The MSC50 Wind and Wave Reanalysis

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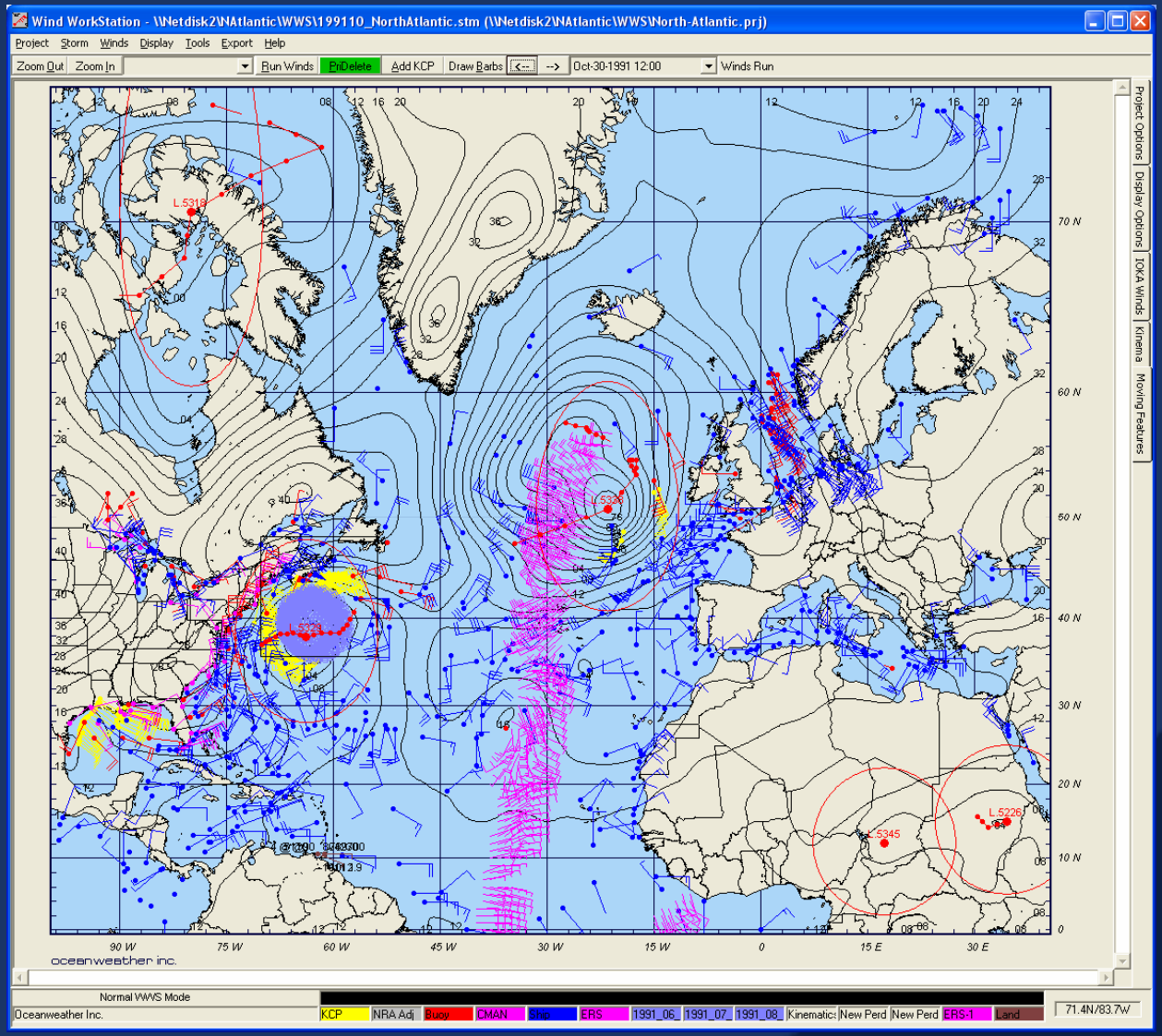
Introduction: History of Studies leading up to the MSC50

- 1982-85: 29 Severe storms for Hibernia platform
- 1989: PERD update to include 68 storms in Grand Banks, Scotian Shelf, and Georges Bank
- 1995/96: 82 Storms on 3rd generation wave model
- 1997: AES40 – 40+ years of continuous winds and waves on North Atlantic grid

Introduction: Purpose of MSC50

- Model the Canadian East Coast at significantly higher resolution
- Include shallow water modeling
- Increase resolution of North Atlantic basin model
- Increase temporal resolution of archive
- Increase accuracy to reduce uncertainty on any climate or design data statistics

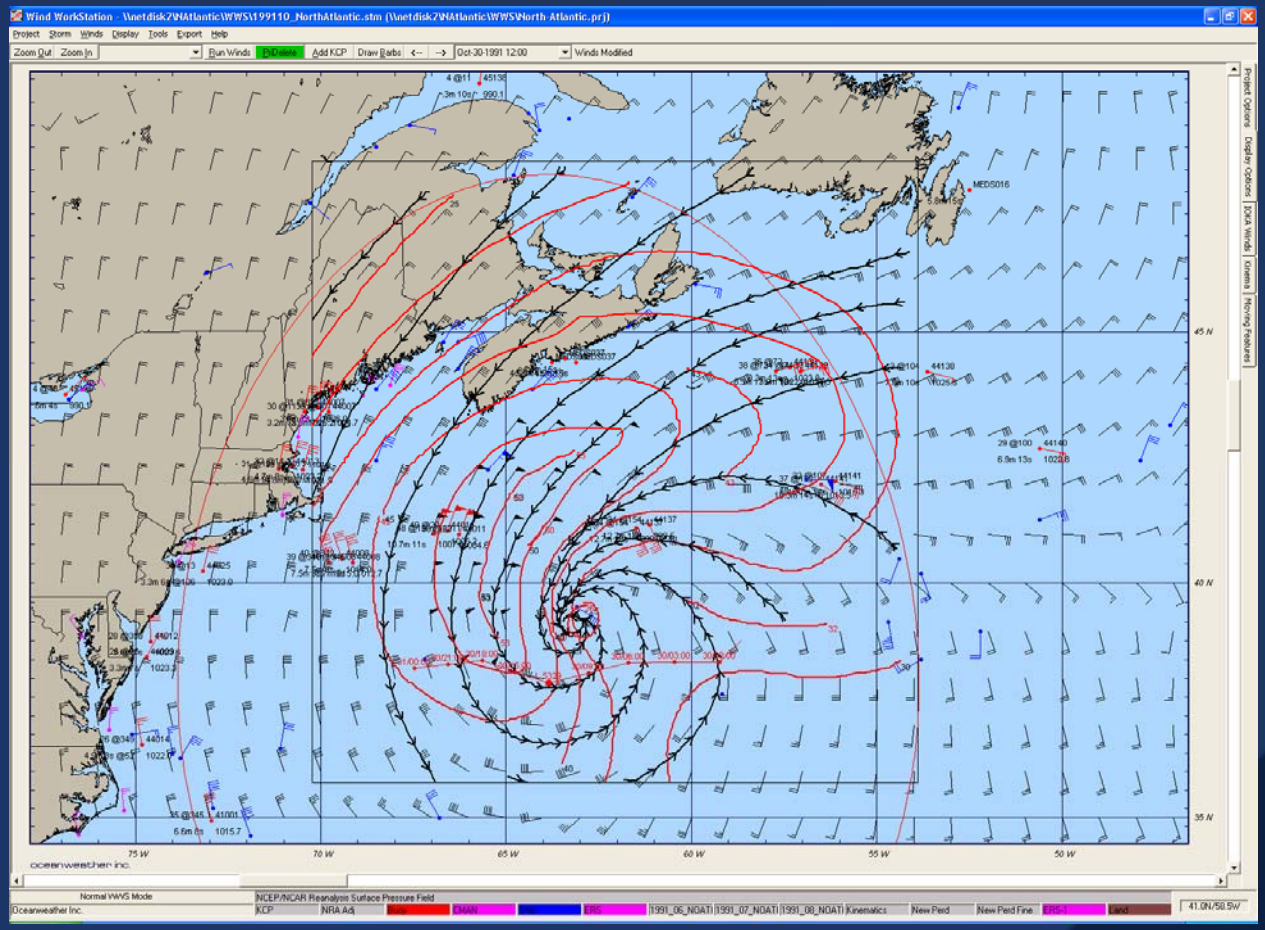
Methodology: Wind Fields



Screenshot of the Wind WorkStation used for analysis of the NA wind fields

AES40 which employed 10,000+ hours of analysis was used as basis with improvements in storm hindcasting techniques

