Aquarius L2 Swath Single Orbit Soil Moisture, Version 4

USER GUIDE

How to Cite These Data

As a condition of using these data, you must include a citation:

Bindlish, R. and T. Jackson. 2015. *Aquarius L2 Swath Single Orbit Soil Moisture, Version 4*. [Indicate subset used]. Boulder, Colorado USA. NASA National Snow and Ice Data Center Distributed Active Archive Center. https://doi.org/10.5067/Aquarius/AQ2_SM.004. [Date Accessed].

FOR QUESTIONS ABOUT THESE DATA, CONTACT NSIDC@NSIDC.ORG

FOR CURRENT INFORMATION, VISIT https://nsidc.org/data/AQ2_SM

National Snow and Ice Data Center

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1 DETAILED DATA DESCRIPTION

Aquarius LeveL-2 Soil Moisture products are produced by the NASA Goddard Space Flight Center's Aquarius Data Processing Segment (ADPS).

1.1 Format

The data files are in Hierarchical Data Format 5 (HDF5).

1.2 File and Directory Structure

Data are available on the HTTPS site in the `https://n5eil01u.ecs.nsidc.org/AQUARIUS/AQ2_SM.004/` directory. Within this directory, the folders are organized by date, for example:

```
/2013.09.28/
/2013.09.29/
/2013.09.30/
```

Folders contain HDF5 data files and XML metadata files.

1.3 File Naming Convention

Soil moisture files are named according to the following conventions and as described in Table 1:

```
Q2014271210000.L2_SOILM_V4.0
Qyyyydddhhmmss.L2_ppppp_vvvv
```

Where:

Table 1. File Naming Convention

Variable	Description
Q	Indicates Aquarius instrument
yyyy	UTC four-digit year
ddd	UTC day of year
hhmmss	UTC hours, minutes, and seconds of the first sample block in the product. Sample block is defined as the first set of observations from the three Aquarius beams.
L2	Processing level
ppppp	Geophysical parameter: SOILM = soil moisture
vvvv	Version, e.g. V4.0

Each data file is paired with an XML file of the same name with .XML extension. The XML file contains metadata associated with the data file.

1.4 File Size

HDF5 files range from approximately 1 MB to 16 MB.

XML files average approximately 16 KB.

1.5 Volume

Total data volume is approximately 21 GB.

1.6 Spatial Coverage

Coverage spans from 180°W to 180°E, and from approximately 90°N to 90°S. The swath width is about 390 km, enabling nearly global coverage every seven days. Figure 1 shows the spatial coverage of the Aquarius Radiometer for one orbit, which comprises one granule of this data set.

