JCOMM Technical Workshop on Wave Measurements

New York
October 2 & 3, 2008

Bruce Bradshaw

Wave & Drifting Buoy Programme Manager

Integrated Science Data Management – Fisheries and Oceans Canada

ISDM
Integrated Science Data Management

A Branch of DFO Science

Fisheries and Oceans Canada | Pêches et Océans Canada

Formed in 2006 by the merger of DFO's Marine Environmental Data Service and the Engineering and Geomatics Branch of CHS.

Marine Environmental Data Service

+

Canadian Hydrographic Service

Continuously Managed Archives

- Waves
- Argo
- Tides & Water Levels
- Physical & Chemical Profiles
- Drifting & Moored Buoys
- Contaminants & Invasive Species…
- Navigation and Chart Services
- GeoPortal…

ISDM & International Data Management

ISDM Participates in several JCOMM Data Management Programmes

Work consists of

- **Procedures for end-to-end data management**
- **Standards (metadata, formats, QC, etc.)**
- **Integrating ice, ocean, meteorological climatology**

An International Data Centre within the Intergovernmental Oceanographic Data and Information Exchange programme

Work consists of

- **Sharing data, experience and expertise**
- **Collaborating on a number of projects with international partners including the GTSPP, GOSUD and GLOSS**
- **ISDM operates two world data centres, one for real-time profiles and one for surface drifter data**

ISDM as a Data Centre

- **ISDM manages data in the real-time (hours-days) and delayed mode (months to years).**

- **We receive data from the Global Telecommunications System, and others, as often as every 15 minutes**

- **We send data through the GTS every 6 hours.**

- **We accept data from DFO and international partners months and years after collection.**

- **We add value by carrying out QC, duplicates identification and the standardization of content and structure.**

- **We deliver data to clients daily, weekly and on request.**

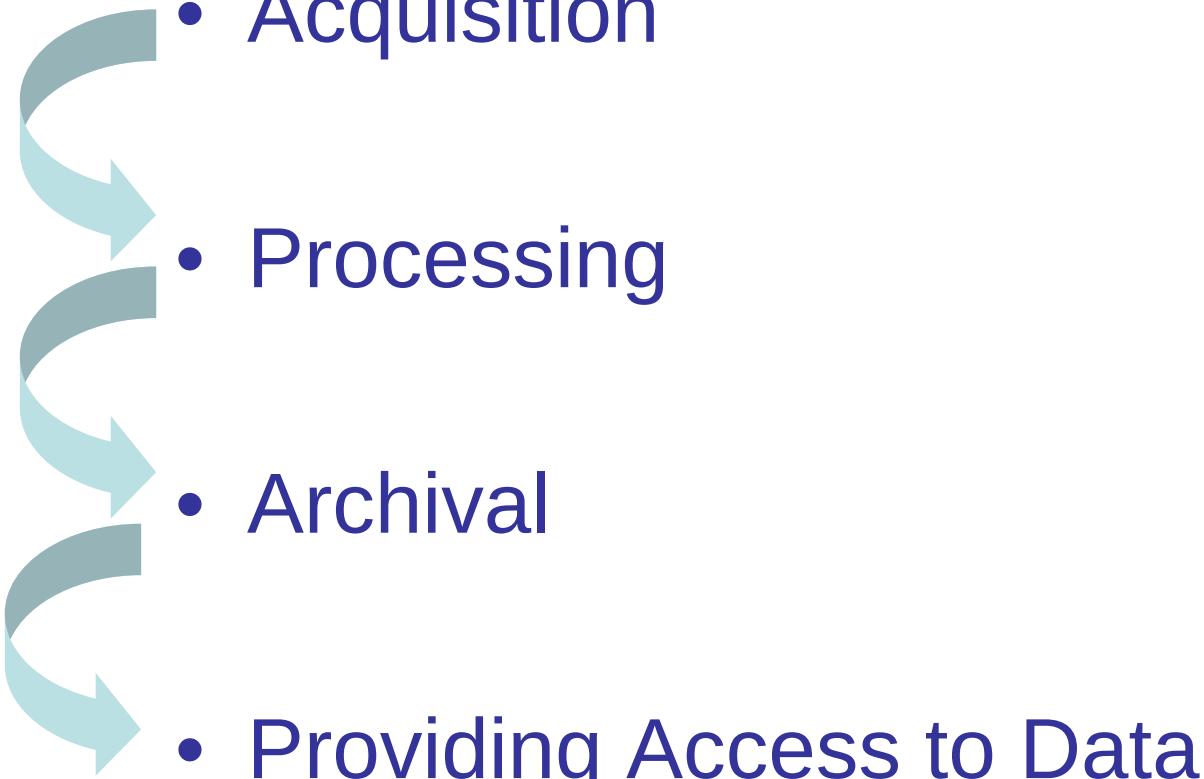
ISDM Wave Data Services

- From the early 70's to mid 90's MEDS developed and maintained a complete scientific, engineering and field buoy programme.
- National archive of wave data with:
  - 8 million measured spectra
  - 300,000 new MSC spectra/year
  - 500,000 timeseries records
  - several model and hindcast datasets (AES40, MSC50, Beaufort, GL…)
  - Environmental Data collected by the Oil & Gas industry
- All data is available online or by request.

  http://www.meds-sdmm.dfo-mpo.gc.ca

The ISDM Wave Data Services

We describe our services in terms of the following four steps:



- Acquisition
- Processing
- Archival
- Providing Access to Data

Wave Data Acquisition

All wave and ancillary data from the Canadian area of interest (n of 35)

- Meteorological and oceanographic data from MSC weather buoy network transmitted over the GOES satellite network
- Annual oil and gas industry submissions
- Hindcast and model data
- Other engineering or scientific research data (altimeter, radar etc.)

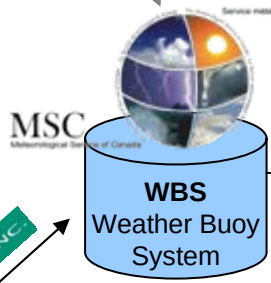
MSC Buoy Data Acquisition

DOMSAT or Network

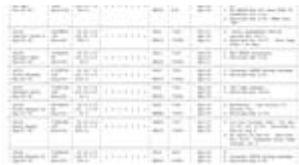
LRGS Servers

INTERNET

GOES Message Processing by NESDIS



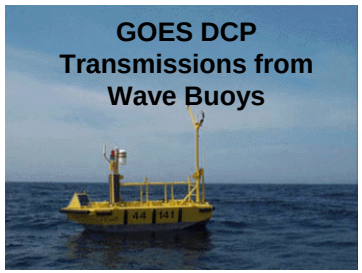
MSC Buoy Status Reports with GOES Platform ID's



ILEX DCS Toolkit Download

Configure Deploy Buoys

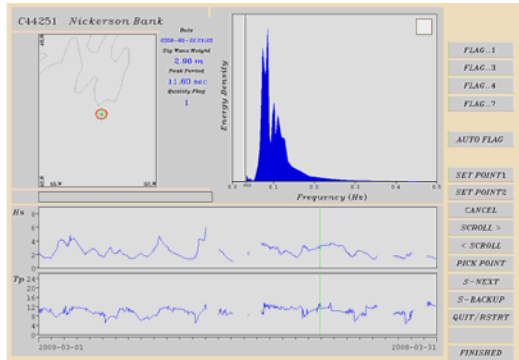
AXYS TECHNOLOGIES INC.



