



## Data User Guide

# ***NRT AMSR2 L2B Global Swath GSFC Profiling Algorithm 2010: Surface Precipitation, Wind Speed over Ocean, Water Vapor over Ocean and Cloud Liquid Water over Ocean***

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### **Introduction**

The GCOM-W1 near real-time (NRT) AMSR2 Level 2B rain and ocean products include global precipitation and ocean parameters (excluding sea surface temperatures) that were created using the Goddard Space Flight Center (GSFC) PROFiling algorithm (GPROF) 2010 version 2. The GPROF generates the rain and ocean data products using resampled brightness temperature (Level-1R) data provided by the Japanese Aerospace Exploration Agency (JAXA), and the NOAA Optimally Interpolated Sea Surface Temperature retrieved from NOAA's National Centers for Environmental Information (NCEI). Parameters generated for this data product include global total precipitation, global rainfall, total perceptible water (TPW), ocean wind speed (OWS), columnar cloud liquid water (CLW) over the ocean, and columnar water vapor (CWV) over the ocean. NRT products are generated within 3 hours of the last observations in the file by the Land Atmosphere Near real-time Capability for EOS (LANCE) at the AMSR Science Investigator-led Processing System (AMSR SIPS), which is collocated with the Global Hydrology Resource Center (GHRC) Distributed Active Archive Center (DAAC).

### **Notice:**

All LANCE AMSR2 data should be used with the understanding that these are preliminary products. Cross calibration with AMSR-E products has not been performed. As updates are made to the L1R data set, those changes will be reflected in this higher level product.

## Citation

Kummerow, C. 2015. NRT AMSR2 L2B Global Swath GSFC Profiling Algorithm 2010: Surface Precipitation, Wind Speed over Ocean, Water Vapor over Ocean and Cloud Liquid Water over Ocean [indicate subset used]. Dataset available online from NASA LANCE AMSR2 at the GHRC DAAC Huntsville, Alabama, U.S.A. doi: [http://dx.doi.org/10.5067/AMSR2/A2\\_RainOcn\\_NRT](http://dx.doi.org/10.5067/AMSR2/A2_RainOcn_NRT)

## Keywords:

*Rain; ocean; global total precipitation; global rainfall; total perceptible water; ocean wind speed; columnar cloud liquid water; columnar water vapor*

## LANCE

The Land Atmosphere Near real-time Capability for EOS (LANCE) makes EOS data from MODIS, AIRS, MLS, OMI, AMSR2, and MISR available within three hours of satellite overpass to meet the timely needs of applications such as numerical weather and climate prediction; forecasting and monitoring natural hazards, ecological/invasive species, agriculture, and air quality; providing help with disaster relief; and homeland security. Please note that LANCE has a rolling archive life of ten days on the HTTPS server. Once ten days pass following the data acquisition date, users must use the standard products.

If data latency is not a primary concern, please consider using science quality standard products. Science products are created using the best available ancillary, calibration and ephemeris information. Science quality products are an internally consistent, well-calibrated record of the Earth's geophysical properties to support science. The AMSR2 standard science quality data products will be available from the NSIDC DAAC.

## Instrument Description

The Advanced Microwave Scanning Radiometer 2 (AMSR2) instrument aboard the Global Change Observation Mission - Water 1 (GCOM-W1) provides global passive microwave measurements of terrestrial, oceanic, and atmospheric parameters for the investigation of global water and energy cycles. Both AMSR2 and GCOM-W1 are built and operated by Japan Exploration Agency (JAXA). Data from this instrument are ingested from JAXA into NASA's LANCE element at the AMSR SIPS to be processed with US AMSR Science Team members' algorithms.

The AMSR instruments improved upon the heritage of the Scanning Multichannel Microwave Radiometer (SMMR), Special Sensor Microwave/Imager (SSM/I) and Tropical Rainfall Measuring Mission (TRMM) Microwave Instrument (TMI) instruments. Major improvements over those instruments included channels spanning the 6.9 GHz to 89 GHz frequency range, and higher spatial resolution from

the 1.6 m reflector. More information about AMSR2 can be found at [http://global.jaxa.jp/projects/sat/gcom\\_w/](http://global.jaxa.jp/projects/sat/gcom_w/).

## Investigators

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## File Naming Convention

The data are formatted using the following file naming convention.