1.6.1 Spatial Coverage Map

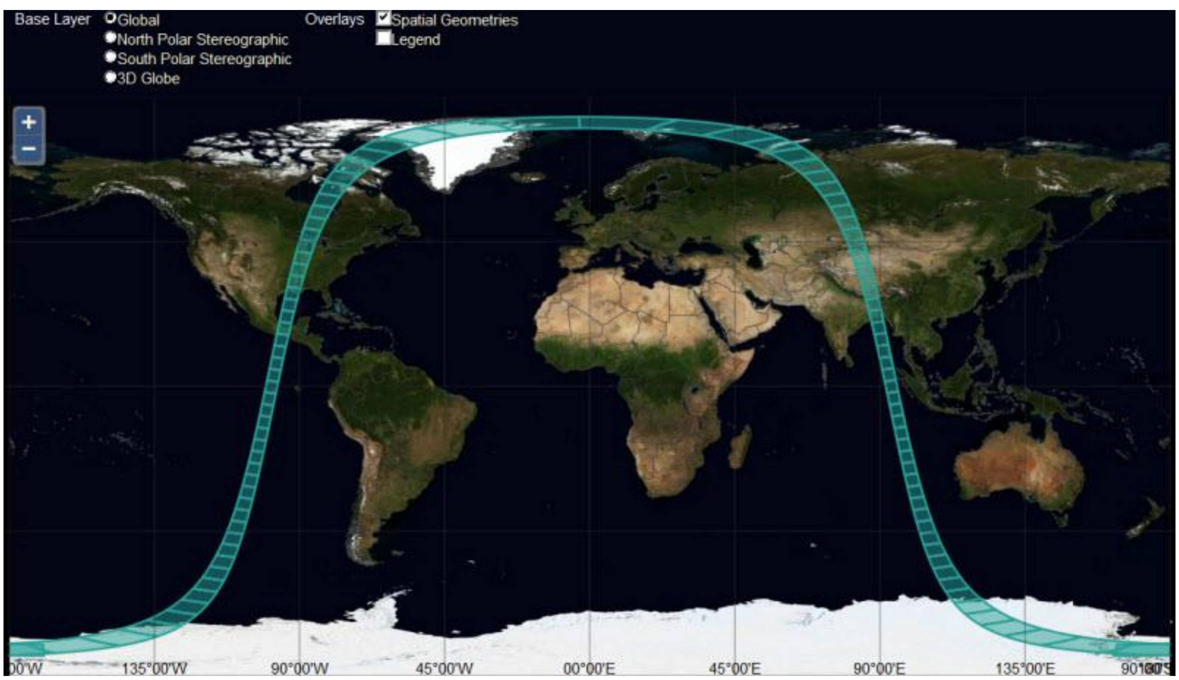

Figure 1. Spatial Coverage Map displaying one orbit of the Aquarius Radiometer. The map was created using Reverb | ECHO.

1.6.2 Spatial Resolution

The Aquarius radiometer consists of 3 beams of sizes 76 x 94 km (inner beam), 84 x 120 km (middle beam) and 96 x 156 km (outer beam). The total swath width of the 3 beams is about 390 km.

Soil moisture is estimated for each individual radiometer beam footprint. The exact spatial resolution of the Level-2 product varies depending on the beam position (inner, middle or outer beam).

Figure 2 shows the position of the Aquarius beams.

