




JAXA
Japan Aerospace
Exploration Agency

Space-based Earth Observation Applications for Resilient Cities

Kunming Forum on UN GGIM
Cities of the Future: Smart, Resilient and Sustainable
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- Examples of Space-based Earth observation for cities

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JAXA Activities

Space Transportation



Aeronautics



Human Space Activities




Space Science



Satellite Programs



Lunar & Planetary Exploration Programs

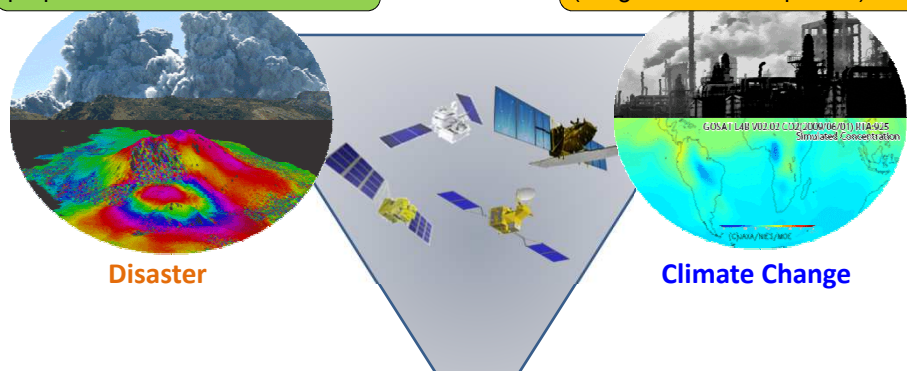


Priorities of JAXA Earth Observations

GOAL: Earth observation system based upon advanced space technologies becomes a part of social infrastructure and provide solutions to issues

Disaster prevention / disaster preparedness

Climate Change (Mitigation and Adaptation)



Disaster

Climate Change


New frontier / innovation

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JAXA **Major International Agreements**

JAXA efforts to define satellites' roles in major international agreements

- Sendai Framework for DRR (March 2015)
- 2030 Agenda for SD (Sep 2015)
- COP21 Paris Agreement (Dec 2015)



29th CEOS Plenary, Kyoto, Nov 5-6, 2015



World Conference on Disaster Risk Reduction
2015 Sendai Japan



17 SDGs and 169 Targets



PARIS2015
UN CLIMATE CHANGE CONFERENCE
COP21·CMP11

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JAXA **JAXA's Activities for SDGs**

Vision

1. Provide solutions to issues using space technologies
2. Provide rationale for decision making (define role of satellites in the SDG Indicator framework)

↓

Working through EO communities

- Group on Earth Observations (GEO)
- Committee on Earth Observation Satellites (CEOS)

Partnership with non-space communities

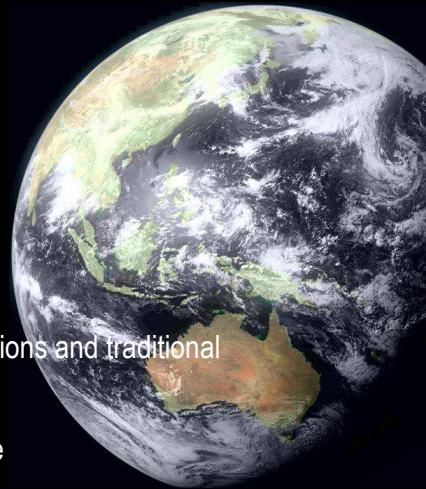
- JICA, JST
- WB, ADB
- UNSC, WGGI
- NSO

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Features of Satellite Earth Observations

A number of common characteristics are driving satellite-based Earth observation demand in support of global governance and derivation of Indicator information:

- Scale
- Long time series and continuity
- Consistency and comparability
- Diversity of measurements
- Complementarity with in-situ observations and traditional statistical methods
- Free and open data is on the increase



GROUP ON EARTH OBSERVATIONS

GEO and SDGs

GROUP ON EARTH OBSERVATIONS
SDG Initiative

THE GLOBAL GOALS
FOR SUSTAINABLE DEVELOPMENT

Sustainable Development Goals
GEO & Earth Observations in Service to *Agenda 2030*