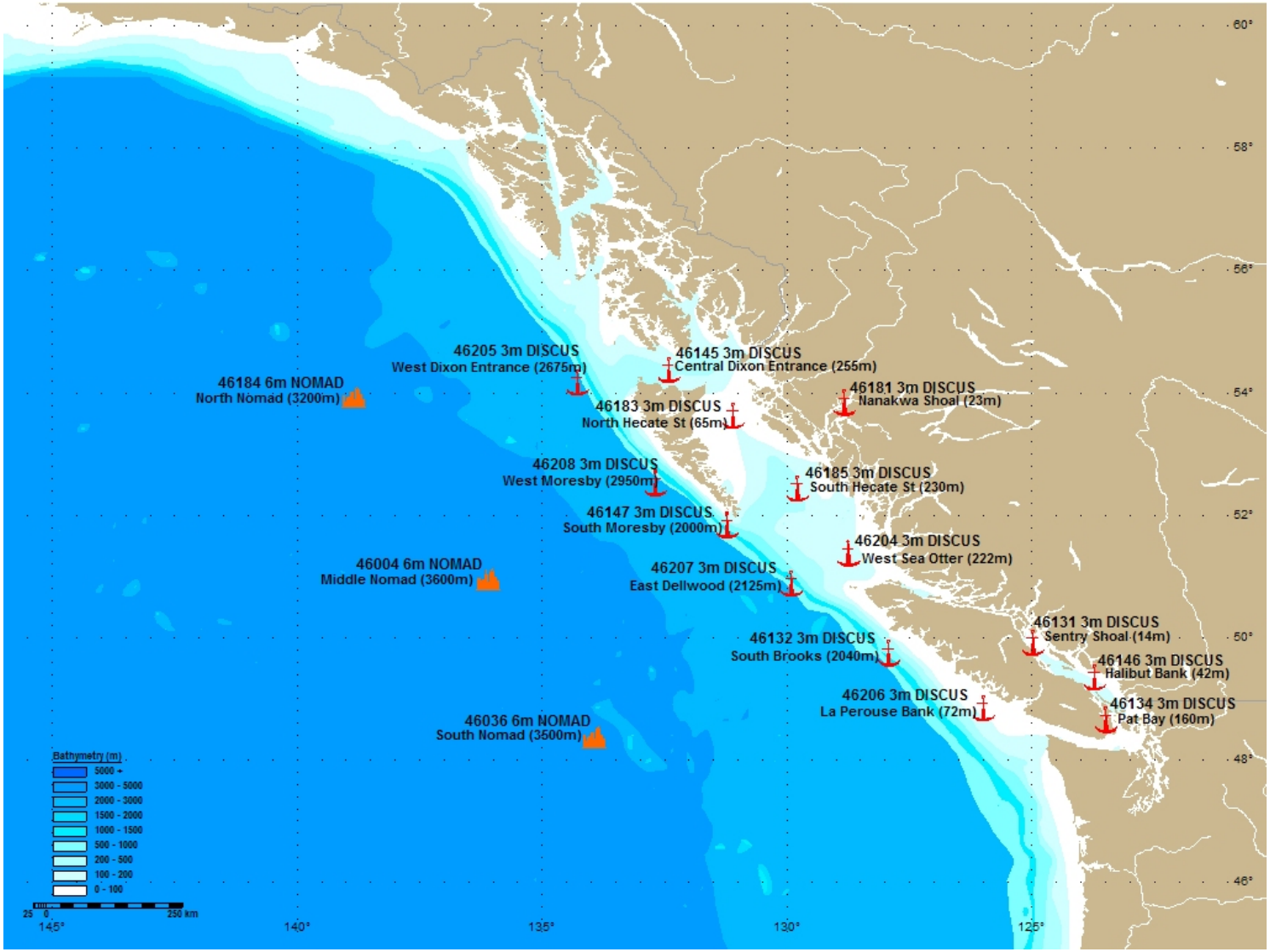
INTERNET

ISDM Data Management

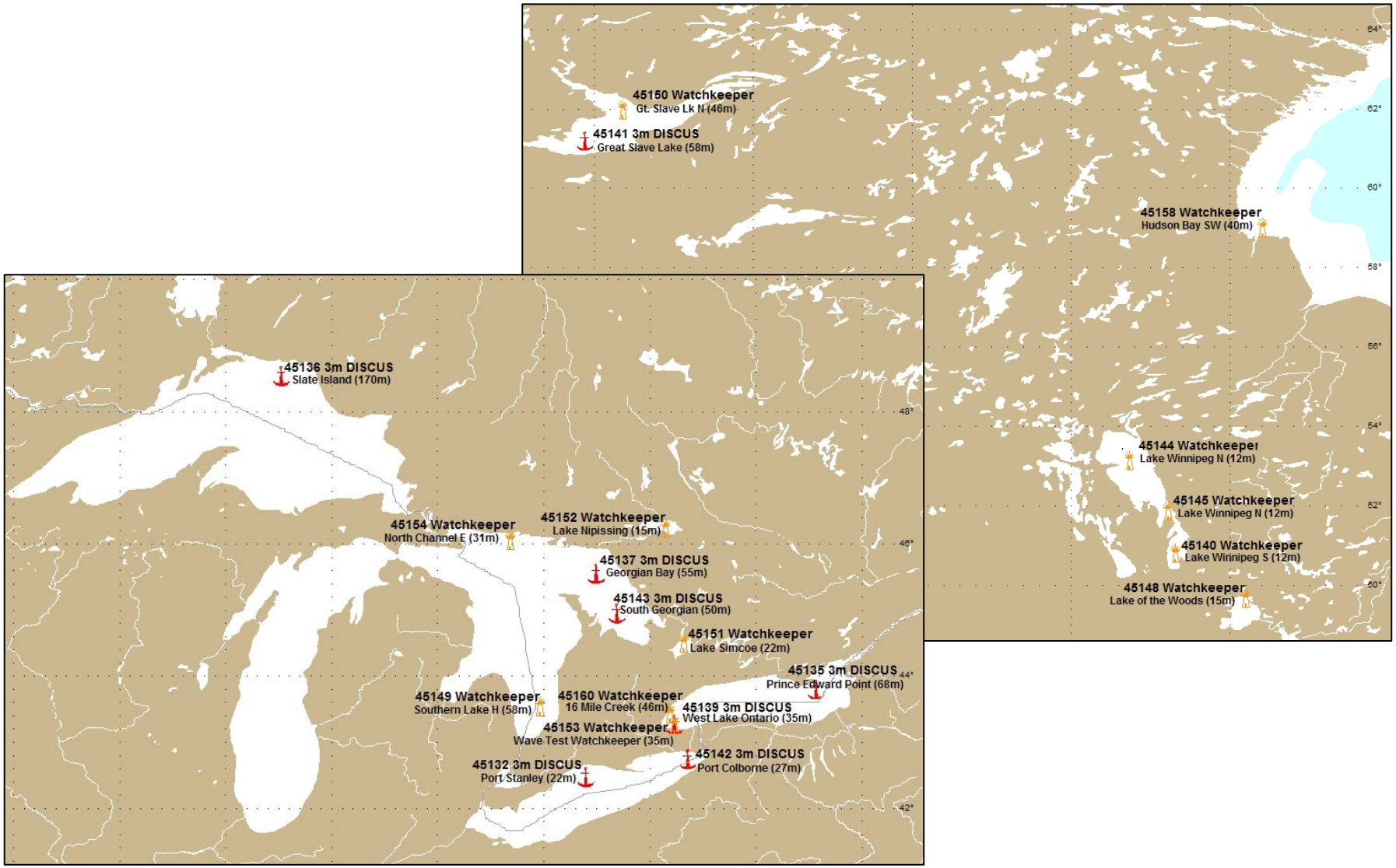
ISDM Quality Control



Pacific Buoy Network

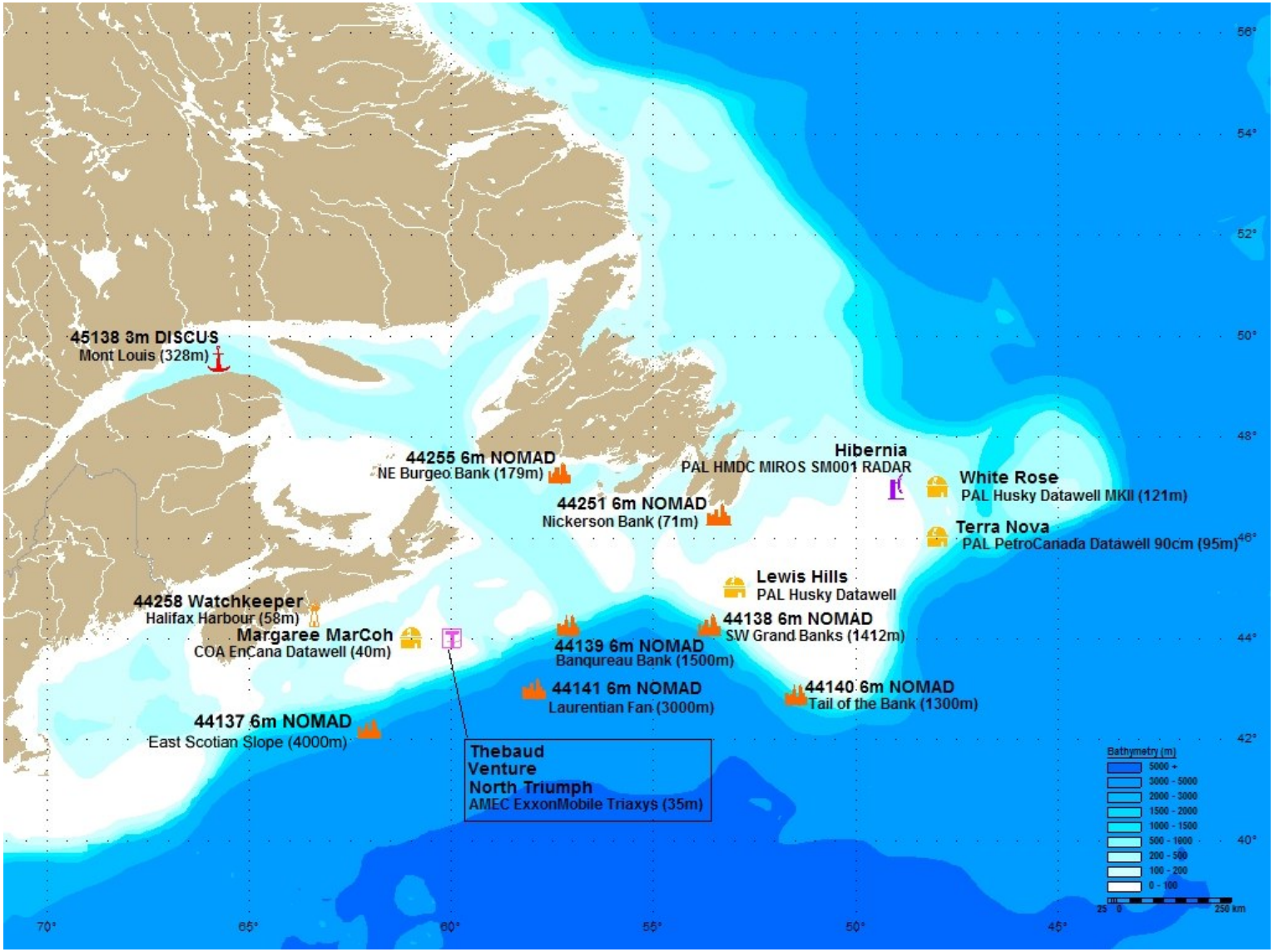


Lake Buoy Network



Fisheries and Oceans Canada
Pêches et Océans Canada

East Coast Buoy Network



Typical Daily MSC Acquisition

- 47 buoys * 24 hours = 1128 possible messages
- DCS Toolkit gets 1105 headers and messages
  (22 missed scheduled transmission, 1 transmission parity error)
- 1058 records decoded from the ASCII and PSUEDO ASCII portions of the original buoy messages ready for visual inspection and archival
  (47 truncated/garbled messages or with negative spectral densities)
- Approximately 94% recovery

GOES Message Format

```
475025740824416140 9G40-1NN081EUP00337
45167 1537 WKPR  46/// /055058(/000000) 10195 49795(4////) 22200 00197 1213007
