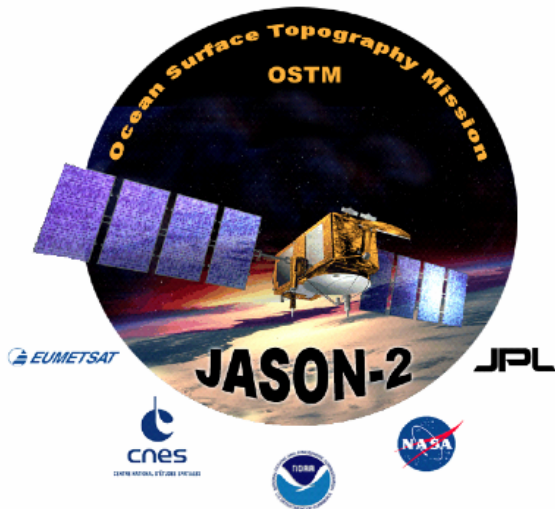




# Data Access for Jason-2 and Jason-3

*Deirdre A. Byrne*  
*Yongsheng Zhang*  
NOAA/NODC





# What is NODC?

- **NODC was founded in 1961 as part of the Naval Oceanographic Office**
- **One of three national environmental data centers operated by NOAA.**
- **NODC holds the world's largest collection of publicly available oceanographic data with approximately 100,000 individually archived data sets.**
- **A relative latecomer to satellite data.**
- **Mission to provide scientific stewardship of marine data and information – extremely broad - broader than the initial scope of the NASA DAACs:** *“As data and information management needs of science researchers have become more sophisticated, we have been able to take advantage of maturing information technologies to develop and implement tools and services that help science researchers extract the information they seek from the data they work with.”*
- **Scope is all oceanographic data and information of scientific interest - not just NOAA data.** (This of course is how we ended up with 100k datasets).
- **Policy is to preserve data for 75 years or as long as scientifically significant – also somewhat different than the original scope of the NASA DAACs and has given rise to the arrangement seen in GHRSSST, where the PO.DAAC serves as the GDAC and NODC serves as the LTSRF.**
- **However, there is no doubt that the mission of NODC and the mission of the PO.DAAC, in particular, overlap in the area of Ocean Surface Topography – not to mention AVISO. Careful and close coordination is required.**



# Altimetry User Communities Defined

**High  
volume,  
Low  
assistance**

- **Jason-2/3 Science Working Teams (SWT):** Level of expertise: Highest. SWT members monitor instrument performance, apply calibrations, specify reprocessing requirements and schedule and so on.
- **Ocean Surface Topography Science Team (OSTST):** Level of expertise: high. OSTST members are data users but also data producers. They help define the data formats, products and protocols that should be routinely supported.

**Medium  
volume,  
medium  
assistance**

- **Scientists without subject expertise in altimetry:** most agency clients (e.g. NOAA's NCCOS, NMS and HPC), and academics such as ecologists, chemical and biological oceanographers. Level of expertise: low to intermediate. These users often have a high-level understanding of what altimetry can provide but lack the technical skill or familiarity to manipulate the data. They tend to be primary drivers for routine, value-added products such as gridded fields and derived products such as currents and heat content.

**Low  
volume,  
high level of  
assistance,**

- **Non-specialists** conducting scientific research or planning: undergraduates, geospatial information system (GIS) users. Level of expertise: low. These users are aware of the existence of satellite altimetry and have some idea of the information it might provide, but often need individual help accessing the data or reformulating it into a product such as a time series or georeferenced image.
- **The general public:** Level of expertise: low to non-existent. These users are often seeking general ocean information and have no prior awareness of satellite altimetry. Sample users: individuals wanting wave height statistics.



# Altimetry User Communities in Practice

Jason-2 annual data download volume (est. from 2011/Q1)
over 6,500 users (based on IP address)
3 million files
over 7 Tb or > 700% of the annual volume of new data

- **Science Working Teams (SWTs) and Ocean Surface Topography Science Team (OSTST):** 3 user queries in past 12 months, primarily when a service outage or product delivery delay occurred.
- **Scientists without subject expertise in altimetry:** Current examples include the Gulf of Mexico Digital Atlas, a combined federal-state partnership to provide information to support the *Gulf Coast Restoration Support Plan*, NCCOS, NMS, and NHC, with whom we are working to define needs.
- **Non-specialists:** E.g., 50% of user requests to the NODC satellite team in past 12 months have been for information/data in GIS-ready format.
- **The general public:** Sample users: individuals wanting wave height statistics. 5 users in the past 12 months requested “radar information” or wave data.



