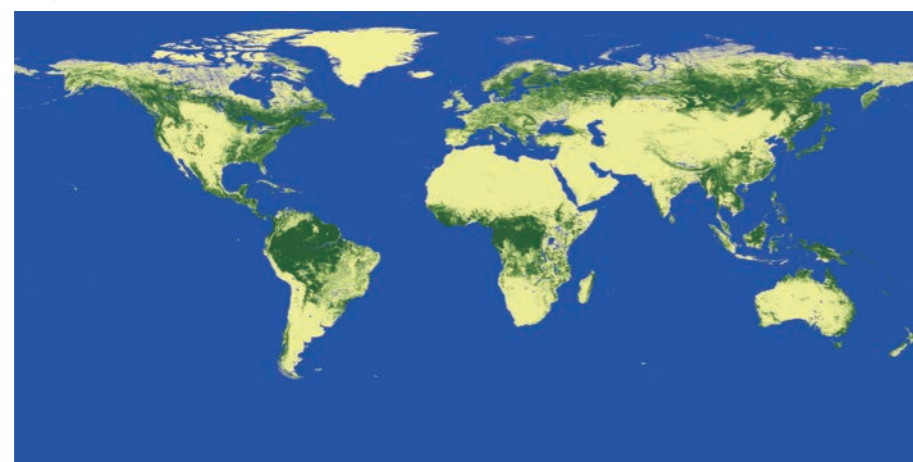


Information

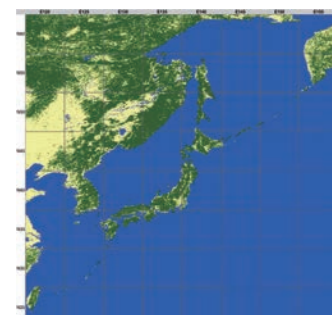
| | |
|--|---|
| Deliverables | <ul style="list-style-type: none"> Global mosaic SAR image data by PALSAR-2/PALSAR/JERS-1 (resolution 10m: 2007, 2009; 25m: 1996, 2007, 2008, 2009, 2010, 2014, 2015) Global forest/non-forest mosaic data by PALSAR-2/PALSAR (resolution 10m: 2007, 2009; 25m: 2007, 2008, 2009, 2010, 2014, 2015) High-accuracy SAR processing technologies Forest/non-forest analysis and processing technologies <p>URL http://www.eorc.jaxa.jp/ALOS/en/palsar_fnf/fnf_index.htm</p> |
| Quality (accuracy and other information) | <ul style="list-style-type: none"> Spatial resolution: 10m, 25m Radiometric accuracy: 1dB or less Geometric accuracy: 10m or less Forest/non-forest classification accuracy: Approximately 90% (forest classification standard: natural forest with an area larger than 0.5ha and forest cover over 10%) |
| Utilizations | Identifying areas of forest decrease or increase, reference for estimating forest biomass quantities, educational materials |
| Past usage in business and other fields | <ul style="list-style-type: none"> Applications to measurement, reporting, and verification (MRV) systems for REDD+ (scheduled) Applications to global maps by the International Steering Committee for Global Mapping (ISCGM) (scheduled) |
| Usage policy | <ul style="list-style-type: none"> Dataset with 10m spatial resolution is provided according to a license agreement for usage (fees apply) Dataset with 25m spatial resolution conforms to JAXA Standard Products (no cost) |
| Availability of customization | Display ranges can be customized (contact JAXA regarding forest classification analysis and processing customization) |
| Joint research institution(s) | — |

Specific examples



Global forest/non-forest map (2009)

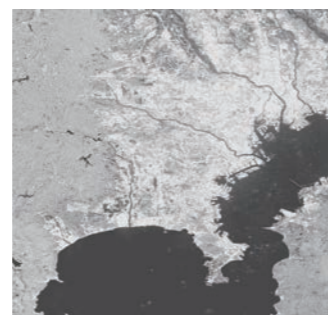
■ Forest ■ Non-forest



Near Japan (forest/non-forest)



Near Tokyo (forest/non-forest)



Near Tokyo (SAR mosaic/HH-polarization)

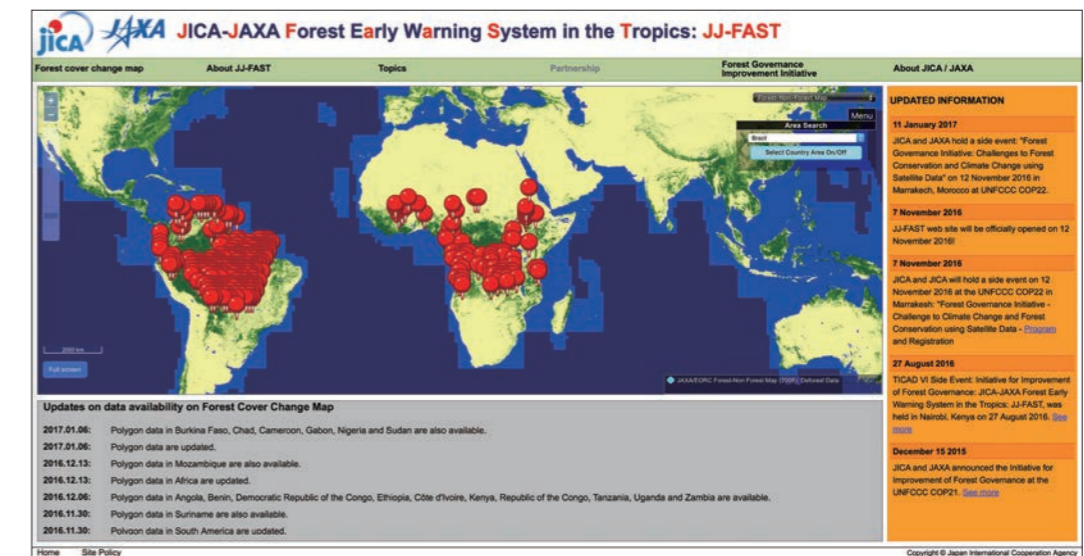
* User registration/download
http://www.eorc.jaxa.jp/ALOS/en/palsar_fnf/fnf_index.htm

* JAXA Let's SAR (free PALSAR analysis software)
http://www.eorc.jaxa.jp/ALOS-2/en/doc/pal2_tool.htm

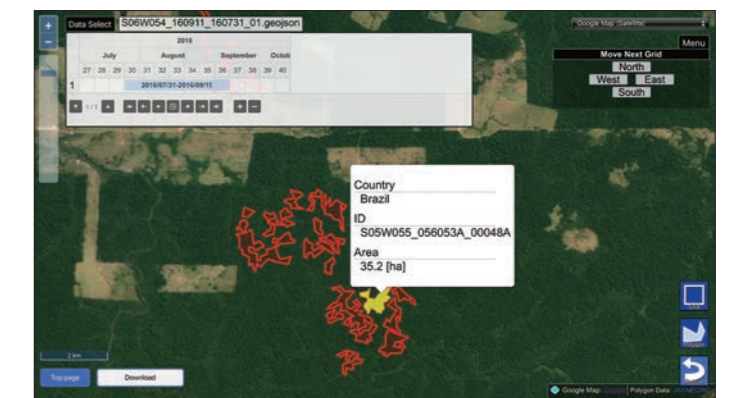
Information

| | |
|--|---|
| Deliverables | <ul style="list-style-type: none"> Near-real-time monitoring system for illegal logging using observation data from ALOS and ALOS-2 The user can download tile image data for forest change regions and KML and shapefile data for change regions <p>URL http://www.eorc.jaxa.jp/jjfast/</p> |
| Quality (accuracy and other information) | <ul style="list-style-type: none"> Minimum area of detection: 5ha * Will support areas smaller than 5ha in the future Detection accuracy: Currently being evaluated Update frequency: Once every 1.5 months Supported regions: South America, Africa * Supported areas will be gradually expanded to Central America and Asia |
| Utilizations | <ul style="list-style-type: none"> Early-stage detection of illegal forest logging Understanding of changes in forest resources |
| Past usage in business and other fields | This system is operated as one facet of the JICA-JAXA Initiative for Improvement of Forest Governance |
| Usage policy | <ul style="list-style-type: none"> Free for research and educational purposes only A credit stating "©JICA/©JAXA" is required when using the data as-is or after re-processing |
| Availability of customization | — |
| Joint research institution(s) | JICA (research contracted by JICA to JAXA) |

Specific examples



JJ-FAST top page

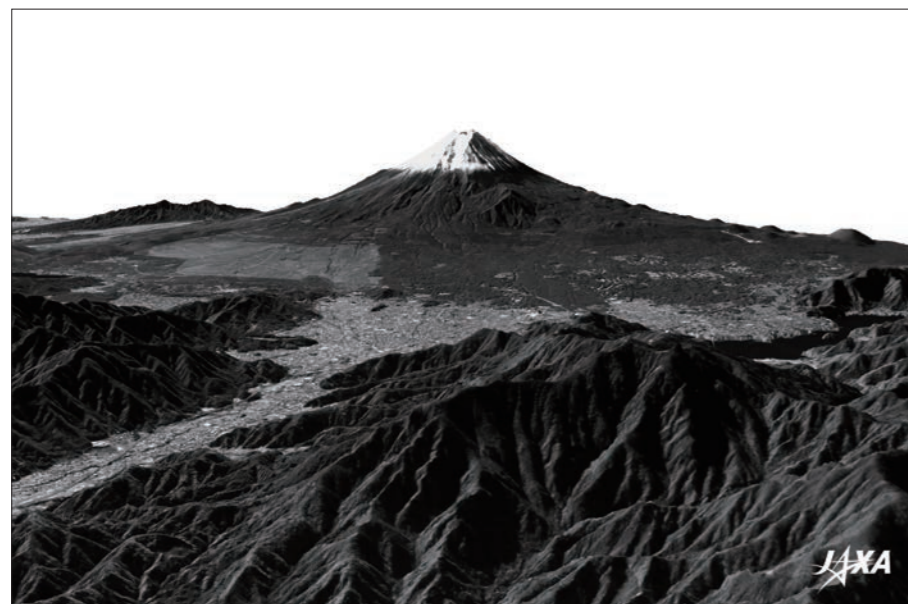


Example change map

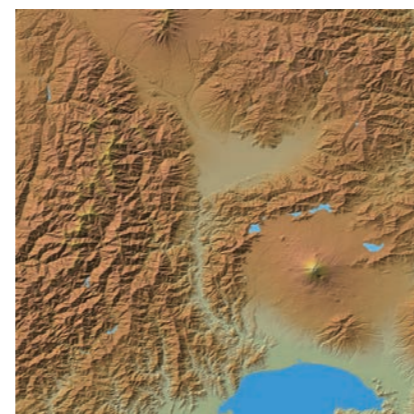
Information

| | | | | | | | | | |
|--|--|----------------|--------------------|--|---|--|--|--|--|
| Deliverables | Digital surface model for the global land surface with optional ortho-rectified images utilizing approximately three million data images observed by PRISM onboard ALOS * Using PRISM archive data Free version URL http://www.eorc.jaxa.jp/ALOS/en/aw3d30/index.htm | | | | | | | | |
| Quality (accuracy and other information) | <table border="0"> <tr> <td>[Paid version]</td> <td>[Free version DSM]</td> </tr> <tr> <td>• Spatial resolution: DSM equivalent of 5m, ortho image equivalent of 2.5m</td> <td>• Spatial resolution: DSM equivalent of 30m</td> </tr> <tr> <td>• Target accuracy: Horizontal 5m, vertical 3.5m (RMSE)</td> <td>• Target accuracy: Horizontal 5m, vertical 4.4m (RMSE)</td> </tr> <tr> <td>• Coverage: Nearly all land areas across the globe</td> <td>• Coverage: Nearly all land areas across the globe</td> </tr> </table> | [Paid version] | [Free version DSM] | • Spatial resolution: DSM equivalent of 5m, ortho image equivalent of 2.5m | • Spatial resolution: DSM equivalent of 30m | • Target accuracy: Horizontal 5m, vertical 3.5m (RMSE) | • Target accuracy: Horizontal 5m, vertical 4.4m (RMSE) | • Coverage: Nearly all land areas across the globe | • Coverage: Nearly all land areas across the globe |
| [Paid version] | [Free version DSM] | | | | | | | | |
| • Spatial resolution: DSM equivalent of 5m, ortho image equivalent of 2.5m | • Spatial resolution: DSM equivalent of 30m | | | | | | | | |
| • Target accuracy: Horizontal 5m, vertical 3.5m (RMSE) | • Target accuracy: Horizontal 5m, vertical 4.4m (RMSE) | | | | | | | | |
| • Coverage: Nearly all land areas across the globe | • Coverage: Nearly all land areas across the globe | | | | | | | | |
| Utilizations | Map production and updating (up to scale of roughly 1:12,500), infrastructure improvement, disaster prevention, resource surveying, transportation field, communications field, etc. | | | | | | | | |
| Past usage in business and other fields | National Spatial Data Infrastructure (NSDI) information in various countries, overseas expansion and overseas aid projects by domestic private enterprises | | | | | | | | |
| Usage policy | <ul style="list-style-type: none"> The paid version is sold for commercial usage by business operators (e-mail: aw3d@kits.nttdata.co.jp or data@restec.or.jp) The free version conforms to JAXA Standard Products (e-mail: aproject@jaxa.jp) | | | | | | | | |
| Availability of customization | Not available (can be customized by the user) | | | | | | | | |
| Joint research institution(s) | NTT DATA Corporation, Remote Sensing Technology Center of Japan | | | | | | | | |