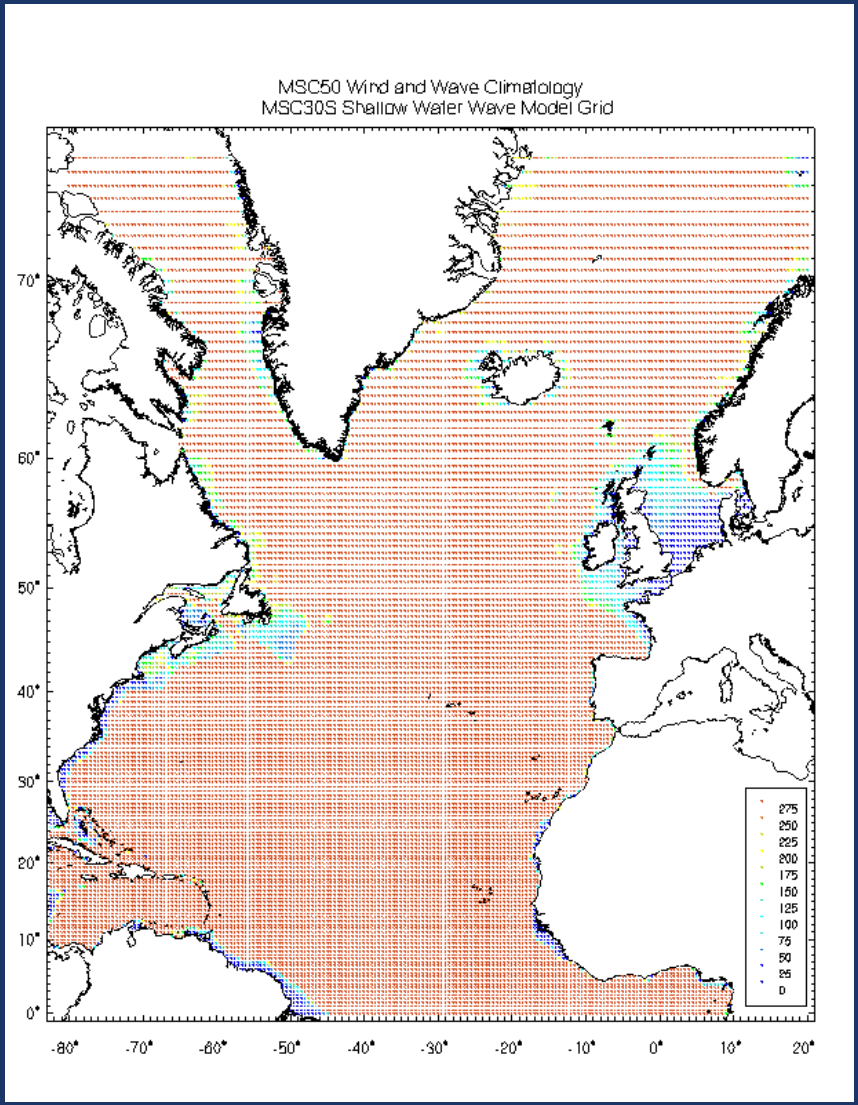
Methodology: Wind Fields

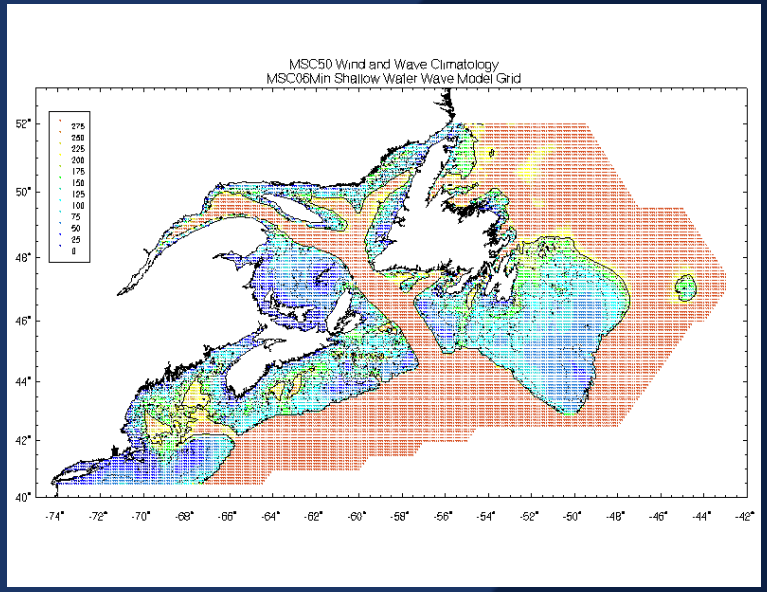


Sample of direct isotach and streamline analysis in the WWS during the “Halloween Storm” of 1991.

The MSC50 project led to the data recovery of original hand-drawn kinematic analyses from previous projects

Methodology: Wave Models





MSC30S (left):

0.5-degree 3G Shallow

18637 active grid points

MSC06Min (Above):

0.1-degree 3G Shallow

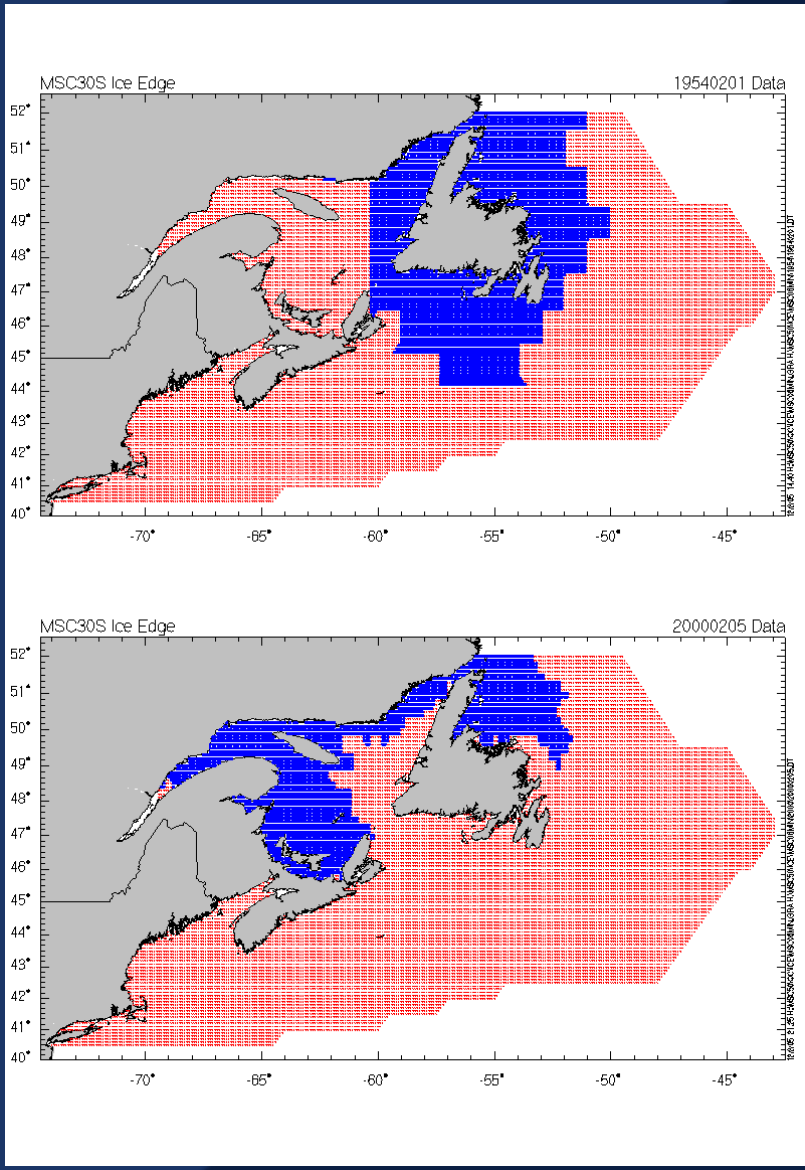
18551 active grid points

Methodology: Ice Edge

Source	Frequency	Coverage	Date Range
Walsh and Johnson	Monthly	Full	Jan 1954-Dec 1971
SIGRID	Weekly	Full	Jan 1972-Oct 1978
GFSC	Daily	Full	Nov 1978-Dec 2000
DMSP	Daily	Full	Jan 2001-Present
CIS Gridpoint	Weekly	Canadian Waters	Jan 1962-Jul 1983
CIS NetCDF	Weekly	Canadian Waters	Jan 1971-Present

