Development of NODC Satellite Data Quality Monitoring System (DQMS)

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Background

In 2008, NODC launched this work in order to provide capabilities to monitor quality of Jason-2 products based on the concept of Rich Inventory (RI), which is originally developed in NGDC for supporting data management in CLASS/NOAA.

The RI principle concept is to extract existing metadata from granule headers and calculate descriptive statistics for the parameters in the files, load the data to store them in a database, and make it available as part of a data discovery system. Data anomalies are also monitored and reported to interested parties (data archivist, producers and users).



Rich Inventory Architecture

Objective

 To build a software system that will enable NODC data archive managers to view the live satellite data ingest in near real-time, and to see if the descriptive data quality statistics in the selected parameters fall out of acceptable ranges.

QA statistics: observation number, minimum, maximum, mean, media, and standard deviation after applying the quality and mask flags in the calculation.

- To develop friendly interfaces for public users to access the data quality information (NetCDF-formatted data or images of time series) in near real time through OpeNDAP, THREDDS and Live Access Server (LAS), or a direct access to pre-generated images.
- 2. To build a notification system for data archivist, producer and users and provide them alert information when a bad file is identified according to the defined thresholds.

Why do we need a DQMS?



Mean statistics of radiometer water vapor in each pass (ascending or descending obit) from Jason-1 satellite-observed Interim Geophysical Data Records (IGDRs).

Why Do we need a DQM? IGDR Sea Surface Height Anomaly Total observational number 3000 2000 1000 0 Total observational number over 3-Sigma edited 90 60 30 0 Mean (unit:m) Monitored change of 0.5 0.4 data values with the 0.3 0.2 change of product 0.1 versions. -0.1Total number filled by default value 3000 2000 1000 0 Total number of extreme values (>1.5m or <-1.5m) 25 20 15 10 11/27/08 04/25/09 09/21/09 02/17/10 07/15/10 12/11/10 05/09/11 10/05/11 03/01/12 07/28/12 12/24/12 05/31/13 11/06/13

Cycle/Pass31/1 46/1 61/1 76/1 91/1 106/1 121/1 136/1 151/1 166/1 181/1 196/1

Statistics of sea surface height in each pass (an ascending or descending obit) from Jason-2 satellite-observed IGDR data.

Implementation of Satellite Data Quality monitoring at NODC

NODC Data Quality Monitoring Flow Chart



Implementation of Satellite Data Quality monitoring at NODC:

- Jason-2/3 level-2 altimetry (X-GDRs), NOAA
- Pathfinder V5.2 SST, NODC/NOAA
- Aquarius level-2 sea surface salinity (SSS), NASA
- Soil Moisture and Ocean Salinity (SMOS) mission level-2 SSS, ESA
- Sentinel-1 SAR wind products, NOAA
- Satellite-derived ocean heat content, NOAA
- Pathfinder V5.3 & V6.0 SST, NODC/NOAA
- Ocean Color Reprocess products, NOAA
- Group for High Resolution SST (GHRSST)

NODC Jason-2 GDR Rich Inventory published on NGDC RI Database

Jason-2 GDR rich inventory webpage

Granule Type Overview - Mozilla Firefox Elle Edit View History Bookmarks Tools Help

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SGranule Type Overview

NESDIS Rich Inventory

Granule Type Properties

Granule Type JASON-2 GDR Metadata ID GOV NOAA CLASS12-XGDR Description Quality Monitor the JASON-2 Final Geophysical Data Record (GDR) Granule Data Last Update 2010-01-06 103901.0

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	ĸ	2009-09-03 08:20:54.0
wind_speed_alt	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_alt_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	ĸ	2009-09-03 08:20:54.0
mean_sea_surface	Mean sea surface height	Mean sea surface height above reference ellipsoid	l 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^:	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
ssha	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^:	2008-06-03 14:10:49.0
Granule Ty	pe Attributes			