Specific examples

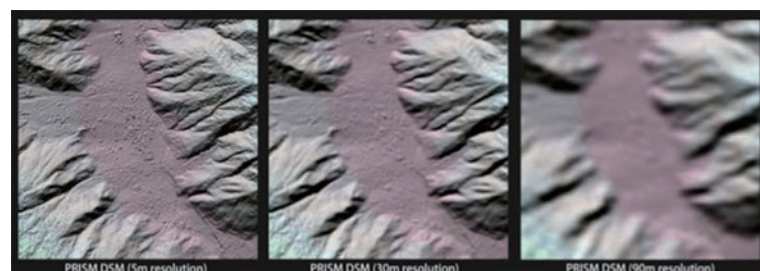


Digital 3D map image example: Mt. Fuji



Released dataset thumbnails (resolution equivalent of 180m, the black color is a cloud mask)

<http://www.eorc.jaxa.jp/ALOS/en/aw3d30/index.htm>



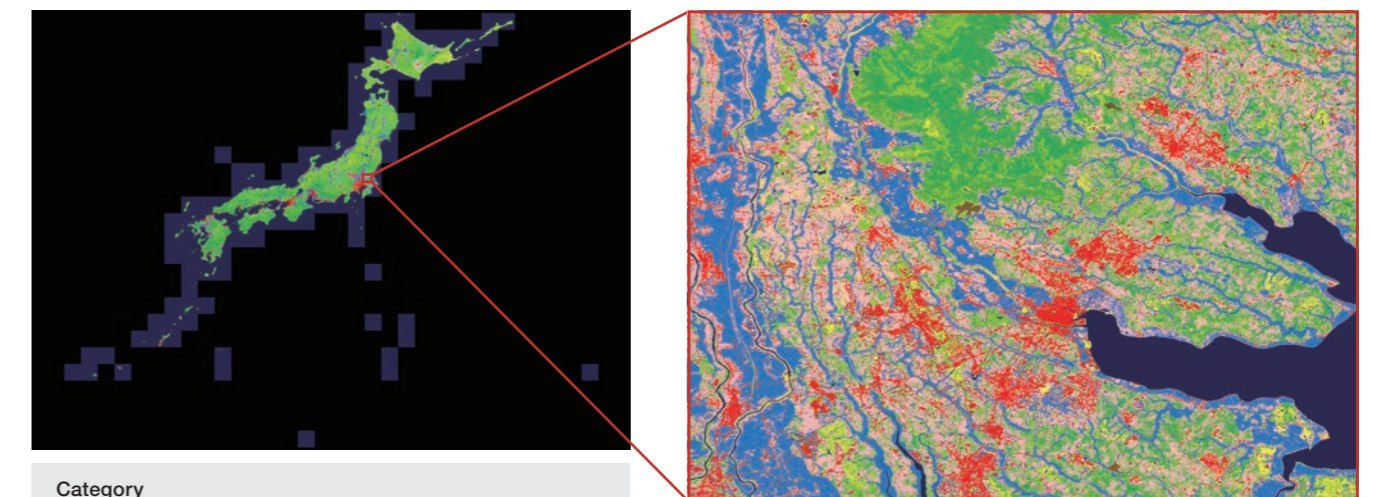
Example of ALOS World 3D (AW3D) (Left: 5m resolution, center and right: simulated DSMs with 30m and 90m resolutions for reference)

http://www.eorc.jaxa.jp/ALOS/en/aw3d/index_e.htm

Information

| | | | | | | | | | |
|--|---|-------------------------------------|-----------------------------------|---------------------------|---------------------------|--|---|----------------------------------|---|
| Deliverables | <ul style="list-style-type: none"> Land-use and land-cover maps of all areas in Japan produced using observation data mainly from AVNIR-2 (onboard ALOS) from 2006 to 2011 Land-use and land-cover maps of northern Vietnam produced using data from multiple satellites in 2007 and 2015 (Landsat, ASTER, PALSAR, and PALSAR-2 mosaics, etc.) URL http://www.eorc.jaxa.jp/ALOS/en/lulc/lulc_index.htm | | | | | | | | |
| Quality (accuracy and other information) | <table border="0"> <tr> <td>[All areas in Japan: Version 16.09]</td> <td>[Northern Vietnam: Version 16.09]</td> </tr> <tr> <td>• Spatial resolution: 10m</td> <td>• Spatial resolution: 10m</td> </tr> <tr> <td>• Classification categories: 1) water, 2) urban, 3) paddy, 4) crop field, 5) grass land, 6) deciduous broad-leaved tree, 7) deciduous coniferous tree, 8) evergreen broad-leaved tree, 9) evergreen coniferous tree, 10) bare land, 11) snow and ice</td> <td>• Classification categories: 1) water, 2) urban, 3) paddy, 4) crop field, 5) grass land, 6) orchard, 7) bare land, 8) forest, 9) mangrove</td> </tr> <tr> <td>• Classification accuracy: 78.0%</td> <td>• Classification accuracy: 81.3% (2007), 89.1% (2015)</td> </tr> </table> | [All areas in Japan: Version 16.09] | [Northern Vietnam: Version 16.09] | • Spatial resolution: 10m | • Spatial resolution: 10m | • Classification categories: 1) water, 2) urban, 3) paddy, 4) crop field, 5) grass land, 6) deciduous broad-leaved tree, 7) deciduous coniferous tree, 8) evergreen broad-leaved tree, 9) evergreen coniferous tree, 10) bare land, 11) snow and ice | • Classification categories: 1) water, 2) urban, 3) paddy, 4) crop field, 5) grass land, 6) orchard, 7) bare land, 8) forest, 9) mangrove | • Classification accuracy: 78.0% | • Classification accuracy: 81.3% (2007), 89.1% (2015) |
| [All areas in Japan: Version 16.09] | [Northern Vietnam: Version 16.09] | | | | | | | | |
| • Spatial resolution: 10m | • Spatial resolution: 10m | | | | | | | | |
| • Classification categories: 1) water, 2) urban, 3) paddy, 4) crop field, 5) grass land, 6) deciduous broad-leaved tree, 7) deciduous coniferous tree, 8) evergreen broad-leaved tree, 9) evergreen coniferous tree, 10) bare land, 11) snow and ice | • Classification categories: 1) water, 2) urban, 3) paddy, 4) crop field, 5) grass land, 6) orchard, 7) bare land, 8) forest, 9) mangrove | | | | | | | | |
| • Classification accuracy: 78.0% | • Classification accuracy: 81.3% (2007), 89.1% (2015) | | | | | | | | |
| Utilizations | Research and practical utilization for land management, vegetation surveys, forest management, landslide disaster surveys, food security, ecosystems, and other fields; education | | | | | | | | |
| Past usage in business and other fields | Disaster simulations by private enterprises, textbooks, publications, etc. | | | | | | | | |
| Usage policy | JAXA products: Free for research and educational purposes and individual usage | | | | | | | | |
| Availability of customization | Not available (can be customized by the user) | | | | | | | | |
| Joint research institution(s) | Tsukuba University | | | | | | | | |

Specific examples



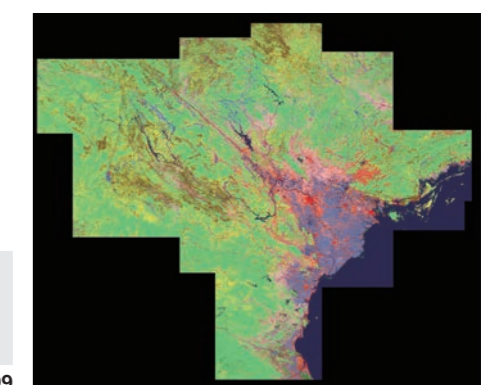
| Category | |
|-------------------------------|-------------------------------|
| 1 Water | 7 Deciduous coniferous tree |
| 2 Urban | 8 Evergreen broad-leaved tree |
| 3 Paddy | 9 Evergreen coniferous tree |
| 4 Crop field | 10 Bare land |
| 5 Grass land | 11 Snow and ice |
| 6 Deciduous broad-leaved tree | |

Land cover near Tsukuba and Tsuchiura Cities

High Resolution Land-Use and Land-Cover Map Products of all areas in Japan : Version 16.09
http://www.eorc.jaxa.jp/ALOS/en/lulc/lulc_index.htm (Japanese only)

| Category | | |
|----------|--------------|-------------|
| 1 Water | 4 Crop field | 7 Bare land |
| 2 Urban | 5 Grass land | 8 Forest |
| 3 Paddy | 6 Orchard | 9 Mangrove |

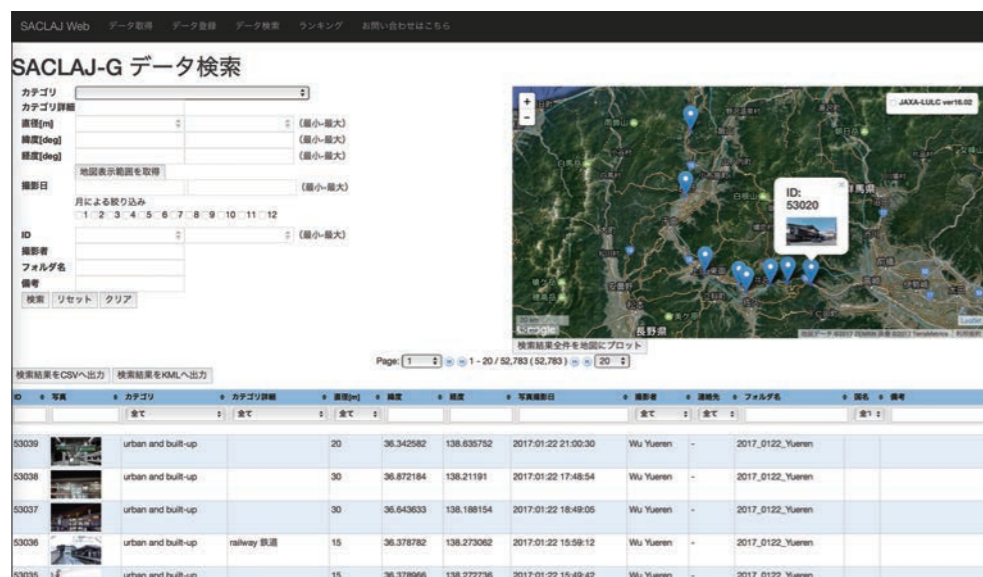
High Resolution Land-Use and Land-Cover Map Products of Northern Vietnam: Version 16.09



