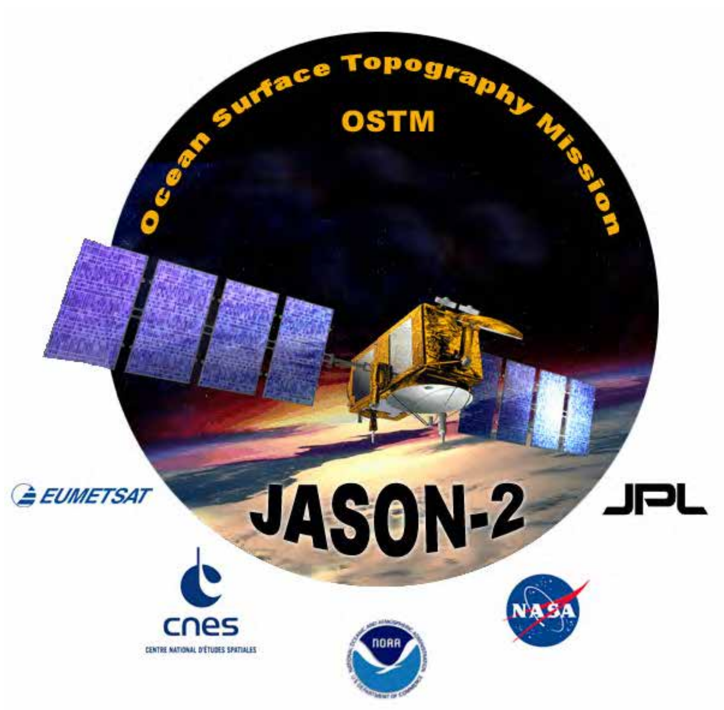
OSTM / Jason-2

Near Real-Time Data Annual Quality Report 2012-2013

August 2013



Prepared by:

U.S. Department of Commerce
National Oceanic and Atmospheric Administration (NOAA)
National Environmental Satellite, Data, and Information Service (NESDIS)
Center for Satellite Applications and Research (STAR)

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Preface

This document comprises the initial National Oceanic and Atmospheric Administration (NOAA) National Environmental Satellite, Data, and Information Service (NESDIS) baseline publication of the OSTM / Jason-2 *Near Real-Time Data Annual Quality Report 2012-2013* (August 7, 2013 issue).

The purpose of this document is to assess the overall quality of the Jason-2/OSTM near real-time products, Operational Geophysical Data Records (OGDRs), which are produced by NOAA and EUMETSAT. For each 10-day cycle, five primary parameters are displayed, divided into ascending and descending passes: sea surface height, significant wave height, ocean surface wind speed, altimeter-based ionosphere correction, and radiometer-based wet troposphere correction. All anomalies evident in these plots, such as orbital maneuvers or data gaps from calibration exercises, are described and documented based upon operational processing logs, etc. Statistics for data latency and data return are presented to demonstrate that high-level mission requirements have been met.

Future updates and revisions to this document will be produced and controlled by NOAA/NESDIS.

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Section 1.0 Introduction

The Jason-2/Ocean Surface Topography Mission is the successor to the Topex/Poseidon and Jason-1 radar altimetry missions. Jason-2 was launched from Vandenberg AFB on 20-Jun-2008, and the onboard instruments began producing data shortly thereafter, on 22-Jun-2008. Prior to achieving its final ~10-day exact repeat orbit, Jason-2 executed a series of maneuvers after injection into orbit. The exact repeat orbit was finally achieved on 04-Jul-2008. Since this resulted in a partial 10-day cycle, it was dubbed cycle-0. All subsequent cycles (beginning with cycle-1) are comprised of 254 half-revolution ‘passes’ with odd-numbered ascending passes extending from south to north, and even-numbered descending passes going north to south.

The primary instrument on-board Jason-2 is a dual-frequency radar altimeter (Ku-band & C-band) that provides measurements of sea surface height, significant wave height, and ocean surface wind speed. Three independent orbit determination systems are provided by the DORIS, GPSP, and passive laser retro-reflector instruments. Sea surface height is computed from the difference in orbital altitude from these systems and the fundamental range measurement (from round-trip travel time) made by the altimeter. Finally, a three-frequency passive microwave radiometer provides measurements of integrated total precipitable water, which is used to correct the sea surface height measurements for path delays due to atmospheric water vapor. Path delay corrections for the ionosphere are based on the dual-frequency altimeter measurements, and for the dry troposphere based on ECMWF model surface pressure fields. Finally, sea surface heights are corrected for signals not associated with large-scale ocean circulation (tides, inverse barometer, and sea state bias).

The Ocean Surface Topography Mission is a four-partner collaboration between NOAA, NASA, CNES and EUMETSAT. As partner operational agencies, NOAA and EUMETSAT share responsibility for production of near real-time data sets. These data, the Operational Geophysical Data Records (OGDRs) are the focus of this quality assessment report. OGDRs are typically produced 1-3 hours after the telemetry are received from the spacecraft, leading to nominal data latencies of 3-5 hours after accounting for two hours of data acquisition on board between data dumps to the ground. The data latency statistics over the fifth year of mission operations are discussed in the next section.

This year’s report documents the fifth year of operations, marking the end of the ‘official’ extended mission. It is also the first report to be based on OGDR-D products, and some anomalies are highlighted. Finally, this year Jason-2 experienced its first satellite safeholds, resulting in an unusually low data return. Nonetheless, the 95% mission data return requirement was still met.

Section 2.0 Data Latency Statistics

The four project partners hold Operational Coordination Group (OCG) meetings weekly, and NOAA routinely reports statistics for near real-time product latency. The latency is computed for each OGDR, based on the time difference between the data itself (measurement time) and the time of availability of the product to end users. The calculation is performed for both the 3 hour / 75% requirement and 5 hour / 95% requirement. The overall latency of the OGDRs, produced by both NOAA and EUMETSAT, is accumulated over the previous week for reporting at the OCG meeting.

Figure 1 is a graphical representation of the weekly latency statistics over the fifth year of operations. At each weekly interval along the x-axis, the percentage of data available within 3 hours is shown by the height of the green area (on a y-axis scale of 60-100%). The percentage of data available within 5 hours is shown by the height of the combined green + yellow areas. Finally, the red areas show the percentage of data NOT available within 5 hours, as a difference between 100% and the yellow area. The target 75% and 95% requirements are shown as horizontal dashed lines.

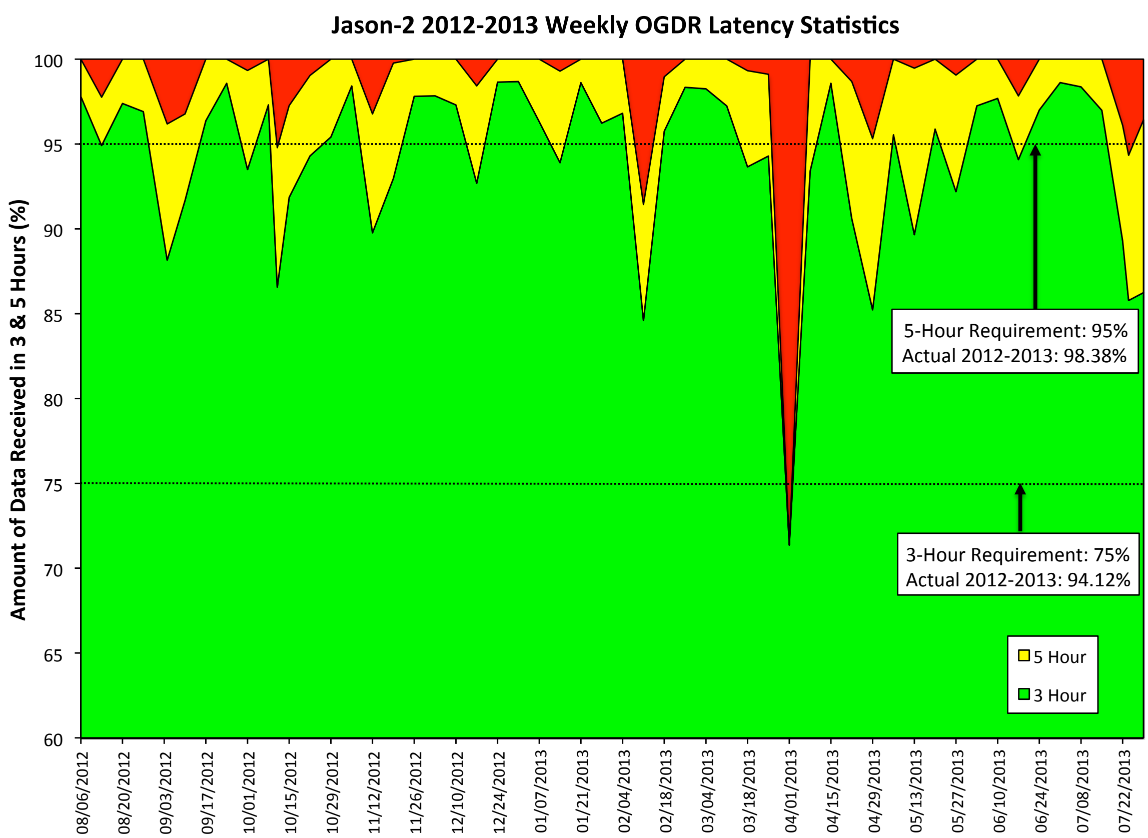


Figure 1 – Jason-2 OGDR Latency Statistics for July 2012 to July 2013

This figure demonstrates that the 3-hour/75% requirement was satisfied for all weeks except 01-Apr-2013, when back-to-back satellite safehold events resulted in a significant reduction in data return. The 5-hour/95% requirement was not met this week, and on the three weeks of 11-Oct-2012, 11-Feb-2013, and 24-Jul-2013. These were largely due to problems with the ground stations resulting in data redumps. **The yearly averaged values (over the 55 weeks shown in Figure 1) are: 94.12% of all data were available within 3 hours and 98.38% of all data were available within 5 hours.** This annual average is less than a half a percent lower than last year's statistics.

Section 3.0 Data Quality Analysis Plots

In this section data from the fifth year of operations are analyzed, covering the time period from 31-Jul-2012 to 20-Jul-2013: cycles 150-185. This year's analysis contains only a part of cycle 150, to account for the transition from OGDR-C to OGDR-D on 31-Jul-2012 12:02Z. The first figure in Appendix-A is a 10-day span starting with the first OGDR-D, and therefore spans the end of cycle-150 and beginning of cycle-151. We focus the analysis on five primary geophysical parameters measured by the on-board instruments: sea surface height anomaly (relative to a multi-year altimetric mean sea surface), significant wave height, ocean surface wind speed, wet tropospheric path delay from the radiometer, and ionospheric path delay based on dual-frequency altimeter measurements.

Each of the five geophysical parameters are analyzed on a per-cycle basis, with data from ascending and descending portions of the ground track plotted separately to prevent overlapping points. The start and end times of each cycle are based on an average cycle duration of 9d 21h 58m 31.612s (856711.612 seconds). The start and end times in the plot labels are rounded to the nearest second, and agree within a few seconds with the actual cycle boundaries. The individual 1-second data points, read from the NetCDF formatted OGDR files, are reported every 10-seconds along track. Each of these 10-second values is plotted as a filled circle, color coded by the vertical scale bar, which is based on a prescribed maximum-minimum range for that variable. Note that the scale for SSHA is now centered on zero, after the removal of an ~18cm bias in OGDR-D range compared to OGDR-C. For each ~10-day cycle, the five parameters are plotted on a single page as ten subplots (separate ascending/descending data) in Appendix-A. Each cyclic subplot represents a map view of a single variable, over the region 22°-382° longitude, ± 70° latitude. The longitude axis is offset by 22° to split the plots at Cape Agulhas, where there is minimal oceanic latitudinal extent between the Atlantic & Indian basins.

Plots for cycles 150-185, comprising the fifth year of operations for Jason-2, are contained in Appendix-A. These plots provide an excellent means of assessing the overall data coverage (or data gaps) as well as anomalies in the data values of the five analyzed parameters. If a parameter map has long stretches of data that are 'off-scale' in either the positive (red) or negative (blue) directions, there is a clear indication of degraded quality. These 36 plots form the basis of the quality assessment provided in the following sections.

Section 4.0 Anomalies Impacting Quality

Since the launch of Jason-2 a variety of anomalies have occurred which impact the quality of the data. These can be related to spacecraft maneuvers, instrumental problems, telemetry transmission difficulties, ground station anomalies, or data processing errors. The anomalies impacting data quality from July 2012 to July 2013 are presented in chronological order below, including the names of the impacted OGDR files. These are largely based on the cyclic GDR reports kindly provided by CNES.

A general observation regarding the SSHA figures at the top of each page is that there are numerous data dropouts distributed randomly across the globe, which are not observed in the other four variables. The previous annual reports for 2008-2012 didn't exhibit this SSHA data loss. It is due to the fact that SSHA values are now defaulted whenever the rain flag is set. This is new in OGDR-D, since OGDR-C didn't have a usable rain flag, and SSHA values were not defaulted when edit flags were set. Flags are provided so end users can edit according to their needs; the SSHA data itself should NOT be set to a default value when flags are set. **This needs to be addressed immediately by the four-partner project teams.**

Cycle-150

Maneuver Burn on 2012-08-01 from 04:14:02 to 04:14:04 (Pass 095).

JA2_OPN_2PdS150_094_20120801_025107_20120801_044718.nc

Cycle-154

No missing pass, but there is a small portion of missing data in central Pacific on pass 210 (on 2012-09-14 between 07:45:08 and 07:46:07).

JA2_OPN_2PdS154_208_20120914_053122_20120914_085757.nc

Cycle-155

DORIS restart on 2012-09-19 at 10:20 (pass 087). Note that passes 85 to 89 were reprocessed on 29th November in order to complete data coverage. These passes were previously (6th November production) partly or completely missing due to datation problems following the DORIS restart.

JA2_OPN_2PdS155_085_20120919_085403_20120919_105015.nc
JA2_OPN_2PdS155_087_20120919_105014_20120919_124941.nc
JA2_OPN_2PdS155_089_20120919_124940_20120919_144754.nc

Cycle-156

Special calibration CAL1 (I and Q) on 2012-10-04 at 20:40:18 with 40 seconds duration (pass

228, mostly over land).

JA2_OPN_2PdS156_228_20121004_201855_20121004_221749.nc

Special calibration CAL2 on 2012-10-05 at 00:07:08 with 33 minutes 22 seconds duration (pass 232, over sea).

JA2_OPN_2PdS156_231_20121004_235455_20121005_015110.nc

Special CNG calibration on 2012-10-05 at 03:11:47 UTC with 26 minutes 10 seconds duration (pass 235, mostly over land).

JA2_OPN_2PdS156_234_20121005_015109_20121005_051634.nc

Cycle-158

Maneuver Burn on 2012-10-18 from 06:42:04 to 06:42:06 (Pass 064). [Not evident in Appendix-A SSHA plot].

JA2_OPN_2PdS158_063_20121018_062041_20121018_100457.nc

Maneuver Burn on 2012-10-22 from 19:23:52 to 19:23:54 (Pass 180).

JA2_OPN_2PdS158_179_20121022_190702_20121022_210314.nc

No missing pass but a part of pass 252 has 12.6% of missing measurements over sea due to ACKMM_ALL command that was executed inadvertently at CDA Fairbanks on 2012-10-25 from 14:49:54 to 14:56:02.

JA2_OPN_2PdS158_252_20121025_144231_20121025_164509.nc

Cycle-164

Maneuver Burn on 2012-12-19 from 17:21:34 to 17:21:35 (Pass 139). [Not evident in Appendix-A SSHA plot].

JA2_OPN_2PdS164_137_20121219_152456_20121219_172326.nc

Cycle-168

The maps from this cycle require some additional explanation. Three separate events occurred within this 10-day span resulting in different types of data loss or anomalies:

1) An AMR reset occurred on 2013-01-28, and the lack of radiometer measurements caused all variables other than SWH to be defaulted for most of passes 141-144.

2) A planned gyro calibration was executed on 2013-01-29, resulting in a data gap that affected all 5 parameters. This impacted pass 158, in the lower right (SE Atlantic) portion of the ascending plots.

3) An ‘expertise calibration’ was performed in conjunction with the gyro calibration, but the resulting long-term measurement calibration file was corrupt:

PJ2_CA1_AXXCNE20130130_110029_20080615_115927_20130129_120000

This resulted in defaulted SSHA, ionosphere, and wind speed values, but no impact on the wet troposphere and SWH values. This anomaly was corrected prior to IGDR and GDR production, so ONLY the following OGDRs were impacted:

JA2_OPN_2PdS168_191_20130130_100550_20130130_120309.nc
JA2_OPN_2PdS168_193_20130130_120310_20130130_135854.nc
JA2_OPN_2PdS168_196_20130130_135854_20130130_155656.nc
JA2_OPN_2PdS168_198_20130130_155656_20130130_174359.nc
JA2_OPN_2PdS168_200_20130130_174358_20130130_193835.nc

The details provided by CNES’ cyclic GDR reports for the first two anomalies are provided below:

1) Passes 141 to 144 are partly or completely edited (respectively 48%, 100%, 100% and 15%) due to radiometer wet troposphere correction at default values). AMR underwent an autonomous reset at 10:50:41 on 2013-01-28. After the reset it came up into a non-data gathering mode (this is the expected effect of a reset). AMR was recovery in a nominal data gathering mode at 13:24:34 on 2013-01-28. Note that this had no impact on SWH.

JA2_OPN_2PdS168_139_20130128_091751_20130128_111644.nc
JA2_OPN_2PdS168_141_20130128_111643_20130128_131326.nc
JA2_OPN_2PdS168_144_20130128_131326_20130128_150945.nc

2) Gyro calibration on 2013-01-29 from 03:08:20 to 04:02:37 impacting passes 158 and 159. No missing pass, but due to gyro calibration, passes 158 and 159 are partly missing with respectively 14% and 100% of missing ocean measurements. Note that this had no impact on SWH nor on the AMR measurements.

JA2_OPN_2PdS168_158_20130129_022113_20130129_030819.nc
JA2_OPN_2PdS168_159_20130129_040219_20130129_054626.nc

Cycle-169

Pass 176 is partly edited (68%) and passes 177 to 181 are completely edited due to radiometer wet troposphere correction at default values because of AMR reset. Note that this had no impact on SWH.

JA2_OPN_2PdS169_176_20130208_171438_20130208_191120.nc
JA2_OPN_2PdS169_178_20130208_191119_20130208_205102.nc
JA2_OPN_2PdS169_179_20130208_205101_20130208_224619.nc
JA2_OPN_2PdS169_181_20130208_224618_20130209_004315.nc

Cycle-172

No missing pass but due to an operator error, there is no data on 2013-03-07 from 08:18:37 to 09:30:49. Passes 96 and 97 are partly missing, with respectively 71.34% and 51.69% of missing measurements over sea.

JA2_OPN_2PdS172_096_20130307_081448_20130307_100201.nc

Maneuver Burn on 2013-03-07 from 17:20:47 to 17:20:49 (Pass 105). [Not evident in Appendix-A SSHA plot].

JA2_OPN_2PdS172_103_20130307_153343_20130307_172928.nc

Cycle-174

First Safe Hold Mode (SHM) occurred from 2013-03-25 at 02:42 to 2013-03-29 at 17:53. Due to first SHM, pass 43 has 63.1% of missing measurements over ocean and passes 44 to 161 are entirely missing. Due to a second SHM, pass 191 has 8.7% of missing measurements over ocean and passes 192 to 254 are entirely missing.

JA2_OPN_2PdS174_042_20130325_013009_20130325_024231.nc
JA2_OPN_2PdS174_161_20130329_175246_20130329_213352.nc

Cycle-175

Second SHM occurred from 2013-03-30 at 21:57 to 2013-04-05 at 14:19. Due to second SHM, passes 1 to 82 are entirely missing and pass 83 has 90% of missing measurements over ocean.

JA2_OPN_2PdS174_189_20130330_195735_20130330_215748.nc
JA2_OPN_2PdS175_083_20130405_141812_20130405_181946.nc

After the second SHM, measurements were rejected due to radiometer wet troposphere at default value impacting passes 83, 84 and 85 with respectively 100%, 100% and 96% of rejected measurements.

JA2_OPN_2PdS175_083_20130405_141812_20130405_181946.nc

Cycle-178

Due to a problem with the telemetry receiver, pass 234 is partly missing (North Pacific) and has 10% of missing measurements over ocean.

JA2_OPN_2PdS178_234_20130511_051753_20130511_084311.nc

Cycle-179

Due to a problem with the telemetry receiver, pass 38 has 6.8% of missing measurements over ocean. An update on Usingen receiver was done on 2013-05-15 at 11:05 in order to solve this problem.

JA2_OPN_2PdS179_037_20130513_112550_20130513_132447.nc

Maneuver Burn on 2013-05-16 from 01:14:53 to 01:14:55 (Pass 103). [Not evident in Appendix-A SSHA plot].