Name Description Last Update Number of Values

Granule Type Granules

Plotting and downloading



👻 Granule Type Granule List - Mozilla Firefox					\times	
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< 🕑 🔀 😴 🛧 📀 http://www.ngdc.noaa.gov/idb/struts/results?eq_0=≤_ 🟠 + 🚼 - Coogle						
🐄 WX 🍮 NODC 🞯 YF 🤻 MSN 🗋 WXf 🛅 😪 徤 Sina 🗋 STGTS 🛄 BCN 🎇 Dictionary 📑 STG 🛃 NYMO 🛃 NYSI 📑 IS						
S Granule Type Granule List *						
Granule Type Granule List Granule Type ID = 17508303: <u>Number of granules</u>						
Description	Start	End	Last Update	Links		
JA2_GPN_2PTP066_254_20100427_104635_20100427_114248; Cycle 066, Pass 254	2010/04/27 10:46:32	2010/04/27 11:42:45	2010/07/12 13:22:02	RIML		
JA2_GPN_2PTP066_253_20100427_095023_20100427_104635; Cycle 066, Pass 253	2010/04/27 09:50:19	2010/04/27 10:46:32	2010/07/12 13:21:56	RIML		
JA2_GPN_2PTP066_252_20100427_085410_20100427_095023; Cycle 066, Pass 252	2010/04/27 08:54:06	2010/04/27 09:50:19	2010/07/12 13:21:59	RIML.		
JA2_GPN_2PTP066_251_20100427_075757_20100427_085410; Cycle 066, Pass 251	2010/04/27 07:57:53	2010/04/27 08:54:06	2010/07/12 13:21:51	<u>RIML</u>		
JA2_GPN_2PTP066_250_20100427_070144_20100427_075757; Cycle 066, Pass 250	2010/04/27 07:01:41	2010/04/27 07:57:53	2010/07/12 13:21:54	RIML		
JA2_GPN_2PTP066_249_20100427_060531_20100427_070144; Cycle 066, Pass 249	2010/04/27 06:05:28	2010/04/27 07:01:41	2010/07/12 13:21:49	RIML		
JA2_GPN_2PTP066_248_20100427_050918_20100427_060531; Cycle 066, Pass 248	2010/04/27 05:09:15	2010/04/27 06:05:28	2010/07/12 13:21:46	RIML	~	
Done						

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



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

NODC Jason-2 GDR/IGDR Data Quality Statistics published on LAS and OPeNDAP Servers