333 912074(912000) WQ12029 A19999 A2000 A3139 A4130 A534// A62010 A7145
A95047.998,09644.019 A16+0000 A17001 A19001 A200 B21F15111111
$|DE`eOA@@`@`@`@`@`@`@`JAfRPn@PGQEA~GnTowO~OmoboLNHnlmHL~JRlMLjJRj`Jdi}hAhPh
UhNhQHNgwgUgEGWfheAEldVdmc|BibuB~bwEpH}hgG/
```

Data Recovery Challenges

- Dependant on an up to date list of all GOES transmitters ID's in use by EC.
- Transmission gaps resulting from deteriorating satellite orbits (elevation angle for NW buoys), environmental conditions and transmitter malfunctions.
- Data recovery has improved significantly with transmitter improvements, satellite networks, download protocols and better coordination between MSC and ISDM.

Wave Data Processing

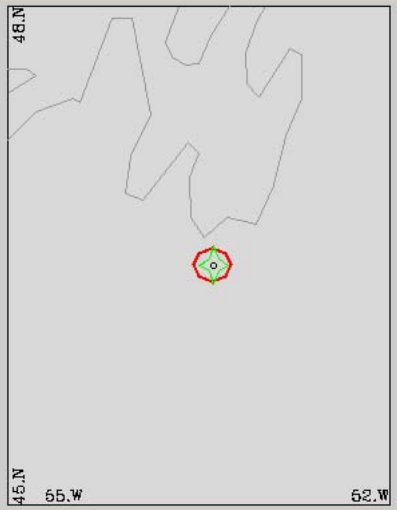
Data Quality Control and Spectral Analysis for

- Buoy Deployment Position
- Wave Instrument Operation
- Spectral Frequency Range
- Spectral Shape
- Significant Wave Height
- Peak Period