JA2_OPN_2PdS179_100_20130515_214739_20130516_012309.nc

Section 5.0 Analysis of Data Gaps in the OGDRs

There is a high-level Jason-2 mission/system requirement that is relevant to the anomalies discussed in the previous section:

> ***The GDR shall contain 95% of all possible over-ocean data (acquisition and archive) during any 12 month period, with no systematic gaps.***

To assess our performance with regard to this requirement, based on the near real-time OGDRs, all of the data for cycles 150-185 were checked for data gaps between measurements (and between files) when either of the two measurements was over the ocean. Using a nominal inter-record spacing of $\Delta t = 1.02$ seconds, a gap is identified whenever two measurements are separated by more than $2^*\Delta t$. Duplicate data, associated with re-dumping of data stored on-board Jason-2 (i.e. when two OGDRs have the same start time) were skipped during gap detection.

The cumulative result over the 4234 analyzed OGDRs is a total of 20,634,645 over-ocean records (out of a total 28,382,317 records) with data gaps totaling 897,384 records. This equates to 10d 14h 15m 31s of missing data over the course of the year, and an over-ocean data return of 95.65%. The majority of this loss is due to the two safeholds in March and April, affecting cycles 174-175. If we exclude data loss due to the safeholds, the total number of records lost over the ocean is 23,812 (6h 44m 48s), representing an over-ocean data return greater than 99.88%.

The following OGDRs had cumulative data gaps (both internally and relative to the previous file) in excess of 100 seconds. OGDRs are not reported in this list if the data were redumped on a subsequent pass, but they are included in the statistics reported above. The largest gaps from the first 8 OGDRs below are visible in the cyclic plots in Appendix-A.

OGDR File Name	Gap
JA2_OPR_2PdS175_083_20130405_141812_20130405_181946	481201
JA2_OPR_2PdS174_161_20130329_175246_20130329_213352	392371
JA2_OPR_2PdS172_096_20130307_081448_20130307_100201	4247
JA2_OPR_2PdS155_087_20120919_105014_20120919_124941	3671
JA2_OPR_2PdS168_159_20130129_040219_20130129_054626	3178
JA2_OPR_2PdS156_231_20121004_235455_20121005_015110	1963
JA2_OPR_2PdS158_252_20121025_144231_20121025_164509	367
JA2_OPR_2PdS178_234_20130511_051753_20130511_084311	339
JA2_OPR_2PdS179_013_20130512_130117_20130512_165529	124
JA2_OPR_2PdS167_050_20130114_231617_20130115_011328	117
JA2_OPR_2PdS179_037_20130513_112550_20130513_132447	116
JA2_OPR_2PdS181_196_20130608_113954_20130608_133557	106

In the process of performing the gap analysis, a region of small but systematic gaps was detected in the NE Atlantic, associated with the visibility ellipse of the Usingen ground station. This is the area where OGDRs begin and end, due to the way in which telemetry is dumped from Jason-2 to Usingen. There is a consistent 2 record gap between OGDRs. Although this represents a small data loss, it may be due to a bug in the TM-NRT processing which results in consistent gaps between OGDRs. This is shown in Figure 2.

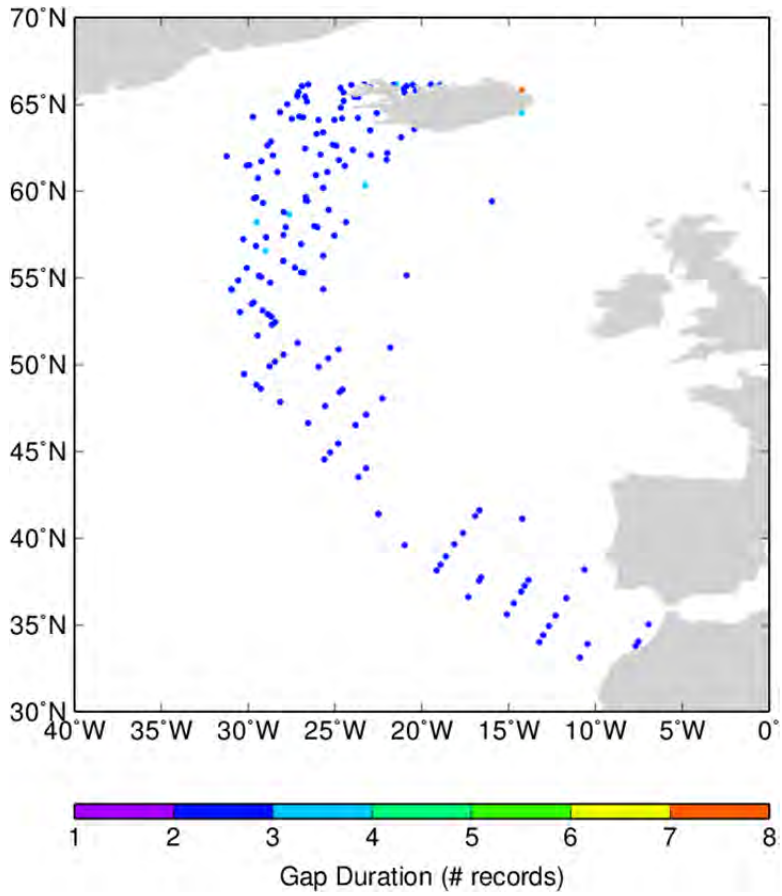


Figure 2 - Data gaps observed between OGDRs associated with Usingen visibility ellipse.

Section 6.0 Summary

The overall quality of the Jason-2/OSTM near real-time OGDR data is extremely good. Jason-2 suffered its first two satellite safeholds this year, resulting in a loss of more than 10 days of data during cycles 174 and 175. Seven of the remaining 34 cycles had noticeable defects due to data gaps, AMR or DORIS anomalies, and maneuvers: cycles 150, 155, 156, 158, 168, 169, and 172. The amount of missing data, attributed to all of the anomalies discussed in sections 4 and 5 (excluding safeholds) is a about 6 hours and 45 minutes. **This represents an over-ocean data return of 99.88%, excluding safeholds, over the time period of 354 days analyzed in this report.**

In addition to the high overall data return, the data availability in terms of latency is also well above the mission requirements: **94.12% of all data were available within 3 hours and 98.38% of all data were available within 5 hours**.

This first report based on OGDR-D data has highlighted two concerns which the project teams need to address:

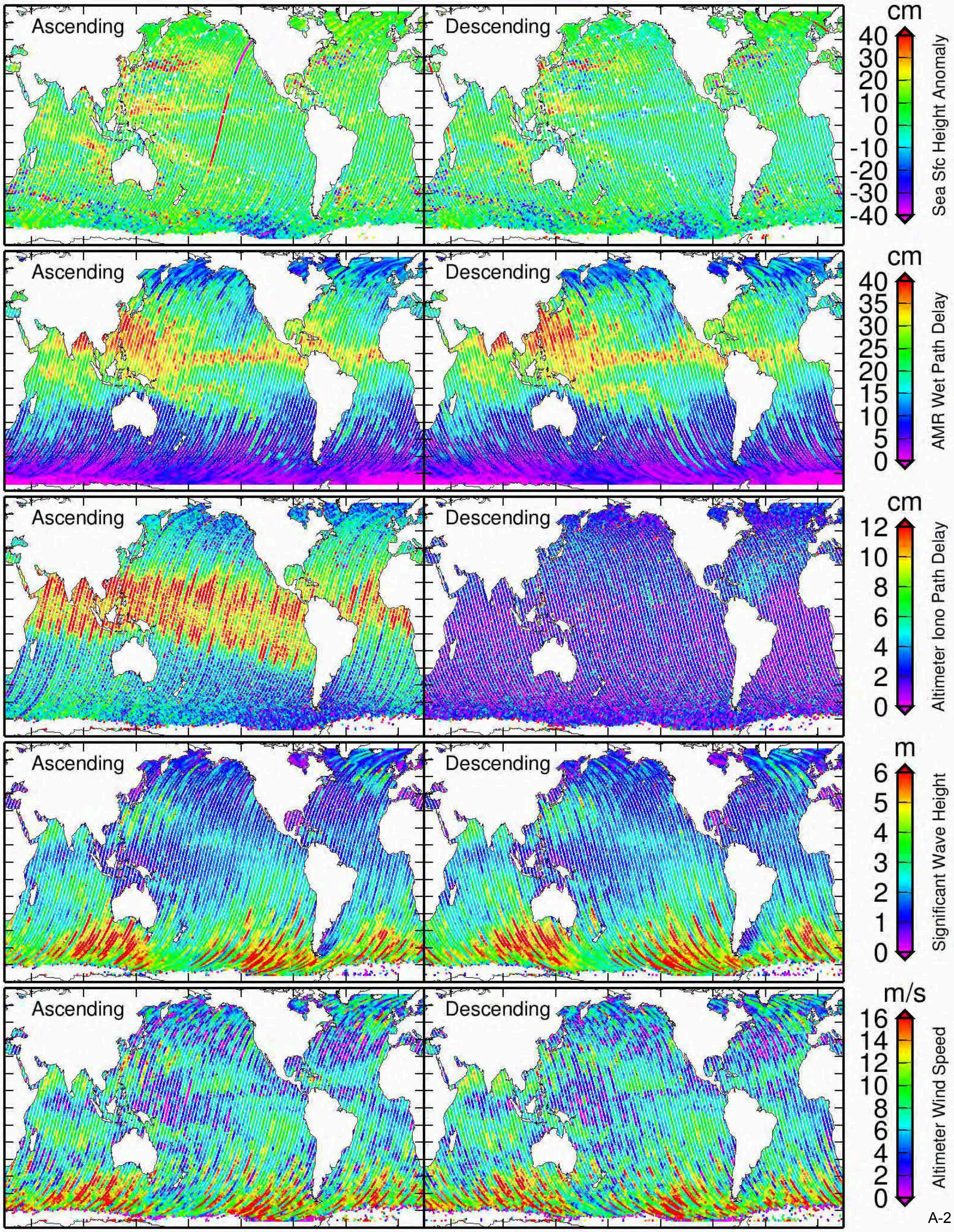
1) SSHA values are being defaulted when the rain flag (and others) are set. The values should be provided, with the flags providing edit criteria guidance.

2) Systematic losses of single 1-Hz records is occurring between OGDRs created from Usingen telemetry. The source of this anomaly, most likely within the TM-NRT processors, needs to be identified and corrected.

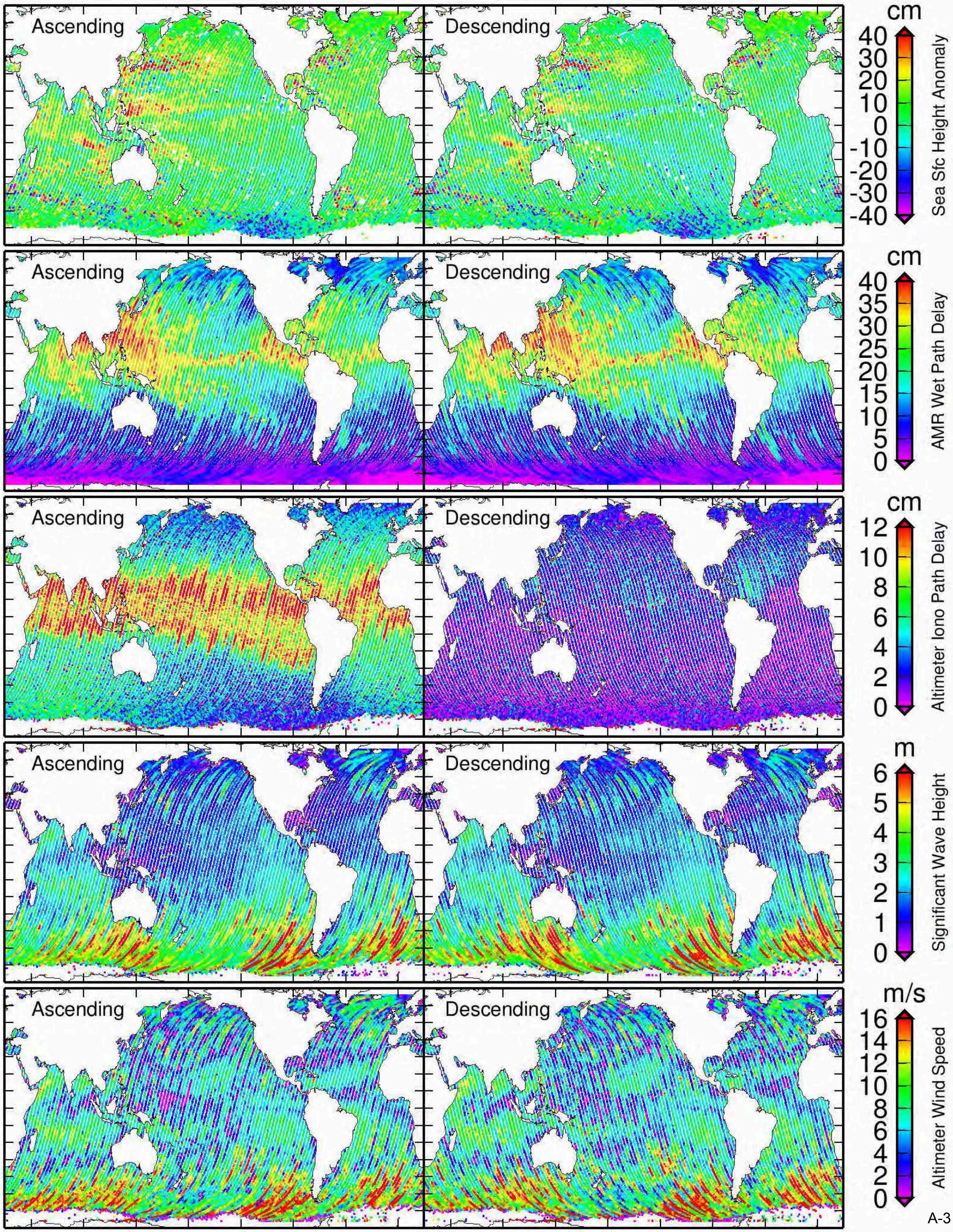
Appendix A. Cyclic Parameter Plots Cycle-150 to Cycle-185

See individual plots on the following 36 pages.

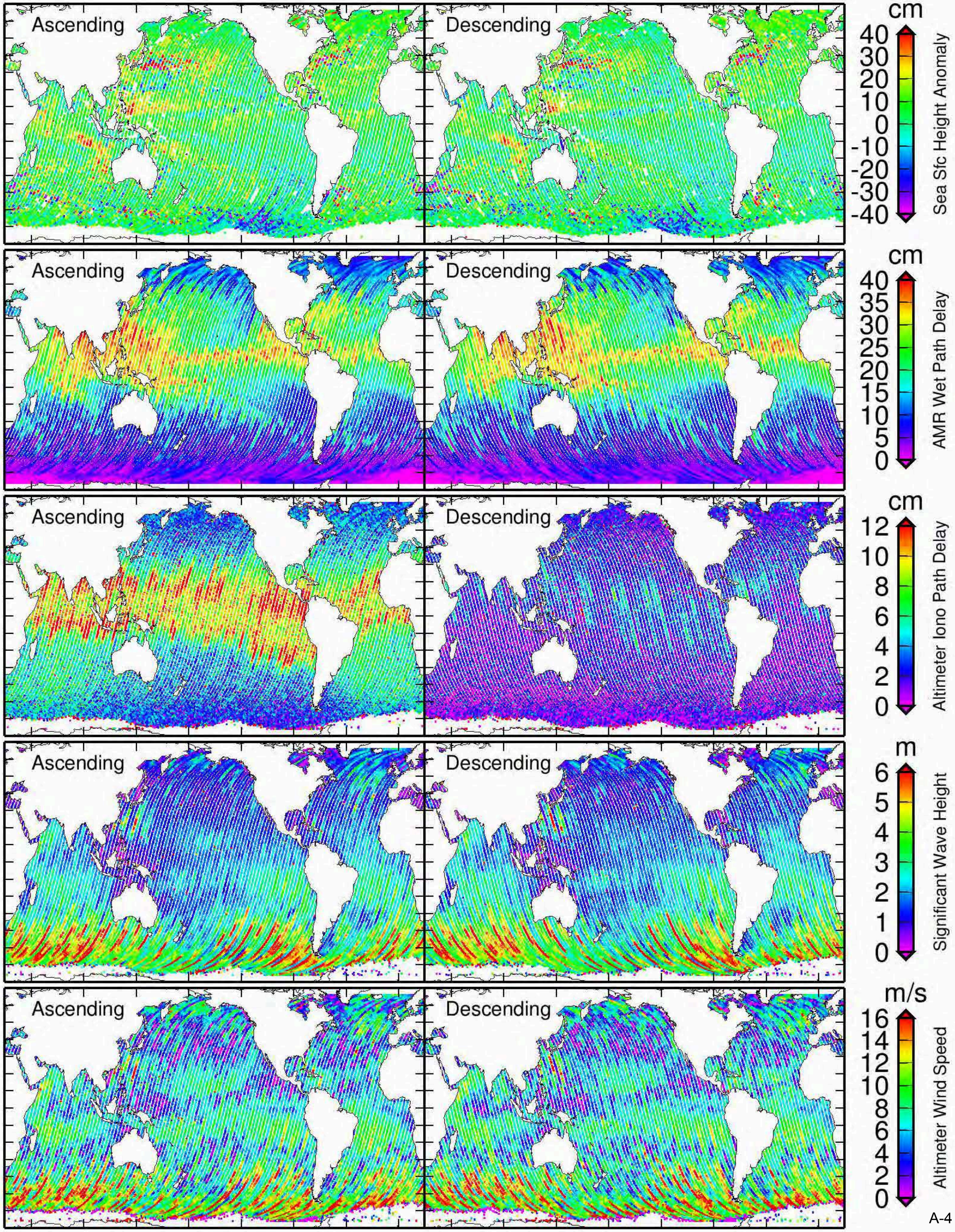
Jason-2 Cycle-150/151 2012-07-31 12:02:00 - 2012-08-10 10:00:32



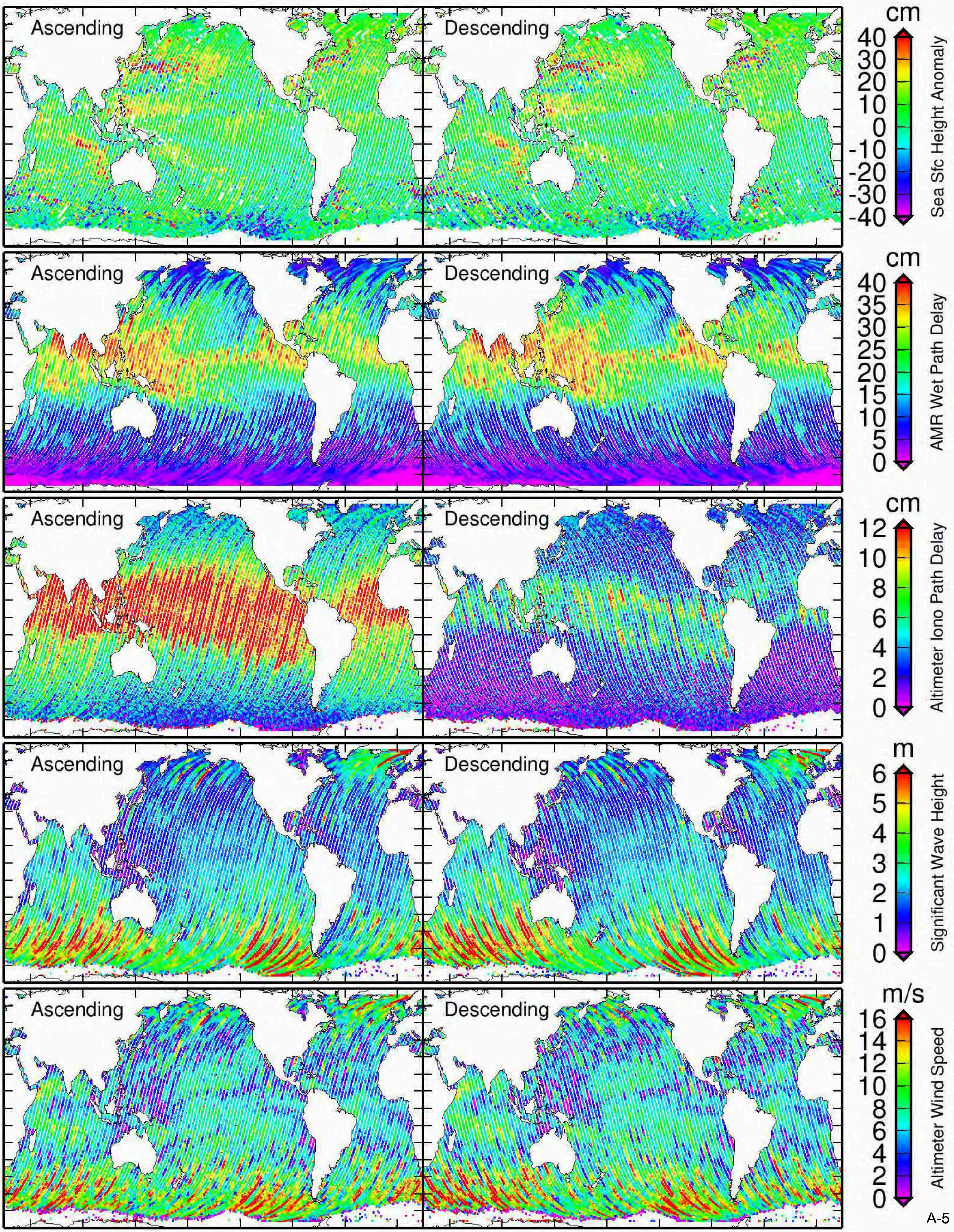
Jason-2 Cycle-151 2012-08-07 09:38:54 - 2012-08-17 07:37:26