OPeNDAP

Contents of /jason2/QA_assurance/GDRs

Name	Last Modified	Size	Response Links				
Parent Directory/							
JA2 GPN agc c.nc	2014-05-21T07:11:10	2550952	<u>ddx</u> <u>dds</u> <u>das</u> <u>info</u> <u>html</u>				
JA2 GPN agc ku.nc	2014-05-21T07:11:10	2550976	<u>ddx</u> <u>dds</u> <u>das</u> <u>info</u> <u>html</u>				
JA2 GPN bathymetry.nc	2014-05-21T07:11:10	2551052	<u>ddx</u> <u>dds</u> <u>das</u> <u>info</u> <u>html</u>				
JA2 GPN diff tropo corr.nc	2014-05-21T07:11:10	2338824	<u>ddx</u> <u>dds</u> <u>das</u> <u>info</u> <u>html</u>				
JA2 GPN diff wind speed.nc	2014-05-21T07:11:10	2338732	<u>ddx</u> <u>dds</u> <u>das</u> <u>info</u> <u>html</u>				
JA2 GPN geoid.nc	2014-05-21T07:11:10	2550888	<u>ddx</u> <u>dds</u> <u>das</u> <u>info</u> <u>html</u>				
JA2 GPN iono corr alt ku.nc	2014-05-21T07:11:12	2551220	<u>ddx</u> <u>dds</u> <u>das</u> <u>info</u> <u>html</u>				
JA2 GPN mean sea surface.nc	2014-05-21T07:11:12	2551268	<u>ddx</u> <u>dds</u> <u>das</u> <u>info</u> <u>html</u>				
JA2 GPN mean topography.nc	2014-05-21T07:11:12	2551152	<u>ddx</u> <u>dds</u> <u>das</u> <u>info</u> <u>html</u>				
JA2 GPN rad liquid water.nc	2014-05-21T07:11:12	2551140	<u>ddx</u> <u>dds</u> <u>das</u> <u>info</u> <u>html</u>				
JA2 GPN rad water vapor.nc	2014-05-21T07:11:12	2551132	<u>ddx</u> <u>dds</u> <u>das</u> <u>info</u> <u>html</u>				
JA2 GPN sea state bias c.nc	2014-05-21T07:11:12	2551156	<u>ddx</u> <u>dds</u> <u>das</u> <u>info</u> <u>html</u>				
JA2 GPN sea state bias ku.nc	2014-05-21T07:11:12	2551176	<u>ddx</u> <u>dds</u> <u>das</u> <u>info</u> <u>html</u>				
JA2 GPN sig0 c.nc	2014-05-21T07:11:12	2551128	<u>ddx</u> <u>dds</u> <u>das</u> <u>info</u> <u>html</u>				
JA2 GPN sig0 ku.nc	2014-05-21T07:11:12	2551136	<u>ddx</u> <u>dds</u> <u>das</u> <u>info</u> <u>html</u>				
JA2 GPN ssha.nc	2014-05-21T07:11:12	2550992	<u>ddx</u> <u>dds</u> <u>das</u> <u>info</u> <u>html</u>				
JA2 GPN swh c.nc	2014-05-21T07:11:12	2551104	<u>ddx</u> <u>dds</u> <u>das</u> <u>info</u> <u>html</u>				
JA2 GPN swh ku.nc	2014-05-21T07:11:12	2551128	<u>ddx</u> <u>dds</u> <u>das</u> <u>info</u> <u>html</u>				
JA2 GPN tb 187.nc	2014-05-21T07:11:12	2551136	<u>ddx</u> <u>dds</u> <u>das</u> <u>info</u> <u>html</u>				
JA2 GPN tb 238.nc	2014-05-21T07:11:12	2551136	<u>ddx</u> <u>dds</u> <u>das</u> <u>info</u> <u>html</u>				
JA2 GPN tb 340.nc	2014-05-21T07:11:12	2551120	<u>ddx</u> <u>dds</u> <u>das</u> <u>info</u> <u>html</u>				
JA2 GPN wind speed alt.nc	2014-05-21T07:11:12	2551032	<u>ddx</u> <u>dds</u> <u>das</u> <u>info</u> <u>html</u>				
JA2 GPN wind speed rad.nc	2014-05-21T07:11:12	2551040	<u>ddx</u> <u>dds</u> <u>das</u> <u>info</u> <u>html</u>				

http://data.nodc.noaa.gov/opendap/jason2/QA_assur ance/GDRs/contents.html

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

NODC-binned Sea Surface Salinity from SMOS and Aquarius satellites provided by LAS

SMOS 3-day mean



Aquarius 7-day mean



Quality Monitoring on Aquarius Sea Surface Salinity level-2 products

QA Statistics for SSS in each Aquarius level-2 granule



QA Statistics for SSS (psu) in each Aquarius level-2 granule. Red line represents the results from original data while black line denotes the results after contaminated records are filtered by applying radiometer and scatterometer quality flags. Histogram of monthly level-3 sea surface salinity difference between SMOS and Aquarius satellites, April 2012

Quality Monitoring on Pathfinder V5.2 SST



Monitored anomalous increase of hot spot events in 2011-2012 years

QA statistics in each granule of Pathfinder V5.2 daily SST for ascending orbit during 1981-2012, in unit of degree.