# Data Services @ NODC

## Existing

### **Data Discovery services (all files)**

- Federal Geospatial Digital Content (FGDC)-compliant metadata published via a Web Accessible Folder (WAF) supporting the NOAA Global Earth Observation - Integrated Data Environment (GEO-IDE) and Geospatial One-Stop (GOS).
- ISO 19115-2 metadata published through a WAF
- Catalog Service for the Web (CSW) through the ArcGIS geoportal

### **Data Access services - Level 2 data (science data)**

- ftp
- http
- OPeNDAP server
- Web Coverage Service (WCS)
- THREDDS Data Server (TDS)

### **Data Archive services (all files)**

- Archival storage in the Comprehensive Large Array-data Stewardship System (CLASS) (provision of versioning, offline backup and redundancy)
- Additional data quality monitoring/notification for delayed-mode Level-2 products



# Data Services @ NODC

## To be deployed in 2012

### **Data Discovery services (all files)**

- Search and Retrieval via URL (SRU)

### **Data Access services**

- Web Mapping Service (WMS)
- Live Access Server (LAS) Development
  - ✓ custom front-end
- **ESRI ArcGIS for Server**

### **Data Archive services (all files)**

- “Dashboard” monitoring of O/I/GDR quality statistics
- Really Simple Syndication (RSS) notification of missed file delivery into archive



# NODC Jason-2 home page

NODC Jason-2 Archive

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## NODC Jason-2 Archive



**Latest Data News**

### Introduction

This site contains an overview of the NOAA services being provided by the National Oceanographic Data Center (NODC) for the Jason-2 satellite altimetry mission (note: Jason-2 is also known as the Ocean Surface Topography Mission or OSTM) and for Jason-3, which is scheduled for launch in April, 2014.

### Background

The Jason-2 satellite launched 20 June 2008 and is the latest in a series of ocean altimeter missions designed to observe ocean circulation, sea level rise, and wave heights. Earlier altimeter missions include [Geosat](#) and [Geosat Follow-On](#) satellites, which flew in 1985-1989 and 1998-2000, respectively, and the [TOPEX/Poseidon](#) (1992-2005) and [Jason-1](#) (2001-present) missions, which were launched into the same orbit now occupied by Jason-2. Jason-2 is currently flying in what is known as the "reference" orbit. Jason-1 continues to operate today in a similar "interleaved" orbit, offset by approximately 5 days and 0.7 degrees longitude at the equator from Jason-2.

### Level-2 X-GDR Data Access

- **HTTP:** <http://data.nodc.noaa.gov/jason2/>
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- **OPeNDAP:** <http://data.nodc.noaa.gov/opendap/jason2/>
- **THREDDS:** <http://data.nodc.noaa.gov/thredds/catalog/jason2/catalog.html>
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### Quality Monitoring of the Science Data

For deriving long-term quality measurements on Jason satellite data, we have developed a climate-oriented quality monitoring system. This system uses the [Rich Inventory](#) concept developed at NGDC, providing a searchable database for tracking and discovering data quality, metadata, and data set attributes. A near real time data quality check comprising of 8 statistics calculated on 23 parameters is performed as each Level-2 data file is ingested into NODC's archives.

- **Quality Monitoring:** [Jason-2 GDR and IGDR quality monitoring](#)

### Jason-2 News from the Archives

Subscribe to RSS feed [ [What is RSS?](#) ]

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### Archive

1. [Requirements](#)
2. [Strategy](#)
3. [Submission Agreement](#)
4. [Services](#)

SOG NODC NOAA CLASS AVHRR SST GODAE MPMC GAC RSMAS GHRSSST-PP MCSST NLSST SeaWiFS OAIS  
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# Data access and visualization

**NODC**  
National Oceanographic Data Center



**NODC TDS**

**THREDDS Data**

## Server

## Catalog

[http://data.nodc.noaa.gov/thredds/catalog/jason2/gdr/gdr\\_ssh/cycle114/catalog.html](http://data.nodc.noaa.gov/thredds/catalog/jason2/gdr/gdr_ssh/cycle114/catalog.html)

**Dataset:** cycle114/JA2\_GPR\_2PTP114\_254\_20110816\_093547\_20110816\_103200

- *ID:* jason2/gdr/gdr\_ssh/cycle114/JA2\_GPR\_2PTP114\_254\_20110816\_093547\_20110816\_103200