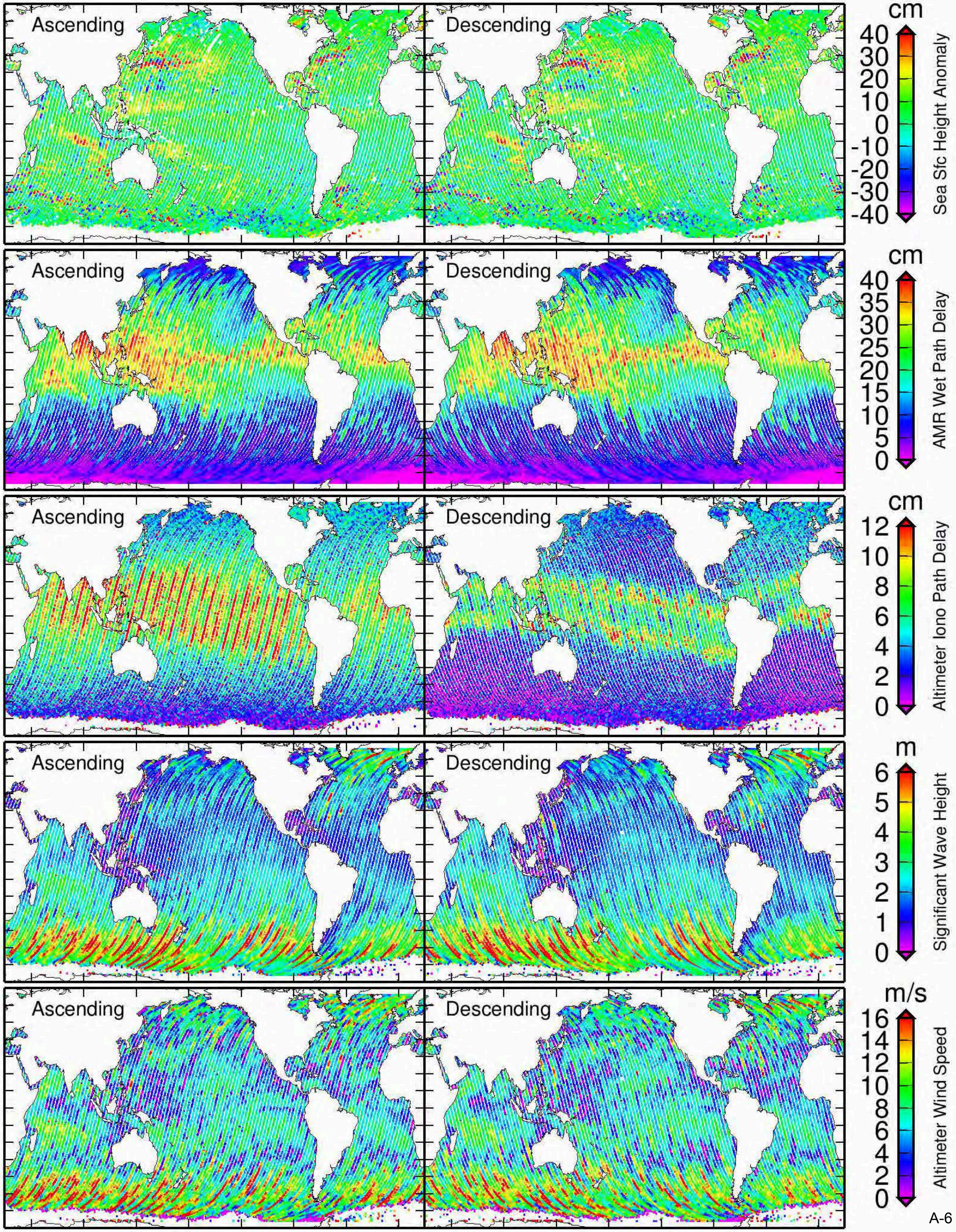
Jason-2 Cycle-152 2012-08-17 07:37:26 - 2012-08-27 05:35:57



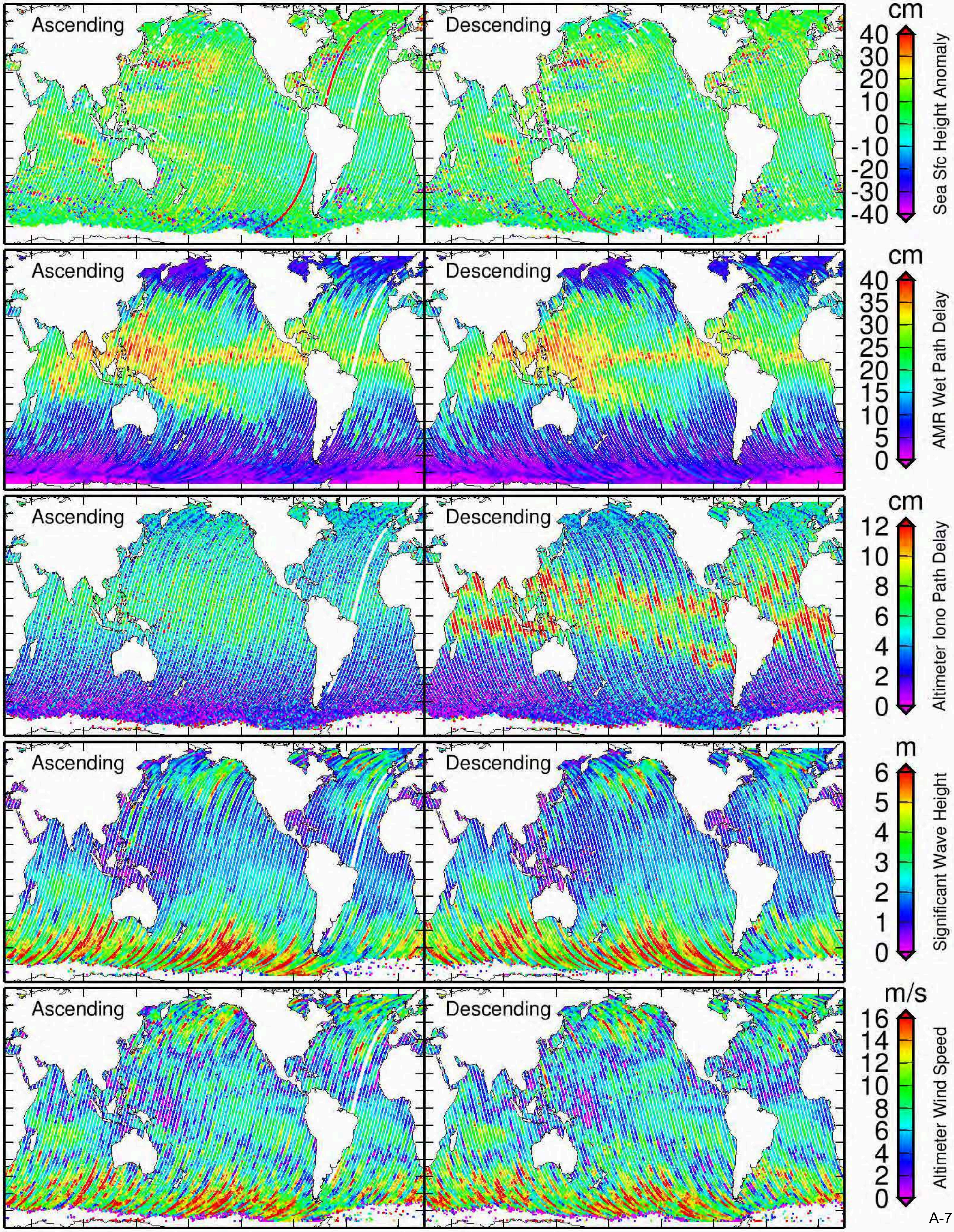
Jason-2 Cycle-153 2012-08-27 05:35:57 - 2012-09-06 03:34:29



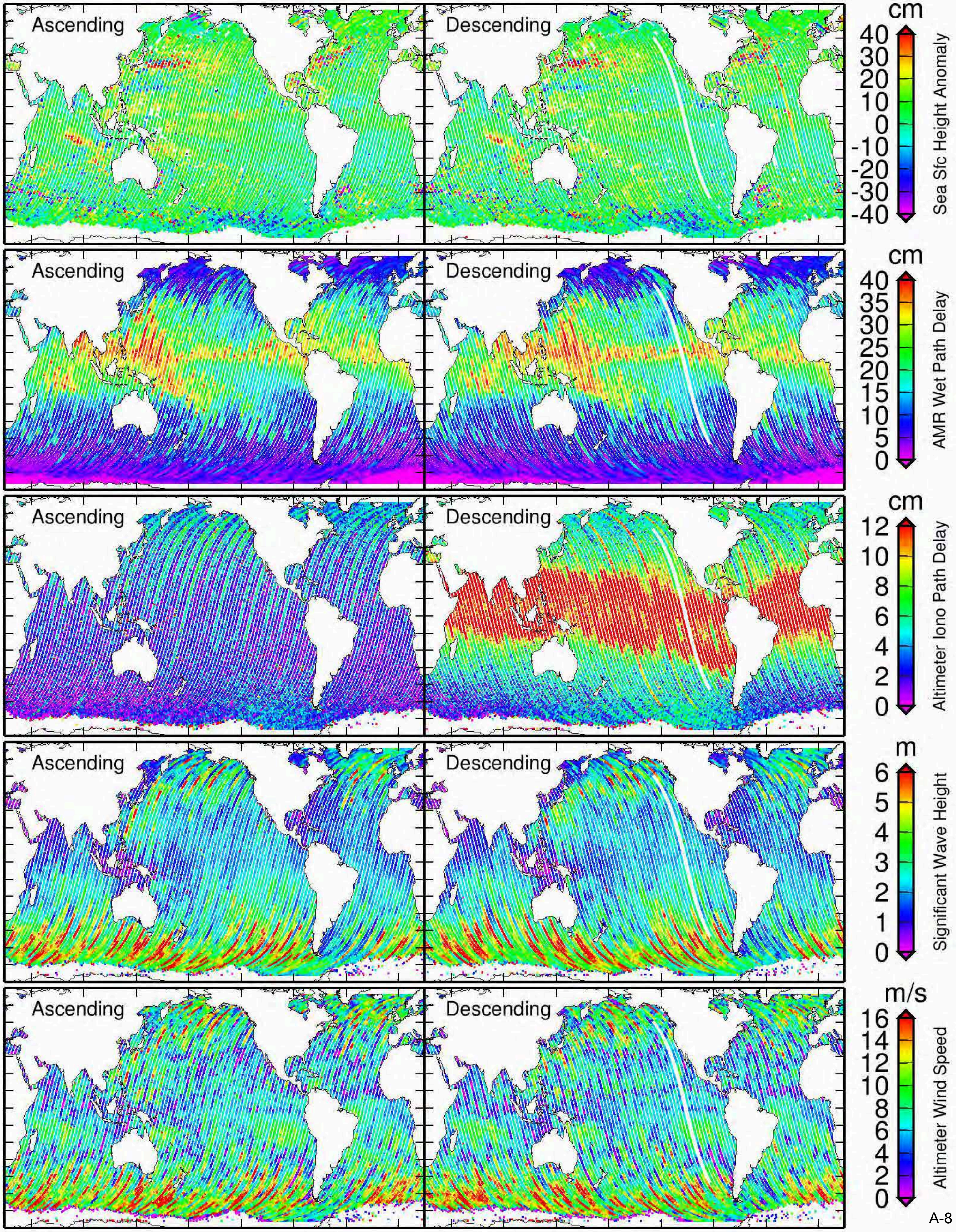
Jason-2 Cycle-154 2012-09-06 03:34:29 - 2012-09-16 01:33:00



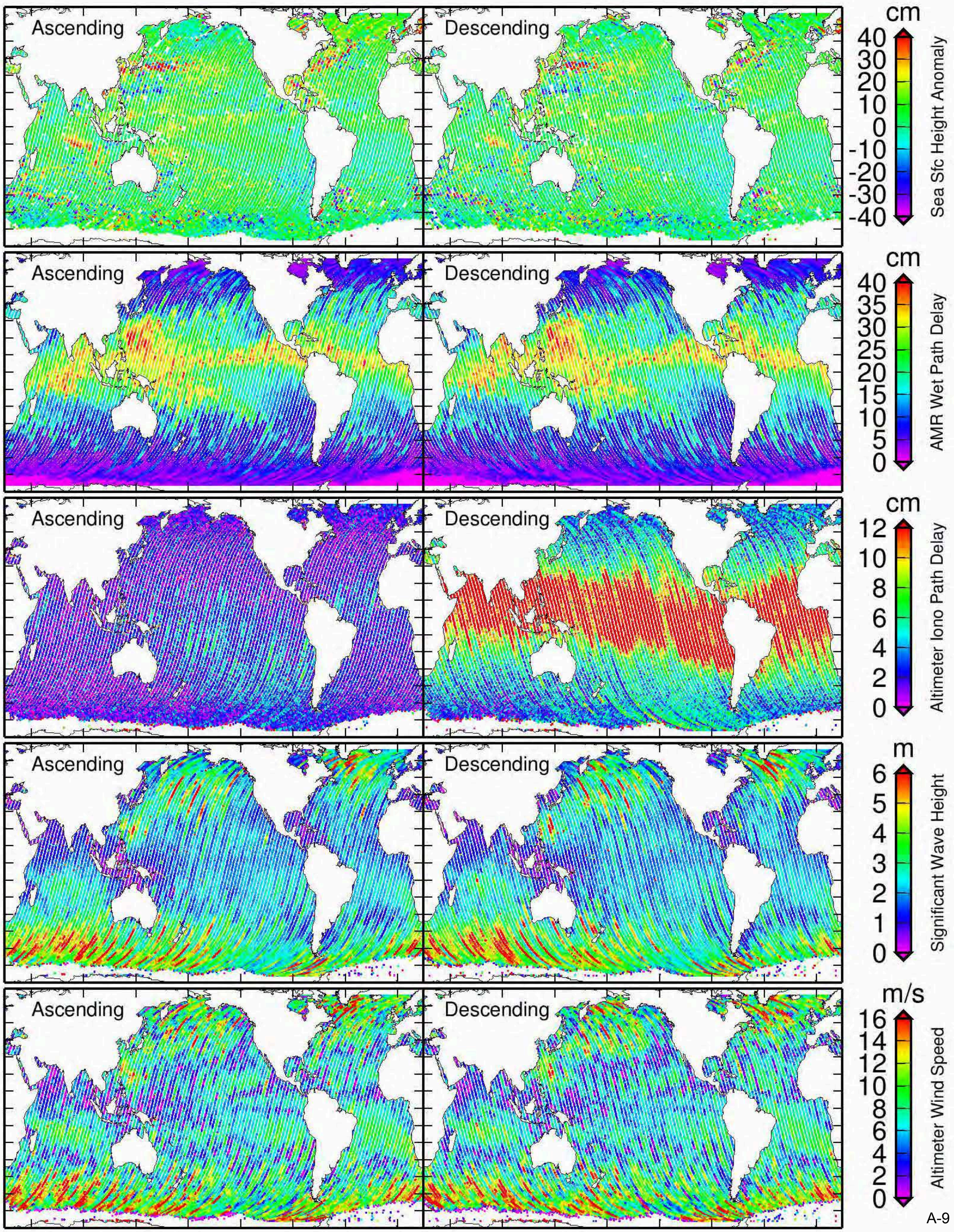
Jason-2 Cycle-155 2012-09-16 01:33:00 - 2012-09-25 23:31:32



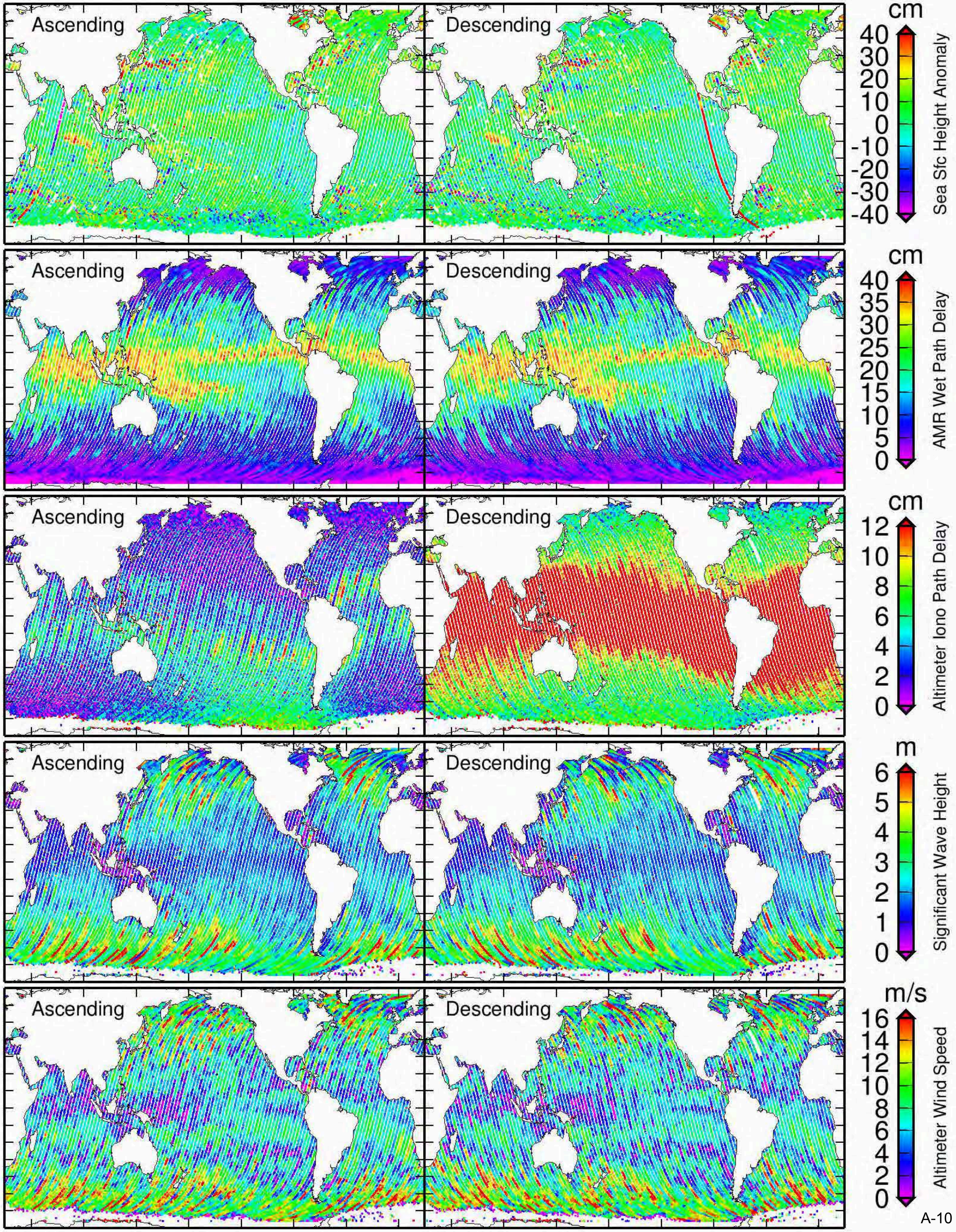
Jason-2 Cycle-156 2012-09-25 23:31:32 - 2012-10-05 21:30:04