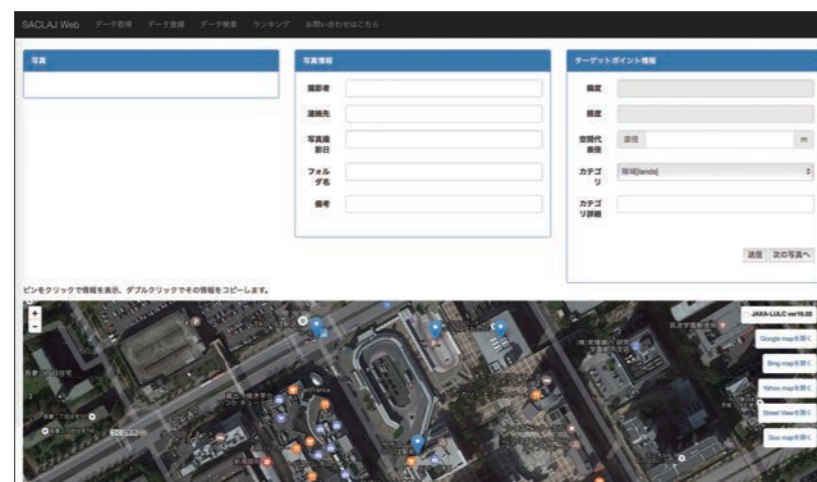
Information

| | |
|--|--|
| Deliverables | <ul style="list-style-type: none"> 4D reference data (training data/verified information) dataset for land-cover maps Reference data posting and sharing system |
| Quality (accuracy and other information) | <ul style="list-style-type: none"> SACLAJ_Gref (Ground photos): On-site photograph-based reference data with clear shooting dates for each image SACLAJ_Rref (Remote sensing data): Satellite image interpretation-based reference data that enables wide-area coverage including hard-to-access areas, overseas locations, etc. |
| Utilizations | Sharing of reference data for producing land-cover maps, satellite product verification |
| Past usage in business and other fields | — |
| Usage policy | Must participate in the JAXA Land-Cover Community or complete user registration (for non-commercial purposes) E-mail: aproject@jaxa.jp |
| Availability of customization | — |
| Joint research institution(s) | University of Tsukuba |

Specific examples



SACLAJ Web data search screen (list display)

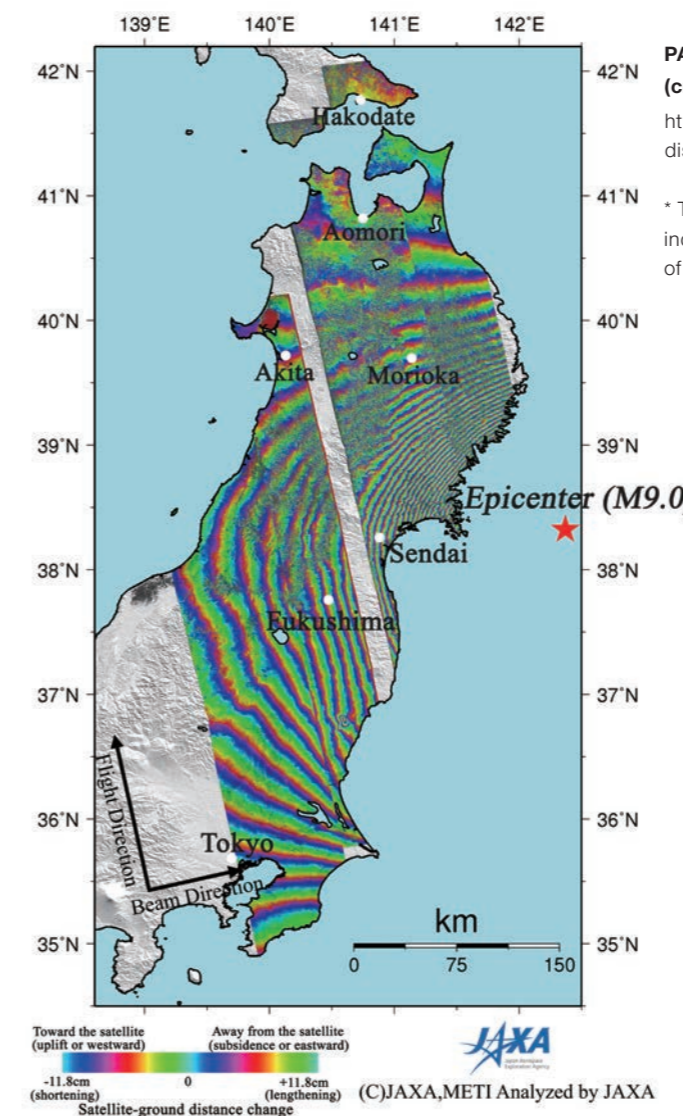


SACLAJ Web on-site data registration screen example

Information

| | |
|--|--|
| Deliverables | SAR interferometry images and SAR interferometry algorithms for L-band Synthetic Aperture Radar |
| Quality (accuracy and other information) | <ul style="list-style-type: none"> Accuracy: The target is around 3cm for crustal displacement amount, excluding atmospheric and ionospheric conditions 8m height accuracy (DEM generation) of ALOS/PALSAR data has been verified Spatial resolution: Depends on the average sample number, but generally 30m |
| Utilizations | Infrastructure management, disaster prevention, investigating crustal deformation and land subsidence (including time series analysis), DEM generation, deforestation research |
| Past usage in business and other fields | Provision of analysis software for research purposes (Meteorological Research Institute/Japan Meteorological Agency, National Institute for Land and Infrastructure Management [Japan], PIXEL researchers) |
| Usage policy | Can be used through contracted or joint research |
| Availability of customization | Contact JAXA |
| Joint research institution(s) | — |

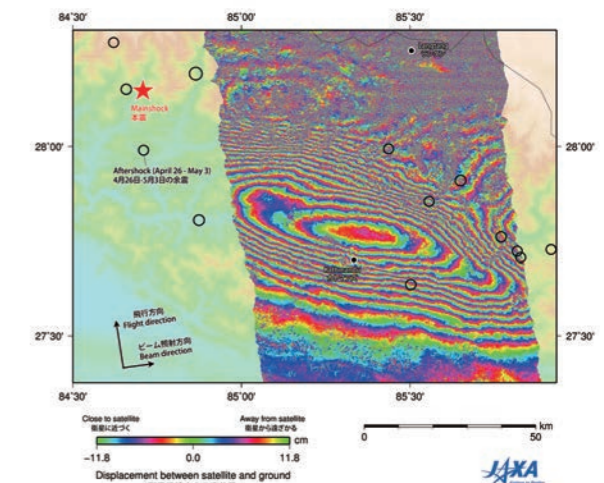
Specific examples



PALSAR differential interferogram (crustal deformation)

http://www.eorc.jaxa.jp/ALOS/en/img_up/dis_pal_tohokueq_110401-06.htm

* The color changes from blue to red, yellow, green, and back to blue indicate an extension (and an opposite pattern indicates a shortening) of the satellite-ground distance. One color cycle is equal to 11.8cm.



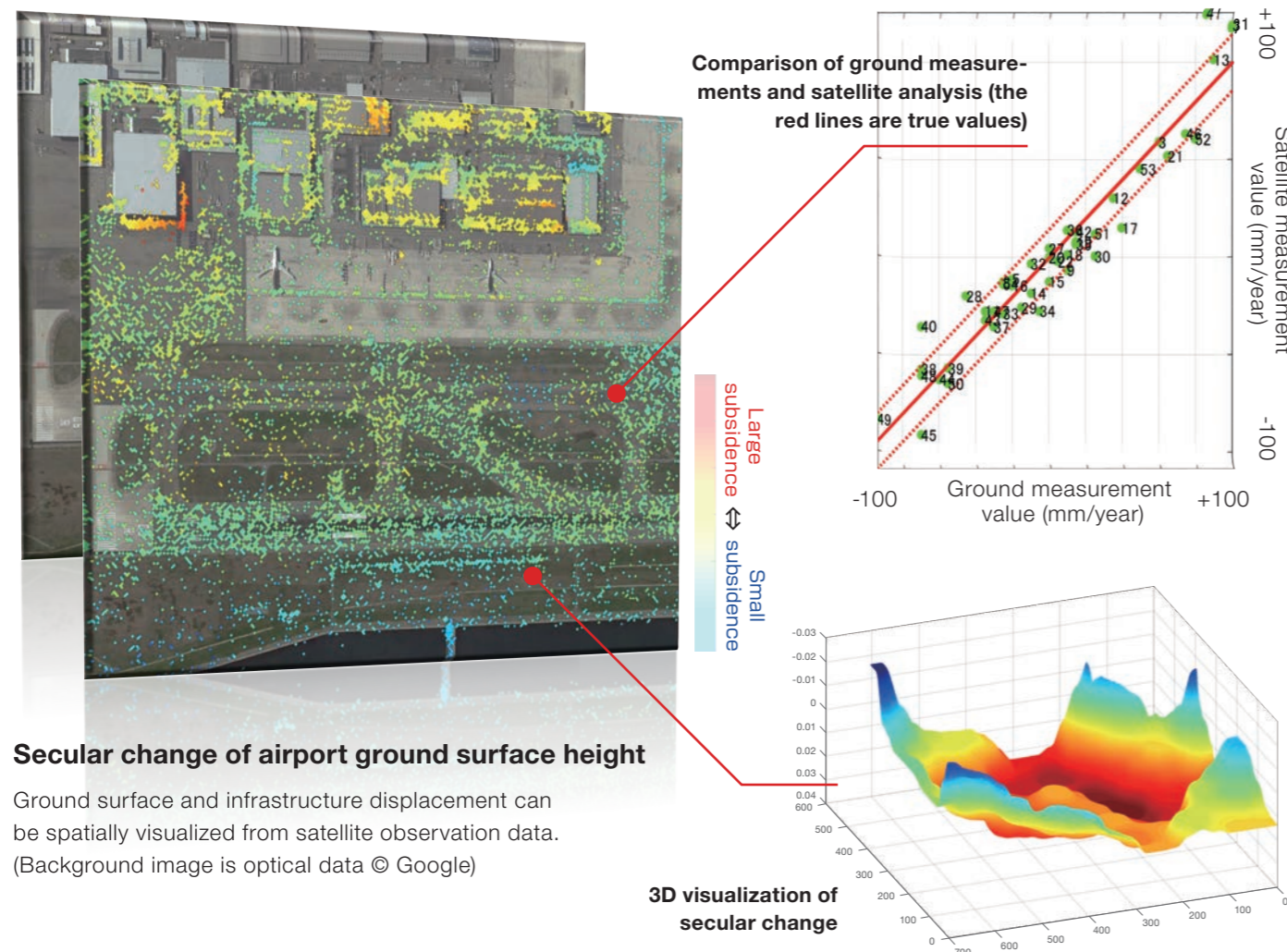
Interferogram obtained by the analysis of the ALOS-2 PALSAR-2 data acquired before (Feb. 21) and after (May 2) the earthquake in Nepal

http://www.eorc.jaxa.jp/ALOS-2/en/img_up/dis_pal2_npl-eq_20150502.htm

Information

| | |
|--|--|
| Deliverables | This algorithm utilizes SAR interferometry time-series analysis to measure small-scale displacement of land surface items and infrastructure over a wide area |
| Quality (accuracy and other information) | <ul style="list-style-type: none"> • Deformation speed accuracy: Around 10 – 100mm/year *1 • Spatial resolution: Around 3m – 50m *1 • Measurement targets: Small changes to the ground surface during the observation period *2 <p>*1 Depends on SAR data and measurement target used. The accuracy error for the runway surface example below is 17mm/year. *2 Measurement is suspended due to ground level raising, ground surface improvement work, and new building construction during the observation period.</p> |
| Utilizations | Detecting small-scale displacement of infrastructure (infrastructure deterioration changes, building subsidence, etc.) Understanding ground deformation (oil fields, landslide disasters, urban development, crustal deformation, etc.) |
| Past usage in business and other fields | Empirical research with private enterprises |
| Usage policy | Can be used with the automatic analysis tool through contracted or joint research |
| Availability of customization | To be determined (empirical research is underway) |
| Joint research institution(s) | JAXA researched and developed the algorithm. Usage research is conducted with the Infrastructure Development Institute-Japan; Penta-Ocean Construction Co. Ltd.; and Nippon Koei Co., Ltd. |