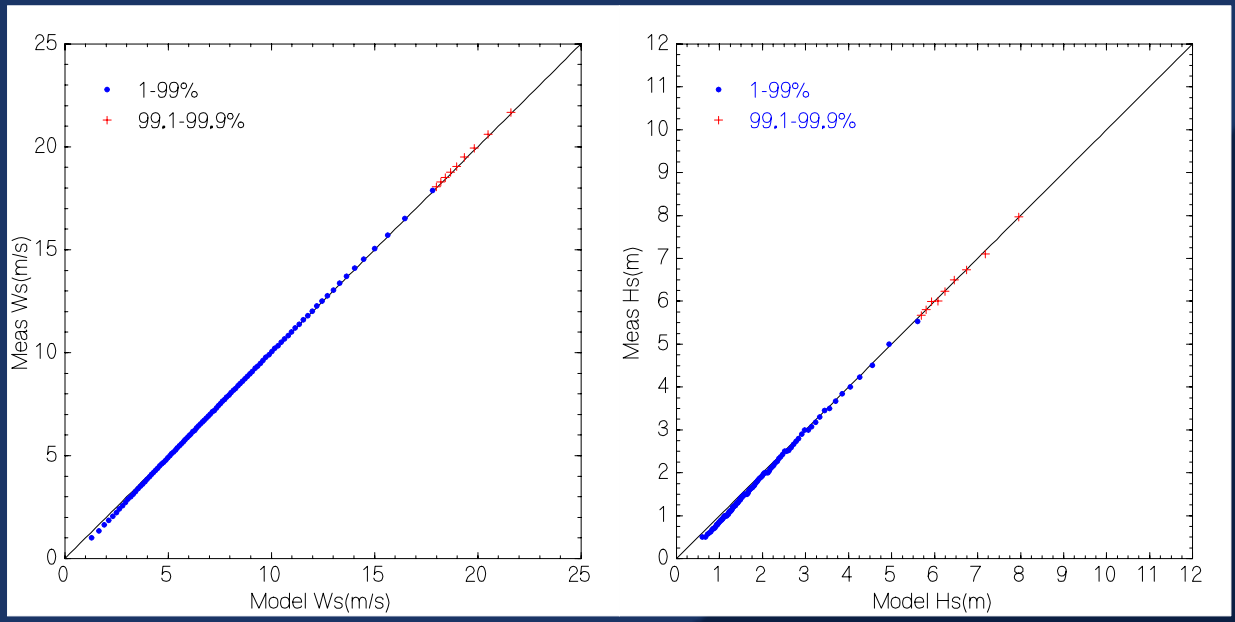
Methodology: Ice Edge

CIS Weekly Ice data (below) applied 1962-present available at much higher resolution than mid-monthly Walsh and Johnson archive applied from 1954-1961

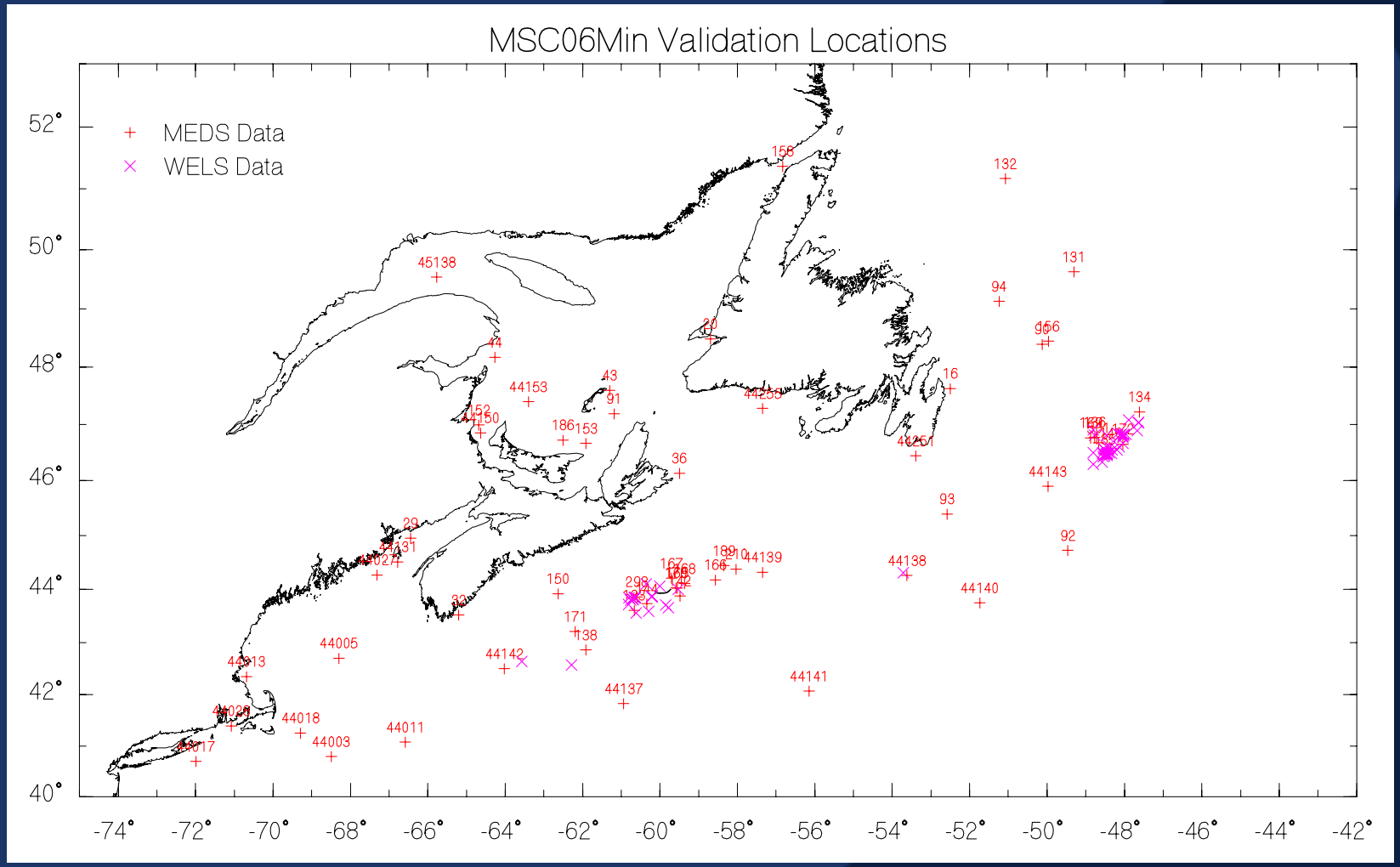


Validation: NA Basin Hindcast *Insitu* Validation

	Number of Points	Mean Meas	Mean Hind	Diff (H-M)	RMS Error	Std. Dev.	Scatter Index	Corr. Coeff.
Ws (m/s)	2827968	7.49	7.54	0.05	0.71	0.71	0.09	0.98
Wd (°)	2806995	242.94	243.61	-0.02	N/A	8.00	0.02	N/A
Hs (m)	2316795	1.83	1.93	0.10	0.32	0.30	0.17	0.96
Period (s)	2168226	6.37	6.10	-0.27	0.93	0.89	0.14	0.91
VMD(°)	241169	127.86	139.10	9.17	N/A	23.76	0.07	N/A



