CONAE - MWR Science Team

# Sea Ice Concentration User Manual
# CUSS Version 004

Authors: Carolina B.Tauro and Felipe Madero

Date: May 10, 2013

COMISION NACIONAL DE
ACTIVIDADES ESPACIALES
ARGENTINA

## DOCUMENT CHANGES RECORD

| Doc. Version | Date | Section | Reason for change |
|---|---|---|---|
| A | 05/10/2013 | All | First Version |

# Table of Contents

**1 Introduction** **4**
1.1 Purpose . . . . . 4
1.2 SAC-D/Aquarius mission overview . . . . . 4
1.3 Limitations in the use of MWR L2 products . . . . . 5

**2 MWR Sensor** **6**

**3 MWR L2 Products** **7**
3.1 Reference system for MWR products . . . . . 7
3.2 Gridding for MWR L2 product . . . . . 8
3.3 Geolocation information . . . . . 8
3.4 Retrieval versions . . . . . 9

**4 Sea Ice Concentration Algorithm** **10**

**5 Helpdesk and data access** **12**

**6 Data description** **12**
6.1 Wind Speed product characteristics . . . . . 12
6.2 File formats . . . . . 12
6.3 Data and metadata contents . . . . . 13
6.4 HDF5 Data format . . . . . 13
6.4.1 Global Attributes . . . . . 13
6.4.2 Datasets . . . . . 14

**7 Data quality** **16**
7.1 Validation . . . . . 16
7.2 Accuracy . . . . . 16

**A How to manage MWR data in hdf5 format** **17**
A.1 Using HDFView . . . . . 17
A.2 Using Visat . . . . . 17
A.3 Using MatLab . . . . . 17
A.4 Useful programs . . . . . 17

**B Abbreviations** **20**

**C References** **21**

# 1 Introduction

## 1.1 Purpose

The purpose of this document is to describe CONAE's Microwave Radiometer L2 product **Sea Surface Wind Speed** to the end-users. It contains summary information on the sensor, the applied processing, and the product's data format.

## 1.2 SAC-D/Aquarius mission overview

The SAC-D/Aquarius mission is a cooperative international scientific mission developed between Comisión Nacional de Actividades Espaciales (CONAE) of Argentina and the National Aeronautics and Space Administration (NASA) of United States of America, which includes instrument contributions from Agenzia Spaziale Italiana (ASI), Centre National d'Etudes Spatiales (CNES), and the Canadian Space Agency (CSA). The SACD service platform was provided by CONAE and the launch was on June 10th 2011 (provided by NASA), from Western Test Range (WTR) at Vanderberg Air Force Base (VAFB). On board SAC-D/Aquarius there are 8 instruments. Aquarius, the main instrument, comprises a passive microwave radiometer operating in the protected "radio astronomy" frequency band at $1.413GHz$ and a scatterometer in the space-radar frequency band at $1.26GHz$. The measurement of L-band brightness temperature by the Aquarius radiometer is the primary means for remote sensing SSS, and the ocean backscatter measurements from the scatterometer provides a critical roughness correction for the passive SSS retrievals. In addtion, the MicroWave Radiometer called MWR, operating at K (single polarized) and Ka (dual polarized) bands, measures the surface brightness temperature in the frequency range sensitive to geophysical parameters over the ocean such as surface wind speed, rain rate, water vapor, cloud liquid water and sea ice concentration. MWR geophysical retrievals provides critical corrections to the Aquarius instrument for accurate sea surface salinity estimates. Under CONAE's supervision, MWR was entirely designed and built in Argentina at the Instituto Argentino de Radioastronomía (IAR) under the authority of the Consejo Nacional de Investigaciones Científicas (CONICET), and the Grupo de Ensayos Mecánicos Aplicados (GEMA), under the authority of the Departamento de Aeronaútica de la Universidad Nacional de La Plata (UNPL).

SAC-D/Aquarius mission focuses on understanding the interaction between the global water cycle, ocean circulation and climate through the measurement of sea surface salinity (SSS). In addition, this mission objective is to provide data of ocean salinity, ocean winds, rain, sea ice, sea surface temperature, soil moisture, high temperature events (fires and volcanic activities), nighttime light sources, atmospheric temperature/humidity/pressure, and space environment, distributing also autonomous data acquired from remote ground stations.

Figure 1.2.0.-1 shows the schematic representation of the spacecraft. The SAC-D/Aquarius orbit can be summarize:

- Type: sun-synchronous.
- Global coverange: 7 days.
- Altitud: 657 km
- Orbit period: $\approx$ 97 minutes 52 seconds (14 to 15 orbits per day, 103 orbits per week).
- Ascending node: 6 pm.