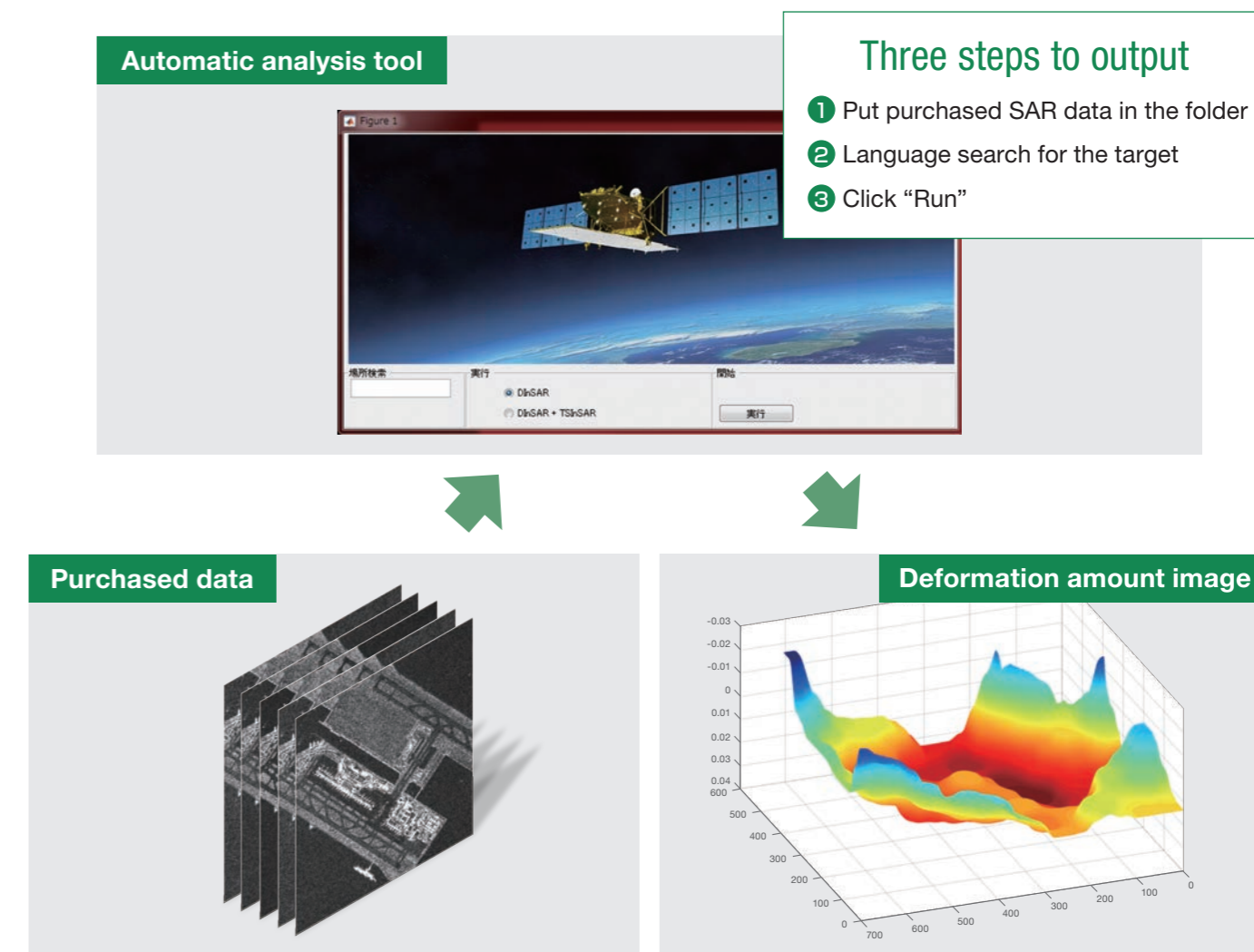
Specific examples



Information

| | |
|--|---|
| Deliverables | This product performs automatic SAR interferometry time-series analysis to output small-scale displacement of land surface items and infrastructure |
| Quality (accuracy and other information) | <p>The output result accuracy depends on the the SAR data and analysis subject used. Operating environment: Commercially manufactured PC (Windows, 8GB or greater memory) Differences compared to existing tools:</p> <ul style="list-style-type: none"> • Full automation of the following settings required for processing settings Interference pair (satellite, sensor, mode) selection, data selection/adjustment for target analysis scope, downloading of required external data, various parameter settings, selection/conversion of target area scope in images • Easier operation of necessary settings Analysis target selection (latitude and longitude) by searching in natural language Intuitive operation with KML data for making minute adjustments to the target range |
| Utilizations | Support for displacement amount analysis by non-specialist users |
| Past usage in business and other fields | Empirical research is underway with private enterprises |
| Usage policy | Contact JAXA |
| Availability of customization | To be determined (empirical research is underway) |
| Joint research institution(s) | Developed by: JAXA / Verified by: JAXA, Kyoto University, private enterprises |

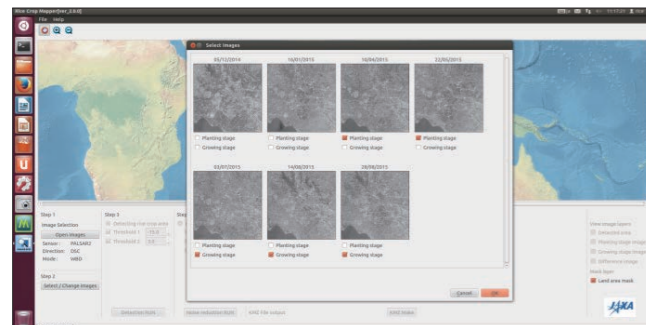
Specific examples



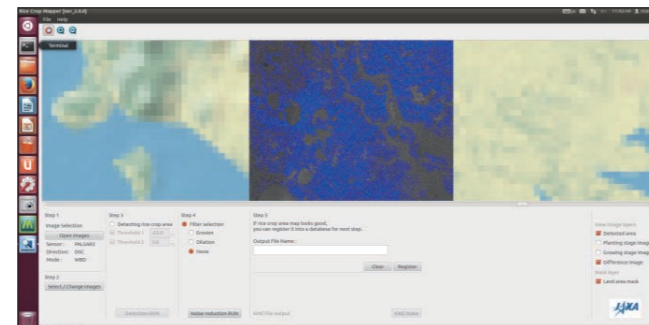
Information

| | |
|--|---|
| Deliverables | Synthetic Aperture Radar (ALOS PALSAR, ALOS-2 PALSAR-2) data from multiple time periods is used for easy operations to identify rice planting locations and estimate areas |
| Quality (accuracy and other information) | Detection accuracy of 80 – 90% at verification sites in Southeast Asia and Japan (Verification in Southeast Asia has been completed in Indonesia, Vietnam, Laos, the Philippines, and Thailand) |
| Utilizations | Producing agricultural statistics (rice crop planted area, production) * Input of yield data (harvest amount per area unit) is separately required for the estimation of production |
| Past usage in business and other fields | Used in Innovative Data Collection Methods for Agricultural and Rural Statistics, a technical cooperation project by the Asian Development Bank |
| Usage policy | Can be used through contracted or joint research. The Asian Development Bank will release online training materials including the results of the aforementioned project. |
| Availability of customization | Available (such as local customization) within joint research frameworks |
| Joint research institution(s) | Joint verification work is underway with government agencies in Indonesia, Thailand, Vietnam, Cambodia, Myanmar, etc. |

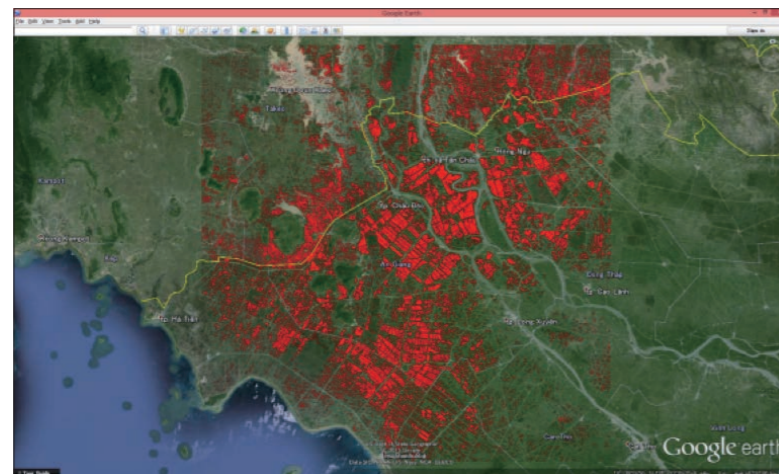
Specific examples



Choose the ALOS-2 images to use



Estimated rice-paddy planting locations (blue)

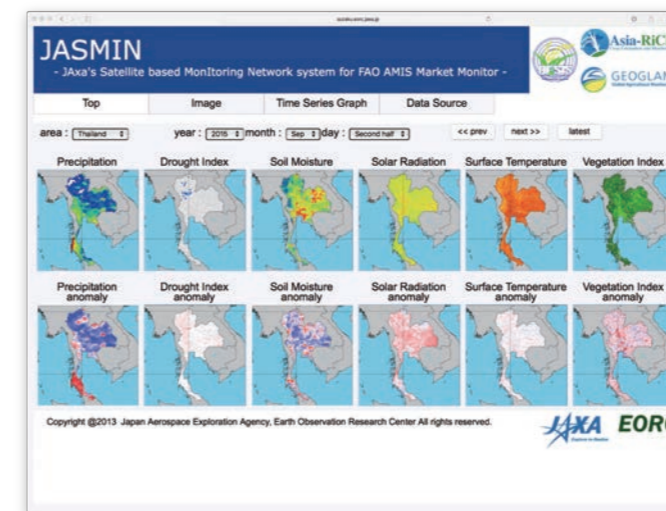


Output is available in a format (KMZ) that can be displayed in Google Earth (red is rice-paddy planting locations)

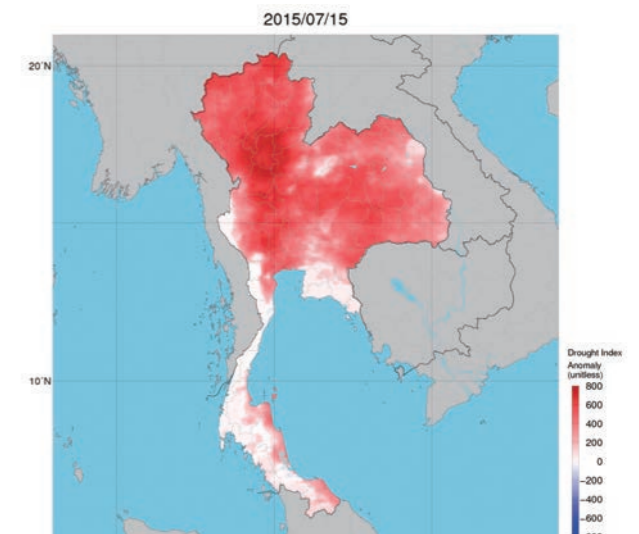
Information

| | |
|--|---|
| Deliverables | Agricultural weather data (soil moisture, solar radiation, precipitation, etc.) and crop growth status can be viewed online in near real time (updated every 15 days) |
| Quality (accuracy and other information) | Conforms to GSMaP and JASMES |
| Utilizations | Supplementary information for judging principal grain crop situations |
| Past usage in business and other fields | <ul style="list-style-type: none"> Overseas Food Supply and Demand Reports by the Ministry of Agriculture, Forestry and Fisheries Agriculture Market Information System (AMIS) Market Monitor (Food and Agriculture Organization [FAO]) |
| Usage policy | Conforms to JAXA Standard Products |
| Availability of customization | Available (such as local customization) within joint research frameworks |
| Joint research institution(s) | Drought indexes are joint research results with the University of Tokyo |