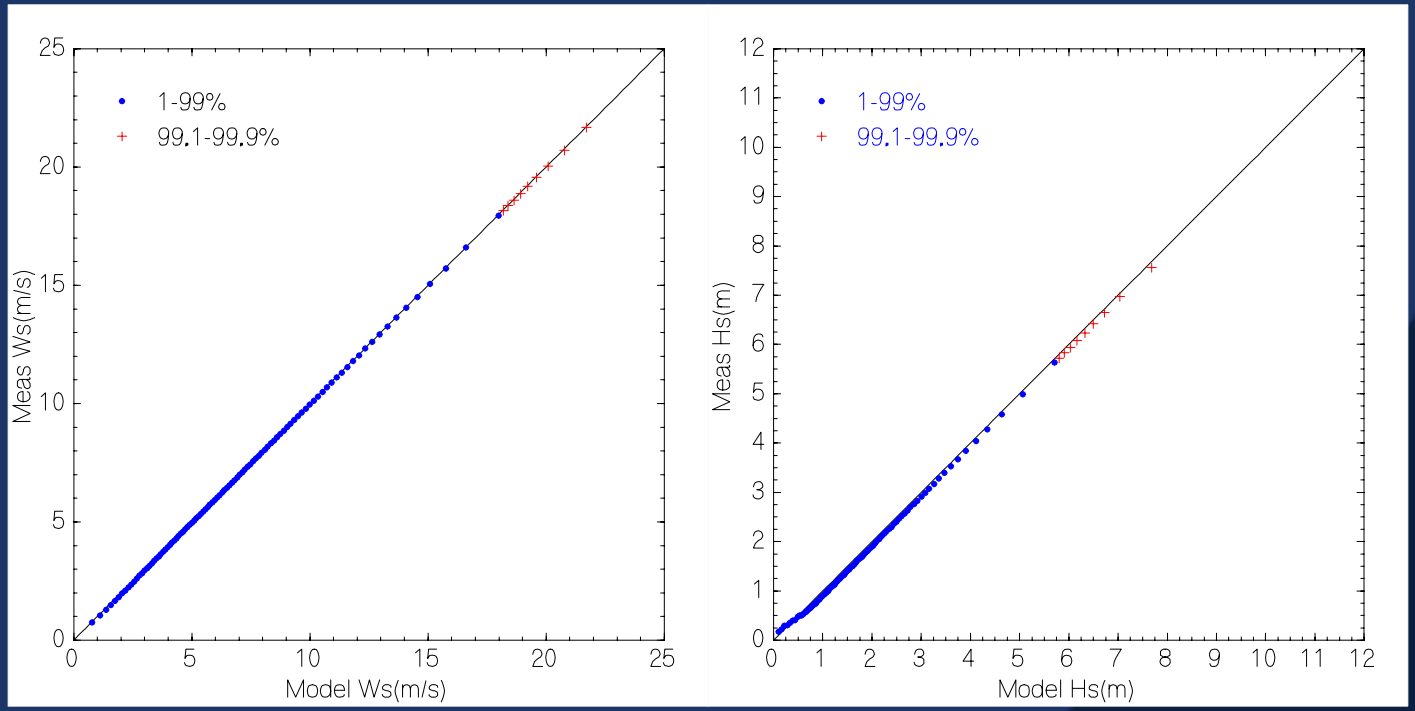
Validation: Regional Validation Locations



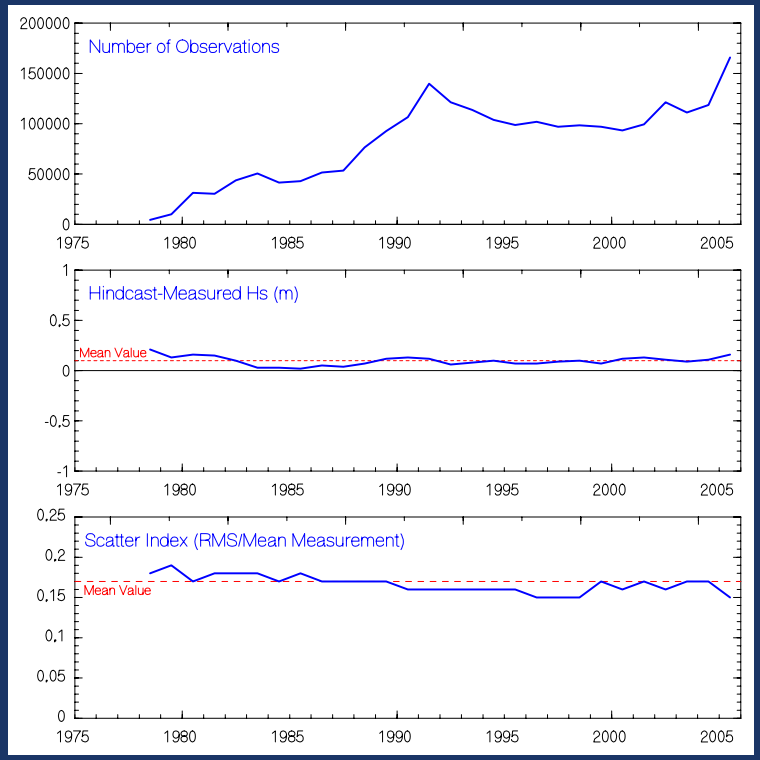
Validation: Regional Hindcast *Insitu* Validation

	Number of Points	Mean Meas	Mean Hind	Diff (H-M)	RMS Error	Std. Dev.	Scatter Index	Corr. Coeff.
Buoys with Depths < 50 meters								
Ws (m/s)	208011	6.29	6.28	-0.01	0.46	0.46	0.07	0.99
Wd (°)	204717	254.32	254.92	0.75	N/A	6.56	0.02	N/A
Hs (m)	282913	1.05	1.12	0.07	0.27	0.26	0.25	0.95
Period (s)	274143	5.68	5.34	-0.35	0.90	0.84	0.15	0.91
VMD(°)	26385	84.31	89.11	7.48	N/A	20.18	0.06	N/A
All Data Combined								
Ws (m/s)	951814	6.99	7.04	0.04	0.69	0.69	0.10	0.98
Wd (°)	947891	259.50	260.48	0.41	N/A	8.62	0.02	N/A
Hs (m)	1271451	1.72	1.80	0.08	0.32	0.31	0.18	0.96
Period (s)	1249378	7.09	6.81	-0.28	0.89	0.85	0.12	0.94
VMD(°)	26385	84.31	89.11	7.48	N/A	20.18	0.06	N/A

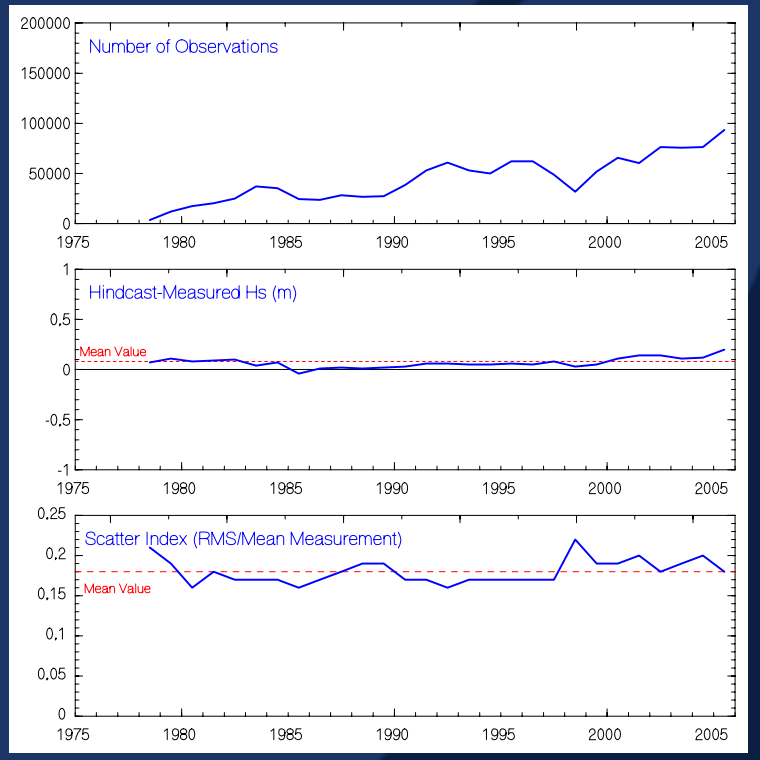
Validation: Regional Hindcast *Insitu* Validation