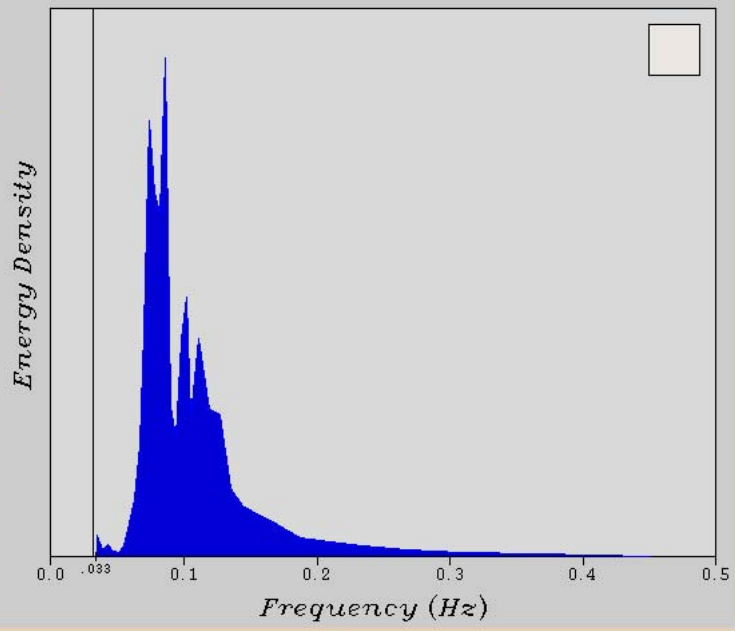
GKS

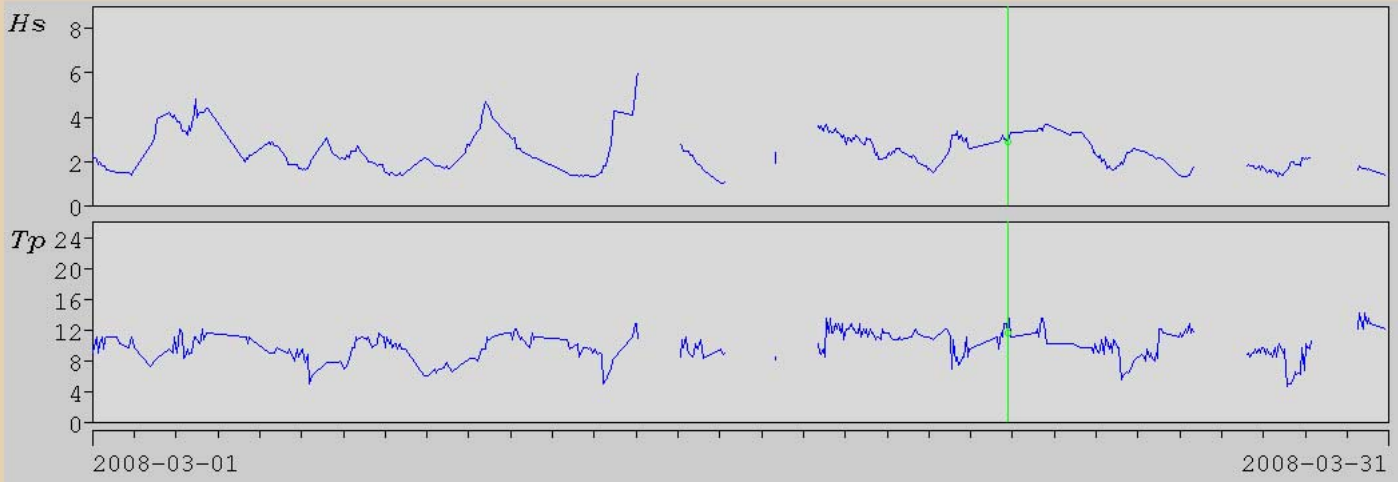
Reset

C44251 Nickerson Bank



Date
2008-03-22 21:20
Sig Wave Height
2.90 m
Peak Period
11.60 sec
Quality Flag
1





FLAG..1
FLAG..3
FLAG..4
FLAG..7

AUTO FLAG

SET POINT1
SET POINT2
CANCEL
SCROLL >
< SCROLL
PICK POINT
S-NEXT
S-BACKUP
QUIT/RSTRT

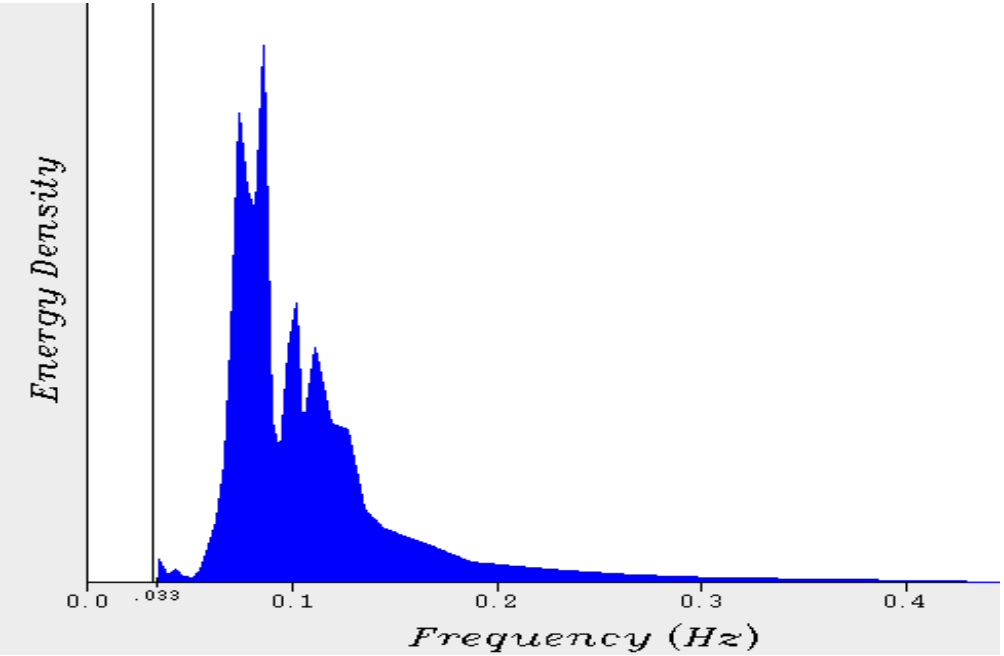
FINISHED

start
Inbox -...
(A) ME...
eXcursion
DECterm
(B) ME...
GKS
EN
1:31 PM

Data Analysis and Quality Control Methodologies from

- ISDM (DFO Canada) procedures
- AXYS Technologies spectral transfer function
- WMO formulae for spectral parameters
- IOC Manual of Quality Control

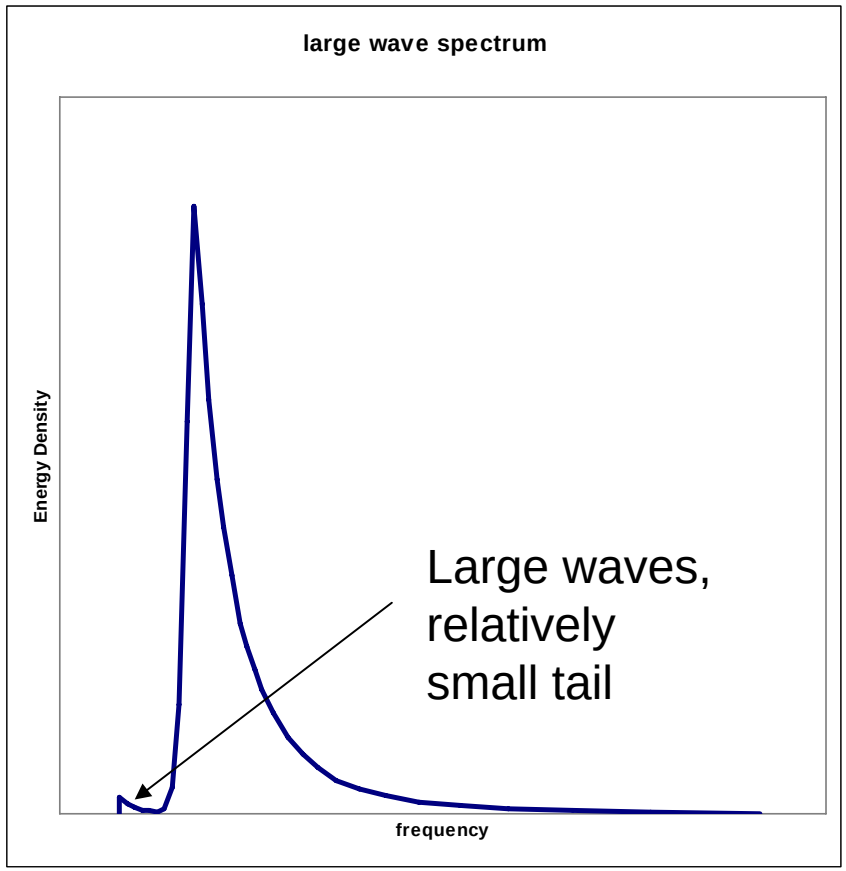
Calculating Significant Wave Height (Hs) and Peak Period (Tp) from the Spectrum

