

WORLD METEOROLOGICAL ORGANIZATION

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(30.1.2019)

COMMISSION FOR BASIC SYSTEMS
OPEN PROGRAMME AREA GROUP ON INTEGRATED OBSERVING SYSTEMS

INTER-PROGRAMME EXPERT TEAM ON SATELLITE UTILIZATION AND
PRODUCTS

ITEM:

FIFTH SESSION

Original: ENGLISH

GENEVA, SWITZERLAND, 11 – 13 FEBRUARY 2019

RA II and RA V Survey on the Use of Satellite Data 2018

(Submitted by RA II WIGOS Project Coordinating Group Co-coordinators and RA V TT-SU Lead)

Summary and Purpose of Document

"The RA II and RA V Survey on the Use of Satellite Data 2018" had been designed by the Coordinating Group of the RA II WMO Integrated Global Observing System (WIGOS) Project to Develop Support for National Meteorological and Hydrological Services (NMHSs) in Satellite Data, Products and Training and the RA V Task Team on Satellite Utilization to collect up-to-date information on the use of satellite data for meteorological, climate, water and related environmental applications in WMO RA II and RA V. The questionnaire was issued by the deadline of 31 January, and 31 countries have submitted their responses. The Project and the Task Team plan to provide a preliminary report at CGMS-47 in May 2019 and a final report at 2nd Joint Meeting of RA II WIGOS Project and RA V TT-SU for RA II and RA V NMHSs in December 2019.

ACTION PROPOSED

The fifth session is invited to:

- (a) take note of the information provided in this report;

Appendices: "RA II and RA V Survey on the Use of Satellite Data 2018," WMO, December 2018.

DISCUSSION

On 3 December, 2018 WMO issued a letter to Permanent Representatives of Members of WMO in Regions II and V to solicit their response to the “Regional Association II (RA II) and Regional Association V (RA V) Survey on the Use of Satellite Data 2018”, designed to collect up-to-date information on WMO Members’ capabilities and needs regarding the use of satellite data in meteorological, climate, water and related environmental applications by the deadline of 31 January, and 31 responses have been submitted from those countries/regions.

The survey had been prepared by the Coordinating Group of the RA II World Meteorological Organization (WMO) Integrated Global Observing System (WIGOS) Project to Develop Support for National Meteorological and Hydrological Services (NMHSs) in Satellite Data, Products and Training¹ and the RA V Task Team on Satellite Utilization² for the NMHSs located in the RA II and RA V.

The results of the survey will help identify challenges and possible solutions in the use of satellite data and will help bridge the gaps between the increasing amount of satellite data available and the need for improved and easy access to those data and to related products, tools, derived information, and user training. It is also hoped that users deepen their understanding of satellite data and products through this survey.

The information collected through the survey will be used to inform meteorological satellite agencies about user needs and priorities in the regions and will help the WMO Space Programme³ respond effectively to satellite-specific needs. The survey is targeted at National Meteorological and Hydrological Services of the WMO Member states and territories, as well as other satellite users worldwide involved in meteorology, climate, hydrology and related environmental applications.

The RA II and RA V 2018 Survey is consisted of 4 sections: Section 1: Access to Satellite Data and Products, Session 2: Use and Applications of Satellite Data and Products, Section 3: Education and Training, and Section 4: Satellite Data/Product Inventory. RA II Project co-coordinators and RA V TT-SU Lead have developed the questionnaire for the RA II and RA V 2018 survey through several teleconferences. The RA II and RA V 2018 survey was developed and based on the results of the prior WMO, RA II, RA III-IV, and AOMSUC surveys. An initial inventory of available satellite data/products (provided by JMA and KMA) in RA II and RA V is compiled in accordance with CBS-15/Doc. 4.2(1) and the inventory was incorporated in the survey.

The Project and Task Team plan to provide a preliminary report at CGMS-47 in May 2019 and a final report at 2nd Joint Meeting of RA II WIGOS Project and RA V TT-SU for RA II and RA V NMHSs in December 2019.

Appendix/ices:

"RA II and RA V Survey on the Use of Satellite Data 2018," WMO, 3 December 2018.

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- 1 See http://www.jma.go.jp/jma/jma-eng/satellite/ra2wigosproject/ra2wigosproject-intro_en_jma.html.
 - 2 See <http://www.virtuallab.bom.gov.au/portal/ttsu/>.
 - 3 See http://www.wmo.int/pages/prog/sat/index_en.php.



WMO OMM

World Meteorological Organization
 Organisation météorologique mondiale
 Organización Meteorológica Mundial
 Всемирная метеорологическая организация
 المنظمة العالمية للأرصاد الجوية
 世界气象组织

Secrétariat

7 bis, avenue de la Paix – Case postale 2300
 CH 1211 Genève 2 – Suisse
 Tél.: +41 (0) 22 730 81 11
 Fax: +41 (0) 22 730 81 81
 wmo@wmo.int – public.wmo.int

Our ref.: 31885/2018/OBS/SAT/RAII-RAV/Survey

3 December 2018

Subject: RA II and RA V Survey on the Use of Satellite Data 2018

Action required: To complete the survey by **31 January 2019**

Dear Sir/Madam,

I am soliciting your response to the "Regional Association II (RA II) and Regional Association V (RA V) Survey on the Use of Satellite Data 2018", designed to collect up-to-date information on WMO Members' capabilities and needs regarding the use of satellite data in meteorological, climate, water and related environmental applications.

The survey has been prepared by the Coordinating Group of the RA II World Meteorological Organization (WMO) Integrated Global Observing System (WIGOS) Project to Develop Support for National Meteorological and Hydrological Services (NMHSs) in Satellite Data, Products and Training¹ and the RA V Task Team on Satellite Utilization² for the NMHSs located in the RA II and RA V and is available in English under the following link:

<https://goo.gl/forms>

Your responses will help identify challenges and possible solutions in the use of satellite data and will help bridge the gaps between the increasing amount of satellite data available, and the need for improved and easy access to those data and to related products, tools, derived information, and user training.

The information collected through the Survey will be used to inform meteorological satellite agencies about user needs and priorities in the regions and will help the WMO Space Programme³ respond effectively to satellite-specific needs.

The Survey is targeted at National Meteorological and Hydrological Services of the WMO Member states and territories, as well as other satellite users worldwide involved in meteorology, climate, hydrology and related environmental applications.

WMO would be very grateful for its broad circulation to organizations which use or plan to use satellite data. The Coordinating Group is ready to accept multiple responses per country, and I therefore encourage you to circulate the announcement of this Survey to major user organizations in your country.

¹ See http://www.jma.go.jp/jma/jma-eng/satellite/ra2wigosproject/ra2wigosproject-intro_en_jma.html

² See <http://www.virtuallab.bom.gov.au/portal/ttsu/>

³ See http://www.wmo.int/pages/prog/sat/index_en.php

To: Permanent Representatives (or Directors of Meteorological or Hydrometeorological Services) of Members of WMO in Regions II and V

If you have any questions or require any clarifications regarding the content of the survey, please contact Mr Toshiharu Izumi and Mr Hiroshi Kunimatsu (toshiharu-izumi@met.kishou.go.jp, kunimatu@met.kishou.go.jp and metsat@met.kishou.go.jp) from the Satellite Programme Division of Japan Meteorological Agency (JMA), who will act as focal points for the Survey on behalf of the Coordinating Group.

The Coordinating Group of the RA II WIGOS Project and the RA V Task Team look forward to receiving the completed survey by **31 January 2019**.

Your participation in this important survey is greatly appreciated.

Yours faithfully,

A handwritten signature in black ink, appearing to be 'W. Zhang', with a long horizontal line extending to the right.

(W. Zhang)

for the Secretary-General

RA II and RA V Survey on the Use of Satellite Data 2018

**The Coordinating Group of the RA II WIGOS Project to Develop Support for NMHSs
in Satellite Data, Products and Training
and the RA V Task Team on Satellite Utilization**

Thank you for taking the time to participate in our survey.

