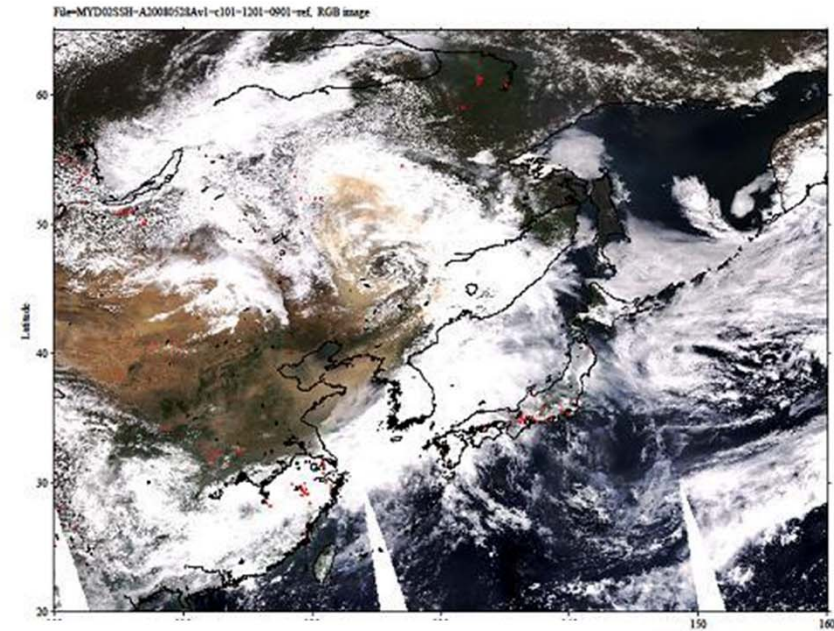
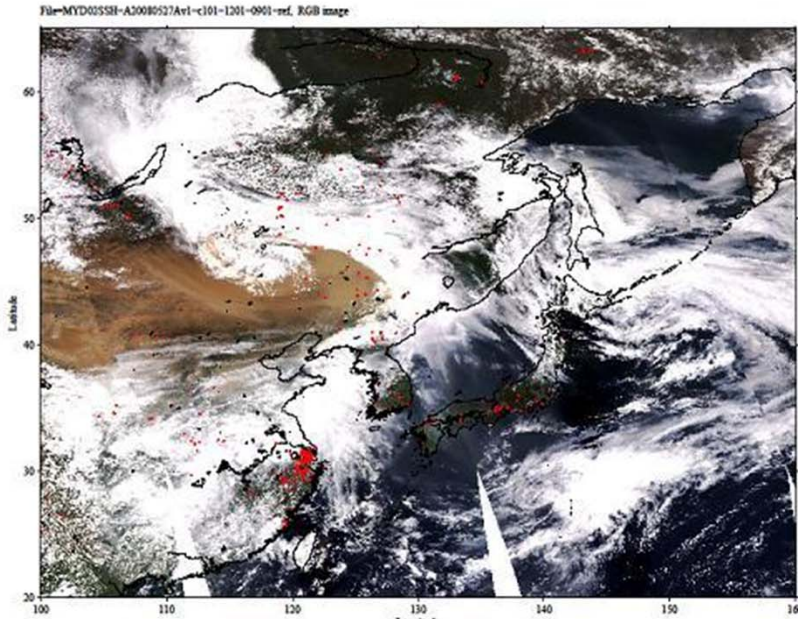