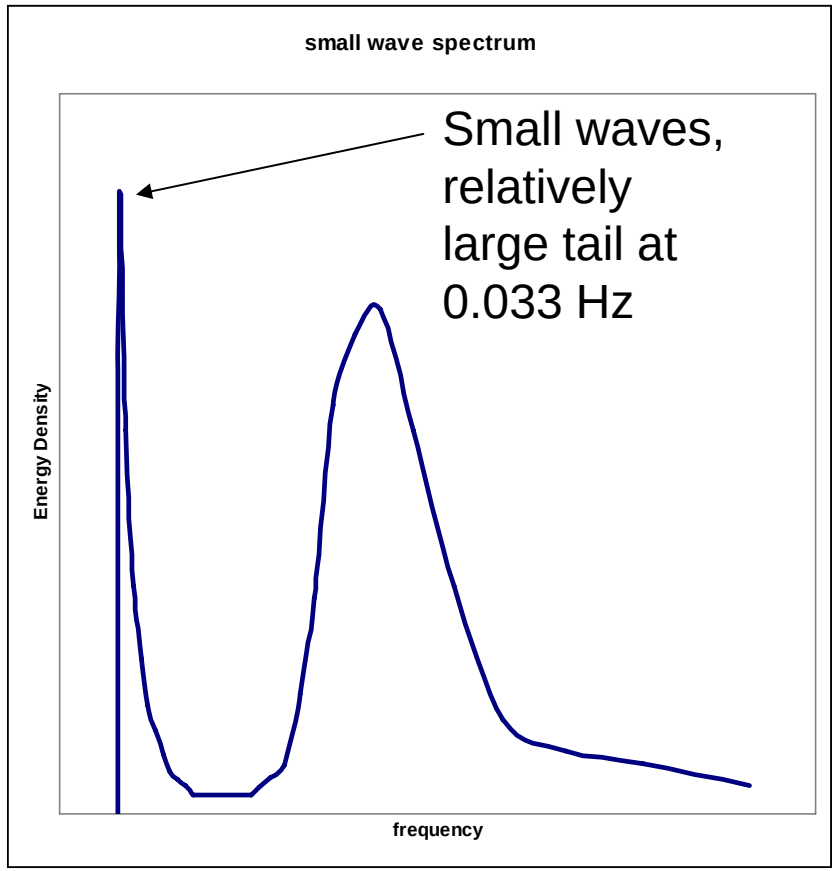


- Hs is from the total spectral energy
- Tp from the frequency with the highest energy
- In small seas, low frequency noise appears in the spectrum and causes errors in the Hs and Tp values.
- The noise has to be removed to get accurate Hs and Tp.

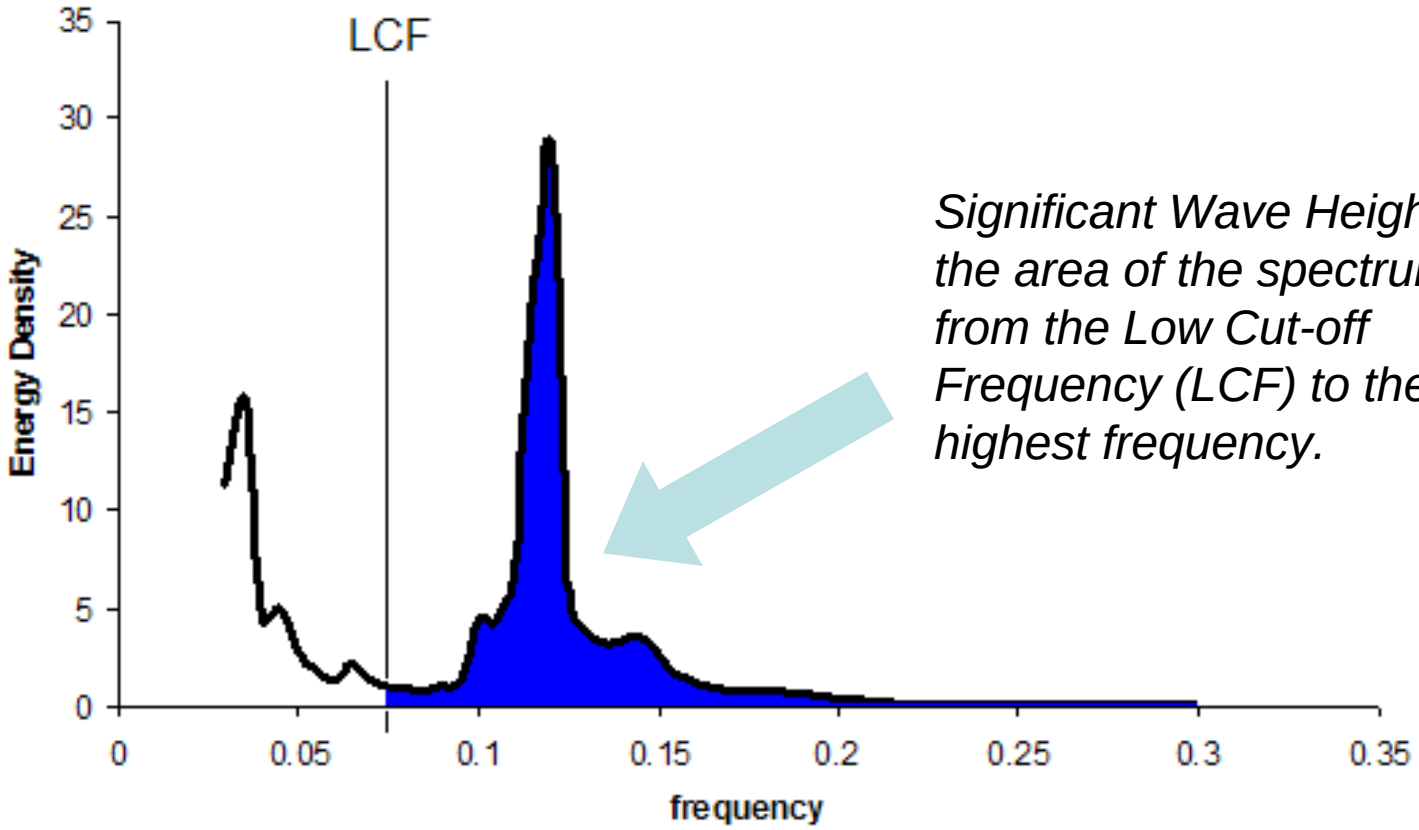
Low Frequency Noise “Tail” in Small Seas

- Standard spectral lowest frequency is 0.033 Hz
- Tail results of low frequency energy amplification transfer function.