We designed the survey to collect up-to-date information on the use of satellite data for meteorological, climate, water, and related environmental applications in WMO RA II and RA V. We are particularly interested in the needs and challenges that users and countries face in accessing, visualizing and using satellite data. We also hope for users to deepen their understanding of satellite data and products through this survey. Your feedback to this survey is important to us. Feedback will facilitate international action to better serve the global community of satellite data users.

THE SURVEY INPUT FORM IS AVAILABLE IN ENGLISH LANGUAGE UNDER THE FOLLOWING LINK:

<https://goo.gl/forms/ebWj43MxLCIGbqWD3>

PLEASE DOWNLOAD THE FORM FROM THE LINK, FILL IN IT, AND SUBMIT THE COMPLETED FORM TO MR. TOSHIHARU IZUMI and MR. HIROSHI KUNIMATSU VIA E-MAIL (ADDRESS: toshiharu-izumi@met.kishou.go.jp, kunimatu@met.kishou.go.jp and metsat@met.kishou.go.jp) BY THE 31st JANUARY 2019.

NOTE: THIS DOCUMENT IS ONLY FOR READING, NOT FOR FILLING IN.

1. Are you completing this survey as an individual, on behalf of your organization, or on behalf of the Permanent Representative of your country to WMO?

<input type="text"/>	Options for answer: <ul style="list-style-type: none">• I am completing this survey as an individual• I am completing this survey on behalf of my organization• I am completing this survey on behalf of the Permanent Representative of my country with WMO
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2. Please tell us about yourself.

(Note the personal information you provide will be treated confidentially, in line with the WMO, relevant institutes and Google privacy policies. The information will only be used for the purpose of this survey.)

Name*
Organization*
City/Town
Country*
Email Address
Phone Number

3. Your organization type

<input type="text"/>	Options for answer: <ul style="list-style-type: none">• National Meteorological/Hydrological Service (NMHS)• Other operational governmental agency• Regional / International organization• Research / Academic institution• Other
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4. Please select your geographic region (see [Map of WMO Regions](#). If your organization is active within more than one WMO Region, please complete this survey for each Region separately.)

<input type="text"/>	Options for answer: <ul style="list-style-type: none">• Region II (Asia)• Region V (South-West Pacific)
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SECTION 1 – ACCESS TO SATELLITE DATA AND PRODUCTS

Question 1) Please indicate your use of the following GEOSTATIONARY satellites as of December 1, 2018.

	Planned but not used at present	Use of L0 or L1 data ¹	Use of L2 (or higher) products ¹	Used for data assimilation	Used for nowcasting	Used for forecast verification	Used for satellite cal/val	Used for imagery applications ¹	Used for other applications
METEOSAT 0 degree	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
METEOSAT INDIAN OCEAN	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
INSAT-3D, 3DR	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
ELECTRO-L N 2	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
FY-2	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
FY-4A	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
COMS	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
HIMAWARI -8/9	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
GOES-WEST (GOES-15)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
GOES-EAST (GOES-16)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Other applications of these satellite data (please specify)?

¹ "From data to products, WMO Space Programme, " http://www.wmo.int/pages/prog/sat/dat_aandproducts_en.php

Question 2) Below is a list of future GEOSTATIONARY satellite missions as of December 1, 2018 (approximate launch dates are in brackets). Please can you indicate:

a) The level of challenge you anticipate in utilizing these data (1=low challenge to 5=high challenge, 0=won't use);

b) Your readiness to utilize the data from these satellites when they are available; and

Options for answer:

We are aware of the mission but have not acted

We have started the planning process

We have plans to upgrade our systems

We are implementing plans to upgrade our systems

c) The level of support you feel that satellite operators are providing to help you with your planning (e.g. information, training, test data etc)?

Options for answer:

Not adequate

Adequate

Good

Very Good

	Level of challenge anticipated	Readiness Level	What level of support are the satellite operators providing for you?
MTG-I (2021)			
MTG-S (2023)			
INSAT-3DS (2022)			
ELECTRO-L N 3 (TBD)			
FY-4B (2019), -4C (2021)			
GEO-KOMPSAT-2A (2018)			
GEO-KOMPSAT-2B (2019)			
GOES-17 (Launched)			

Other information you would like to tell us about your readiness, or need for support, to effectively utilize the satellite data (please specify)?

Question 3) How do you currently receive and access satellite data via GEO/LEO satellites and landline services in RA II and RA V?

Service	Do you receive/access? (yes/no)
COMS HRIT	
COMS LRIT	
FY-2 HRIT	
FY-2 LRIT	
FY-4 HRIT	
FY-4 LRIT	
GOES GVAR	
GOES LRIT	
GOES EMWIN	
JPSS HRD	
POES HRPT	
POES APT	
MetOp AHRPT	
CMACast (GEONETCast)	
HimawariCast	
GTS point-to-point	
Internet (ftp, http, etc.)	

Other data access mechanisms? (Please specify)

Are you experiencing difficulties in accessing the satellite data? Are you planning to address these difficulties? (Please specify)

SECTION 2 – USE AND APPLICATIONS OF SATELLITE DATA AND PRODUCTS

Question 4)

For each application area in Table 1 below, indicate the three (3) most important available parameters (A) and the three (3) most required but not available parameters (B), utilizing the codes provided in Table 2. “Not available” means either completely unavailable or not available with sufficient accuracy, timeliness or resolution to meet your requirements.

Table 1

Application Area	(A) Most important available parameters			(B) Most required but not available parameters		
Nowcasting & very short-range forecasting						
Synoptic meteorology						
Global and regional NWP data assimilation						
Aeronautical meteorology						
Marine meteorology and oceanography						
Agricultural meteorology						
Hydrology						
Atmospheric chemistry						
Climatology and climate change						
Environmental applications						
Disaster monitoring and Security						
Research applications						
Public Weather Services (PWS)						

Table 2 Codes for answering Question 4.

Code	Parameter	Code	Parameter
1	Aerosol total column	34	Ozone profile
2	Apparent Thermal Inertia	35	Ozone total column
3	Atmospheric Instability Index	36	Precipitation index
4	Atmospheric motion vector	37	Precipitation rate
5	Chlorophyll concentration	38	Rain profile
6	Cloud base height	39	Salinity
7	Cloud cover	40	Sea-ice cover
8	Cloud ice total column	41	Sea-ice surface temperature
9	Cloud imagery	42	Sea-ice type
10	Cloud top height	43	Sea level / Sea surface height
11	Cloud Top Temperature	44	Sea surface temperature
12	Cloud type	45	Short-wave irradiance at surface
13	Cloud water profile	46	Short-wave outgoing radiation at top-of-atmosphere (TOA)
14	Cloud water total column	47	Significant wave height
15	Crustal movement	48	Smoke
16	Drought monitoring	49	Snow cover
17	Dust	50	Snow melting conditions
18	Fires	51	Soil moisture
19	Global radio-occultation sounding	52	Sounder radiances
20	Height of tropopause	53	Specific humidity profile
21	Icebergs	54	Specific humidity total column
22	Imager radiances	55	Temperature Profile
23	Land cover	56	Trace gases
24	Land surface features	57	Tropopause temperature
25	Land surface temperature	58	Turbulence
26	Leaf Area Index (LAI)	59	Ultraviolet index
27	Lightning detection	60	Vegetation Type
28	Long-wave incoming surface radiation	61	Volcanic ash
29	Long-wave outgoing radiation at top-of-atmosphere (TOA)	62	Wave period/direction/spectrum
30	Long-wave surface emissivity	63	Wind profile
31	Low cloud and fog	64	Wind speed over sea surface
32	Normalized Difference Vegetation Index (NDVI)	65	Wind vector over sea surface
33	Ocean currents	66	Other geophysical parameter (please specify)

If you selected code no. 66, please specify these "other geophysical parameters" in the space below.