## Access:

1. **OPENDAP:** /thredds/dodsC/jason2/gdr/gdr\_ssh/cycle114/JA2\_GPR\_2PTP114\_254\_20110816\_093547\_20110816\_103200
2. **HTTPServer:** /thredds/fileServer/jason2/gdr/gdr\_ssh/cycle114/JA2\_GPR\_2PTP114\_254\_20110816\_093547\_20110816\_103200
3. **WCS:** /thredds/wcs/jason2/gdr/gdr\_ssh/cycle114/JA2\_GPR\_2PTP114\_254\_20110816\_093547\_20110816\_103200
4. **WMS:** /thredds/wms/jason2/gdr/gdr\_ssh/cycle114/JA2\_GPR\_2PTP114\_254\_20110816\_093547\_20110816\_103200
5. **NCML:** /thredds/ncml/jason2/gdr/gdr\_ssh/cycle114/JA2\_GPR\_2PTP114\_254\_20110816\_093547\_20110816\_103200
6. **UDDC:** /thredds/uddc/jason2/gdr/gdr\_ssh/cycle114/JA2\_GPR\_2PTP114\_254\_20110816\_093547\_20110816\_103200
7. **ISO:** /thredds/iso/jason2/gdr/gdr\_ssh/cycle114/JA2\_GPR\_2PTP114\_254\_20110816\_093547\_20110816\_103200

## Dates:

- 2011-10-11 01:22:31Z (modified)

## Viewers:

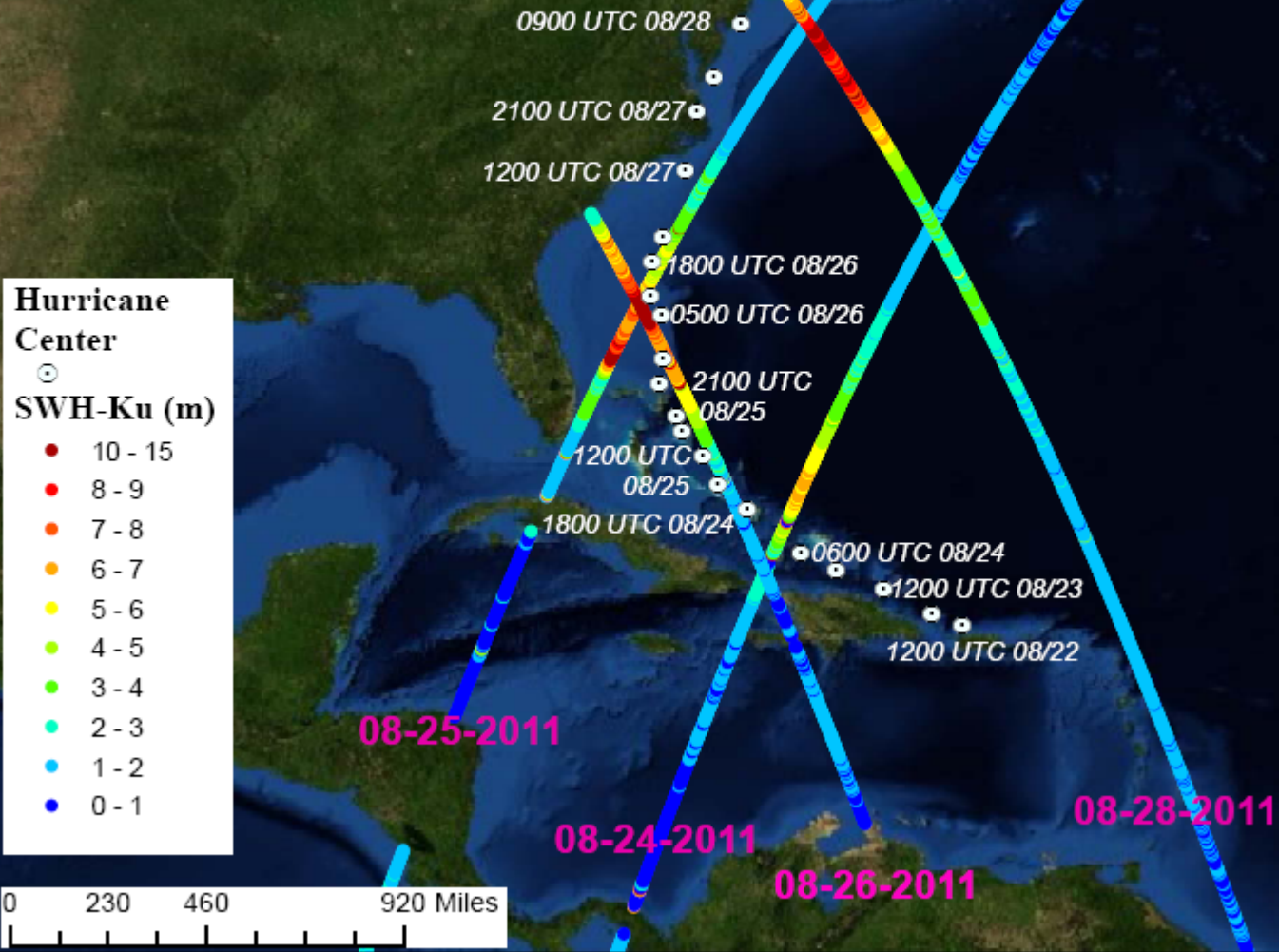
- [NetCDF-Java ToolsUI \(webstart\)](#)
- [Godiva2 \(browser-based\)](#)