Target										Goal	Indicator											
<small>Contribute to progress on the Target yet not the Indicator per se</small>											<small>Direct measure or indirect support</small>											
DRAFT										1.4	1.5	1	1.4.2									
				2.3	2.4	2.c	2	2.4.1														
			3.3	3.4	3.9	3.d	3	3.9.1														
						5.a	5	5.9.1	5.a.1													
6.1	6.3	6.4	6.5	6.6	6.a	6.b	6	6.3.2	6.4.2	6.5.1	6.6.1											
				7.2	7.3	7.a	7.b	7	7.1.1													
						8.4	8															
				9.1	9.4	9.5	9.a	9.1.1	9.4.1													
			10.6	10.7	10.8	10.a	10															
11.1	11.3	11.4	11.5	11.6	11.7	11.b	11.c	11.1.1	11.2.1	11.3.1	11.5.2	11.6.2	11.7.1									
			12.2	12.4	12.8	12.a	12.b	12.a.1														
				13.1	13.2	13.3	13.b	13.1.1														
14.1	14.2	14.3	14.4	14.6	14.7	14.a	14	14.3.1	14.4.1	14.5.1												
15.1	15.2	15.3	15.4	15.5	15.7	15.8	15.9	15.1.1	15.1.2	15.2.1	15.3.1	15.4.1	15.4.2									
						16.8	16															
17.2	17.3	17.6	17.7	17.8	17.9	17.16	17.17	17.18	17	17.6.1	17.18.1											

Alignment of Earth Obs. and GEO to the 17 Goals, 169 Targets, and 230 Indicators


SDGs with most opportunities:


6 CLEAN WATER AND SANITATION

11 SUSTAINABLE CITIES AND COMMUNITIES

14 LIFE BELOW WATER

15 LIFE ON LAND

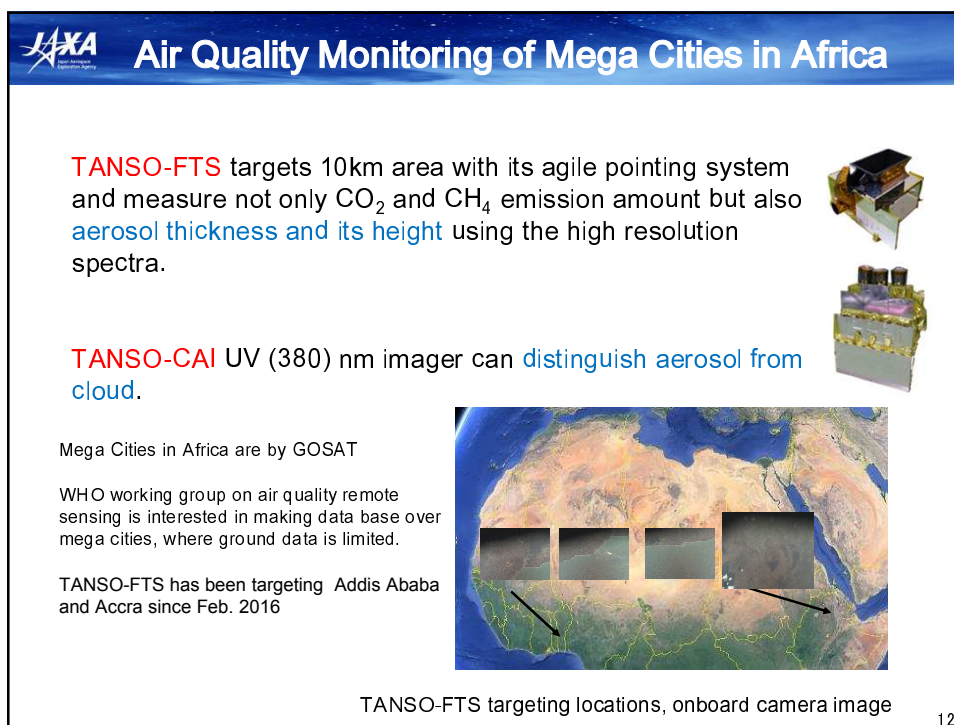
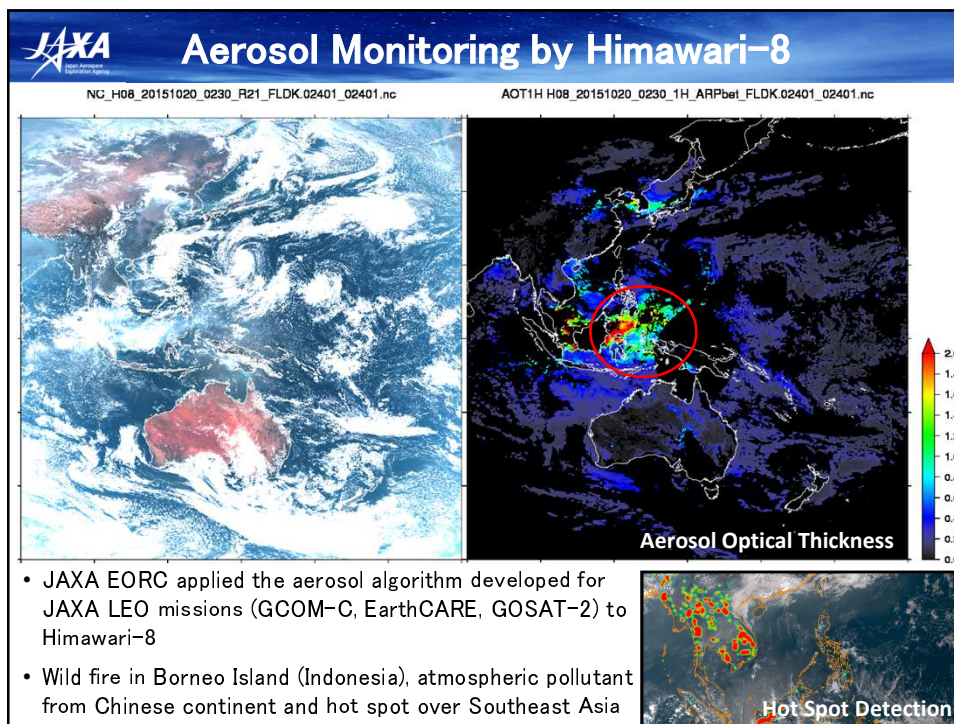
 SDG Indicators related to Cities				
Goals	Indicators	Tier	Custodian Agency	Domestic Ministry
Goal 3. Health	3.9.1 Mortality rate attributed to household and ambient air pollution	I	WHO	MHLW
Goal 6. Water	6.4.2 Level of water stress	II	FAO	MLIT
	6.5.1 Degree of integrated water resource management implementation	I	FAO	ditto
Goal 7. Energy	7.1.1 Population with access to electricity	I	WB	METI
Goal 9. Infrastructure, Industry	9.4.1 CO2 emission per unit of value added	I	UNIDO, IEA	MOE, CAO, METI, MLT
Goal 11. Cities	11.1.1 Urban population living in slums, informal settlements or inadequate housing	III	UN-Habitat	MHLW
	11.2.1 Population that has convenient access to public transport	II	UN-Habitat	MIC MLIT
	11.3.1 Ratio of land consumption rate to population growth rate	II	UN-Habitat	MLIT MAFF
	11.5.2 Direct disaster economic loss in relation to global GDP	II	UNISDR	CAO, FDMA, MLIT
	11.6.2 Annual mean levels of fine particulate matter (e.g. PM2.5 and PM10) in cities	I	WHO	MOE
	11.7.1 Average share of the built-up area of cities that is open space for public use	III	UN-Habitat	MLIT
Goal 13 Climate change	13.1.1 Number of countries with national and local disaster risk reduction strategies	II	UNISDR	CAO



Examples of EO data applications for Cities

- Air quality monitoring
- Precipitation monitoring
- Disaster damage assessment
- Land use and environment monitoring

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JAXA Global Satellite Mapping of Precipitation (GSMaP)


2015-10-20 00:00 - 00:59 (UTC) - MVK
 Rainfall by GSMaP IR Image (GJMA EUMETSAT/NOAA) Background Image by ADEOS-II/GLI

GSMaP (Global) observed Hurricane Patricia and Olaf, and Typhoon Champi: 20-24 Oct. 2015, hourly animation

- Global rainfall map merging GPM Core Observatory, polar orbiting microwave radiometer/sounders, and geostationary infrared radiometers.

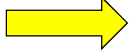
JAXA Global Rainfall Watch (4-hr delay) : <http://sharaku.eorc.jaxa.jp/GSMaP>
 JAXA Realtime Rainfall Watch (Himawari-area) : http://sharaku.eorc.jaxa.jp/GSMaP_NOW


JAXA Disaster Damage Assessment in Tacloban city



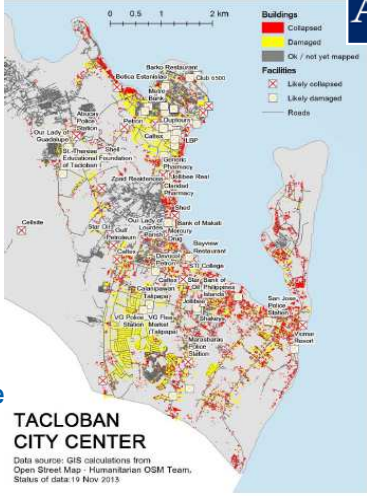
Base maps
(Layers of houses, infrastructure, roads, etc.)