Question 5)

a) What would be the optimal temporal frequency of geostationary satellite data delivery suitable for your operations (forecast, warning, advisory, etc.) ? ²

Options for answer:

10 min

15 min

30 min

1 hour

Other frequency (Please specify)

If you selected "Other frequency," please specify the frequency. Please give a reason why you selected the frequency:

b) Evaluate the positive or negative impact of the traditional imagery of the latest available GEO satellites on your work.

Satellite data	Impact on your work
High resolution visible band imagery (e.g. 0.64µm, Himawari-8 Band 3)	
Infrared window imagery (e.g. 10.4µm, Himawari-8 Band 13)	
Water vapor band imagery (e.g. 6.2-7.3 µm, Himawari-8 Band 8-10)	

Options for answer:

1 - Large positive impact

2 - Positive impact

3 - No impact

4 - Negative impact

² A study conducted by the Australian Bureau of Meteorology found that the 10 minute imagery resulted in more effective use of satellite data within the nowcasting, analysis and short term forecasting process because it allowed better situational awareness, and better use of surface observations which are on a similar timescale: Zeschke, B., Willmott, M., Lane, A., Rea, A., "How Himawari-8 data has revolutionised the work of Bureau of Meteorology Forecasters," Submitted to the Bulletin of the Australian Meteorological and Oceanographic Society, September 2018.

- 5 - Large negative impact
- 6 - I have not used the product

Please add any comments regarding your answer to the above question 5b in the space provided below

c) Evaluate the positive or negative impact of the latest available GEO satellite RGB (Red-Green-Blue) and derived products on your work.³

Satellite data	Impact on your work
Natural Color RGB	
Day Microphysics RGB	
Day Snow-Fog RGB	
Night Microphysics RGB	
Day Convective Storm RGB	
Dust RGB	
Airmass RGB	
Ash RGB	
True Color RGB	
Sandwich (Blended IR-HRV) product ⁴	

Options for answer:

- 1 - Large positive impact
- 2 - Positive impact
- 3 - No impact
- 4 - Negative impact
- 5 - Large negative impact
- 6 - I have not used the product

³ "Himawari RGB Training Library," https://www.data.jma.go.jp/mscweb/en/VRL/VLab_RGB/RGBimage.html, JMA MSC.

⁴ "Workshop on physics and dynamics of convective storms and their manifestation in satellite imagery," https://www.eumetsat.int/website/home/Data/Training/TrainingLibrary/DAT_2042885.html, EU METSAT, 2010.

Please add any comments regarding your answer to the above question 5c in the space provided below

Question 6) The purpose of this question is to identify satellite data/products that could improve your service (forecast, warning, advisory, etc.) for weather-related hazards.

- a) List your country's top three weather-related hazards for which the use of satellite data is crucial in the provision of meteorological services (forecasts, warnings, advisory, etc.).

Hazard 1	
Hazard 2	
Hazard 3	

Options for answer ⁵ :

Tornado, Flash flood, Strong winds, Hailstorm, Thunderstorm or lightning, Heavy snow, Freezing rain, Dense fog, Tropical cyclone, Storm surge, Coastal flooding, Heat wave, Cold wave, Drought, River flooding, Marine hazards (storm, sea ice, icebergs, etc.), Sandstorm, Landslide or mudslide, Airborne hazardous substances, Waterborne hazards, Desert locust swarm, Hydrometeorological hazards to aviation (i.e., turbulence, icing), Avalanche, Forest or wild land fire, Smoke/Dust/Haze, Volcanic events

- b) How has the use of the latest available geostationary (GEO) satellite data improved your ability in detecting/monitoring the hazards, when compared to previous generation satellite data?

Hazard 1	
Hazard 2	
Hazard 3	

Options for answer:

- 1 - Significant improvement
- 2 - Improvement
- 3 - No Difference
- 4 - It is more difficult now
- 5 - Not applicable

⁵ “Annex 1 - The Survey Questionnaire,” p.272, Capacity Assessment of National Meteorological and Hydrological Services in Support of Disaster Risk Reduction, WMO, 2008.

c) For each hazard, select the codes from the Appendix to indicate up to five (5) most important satellite data/products currently used by your staff in charge of weather-related hazards along with traditional imagery.

	Codes from Appendix					If you selected code no.51 (other), please specify the other satellite data and products.
Hazard 1						
Hazard 2						
Hazard 3						

d) With regard to satellite data and products what would help you improve your services for these hazards?

	Training (yes/no)	Faster or more reliable data communications (yes/no)	Data processing software and/or visualization tools (yes/no)
Hazard 1			
Hazard 2			
Hazard 3			

If you answered yes in any of your answers to question 6 d), please provide more detail of your requirements in the space provided below.

Question 7) In the Table 3, please indicate which polar orbiting products that your analysts and forecasters currently use to improve meteorological and hydrological monitoring and forecast and which products they would like to use.

Table 3 Polar orbiting satellite products which analysts and forecasters currently use to improve meteorological and hydrological monitoring and forecast (provided by BOM). (This table gives a set of useful visualized products on the Internet as examples.)

Listed as: **SATELLITE** SENSOR, PRODUCT or SERVICE

General purpose products	
FENGYUN Satellite Data Center ⁶	
JPSS (SNPP, NOAA-20, etc.) VIIRS , VIS and IR imagery ⁷	
NUCAPS Products (JPSS , atmospheric vertical temperature and moisture profiles, cloud fraction and cloud top pressure, O ₃ , CH ₄ , CO, CO ₂ , SO ₂ , N ₂ O, HNO ₃ , dust, volcano emission, etc.) ⁸	
Worldview (Aqua and Terra MODIS , JPSS VIIRS , etc., Air Quality, Ash Plumes, Drought, Dust Storms, Fires, Floods, Severe Storms, Shipping, Smoke Plumes, Vegetation) ⁹	
RealEarth (a data discovery and visualization platform) ¹⁰	
Ocean products	
JASON-3 Poseidon-3B , surface wind speed and significant wave height ¹¹	
JPSS (SNPP, NOAA-20, etc.) VIIRS , SST ¹²	
METOP-A/B/C ASCAT , Coriolis WindSat , GCOM-W AMSR-2 , and DMSP SSMIS , sea surface winds ¹³	
Various polar orbiting satellites, significant wave height ¹⁴	

⁶ "FENGYUN Satellite Data Center," <https://satellite.nsmc.org.cn/PortalSite/Default.aspx>, CMA NS MC.

⁷ "STAR JPSS - Environmental Data Record Teams - Imagery," <https://www.star.nesdis.noaa.gov/jpss/imagery.php>, NOAA NESDIS.

⁸ "STAR JPSS - Environmental Data Record Teams - NUCAPS Products," <https://www.star.nesdis.noaa.gov/jpss/soundings.php>, NOAA NESDIS.

⁹ "Worldview," <https://worldview.earthdata.nasa.gov/index.html>, NASA.

¹⁰ "RealEarth," <http://www.ssec.wisc.edu/realearth>, SSEC/CIMSS.

¹¹ "Jason-3 Ocean data products become available to all Users," https://www.eumetsat.int/website/home/News/DAT_3112298.html, EUMETSAT.

¹² "STAR JPSS - Environmental Data Record Teams - Sea Surface Temperature," <https://www.star.nesdis.noaa.gov/jpss/SST.php>, NOAA NESDIS.

¹³ "Ocean Surface Winds," <https://manati.star.nesdis.noaa.gov/datasets/ASCATData.php>, NOAA NESDIS.

