AQUARIUS MISSION and SCIENCE OVERVIEW

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¹Earth & Space Research, Seattle WA, USA

Understanding the Interaction Between Ocean Circulation, the Water Cycle, and Climate by Measuring Ocean Salinity

Aquarius/SAC-D
Calendar Year 2012 Animation; Data Version 2.0
### Latest Monthly Average (V2.0)

<table>
<thead>
<tr>
<th>Projection</th>
<th>Entire Orbit</th>
<th>Descending Only (morning)</th>
<th>Ascending Only (evening)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Orthographic</td>
<td>![Image]</td>
<td>![Image]</td>
<td>![Image]</td>
</tr>
<tr>
<td>Plate Carrée</td>
<td>![Image]</td>
<td>![Image]</td>
<td>![Image]</td>
</tr>
<tr>
<td>Mollweide</td>
<td>![Image]</td>
<td>![Image]</td>
<td>![Image]</td>
</tr>
</tbody>
</table>

Norman Kuring  
NASA/GSFC  

Oct 2013
SAC-D Service Platform is presently in good health and operating normally

Issues to report briefly

• Star Tracker and Attitude Control – Resolved
  – Frequent safe-hold anomalies in 2012; some data loss
  – Usually quarter moon disruption of star tracker performance
  – Resolved with adjustment to certain star tracker settings
  – No anomalies since July 2013

• Cold Sky Calibrations

• RTU1B (Power supply Side B for Attitude Control System)
  – Spontaneously powered off 12 Sep 2013; not responding
  – Switch to Side A was automatic; no disruption.
  – Investigation underway
<table>
<thead>
<tr>
<th>Month</th>
<th>Time Spent in Planned Operations</th>
<th>Time Spent in Pointing Anomalies</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>days hh:mm:ss 0 0.01% 0.1% 1% 10% %</td>
<td>days hh:mm:ss 0 0.01% 0.1% 1% 10% %</td>
</tr>
<tr>
<td>Dec 2011</td>
<td>00: 21:11</td>
<td>0.047</td>
</tr>
<tr>
<td>Jan 2012</td>
<td>00: 00:00</td>
<td>0</td>
</tr>
<tr>
<td>Feb 2012</td>
<td>00: 22:08</td>
<td>0.053</td>
</tr>
<tr>
<td>Mar 2012</td>
<td>04: 46:05</td>
<td>0.641</td>
</tr>
<tr>
<td>Apr 2012</td>
<td>00: 52:16</td>
<td>0.121</td>
</tr>
<tr>
<td>May 2012</td>
<td>00: 44:26</td>
<td>0.1</td>
</tr>
<tr>
<td>Jun 2012</td>
<td>00: 52:16</td>
<td>0.121</td>
</tr>
<tr>
<td>Jul 2012</td>
<td>00: 52:16</td>
<td>0.117</td>
</tr>
<tr>
<td>Aug 2012</td>
<td>06: 41:36</td>
<td>0.9</td>
</tr>
<tr>
<td>Sep 2012</td>
<td>04: 12:11</td>
<td>0.584</td>
</tr>
<tr>
<td>Dec 2012</td>
<td>1 11: 34:46</td>
<td>4.782</td>
</tr>
<tr>
<td>Jan 2013</td>
<td>1 11: 15:49</td>
<td>4.74</td>
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<tr>
<td>Feb 2013</td>
<td>1 10: 45:05</td>
<td>5.171</td>
</tr>
<tr>
<td>Mar 2013</td>
<td>1 03: 51:04</td>
<td>3.743</td>
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<tr>
<td>Apr 2013</td>
<td>22: 38:31</td>
<td>3.145</td>
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<td>May 2013</td>
<td>11: 44:47</td>
<td>1.579</td>
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<tr>
<td>Jun 2013</td>
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<td>1.154</td>
</tr>
<tr>
<td>Jul 2013</td>
<td>02: 37:30</td>
<td>0.353</td>
</tr>
<tr>
<td>Aug 2013</td>
<td>00: 52:16</td>
<td>0.117</td>
</tr>
<tr>
<td>Sep 2013</td>
<td>01: 35:50</td>
<td>0.222</td>
</tr>
<tr>
<td>Oct 2013</td>
<td>00: 52:16</td>
<td>0.117</td>
</tr>
<tr>
<td>Nov 2013</td>
<td>00: 00:00</td>
<td>0</td>
</tr>
<tr>
<td>Mission to Date 708 days 17:28:30</td>
<td>10 02: 12:47</td>
<td>1.424</td>
</tr>
</tbody>
</table>