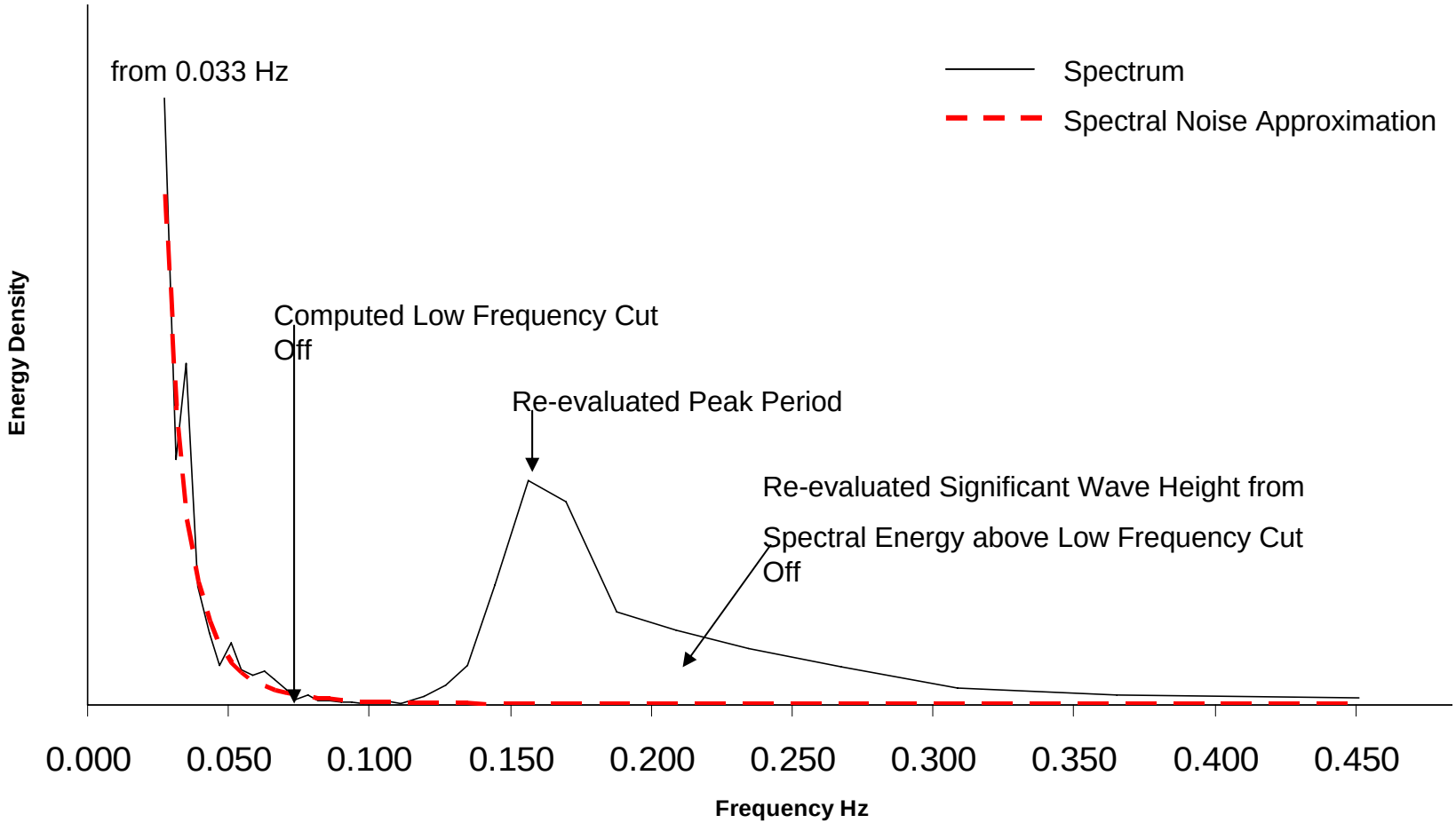
Cut Off the Tail



Significant Wave Height is the area of the spectrum from the Low Cut-off Frequency (LCF) to the highest frequency.

Find the **Low Cut-off Frequency**

by removing the low frequency spectral noise “tail”



Spectral Analysis and Quality Control

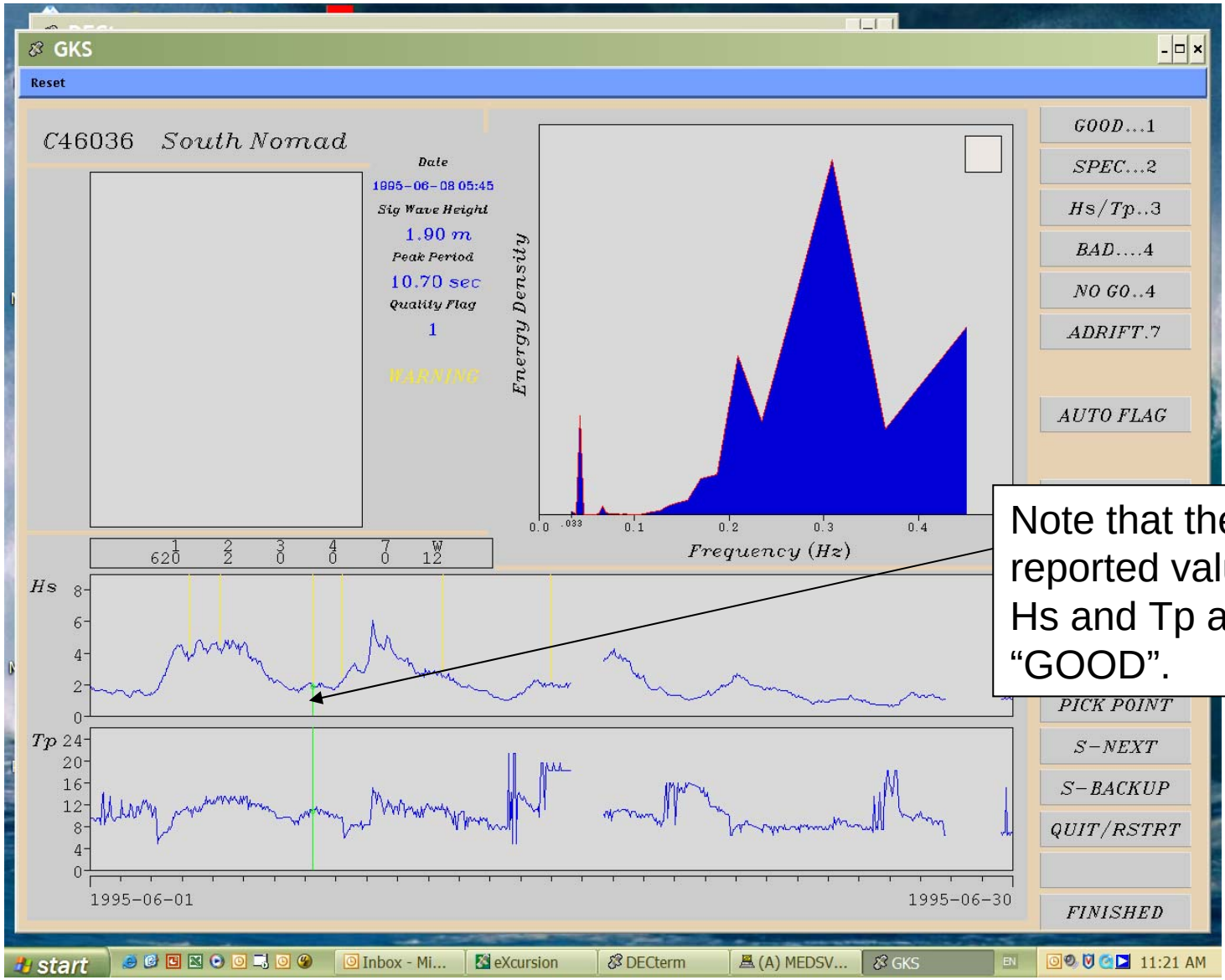
Includes:

- Comparison of reported significant wave height (Hs) and peak period (Tp) to values computed from the spectrum.
- Physics in the spectrum, such as limits to wave steepness and zero crossing.
- Wave height ranges and continuity or changes over time.
- Comparison of GPS position to reported deployment station locations

Our system uses automated tests and visual checks which result in:

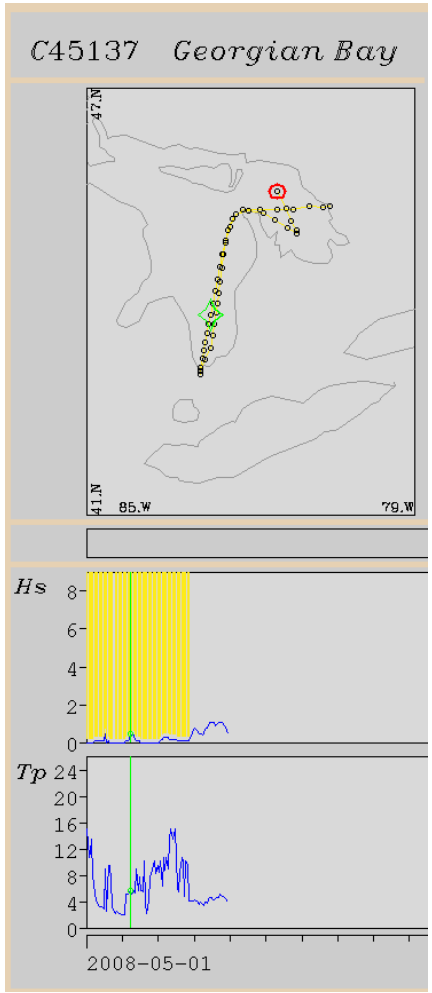
- Reported values changed to computed ones where appropriate
- Quality Control Flags for bad or corrupted spectra, bad or changed Hs and Tp, or buoys gone adrift or transmitting when not deployed.