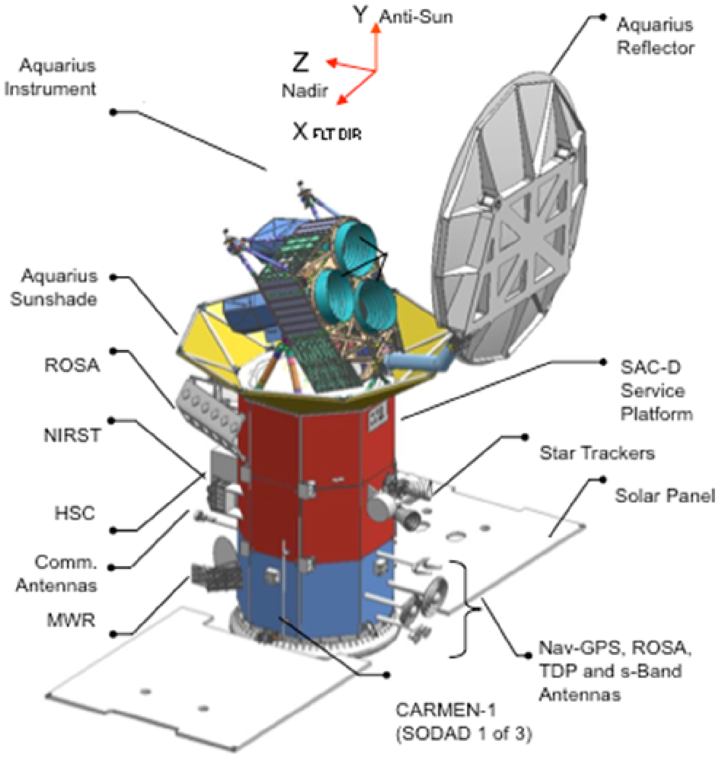


Figure 1.2.0.-1: The SAC-D/Aquarius spacecraft.

## 1.3 Limitations in the use of MWR L2 products

1. All the current versions of products are available as evaluation data sets and are to be used with caution and for evaluation purposes only.
2. MWR Sea Surface Wind Speed is under validation.
3. Actual MWR Sea Surface Wind Speed validation was developed for sea surface temperatures higher than 3°C.

# 2 MWR Sensor

MWR (MicroWave Radiometer) sensor consists of two microwave radiometers.The K band radiometer is aft-looking, operates at central frequency of 23.8 GHz and measures horizontal polarization. The Ka band radiometer is forward-looking, operates at central frequency of 36.5 GHz and measures vertical, horizontal, and $\pm$ 45° polarizations.

Both radiometers view toward the night side of the orbit, 272 km across track, with a swath width of 380 km, providing global coverage in a 7 day period. As this swath overlaps with the swath of Aquarius, MWR data complements sea surface salinity retrievals. The swath is composed of 8 beam measurements, each with a width of approximately 50 km. Each one of the five bands of the sensor (K H, Ka H, Ka V, Ka +45, Ka -45), generates these measurements every 1.92 seconds. The physical configuration of MWR antennas and the footprint distribution for the both frequencies are shown in figure 2.0.0.-2.

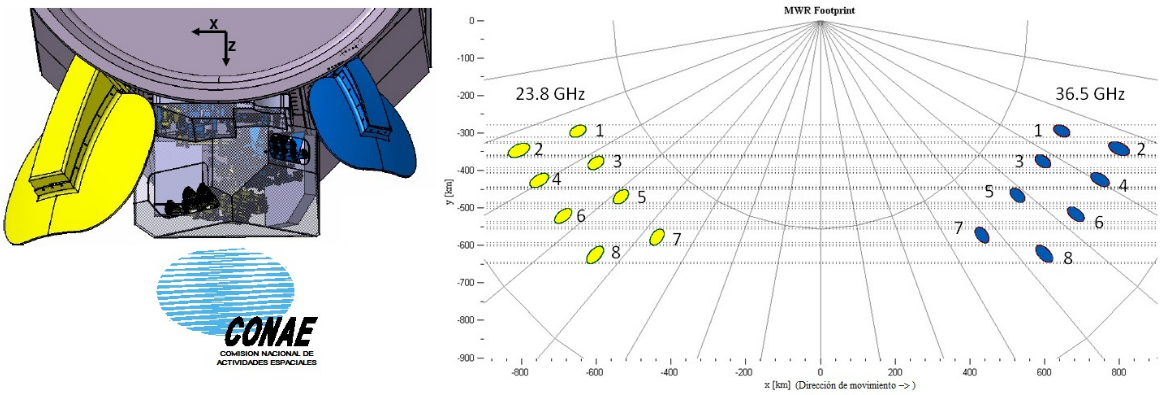


Figure 2.0.0.-2: Physical configuration of MWR antennas onboard SAC-D/Aquarius (left). The right figure show the footprint distribution for the frequencies of 23.8 (yellow) and 36.5 (blue) GHz.