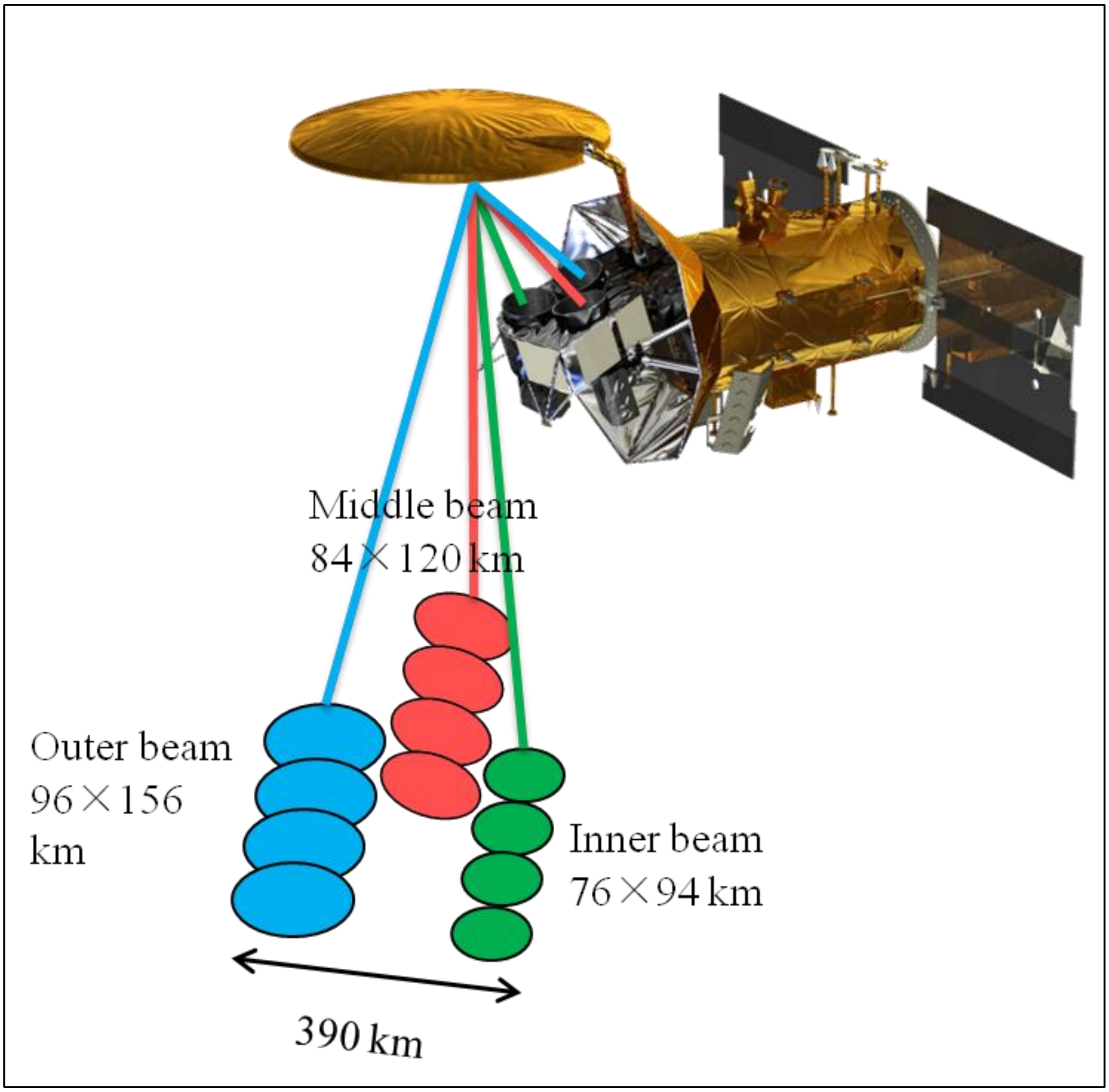

Figure 2. Location and 3 dB size of the Aquarius beams

1.7 Temporal Coverage

Temporal Coverage: 25 August 2011 to 07 June 2015.

Due to a power failure on the Satélite de Aplicaciones Científicas (SAC)-D spacecraft on 08 June 2015, data from NASA's Aquarius instrument are no longer being produced. For more information on this event, please refer to the official NASA announcement. The NASA National Snow and Ice Data Center Distributed Active Archive Center (NSIDC DAAC) will continue to distribute Aquarius soil moisture and polar-gridded data sets for the full duration of the mission, 25 August 2011 to 07 June 2015.

1.7.1 Temporal Resolution

98 minutes per granule. Global coverage is completed every seven days.

1.8 Parameter or Variable

The Single Channel Algorithm (SCA) is used to estimate soil moisture using Aquarius brightness temperature observations. The SCA is applied to the individual Aquarius footprint brightness temperature observations (L2) to produce a swath-based time-order product. Each swath is stored in a separate file. Files are divided into the groups of attributes shown in Figure 3.

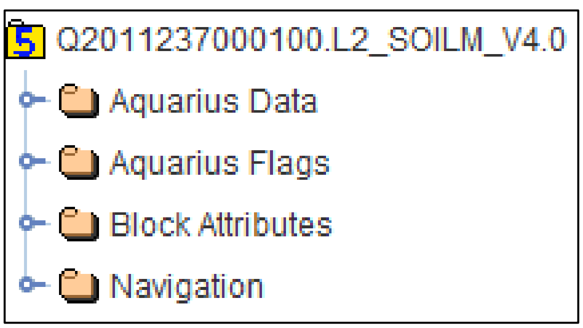

Figure 3. Aquarius soil moisture data file attribute groups

1.8.1 Parameter Description

The following groups of data objects (Aquarius Data, Aquarius Flags, Block Attributes, and Navigation) contain data stored as HDF5 data blocks. Each data object within these four groups contains data for each block and is therefore dimensioned by the value of the global attribute, Number of Blocks.

Aquarius Data: Attributes contained in the Aquarius Data group are described in Table 2. Each parameter in this group contains 4083 x 3 (Aquarius beams) elements.

Table 2. Aquarius Data Group Description

Name	Description	Units
anc_sm	NCEP GFS GDAS soil moisture.	Volumetric Fraction (m3/m3)
anc_subsurf_temp	0-10 cm NCEP GFS sub-surface temperature. The subsurface temperature over the land is the NCEP GFS GDAS product for the layer (0-10 cm) because emission from this layer is most closely correlated with soil moisture.	Kelvin
anc_surface_temp	NCEP GFS surface temperature. The surface temperature over the ocean is the NOAA OISST (Reynolds) product. Over land, the NCEP GFS GDAS product for the surface layer is used.	Kelvin
anc_swe	The snow water equivalent from NCEP GFS GDAS.	Kg/m2
rad_TbH	Aquarius L2 brightness temperature at the Earth surface after atmospheric correction h-pol. Prior to making a correction for roughness.	Kelvin
rad_TbV	Aquarius L2 brightness temperature at the Earth surface after atmospheric correction v-pol. Prior to making a correction for roughness.	Kelvin
rad_ice_frac	Fraction of ice contamination. Gain weighted ice fraction integrated over the antenna footprint. The Integration is over the radiometer footprint with 0 = water and 0 = land and 1 = sea ice weighted by the antenna pattern. Computation is made using the NCEP GFS GDAS ice product.	Area (m2/m2)
rad_land_frac	Fraction of land contamination. The gain weighted land fraction: Integration over the radiometer footprint with 1 = land and 0 = non-land (water and sea ice) weighted by the antenna pattern. Computation is made using the GSFC ODPS (SeaWiFS) 1 km resolution land mask. "Land" includes ice/snow covered land.	Area (m2/m2)
rad_sm	Aquarius volumetric soil moisture estimates.	Volumetric Fraction (m3/m3)
scat_HH_toa	Top Of Atmosphere (TOA) scatterometer Normalized Radar Cross Section (NRCS) for HH (transmit horizontal, receive horizontal) polarization. Aquarius L2 normalized radar cross-section at the top of the atmosphere at HH polarization.	Decibels

