CONAE – HSC Science Group

HSC L1B2 products Catalog (SACD/Aquarius)

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CONTENTS TABLE

1.0 Introduction

The main objective of this document is give a general explanation about HSC (New Infrared Sensor Technology, onboard SAC-D/Aquarius spacecraft) products of different levels, L1A, L1B1 and L1B2, to end users.

1.1 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 Vandenberg 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 (Sea Surface Salinity) retrievals.

HSC (High Sensitivity Camera) is a panchromatic camera (450-900 nm) providing a spatial resolution of 200-300 m on a swath of 700 km. The main objectives of this instrument are: to detect, urban lighting and fires at night and observe Polar Regions and snow cover. The camera is based in TDI CCD technology. A similar camera was on board of SAC-C satellite, obtaining images since its launch in November 2000 until 2013.

The HSC contains two (2) cameras, each Optical System has 36.25º FOV and the angle between the optical axes of each system is 35º. The total resulting FOV is 71.3º with a little overlap of 1.2º in the center. The center of the total FOV (boresight direction) is pointing 25º away from NADIR.

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 shows the schematic representation of the spacecraft. The SAC-D/Aquarius orbit can be summarizing:

- Type: sun-synchronous.
- Global coverage: 7 days.
- Altitude: 657 km
- Orbit period: ≈ 97 minutes 52 seconds (14 to 15 orbits per day, 103 orbits per week).

- Ascending node: 6 pm.

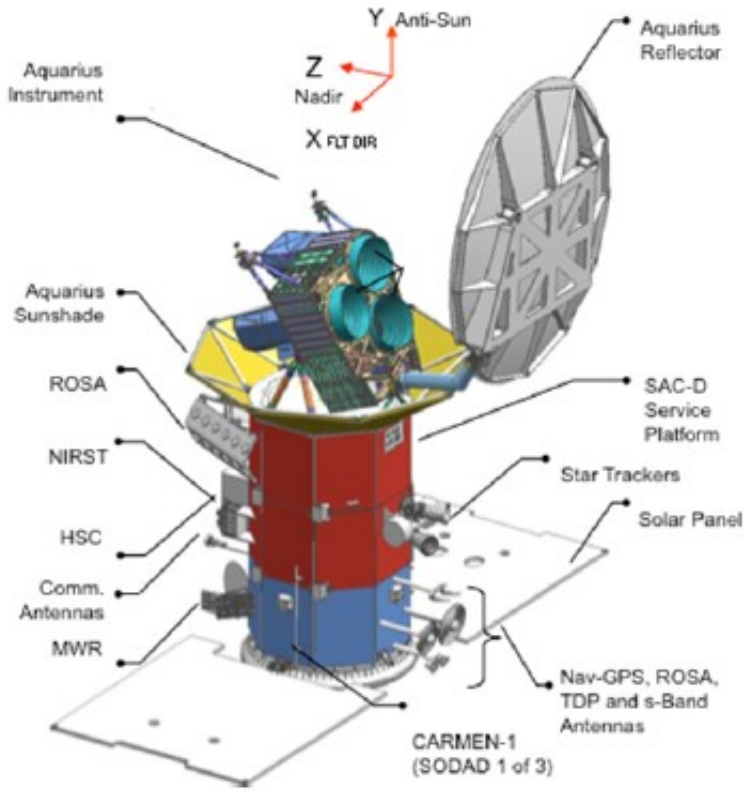
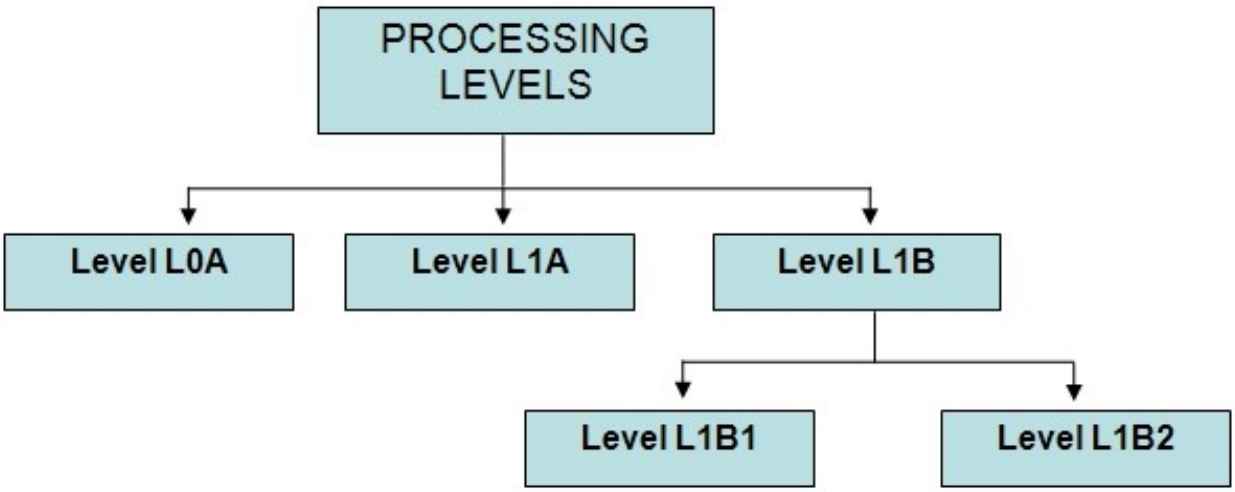