The MWR data recieved are first calibrated to the antenna input temperature, and then used to generate geophysical retrievals. The main objectives of MWR sensor are to provide measurements of surface wind speed, rainfall, water vapor and sea ice.

# 3 MWR L2 Products

MWR L2 product contains the geophysical retrievals generated from MWR data plus ancillary and global data. It contains:

- MWR Geophysical Retrieval Data:
  - Sea Surface Wind Speed.
  - Total atmospheric transmisivity.
  - Sea Ice Concentration.
  - Columnar Water Vapor.
- Geolocation data associated to the retrievals.
- Ancillary data that complement Geophysical Retrieval Data:
  - Grid indices.
  - Beam number indicators.
  - Time.
  - Surface type.
- Intermediate data used to generate the product:
  - GDAS data
  - MWR temperature at antenna input and its geolocation data.
  - MWR temperature at antenna input normalized to 53 degrees incidence angle and its geolocation data.
  - MWR temperature at antenna difference for certain bands and its geolocation data.
  - Excess of brightness temperature due to rain and its geolocation data.
- Global metadata, that includes general information about adquisition, grid parameters, mission, platform, products, production, MWR sensor and software version.
- Quality data indicators.

Note: Some of these data will be explained in following sections. For a complete information see the document *MWR L2 Product HDF5 Data Format Reference* [14].

## 3.1 Reference system for MWR products

As MWR continuously acquires data, a segmentation of the acquisition is required to deliver products to the users. In coincidence with Aquarius products, one MWR product is generated for one orbit, considering the orbit's start time as the time when the spacecraft passes over the south pole. The typical orbit period is 5871 seconds (almost 1 hour 40 minutes). The data within each MWR product includes 10 minutes of the previous orbit at the beginning of the current orbit, and 10 minutes of the next orbit (in the so called overlapped orbit) increasing the product's period to 7071 seconds (almost 2 hours).

Every 7 days, or 103 orbits, the sensor acquires data over the same zone. For this reason, MWR products are classified in cycles (counter of 7 days periods), and pass during each cycle (counter of orbits inside a cycle). For easy cross reference with Aquarius products, the same cycle counter and pass in cycle counter criteria is used. This is also true for orbit number criteria.

As orbits with succesive pass in cycle counters are not geographically adjacent, a different reference system was also defined: the MWR reference system pass id. In this system there are also 103 pass IDs inside a cycle, but the IDs were selected such that successive pass IDs represent geographically adjacent orbits. The counter starts at pass ID 1, for the orbit whose longitude of ascending node is 0, and increments to the east.

Information on the timing of the product and the reference IDs associated to its orbit is contained in the product's metadata. Also, you can find more information in *MWR Orbit Number User Manual* [**?**].

## 3.2 Gridding for MWR L2 product

The wind speed and columnar water vapor algorithms take as input 0.25 $\times$ 0.25 degrees averaged MWR brightness temperature for K H band, Ka H band and Ka V band, together with numerical weather model data from the Global Data Assimilation System (GDAS). The Geophysical Measurement Cell (GMC) grid geometry [**?**] is shown in figure 3.2.0.-3.

The sea ice concentration algorithm take as input not averaged brightness temperature for K H band, Ka H band, and Ka V band. It is based on identification of sea ice in the gradient ratio/polarization ratio space.

Current version of MWR L2 product present the geophysical variables:

- For wind speed, columnar water vapor and excess of brightness temperature: the geophysical measurements are averaged in cells of 0.25$\times$0.25 geodetic coordinates (latitude/longitude) puls grid index.
- For Sea Ice Concentration: the geophysical measurements are related to MWR measurements, whithout any average plus geodesic grid index.