# NODC Jason-2 data visualization services

## Jason-2 Hurricane Irene Real Time Observation Significant Wave Height



Octol



# Data access and visualization



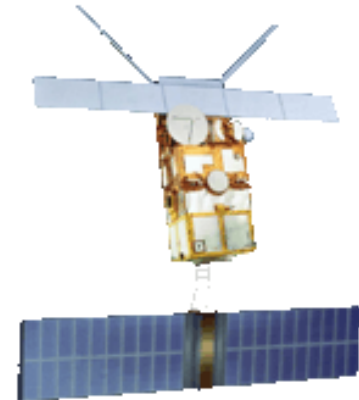
## Radar Altimeter Data Acquisition from RADARS



### Data selection

#### Output data:

- Time
- Latitude
- Longitude
  
- sea level anomaly
- significant wave height
- backscatter coefficient
- wind speed





# NODC Jason-2 home page

NODC Jason-2 Archive

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# Quality monitoring of O/I/GDRs

- Sea surface height anomaly
- Ku-band significant wave height
- Altimeter wind speed
- Difference between altimeter and radiometer wind speeds
- Radiometer wet tropospheric correction
- Difference between the radiometer and model wet tropospheric corrections

## **COMPUTED, PUBLISHED and MONITORED through:**

1. LAS server visualization of the QA statistics at NODC and public access to the NetCDF-format statistical values - robust and simple. NODC Jason-3 Real-time QA assurance homepage.
2. NODC Jason-3 RSS Feed of operational status and automated notification service if any predefined conditions met (e.g., to Project Scientist and/or Systems or Archive and Access Engineers)



# Quality monitoring of O/I/GDRs

Jason-2 GDR/IGDR Data

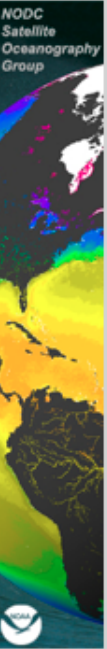
http://www.nodc.noaa.gov/SatelliteData/Jason2/qa.html

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## Jason-2 Geophysical Data Record (GDR) and Interim GDR Data Quality Monitoring

The data quality monitoring (DQM) system developed by the satellite oceanography team at NODC is based on the concept of a Rich Inventory developed by the Enterprise Data Systems Group at the National Geophysical Data Center (NGDC). The principle concept of a Rich Inventory is to calculate statistics for selected parameters as files are received and ingested into the archive, store them in a database, and make them available to users and managers of the archive. A "granule" is the smallest data unit over which statistics are calculated - in this case, one pass (half-orbit) of the Jason-2 satellite. Thus, the DQM produces 254 statistical estimates per cycle, one for each pass.

Below are some representative statistics calculated from the selected parameters in a granule as it is ingested into NODC's archive. Parameters we monitor include sea surface height anomaly, Ku-band significant wave height, altimeter wind speed, the difference between altimeter and radiometer wind speeds, the radiometer water vapor content, and the difference between the radiometer and model wet tropospheric corrections.

- [Take me to the Data Quality Monitoring Interface](#)

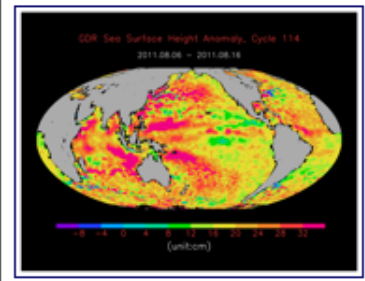
GDR Granule Statistics	IGDR Granule Statistics
<p>GDR Sea Surface Height Anomaly Total observational number</p>	<p>IGDR Sea Surface Height Anomaly Total observational number</p>
<p>Total observational number over 3-Sigma edited</p>	<p>Total observational number over 3-Sigma edited</p>
<p>Mean (um/m)</p>	<p>Mean (um/m)</p>
<p>Total number filled by default value</p>	<p>Total number filled by default value</p>
<p>Total number of extreme values (&gt;1.5m or &lt;-1.5m)</p>	<p>Total number of extreme values (&gt;1.5m or &lt;-1.5m)</p>

(click for a larger view)

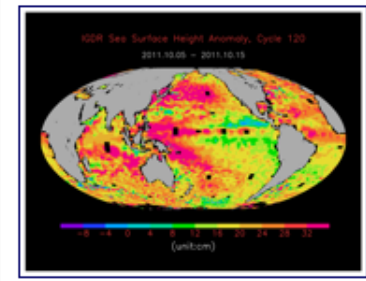
### Statistics for other parameters:

- Significant wave height (Ku Band): [GDR](#); [IGDR](#)
- Altimeter wind speed: [GDR](#); [IGDR](#)
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### Latest GDR Sea Surface Height Anomaly (gridded to 3.0x1.0 longitude/latitude)