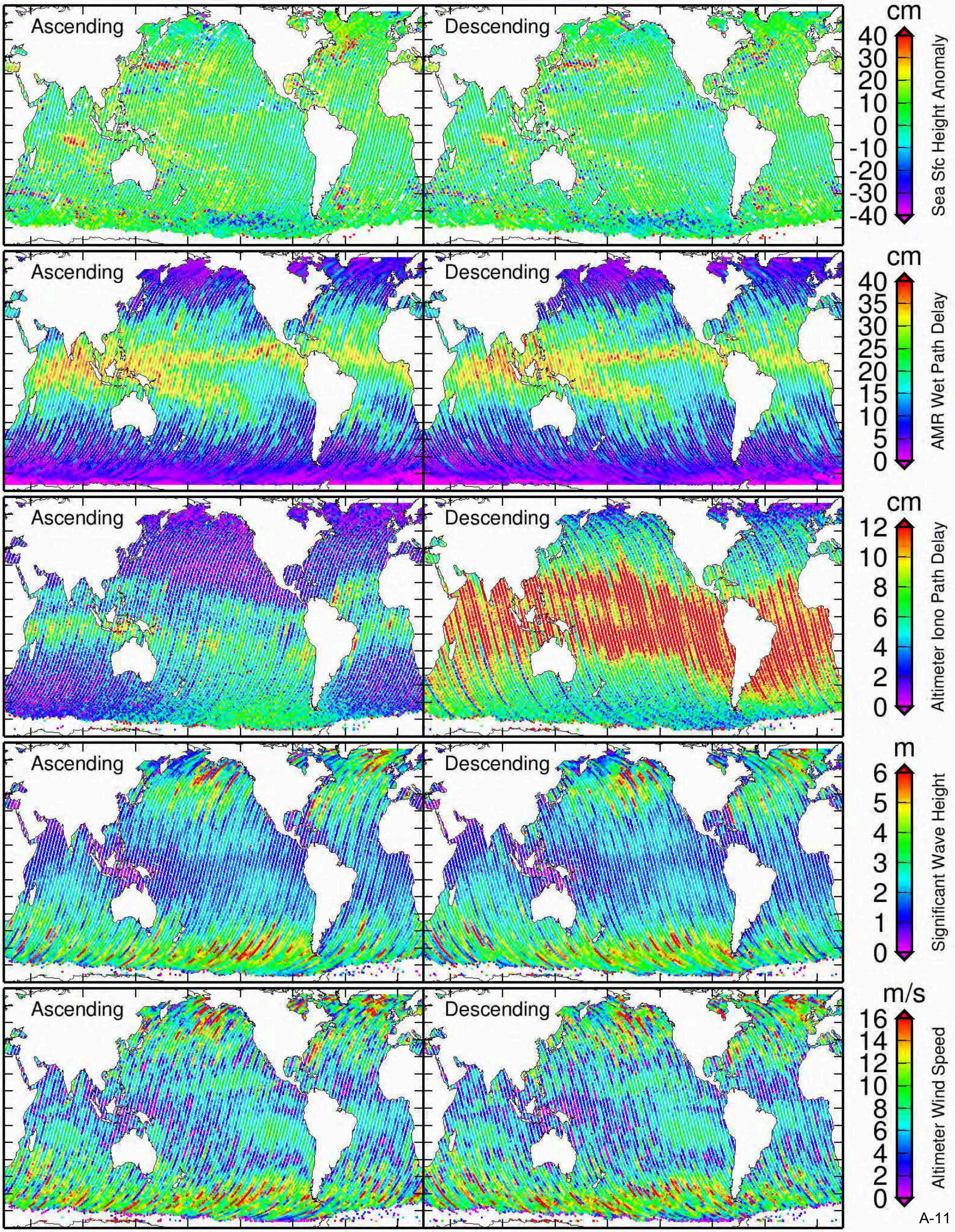
Jason-2 Cycle-157 2012-10-05 21:30:04 - 2012-10-15 19:28:35



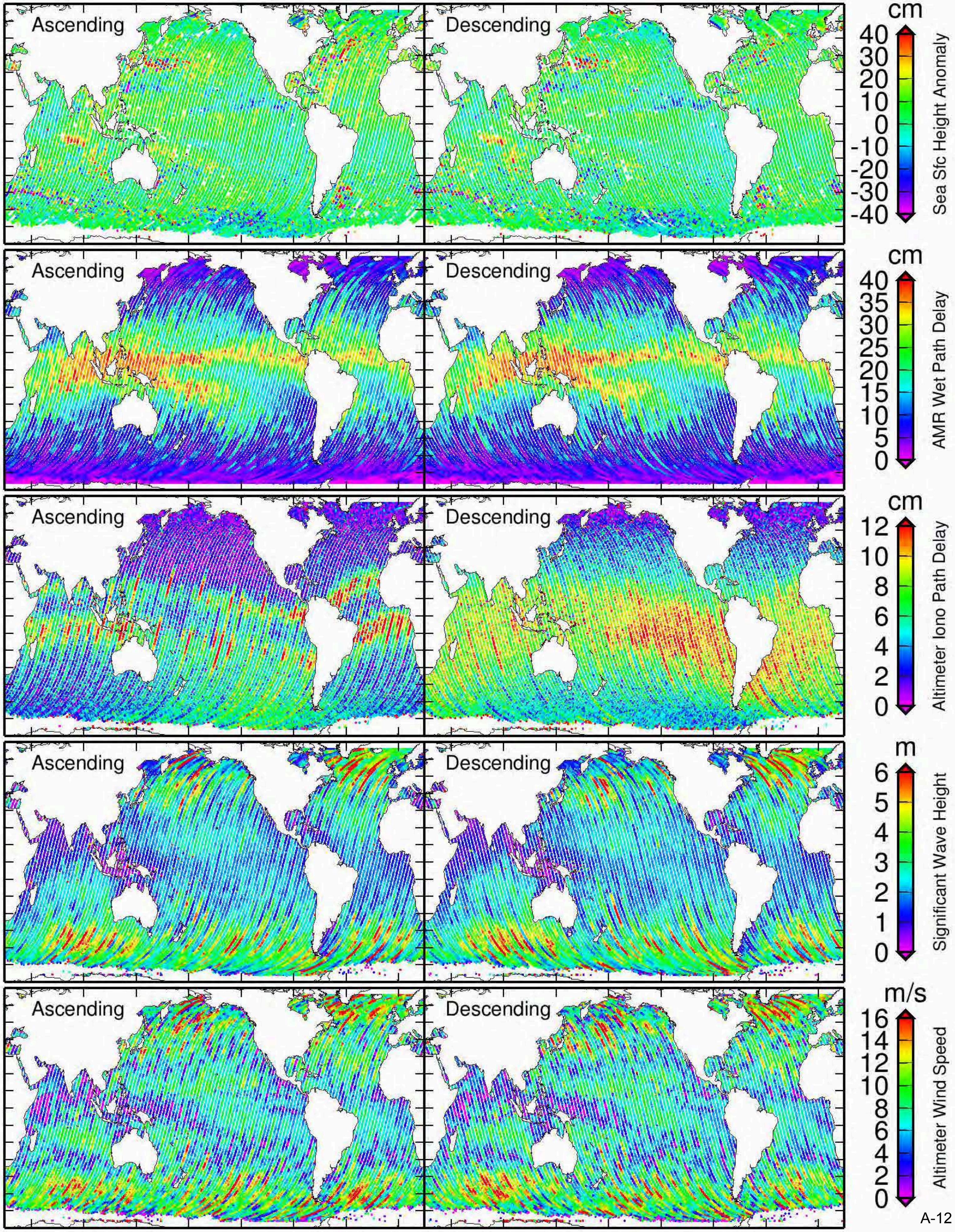
Jason-2 Cycle-158 2012-10-15 19:28:35 - 2012-10-25 17:27:07



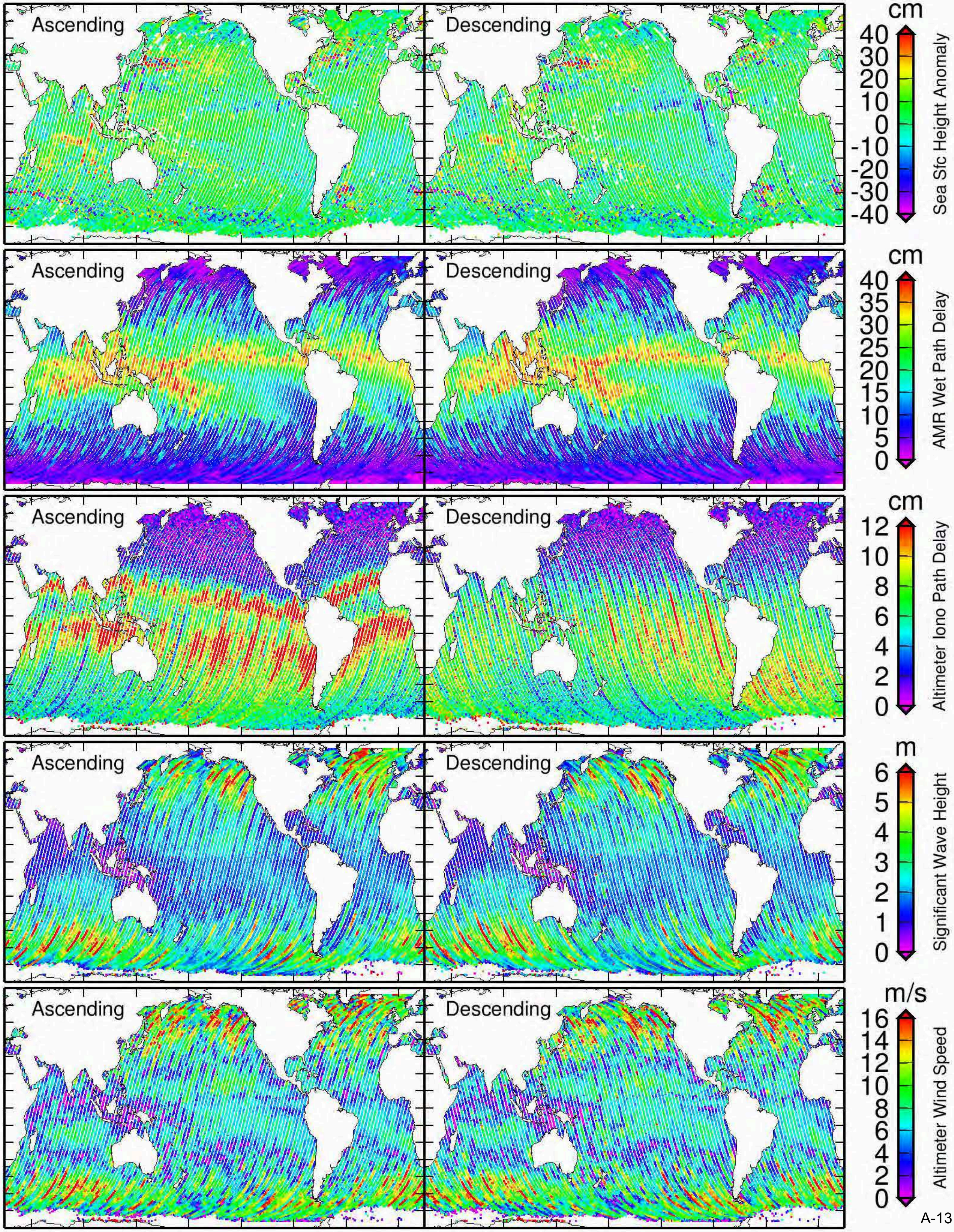
Jason-2 Cycle-159 2012-10-25 17:27:07 - 2012-11-04 15:25:38



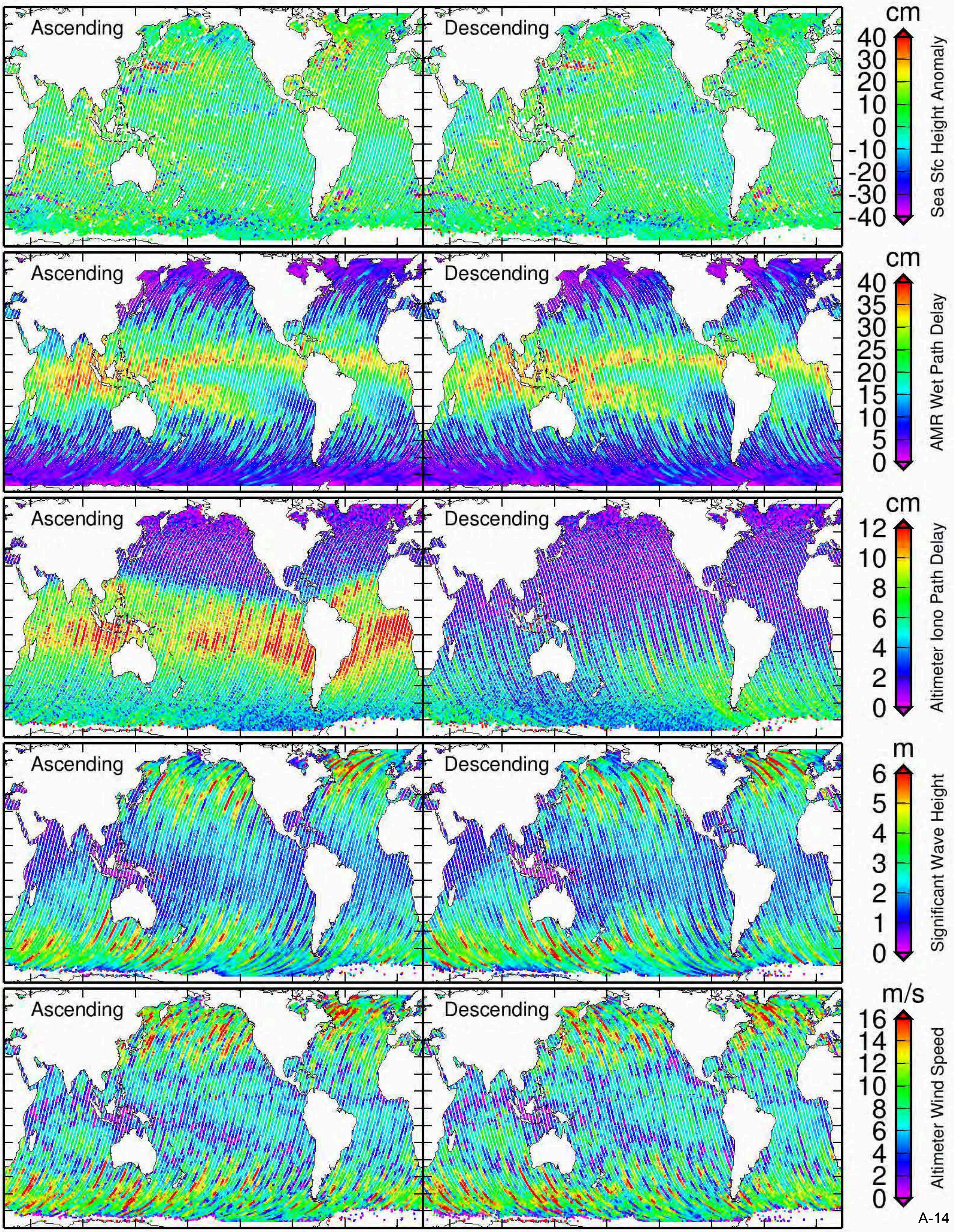
Jason-2 Cycle-160 2012-11-04 15:25:38 - 2012-11-14 13:24:10



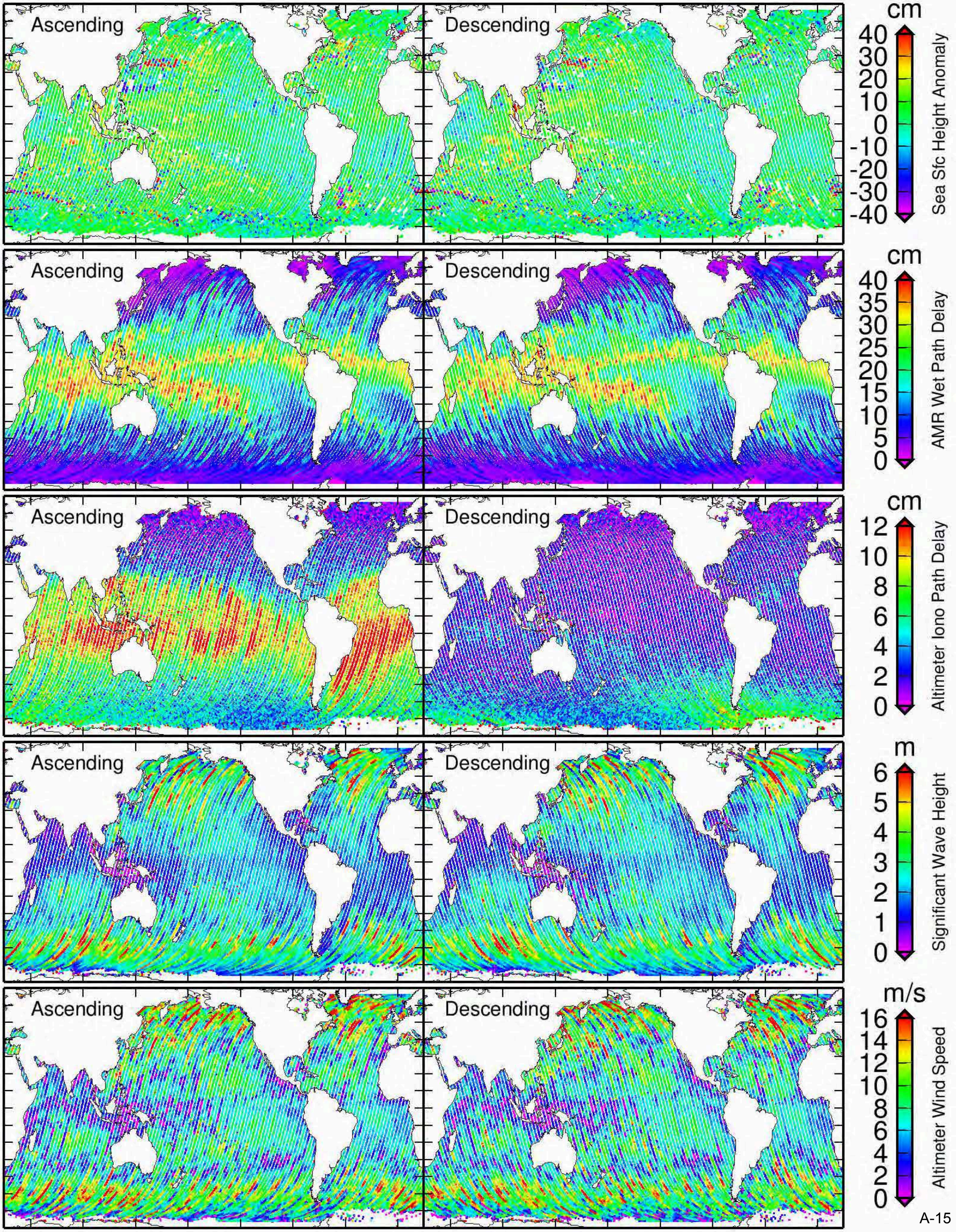
Jason-2 Cycle-161 2012-11-14 13:24:10 - 2012-11-24 11:22:42



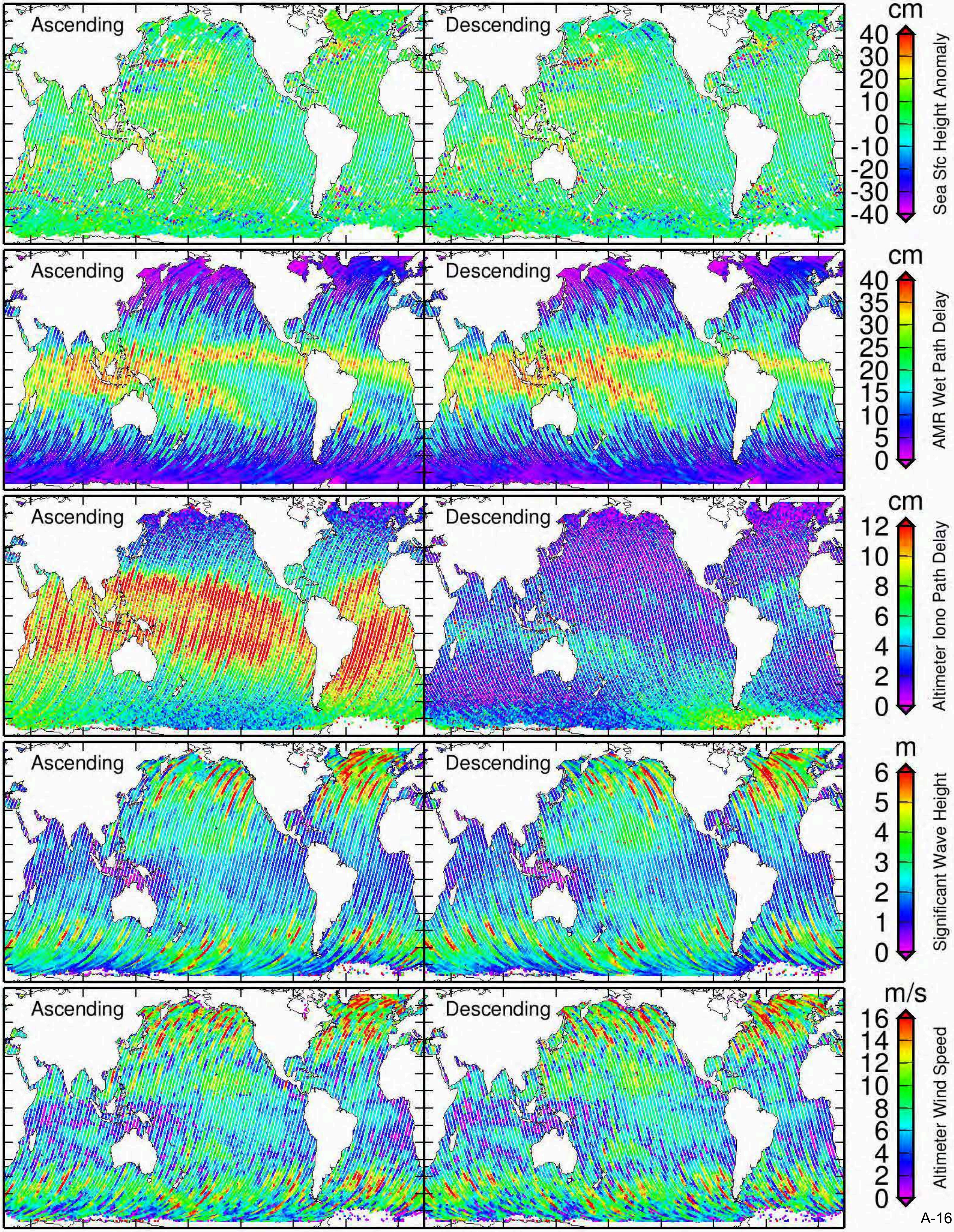
Jason-2 Cycle-162 2012-11-24 11:22:42 - 2012-12-04 09:21:13