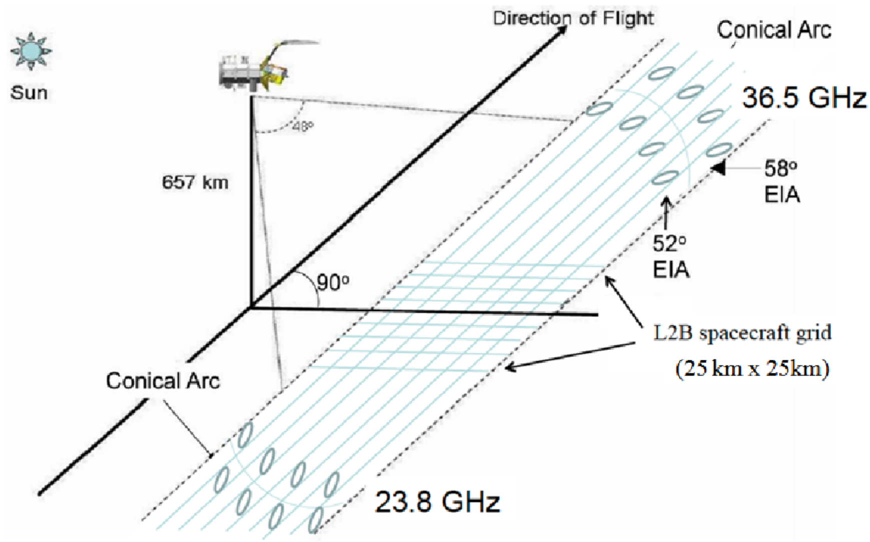


Figure 3.2.0.-3: Spacecraft Geophysical Measurement Cell (GMC) grid geometry for wind speed, columnar water vapor and excess of brightness temperature [**?**].

## 3.3 Geolocation information

Geodetic coordinates are provided for each geophysical variable measured, based on L1B geolocation information [15].

The standard geolocation technique of intersecting the line of sight of the beams with an earth model is used as the basis for obtaining the geographic information associated to each measurement.

This technique relies on the accuracy of satellite position, velocity, and orientation measurements, and on the quality of geolocation parameters obtained by calibration procedures. The obtained geolocation parameters are: Latitude, Longitude, Range to spacecraft, Zenith angle to spacecraft (incidence angle), Azimuth angle to spacecraft, Zenith angle to sun, Azimuth angle to sun, Zenith angle to moon, Azimuth angle to moon.

## 3.4 Retrieval versions

The algorithms and calibration parameters used for this retrievals result from the joint work of personnel of CONAE and CFRSL (Central Florida Remote Sensing Laboratory, University of Central Florida, USA). The CONAE version number for ice concentration retrieval is 5. CFRSL version number for wind speed, rain rate, and water vapor retrievals is 5. The CONAE version is number 004.

# 4 Sea Ice Concentration Algorithm

It is known that microwave emissions can be used to estimate sea ice concentration (IC) and type (age) [12, 7, 6, 5, 9]. The physical bases of all the algorithms reside on the different emissivity properties of both vertical and horizontal polarizations for different types of ice. The next figure shows a logarithmic plot for the emissivity as a function of frequency. The red vertical lines, which are the frequency bands corresponding to MWR, show the feasibility of using MWR data for sea ice detection.

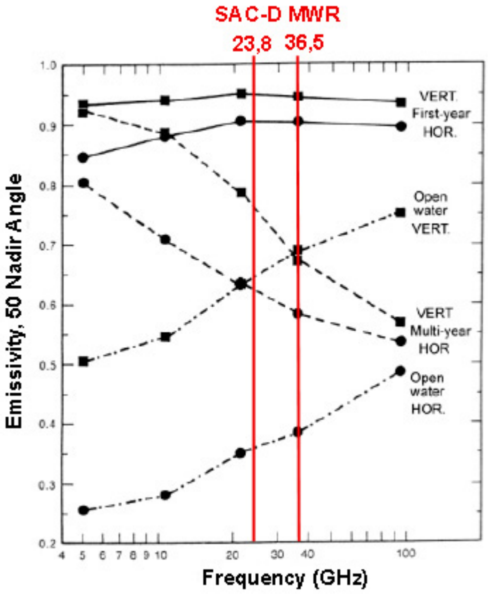


Figure 4.0.0.-4: Emisivity properties of sea ice for MWR frequencies bands. Modified from [10]. Courtesy of SHNA.

Recently approaches such as the Bootstrap [8, 9, 4] and the NASA Team (NT) [11] algorithms have been designed to this purpose. These algorithms rely primarily on two factors: the differences in the polarizing qualities of ice and open ocean water and the greater spectral dependence of ocean than ice.