Name	Description	Units
scat_HV_toa	TOA Scatterometer NRCS for HV (transmit horizontal, receive vertical) polarization. Aquarius L2 normalized radar cross-section at the top of the atmosphere at HV polarization.	Decibels
scat_VH_toa	TOA Scatterometer NRCS for VH (transmit vertical, receive horizontal) polarization. Aquarius L2 normalized radar cross-section at the top of the atmosphere at VH polarization.	Decibels
scat_VV_toa	TOA Scatterometer NRCS for VV (transmit vertical, receive vertical) polarization. Aquarius L2 normalized radar cross-section at the top of the atmosphere at VV polarization.	Decibels

Aquarius Flags: The Aquarius Flags group contains one set of attributes for `radiometer_flags`, described in Table 3.

Table 3. `radiometer_flags` Attributes

Bit Position	Name	Value	Description
0	No SM Retrieval	SMRET	No Soil Moisture retrieval performed
1	Brightness Temp	TB	TB < 0 or Tb > 320
2	Orbit Maneuver	ORBIT	ACS mode = 5
3	RFI	RFI	Tbh > Tbv; Tb > 320
4	Surface Temp	TSURF	Tb > Tsurf
5	Frozen Ground	FROZ	NCEP surface or sub-surface temperature below 273.15
6	Snow	SNOW	NCEP SWE > 10 kg/m2
7	Ice	ICE	NCEP ice fraction > 0.1
8	NDVI	NDVI	MODIS NDVI climatology flag
9	Dense Vegetation	VEG	Vegetation Water Content > 5 kg/m2
10	Urban	URBAN	IGBP Land Cover
11	Soil	SOIL	Invalid Soil Texture data
12	Water	WATER	Land Fraction < 0.99

Block Attributes: Parameters contained in the Block Attributes group are described in Table 4. Each parameter in this group contains 4083 x 1 elements.

Table 4. Block Attributes Group Description

Name	Description	Units
sec	Mid-block times of Aquarius physical parameter values in seconds of day.	Seconds
secGPS	GPS time; block times of Aquarius physical parameter values in seconds since the GPS epoch (0 hours UTC on 6 January 1980).	Seconds

Navigation: Parameters contained in the Navigation group are described in Table 5. Each parameter in this group contains 4083 x 3 elements, except zang which is 4083 x 1.

Table 5. Navigation Parameter Description

Name	Description	Units
att_ang	Spacecraft roll, pitch, yaw	Degrees
beam_clat	Beam Center Latitude	Degrees
beam_clon	Beam Center Longitude	Degrees
zang	Intra-Orbit Angle	Degrees

Metadata are included as global attributes with the Level-2 data files. Table 6 lists attribute names and values for data file `Q2011237000100.L2_SOILM_V4.0` Values that vary from granule to granule are noted.

Table 6. Level-2 Soil Moisture Metadata General Attributes

Name	Value
Product Name	Q2011237000100.L2_SOILM_V4.0
Title	Aquarius Level-2 Soil Moisture Data
Data Center	NASA/GSFC Aquarius Data Processing Center
Mission	SAC-D Aquarius
Mission Characteristics	Nominal orbit: inclination=98.0 (Sun-synchronous); node=6PM (ascending); eccentricity=<0.002; altitude=657 km; ground speed=6.825 km/sec
Sensor	Aquarius
Sensor Characteristics	Number of beams=3; channels per receiver=4; frequency 1.413 GHz; bits per sample=16; instantaneous field of view=6.5 degrees; science data block period=1.44 sec.
Data Type	SM
Software ID	3.01
Processing Version	V4.0
Processing Time	2015167000645000 (varies)
Input Files	Q2011237000100_L2_SM.txt (varies)