Precipitation products	
GPM IMERG , Multi-sensor precipitation ¹⁵	
GSMaP, hourly Global Rainfall Map using GPM-Core DPR/GMI , TRMM PR/TMI , GCOM-W AMSR2 , DMSP SSMIS , NOAA/MetOp AMSU , JPSS ATMS , and Geostationary IR imager ¹⁶	
Multi-sensor Integrated Microwave Imagery (Total Precipitable Water and anomalies): MIMIC-TPW version 2 ¹⁷ NOAA/NESDIS OSPO TPW/PCT ¹⁸	
Tropical Cyclone monitoring	
Multi-sensor Morphed Integrated Microwave Imagery ¹⁹	
Multi-sensor 37GHz and 85-91GHz microwave data ²⁰	
Volcanic Ash	
AURA OMI , SO2 data ²¹	
Other (please specify)	

Options for answer:

- 1 - We currently use the product
- 2 - We don't currently use the product but would like to
- 3 - We were not aware of the product

¹⁴ "Altimeter Data Products," <https://manati.star.nesdis.noaa.gov/datasets/SGWHDData.php>, NOAA NESDIS.

¹⁵ "Data Access | Precipitation Measurement Missions," <https://pmm.nasa.gov/data-access>, NASA.

¹⁶ "Global Rainfall Map (GSMaP)," https://sharaku.eorc.jaxa.jp/GSMaP_NOW/index.htm, JAXA.

¹⁷ "MIMIC-TPW2," http://tropic.ssec.wisc.edu/real-time/mtpw2/product.php?color_type=tpw_nrl_colors&prod=global2×pan=24hrs&anim=html5, CIMSS.

¹⁸ "NESDIS Blended Total Precipitable Water (TPW) Products," <https://catalog.data.gov/dataset/nesdis-blended-total-precipitable-water-tpw-products>, Data.gov, U. S. Government.

¹⁹ "Morphed Integrated Microwave Imagery at CIMSS (MIMIC-TC)," <http://tropic.ssec.wisc.edu/real-time/mimtc/tc.shtml>, CIMSS.

²⁰ "NRL Tropical Cyclone Page," <https://www.nrlmry.navy.mil/TC.html>, US Naval Research Laboratory.

²¹ "Global Sulfur Dioxide Monitoring Home Page," <https://so2.gsfc.nasa.gov/>, NASA.

SECTION 3 – EDUCATION AND TRAINING

Question 8)

a) Please indicate your training needs and delivery of training for the following:

Operation and maintenance of satellite data reception equipment	
Access to satellite data and products	
Satellite imagery interpretation	
Satellite data processing, visualization, and analysis including use of software tools	
Satellite products utilization and interpretation	
Physical basis for remote sensing	
Application of satellite data to Climate, Aviation, Marine, Agrometeorology, Hydrology, etc.	
Preparation and effective utilization of the new generation Satellites (Himawari-8, FY-4, GK-2A, GOES-17, etc.)	

Options for answer:

Needed and delivered

Needed, but not delivered

Not needed

b) Please rank the following training delivery and resources relating to satellite meteorology in terms of their importance to your organization (4=most important, 1=least important, 0=not used).

	Use and importance of resource
Classroom courses	
Online courses	
Physical resources (books, manuals)	
Online resources	

- c) Please state your level of awareness of the following distance-learning resources and other information sources provided by WMO-CGMS Virtual Laboratory (VLab) Centre of Excellence (CoE), Satellite Operator and other WMO members in RA II and RA V regions. State whether or not you use these resources for keeping abreast of new developments in satellite systems and applications.

	Level of awareness (High, Low, Unaware)	Level of use (Used/Very important, Used/ somewhat important, not used)
Monthly Australian VLab CoE Regional Focus Group online weather discussions ²²		
Annual Training events by AOMSUC ²³		
Classroom courses hosted by CoE-China ^{24 25}		
Classroom courses hosted by CoE-Korea ²⁶		
Satellite operator websites		

- d) In which topics do you need additional training by WMO-CGMS VLab CoE and/or Satellite operators? (Multiple answer possible)

Satellite data use in public weather services	
Satellite data use in aviation services	
Satellite data use in climate services	
Satellite data use in marine services	
Satellite data use in agrometeorological services	
Satellite data use in space weather services	

²² "Centres of Excellence: Australia," <https://www.wmo-sat.info/vlab/australia/>, WMO.

²³ "The 9th Asia-Oceania Meteorological Satellite Users' Conference (AOMSUC-9)," <http://aomsuc9.bmkg.go.id/>, BMKG.

²⁴ "Centres of Excellence: China - Beijing," <https://www.wmo-sat.info/vlab/china-beijing/>, WMO.

²⁵ "Centres of Excellence: China - Nanjing," <https://www.wmo-sat.info/vlab/china-nanjing/>, WMO.

²⁶ "Centres of Excellence: Republic of Korea," <https://www.wmo-sat.info/vlab/korea/>, WMO.

Satellite data use in hydrology services	
Satellite data use in environmental services	

e) Please nominate a focal point for training events in your organization:

Name:

E-mail:

Phone number:

SECTION 4 – A SATELLITE DATA/PRODUCT INVENTORY

Question 9) An initial inventory of satellite data/products for RA II and RA V has been developed with the cooperation of KMA and JMA.^{27 28}

a) In the inventory, please select the priority of each product for your services, the required timeliness, and specify the application (please refer to the example below).

INFORMATION FROM PROVIDERS										User Requirements				
ID #	Parameter (Select one of the options)	Data Provider	Data Characteristics	Format	Data Distribution	Geographical Area	Horizontal Resolution (km/deg)	Frequency	Maximum Data Traffic at a Time (kB, 2 significant digits)	Reference	Priority (Select one of the options)	Timeliness (Select one of the options)	Most Important Application Area (Select one of the options)	Specific Application (Detailed, if any)
16	Himawari-SIS Imagery	JMA	Himawari-SIS Imagery All 16 Bands	Himawari Standard Data (HSD)	HimawariCloud (Internet)	Full disk	0.5 km: Band 2, 1 km: Band 1, 2, 4, 2 km: Band 5-1E	10 minutes	830000	https://www.jma.go.jp/mof/guide/himawari/cloud/ https://www.jma.go.jp/mof/guide/himawari/cloud/0501.html https://www.jma.go.jp/mof/guide/himawari/cloud/0502.html https://www.jma.go.jp/mof/guide/himawari/cloud/0503.html https://www.jma.go.jp/mof/guide/himawari/cloud/0504.html https://www.jma.go.jp/mof/guide/himawari/cloud/0505.html https://www.jma.go.jp/mof/guide/himawari/cloud/0506.html https://www.jma.go.jp/mof/guide/himawari/cloud/0507.html https://www.jma.go.jp/mof/guide/himawari/cloud/0508.html https://www.jma.go.jp/mof/guide/himawari/cloud/0509.html https://www.jma.go.jp/mof/guide/himawari/cloud/0510.html https://www.jma.go.jp/mof/guide/himawari/cloud/0511.html https://www.jma.go.jp/mof/guide/himawari/cloud/0512.html https://www.jma.go.jp/mof/guide/himawari/cloud/0513.html https://www.jma.go.jp/mof/guide/himawari/cloud/0514.html https://www.jma.go.jp/mof/guide/himawari/cloud/0515.html https://www.jma.go.jp/mof/guide/himawari/cloud/0516.html	High	30 min	Disaster monitoring and Security	Regional image generation for Oceania

b) Please indicate at the end of the inventory other relevant satellite products, if any, which are not present in the table and that you would like to be disseminated in the region.

THANK YOU FOR COMPLETING THIS SURVEY!

²⁷ This question is based on the WMO CBS Recommendation: CBS-15/Doc. 4.2(1), APPROVED p. 3 4, http://www.wmo.int/pages/prog/sat/documents/SAT-GEN_CBS-15-ProcedureRegionalDataAccessReq.pdf (PDF)

²⁸ The scope of the initial inventory of satellite data/products for RA II and RA V is: GEO and LEO satellite data and products which JMA and KMA distribute to RA II and V members, including those made from the satellite data of other region institutes.