GIS Analysis





Damaged infrastructure by visual check of satellite imagery



TACLOBAN CITY CENTER
 Data source: GIS calculations from Open Street Map - Humanitarian OSM Team.
 Status of data: 19 Nov 2013.

1. Number of damaged infrastructure
2. Damaged infrastructure maps

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Land Deformation : 2015 Nepal Earthquake

- The deformation area extended more than 100 km from north to south.
- The land around the central Kathmandu moved toward the satellite about 1 meter.
- Several local displacements detected around Kathmandu

Interferogram obtained by ALOS-2 PALSAR-2 data and In situ photo

(1) Wide observation mode (350 km swath, Apr. 5/May 3)
 (2) High resolution mode (70 km swath, Feb. 21/May 2) : Map data © OpenStreetMap Contributors
 (3) Photo taken on May 1. Courtesy of the investigation team of the Japan Society of Civil Engineers, Japanese Geotechnical Society, and Japan Association of Earthquake Engineering.)

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Infrastructure Monitoring

Big

Application:
 Infra monitoring about airport runway, dam, levee, etc. (Cross-ministerial strategic innovation promotion program (SIP) in Japan) to provide irregularity (subsidence).

Technology:
 Detect elevation irregularity using Interferometric synthetic aperture radar of L-band SAR (InSAR)

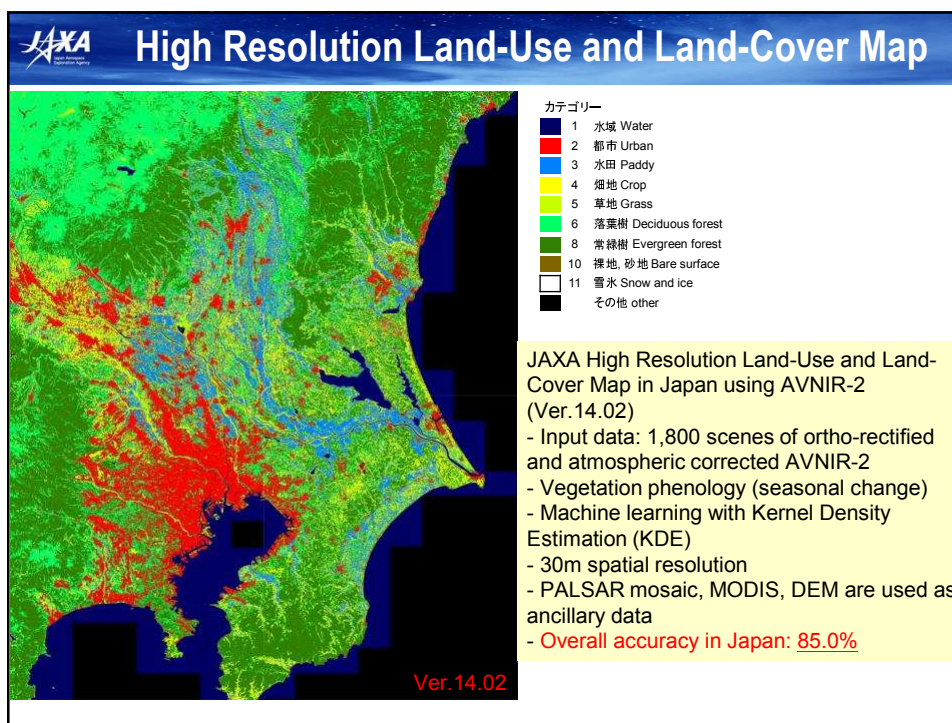
JAXA's Contribution:
 Can provide InSAR data, InSAR technology skill / advice to check irregularity using L-SAR.

Small

Irregularity check of Runway of airport (Application of subsidence)

Runway check was already validated at some airport located with related organization. And, dam and levee are also applied and verified now in Japan.

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JAXA Summary

- SDGs provide guidance for planning and monitoring city development.
- Space-based Earth observation has great potentials to contribute to implementation of various SDG Indicators for cities and solving its issues.
- JAXA would like to work with stake holders for city planning and monitoring, including the custodian agencies and NSO, to define the role of space technology.

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