Name	Value
Processing Control	ifile=Q2011237000100_L2_SM.txt ofile=Q2011237000100.L2_SOILM_V4.0 pversion=V4.0 (varies)
_lastModified	2015167000645000 (varies)
Conventions	CF-1.6
institution	NASA/GSFC OBPG
Start Time	2011237000101 (varies)
Start Year	2011 (varies)
Start Day	237 (varies)
Start Millisec	60001 (varies)
End Time	2011237013859 (varies)
End Year	2011 (varies)
End Day	237 (varies)
End Millisec	60001 (varies)
Node Crossing Time	2011237002530000 (varies)
Orbit Node Longitude	-95.19445 (varies)
Latitude Units	degrees North
Longitude Units	degrees East
Orbit Number	1110 (varies)
Cycle Number	1 (varies)
Pass Number	1 (varies)
Nominal Navigation	TRUE
Ancillary Files	Aquarius_sand_p05d.bin,Aquarius_clay_p05d.bin,Aquarius_bd_p05d.bin,Aquarius_land_cover_5km.dat, ndvi_max.dat,ndvi_min.dat,ndvi_cmg_08_3.dat,flag_cmg_08_3.dat,ndvi_cmg_08_3.dat

1.8.2 Sample Data Record

Below is a sample of data records from the rad_sm parameter within the Aquarius Data group in the Aquarius soil moisture file: `Q2011237000100.L2_SOILM_V4.0`.

2308	0.1887	0.1569	0.0776
2309	0.1818	0.1537	0.1121
2310	0.1757	0.1547	0.1442
2311	0.1739	0.1566	0.1639
2312	0.1741	0.1625	0.1802
2313	0.1746	0.1659	0.1922
2314	0.1763	0.1744	0.2068
2315	0.1768	0.1801	0.2171
2316	0.1833	0.1845	0.2182
2317	0.1861	0.1875	0.2286
2318	0.1913	0.19	0.2351

Figure 4 shows the Aquarius soil moisture estimates using all three beams for July 1, 2012.

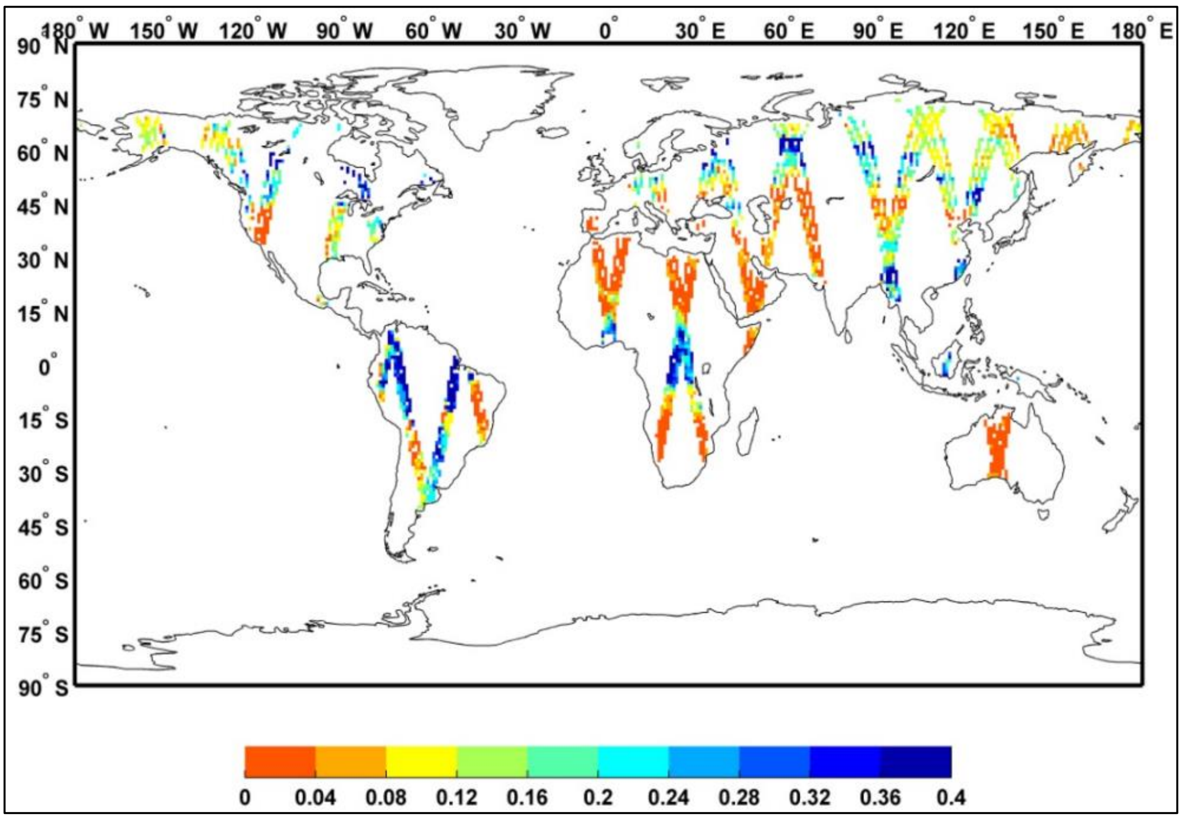

Figure 4. Aquarius soil moisture estimates using all three beams July 1, 2012

2 SOFTWARE AND TOOLS

HDF-aware software must be used to read the Aquarius soil moisture files. The following external links provide access to software for reading and viewing HDF5 data files. Please be sure to review instructions on installing and running the programs.