Validation: *Insitu* Validation over Time



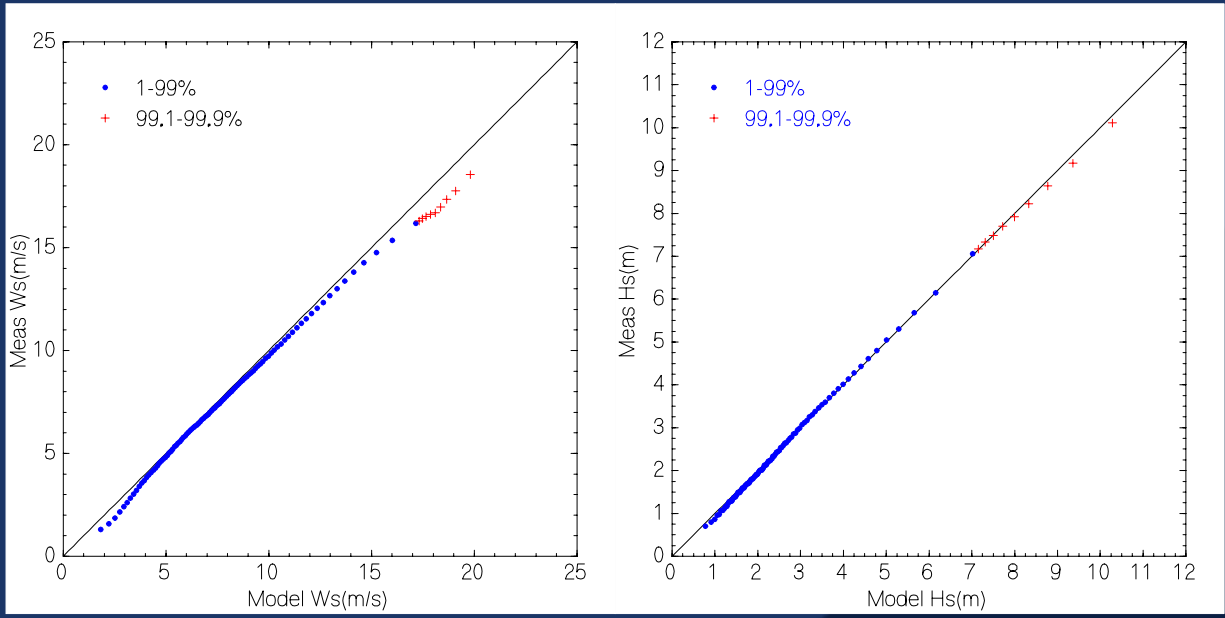
MSC50 NA Basin



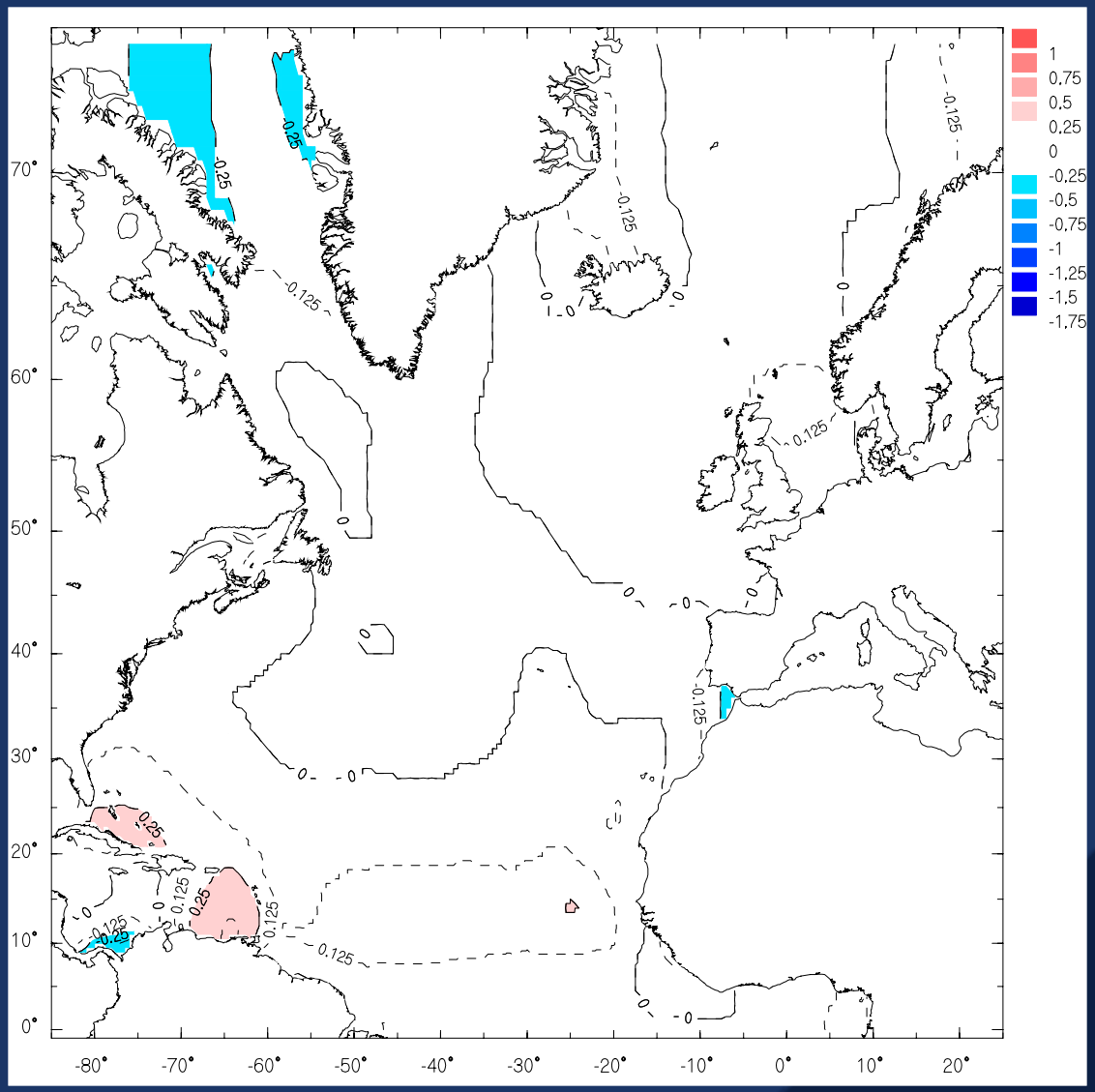
MSC50 Regional

Validation: Basin Hindcast Altimeter Validation

	Number of Points	Mean Meas	Mean Hind	Diff (H-M)	RMS Error	Std. Dev.	Scatter Index	Corr. Coeff.
Ws (m/s)	5063147	7.45	7.69	0.24	1.52	1.50	0.20	0.90
Hs (m)	5434181	2.43	2.47	0.04	0.40	0.40	0.17	0.95