### Latest IGDR Sea Surface Height Anomaly (3.0x1.0 longitude/latitude)



### Observations for other parameters:

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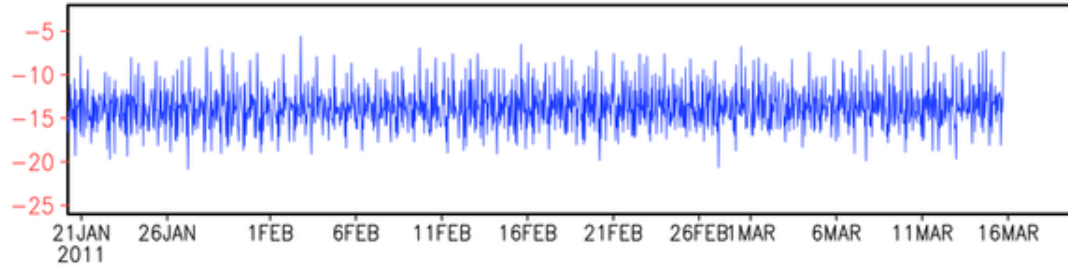
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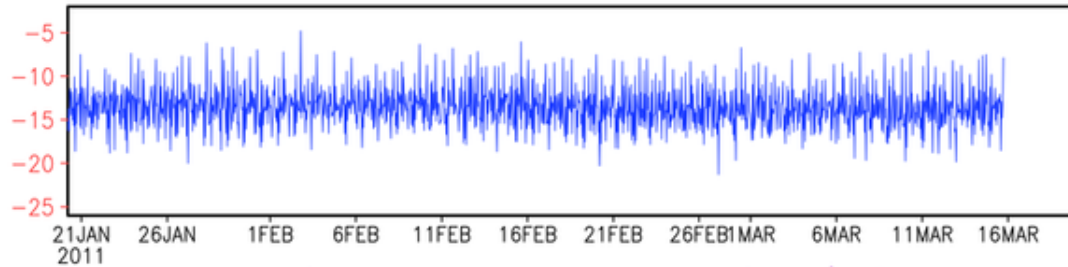


statistics in each IGDR granule (pass): Mean

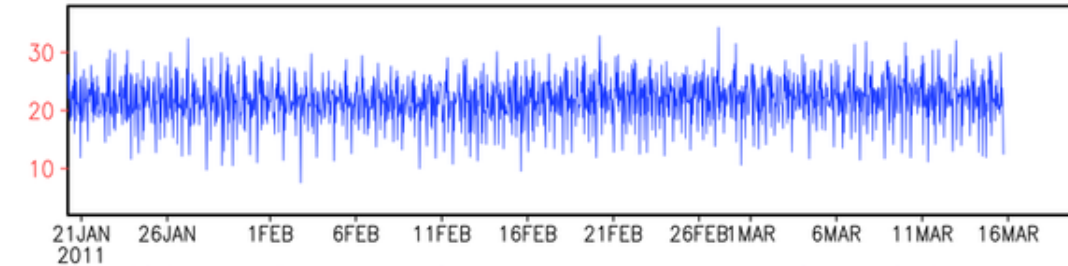
model wet tropospheric correction, unit: 0.01m



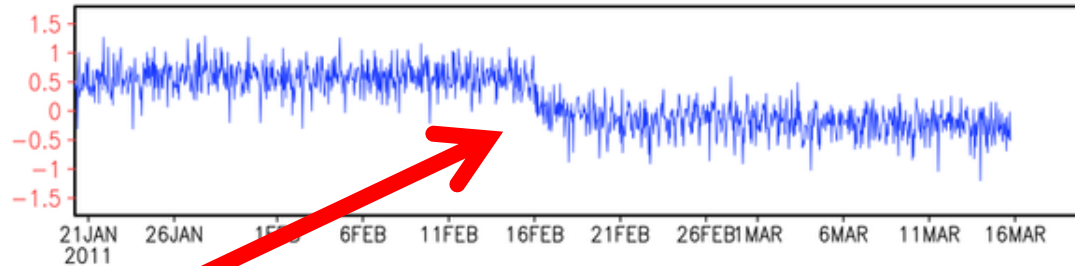
radiometer wet tropospheric correction, unit: 0.01m



radiometer water vapor content, unit: kg/m^2



Difference Between radiometer and model correction, unit 0.01m





# Quality monitoring of O/I/GDRs

Jason-2 GDR/IGDR Data

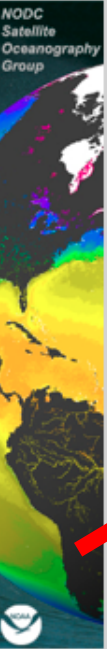
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- [Take me to the Data Quality Monitoring Interface](#)