Jason-2 OGDR Data monitoring: Dashboard

Jason-2 OGDR Data Quality Monitoring



(SWH: Ku Band significant waveheight; WSPD: Altimeter wind speed; DRWTMC: Difference between radiometer wet tropospheric and model correction; DWSPD: Difference between altimeter and radiometer wind speed; RVAP: Radiometer water vapor content; SSHA: Sea surface height anomaly.)

Data file	Created Date	Size(byte)	SWH	WSPD	DRWTMC	DWSPD	RVAP	SSHA
JA2_OPN_2PdS209_137_20140310_201833_20140310_221658.nc	2014-03-10 23:50:40	13246948						
JA2_OPN_2PdS209_135_20140310_182351_20140310_201834.nc	2014-03-10 23:50:40	13016788						
JA2_OPN_2PdS209_132_20140310_145800_20140310_182352.nc	2014-03-10 23:50:40	23301308						
JA2_OPN_2PdS209_129_20140310_130243_20140310_145800.nc	2014-03-10 23:50:40	13081876						
JA2_OPN_2PdS209_127_20140310_110614_20140310_130245.nc	2014-03-10 23:50:39	13030220						
JA2_OPN_2PdS209_126_20140310_092616_20140310_110616.nc	2014-03-10 23:50:39	11355676						
JA2_OPN_2PdS209_123_20140310_071431_20140310_092617.nc	2014-03-10 23:50:39	14942448						
JA2_OPN_2PdS209_122_20140310_054320_20140310_071432.nc	2014-03-10 23:50:38	10366304						
JA2_OPN_2PdS209_120_20140310_034632_20140310_054321.nc	2014-03-10 23:50:38	13254620						
JA2_OPN_2PdS209_117_20140310_015016_20140310_034633.nc	2014-03-10 23:50:38	13194976						
JA2_OPN_2PdS209_115_20140309_235257_20140310_015016.nc	2014-03-10 23:50:37	13124512						
JA2_OPN_2PdS209_113_20140309_215402_20140309_235258.nc	2014-03-10 23:50:37	13306108						
JA2_OPN_2PdS209_111_20140309_195608_20140309_215403.nc	2014-03-09 23:50:39	13377372						
JA2_OPN_2PdS209_109_20140309_180232_20140309_195609.nc	2014-03-09 23:50:39	12894036						
JA2_OPN_2PdS209_108_20140309_163220_20140309_180233.nc	2014-03-09 23:50:39	10255184						
JA2_OPN_2PdS209_105_20140309_143504_20140309_163222.nc	2014-03-09 23:50:39	13308312						
JA2_OPN_2PdS209_103_20140309_123849_20140309_143506.nc	2014-03-09 23:50:38	13196956						
JA2_OPN_2PdS209_102_20140309_110059_20140309_123849.nc	2014-03-09 23:50:38	10924368						
JA2_OPN_2PdS209_100_20140309_090320_20140309_110100.nc	2014-03-09 23:50:38	13352128						
JA2_OPN_2PdS209_097_20140309_065208_20140309_090320.nc	2014-03-09 23:50:38	14877124			٠			
JA2_OPN_2PdS209_096_20140309_052024_20140309_065209.nc	2014-03-09 23:50:37	10237612						
JA2_OPN_2PdS209_094_20140309_032336_20140309_052024.nc	2014-03-09 23:50:37	13252404						

Future Perspective

Data quality monitoring system should:

- Provide capabilities of automatic monitoring data quality during the archive ingest process at near real time and sending out notification for the anomalies.
- Be designed and built as a common tool (from calculator, database to webbased monitoring interface).
- Provide capabilities of web-based interface search tools for the QA statistical time series. The user can specify their needs and search with criteria.
- Provide different levels of services from pure data QA monitoring to scientific evaluation and validation of satellite products with the conventional observations (for example, satellite sea surface salinity via NODC Word Ocean Database in situ data).

More work need to do:

- Development of data quality monitoring methods and tools.
- Improve user's service and trace user's needs.