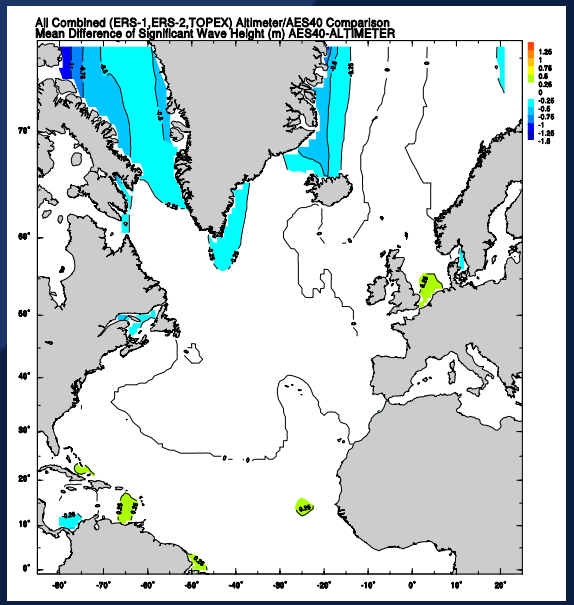


Validation: Basin Hindcast Altimeter Validation

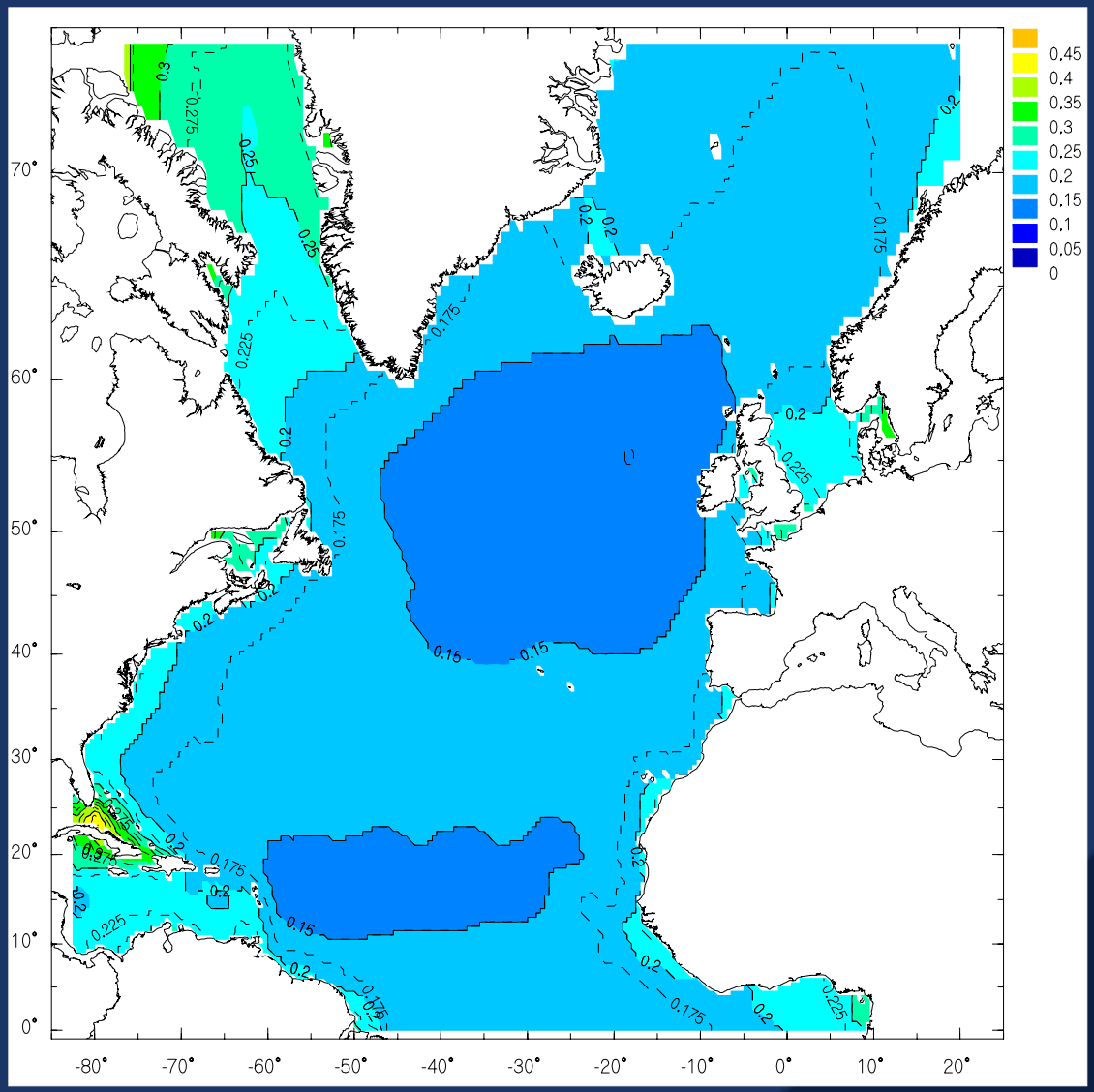


Mean Bias of MSC30S Basin Hindcast vs. Combined Altimeter Measurements

AES40 Mean Bias

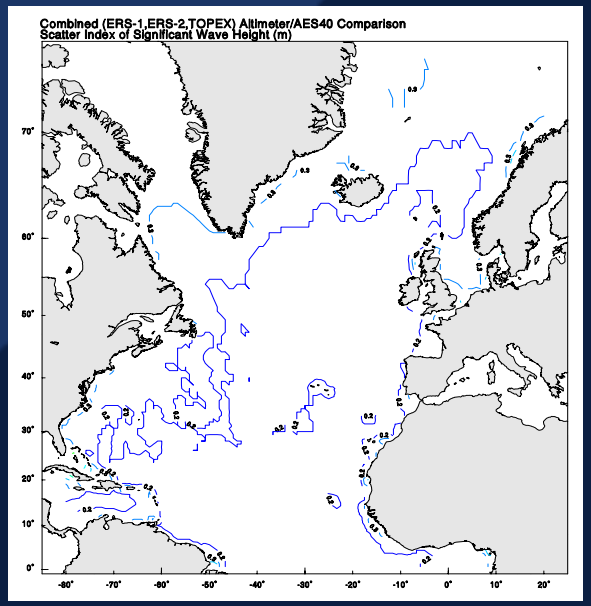


Validation: Basin Hindcast Altimeter Validation

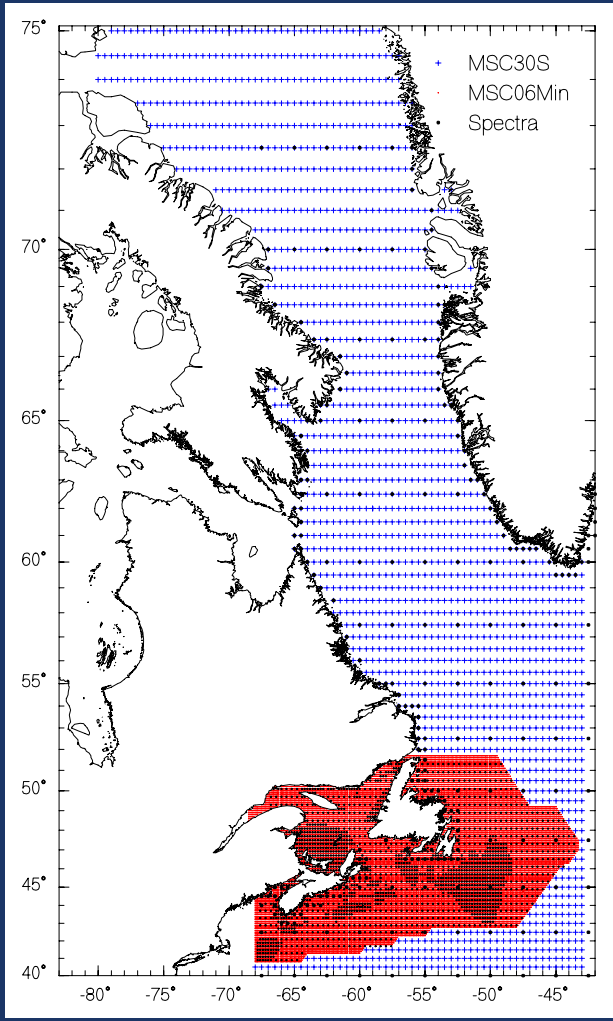


Scatter Index (RMS/Mean Meas) of MSC30S Basin Hindcast vs. Combined Altimeter Measurements

AES40 Scatter Index

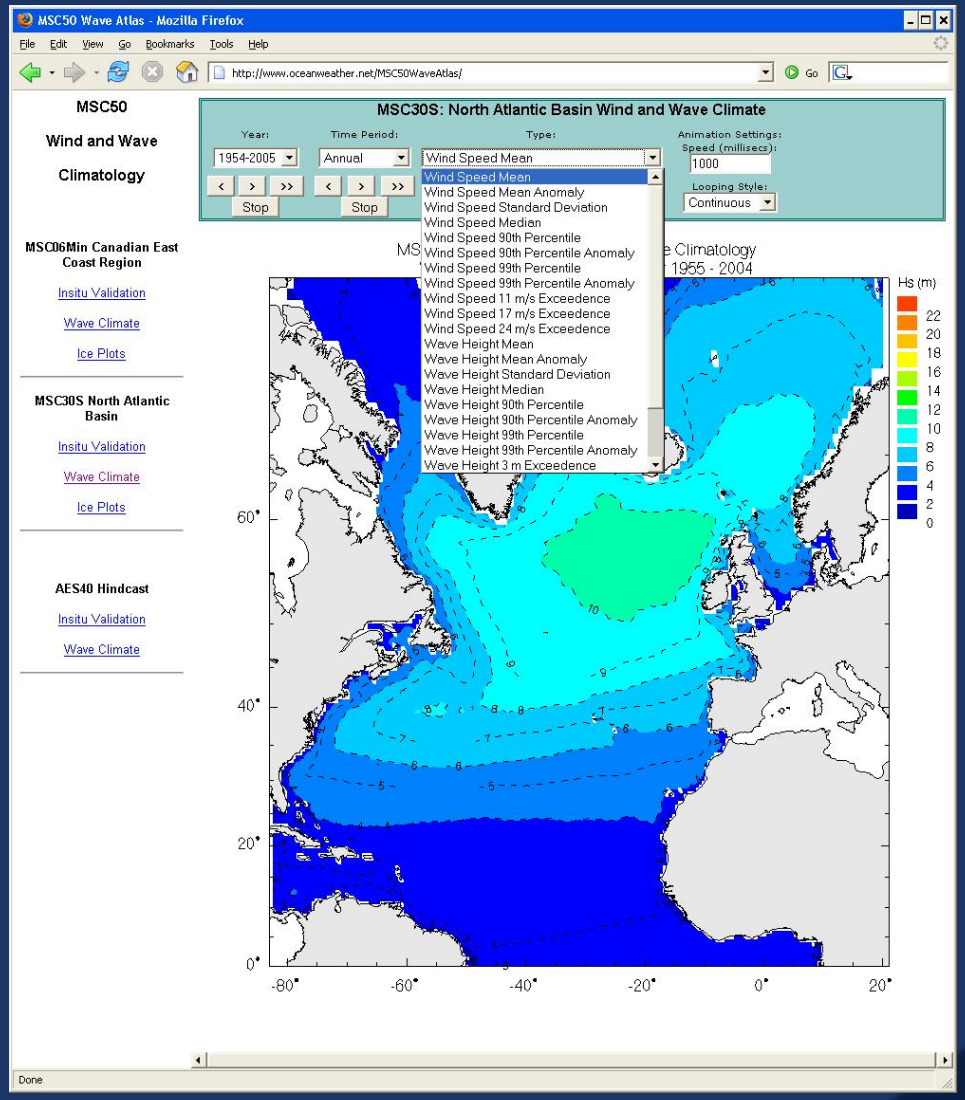


Reanalysis Products: Hindcast Saveset



- MSC30S Basin 3-hourly archive
- MSC06Min Region 1-hourly archive
- Wind and wave fields at all locations in Canadian waters
- 2-D Wave spectra at numerous locations
- All data point-sorted for easy reference