Appendix: Examples of satellite data and products (except for traditional imagery) useful in the provision of meteorological services by NMHSs (provided by WMO-CGMS Australian VLab Centre of Excellence)

Precipitation/Heavy rainfall:

Principally Geostationary Satellite Data

(alphabetical order):

1. Color enhanced infrared image
2. GOES-16 Total Precipitable Water (TPW)ⁱ
3. JMA SWFDP productsⁱⁱ
4. Sandwich productⁱⁱⁱ
5. Water vapor bands
6. 3.9 micron band (for areas of flooding)

Polar Orbiter Data (alphabetical order):

7. Global Rainfall Map^{iv}
8. Microwave TPW and PCT (Percentage of TPW normal)^{v, vi}
9. MODIS Bands 3-6-7 (snow and ice)^{vii}
10. MODIS Bands 7-2-1 (burn scars vs. naturally low vegetation or bare soil; floods; snow and ice vs. clouds)^{viii}
11. MODIS product (flooded regions, soil moisture)^{ix}
12. VIIRS Day/Night band (for heavy precipitation: attenuation of city lights by thick convective clouds)^x

Strong winds/gales:

Principally Geostationary Satellite Data:

13. High resolution visible band
14. True Color RGB^{xi} ("Sunglint" phenomenon permits subjective determination of surface winds over the maritime regions)

Polar Orbiter Data:

15. Sea surface winds (as determined from a number of polar orbiting satellites: ASCAT, WindSAT, AMSR-2, and SSMIS)^{xii}

Volcanic emissions:

Principally Geostationary Satellite Data:

16. Ash RGB^{xiii}
17. BOM/BMKG Volcanic Ash RGB^{xiv}
13. High resolution visible band
18. Split window method (10.4-12.4 micron)^{xv}
14. True Color RGB
6. 3.9 micron band (hotspots)

Polar Orbiter Data:

19. Aura OMI SO₂^{xvi}
20. VIIRS Volcanic Ash RGB

Fire/smoke:

Principally Geostationary Satellite Data:

21. Fire Temperature RGB^{xvii xviii}
22. CIRA's Natural Fire Color product^{xviii}
23. Day Microphysics RGB^{xiii}
14. True Color RGB

Polar Orbiter Data:

10. MODIS Bands 7-2-1
12. VIIRS Day/Night band

Convection:

Principally Geostationary Satellite Data:

24. Airmass RGB (environment for storm formation)^{xix}
25. Cloud Phase RGB^{xx}
26. Cloud Type RGB from Andrew Heidinger (CIMSS)^{xxi}

Polar Orbiter Data:

1. Color enhanced infrared image
27. COMS Cloud Top Height^{xxii}
28. COMS Cloud Top Temperature^{xxii}
29. COMS Convective Clouds RGB^{xxii}
30. COMS Water Vapor RGB^{xxii}
31. Day Convective Storm RGB^{xxiii}
13. High resolution visible band
32. Lightning mapper (GLM) data^{xxiv xxv}
4. Sandwich product
5. Water vapor bands (monitoring gravity waves that may cause secondary convection)

Polar Orbiter Data:

33. MODIS/VIIRS high resolution visible and color enhanced infrared image for identifying small scale storm top features, outflow boundaries to the storm, etc.
34. POES AVHRR Cloud Top Temperature and Cloud Top Height products^{xxvi}
12. VIIRS Day/Night band (for lightning strikes)

Turbulence:**Principally Geostationary Satellite Data:**

- 24. Airmass RGB
- 1. Color enhanced infrared image
- 35. GOES-16 1.37 micron band (transverse band detection) ^{xxvii}
- 13. High resolution visible band
- 36. Himawari High Pass Product (Dr. Wimmers, NOAA affiliated) ^{xxviii}
- 5. Water Vapor bands

Polar Orbiter Data:

- 37. Suomi NPP VIIRS 11.45 micron band (high resolution representation of transverse banding related to possible turbulence)

Dust:**Principally Geostationary Satellite Data:**

- 38. COMS Aerosol Index ^{xxix}
- 39. COMS Aerosol Optical Depth ^{xxix}
- 40. Dust RGB ^{xxx}
- 41. GOES-16 Aerosol Optical Depth product ^{xxxi}
- 18. Split window method (10.4-12.4 micron)
- 14. True Color RGB (Rayleigh corrected and uncorrected)

Polar Orbiter Data:

- 42. MODIS and VIIRS True Color RGB product
- 43. TERRA and AQUA MODIS (11-12 micron) IR brightness temperature difference product

Fog/low cloud:**Principally Geostationary Satellite Data:**

- 39. COMS Aerosol Optical Depth
- 44. COMS fog detection ^{xxxii}
- 45. Night Microphysics RGB ^{xxxiii}
- 46. 3.9micron band, GEOCAT FLS (Fog and Low level Stratus) (derived product) ^{xxxiv}

Polar Orbiter Data:

- 12. VIIRS Day/Night band
- 47. VIIRS IR brightness temperature "Fog/Stratus product" ^{xxxv}

Tropical Cyclones:**Principally Geostationary Satellite Data:**

- 1. Color enhanced infrared image
- 48. Dvorak enhanced infrared image ^{xxxvi}
- 13. High resolution visible band
- 4. Sandwich product
- 5. Water vapor bands (6.2 microns)

Polar Orbiter Data:

- 49. Blended microwave data (37, 85-91 GHz) ^{xxxvii xxxviii}
- 7. Global Rainfall Map
- 12. VIIRS Day/Night Band

High altitude Aviation Icing:**Principally Geostationary Satellite Data:**

- 1. Color enhanced infrared image
- 5. Water vapor bands (6.2 micron)

Midlevel Aviation Icing:**Principally Geostationary Satellite Data:**

- 23. Day Microphysics RGB
- 50. 1.6 micron NIR and 10.4 micron IR in comparison

Polar Orbiter Data:

- 9. MODIS Bands 3-6-7

Other:

- 51. Other

References for Appendix

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- ^{viii} "MODIS Bands 7-2-1" (burn scars vs. naturally low vegetation or bare soil; floods; snow and ice vs. clouds), <https://earthdata.nasa.gov/faq> (under MODIS Near Real-Time Data / Rapid Response options), NASA.
- ^{ix} "MODIS product (flooded regions, soil moisture)", Worldview, <https://worldview.earthdata.nasa.gov/index.html> (choose Add Layers/Floods option), NASA.
- ^x "VIIRS Day/Night band" (for heavy precipitation: attenuation of city lights by thick convective clouds), Worldview, <https://worldview.earthdata.nasa.gov/index.html> (choose Add Layers/Other/Earth at Night/ Suomi NPP/VIIRS Day/Night Band option), NASA.
- ^{xi} "Himawari RGB Training Library: True Color RGB," https://www.data.jma.go.jp/mscweb/en/VRL/VLab_RGB/RGBimage.html, JMA MSC.
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- ^{xiii} "Ash RGB," Himawari RGB Training Library, https://www.data.jma.go.jp/mscweb/en/VRL/VLab_RGB/RGBimage.html, JMA MSC.
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- ^{xxii} "Rapidly Developing Thunderstorm Detection using various Satellite Products" (KMA, 18 May 2017), Regional Focus Group Recordings, <http://www.virtuallab.bom.gov.au/archive/regional-focus-group-recordings/>, BOM.
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- ^{xxv} "GOES East GLM Full Disk Group Density View," RealEarth, <http://realearth.ssec.wisc.edu/?products=GLM.100¢er=22.59822176934283,-96.82421875&zoom=3&width=2022&height=1223&timeproduct=GLM×pan=-12t&animationspeed=99.210526315789&animate=true> (for real time data), SSEC/CIMSS.
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- ^{xxxviii} "MIMIC Gallery," <http://tropic.ssec.wisc.edu/real-time/mimic-tc/gallery/mainpage.html>, CIMSS.