We will assume that the brightness temperature received by the radiometer comes from open ocean ($T_{BO}$) with concentration $C_O$, and from sea ice ($T_{BI}$) with concentration $C_I$.

$$T_B = T_{BO}C_O + T_{BI}C_I \tag{1}$$

$$1 = C_O + C_I \tag{2}$$

### Polarization and gradient differences

We will define two quantities, based on *Gradient* and *Polarization Ratio* used by NT Algorithm, namely **Gradient** and **Polarization difference** as follow:

$$\Delta T^G = T_B^H(37) - T_B^H(24) = GR(T_B^V(37) + T_B^H(37)), \tag{3}$$

$$\Delta T^P = T_B^V(37) - T_B^H(37) = PR(T_B^V(37) + T_B^H(37)). \tag{4}$$

**Sea ice concentration function:**

After some mathematical calculation [13], we can obtain the following function for sea ice concentration:

$$C_I = \frac{\Delta T^G - \Delta T_O^G(\Delta T^P - \Delta T_O^P)\alpha}{\Delta T_M^G - \Delta T_O^G(\Delta T_M^P - \Delta T_O^P)\alpha} \tag{5}$$

where $\alpha$ is given by:

$$\alpha = \frac{\Delta T_F^G - \Delta T_M^G}{\Delta T_F^P - \Delta T_M^P}. \tag{6}$$

Also, $M$ and $F$ refer to Multi Year and First Year sea ice type, $\Delta T^G$ and $\Delta T^P$ are data measured by MWR, $\Delta T_O^{G,P}$, $\Delta T_F^{G,P}$ and $\Delta T_F^{G,P}$ are **reference points** that must be determinated.

**Implentation:**

The next steps were followed in order to implement the algorithm:

- Step 1: Brightness temperatures gradient and polarization differences.
- Step 2: Scatter plots construction.
- Step 3: Reference points obtention.
- Step 4: Sea Ice Concentration calculation.
- Step 5: Sea Ice Concentration representation in a map.

The table below shows the reference points found for the present algorithm version. The details about how these points were obtained are in [13].

| Point | $\Delta T^P$ (K) | $\Delta T^G$ (K) |
|---|---|---|
| Odd Open Water | 62.73 | 12.36 |
| Even Open Water | 73.31 | 13.87 |
| Odd First Year Ice | 27.35 | -5.66 |
| Even First Year Ice | 21.60 | -4.40 |
| Odd Multi Year Ice | 25.04 | -10.24 |
| Even Multi Year Ice | 20.51 | -11.20 |
| | | |

Table 4.0.0.-b: Reference points calculated for the three zones (open water, and two sea ice types). We have separated them into odd and even beams.

# 5 Helpdesk and data access

MWR CONAE products are accessible via CUSS, all of them in HDF5 format. TBC.

# 6 Data description

## 6.1 Wind Speed product characteristics

The wind speed retrieved parameters are:

- The neutral stability ocean surface wind speed at 10 m height ($W$) in $m/s$.
- The atmospheric transmissivity at 36.5 GHz ($\tau$).

## 6.2 File formats

The L2 product is delivered as a tar gzipped file (.tar.gz), of name

EO_YYYYMMDD_hhmmss_CUSS_SACD_MWR_L2_SCI_PPP_000_VVV.tar.gz,

where:

- YYYYMMDD_hhmmss refers to the start of the overlapped orbit.
- CUSS refers to the CONAE service which generates, archives and distributes the products.
- SCI indicates that the product contains only science data.
- PPP refers to inside cycle MWR orbit number.
- 000 refers to CUSS filename convention (to refer to kind of product inside specific level)
- VVV refers to version number.

Once extracted, a directory of the same name is generated,

EO_YYYYMMDD_hhmmss_CUSS_SACD_MWR_L2_SCI_PPP_000_VVV/.

It will contain the following files:

- EO_YYYYMMDD_hhmmss_CUSS_SACD_MWR_L2_SCI_PPP_000_VVV.h5
- EO_YYYYMMDD_hhmmss_CUSS_SACD_MWR_L2_SCI_PPP_000_VVV.xml
- EO_YYYYMMDD_hhmmss_CUSS_SACD_MWR_L2_SCI_PPP_000_VVV_wind_speed_retrieval.png
- EO_YYYYMMDD_hhmmss_CUSS_SACD_MWR_L2_SCI_PPP_000_VVV_sea_ice_concentration_retrieval.png
- EO_YYYYMMDD_hhmmss_CUSS_SACD_MWR_L2_SCI_PPP_000_VVV_columnar_water_vapor_retrieval.png
- EO_YYYYMMDD_hhmmss_CUSS_SACD_MWR_L2_SCI_PPP_000_VVV_total_atmospheric_transmissivity_at _ka_retrieval.png
- EO_YYYYMMDD_hhmmss_CUSS_SACD_MWR_L2_SCI_PPP_000_VVV_sic_grid_mask.png
- EO_YYYYMMDD_hhmmss_CUSS_SACD_MWR_L2_SCI_PPP_000_VVV_ws_cwv_grid_mask.png

### 6.3 Data and metadata contents

The main data and metadata contents for the product are present in the file

**EO_YYYYMMDD_hhmmss_CUSS_SACD_MWR_L2_SCI_PPP_000_VVV.h5**,

which is in **HDF5** data format.