No science data lost to pointing anomalies since July.
Worst-case Months

July 2012

November 2012
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Cold Sky Calibrations

Dates:
- 2012-03-24
- 2012-04-28
- 2012-06-30
- 2012-07-23
- 2012-11-27
- 2013-01-10 (*)
- 2013-03-26
- 2013-04-23
- 2013-06-11
- 2013-08-06
- 2013-09-17
- 2013-10-15
- 2013-11-12

(*) Land Crossing

Emmanuel Dinnat; GSFC
Mission Status

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NASA Science Mission Timeline

2011
- Launch 10 June 2011
- Aquarius on 25 Aug 2011
- NASA Plan 10 Nov 2011

2012
- 7th Aquarius/SAC-D Science Meeting 11–13 April 2012
- Aquarius V1.3 Data
- Aquarius 1 Year of Data 25 Aug 2012

2013
- Webinar 29–30 Jan 2013
- Aquarius V2.0 Validated Data 25 Feb 2013
- Joint SMOS-Aquarius Workshop, Brest 15–17 April 2013
- Aquarius 2 Years of Data 25 Aug 2013

2014
- 10 Month Interim Extension

2015
- NASA End of Prime Mission 30 Nov 2014
- Science Meeting Seattle September 2014 (TBC)
- NASA Extended Mission Spring 2015
- Semi-Annual Review Proposal

2016
- NASA 2-Year Extended Mission Begins 1 Oct 2015

8th Aquarius/SAC-D Science Meeting
Buenos Aires, 12-14 November 2013

G. Lagerloef, Aquarius PI
• **Version 1:** (Sep 2011) Initial calibration, but showed a calibration drift in the following months.

• **Version 1.3:** (Apr 2012) Deflection Ratio (DR) calibration algorithm corrected drift and some variations, but left residual quasi-monthly oscillations.

• **Version 2.0:** (Feb 2013) Current operational version. Pointing correction applied. Empirical calibration method corrected quasi monthly oscillations. SSS errors are primarily seasonal residuals of the galaxy correction.

• **Version 3.0:** (Jan 2014) Corrects galaxy residual error. Improved wind roughness correction. Updated data quality flags. Reduced warm and cold end calibration biases. Next key problem is RFI.

• **Version 4.0** (TBD 2014) Add MWR rain correction. Address RFI (somehow). Improve L3 gridding algorithms (resolution, de-biasing, …), other updates.
Improved Corrections for the Galaxy term in the next data version, January 2014

Old: V2.0

2012

SSS MAY 2012 ASC – DSC V2.3.1

May

Asc-Dsc Maps:

New: V3.0

2013

SSS MAY 2013 ASC – DSC V2.3.1

RFI

T. Meissner, Remote Sensing Systems

8th Aquarius/SAC-D Science Meeting
Buenos Aires, 12-14 November 2013
Aquarius ascending - descending

Hsun-Ying Kao, ESR

V2.0

V2.5.1
Over most of the ocean STD is less than 0.1 psu.

Bin-averaging of Aquarius data within 4° x 4° bins centered on a global grid with the grid spacing of 2°.
Over most of the ocean STD is less than 0.2 psu.