**Data:** AMSR\_2\_L2\_RainOcean\_R##\_yyyymmddhhmm\_f.he5

**Browse:** AMSR\_2\_L2\_RainOcean\_R##\_yyyymmdd\_f\_WW.png

**QA Summary Files:** AMSR\_2\_L2\_RainOcean\_R##\_yyyymmddhhmm\_f.qa

Table 1: File naming convention variables

Variable	Description
R	Near real-time product
##	Two-digit file version number
yyyy	Four-digit year
mm	Two-digit month
dd	Two-digit day
hh	Two-digit hour
mm	Two-digit minute
f	A = Ascending, D = Descending
WW	LW = Cloud liquid water SP = Total surface precipitation rate SR = Surface rain rate WS = Surface wind speed over ocean WV = Atmospheric water vapor
.he5	HDF-EOS5 format
.xml	Metadata file
.met	Metadata file
.png	Portable Network Graphics format
.qa	GPS Quality Assessment Data

## Data Format Description

Data are stored in HDF-EOS5 format and are available via HTTP from the EOSDIS LANCE system at <https://lance.nsstc.nasa.gov/amsr2-science/data/level2/rainocean/> or <https://lance.itsc.uah.edu/amsr2-science/data/level2/rainocean/>. Please refer to Table 2 for information on the dataset characteristics.

Table 2: Dataset Characteristics

Characteristic	Description
Platform	Global Change Observation Mission - Water 1 (GCOM-W1)
Instrument	Advanced Microwave Scanning Radiometer 2 (AMSR2)
Spatial Coverage	N: 89.24, S: -89.24, W: -180, E: 180 (Global)
Spatial Resolution	Varies between parameters
Temporal Coverage	Start date: 10-24-2015 Stop date: Ongoing
Temporal Resolution	Daily, Half-orbit (duration 50 minute)
Parameter	Surface Precipitation Wind Speed over Ocean Water Vapor over Ocean Cloud Liquid Water over Ocean
Processing Level	Level 2B
Data Format	HDF-EOS5

## Data Parameters

Each data file contains core metadata, product-specific attributes, and data fields. Please refer to Table 3 for additional parameter information.

Table 3: Data Variables

Field Name	Description	Data Type	Unit	NoData Value
chiSquared	Error diagnostic for Optimal Estimation calculation of TPW and wind speed. Values greater than the number of channels (9 for TMI) should be considered suspect, with values greater than 18 of limited use. Rainfall is possible above these values. Values could range from 0 to 10000, but should be less than 100.	Int8	N/A	N/A
cloudWaterPath	Total cloud liquid water in the column. Values range from 0 to 3.0 kg m <sup>-2</sup> .	Float32	kg m <sup>-2</sup>	-9999.9
columnarCloudLiquidWater	The liquid water path derived from the OE retrieval of non-raining parameters. This is not to be confused with the columnar	Float32	kg m <sup>-2</sup>	N/A