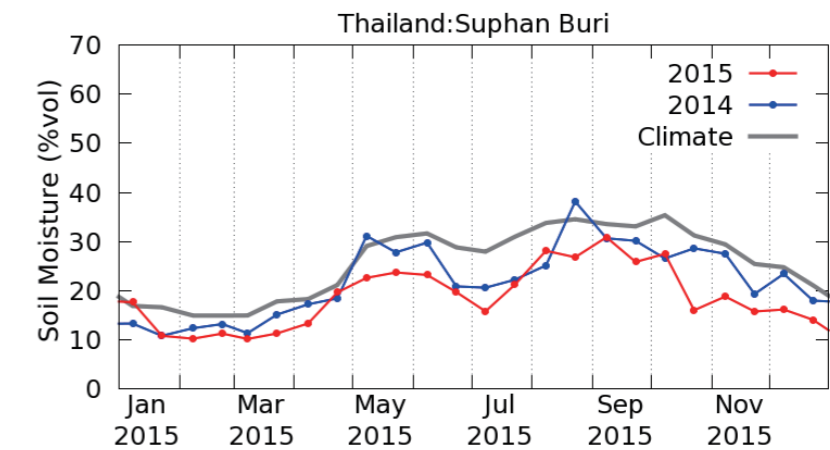
Specific examples



Example: Agrometeorological information display (Kingdom of Thailand)



Drought index deviation (Kingdom of Thailand)



Temporal change in soil moisture in Suphan Buri Province (Kingdom of Thailand)

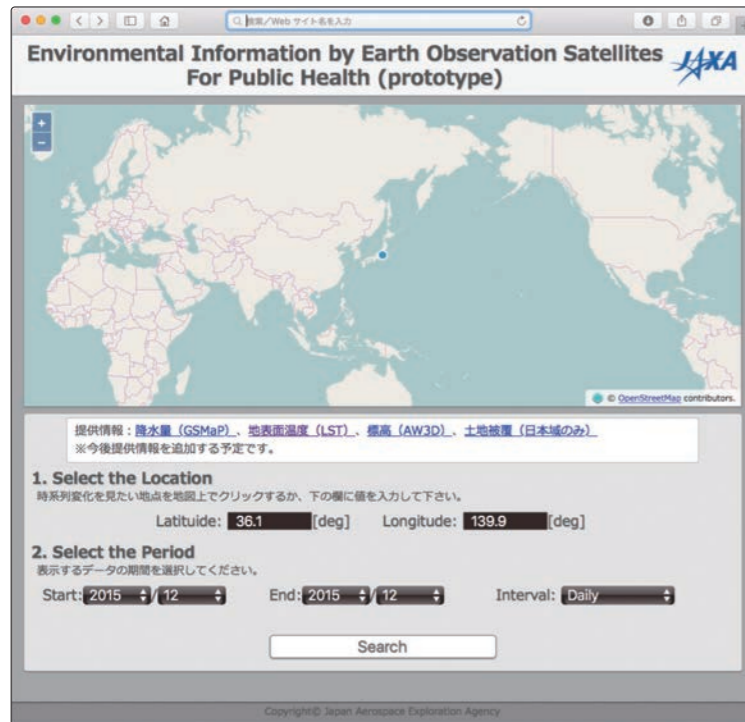
System customized for producing rice crop growing outlooks in Asia

http://suzaku.eorc.jaxa.jp/GCOM_W/JASM/index.html

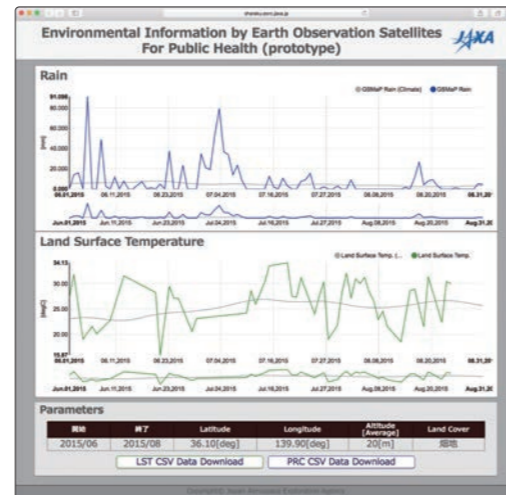
Information

| | |
|--|--|
| Deliverables | This website provides environmental information (rain, solar radiation, land surface temperature, etc.) for locations (latitude and longitude or country/administrative district such as municipality) and times specified by the user |
| Quality (accuracy and other information) | Conforms to GSMaP and JASMES |
| Utilizations | Environmental epidemiology, including the analysis of correlations between environmental conditions and illnesses |
| Past usage in business and other fields | Joint research with Japanese universities (including the analysis of relationships between environmental factors and the outbreak of infectious diseases and other illnesses in regions such as Southeast Asia and Africa) |
| Usage policy | Contact JAXA |
| Availability of customization | Available within joint research frameworks as much as possible technically |
| Joint research institution(s) | — |

Specific examples



Top page



Graph format (top image: rain, bottom image: land surface temperature)

```

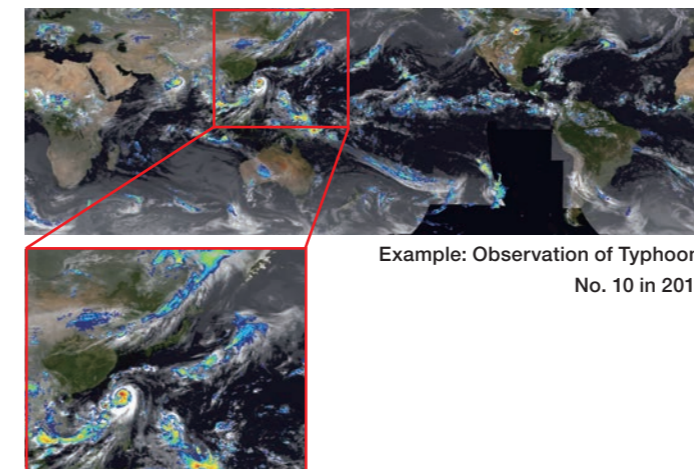
Date, Precipitation (mm), Average (2010-2015), Altitude (m), LandCoverFlag (4), Interval (daily)
2015/06/01, 0.00000, 0.238214
2015/06/02, 14.11780, 0.239943
2015/06/03, 15.96824, 0.234294
2015/06/04, 0.00000, 0.240892
2015/06/05, 91.09834, 0.244658
2015/06/06, 0.00000, 0.252910
2015/06/07, 0.00000, 0.257708
2015/06/08, 68.74785, 0.260890
2015/06/09, 45.61688, 0.261056
2015/06/10, 0.00000, 0.261128
2015/06/11, 11.79524, 0.260463
2015/06/12, 0.00000, 0.263420
2015/06/13, 7.78514, 0.264056
2015/06/14, 0.00000, 0.271851
2015/06/15, 0.00000, 0.283251
2015/06/16, 7.72185, 0.290881
2015/06/17, 1.30258, 0.301624
2015/06/18, 1.17048, 0.314177
2015/06/19, 1.10948, 0.320486
2015/06/20, 0.00000, 0.329841
2015/06/21, 4.80948, 0.334225
2015/06/22, 0.00000, 0.338532
2015/06/23, 11.19556, 0.339940
2015/06/24, 0.00000, 0.350974
2015/06/25, 0.00000, 0.372071
2015/06/26, 23.64399, 0.373533
2015/06/27, 0.00000, 0.373278
2015/06/28, 0.00000, 0.374493
2015/06/29, 0.00000, 0.370287
2015/06/30, 0.00000, 0.370702
2015/07/01, 21.02376, 0.390218
2015/07/02, 19.64848, 0.390625
2015/07/03, 52.88445, 0.392560
2015/07/04, 79.24832, 0.393644
2015/07/05, 34.74038, 0.391240
2015/07/06, 32.77805, 0.394953
2015/07/07, 14.08824, 0.397443
    
```

Text format (CSV format)

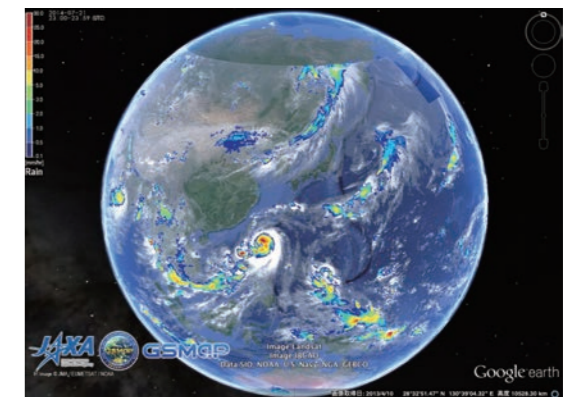
Information

| | |
|--|--|
| Deliverables | Global rainfall dataset using multiple satellites |
| Quality (accuracy and other information) | <ul style="list-style-type: none"> Variable: Rainfall rate (mm/hr) Grid resolution: 0.1 degree lat/lon (approximately 11km mesh near the equator) <p>[Near real-time version]</p> <ul style="list-style-type: none"> Domain: Global (60N - 60S) Temporal resolution: 1 hour (1 hour averaged rainfall) Update frequency: Every hour (available 4 hours after the end of observation; will be replaced by the standard version later) RMSE: 0.41mm/hr (average) <p>URL http://sharaku.eorc.jaxa.jp/GSMaP/index.htm</p> <p>[Real-time version]</p> <ul style="list-style-type: none"> Domain: Himawari (geostationary meteorological satellite) observation area Temporal resolution: 1 hour (one hour averaged rainfall) Update frequency: Every 30 minutes (available on a quasi real-time basis) RMSE: Same as, or slightly lower than the NRT version <p>URL http://sharaku.eorc.jaxa.jp/GSMaP_NOW/index.htm</p> |
| Utilizations | Weather, disasters, education, climate, environment, marine, agriculture (weather information websites, flood prediction and warning, scientific educational materials, crop production prediction, etc.) |
| Past usage in business and other fields | <ul style="list-style-type: none"> Japan Weather Association Pakistan project (contracted by UNESCO) Images are provided as content for Tangible Earth and World Eye (Gakken) Japan Water Agency Public Works Research Institute Infrastructure Development Institute-Japan Many uses in TV broadcasting, including news programs Posted on the Ogasawara Village website |
| Usage policy | JAXA Standard Products |
| Availability of customization | Available (such as local customization) within joint research frameworks |
| Joint research institution(s) | Algorithm improvement through joint research by JAXA, the Japanese Meteorological Agency, Kyoto University, Osaka University, and the University of Tokyo |

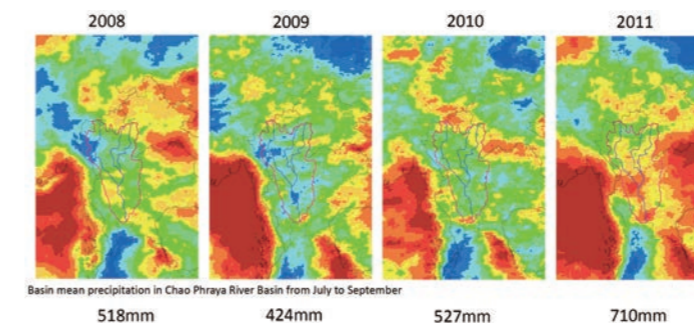
Specific examples



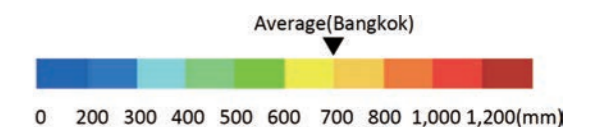
Example: Observation of Typhoon No. 10 in 2015