HDFView: Visual tool for browsing and editing HDF4 and HDF5 files.

Panoply netCDF, HDF and GRIB Data Viewer: Cross-platform application. Plots geo-gridded arrays from netCDF, HDF and GRIB data sets.

For additional tools, see the HDF5 Tools and Software website.

3 DATA ACQUISITION AND PROCESSING

Aquarius L2 Swath Single Orbit Soil Moisture Data products are produced by the NASA Goddard Space Flight Center's Aquarius Data Processing Segment (ADPS).

3.1 Theory of Measurements

The Aquarius SCA algorithm uses the L-band horizontally polarized (h-pol) brightness temperature observations due to the higher sensitivity of this channel to soil moisture and land surface than the v-pol observations. The Aquarius SCA approach is based on the simplified radiative transfer model developed under the assumption that the canopy and soil temperatures are the same (Jackson 1993). The SCA is applied to the individual Aquarius footprint Level-2 brightness temperature observations to produce a swath-based time-order product (Bindlish and Jackson, 2013 and Meissner et al, 2014). Details on these steps are provided in Section 3.3.

3.2 Data Acquisition Methods

The Version 4 Aquarius L2 Swath Single Orbit Soil Moisture Data product is generated from measurements derived from the NASA Aquarius Level-2 Sea Surface Salinity & Wind Speed Data V4.0 product. The soil moisture product contains measurements at the observed surface locations, along with coordinates of viewed locations and navigation data. This product is stored as one physical HDF file. Each product contains data from one orbit of Aquarius data. An orbit begins and ends as the SAC-D spacecraft crosses the South Pole. The best quality data are selected for each orbit during Level-0 to Level-1A data processing and are then used to create the Level 1A file that is input to the Level-2 science file (Pratt 2013). here

3.3 Derivation Techniques and Algorithms

The derivation techniques and algorithms in this section are from the Aquarius Soil Moisture ATBD Users Guide (Bindlish and Jackson, 2013 and Meissner et al, 2014).

Brightness temperatures are converted to emissivity using a surrogate for the effective physical temperature (T) of the emitting layer. The observed emissivity (e_{obs}) is corrected for vegetation and surface roughness to obtain the smooth soil emissivity (e_{soil}). The Fresnel equation is then used to determine the dielectric constant of the soil-water mixture (*k*). Finally, a dielectric mixing model is used to obtain the soil moisture (*SM*).

Brightness temperature of the land surface is equivalent to its emissivity (e_{obs}, where e_{obs} = 1 - *r*) (r = Reflectivity) multiplied by its physical temperature (*T*). It is assumed that the temperatures of the soil and the vegetation are the same.

Based upon the above, the complete radiative transfer model can be simplified yielding the following expression for the observed TB in Equation 1:

$$TB = Te_{obs}$$ **(Equation 1)**

Where:

Table 7. Observed Brightness Temperature

Variable	Description
TB	brightness temperature
e_{obs}	observed emissivity

Ancillary surface temperature data from the Numerical Weather Prediction model of the National Centers for Environmental Prediction Global Forecast System (NCEP GFS) is used as the effective physical temperature of the emitting medium.

The emissivity retrieved above is that of the soil as modified by any overlying vegetation and surface roughness. In the presence of vegetation, the observed emissivity is a composite of the soil and vegetation. To retrieve soil water content, it is necessary to isolate the soil surface emissivity (e_{surf}). First, the correction for the presence of vegetation is done based on Jackson and Schmugge (1991), as in Equation 2:

$$e_{obs} = [1 - \omega][1 - \gamma]\left[1 + (1 - e_{surf})\gamma\right] + e_{surf}\gamma$$ **(Equation 2)**

Where:

Table 8. Emissivity - Correction For Presence of Vegetation

Variable	Description
ω	single scattering albedo
γ	one-way transmissivity of the canopy

Variable	Description
e_{surf}	soil surface emissivity

Both the single scattering albedo (ω) and the one-way transmissivity of the canopy (γ) are dependent upon the vegetation structure, polarization and frequency. The transmissivity is a function of the optical depth (τ) of the vegetation canopy:

$$\gamma = \exp[-\tau \sec \theta]$$ **(Equation 3)**

Where:

Table 9. One-way Transmissivity of Canopy

Variable	Description
τ	optical depth of vegetation canopy
θ	system incidence angle

A constant value of the single scattering albedo is used in the Aquarius formulation (ω=0.05). Re-arranging equation 2 yields:

$$e_{surf} = \frac{e_{obs} - 1 + \gamma^2 + \omega - \omega\gamma^2}{\gamma^2 + \omega\gamma - \omega\gamma^2}$$ **(Equation 4)**

The vegetation optical depth is a function of the Vegetation Water Content (VWC). In studies reported in Jackson and Schmugge (1991), it was found that the following functional relationship between the optical depth and vegetation water content could be applied:

$$\tau = (b \times VWC) / \cos \theta$$ **(Equation 5)**

Where:

Table 10. Relation Between Optical Depth and Vegetation Water Content

Variable	Description
b	Proportionality value. Depends on vegetation structure and microwave frequency
VWC	Vegetation Water Content

The algorithm uses a default global constant value of b = 0.8 for all vegetation classes. The vegetation water content can be estimated using several ancillary data sources. The baseline approach utilizes a set of land cover-based equations to estimate VWC from values of the Moderate Resolution Imaging Spectroradiometer (MODIS) derived Normalized Difference Vegetation Index (NDVI), an index derived from visible-near infrared reflectance data. The approach uses a MODIS NDVI climatology that was derived based on observations from 2001-2010.

The emissivity that results from the vegetation correction is that of the soil surface, including any effects of surface roughness. These effects are removed in order to determine the smooth surface soil emissivity (e_{soil}), which is required for the Fresnel equation inversion. One approach to removing this effect is a model described in Choudhury et al. (1979) that yields the bare smooth soil emissivity:

$$e_{soil} = 1 - \left[1 - e_{surf}\right] \exp[h \cos^2 \theta]$$ **(Equation 6)**

Where:

Table 11. Bare Smooth Soil Emissivity

Variable	Description
h	h is dependent on the polarization, frequency, and geometric properties of the soil surface. A constant roughness parameter of h = 0.1 is used in the formulation.

The $\cos^2 \Theta$ term is often dropped to avoid overcorrecting for roughness. The Aquarius soil moisture algorithm does not drop this term.

Emissivity is related to the dielectric properties (ε) of the soil and the viewing or incidence angle. For ease of computational inversion, it is assumed that the real component (ε_r) of the dielectric constant provides a good approximation of the complex dielectric constant. However, this assumption can be modified if additional evidence is found to support the use of this more complex formulation. The Fresnel equations link the dielectric constant to emissivity. For horizontal polarization:

$$e_{surf} = 1 - \left|\frac{\cos\theta - \sqrt{\varepsilon_r - \sin^2\theta}}{\cos\theta + \sqrt{\varepsilon_r - \sin^2\theta}}\right|^2$$ **(Equation 7)**

Where:

Table 12. Surface Emissivity - Horizontal Polarization

Variable	Description
ε_r	real component of the dielectric constant

The dielectric constant of soil is a composite of the values of its components air, soil, and water, which have greatly different values. A dielectric mixing model is used to relate the estimated dielectric constant to the amount of soil moisture. The Aquarius SCA uses Wang and Schmugge (1980) dielectric mixing model to estimate soil moisture.

3.3.1 Version History

Changes in the Version 4 Aquarius Soil Moisture data include: use of the most recent version (Version 4) of Aquarius Brightness Temperatures as input.

Changes in the Version 3 Aquarius Soil Moisture data include: use of the most recent version (Version 3) of Aquarius Brightness Temperatures as input; Aquarius Brightness Temperatures are no longer re-calibrated before soil moisture retrievals as was done for Version 2 data; soil moisture observations are valid over a wider range of brightness temperatures compared to Version 2 data; updates to the soil moisture model parameters (b and ω).

3.4 Sensor or Instrument Description

Aquarius/SAC-D is a collaboration between NASA and Argentina's space agency, Comisión Nacional de Actividades Espaciales (CONAE), with participation from Brazil, Canada, France and Italy. The Aquarius instrument was built jointly by NASA's Jet Propulsion Laboratory and NASA's Goddard Space Flight Center.

The Aquarius instrument includes three radiometers and one scatterometer. The soil moisture data are collected by the radiometers. The radiometers measure brightness temperature at 1.414 GHz in the horizontal and vertical polarizations (T_H and T_V). The scatterometer is a microwave radar sensor that measures backscatter for surface roughness corrections. Table 13 summarizes instrument characteristics.