Corrupted Spectrum Transmission Error



Note that the reported values for Hs and Tp are "GOOD".

Buoy Transmitting Off of Station



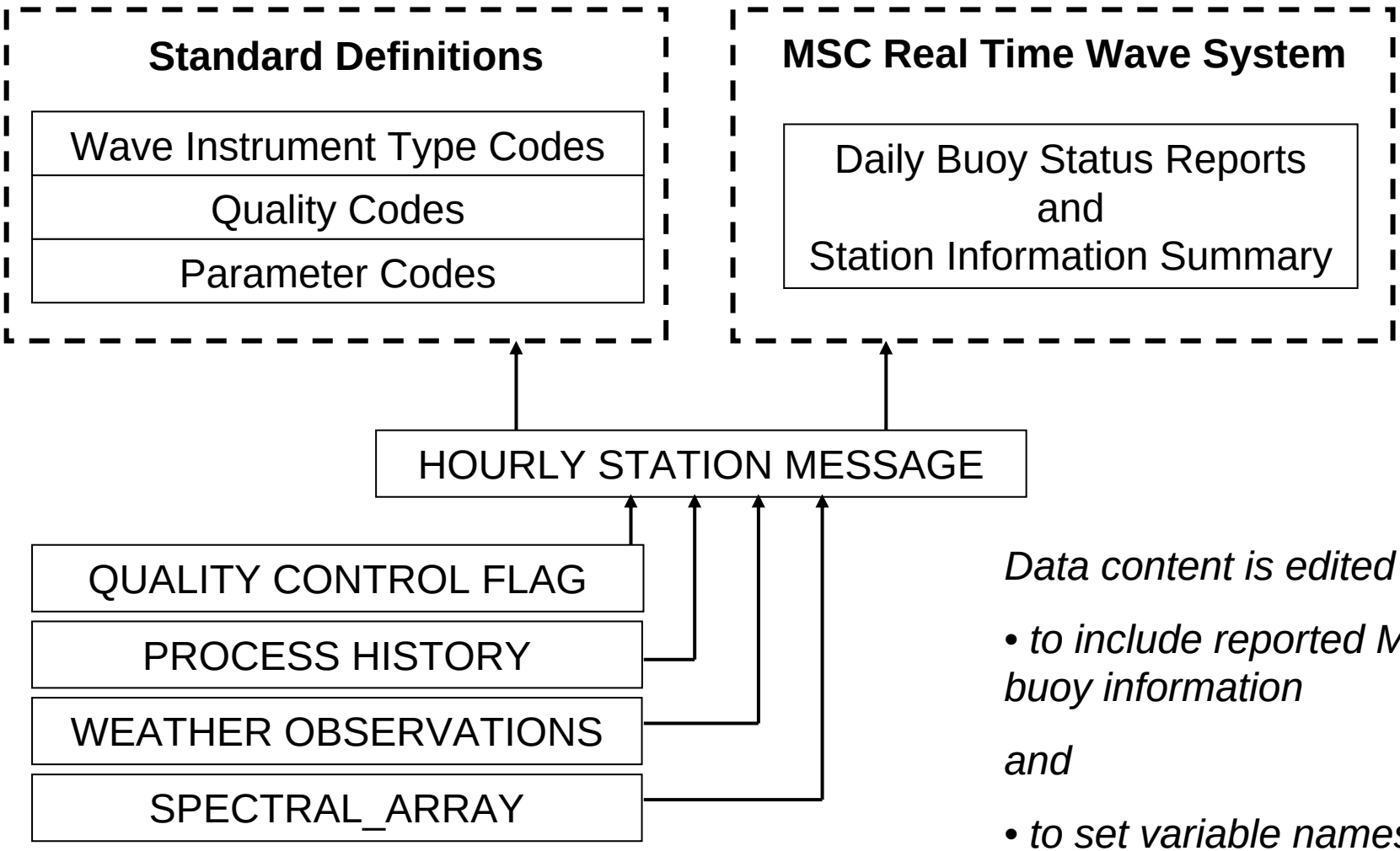
1. Station position is in red. Buoy is traveling, and plotted as a yellow track.
2. Auto QC uses the data message GPS locations, and issues warnings as yellow markers.
3. Our technician flags all of these off station data messages as “BAD”.

Wave Data Archival

Enterprise Architecture in the ISDM Archive Technology

- We are making Oracle Databases, based on data standards.
- Our programmers are developing scientific data management applications in Java, together with the Oracle databases.
- We are beginning to base applications around standard Java libraries for oceanography.
- We employ multi-tier web and application servers including service oriented architecture (SOA) and J2EE.

Archive Tables for MSC Data



Data content is edited

- *to include reported MSC buoy information*

and

- *to set variable names to standard definitions*

Wave Data Services
Providing Access to Data

ISDM Online Resources

Fisheries and Oceans Canada | Pêches et Océans Canada — Canada

Fisheries and Oceans Canada
www.dfo-mpo.gc.ca

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SUBJECTS
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- Waves

FIND INFO ON:
- Location
- ISDM Staff
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- Site Map
- Request Form

Proactive Disclosure

Waves

ISDM has been collecting, archiving and providing spectral wave data on behalf of Canadians since 1970. On a daily basis we process data reported on the GOES and ARGOS networks within the Canadian area of interest. Please see the overview page for more programme detail.

*** All of our observed wave spectra and some specialized products are now available on-line. Please note that the data are only updated on a weekly basis. In case of emergency or should you require wave data that are not available online, please contact us using our request form***

Data and Products

Download Data
Search for and download data and products. View inventory information in HTML tables or Scalable Vector Graphic (SVG) maps.

ArchivePlot
One month timeseries plots of individual station data.

MSC Buoy Status Reports

Latest MSC Buoy Status Report
Operational buoy status report from the Environment Canada Meteorological Service of Canada (MSC) buoy network.

Historical MSC buoy status reports
Archived MSC buoy status reports from the Environment Canada Meteorological Service of Canada (MSC) buoy network.

Publications and Documentation

ISDM Wave Programme Overview
Overview and history of the programme.

Selected Canadian Wave Publications
Technical and workshop documents reproduced in Adobe PDF format.

MSC50 Wind and Wave Climatology Atlas
Meteorological Service of Canada wind, wave and ice climatology products

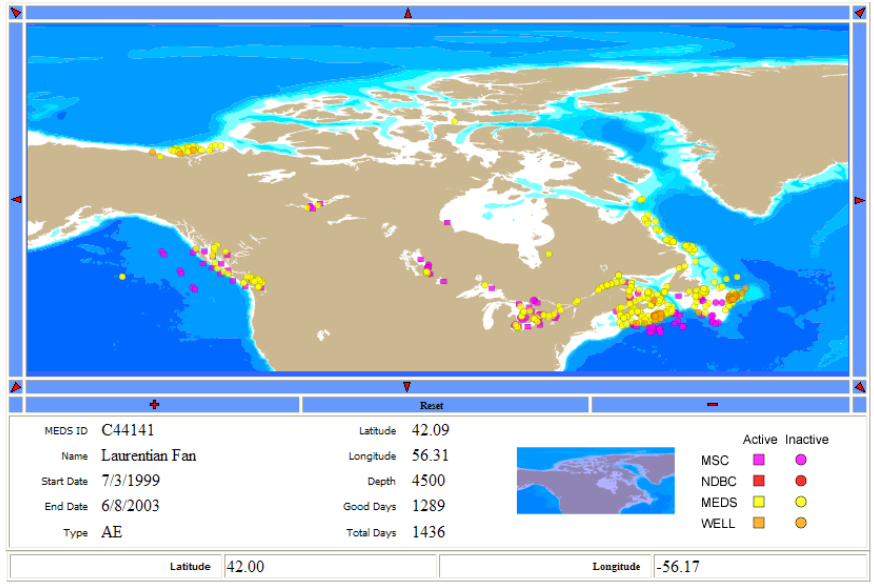
TDC Wind and Wave Climate Atlas
Annual and monthly wind and wave statistics published by Transport Development Canada for the Canadian area of interest.