Example: Output in Google Earth



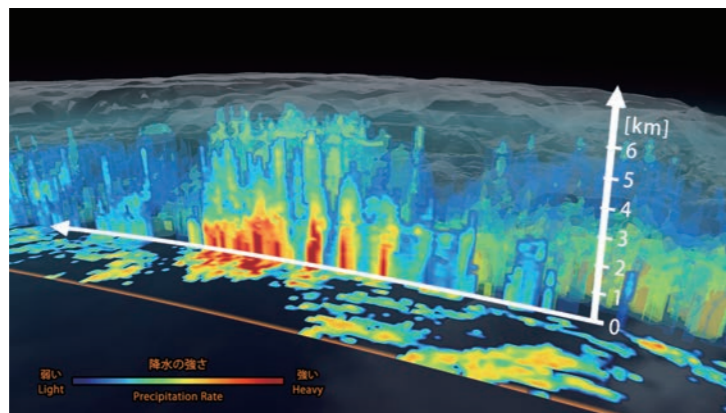
Example: Observation of 2011 flooding in Thailand (by the Infrastructure Development Institute) Accumulated rainfall over Chao Phraya River averaged from July to September in each year



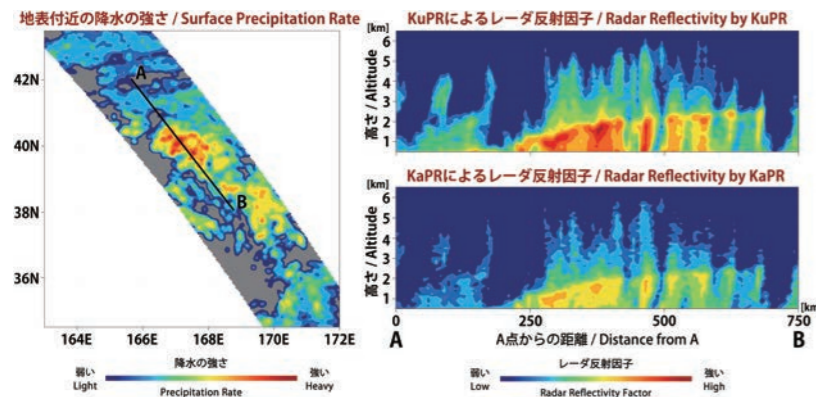
Information

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| Deliverables | 3D distribution of precipitation by GPM/DPR, radar reflectivity strength, precipitation type, bright band height, precipitation top height, etc.; extracted data from observation of typhoons (including cyclones and hurricanes); visualization images including 3D precipitation distribution videos * GPM/DPR products became available from September 2, 2014 |
| Quality (accuracy and other information) | <ul style="list-style-type: none"> Physical quantities: 3D precipitation amount, radar reflectivity intensity, etc. Spatial resolution: 5.2km (horizontal), 250/500m (vertical) RMSE: Difference of 20% or less for data release request accuracy (precipitation intensity difference of around ±50% at the earth's surface by DPR and TRMM/PR) |
| Utilizations | Weather, disasters, education, climate, environment, ocean (weather forecasting, climate model verification, precipitation climatology, typhoon information monitoring, scientific educational materials, etc.) |
| Past usage in business and other fields | <ul style="list-style-type: none"> Currently used at the Japan Meteorological Agency, universities, etc. JAXA/EORC Real-Time Monitoring for Tropical Cyclones (frequently and popularly accessed) provides images from July 2014. Images and movies are broadcast on TV, including NHK. |
| Usage policy | JAXA Standard Products |
| Availability of customization | Available in joint research frameworks, such as data extraction |
| Joint research institution(s) | <ul style="list-style-type: none"> Sensor development by JAXA and the National Institute of Information and Communications Technology (NICT) Onboard satellite (GPM primary satellite) development by JAXA and NASA Algorithm development by a joint Japan-U.S. team (JAXA, NICT, Nagasaki University, Tokai University, NASA, Colorado State University, etc.) |

Specific examples



3D precipitation distribution by DPR (JAXA/NASA)

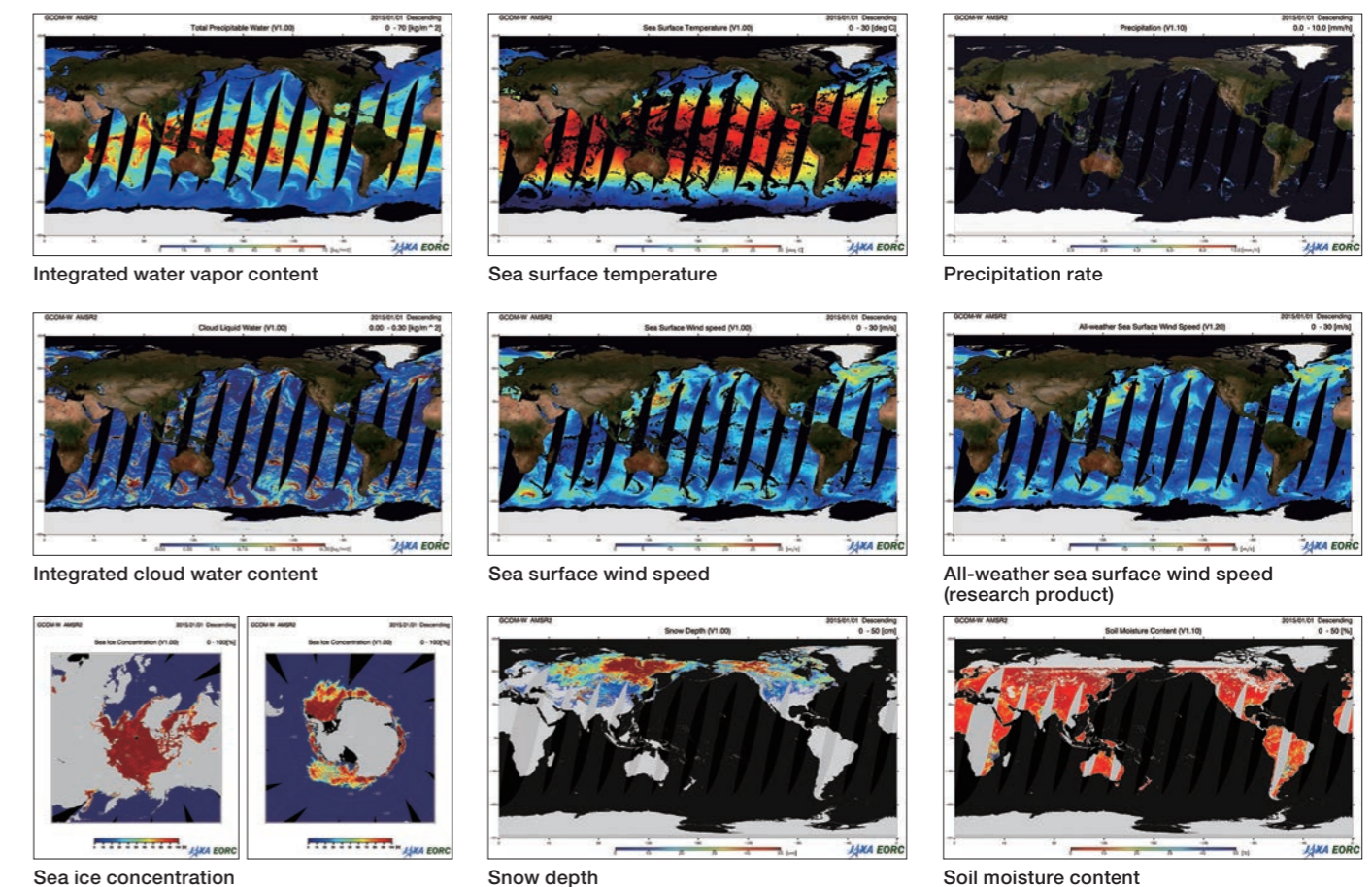


Difference in observations with two DPR frequencies. Left: Precipitation intensity distribution at the earth's surface by DPR. Right: Vertical cross section of radar reflectivity intensity by Ku band (13.6GHz) (top), and vertical cross section of radar reflectivity strength by Ka band (35.5GHz) (bottom), along the black line (AB) from the left image. The horizontal axis shows the distance from point A in the left image, and the left axis shows the altitude (km). The Ku band is suitable for observing strong rain, while the Ka band has the characteristic of being able to observe light rain and snow. By combining observations from these two bands, it is possible to obtain 3D distributions from strong rain to snow.

Information

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| Deliverables | Various types of geophysical parameters that relate to water cycle variations are calculated from AMSR2 data (onboard the GCOM-W) URL [Standard Products] https://gcom-w1.jaxa.jp/ [Research Products] http://suzaku.eorc.jaxa.jp/GCOM_W/research/resdist.html * AMSR2 products have been open to the public since January 25, 2013 |
| Quality (accuracy and other information) | <ul style="list-style-type: none"> See the above URL for details of geophysical parameters, regions, spatial resolution, and accuracy Observation frequency depends on latitudes. The Equatorial region is mostly covered in two days. The polar regions can be observed multiple times in one day. The near real-time product is provided after approximately 150 minutes of observation, and the standard product after one day. |
| Utilizations | Weather, disasters, education, climate, environment, ocean, agriculture, weather forecast, Arctic sea ice monitoring for the Northern Shipping Route, ocean monitoring including the Kuroshio Current, fishing ground information, large-scale crop situations, development of educational materials |
| Past usage in business and other fields | <ul style="list-style-type: none"> Japanese Meteorological Agency (numerical weather forecasts, sea surface water temperature, typhoons, etc.) Japan Coast Guard (quick bulletins of sea ice and ocean conditions, etc.) Ministry of Agriculture, Forestry and Fisheries (<i>Overseas Food Supply and Demand Reports</i>) NOAA, ECMWF (various types of meteorological services) WEATHERNEWS INC. (sea ice prediction business) Japan Fisheries Information Service Center (fishing ground and ocean condition information) |
| Usage policy | JAXA Standard Products |
| Availability of customization | Available within joint research frameworks as much as possible technically |
| Joint research institution(s) | Joint development, improvement, and verification of algorithms with universities and other institutions for each product |

Specific examples



Integrated water vapor content

Sea surface temperature

Precipitation rate

Integrated cloud water content

Sea surface wind speed

All-weather sea surface wind speed (research product)