	cloudWaterPath, which is from the Bayesian retrieval.																			
columnarWaterVapor	Liquid equivalent of the total water vapor in the column. Values range from 0 to 75 mm. Calculated from the OE retrieval. Values in pixels with < 0.175mm CLW are filled with interpolated values.	Float32	mm	N/A																
convectPrecipitation	The instantaneous convective precipitation rate at the surface for each pixel. Check pixelStatus for a valid retrieval.	Float32	mm hr <sup>-1</sup>	-9999.9																
freezingHeight	The height, in meters, of the 0°C isotherm above the Earth ellipsoid	Int16	M	-9999																
iceWaterPath	Total cloud ice in the column. Values range from 0 to 3.0 kg m <sup>-2</sup> .	Float32	kg m <sup>-2</sup>	-9999.9																
landAmbiguousFlag	<p>Defines codes for uncertain/ambiguous retrievals over land</p> <table border="1"> <thead> <tr> <th>Value</th> <th>Description</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>No information</td> </tr> <tr> <td>13</td> <td>Ambiguous T22V/ 2 different scattering screens</td> </tr> <tr> <td>14</td> <td>Cannot discriminate precipitation from cold surface</td> </tr> <tr> <td>63</td> <td>Light precipitation</td> </tr> <tr> <td>64</td> <td>Cold surface</td> </tr> <tr> <td>65</td> <td>Grody light precipitation</td> </tr> <tr> <td>66</td> <td>Huffman ambiguous</td> </tr> </tbody> </table>	Value	Description	0	No information	13	Ambiguous T22V/ 2 different scattering screens	14	Cannot discriminate precipitation from cold surface	63	Light precipitation	64	Cold surface	65	Grody light precipitation	66	Huffman ambiguous	Int8	N/A	N/A
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oceanExtendedDbase	<p>Percent of the extended database entries (i.e., beyond the TRMM database) used in the retrieval (range 0-100).</p> <table border="1"> <thead> <tr> <th>Value</th> <th>Description</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>only the TRMM database entries used</td> </tr> </tbody> </table>	Value	Description	0	only the TRMM database entries used	Int8	Percent	N/A												
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oceanSearchRadius	<p>Expansion of the search radius of the a priori database beyond the initial SST and TPW search range. The profiles for the rain ocean procedure are grouped by SST and TPW. The individual pixels TPW and SST are used to retrieve a group of pixels from the database. If there are fewer than 1000 profile clusters found, the search radius is expanded.</p> <table border="1"> <thead> <tr> <th>Value</th> <th>Description</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>Default search radius used</td> </tr> <tr> <td>1</td> <td>Search radius expanded by +/- 1 mm in TPW and +/- 1 degree in SST</td> </tr> <tr> <td>N</td> <td>Search radius expanded by +/- N mm in TPW and +/- N degrees in SST</td> </tr> </tbody> </table>		Value	Description	0	Default search radius used	1	Search radius expanded by +/- 1 mm in TPW and +/- 1 degree in SST	N	Search radius expanded by +/- N mm in TPW and +/- N degrees in SST	Int8	N/A	-99																		
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probabilityOfPrecip	A diagnostic variable, in percent, defining the fraction of raining vs. non-raining database profiles that make up the final solution. Values range from 0 to 100 percent.	Int8	N/A	-99								
QualityFlag	<p>Indicates the generalized quality of the retrieved pixel. Valid values include:</p> <table border="1"> <thead> <tr> <th>Value</th> <th>Description</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>High quality (retrieval is good)</td> </tr> <tr> <td>1</td> <td>Medium quality (use with caution)</td> </tr> <tr> <td>2</td> <td>Low quality (recommended qualitative use only)</td> </tr> </tbody> </table> <p>Ocean Algorithm:  <b>High:</b> Good retrieval (uses entries from TRMM a priori database)  <b>Medium:</b> Retrieval used extended database and/or expanded search radius for a priori database (see oceanExtendedDbase and/or oceanSearchRadius)  <b>Low:</b> Retrieval used excessive search radius to find matches in a priori database (see oceansearchRadius)</p> <p>Land/Coast Algorithm:  <b>High:</b> Good retrieval  <b>Medium:</b> Ambiguous pixel (see landScreenFlag)  <b>Low:</b> Missing or unable to retrieve pixels (see pixelStatus)</p>	Value	Description	0	High quality (retrieval is good)	1	Medium quality (use with caution)	2	Low quality (recommended qualitative use only)	Int8	N/A	-99
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rainWaterPath	Total rain water in the column. Values range from 0 to 10.0 kg m <sup>-2</sup> .	Float32	kg m <sup>-2</sup>	-9999.9								
ReySeaSurfaceTemperature	Sea surface temperature from the 0.5° daily Reynolds SST dataset (Reynolds et. al 2007).	Float32	K	-9999.9								
sunGlintAngle	sunGlintAngle is the angular separation between the Reflected Satellite View Vector and the Sun Vector. When sunGlintAngle is zero, the instrument views the center of the specular (mirror-like) sun reflection. Values range from 0 to 180 degrees.	Int8	Degree	N/A								
surfacePrecipitation	The instantaneous total precipitation rate at the surface for each pixel. Check pixelStatus for a valid retrieval.	Float32	mm hr <sup>-1</sup>	-9999.9								

surfaceRain	The instantaneous rain rate (liquid portion of precipitation) at the surface for each pixel. Check pixelStatus for a valid retrieval.	Float32	mm hr <sup>-1</sup>	-9999.9	
surfaceType	Pixel indicates surface type using the following codes	Int8	N/A	-99	
	<b>Value</b>				<b>Description</b>
	10				Ocean
	11				Sea ice
	12				Partial sea ice
	20				Land
	30				Coast
31	Inland water				
windSpeed	Wind speed at the 18 meters above sea surface derived from the OE retrieval. No filling is done for values above the CLW threshold.	Int16	m s <sup>-1</sup>	N/A	

## Quality Assessment

A Quality Assessment (QA) summary file is provided for each data file. The QA summary file denotes whether or not the file passed the science quality flags.

## References

Kummerow, C., R. Ferraro, and David Randell. 2014. EOS/AMSR Rainfall: Algorithm Theoretical Basis Document, Version 2 GPROF 2010 L2A. Fort Collins, Colorado, USA: Colorado State University.

Kummerow, C. D., S. Ringerud, J. Crook, D. Randel and W. Berg, 2010. An observationally generated A-Priori database for microwave rainfall retrievals, *Journal of Atmospheric and Oceanic Technology* 28(2): 113-130, doi: 10.1175/2010JTECHA1468.1.

Kummerow, C., and R. Ferraro. 2012. [Supplement] Algorithm Theoretical Basis Document: EOS/AMSR-E Level-2 Rainfall. Fort Collins, Colorado, USA: Colorado State University.

Reynolds, R.W., Smith, T.M., Liu, C., Chelton, D.B., Casey, K.S. and Schlax, M.G., 2007. Daily high-resolution-blended analyses for sea surface temperature. *Journal of Climate*, 20(22), pp.5473-5496.



## Contact Information

To order these data or for further information, please contact:

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User Services

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Web: <https://ghrc.nsstc.nasa.gov/>