Figure 1: The SAC-D/Aquarius spacecraft.

2.0 Basic Products - Specification of the Processing Levels:

The processing levels of the basic products of the HSC instrument are:



Level L0A: Engineered product, not available for external user of CONAE.

Level L1A: This level is generated from L0A product and applying the following processes:

- Relative Radiometric Calibration.
- Geo-location data are calculated and added. (geoloc file).

Level L1B1: This level of product isn´t generated.

Level L1B2: This level is generated from L1A product and applying the following processes:

- Resampling and map projection.
- Geolocation data for the projected image are calculated and added (geoloc file).

3.0 Processing of data

3.1 Relative Radiometric Calibration

A relative radiometric calibration (inter-pixel calibration) is performed in each of the two HSC cameras. Since each individual detector shows a different behavior within each camera, it becomes necessary to match the response of the different detectors and then is very important to normalize de response of two individual cameras.

3.2 Geometric Calibration

Geolocalization

For each measurement or acquisition (one per each detector, per camera), the data latitude and longitude associated is determined. This process is known as Geolocation.

This calculation is based on an estimation of the pointing of each detector, based on a geometric model of the sensor.

The mean pointing of this geometric model, per band, was adjusted by a least squares calculation, based on measurements of errors between image points and points of reference (obtained from comparisons against MODIS Blue Marble data and vector database GSHHG).

The basic concept of latitude - longitude calculation begins with the determination of the position and speed of the satellite at the moment of observation. With this, and with the relative location of the sensor, the "line of sight" between the detector and the Earth (vector pointing from the detector to the ground) is determined. This "line of sight" intersects a model that represents the Earth (WGS-84 ellipsoid). Consequently, the observed point on the surface is obtained, and thus latitude and longitude are determined.

In order to reduce processing time, latitude and longitude are not calculated for every measurement, but only for a subset grid of the acquired image, which has data enough for calculating the remaining latitudes and longitudes by means of a bilinear interpolation process, with a negligible error.

4.0 File formats (under construction)

4.1 Data and metadata contents

4.2 Limitations in the use of HSC products

5.0 Catalog Organization

The products can be selected from the gallery on the web page (http://www.conae.gov.ar/index.php/espanol/catalogos/catalogo-de-imagenes), previous end user registration. The set of images are mostly from Antarctica during the eclipse period (May-August) along 2012, 2013, 2014 and 2015.

6.0 References

6.1