Question 9) An initial inventory of satellite data/products for RA II and RA V has been developed with the cooperation of KMA and JMA.

a) In the inventory, please select the priority of each product for your services, the required timeliness, and specify the application.

SATELLITE DATA REQUIREMENTS FOR RA II AND RA V

INFORMATION FROM PROVIDERS											User Requirements			
ID #	Parameter (Select one of the options)	Data Provider	Data Characteristics	Format	Data Distribution	Geographical Area	Horizontal Resolution (km/deg)	Frequency	Maximum Data Traffic at a Time ($\times 2$ significant digits)	Reference	Priority (Select one of the options)	Timeliness (Select one of the options)	Most Important Application Area (Select one of the options)	Specific Application (detailed), if any
1	Aerosol total column	KMA	Aerosol Optical Depth, Aerosol Index	Binary / PNG	NMSC/KMA Webpage	Full Disk / Extended Northern Hemisphere/ East Asia / Local Area	1 km: Visible based products 4 km: IR-based products	3 hours (Full Disk) / 15 minutes	15000	http://nmsc.kma.go.kr/html/homepage/en/ver2/static/selectStaticPage.do?view=datapcenter.dataS				
2	Aerosol total column	KMA	Aerosol Optical Depth, Aerosol Index	HDF-EOS5 / PNG	DCPC Webpage	Full Disk / Extended Northern Hemisphere	1 km: Visible based products 4 km: IR-based products	3 hours (Full Disk) / 15 minutes	15000	http://dpcp.nmsc.kma.go.kr/openwis-user-portal/srv/en/main_home_products				
3	Atmospheric motion vector	KMA	COMS Atmospheric Motion Vector (AMV)	Binary / PNG	NMSC/KMA Webpage	Full Disk / Extended Northern Hemisphere/ East Asia / Local Area	1 km: Visible based products 4 km: IR-based products	3 hours (Full Disk) / 15 minutes	10000	http://nmsc.kma.go.kr/html/homepage/en/ver2/static/selectStaticPage.do?view=datapcenter.dataS				
4	Atmospheric motion vector	KMA	COMS Atmospheric Motion Vector (AMV)	ASCII / PNG	DCPC Webpage	Full Disk / Extended Northern Hemisphere	1 km: Visible based products 4 km: IR-based products	3 hours (Full Disk) / 15 minutes	10000	http://dpcp.nmsc.kma.go.kr/openwis-user-portal/srv/en/main_home_products				
5	Atmospheric motion vector	JMA	Himawari-8/9 Atmospheric Motion Vector (AMV)	BUFR4	GTS	60S-60N, 90E-160W	34 km	1 hour	3200	http://www.data.jma.go.jp/mc/pweb/en/product/product/amv/index.htm				
6	Atmospheric motion vector	KMA	COMS Atmospheric Motion Vector (AMV)	BUFR4	GTS	60S-60N, 75E-180E	96 km	15 minutes	30					
7	Cloud parameters (Cloud base height, Cloud cover, Cloud ice total column, Cloud imagery, Cloud top height, Cloud Top Temperature, Cloud type, Cloud water profile, Cloud water total column, etc.)	KMA	Cloud Parameter (Cloud Detection, Cloud Analysis, Cloud Top Temperature/Height)	Binary / PNG	NMSC/KMA Webpage	Full Disk / Extended Northern Hemisphere/ East Asia / Local Area	1 km: Visible based products 4 km: IR-based products	3 hours (Full Disk) / 15 minutes	53000	http://nmsc.kma.go.kr/html/homepage/en/ver2/static/selectStaticPage.do?view=datapcenter.dataService				
8	Cloud parameters (Cloud base height, Cloud cover, Cloud ice total column, Cloud imagery, Cloud top height, Cloud Top Temperature, Cloud type, Cloud water profile, Cloud water total column, etc.)	KMA	Cloud Parameters (Cloud Detection, Cloud Analysis, Cloud Top Temperature/Height)	HDF-EOS5 / PNG	DCPC Webpage	Full Disk / Extended Northern Hemisphere	1 km: Visible based products 4 km: IR-based products	3 hours (Full Disk) / 15 minutes	53000	http://dpcp.nmsc.kma.go.kr/openwis-user-portal/srv/en/main_home_products				
9	Cloud parameters (Cloud base height, Cloud cover, Cloud ice total column, Cloud imagery, Cloud top height, Cloud Top Temperature, Cloud type, Cloud water profile, Cloud water total column, etc.)	JMA	Himawari-8/9 High-resolution Cloud Analysis Information (HCAI) Cloud mask, Snow ice mask, Cloud type, Cloud top height and Quality control information.	GRIB2	JDDS (Internet)	Full Disk, North Center, North West, South East, Tropical region and Tropical East region	0.02 deg	1 hour	50000	http://www.data.jma.go.jp/mc/pweb/en/product/product/hcai/index.htm				
10	COMS imagery	KMA	COMS imagery Composite	Binary / PNG	NMSC/KMA Webpage	Extended Northern Hemisphere	4 km	15 minutes	120000	http://nmsc.kma.go.kr/html/homepage/en/ver2/static/selectStaticPage.do?view=datapcenter.dataS				
11	COMS imagery	KMA	COMS imagery Enhanced	Binary / PNG	NMSC/KMA Webpage	Full Disk / Extended Northern Hemisphere/ East Asia / Local Area	1 km: Band 3, 4 km: Band 4-16	15 minutes	120000	http://nmsc.kma.go.kr/html/homepage/en/ver2/static/selectStaticPage.do?view=datapcenter.dataS				