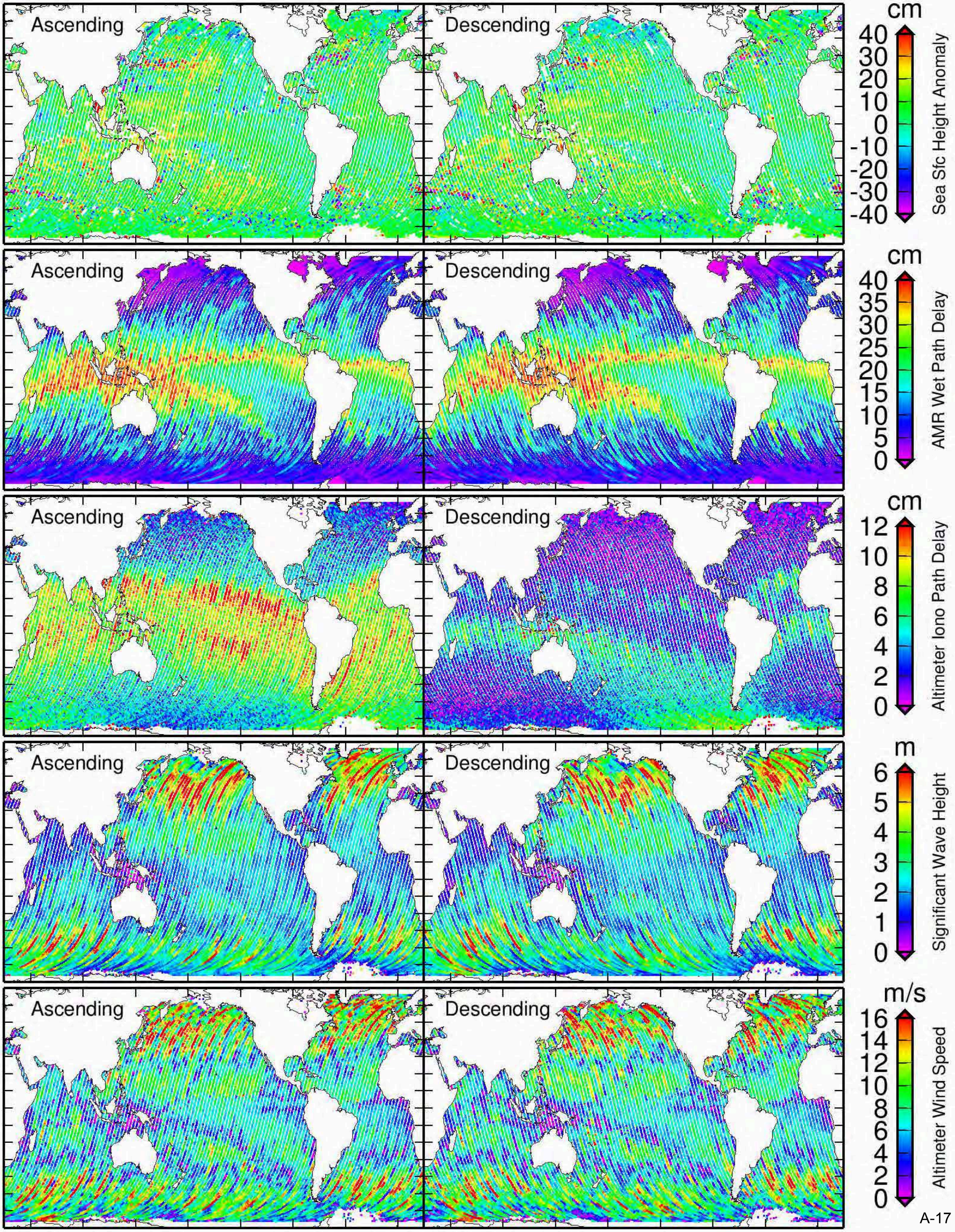
Jason-2 Cycle-163 2012-12-04 09:21:13 - 2012-12-14 07:19:45

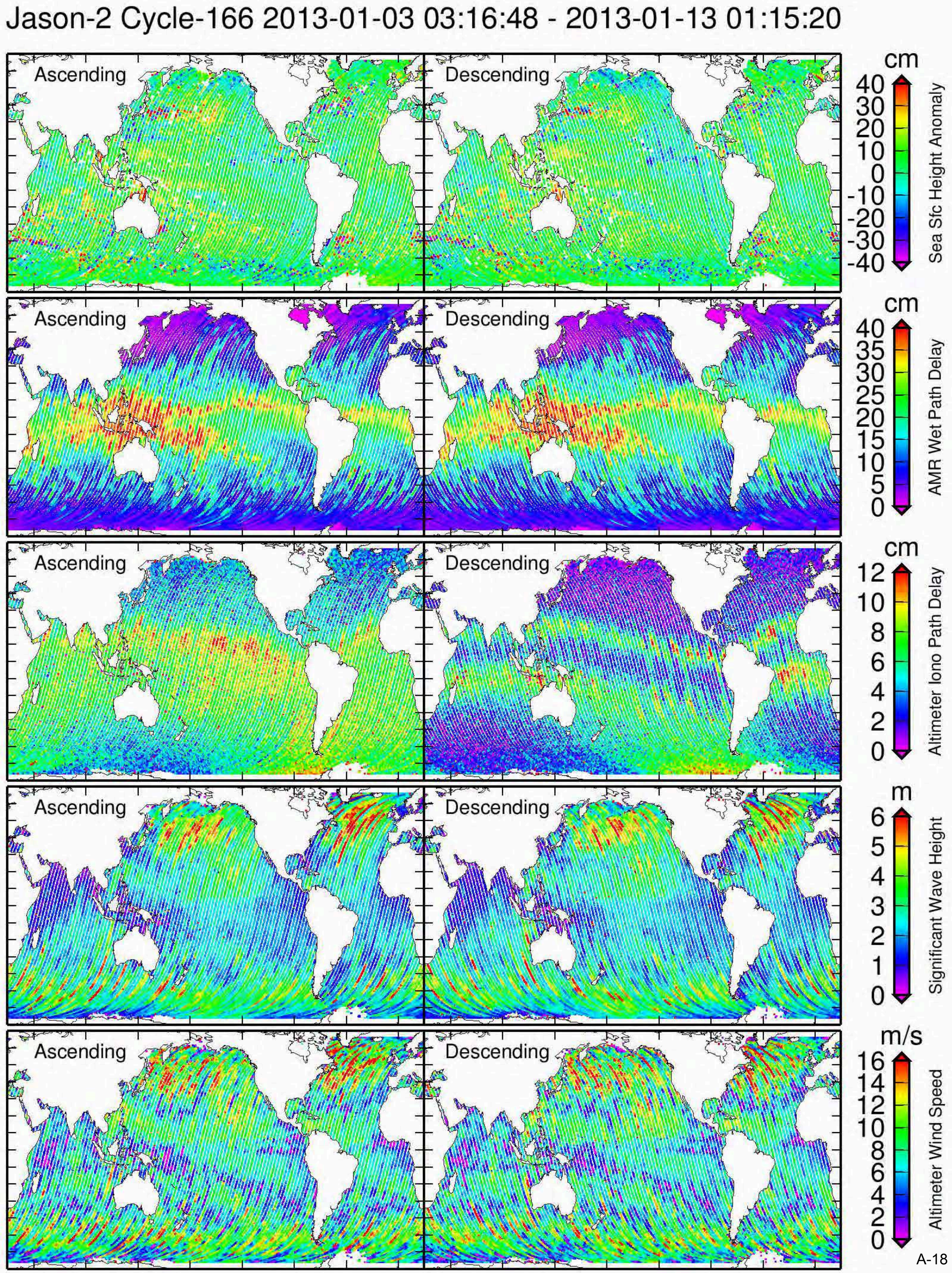


Jason-2 Cycle-164 2012-12-14 07:19:45 - 2012-12-24 05:18:16

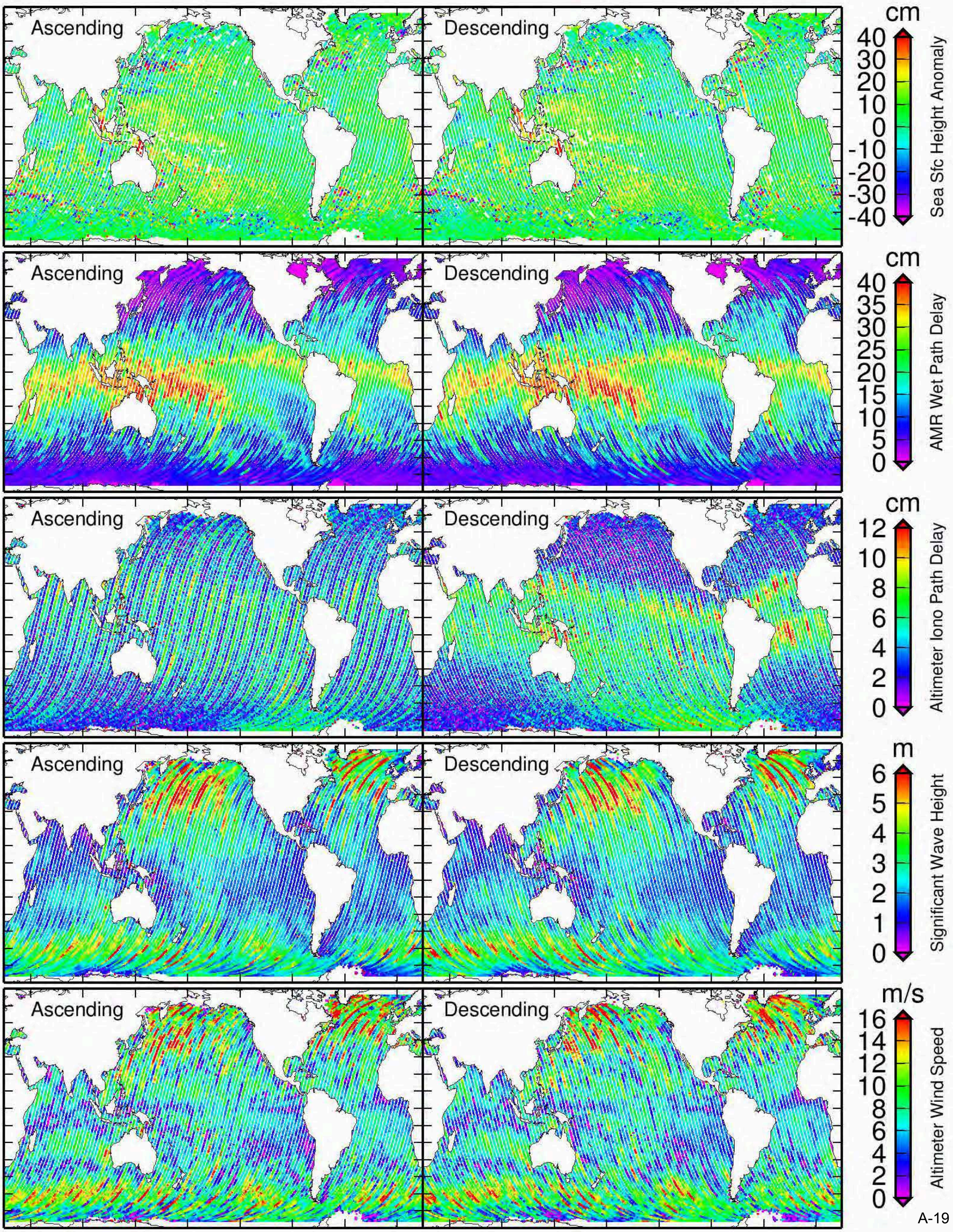


Jason-2 Cycle-165 2012-12-24 05:18:16 - 2013-01-03 03:16:48

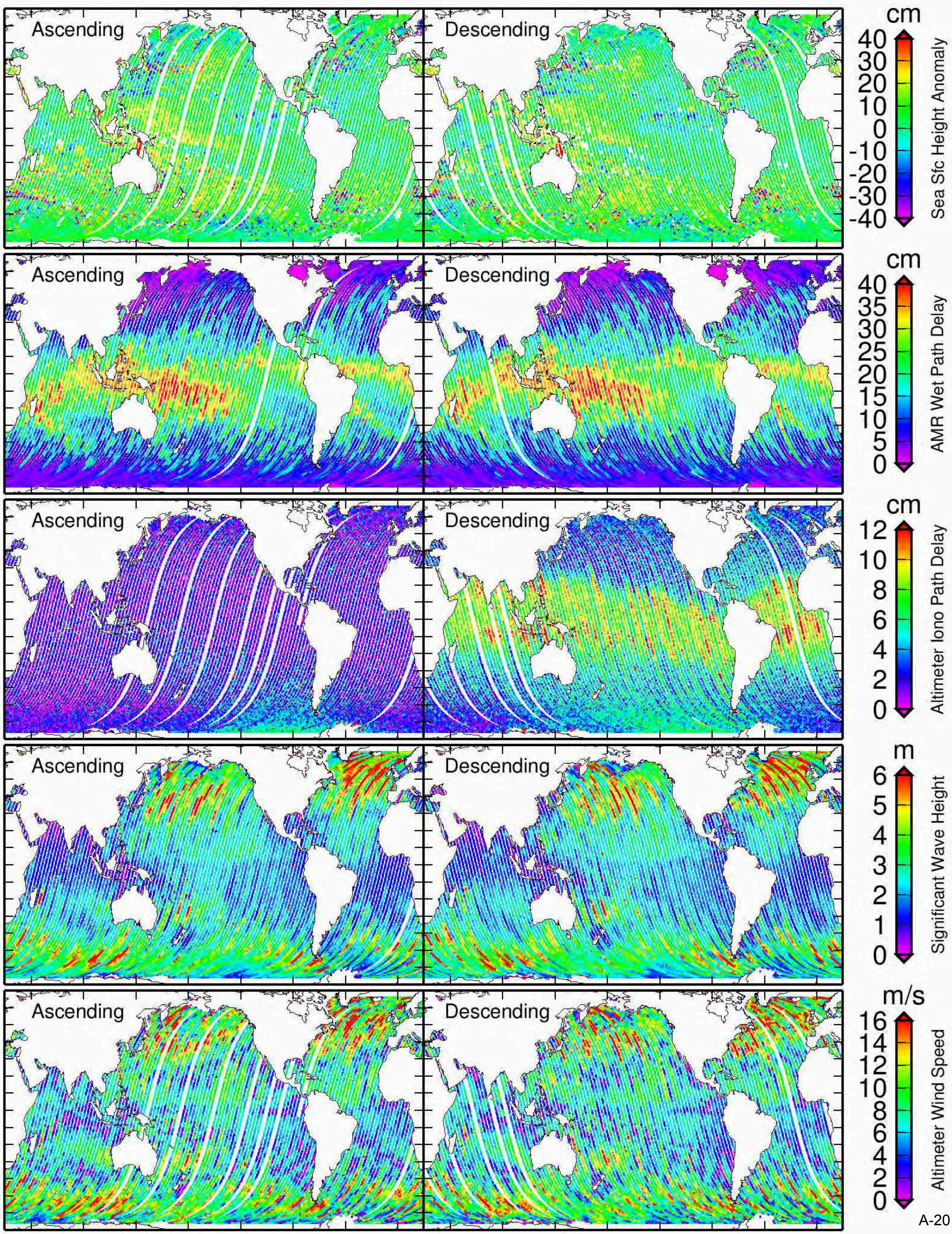



Jason-2 Cycle-166 2013-01-03 03:16:48 - 2013-01-13 01:15:20
Ascending
Descending
cm
40
30
20
10
0
-10
-20
-30
-40
Sea Sfc Height Anomaly
cm
40
35
30
25
20
15
10
5
0
AMR Wet Path Delay
cm
12
10
8
6
4
2
0
Altimeter Iono Path Delay
m
6
5
4
3
2
1
0
Significant Wave Height
m/s
16
14
12
10
8
6
4
2
0
Altimeter Wind Speed

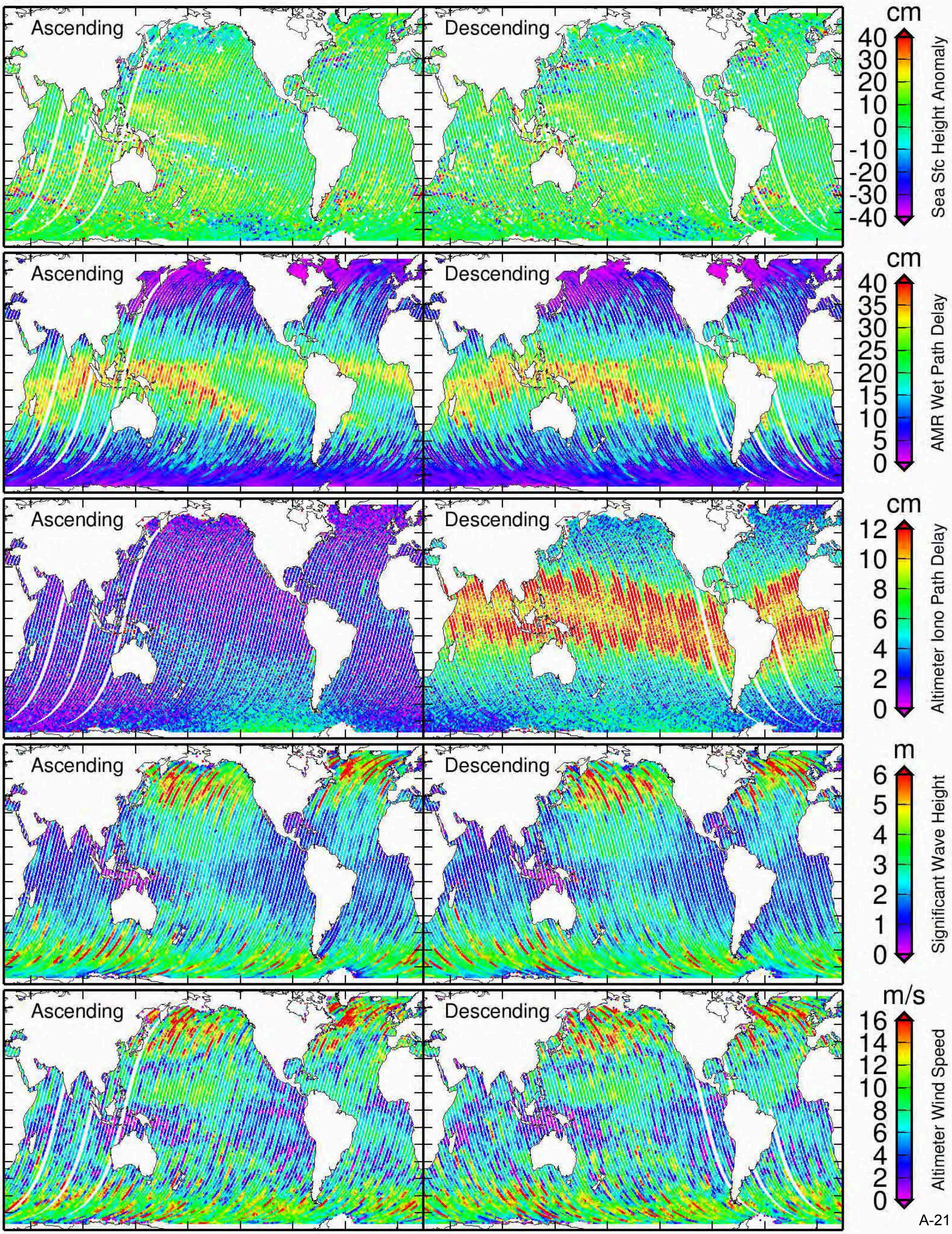
Jason-2 Cycle-167 2013-01-13 01:15:20 - 2013-01-22 23:13:51