Table 13. Aquarius Instrument Characteristics

Instrument	Characteristics
3 radiometers in push-broom alignment	Frequency: 1.413 GHz Band width: less than or equal to 26 MHz Swath Width: 390 km Science data block period: 1.44 sec Footprints for the beams are: 74 km along track x 94 km cross track, 84 x 120 km, and 96x156 km, yielding a total cross track of 390 km. Beam incidence angles of 29.36, 38.49, and 46.29 degrees incident to the surface. Beams point away from the sun.
Scatterometer	Frequency: 1.26 GHz Band Width: 4 MHz Swath Width: 390 km Science data block period: 1.44 sec

SAC-D spacecraft Orbit Parameters:

- 98 minute sun-synchronous
- 6 PM ascending orbit, 6 AM descending orbit
- 657 km equatorial altitude (655 km minimum, 685 km maximum over the orbit)
- Ground-track repeat interval: 7-day, 103 orbits

4 REFERENCES AND RELATED PUBLICATIONS

Bindlish, Rajat, Thomas Jackson, Michael Cosh, Tianjie Zhao and Peggy O'Neill. 2014. Global Soil Moisture from the Aquarius/SAC-D Satellite: Description and Initial Assessment. *IEEE Geosciences and Remote Sensing Letters* (in print). doi 10.1109/LGRS.2014.2364151.

Bindlish, Rajat, and Thomas J. Jackson. 2013. *Aquarius Soil Moisture ATBD Users Guide, Version 2.0*. Beltsville, Maryland USA: USDA Hydrology and Remote Sensing Lab. (https://nsidc.org/sites/nsidc.org/files/files/data/aquarius/Aquarius-VSM-ATBD-UsersGuide.pdf, 315 KB).

Bindlish, Rajat, Thomas Jackson, Michael Cosh, Tianjie Zhao and Peggy O'Neill. 2015. Global Soil Moisture from the Aquarius Satellite: Description and Initial Assessment. *IEEE Geosciences and Remote Sensing Letters* 12(5):923-927.

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Choudhury, B. J., T. J. Schmugge, A. Chang, and R. W Newton. 1979. Effect of Surface Roughness on the Microwave Emission from Soils, *Journal Geophysical Research* 84:5699–5706.

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Jackson, T. J., and T. J Schmugge. 1991. Vegetation Effects on the Microwave Emission of Soils, *Remote Sensing of Environment* 36(3): 203–212.

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Pratt, Frederick S. 2013. Aquarius Level-2 Soil Moisture Data Product. NASA Goddard Space Flight Center Aquarius Project Document AQ-014-PS-0021, Version 2.0.

Piepmeier, Jeffrey, Shannon Brown, Joel Gales, Liang Hong, Gary Lagerloef, David Le Vine, Paolo de Matthaeis, Thomas Meissner, Rajat Bindlish, and Thomas Jackson. 2013. *Aquarius Radiometer Post-Launch Calibration for Product Version 2.0*, Aquarius Project Document: AQ-014-PS-0015. ftp://podaac-ftp.jpl.nasa.gov/allData/aquarius/docs/v2/AQ-014-PS-0015_AquariusInstrumentCalibratrionDescriptionDocument.pdf.

Wang, J. R., and T. J. Schmugge. 1980. An Empirical Model for the Complex Dielectric Permittivity of Soils as a Function of Water Content, *IEEE Transactions on Geoscience and Remote Sensing* 18(4): 288–295.

4.1 Related Data Collections

Aquarius Level-1 and Level-2 Sea Surface Salinity Data
SMAP Data Sets at NSIDC
AMSR-E/Aqua L2B Surface Soil Moisture, Ancillary Parms, & QC EASE-Grids, Version 2
AMSR-E/Aqua Daily L3 Surface Soil Moisture, Interpretive Parameters, & QC EASE-Grids, Version 2
AMSR-E Validation Soil Moisture Data
Aquarius L3 Gridded 1-Degree Soil Moisture Data
ESA Soil Moisture and Ocean Salinity (SMOS)
NASA Aquarius Level-2 Sea Surface Salinity & Wind Speed Data V4.0
Soil Moisture Product Using Aquarius/SAC-D Observations

4.2 Related Websites

Aquarius Web site at NASA Goddard Space Flight Center
Aquarius Data Web Site at NSIDC
Aquarius Web Site at PODAAC

SMAP Web Site at NSIDC

SMOS Website at ESA

5 CONTACTS AND ACKNOWLEDGMENTS

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6 DOCUMENT INFORMATION

6.1 Publication Date

02 December 2013

6.2 Date Last Updated

01 October 2015