12	COMS imagery	KMA	COMS imagery Band 1 (0.68u), Band 2 (3.75u), Band 3 (6.75u), Band 4 (10.8u), Band 5 (12.0u).	HRIT	COMS Broadcast	Full Disk / Extended Northern Hemisphere	1 km : Band 1 4 km : Band 2-5	3 hours / 15 minutes	24000	http://nmsc.kma.go.kr/html/homepage/en/ver2/Static/selectStaticPage.do?view=site http://nmsc.kma.go.kr/html/homepage/en/ver2/Static/selectStaticPage.do?view=site				
13	COMS imagery	KMA	COMS imagery Band 1 (0.68u), Band 2 (3.75u), Band 3 (6.75u), Band 4 (10.8u), Band 5 (12.0u).	Binary / PNG	NMSC/KMA Webpage	Full Disk / Extended Northern Hemisphere/ East Asia / Local Area	1 km: Band 3, 4 km: Band 4-16	3 hours (Full Disk) / 15 minutes	4000	http://nmsc.kma.go.kr/html/homepage/en/ver2/Static/selectStaticPage.do?view=site http://nmsc.kma.go.kr/html/homepage/en/ver2/Static/selectStaticPage.do?view=site				
14	COMS imagery	KMA	COMS imagery Band 1 (0.68u), Band 2 (3.75u), Band 3 (6.75u), Band 4 (10.8u), Band 5 (12.0u).	PNG	DCPC Webpage	Full Disk / Extended Northern Hemisphere	1 km: Band 3, 4 km: Band 4-16	3 hours (Full Disk) / 15 minutes	2000	http://dcpc.nmsc.kma.go.kr/superwis-user-portal/ver1/main_home http://nmsc.kma.go.kr/html/homepage/en/ver2/Static/selectStaticPage.do?view=site				
15	COMS imagery	KMA	COMS imagery Band 1 (0.68u), Band 2 (3.75u), Band 3 (6.75u), Band 4 (10.8u), Band 5 (12.0u).	LRIT	COMS Broadcast	Full Disk / Extended Northern Hemisphere	5 km : Band 1-5	3 hours / 15 minutes	500	http://nmsc.kma.go.kr/html/homepage/en/ver2/Static/selectStaticPage.do?view=site http://nmsc.kma.go.kr/html/homepage/en/ver2/Static/selectStaticPage.do?view=site				
16	Himawari-8/9 imagery	JMA	Himawari-8/9 imagery All 16 Bands	Himawari Standard Data (HSD)	HimawariCloud (Internet)	Full disk	0.5 km: Band 3, 1 km: Band 1, 2, 4, 2 km: Band 5-16	10 minutes	830000	http://www.data.jma.go.jp/mscweb/en/himawari89/cloud http://www.data.jma.go.jp/mscweb/en/himawari89/cloud				
17	Himawari-8/9 imagery	JMA	Himawari-8/9 Real-Time Image Band 13(10.4u), Band 3(0.64u), Band 8(6.2u), Band 7(3.9u), Day Microphysics RGB, Night Microphysics RGB, Dust RGB, Airmass RGB, Day Snow-Fog RGB, Natural RGB, True Color RGB, Day Convective Storm RGB, Sandwich, Band3 combined with Band13, Band3 and Band13 at night.	JPEG Image	MSC/JMA's Web page (Internet)	Full Disk, South Asia, Japan, Australia, New Zealand, Central Asia #1, Southeast Asia #1, Southeast Asia #2, Southeast Asia #3, Hi-resolution Asia #1, Hi-resolution Asia #2, Hi-resolution Asia #3, Hi-resolution Asia #4, Pacific Island #1, Pacific Island #2, Pacific Island #3, Pacific Island #4, Pacific Island #5, Pacific Island #6	19 deg / 0.05 deg / 0.037 deg / 0.02 deg / 0.015 deg	10 minutes	180000	"Himawari Real-Time Image." http://www.data.jma.go.jp/mscweb/data/himawari/				
18	Himawari-8/9 imagery	JMA	Himawari-8/9 imagery Band 3(VIS, 0.64u), Band 7 (IR4, 3.9u), Band 8 (WV, 6.2u), Band 13 (IR1, 10.4u), Band 15 (IR2, 12.4u).	SATAID	WIS (Internet)	Northwest square grid, Southeast square grid, North Central grid, South Central grid, East Central grid, West Central grid, Full Domain	0.04 deg	10 minutes	170000	"SATAID Service." https://www.wis.jma.go.jp/msscweb/en/				
19	Himawari-8/9 imagery	JMA	Himawari-8/9 imagery Band 3 (0.64u), Band 7 (3.9u), Band 8 (6.2u), Band 13 (10.4u), Band 15 (12.4u).	HRIT file	JDDS (Internet)	Northern and Southern hemisphere	1 km: Band 3, 4 km: Band 7, 8, 13, 15	30 minutes	130000	via JMA Data Dissemination System (JDDS)." http://www.data.jma.go.jp/msscweb/en/himawari89/jdds-service/JDDS				
20	Himawari-8/9 imagery	JMA	Himawari-8/9 imagery True Color Image Data	PNG	HimawariCloud (Internet)	Full disk	1 km	10 minutes	130000	"Distributed via Internet cloud service; the HimawariCloud service." http://www.data.jma.go.jp/msscweb/en/himawari89/cloud				
21	Himawari-8/9 imagery	JMA	Himawari-8/9 imagery Band 3 (0.64u), Band 4 (0.86u), Band 5 (1.6u), Band 6 (2.3u), Band 7 (3.9u), Band 8 (6.2u), Band 9 (6.9u), Band 10 (7.3u), Band 11 (8.6u), Band 12 (9.6u), Band 13 (10.4u), Band 14 (11.2u), Band 15 (12.4u), Band 16 (13.3u).	HRIT file	HimawariCast (DVB-S2)	Full disk	1 km: Band 3, 4 km: Band 4-16	10 minutes	120000	"Distributed via communication satellite; the HimawariCast service." https://www.data.jma.go.jp/msscweb/en/himawari89/himawari-cast/				

22	Himawari-8/9 imagery	JMA	Himawari-8/9 imagery All 16 Bands	NetCDF	HimawariCloud (Internet)	Target Area (1000km × 1000km)	0.5 km: Band 3, 1 km: Band 1, 2, 4, 2 km: Band 5-16	2.5 minutes	12000	Distribution via Internet cloud service: the HimawariCloud service. http://www.data.jma.go.jp/mmcweb/en/himawari89/cloud-service/cloud-service/				
23	Himawari-8/9 imagery	JMA	Himawari-8/9 imagery All 16 Bands	Himawari Standard Data (HSD)	HimawariCloud (Internet)	Target Area (1000km × 1000km)	0.5 km: Band 3, 1 km: Band 1, 2, 4, 2 km: Band 5-16	2.5 minutes	9900	Distribution via Internet cloud service: the HimawariCloud service. http://www.data.jma.go.jp/mmcweb/en/himawari89/cloud-service/cloud-service/				
24	Himawari-8/9 imagery	JMA	Himawari-8/9 imagery Band 3 (0.64u), Band 7 (3.9u), Band 8 (6.2u), Band 13 (10.4u).	LRIT file	HimawariCast (DVB-S2)	Full disk	5 km	10 minutes	7200	Distribution via communication satellite: the HimawariCast service. https://www.data.jma.go.jp/mmcweb/en/himawari89/himawari_cast/				
25	Himawari-8/9 imagery	JMA	Himawari-8/9 imagery Band 3 (0.64u), Band 7 (3.9u), Band 8 (6.2u), Band 13 (10.4u)	JPEG Image	JDDS (Internet)	Full disk, Northwest square grid, Northeast square grid, Southeast square grid, Southwest square grid, Northwest Pacific square grid, Southwest Pacific square grid, East Asia, Northeast of Japan, Southwest of Japan	1 km: Band 3, 4 km: Band 7, 8, 13	1 hour: Full disk, 30 minutes: others	5700	Distribution via JMA Data Dissemination System (JDDS). http://www.data.jma.go.jp/mmcweb/en/himawari89/JDDS_service/JDDS_service.html				
26	Himawari-8/9 imagery	JMA	Himawari-8/9 Real-Time Image Infrared(Band 13, 10.4u), Visible(Band 3, 0.64u), Water Vapor(Band 8, 6.2u), True Color.	PNG	JMA's Web page (Internet)	Full Disk, East Asia	11 km: Full Disk, 6 km: East Asia	10 minutes	3300	Distribution via JMA Data Dissemination System (JDDS). http://www.jma.go.jp/en/gm				
27	Himawari-8/9 imagery	JMA	Himawari-8/9 imagery True Color Image Data	PNG	HimawariCloud (Internet)	Target Area (1000km×1000km)	1 km	2.5 minutes	2100	Distribution via Internet cloud service: the HimawariCloud service. http://www.data.jma.go.jp/mmcweb/en/himawari89/cloud-service/cloud-service/				
28	Himawari-8/9 imagery	JMA	Himawari-8/9 Real-Time Imagery with heavy rainfall potential areas	JPEG Image	MSC/JMA's Web page (Internet)	Southeast Asia, South Pacific Islands	0.05 deg	10 minutes	2000	Distribution via Internet cloud service: the HimawariCloud service. http://www.data.jma.go.jp/mmcweb/realtime/himawari89/realtime/realtime.html				
29	Himawari-8/9 imagery	JMA	Himawari-8/9 Real-Time Image Infrared(Band 13, 10.4u), Visible(Band 3, 0.64u), Water Vapor(Band 8, 6.2u), True Color.	PNG	JMA's Web page (Internet)	Japan area	8 km	2.5 minutes	1600	Distribution via Internet cloud service: the HimawariCloud service. http://www.jma.go.jp/en/rapid				
30	Imager radiances	KMA	Clear Sky Radiance	HDF-EOS5 / PNG	DCPC Webpage	Full Disk / Extended Northern Hemisphere	1 km:Visible based products 4 km: IR-based products	3 hours (Full Disk) / 15 minutes	170000	Distribution via Internet cloud service: the HimawariCloud service. http://dpcp.nmsc.kma.go.kr/openwis-userportal/srv/en/main_home				
31	Imager radiances	JMA	Clear Sky Radiance	BUFR4	GTS	60S-60N, 80E-160W	60 km	1 hour	2200	Products: Clear Sky Radiance. http://www.data.jma.go.jp/mmcweb/en/product/product/csr/index.htm				
32	Imager radiances	KMA	Clear Sky Radiance	BUFR4	GTS	60S-60N, 75E-180E	30 km	15 minutes	500	Products: Clear Sky Radiance. http://nmsc.kma.go.kr/html/homepage/en/ver2/static/selectStaticPage.do?view=datapcenter_data5				
33	Land surface temperature	KMA	Land Surface Temperature (LST)	Binary / PNG	NMSC/KMA Webpage	Full Disk / Extended Northern Hemisphere/ East Asia / Local Area	1 km:Visible based products 4 km: IR-based products	3 hours (Full Disk) / 15 minutes	9000	Products: Clear Sky Radiance. http://nmsc.kma.go.kr/html/homepage/en/ver2/static/selectStaticPage.do?view=datapcenter_data5				