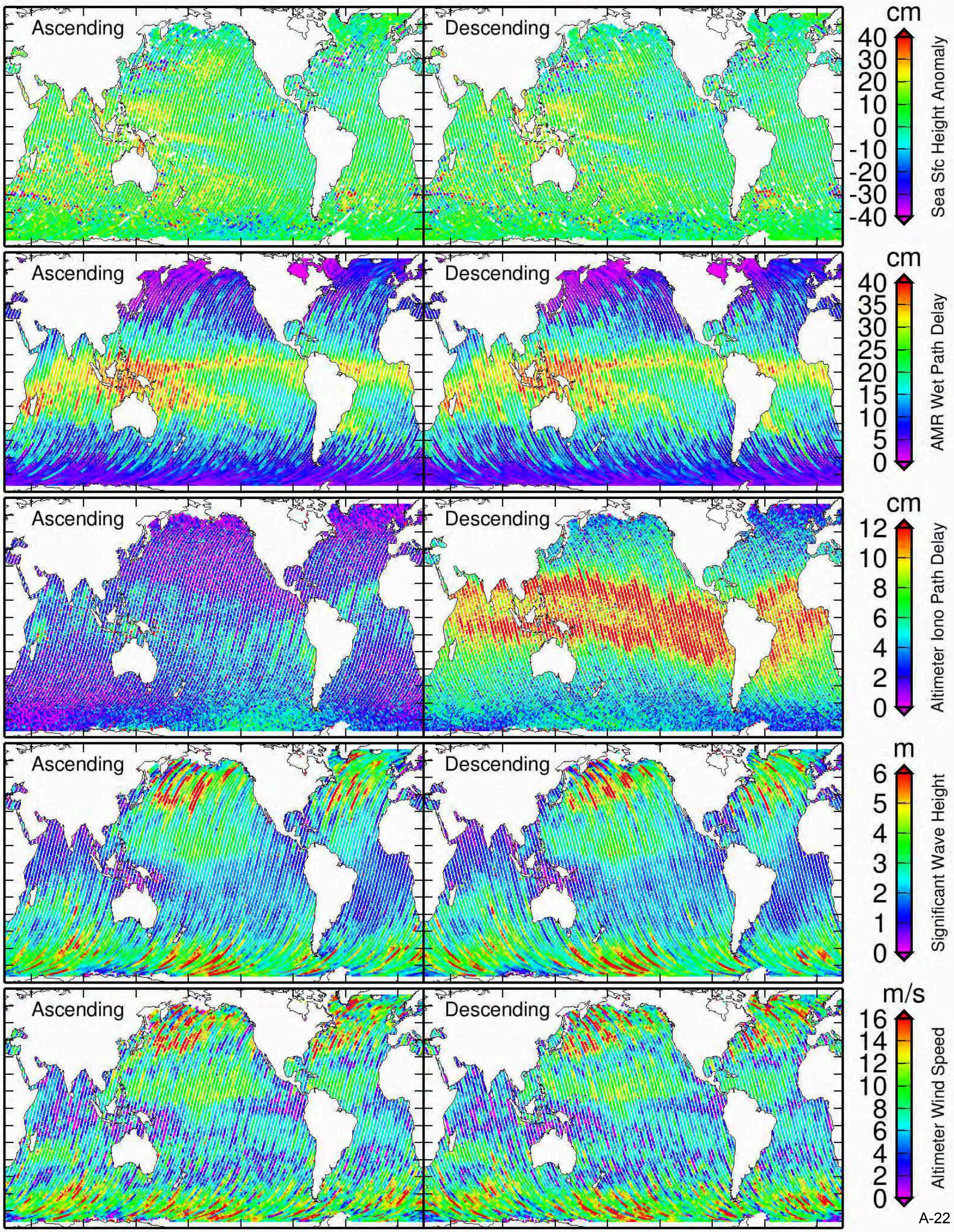
Jason-2 Cycle-168 2013-01-22 23:13:51 - 2013-02-01 21:12:23



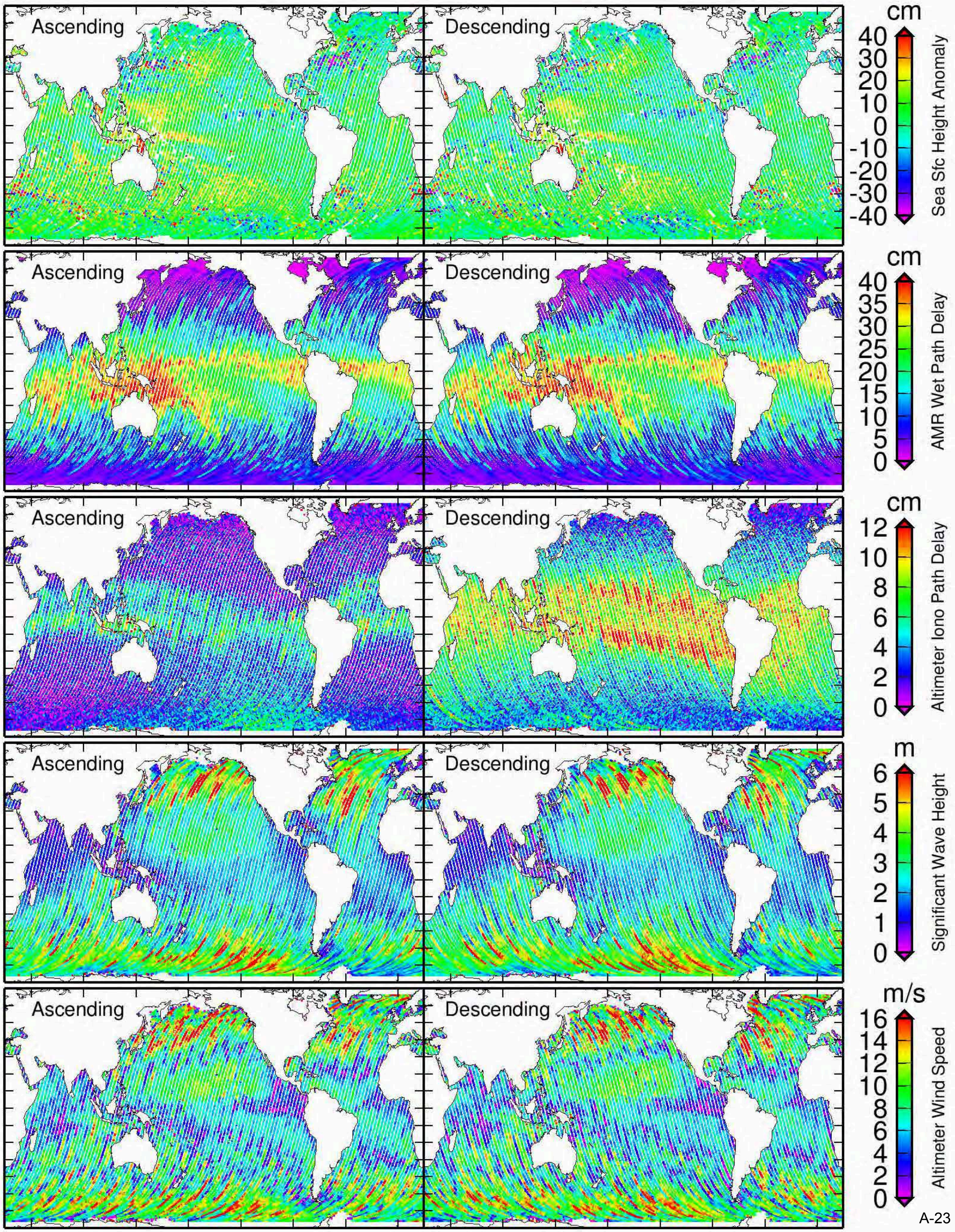
Jason-2 Cycle-169 2013-02-01 21:12:23 - 2013-02-11 19:10:55



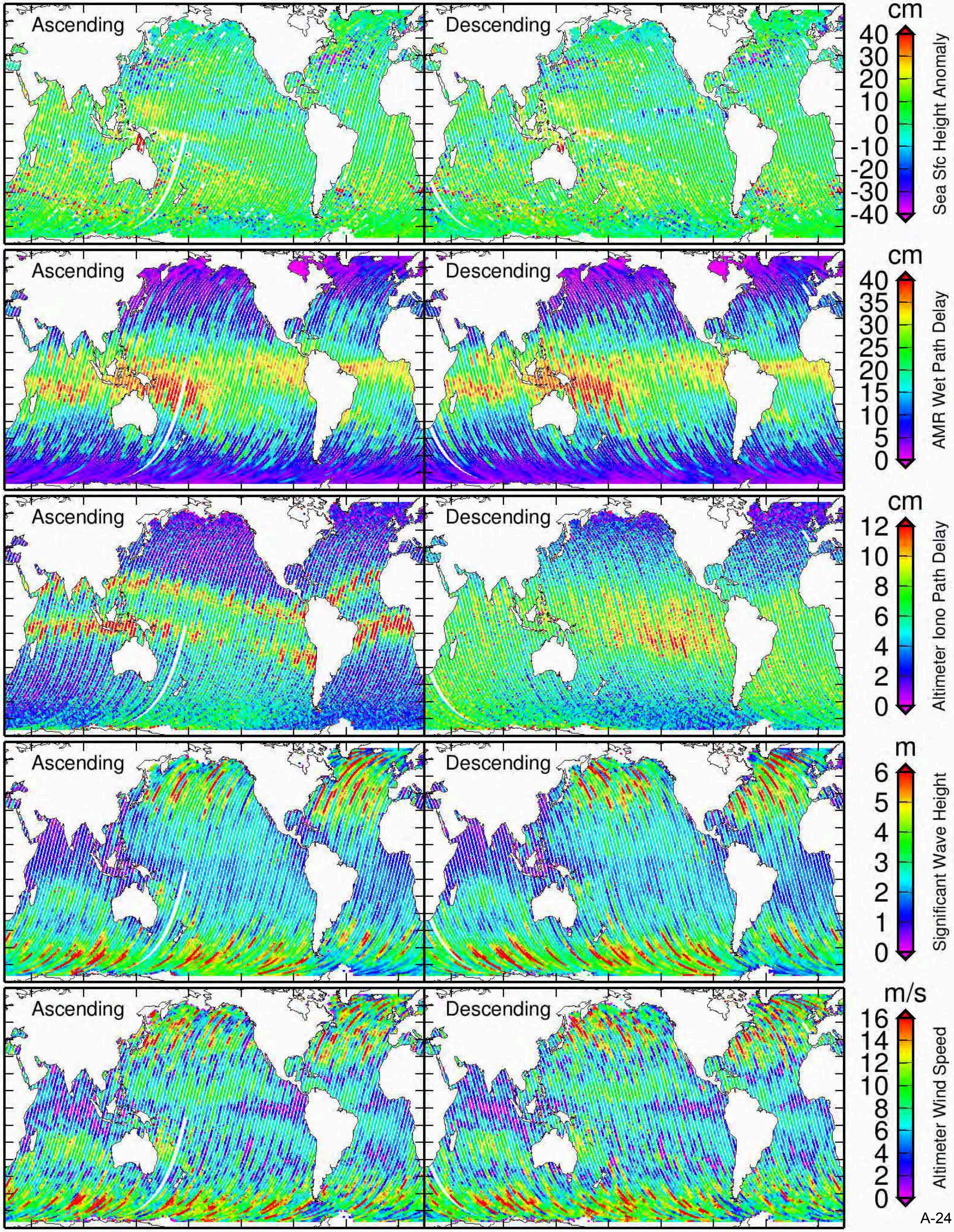
Jason-2 Cycle-170 2013-02-11 19:10:55 - 2013-02-21 17:09:26



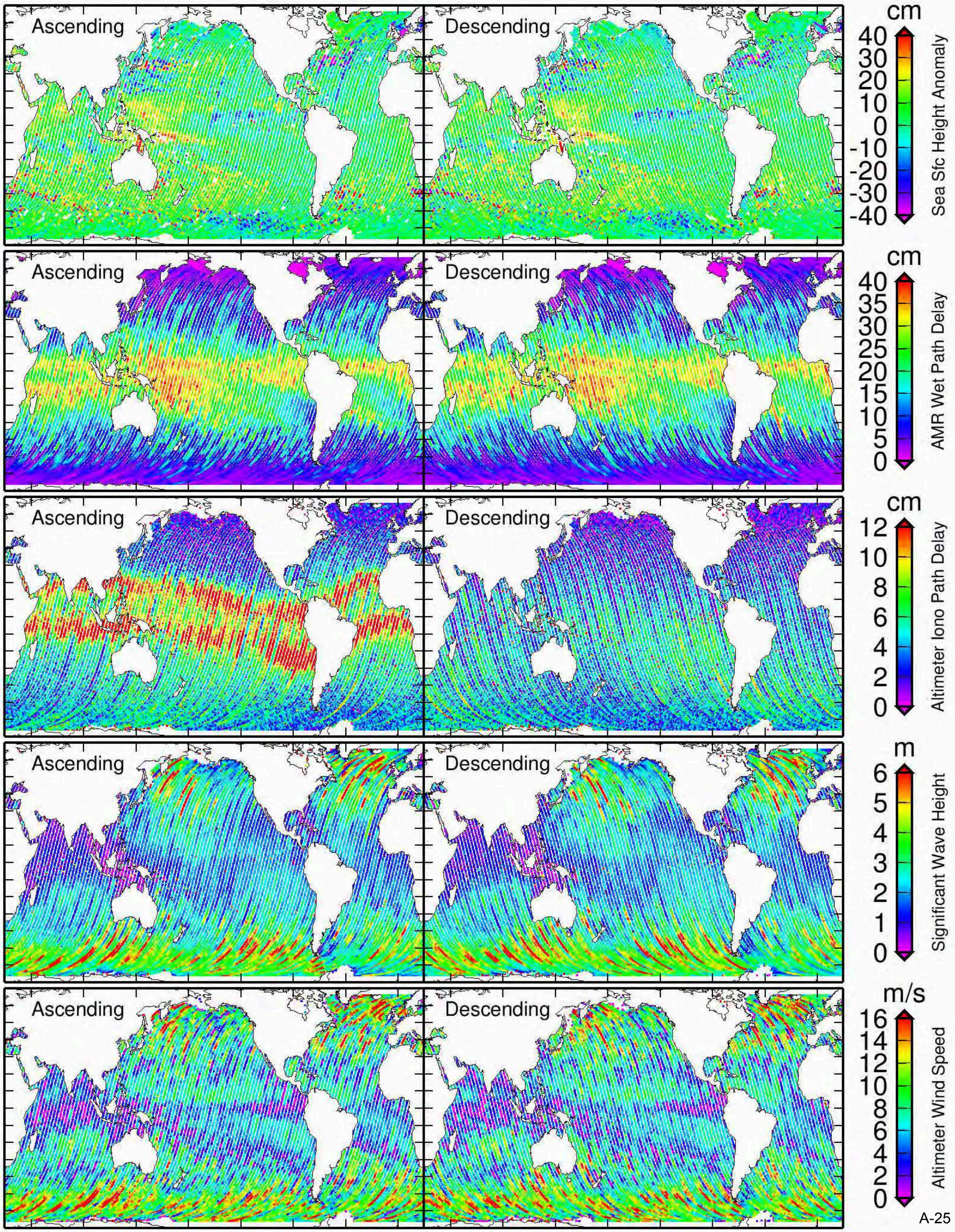
Jason-2 Cycle-171 2013-02-21 17:09:26 - 2013-03-03 15:07:58



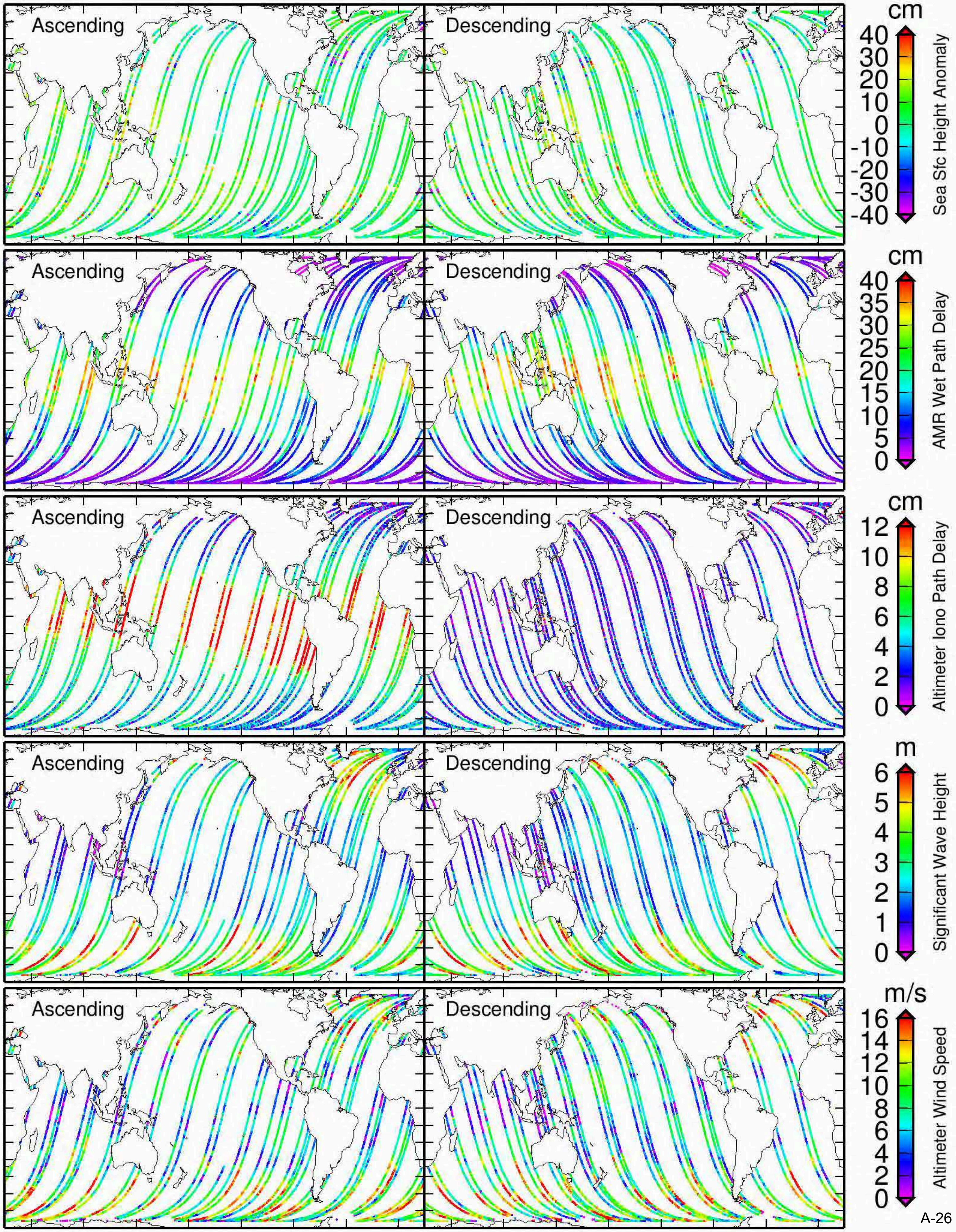
Jason-2 Cycle-172 2013-03-03 15:07:58 - 2013-03-13 13:06:29



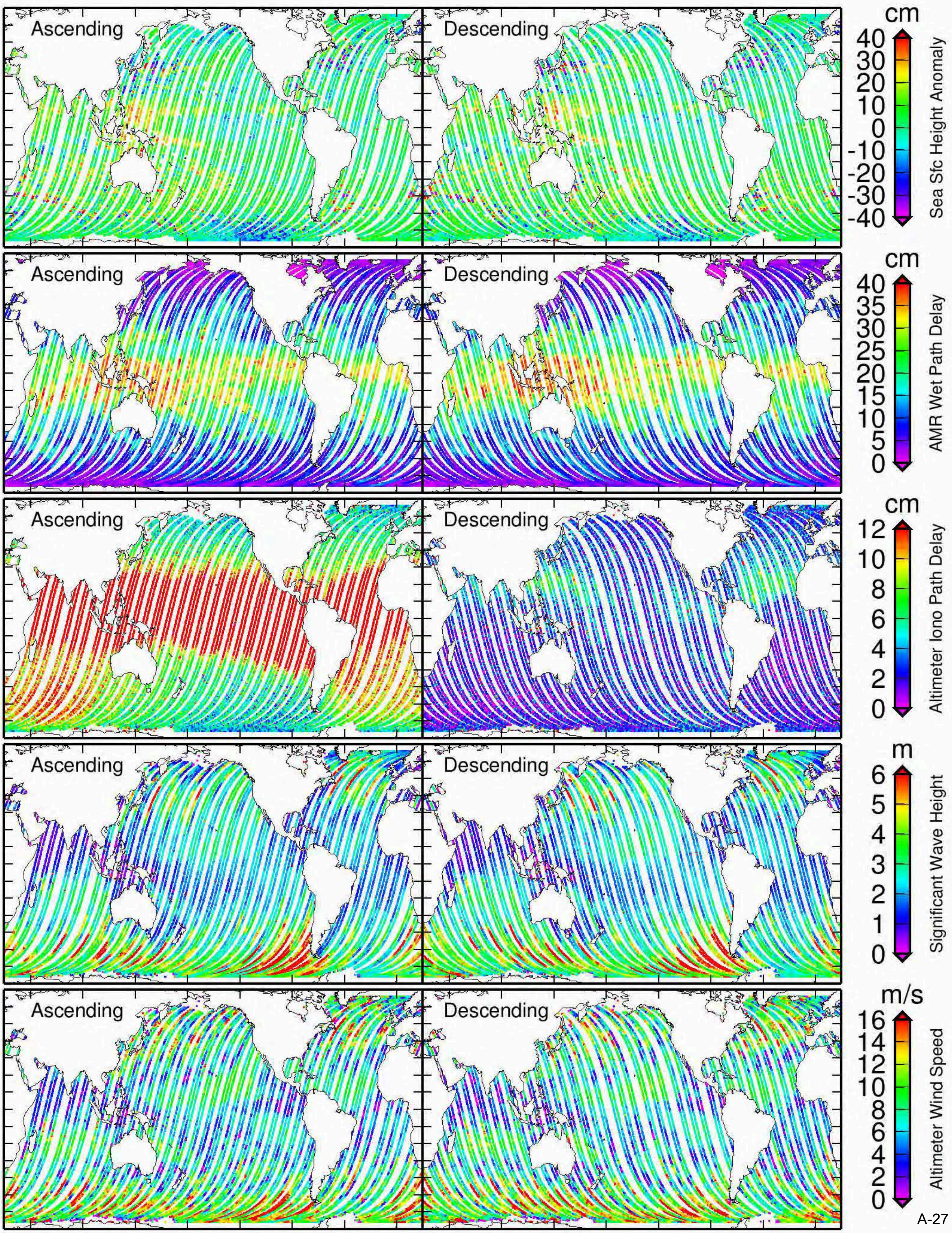
Jason-2 Cycle-173 2013-03-13 13:06:29 - 2013-03-23 11:05:01