The file EO_YYYYMMDD_hhmmss_CUSS_SACD_MWR_L2_SCI_PPP_000_VVV.xml also contains metadata related to the acquisition, with fields and conventions common to all CONAE products.

The .png files are maps obtained from the grids for the retrieved geophysical variables, masks (geographic validity indicators) associated to them, and certain intermediate and auxiliary data.

### 6.4 HDF5 Data format

While a complete description of all the HDF5 attributes and datasets is present in the document *MWR L2 Product HDF5 Data Format Reference* [14], this section try to guide the user in the first approach to the product contents.

#### 6.4.1 Global Attributes

All metadata for the product is available as HDF5 attributes, in the group /Global Metadata/.

There are subgroups related to the sensor, the mission, the orbit (kepler) parameters, the production center and time, and the description of the data contained in the product.

Some important attributes are:

**Attributes related to the product's orbit:**

- /Global Metadata/Acquisition/Orbit Number
- /Global Metadata/Acquisition/Cycle Number
- /Global Metadata/Acquisition/Pass Number in Cycle
- /Global Metadata/Acquisition/Mwr Reference System Pass Number
- /Global Metadata/Acquisition/Overlapped Orbit Start Time UTC
- /Global Metadata/Acquisition/Overlapped Orbit End Time UTC

**Attributes related to the product's input data:**

- /Global Metadata/Acquisition/Start Time UTC (and GPS)
- /Global Metadata/Acquisition/End Time UTC (and GPS)
- /Global Metadata/Acquisition/Length Seconds

**Attributes related to sea ice concentration retrieval:**

- /Global Metadata/Product/Stats/Number of sic geophysical retrievals.

### 6.4.2 Datasets

HDF5 datasets contain the retrieved data. They are present in all the groups except the /Global Metadata/ group. There are groups related to geophysical retrievals, to the geolocation data, and to the auxiliar data. All datasets contain companion attributes that further describe its contents.

Some important datasets related with the wind speed retrieval are:

**Datasets related to sea ice concentration retrieval itself:**

- /MWR Geophysical Retrieval Data/sea_ice_concentration (in meters per second)

**Datasets related to geolocation of sea ice concentration retrieval:**

- /Geolocation Data /sic_latitude : Latitude for each geophysical retrieval. Applies to sea ice concentration.
- /Geolocation Data /ws_cwv_longitude : idem for longitude.

**Time related to sea ice concentration retrieval cell values**

The GPS time tag for the cell values, which refers to seconds since 1980/01/06 00:00:00 UTC for each cell value (that applies to wind speed, columnar water vapor, total atmospheric transmissivity, excess brightness temperature), is indicated in:

Ancillary Data /sic_time.

Observe that tha variable *Time* in the previous matlab format of MWR retrievals provided by CFRSL was referenced as days from 0 January of 0 year. The conversion between both temporal references is:

$$Time_{HDF} = (Time_{mat} - 723186) * 86400. \tag{7}$$

**Grid index related to sea ice concentration retrieval cell values**

Ancillary Data /sic_geodesic_grid_index: Geodesic grid index associated to the sea ice concentration retrieval. valid values = [-1,0,...,655362]

**Beam number related to sea ice concentration retrieval cell values**

Is an indicator of the beam corresponding to each cell. Applies to wind speed, columnar water vapor, total atmospheric transmissivity, excess brightness temperature.

Ancillary Data /sic_beam_number.

**Data quality indicator related to sea ice concentration retrieval cell values**

There is an indicator of the nominal condition of the geophysical cell retrievals (applies to wind speed, columnar water vapor, total atmospheric transmissivity, excess brightness temperature). It is a 8-bit character, with the following valid values, available in:

Quality Data/sic_nominal_indicator_cell_values.

- bit3 = invalid data range (some input to retrieval algorithms is out of range);

- bit2 = not nominal attitude (possible moon intrusion event);
- bit1 = propulsion maneuver;
- bit0 (lsb) = attitude maneuver (possible cold sky calibration)

For example:

$0_{10}$ = $0000_2$ means nominal values and no anomalies.

$1_{10}$ = $0001_2$ means attitude maneuver (possible cold sky calibration).

$2_{10}$ = $0010_2$ means propulsion maneuver.

$4_{10}$ = $0100_2$ means not nominal attitude(possible moon intrusion event).

$8_{10}$ = $1000_2$ means invalid data range (some input to retrieval algorithms is out of range).