Bin-averaging of Aquarius and Argo data within 8° x 8° bins centered on a global grid with the grid spacing of 4°.
Aquarius-Argo Differences

Oleg Melnichenko, U. Hawaii

RMSD (sqrt(mean^2+std^2)), psu

Ascending  
Descending

V2.0

V2.5.1

Bin-averaging of Aquarius and Argo data within 8° x 8° bins centered on a global grid with the grid spacing of 4°.
Aquarius-Argo Differences

Oleg Melnichenko, U. Hawaii  24-month average (Sep 2011-Aug 2013), psu

**V2.0**

**Ascending**

Median = -0.02 psu

**Descending**

Median = -0.01 psu

**V2.5.1**

Bin-averaging of Aquarius and Argo data within 8° x 8° bins centered on a global grid with the grid spacing of 4°.
Fig. SSS3.  

a) Aquarius V2.0 mean 2012 SSS from average of monthly maps [colors in PSS-78] with the Argo mean 2012 values overlaid [grey contours at 0.5 PSS-78 intervals].

b) The difference of Oct. and Apr. 2012 Aquarius maps [colors in PSS-78 yr\(^{-1}\) to allow direct comparison with Fig. SSS1b and Fig. SSS2a]. White ocean areas have excessive land or ice contamination in the Aquarius field of view.

Aquarius year 1 & year 2

YEAR 1  Sep 2011 to Aug 2012

YEAR 2  Sep 2012 to Aug 2013

Hsun-Ying Kao, ESR
Aquarius Inter-annual changes

YEAR 1   Sep 2011 to Aug 2012
YEAR 2   Sep 2012 to Aug 2013

Aquarius Year2 - Year1

Hsun-Ying Kao, ESR

G. Lagerloef, Aquarius PI
Monthly Differences Year 2 – Year 1
Hsun-Ying Kao, ESR
Monthly Differences Year 2 – Year 1
Hsun-Ying Kao, ESR

MAR

JUN

APR

JUL

MAY

AUG

8th Bt

-1 -0.5 0 0.5 1

-1 -0.5 0 0.5 1
Understanding the Interaction Between Ocean Circulation, the Water Cycle, and Climate by Measuring Ocean Salinity

Aquarius/SAC-D
Timeline bar-graph (Launch, Aq-on, 1st-light, PLAR, BOPM, 1yr, 2yr, now, 3yr, EOPM, 10-month Ext, Sr Rev Proposal, Start 2yr Ext Mission.

Issues and plans: next Science Team; EOPM assessment; Ext Mission proposal in Mar-Apr 2015.

8th Aquarius/SAC-D Science Meeting
Buenos Aires, 12-14 November 2013
Outline (30 min)

- Animation
- Project status (2) from Gene
  - Month, week & day most recent Kuring maps
  - Kuring maps Jul & Nov 2012
  - Highlight data loss stats
  - AOCS issues solved
- Timeline bar-graph (Launch, Aq-on, 1st-light, PLAR, BOPM, 1yr, 2yr, now, 3yr, EOPM, 10-month Ext, Sr Rev Proposal, Start 2yr Ext Mission.
- Cold-Sky Cals
- Timeline: Algorithm versions
  - Key improvements V1.3, V2.0, V3.0
  - V2 solved Qusai monthly oscillations
  - V3 solves (mostly) seasonal errors due to galaxy; some residual
- Analyses of V2.5.1 (V3.0 precursor) – 4-5 slides from Oleg & HsunYing
- 2-years of data; some science highlights
  - TIWs; Hurricane Ivan; GOM(gierach, refer to later talk)
  - BAMS SOC 2012
  - Prelims from V2 & V2.5.1: yr2-1, spit itcz, amazon-orinoco outflow; Atl spit ITCZ?
  - Advances in gridding (Olegs paper for SPURS)
  - Gordon Giulivi SPURS analyses
  - EOFs V2 vs V2.5.1
- Wrap-up _ some key issues for meeting to be discussed at end of day.