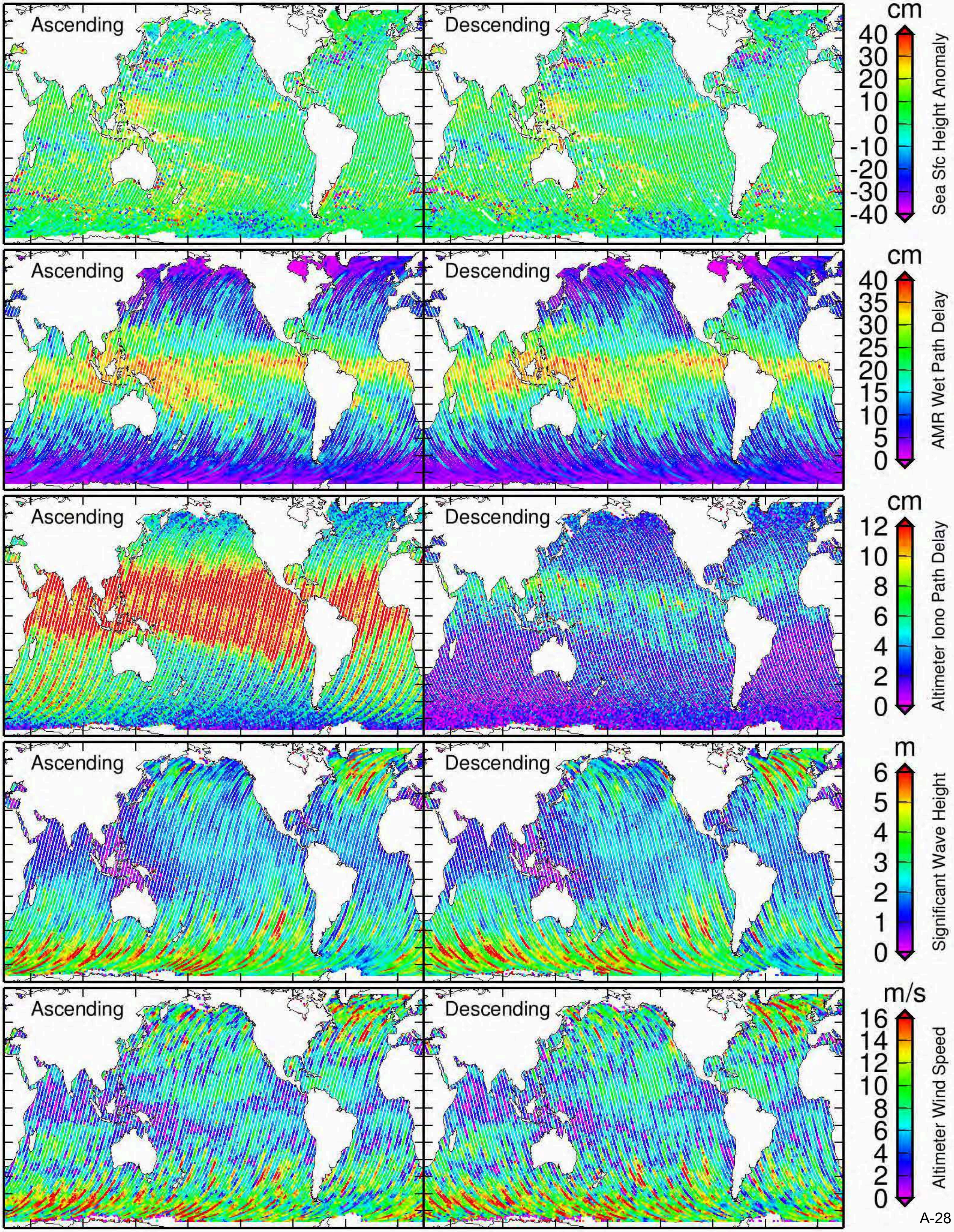
Jason-2 Cycle-174 2013-03-23 11:05:01 - 2013-04-02 09:03:33



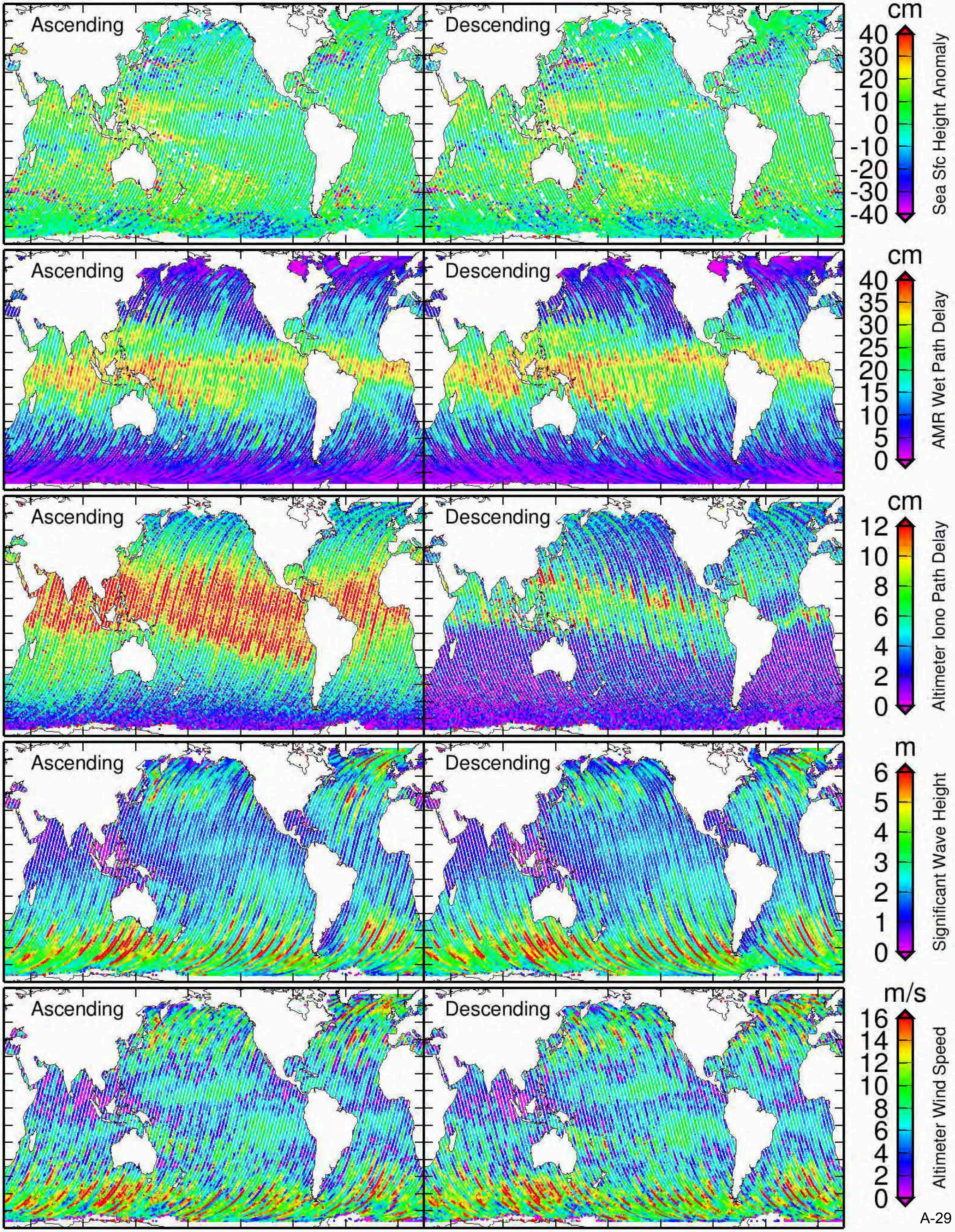
Jason-2 Cycle-175 2013-04-02 09:03:33 - 2013-04-12 07:02:04



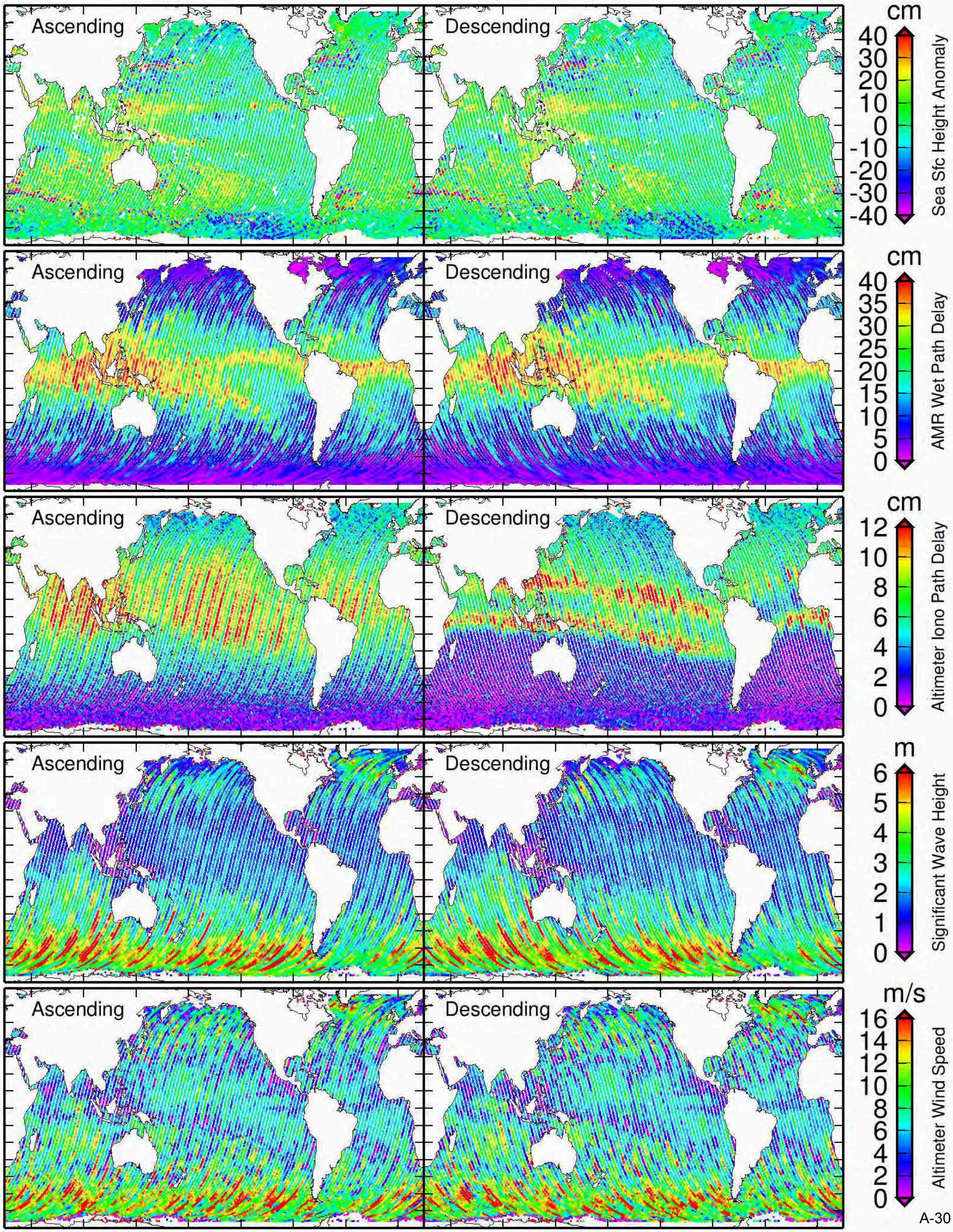
Jason-2 Cycle-176 2013-04-12 07:02:04 - 2013-04-22 05:00:36



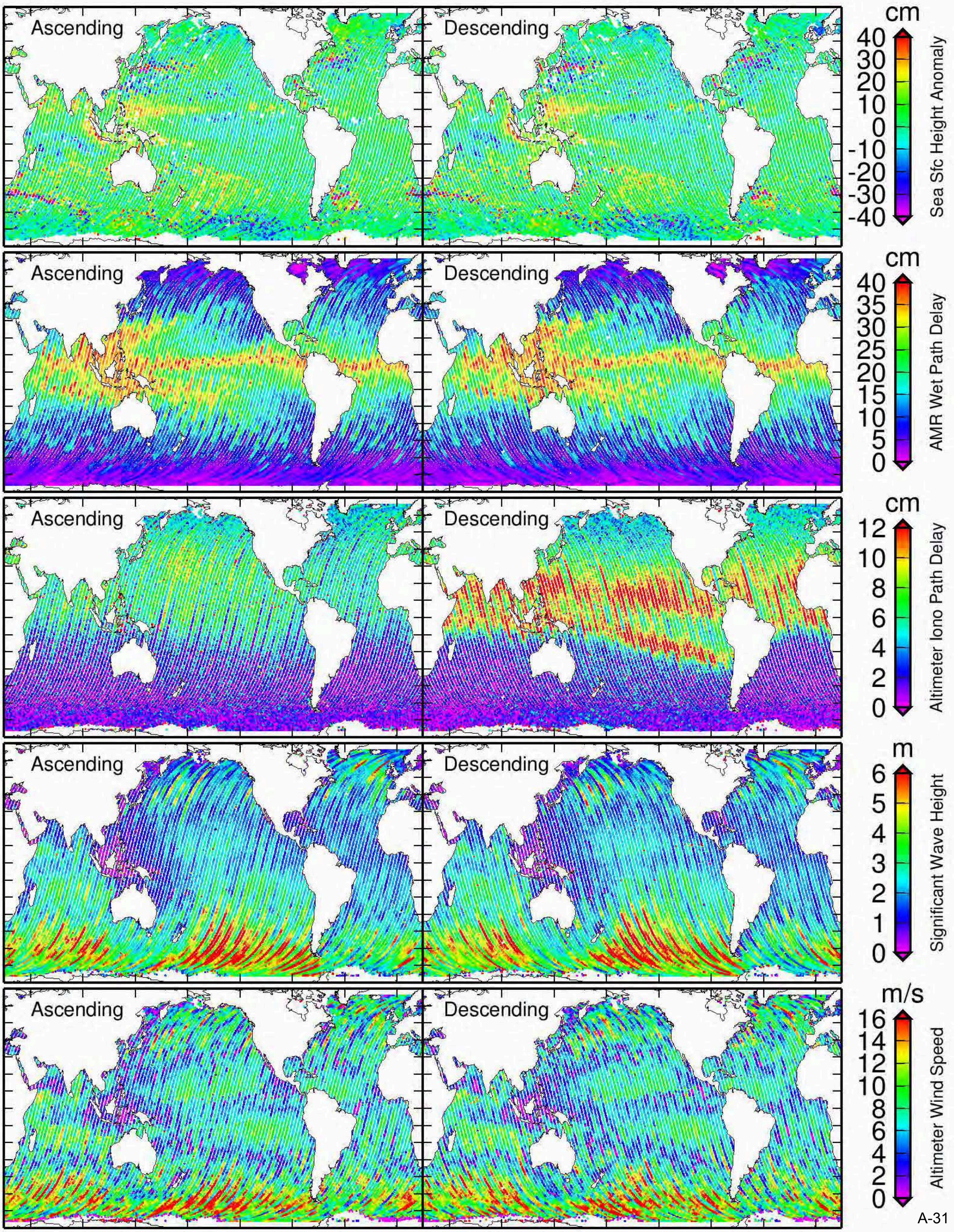
Jason-2 Cycle-177 2013-04-22 05:00:36 - 2013-05-02 02:59:07



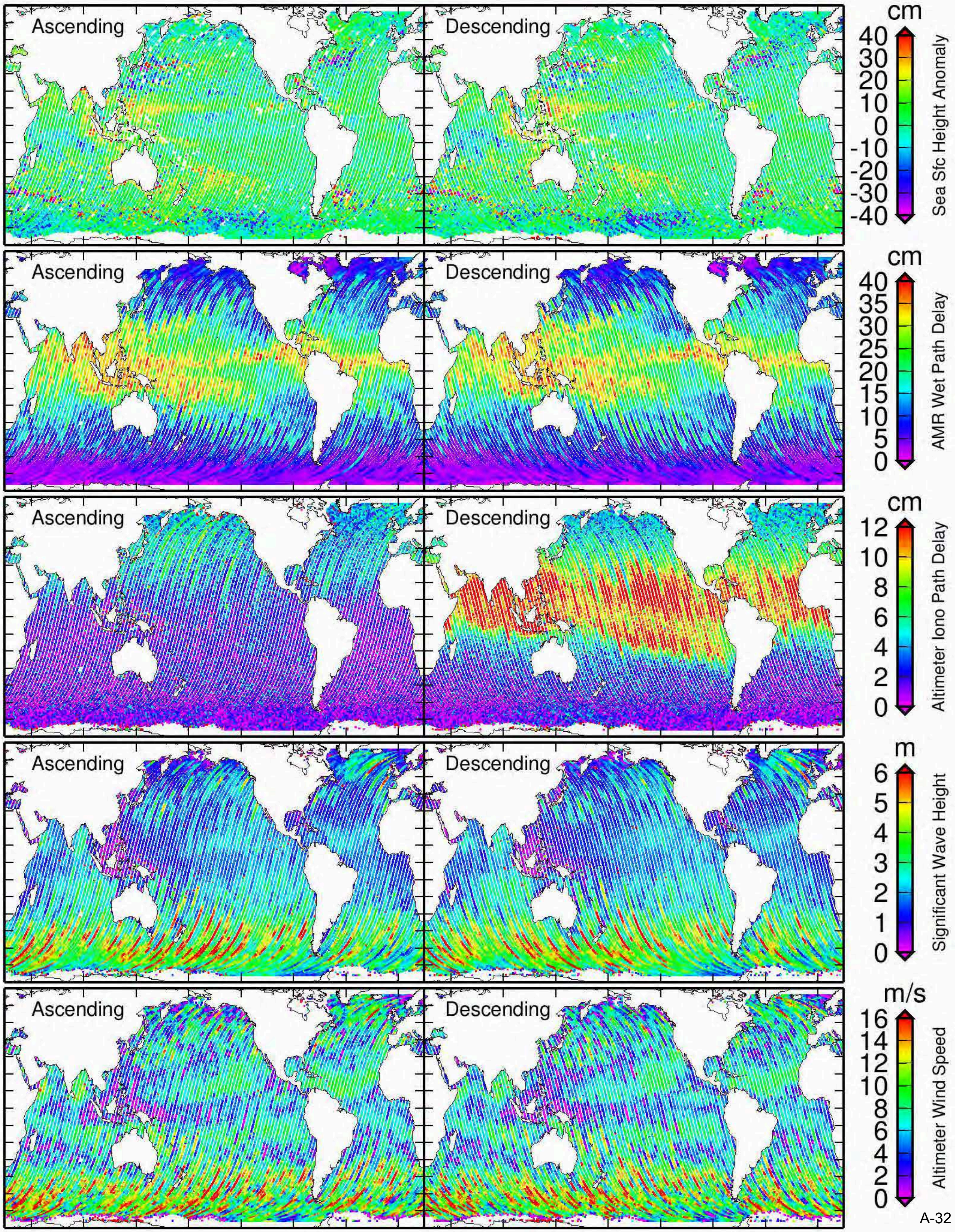
Jason-2 Cycle-178 2013-05-02 02:59:07 - 2013-05-12 00:57:39