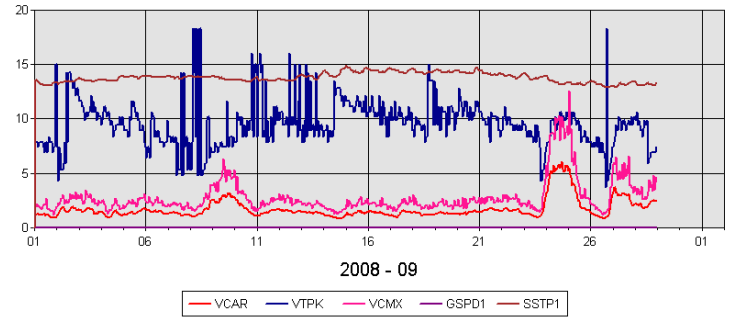
Wave Links
Selected links relevant to the Canadian operational wave programme.

Other

Other off-line wave products and services may be available by request.

Date Modified: 2008-06-03 — Top of the page — Important Notices





C46207

Date	QC	SWH	PP	VCMX	GSPD1	SSTP1
01/09/2008 00:26	1	1.21	7.88	2.1	0.0	13.6
01/09/2008 01:26	1	1.25	7.88	1.9	0.0	13.6
01/09/2008 02:26	1	1.30	7.88	2.2	0.0	13.5
01/09/2008 03:26	1	1.24	7.42	1.9	0.0	13.4
01/09/2008 04:26	1	1.22	7.88	1.9	0.0	13.3
01/09/2008 05:26	1	1.20	7.88	1.8	0.0	13.2
01/09/2008 06:26	1	1.20	7.88	1.7	0.0	13.2
01/09/2008 07:26	1	1.23	7.88	1.9	0.0	13.2
01/09/2008 08:26	1	1.26	7.42	2.1	0.0	13.1
01/09/2008 09:26	1	1.27	6.92	2.2	0.0	13.1
01/09/2008 10:26	1	1.12	7.88	2.1	0.0	13.1

Environment Canada Marine Weather

Environment Canada | Environnement Canada | Canada

Weatheroffice
www.weatheroffice.gc.ca

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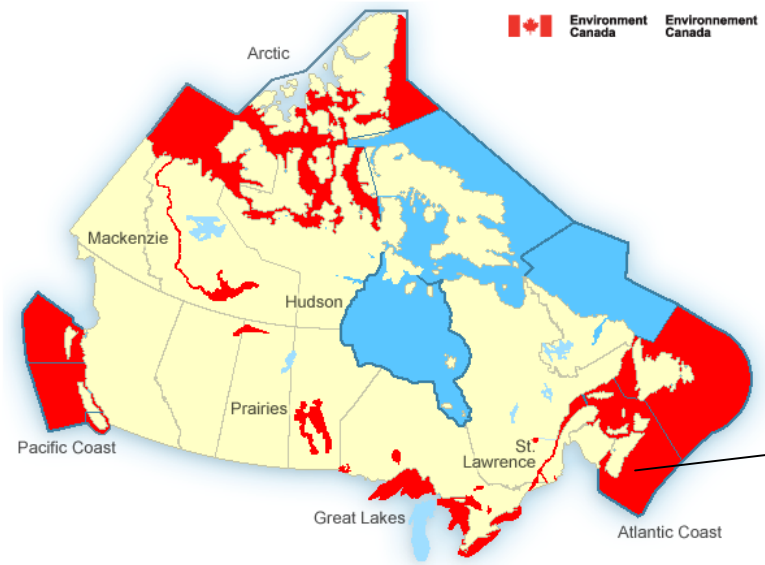
Proactive Disclosure

Marine Weather for Canada

Click on a region of the country to select the marine forecast of interest



Warning | Watch | Ended warning or watch | No warning or watch

MARINE SERVICES ONLINE

East Scotian Slope

Forecast | Weather Conditions | Ice Conditions
Warnings | Synopsis | Maps | Glossary | Another Area

Past 24 Hour Conditions

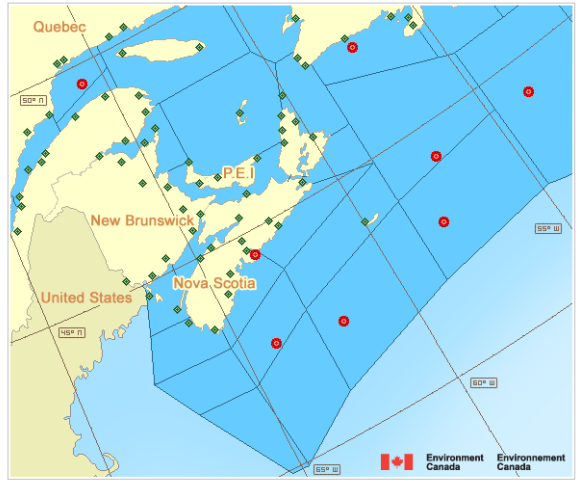
Current Conditions | Past 24 Hour Conditions | Regional Summary

Southwestern Grand Banks - 44138
05:00 PM ADT 30 September 2008

Date / Time (ADT)	Wind (knots)	Wave height (m)	Wave period (s)	Pressure (kPa)	Air temp (°C)	Water temp (°C)
30 September 2008						
17:00	NNE 9 gust 11	2.5	12	101.0	15	16
16:00	NNE 7 gust 7	3.0	13	101.0	15	16
15:00	NE 5 gust 7	3.0	12	101.0	15	16
14:00	NE 7 gust 7	3.0	12	101.0	15	15
13:00	ENE 7 gust 9	3.0	13	101.1	15	16
12:00	E 7 gust 9	2.5	12	101.1	15	16
11:00	E 9 gust 11	2.5	11	101.2	15	15
10:00	ENE 9 gust 11	2.0	12	101.2	15	15
9:00	ENE 7 gust 9	2.0	9	101.2	15	15
8:00	ENE 7 gust 9	2.0	12	101.2	15	15
7:00	ENE 7 gust 11	2.5	12	101.2	15	15
6:00	ENE 7 gust 9	2.5	11	101.2	15	15
5:00	NE 5 gust 7	2.5	12	101.3	15	15
4:00	ENE 7 gust 11	2.5	11	101.3	15	15
3:00	ENE 11 gust 13	3.0	10	101.3	15	15
2:00	ENE 7 gust 11	3.0	12	101.3	16	16
1:00	ENE 11 gust 13	3.0	11	101.4	15	16
00:00	ENE 9 gust 11	3.0	12	101.4	15	16

If you require additional historical weather information please visit
Marine Environmental Data Services

Select a location below: Select a Buoy or Land Station Go



Legend: Buoy Land Station » US Marine Weather

The 10% Difference

- Low frequency cutoff accounts for some reduction in SWH for buoys in less than 233 m since 2002.
- SWS-1 indicated that the strap-down accelerometer consistently undervalues wave heights by about 10% over gimballed Datawell MKII.
- Differences in American/Canadian sampling and timeseries processing onboard the buoys.
  - If SWS TS data is available it might be worth comparing Spectra/SWH/PP from different processors.

ISDM

Integrated Science Data Management

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Bruce Bradshaw

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