Sea ice concentration

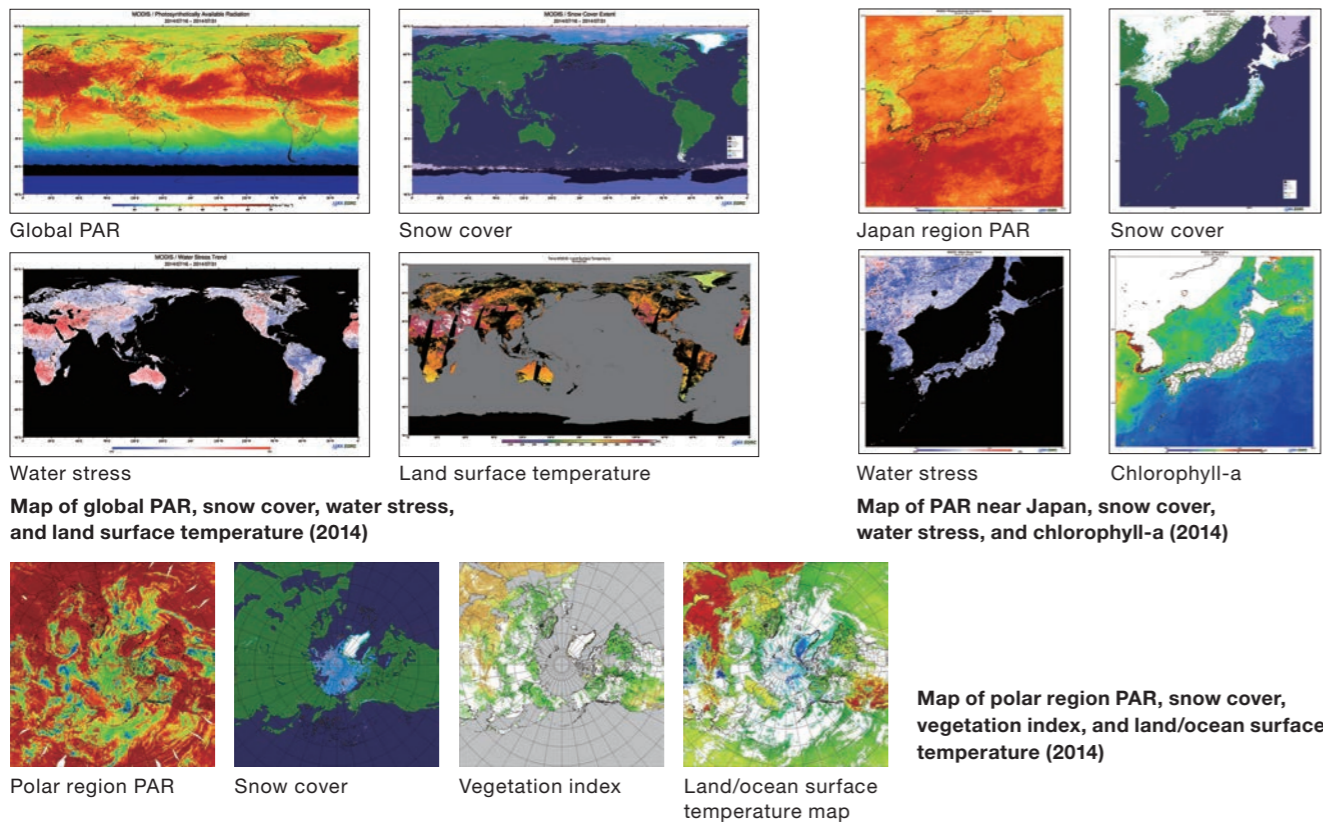
Snow depth

Soil moisture content

Information

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| Deliverables | Climate and geophysical variable dataset calculated from MODIS data (onboard Aqua and Terra) (the dataset will be calculated from GCOM-C data in the future) <ul style="list-style-type: none"> Available variables: Amount of solar radiation at the earth's surface (photosynthetically active radiation [PAR]), cloudiness, snow cover extent, sea ice extent, plant water stress trend, soil moisture content, forest fires, precipitation/precipitable water amount, ocean and land surface temperature, land surface temperature, chlorophyll-a * Aqua and Terra were launched in 2002 and 1999, respectively, and are currently being operated (as of March 2017) URL http://kuroshio.eorc.jaxa.jp/JASMES/index.html |
| Quality (accuracy and other information) | <ul style="list-style-type: none"> Algorithms have been developed and improved by EORC (other than land surface temperature) and by joint research with other institutions (only land surface temperature at present; additions to be made in the future) Processing frequency: 1 day, half month, 1 month Spatial resolution: 5km (global, polar regions), 500m/1km (Japan region) |
| Utilizations | Climate, environment, ocean, weather, education, disasters, agriculture Examples: Using solar radiation data to evaluate land suitability for agriculture, using snow cover data to research the impacts of the nuclear power station accident in Fukushima |
| Past usage in business and other fields | <ul style="list-style-type: none"> Various types of fisheries research institutes (fishing and ocean condition information, red tides, etc.) Japan Atomic Emergency Agency Private enterprises: Preliminary surveys on radiation shielding, evaluation of agricultural land suitability level, etc. |
| Usage policy | Conforms to JAXA Standard Products Contact JAXA regarding usage for commercial or business purposes |
| Availability of customization | Available within joint research frameworks as much as possible technically |
| Joint research institution(s) | Algorithm for land surface temperature has been conducted as "Development of land surface temperature estimation algorithm for GCOM-C/SGLI" with Nagasaki University, (FY25-27) |

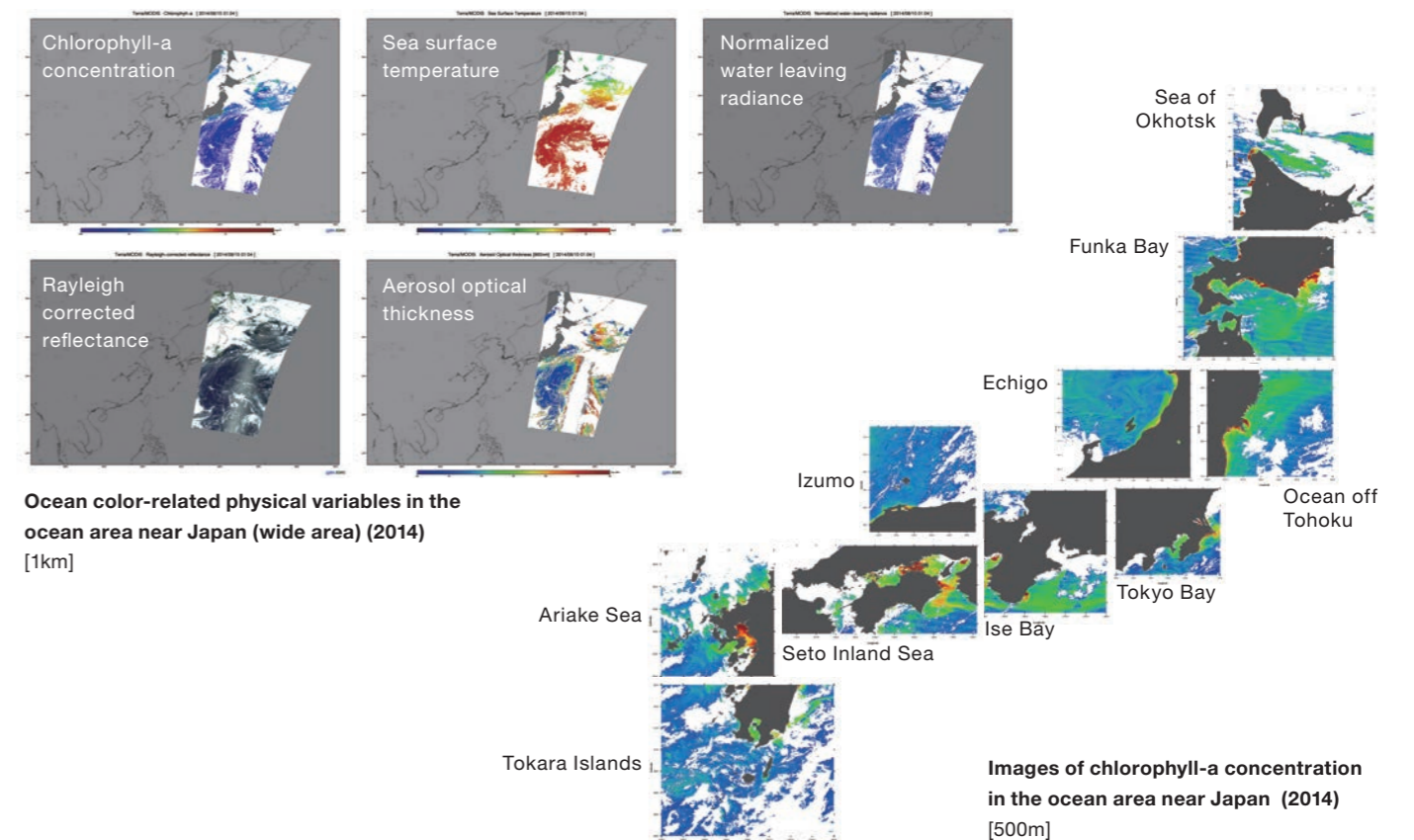
Specific examples



Information

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| Deliverables | Images and data from MODIS (onboard Aqua and Terra) <ul style="list-style-type: none"> Images: Chlorophyll-a concentration, sea surface temperature (SST), normalized water leaving radiance, Rayleigh corrected reflectance, aerosol optical thickness, geometrically corrected images Binary data: Chlorophyll-a concentration and SST URL http://kuroshio.eorc.jaxa.jp/ADEOS/mod_nrt_new/index.html (Japanese only) * Aqua and Terra were launched in 2002 and 1999, respectively, and are currently being operated (as of March 2017) |
| Quality (accuracy and other information) | <ul style="list-style-type: none"> Provision of images and data obtained in the region of Japan by EOC and TRIC directly Observation frequency: Around one to two times per day Spatial resolution: 1km/500m/250m Available within three hours after observation |
| Utilizations | Marine products, ocean, environment, disasters, education, agriculture Examples: Verifying fishing condition changes, fishing and ocean condition predictions, etc. |
| Past usage in business and other fields | <ul style="list-style-type: none"> Various types of fisheries research institutes, etc. (fishing and ocean condition information, red tides, etc.) Japan Coast Guard (sea ice bulletins, marine bulletins, etc.) Japan Fisheries Information Service Center (fishing and ocean condition information) |
| Usage policy | Conforms to JAXA Standard Products Contact JAXA regarding usage for commercial or business purposes |
| Availability of customization | Available within joint research frameworks as much as possible technically |
| Joint research institution(s) | — |

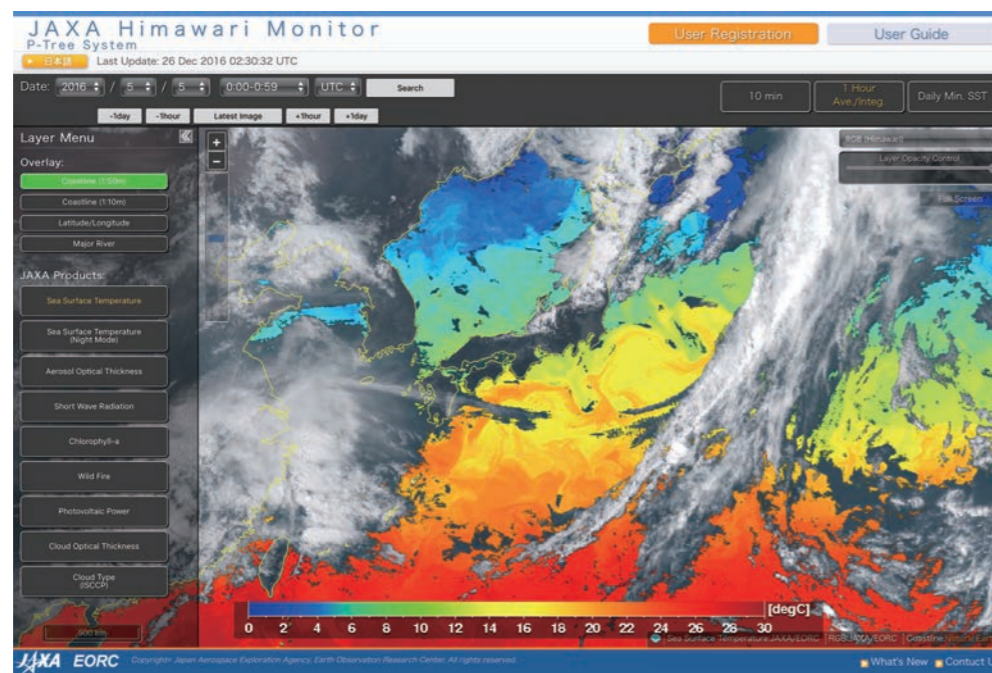
Specific examples



Information

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| Deliverables | Himawari Standard Data (geostationary satellite) provided by the Japanese Meteorological Agency, and physical quantity data processed from the Standard Data by JAXA URL http://www.eorc.jaxa.jp/ptree/index.html | |
| Quality (accuracy and other information) | <p>[Himawari Standard Data]</p> <ul style="list-style-type: none"> • Observation range: Full disk, Japan area, target area • Temporal resolution: 10 minutes, 2.5 minutes, 2.5 minutes • Spatial resolution: 0.5km (band 3), 1km (band 1, 2, 4), 2km (band 5-16) <p>[Aerosol property (optical thickness, angstrom exponent)]</p> <ul style="list-style-type: none"> • Observation range: Full disk • Temporal resolution: 10 minutes, one hour (daytime only) • Spatial resolution: 5km <p>[Short wave radiation (photosynthetically active radiation) (W/m²)]</p> <ul style="list-style-type: none"> • Temporal resolution: 10 minutes (daytime only) • Spatial resolution: 5km | <p>[Sea surface temperature (°C)]</p> <ul style="list-style-type: none"> • Observation range: Full disk • Temporal resolution: 10 minutes (day and night), one hour (day and night, nighttime only) • Spatial resolution: 2km <p>[Chlorophyll-a concentration (mg/m³)]</p> <ul style="list-style-type: none"> • Temporal resolution: 10 minutes (daytime only) • Spatial resolution: 5km <p>[Cloud characteristics]</p> <ul style="list-style-type: none"> • Observation range: Full disk • Temporal resolution: 10 minutes • Spatial resolution: 5km <p>[Wildfire]</p> <ul style="list-style-type: none"> • Observation range: Full disk • Temporal resolution: 10 minutes • Spatial resolution: 2km |
| Utilizations | Marine, environment, disasters, education, marine products (considering fishing condition changes and fishing and ocean condition prediction), etc. | |
| Past usage in business and other fields | Meteorological Research Institute, Japan Agency for Marine-Earth Science and Technology, etc. | |
| Usage policy | Limited to non-profit purposes such as research, education, and R&D | |
| Availability of customization | Customization by JAXA is available within joint research frameworks as much as possible technically | |
| Joint research institution(s) | Japanese Meteorological Agency, National Institute for Environmental Studies | |