Reanalysis Products: Wave Atlas



Wind and Wave (All, Annual, Monthly):

- Mean
- Median
- 90th Percentile
- 99th Percentile
- Exceedences at 3 levels

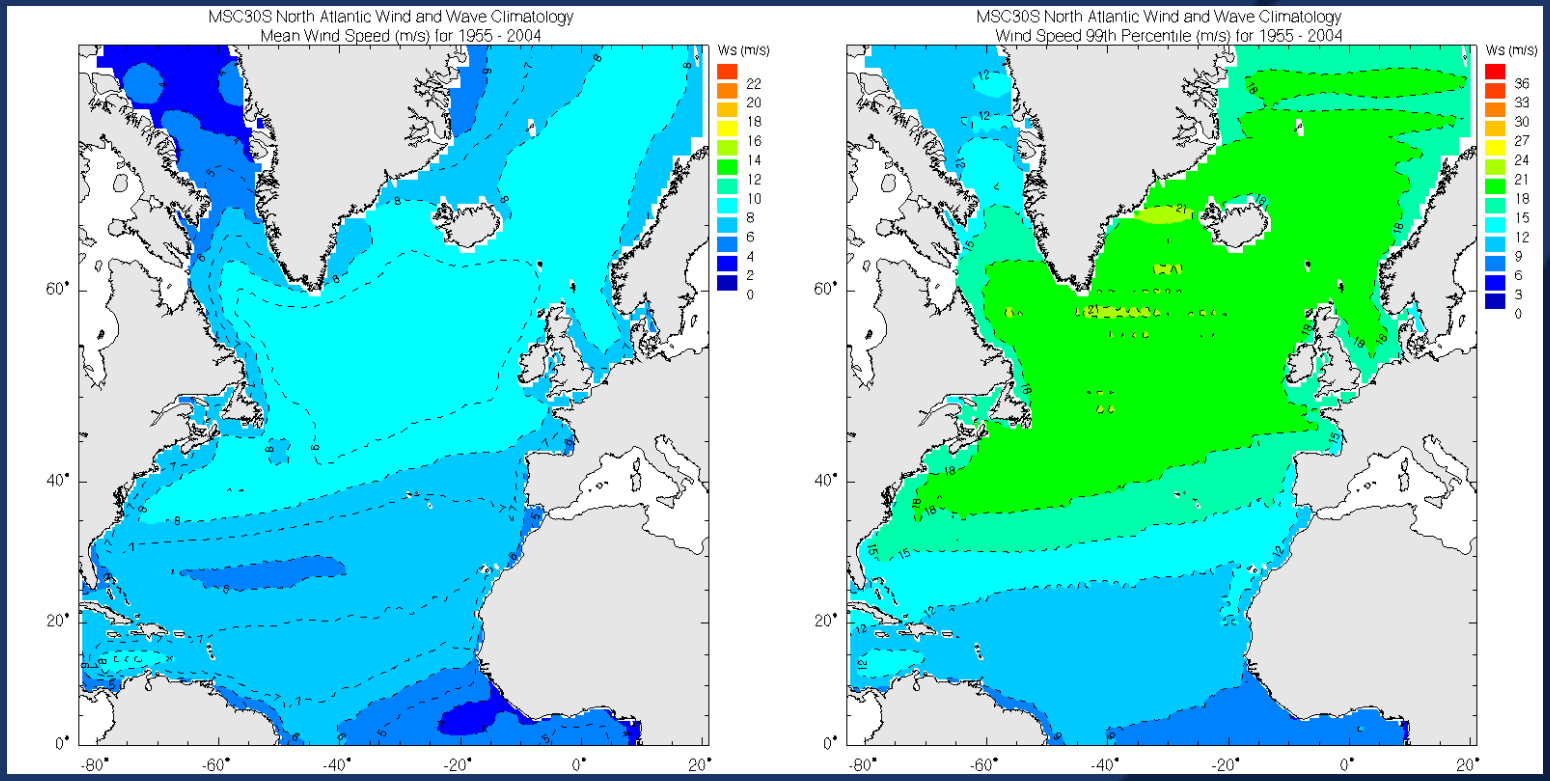
Wind and Wave Anomalies:

- Mean
- Median
- 90th Percentile
- 99th Percentile

http://www.oceanweather.com/MSC50WaveAtlas

Select plots also on MSC50 Poster

Reanalysis Products: Wave Atlas



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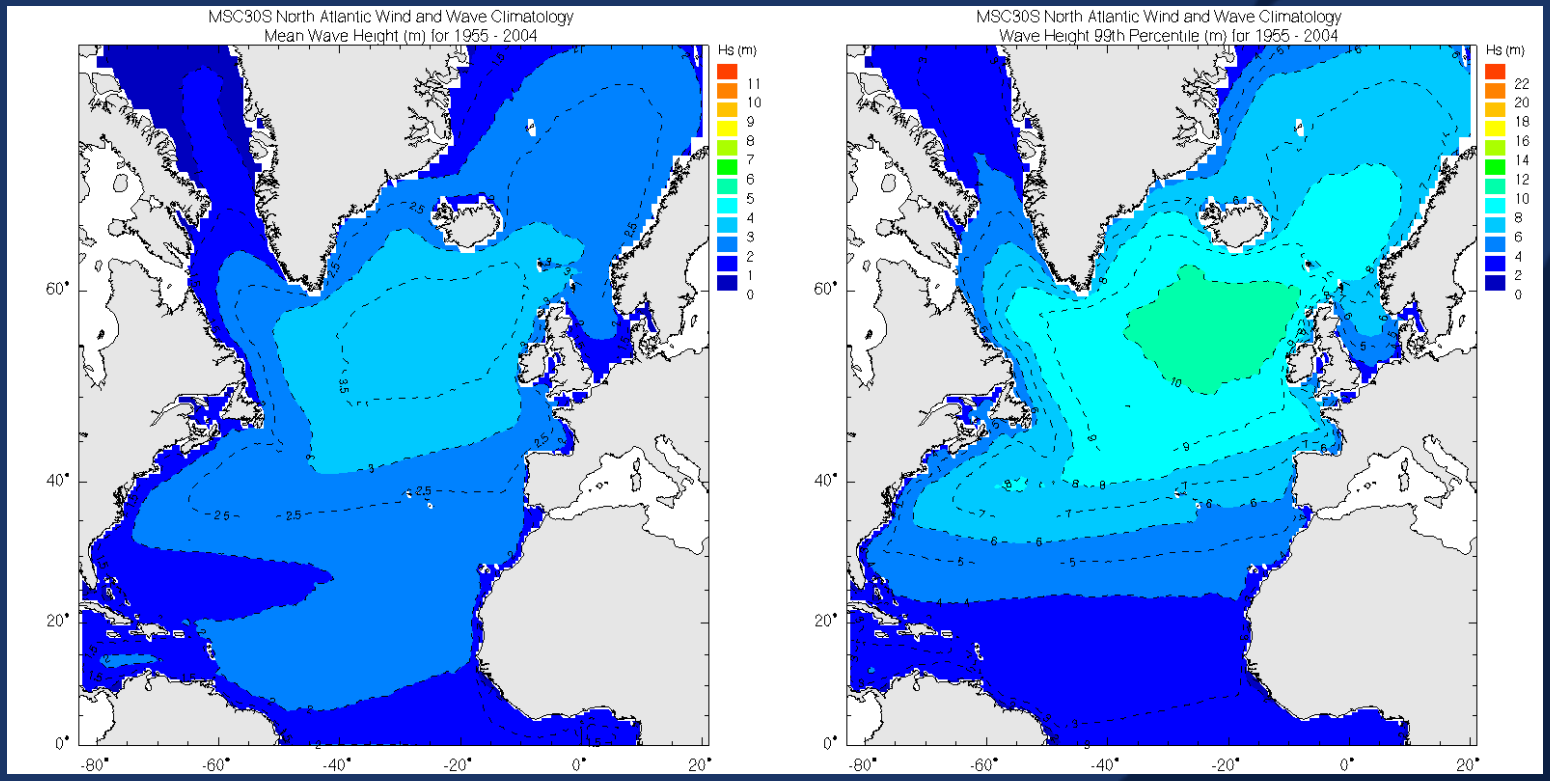