# 7 Data quality

## 7.1 Validation

A preliminary validation process was implemented, in colaboration with SHN, making comparisons between MWR and NSIDC sea ice concentration product. Here we summarize the results, but the details are explained in [13].

In order to make a comparison between both sea ice concentration data, we define and generate a common grid. Next, we calculate the difference between both data for each point of the grid. In the figure 7.1.0.-5 we show some resuts related to the validation process. In the figure on the left we show a plot of the NSIDC vs. MWR sea ice concentration data for each grid point. The figure on the right is a no normalized histogram using the same set of data, which represents the frecuency of the differencies between both sea ice concentration data. The standard deviation calculated using this set of data is 15 %.

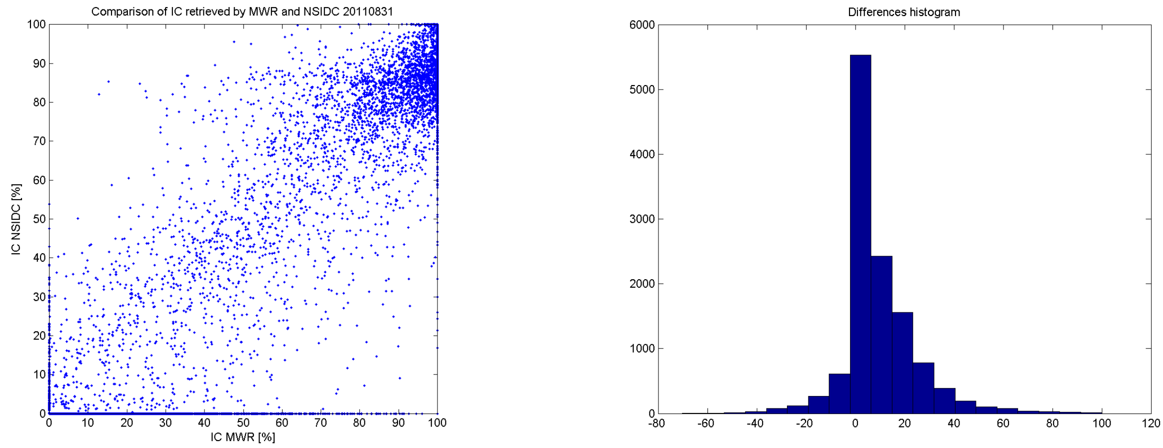


Figure 7.1.0.-5: NSIDC sea ice concentration vs. MWR sea ice concentration for each grid point (left), and histogram of differences between sea ice concentration generated by NSIDC and MWR. The standard deviation calculated is 15 %.

## 7.2 Accuracy

Acording to the process described above, the accuracy of sea ice concentration data is 15 %.

# A How to manage MWR data in hdf5 format

A complete set of documentation for HDF5 can be found at

http://www.hdfgroup.org/HDF5.

Here we present a guide about how to work in HDF5 format.

## A.1 Using HDFView

The user can visualize HDF5 files using HDFView, available for free in:

http://www.hdfgroup.org/downloads/index.html

## A.2 Using Visat

The user can visualize and manage MWR data using Visat, available for free in:

http://www.brockmann-consult.de/cms/web/beam/software

## A.3 Using MatLab

The user can read MWR Sea Ice Concentration data using MatLab. To do that, there is a very useful fuction:

```
data = hdf5read(filename,datasetname)
```

In this example, the variable *data* returns all the data in the data set named *dataset*.

## A.4 Useful programs

### Function MWR_IC_reader.m

This function extracts information from a L2 file corresponding to one orbit.

```
function [lat,lon,IC] = MWR_IC_reader(filename)

%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
%Inputs
%filename : h5 file name with path, for example
%'c:/MWR_L2/EO_20120805_155458_CUSS_SACD_MWR_L2_SCI.h5'
%
%Outputs
%lat               : latitude
%lon               : longitude
%IC                : Ice concentration
%filename_in_excel: file in xls format with three columns (lat,lon,IC)
%filename_in_csv  : file in csv format with three columns (lat,lon,IC)
%Figure with IC in a global map
%
%Authors: C.Tauro and M.Labanda (CONAE)
%Last modification: 04 September 2012
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
```

```
%-------Reading hdf5 lat, lon and IC----------------
lat= hdf5read(filename,'/Geolocation Data Values/sea_ice_concentration_latitude_values');
lon= hdf5read(filename,'/Geolocation Data Values/sea_ice_concentration_longitude_values');
IC = hdf5read(filename,'/MWR Geophysical Retrieval Values/...
                         sea_ice_concentration_retrieval_values');

%--------Ploting in a map --------------------------
hold on
g = geoshow('landareas.shp','DisplayType','polygon','FaceColor',[0.6 0.6 0.6]);
scatter(lon,lat,5,IC)
title({'SAC-D/Aquarius - CONAE property','MWR product: Ice Concentration'});
xlim([-180 180]);
ylim([-90 90]);
colorbar
grid on
hold off

%-------To export to xls format--------------------
xlswrite('filename_in_excel',[lat,lon,IC]);

%-------To export to cvs format-------------------
csvwrite('filename_in_csv',[lat,lon,IC]);
```