Specific examples

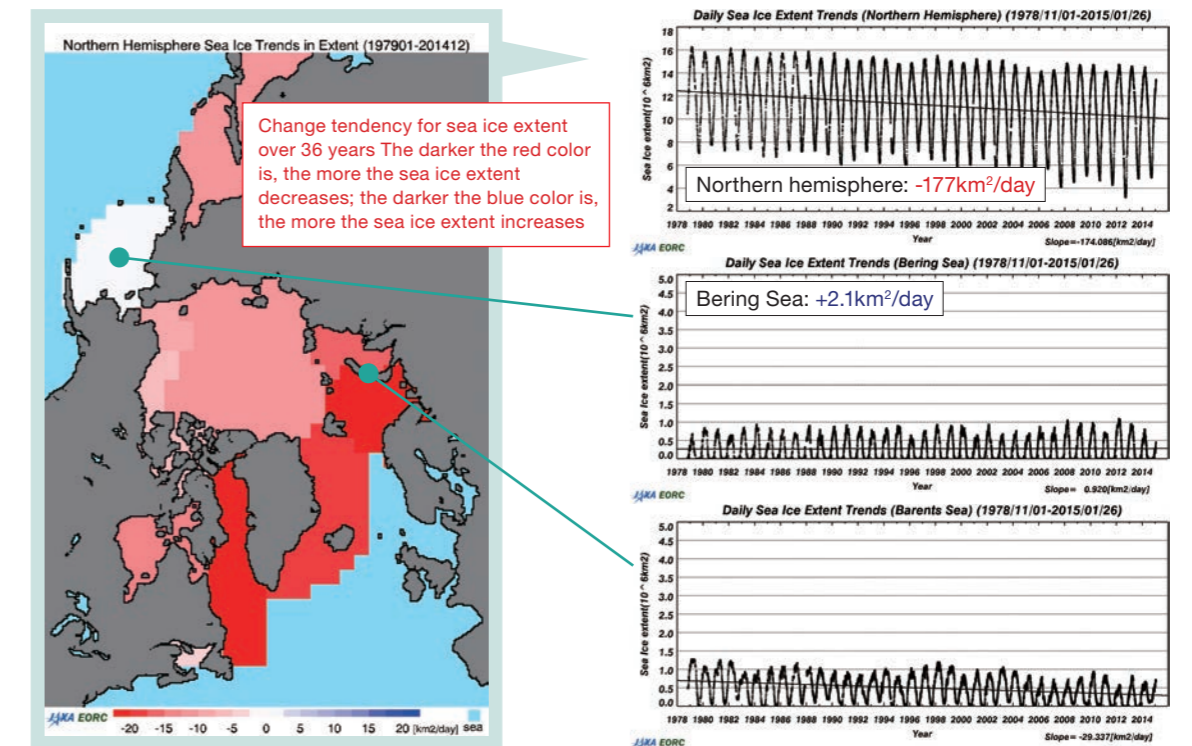


JAXA Himawari Monitor (displaying sea surface temperature)

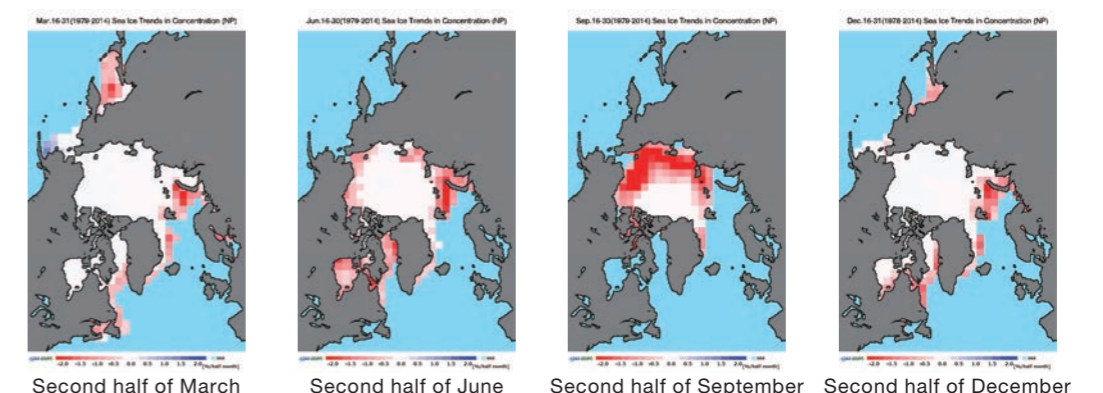
Information

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|--|---|
| Deliverables | Long-term sea ice climatological dataset derived from multiple satellites, and data integration methods |
| Quality (accuracy and other information) | Joint development, improvement, and verification of algorithms with other institutions |
| Utilizations | Climate, environment, ocean, weather, education Example: Research on sea ice and cloud interaction, environmental education lecture materials |
| Past usage in business and other fields | <ul style="list-style-type: none"> • Utilized as source data for sea ice monitoring on the joint IARC-JAXA website (closed in February 2015) • Japanese Meteorological Agency (being considered as sea ice climatology) |
| Usage policy | Conforms to JAXA Standard Products Contact JAXA regarding usage for commercial or business purposes |
| Availability of customization | Available within joint research frameworks as much as possible technically |
| Joint research institution(s) | NASA Goddard Space Flight Center |

Specific examples



Long-term trends for sea ice area by sea (1978 – 2014)



Long-term trends for sea ice concentration (at each grid point) (1978 – 2014)

Information

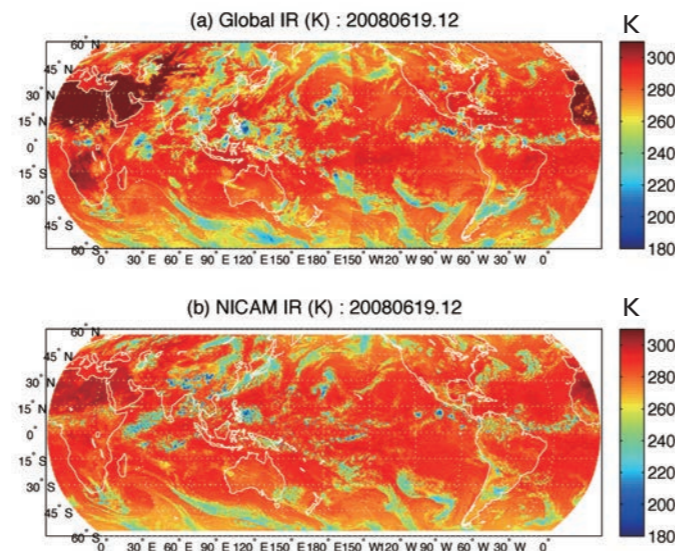
| | |
|--|---|
| Deliverables | Simulated observation data of satellite sensors calculated from atmospheric data of numerical weather models URL https://sites.google.com/site/jointsimulator/home |
| Quality (accuracy and other information) | Simulated sensor data from cloud/precipitation radars, lidars, broadband radiometers, visible-infrared imagers, and microwave radiometers (the resolution of output simulated sensor data depends on the resolution of the entered numerical weather model) |
| Utilizations | Verification of numerical weather and climate models using satellite data |
| Past usage in business and other fields | <ul style="list-style-type: none"> Japanese Meteorological Agency (numerical weather model evaluation) Japan Agency for Marine-Earth Science and Technology (numerical weather model evaluation) RIKEN (numerical weather model evaluation) Universities (numerical weather model evaluation) |
| Usage policy | Conforms to JAXA Standard Products Contact JAXA regarding usage for commercial or business purposes |
| Availability of customization | Allowed within joint research frameworks as much as possible technically |
| Joint research institution(s) | The University of Tokyo |

Specific examples

Examples of Joint-Simulator application to NICAM 3.5km resolution simulation data (Hashino et al. 2013)

- a) Geostationary meteorological satellite observation (IR 10.8 μ m)
- b) Simulated satellite data applying the Joint-Simulator to a global cloud-resolving model (NICAM)

Comparing a) and b) shows that the horizontal distribution of clouds was skillfully reproduced by NICAM.



Names and details of sensors that can perform simulations

| Sensor names | Algorithm details |
|---------------------------|--|
| Visible-infrared imager | RSTAR6b (Nakajima & Tanaka 1986, 1988) |
| Cloud/precipitation radar | EASE (Okamoto et al. 2007, 2008; Nishizawa et al. 2008), Masunaga & Kummerow (2005) |
| Lidar | EASE, Matsui et al. (2009) |
| Microwave radiometer | Kummerow (1993) |
| Broadband radiometer | MSTRN-X (Sekiguchi and Nakajima 2008), CLIRAD (Chou and Suarez 1994, 1999; Chou et al. 2001) |

| | |
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| ALOS | Advanced Land Observing Satellite |
| AMSR | Advanced Microwave Scanning Radiometer |
| AMSR-E | Advanced Microwave Scanning Radiometer for EOS |
| AMSR2 | Advanced Microwave Scanning Radiometer 2 |
| Aqua | Earth Observing System PM-1 |
| AVNIR-2 | Advanced Visible and Near-Infrared Radiometer-2 |
| DEM | Digital Elevation Model |
| DPR | Dual-frequency Precipitation Radar |
| DSM | Digital Surface Model |
| ECMWF | European Centre for Medium-Range Weather Forecasts |
| GCOM-C | Global Change Observation Mission-Climate |
| GCOM-W | Global Change Observation Mission-Water |
| GISTDA | Geo-Informatics and Space Technology Development Agency |
| GMI | GPM Microwave Imager |
| GPM | Global Precipitation Measurement |
| IARC | International Arctic Research Center |
| IDI | Infrastructure Development Institute-Japan |
| JASMES | JAXA Satellite Monitoring for Environmental Studies |
| JAXA | Japan Aerospace Exploration Agency |
| KaPR | Ka-band Precipitation Radar |
| KuPR | Ku-band Precipitation Radar |
| MODIS | Moderate resolution Imaging Spectroradiometer |
| NICAM | Nonhydrostatic ICosahedral Atmospheric Model |
| NICT | National Institute of Information and Communications Technology |
| NOAA | National Oceanic and Atmospheric Administration |
| PALSAR | Phased Array type L-band Synthetic Aperture Radar |
| PALSAR-2 | Phased Array type L-band Synthetic Aperture Radar-2 |
| PRISM | Panchromatic Remote-sensing Instrument for Stereo Mapping |
| REDD+ | Reduction of Emission from Deforestation and forest Degradation+ |
| RMS | Root Mean Square |
| Terra | Earth Observing System AM-1 |