From left, Tokyo, Osaka, Beijing, Shanghai



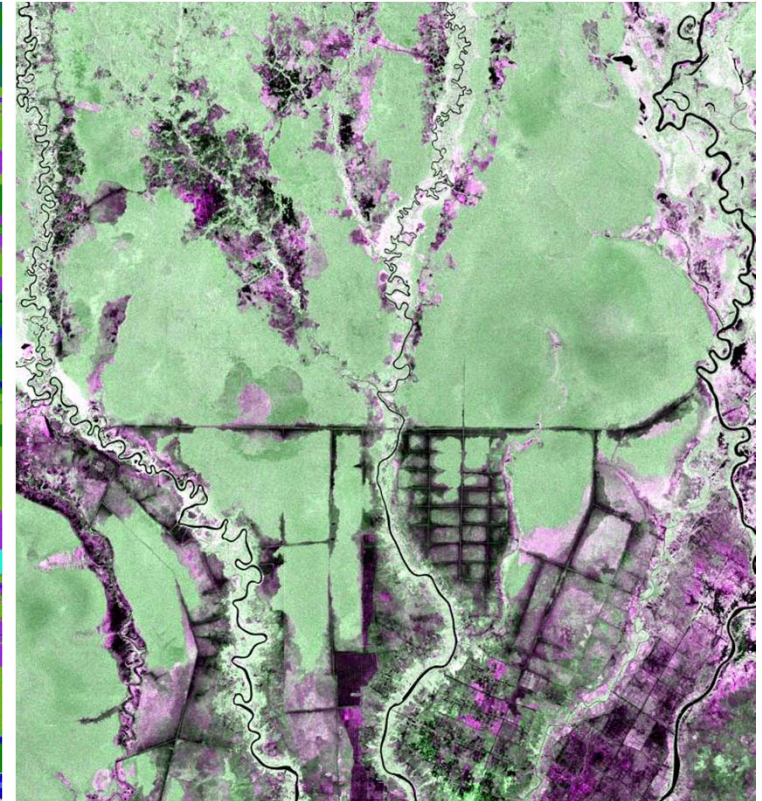
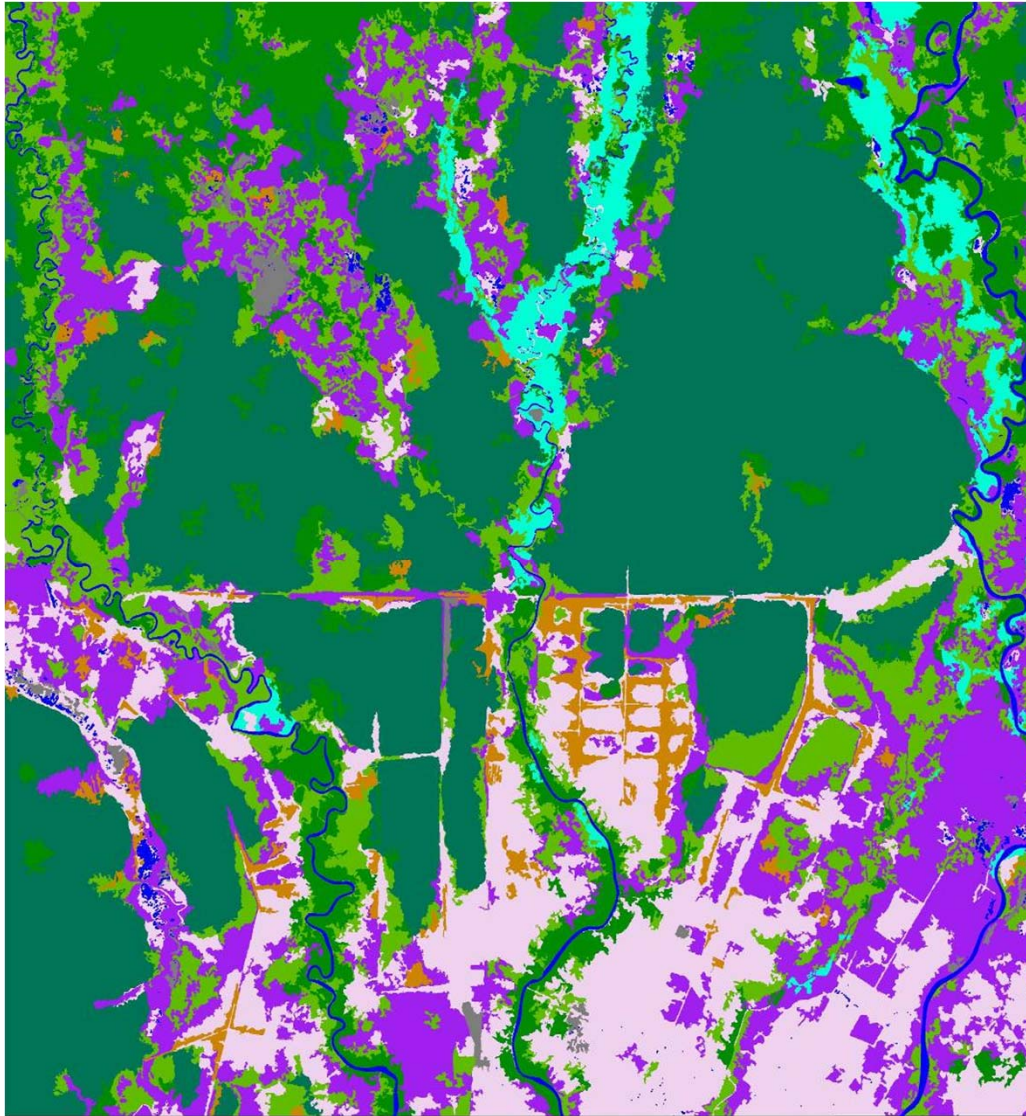
From left, Hanoi, Jakarta, Manila, Bangkok