### GDR Granule Statistics

(click for a larger view)

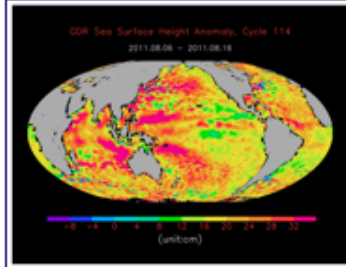
### IGDR Granule Statistics

(click for a larger view)

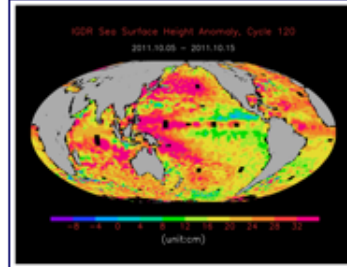
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### Latest IGDR Sea Surface Height Anomaly (3.0x1.0 longitude/latitude)



### Observations for other parameters:

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# Jason-2 Quality Monitoring - LAS

NODC LAS 7.2 BETA 2

http://data.nodc.noaa.gov/las/getUI.do

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Live Access Server About LAS

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OPeNDAP (F-TDS) / THREDDS

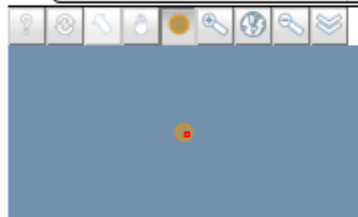
## NODC LAS 7.2 BETA 2

Choose dataset Update Plot Set plot options Animate Compare Google Earth Show Values Export to Desktop Application Save As ... Link To ...

Print

Jason-2 Granule Statistics / Jason-2 Granule Statistics: Geophysical Data Records (GDRs) / difference between radiometer and model wet tropospheric correction

+ mean



0 S  
0 E 0 E  
0 S

### LINE PLOTS

Time Series

Date Range:

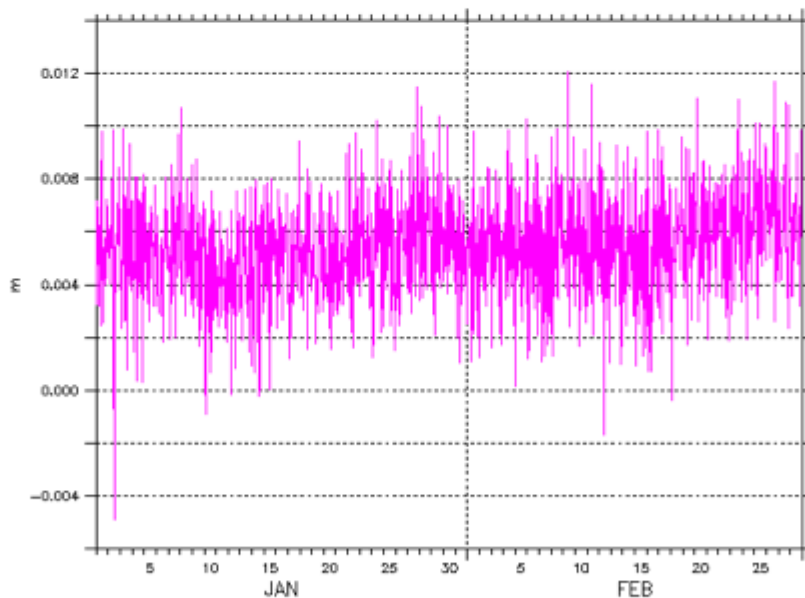
Jan 01 2011 00:00  
Feb 28 2011 23:00

Apply analysis

NOAA/NODC LAS 7.2/Ferret 6.85

YEAR : 2011

DATA SET: Jason-2 Geophysical Data Records (GDRs)  
- Statistics per pass- difference between radiometer and model wet tropospheric correction



mean (m)





# Dashboard monitoring (planned)

Take me to the [GDR](#) →

## Jason-3 IGDR - SLA

	Cycle	278	277	276	275	274
Pass	1	○	●	●	●	●
	2	○	●	●	●	●
	...	●	●	●	●	○
	254	●	●	●	●	●

QA Key:





# Dashboard monitoring (planned)

Jason-3 IGDR – SLA Cycle 278

Take me to the [GDR](#) →

Pass	SLA	SWH-Ku	$U_{alt}$	$U_{alt}-U_{rad}$	RWT	RWT-MWT
1	●	●	●	●	●	●
2	●	●	●	●	●	●
...	●	●	●	●	●	●
254	●	●	●	●	●	●

QA Key:

- Excellent
- Good
- Fair
- Poor



# Jason-2 Quality Monitoring - LAS

NODC LAS 7.2 BETA 2

http://data.nodc.noaa.gov/las/getUI.do

NOAA Google Netflix Google Maps shopping Wikipedia Gapminder TV Listings Apple Weather

Live Access Server About LAS

Help  
OPeNDAP (F-TDS) / THREDDS

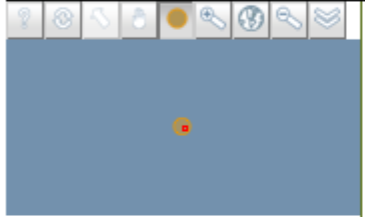
## NODC LAS 7.2 BETA 2

Choose dataset Update Plot Set plot options Animate Compare Google Earth Show Values Export to Desktop Application Save As ... Link To ...