34	Land surface temperature	KMA	Land Surface Temperature (LST)	HDF-EOS5 / PNG	DCPC Webpage	Full Disk / Extended Northern Hemisphere	1 km: Visible based products 4 km: IR-based products	3 hours (Full Disk) / 15 minutes	9000	http://dcpc.nmsc.kma.go.kr/openwis-user-portal/srv/en/main_home				
35	Long-wave incoming surface radiation	KMA	Insolation	Binary / PNG	NMSC/KMA Webpage	Full Disk / Extended Northern Hemisphere / East Asia / Local Area	1 km: Visible based products 4 km: IR-based products	3 hours (Full Disk) / 15 minutes	12000	http://nmsc.kma.go.kr/html/homepage/en/ver2/static/selectStaticPage.do?view=datatable_data				

36	Long-wave incoming surface radiation	KMA	Insolation	HDF-EOS5 / PNG	DCPC Webpage	Full Disk / Extended Northern Hemisphere	1 km:Visible based products 4 km: IR-based products	3 hours (Full Disk) / 15 minutes	12000	http://dcpn.sc.kma.go.kr/openwis-user-portal/srv/en/main_home				
37	Long-wave outgoing radiation at top-of-atmosphere (TOA)	KMA	Outgoing Longwave Radiation	Binary / PNG	NMSC/KMA Webpage	Full Disk / Extended Northern Hemisphere/ East Asia / Local Area	1 km:Visible based products 4 km: IR-based products	3 hours (Full Disk) / 15 minutes	61000	http://nmsc.kma.go.kr/html/homepage/en/ver2/static/selectStaticPage.do?view=datapcenter_data5				
38	Long-wave outgoing radiation at top-of-atmosphere (TOA)	KMA	Outgoing Longwave Radiation	HDF-EOS5 / PNG	DCPC Webpage	Full Disk / Extended Northern Hemisphere	1 km:Visible based products 4 km: IR-based products	3 hours (Full Disk) / 15 minutes	61000	http://dcpn.sc.kma.go.kr/openwis-user-portal/srv/en/main_home				
39	Low cloud and fog	KMA	FOG	Binary / PNG	NMSC/KMA Webpage	Full Disk / Extended Northern Hemisphere/ East Asia / Local Area	1 km:Visible based products 4 km: IR-based products	3 hours (Full Disk) / 15 minutes	12000	http://nmsc.kma.go.kr/html/homepage/en/ver2/static/selectStaticPage.do?view=datapcenter_data5				
40	Low cloud and fog	KMA	FOG	HDF-EOS5 / PNG	DCPC Webpage	Full Disk / Extended Northern Hemisphere	1 km:Visible based products 4 km: IR-based products	3 hours (Full Disk) / 15 minutes	12000	http://dcpn.sc.kma.go.kr/openwis-user-portal/srv/en/main_home				
41	Precipitation index	KMA	Total Precipitable Water (TPW), Rain Intensity	Binary / PNG	NMSC/KMA Webpage	Full Disk / Extended Northern Hemisphere/ East Asia / Local Area	1 km:Visible based products 4 km: IR-based products	3 hours (Full Disk) / 15 minutes	15000	http://nmsc.kma.go.kr/html/homepage/en/ver2/static/selectStaticPage.do?view=datapcenter_data5				
42	Precipitation index	KMA	Total Precipitable Water (TPW), Rain Intensity	HDF-EOS5 / PNG	DCPC Webpage	Full Disk / Extended Northern Hemisphere	1 km:Visible based products 4 km: IR-based products	3 hours (Full Disk) / 15 minutes	15000	http://dcpn.sc.kma.go.kr/openwis-user-portal/srv/en/main_home				
43	Sea surface temperature	KMA	Sea Surface Temperature (SST)	Binary / PNG	NMSC/KMA Webpage	Full Disk / Extended Northern Hemisphere/ East Asia / Local Area	1 km:Visible based products 4 km: IR-based products	3 hours (Full Disk) / 15 minutes	12000	http://nmsc.kma.go.kr/html/homepage/en/ver2/static/selectStaticPage.do?view=datapcenter_data5				
44	Sea surface temperature	KMA	Sea Surface Temperature (SST)	HDF-EOS5 / PNG	DCPC Webpage	Full Disk / Extended Northern Hemisphere	1 km:Visible based products 4 km: IR-based products	3 hours (Full Disk) / 15 minutes	12000	http://dcpn.sc.kma.go.kr/openwis-user-portal/srv/en/main_home				
45	Snow cover	KMA	Snow cover / Sea-ice	Binary / PNG	NMSC/KMA Webpage	Full Disk / Extended Northern Hemisphere/ East Asia / Local Area	1 km:Visible based products 4 km: IR-based products	3 hours (Full Disk) / 15 minutes	3000	http://nmsc.kma.go.kr/html/homepage/en/ver2/static/selectStaticPage.do?view=datapcenter_data5				
46	Snow cover	KMA	Snow cover / Sea-ice	HDF-EOS5 / PNG	DCPC Webpage	Full Disk / Extended Northern Hemisphere	1 km:Visible based products 4 km: IR-based products	3 hours (Full Disk) / 15 minutes	3000	http://dcpn.sc.kma.go.kr/openwis-user-portal/srv/en/main_home				
47	Specific humidity profile	KMA	Upper Tropospheric Humidity	Binary / PNG	NMSC/KMA Webpage	Full Disk / Extended Northern Hemisphere/ East Asia / Local Area	1 km:Visible based products 4 km: IR-based products	3 hours (Full Disk) / 15 minutes	12000	http://nmsc.kma.go.kr/html/homepage/en/ver2/static/selectStaticPage.do?view=datapcenter_data5				
48	Specific humidity profile	KMA	Upper Tropospheric Humidity	HDF-EOS5 / PNG	DCPC Webpage	Full Disk / Extended Northern Hemisphere	1 km:Visible based products 4 km: IR-based products	3 hours (Full Disk) / 15 minutes	12000	http://dcpn.sc.kma.go.kr/openwis-user-portal/srv/en/main_home				

49	Wind vector over sea surface	JMA	ASCAT ocean surface wind	SATAID	HimawariCast (DVB-S2)	65S-65N, 90E-150W	12.5 km	30 minutes	2000	Dissemination via communication satellite: the HimawariCast service. https://www.data.jma.go.jp/mscweb/en/himawari89/himawari_cast/himawari_cast				
b) Please indicate at the end of the inventory other relevant satellite products, if any, which are not present in the table and that you would like to be disseminated in the region.														

THANK YOU FOR COMPLETING THIS SURVEY!