Yellow Sand (Kosa) and Forest Fires



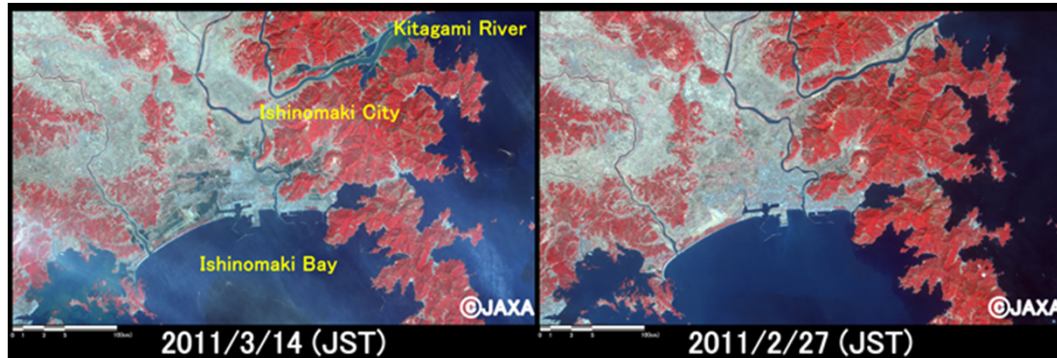
Red:Dust, Green: Fire Aerosol, Blue: Fossil Fuel Burning Aerosol

PALSAR Land Cover Classification BORNEO

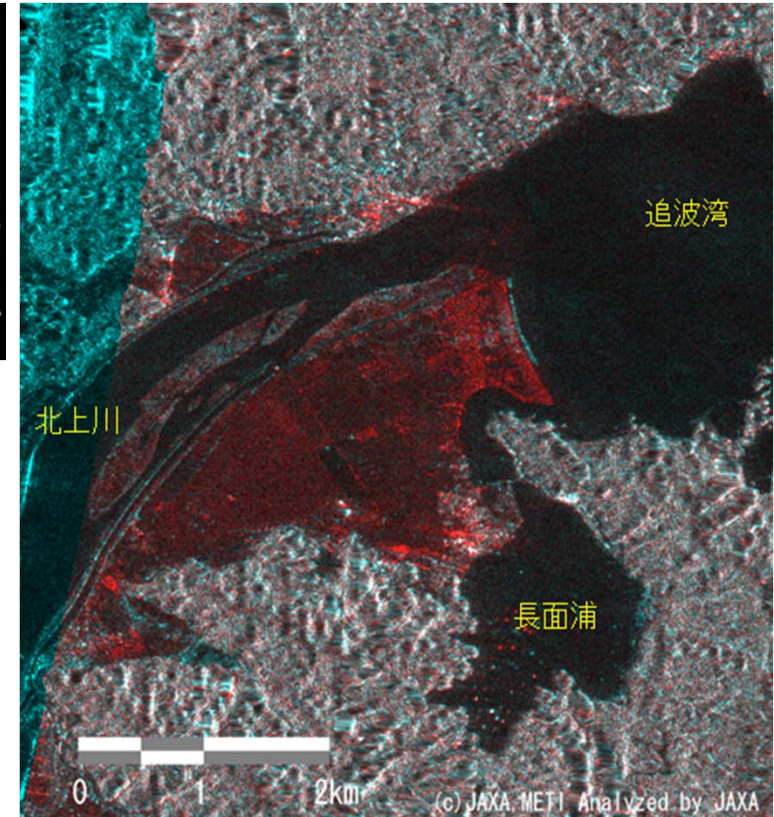


- Mountain Forest
- Lowland Forest
- Degraded/Secondary Forest
- Peat/Non-peat Swamp Forest
- Riverine Forest
- Mangrove/nipiah
- Plantation
- Shrubs/grassland
- Agriculture/Bare soil
- Recently Burnt/clear cut
- Water

Earthquake and Tsunami in Japan on March 11, 2011



- AVNIR-2 Image of Ishinomaki, Tohoku District damaged by M9.0 Earthquake.
- Dark area shows submerged Kitagami River Basin and plain near the coast of Ishinomaki Bay.
- The clearing of a lot of debris, the reconstruction and development of living space are ongoing.
- Some of inhabitants have been evacuated and living in temporary housings.



- PALSAR Color Composite Image of the mouth of Kitagami River.
- Red: low intensity by flood, Blue: high intensity by scatterers after the Earthquake and Tsunami.¹⁵

Conclusion

- Infectious Diseases: JAXA is planning preliminary study on the use of data sets of JASMES and Himawari, to validate that there is correlation between cases and the environmental factors such as LST, WST from satellites or derived atmospheric temperature, humidity from LST, WST and other parameters. And then, validation of possibility to predict infectious disease epidemicity and control.
- Assessment of the pollinosis and the effect of aerosol on health : JAXA is planning statistical analysis on the cases of pollinosis and the environmental factors such as cedar forest cover and PAR in the preceding summer to estimate the total Japanese cedar pollen, and the number of patients. Also consider protective measure and the improvement of prediction accuracy, considering other influential factors.
- Others: Considerations on themes, methodologies, cross-cutting cooperation, implementation plans.