Print

Jason-2 Granule Statistics / Jason-2 Granule Statistics: Geophysical Data Records (GDRs) / difference between radiometer and model wet tropospheric correction

+ mean



0 S  
0 E 0 E  
0 S

### LINE PLOTS

Time Series

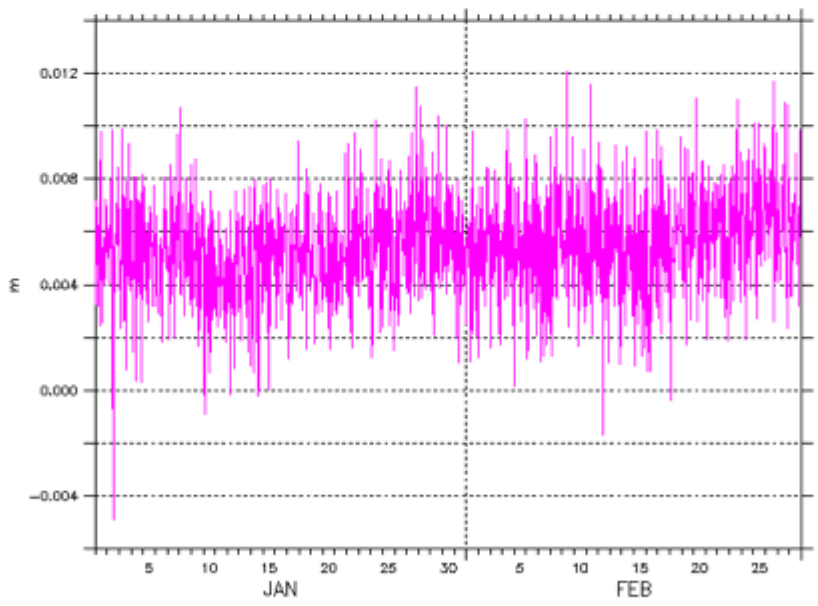
Date Range:

Jan 01 2011 00:00  
Feb 28 2011 23:00

Apply analysis

NOAA/NODC LAS 7.2/Ferret 6.85

YEAR : 2011  
- Statistics per pass- difference between radiometer and model wet tropospheric correction



mean (m)



# Dashboard monitoring (planned)

Jason-3 IGDR – SLA Cycle 278

Take me to the [GDR](#) →

Pass	SLA	SWH-Ku	$U_{alt}$	$U_{alt}-U_{rad}$	RWT	RWT-MWT
1	●	●	●	●	●	●
2	●	●	●	●	●	●
...	●	●	●	●	●	●
254	●	●	●	●	●	●

QA Key:

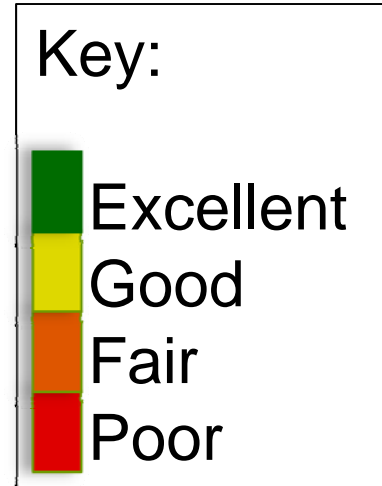
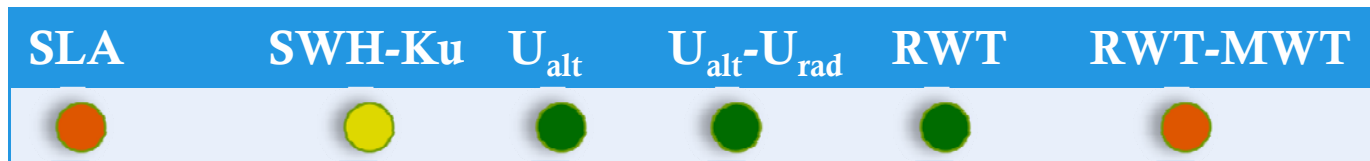




# Dashboard monitoring (planned)

[Back to grid](#) →

## Jason-3 IGDR – Cycle 278 Pass 2





# Data Access for Jason-2 and Jason-3

*Thank you for your time  
and attention!*



Spare slides follow



# NODC Service Provision Model

ESPC (frames, packets, telemetry, Level-2 data)

DDS

NODC  
(ingest via CLASS)

Immediate data processing: dumping and QA statistics calculation  
(Fortran, Perl, c-shell scripts, xml, html ..)