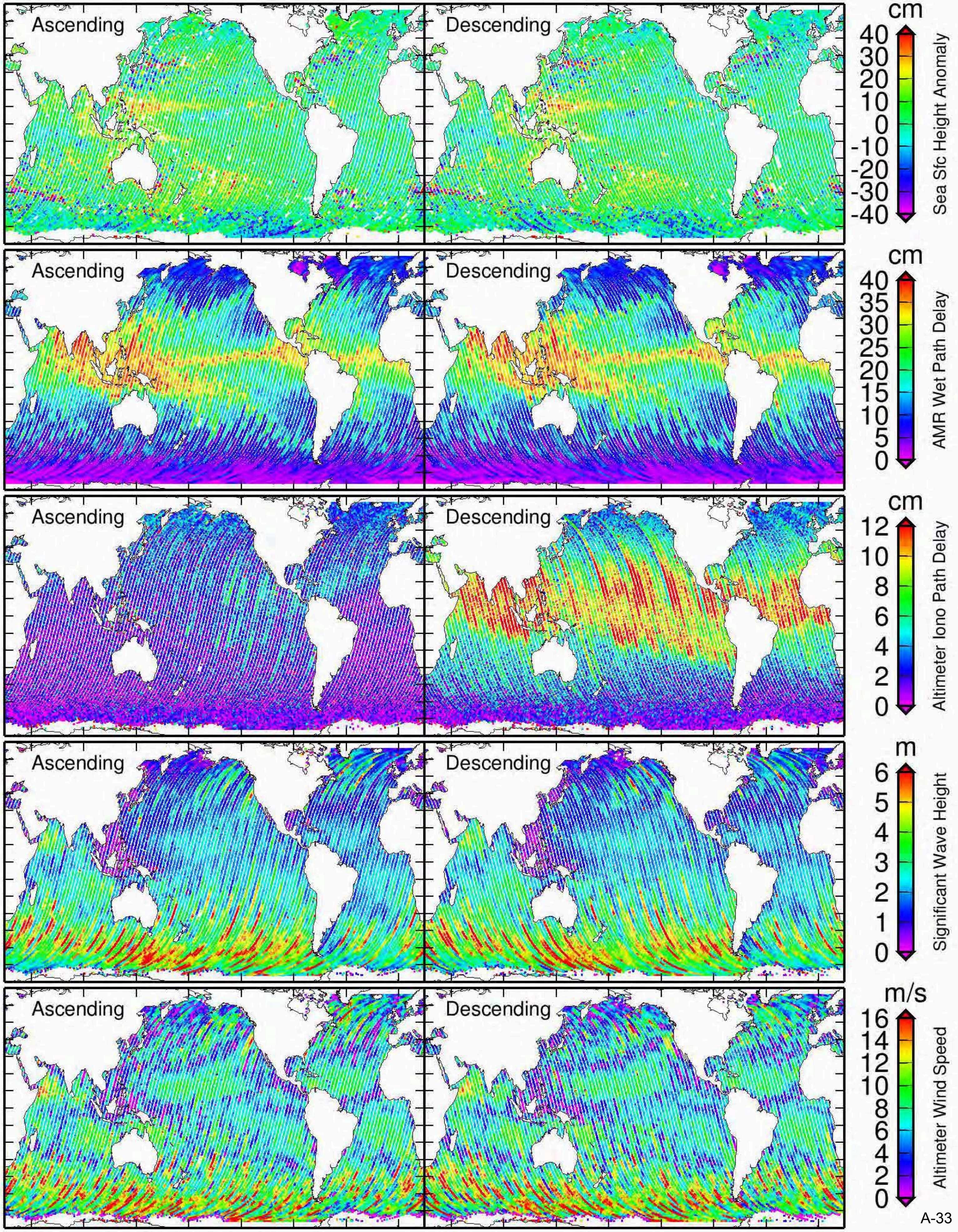
Jason-2 Cycle-179 2013-05-12 00:57:39 - 2013-05-21 22:56:11



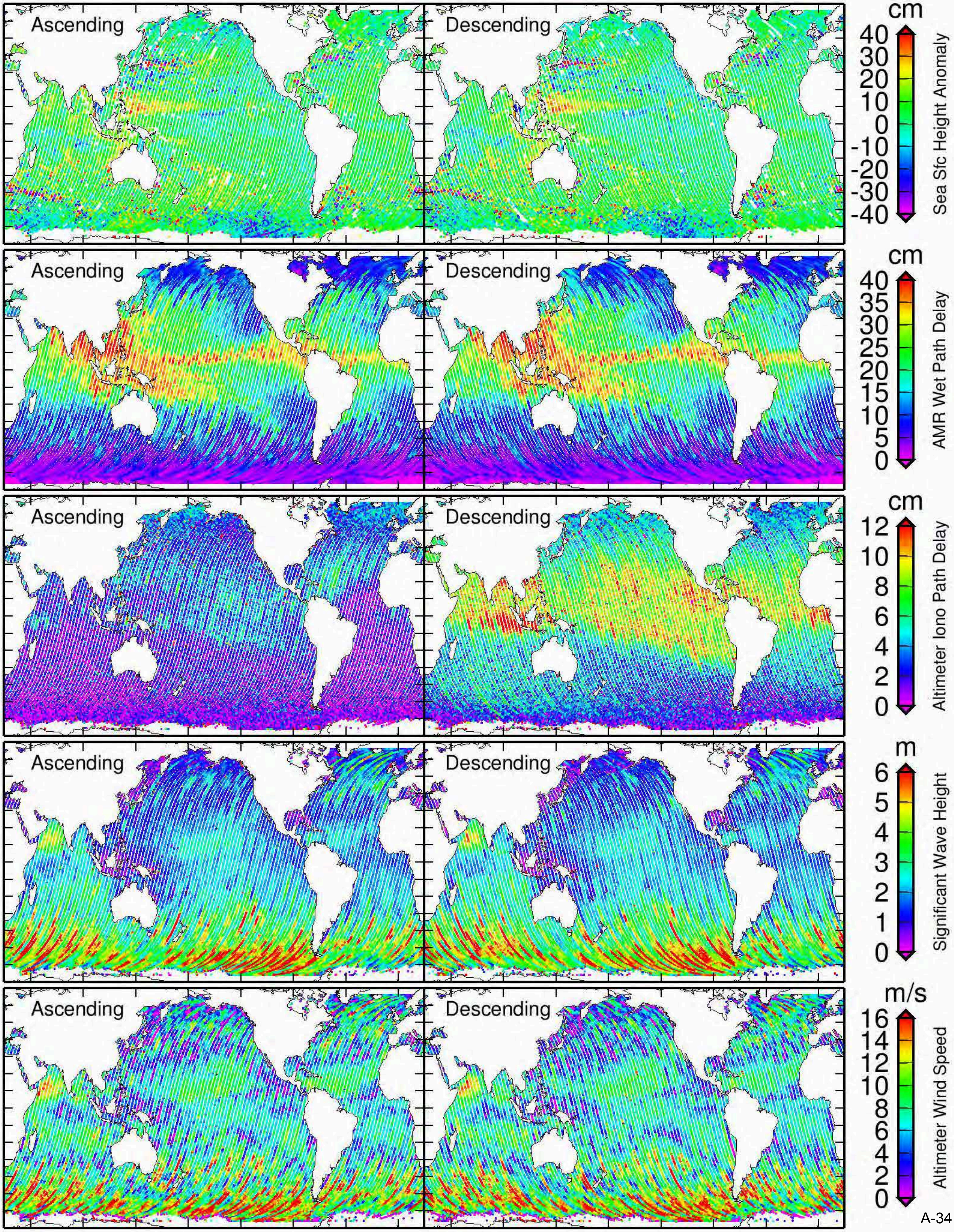
Jason-2 Cycle-180 2013-05-21 22:56:11 - 2013-05-31 20:54:42

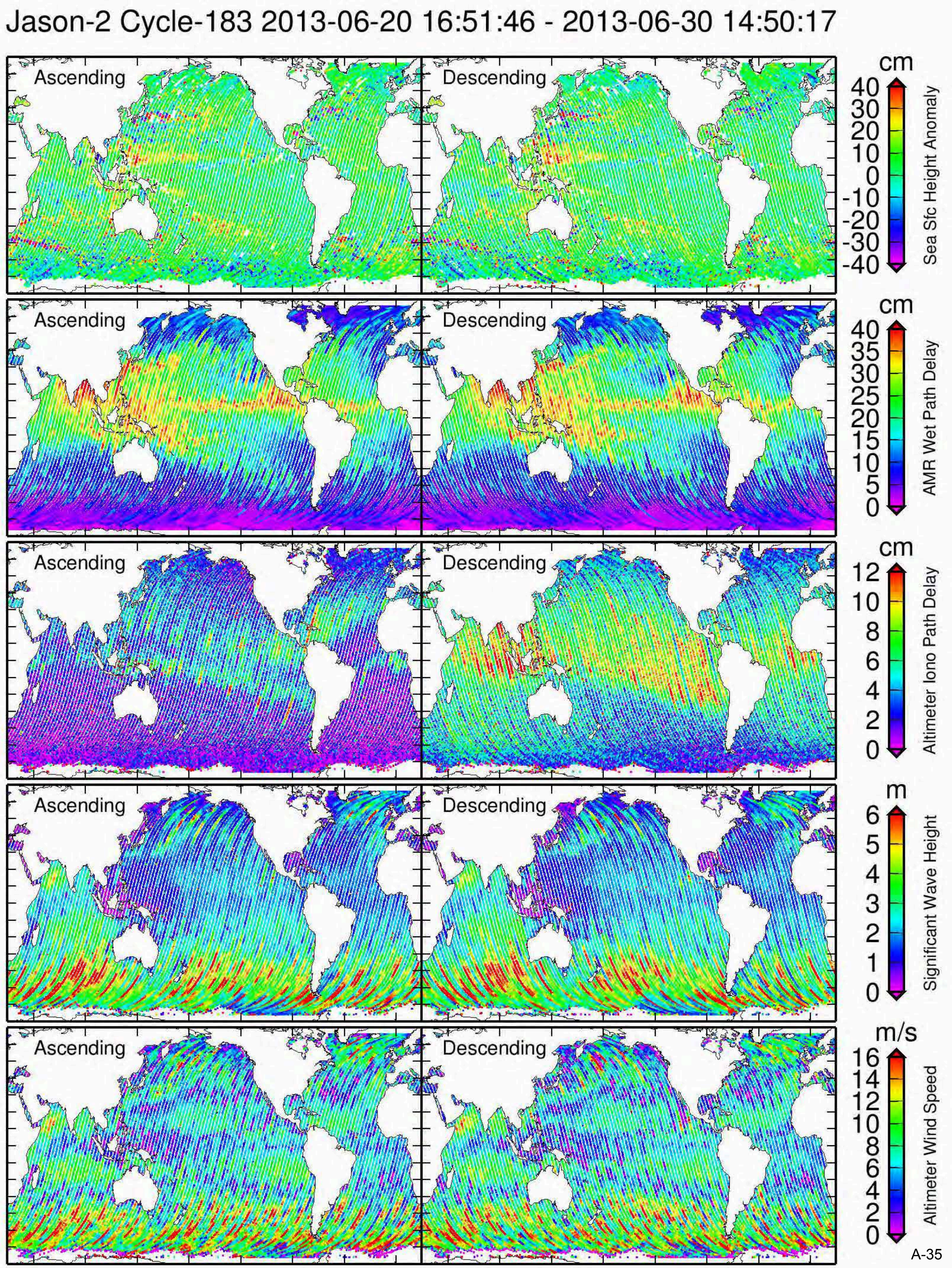


Jason-2 Cycle-181 2013-05-31 20:54:42 - 2013-06-10 18:53:14

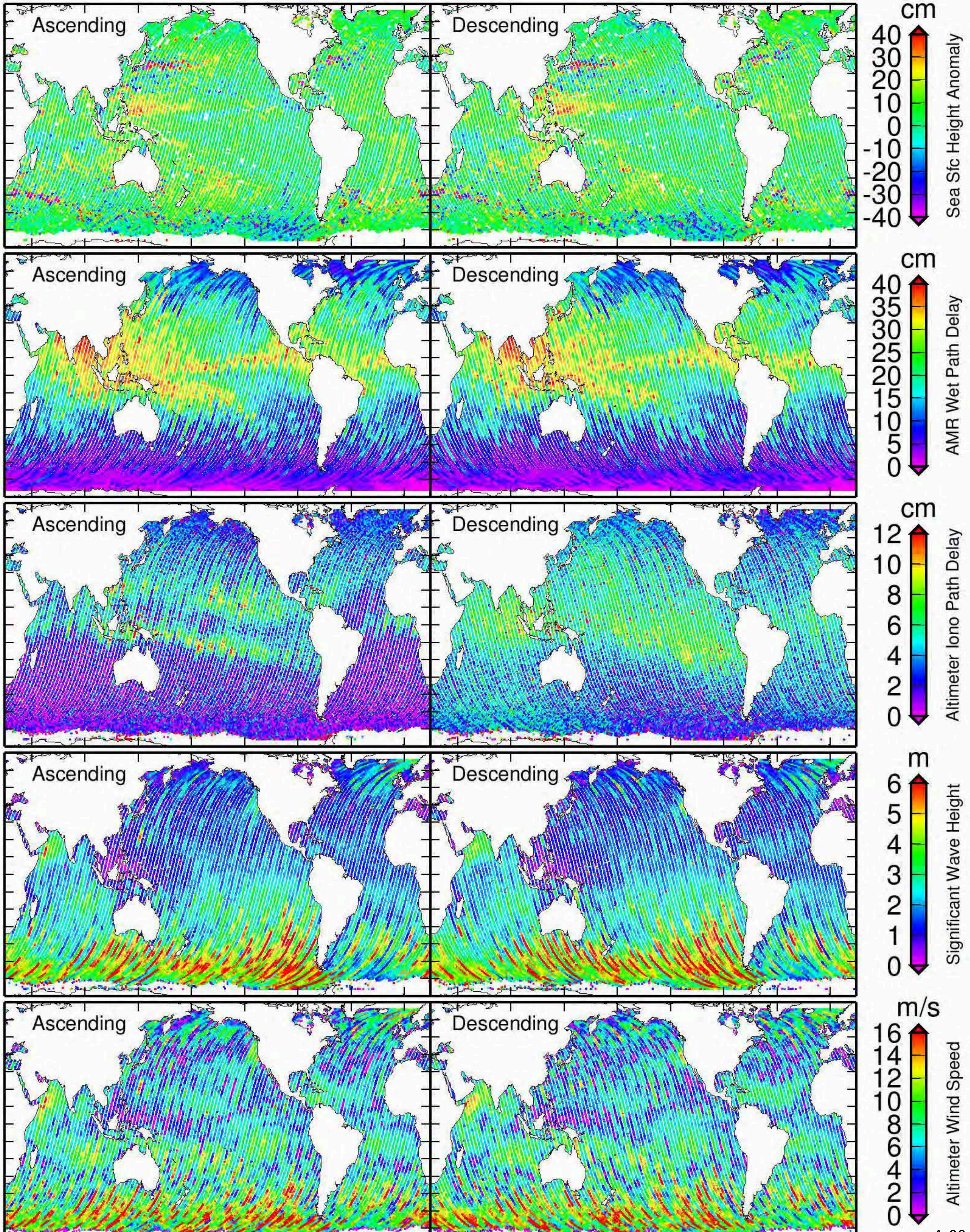


Jason-2 Cycle-182 2013-06-10 18:53:14 - 2013-06-20 16:51:46

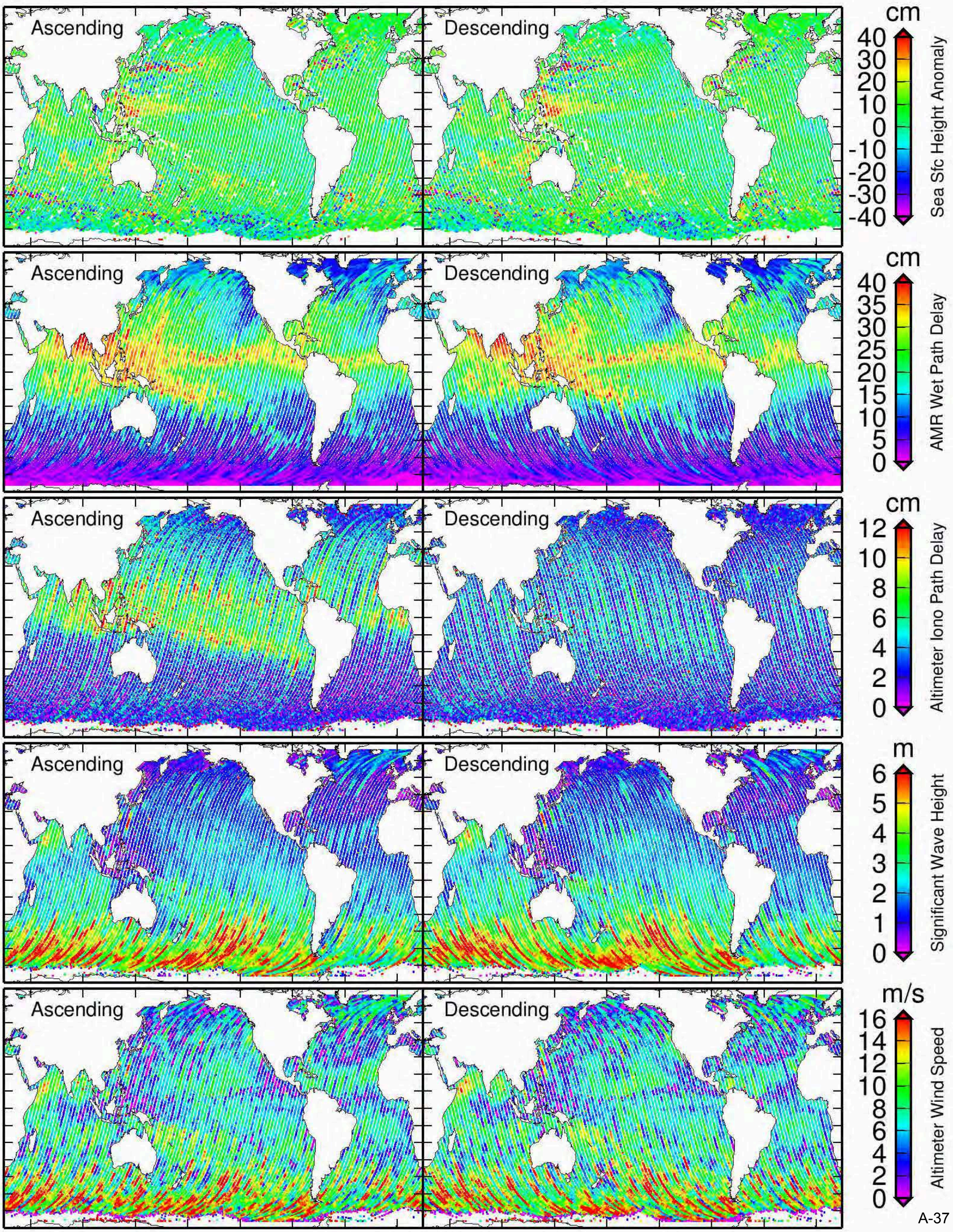



Jason-2 Cycle-183 2013-06-20 16:51:46 - 2013-06-30 14:50:17
Ascending
Descending
cm
40
30
20
10
0
-10
-20
-30
-40
Sea Sfc Height Anomaly
cm
40
35
30
25
20
15
10
5
0
AMR Wet Path Delay
cm
12
10
8
6
4
2
0
Altimeter Iono Path Delay
m
6
5
4
3
2
1
0
Significant Wave Height
m/s
16
14
12
10
8
6
4
2
0
Altimeter Wind Speed

Jason-2 Cycle-184 2013-06-30 14:50:17 - 2013-07-10 12:48:49



Jason-2 Cycle-185 2013-07-10 12:48:49 - 2013-07-20 10:47:20



Appendix B. Acronyms

Acronym	Definition
AMR	Advanced Microwave Radiometer
CLS	Collecte Localisation Satellites
CNES	Centre National d'Etudes Spatiales
CNG	Consigne Numerique de Gain (altimeter gain calibration)
DEM	Digital Elevation Model
DORIS	Doppler Orbitography and Radiopositioning Integrated by Satellite
ECMWF	European Centre for Medium-Range Weather Forecasts
EUMETSAT	European Organisation for the Exploitation of Meteorological Satellites
GPSP	Global Positioning System Payload
J2TCCS	Jason-2 Tele-Command and Control System
JPL	Jet Propulsion Laboratory
NASA	National Aeronautics and Space Administration
NESDIS	National Environmental Satellite Data and Information Service
NOAA	National Oceanic and Atmospheric Administration
NRTAVS	Near Real-Time Altimeter Validation System
OGDR	Operational Geophysical Data Records
OSTM	Ocean Surface Topography Mission
SOCC	Satellite Operations Control Center
SSH(A)	Sea Surface Height (Anomaly)
SWH	Significant Wave Height
TM-NRT	Telemetry analyzer Near Real-Time