### Function L2_unzip.m

This function uncompress L2 files in .tar.gz and returns h5 files.

```
function L2_unzip(L2dir)

%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
%Inputs
%L2dir : directory name where files in .gz.tar format are
%
%Outputs
%Temp\ : directory with files in format .h5
%
%Authors: C.Tauro and M.Labanda (CONAE)
%Last modification: 04 September 2012
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%

sL2 = dir([L2dir 'EO_*_L2_SCI.tar.gz']);
ExtrNum = 0;

for i = 1:length(sL2)
    gunzip([L2dir sL2(i).name],[L2dir 'Temp\']);
    untar([L2dir 'Temp\' sL2(i).name(1:end-3)],[L2dir 'Temp\']);
    delete([L2dir 'Temp\' sL2(i).name(1:end-3)]);
    movefile([L2dir 'Temp\' sL2(i).name(1:end-7) '\data\' sL2(i).name(1:end-7) '.h5'],[L2di
    rmdir([L2dir 'Temp\' sL2(i).name(1:end-7)],'s');
    ExtrNum = ExtrNum + 1;
    disp([num2str(ExtrNum) 'Ready']);
```

```
end
```

# B Abbreviations

| Acr./Abr. | Description |
|---|---|
| MWR | Microwave Radiometer |
| SHN | Servicio de Hifrografía Naval |
| CFRSL | Central Florida Remote Sensing Laboratory |
| NSIDC | National Snow and Ice Data Center |

# C References

## References


[1] Barry R. G., J. Maslanik, K. Steffen, R. L. Weaver, V. Troisi, D. J. Cavalieri, S. Martin, 1993: Advances in sea-ice research based on remotely sensed passive microwave data. Oceanography, 6, 4-12.

[2] AS-213-0097, Mission plan.

[3] GS-SCO-DSN-DS-00200-A, ATBD: Ocean applications.

[4] Belchansky, Gennady I., David C. Douglas. 2002. Seasonal comparisons of sea ice concentration estimates derived from SSM/I, OKEAN and RADARSAT data. Remote Sensing of the Environment, 81, 67-81.

[5] Cavalieri, D.J., and J.C. Comiso, 2000: Algorithm theoretical basis document (ATBD) for the AMSR-E sea ice algorithm.

[6] Cavalieri, D. , 1994: A passive microwave technique for mapping new and young sea ice in seasonal sea ice zones. J. Geophys. Res., 99(C6), 12561-12572.

[7] Cavalieri, D.J., J.C. Comiso, C.L. Parkinson, and P. Gloersen, 1997: Passive microwave algorithms for the sea ice concentration: a comparison of two techniques. Remote Sensing of the Environment, 60, 357-384.

[8] Comiso, J., Donald J. Cavalieri, Claire L. Parkinson, and Per Gloersen, 1997: Passive Microwave Algorithms for Sea Ice Concentration: A Comparison Two Techniques. Remote sensing of environment ,60,3,357-384.

[9] Finnis, J., 2003: Passive microwave methods of determining sea ice concentrations. http://irina.eas.gatech.edu/ATOC5235_2003/Joel_Finnis-paper.pdf

[10] Lubin, D. and R. Massom, 2007: Remote Sensing of Earth's Polar Regions: Opportunities for Computational Science, Computing in Science and Engineering, 9, 1, 58-71.

[11] NSICD 2003b. The NASA Team Algorithm. http://nsidc.org/data/docs/daac/nasateam/index.html.

[12] Rubinstein, I. G., D. M. Nazarenko, and S. Tam, 1994: Passive Microwave Systems in Remote Sensing of Sea Ice and Icebergs. Haykin, Lewis, Raney & Rossiter, ed. John Wiley & Sons, New York.

[13] Tauro, C. B. and S. Masuelli, 2012: SCO Algorithm Theoretical Bases Document: MWR Sea Ice Algorithm, GS-SCO-DSN-DS-00300-B, CONAE document.

[14] Madero, F., 2012: MWR L2 Product HDF5 Data Format Reference, CONAE document.

[15] Madero, F., 2012: MWR L1B Product Description, CONAE document.