(a new mission datatype)

These steps plus computation of checksums = validation

Generate simple data monitoring and QA graphics

Automated Granule QA monitoring and notification.

Update anomaly table and populate with low-level QA information

NOAA Jason-2/3 homepage with daily updates.

NODC access and visualization services using LAS, GrADS, OpenDAP, Geoportal Extension, etc.

NGDC RI database and interface for QA statistics





# NJGS Data Quality Monitoring System: NODC QMS and Rich Inventory

**Jason-2/3 Rich Inventory (JRI)** is a granule metadata management and quality monitoring tool, developed as a NODC/NGDC collaboration. JRI provides:

A database management mechanism for tracking data quality, metadata, and data set attributes. Smallest segment of data monitored = “granule”.

Tracks eight QA statistics and attributes for over 20 Jason-2 parameters for both IGDR and GDR data, and makes the results available to data manager and public users via a web interface in both graphical and numerical representations.

Performs an immediate quality check when granules are ingested into NODC's archives.



# Rich Inventory System: Interface at NGDC RI Database

Entrance webpage

Plotting and downloading

**NESDIS Rich Inventory**

**Granule Type Properties**

Granule Type JASON-2 GDR  
Metadata ID GOV NOAA CLASSJ2-XGDR  
Description Quality Monitor the JASON-2 Final Geophysical Data Record (GDR) Granule Data  
Last Update 2010-01-06 10:59:01.0

**Granule Type Parameters**

Name	Standard Name	Long Name	Description	Units	Precision	Last Update
swh_c	Sea surface wave significant height	C band corrected significant waveheight		m		2009-09-03 08:20:54.0
mean_topography	Mean topography above geoid	Mean dynamic topography above geoid		m		2008-06-03 14:10:49.0
sig0_c	Surface backwards scattering coefficient of radar wave	C band corrected backscatter coefficient		dB		2009-09-03 08:20:54.0
tb_340	Surface brightness temperature	34 GHz main beam brightness temperature		K		2009-09-03 08:20:54.0
wind_speed_ah	Wind speed	Altimeter wind speed		m/s		2008-06-03 14:10:49.0
tb_238	Surface brightness temperature	23.8 GHz main beam brightness temperature		K		2009-09-03 08:20:54.0
agc_c	Automatic gain control	C band corrected AGC		dB		2008-06-03 14:10:49.0
wind_speed_rad	Wind speed	Radiometer wind speed		m/s		2008-06-03 14:10:49.0
iono_corr_ah_ku	Altimeter range correction due to ionosphere	Altimeter ionospheric correction on Ku band		m		2009-09-03 08:20:54.0
geoid	Geoid height above reference ellipsoid	Geoid height		m		2008-06-03 14:10:49.0
bathymetry	bathymetry	ocean depth/land elevation		m		2008-06-03 14:10:49.0
tb_187	Surface brightness temperature	18.7 GHz main beam brightness temperature		K		2009-09-03 08:20:54.0
mean_sea_surface	Mean sea surface height	Mean sea surface height above reference ellipsoid		m		2009-09-03 08:20:54.0
swh_ku	Sea surface wave significant height	Ku band corrected significant waveheight		m		2009-09-03 08:20:54.0
rad_liquid_water	Atmosphere cloud liquid water content	Radiometer liquid water content		kg/m <sup>2</sup>		2008-06-03 14:10:49.0
agc_ku	Automatic gain control	Ku band corrected AGC		dB		2008-06-03 14:10:49.0
sig0_ku	Surface backwards scattering coefficient of radar wave	Ku band corrected backscatter coefficient		dB		2009-09-03 08:20:54.0
sea_state_bias_ku	Sea surface height bias due to sea surface roughness	Sea state bias correction in Ku band		m		2009-09-03 08:20:54.0
ssa	Sea surface height above sea level	Sea surface height anomaly		m		2009-09-03 08:20:54.0
sea_state_bias_c	Sea surface height bias due to sea surface roughness	Sea state bias correction in C band		m		2009-09-03 08:20:54.0
rad_water_vapor	Atmosphere water vapor content	Radiometer water vapor content		kg/m <sup>2</sup>		2008-06-03 14:10:49.0

**Granule Type Attributes**

Name	Description	Last Update	Number of Values
			0

**Granule Type Granules**

**JASON-2 GDR Rich Inventory Parameter Time Series**

MapSize: Medium  
Parameter: C band corrected AGC  
Statistic: Maximum  
Dates (yyyy-MM-dd)  
set start date  
set end date  
Refresh

**JASON-2 GDR: C band corrected AGC**