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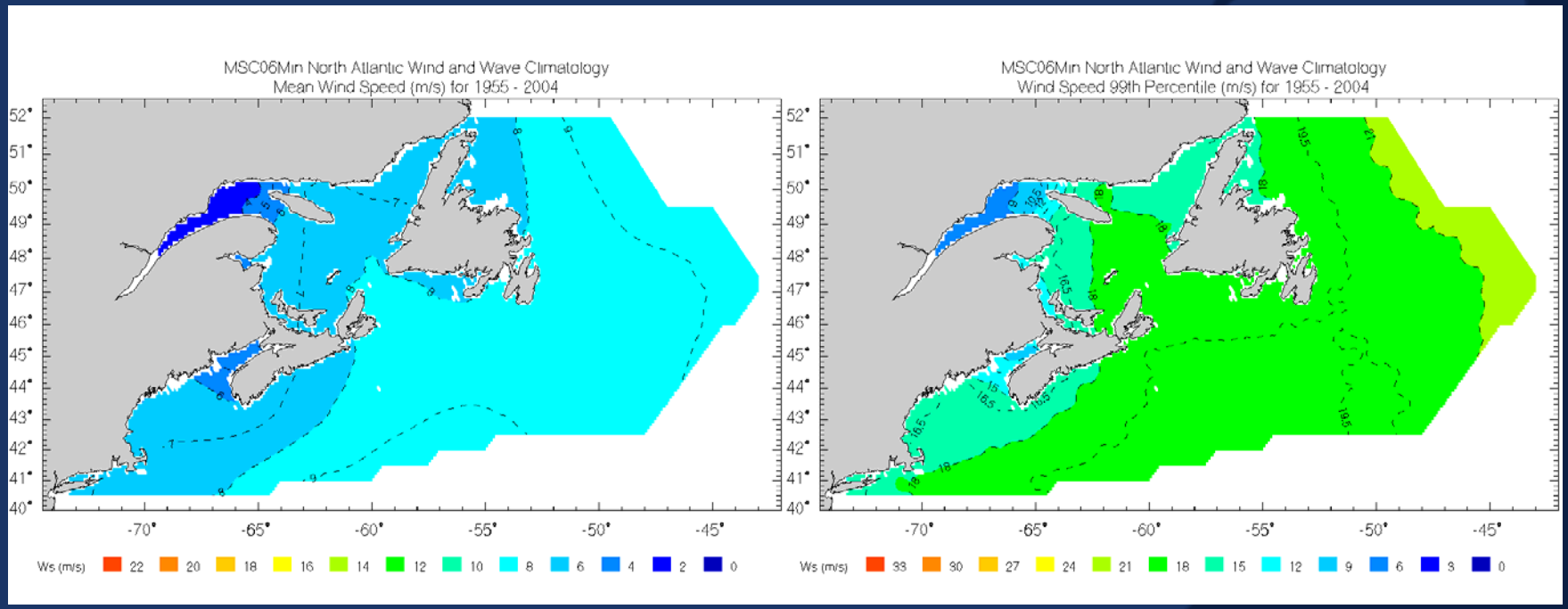
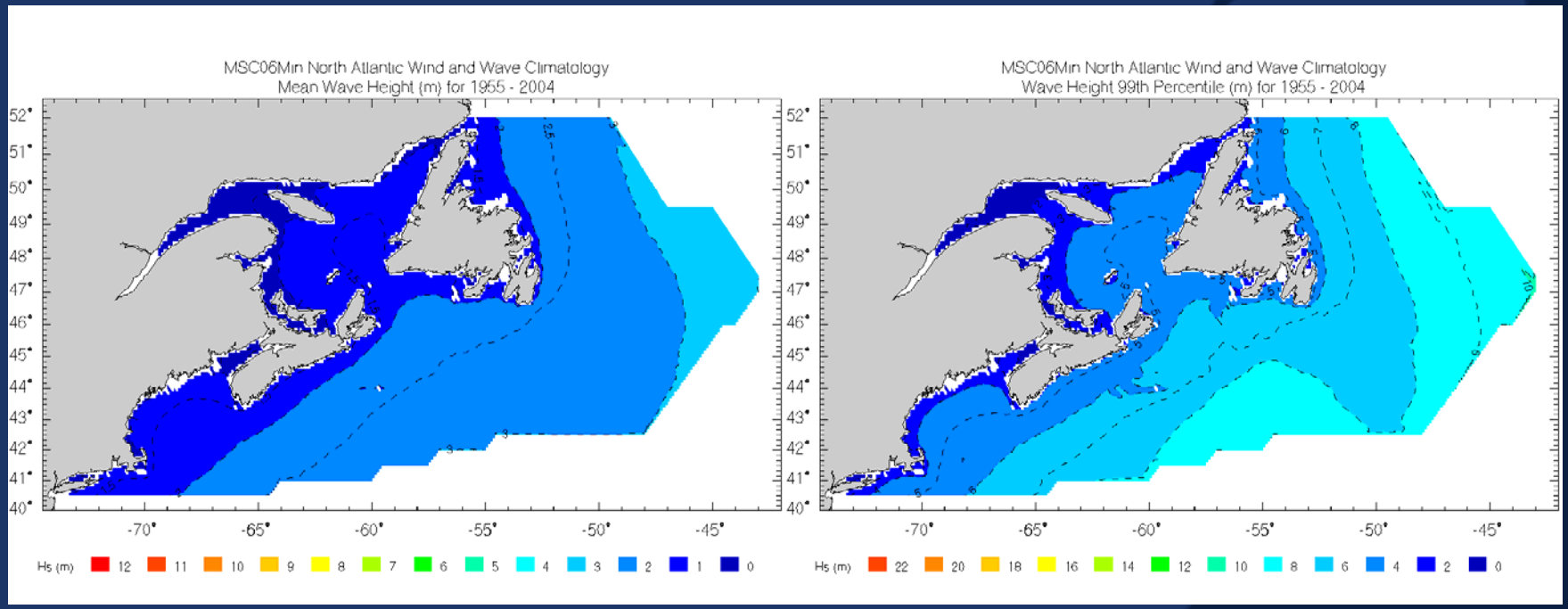
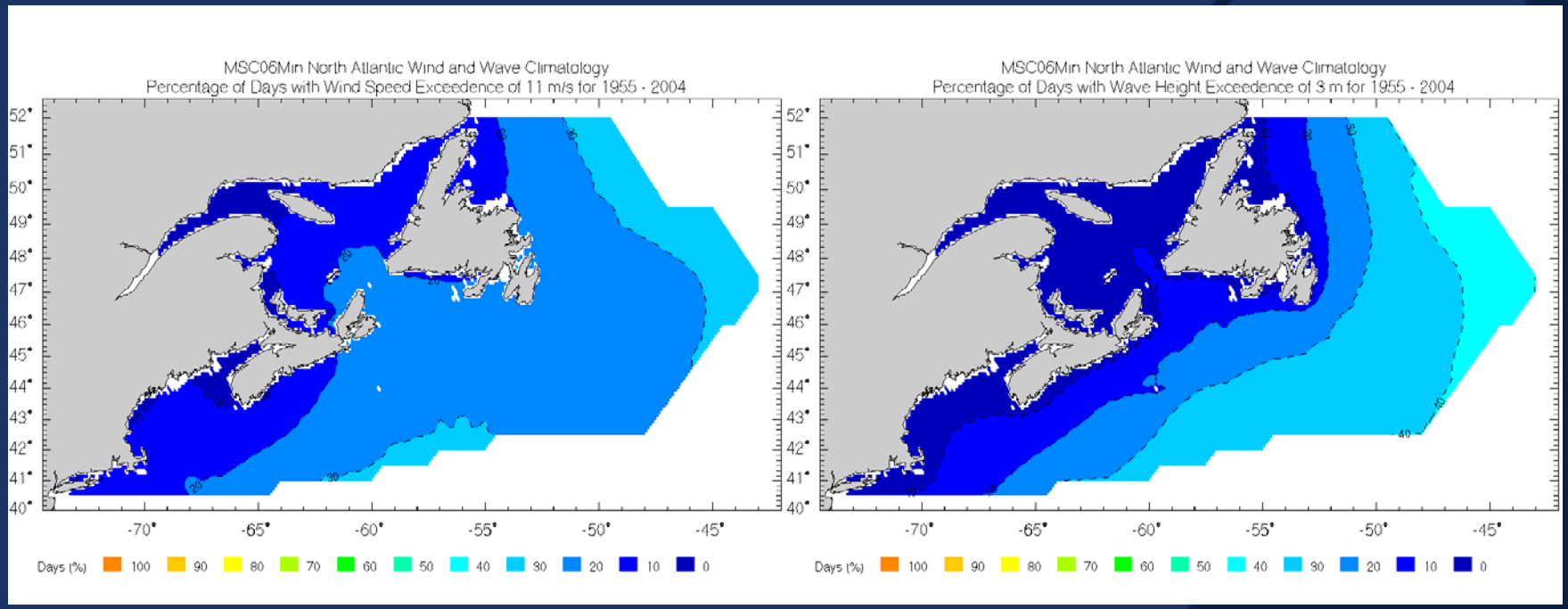


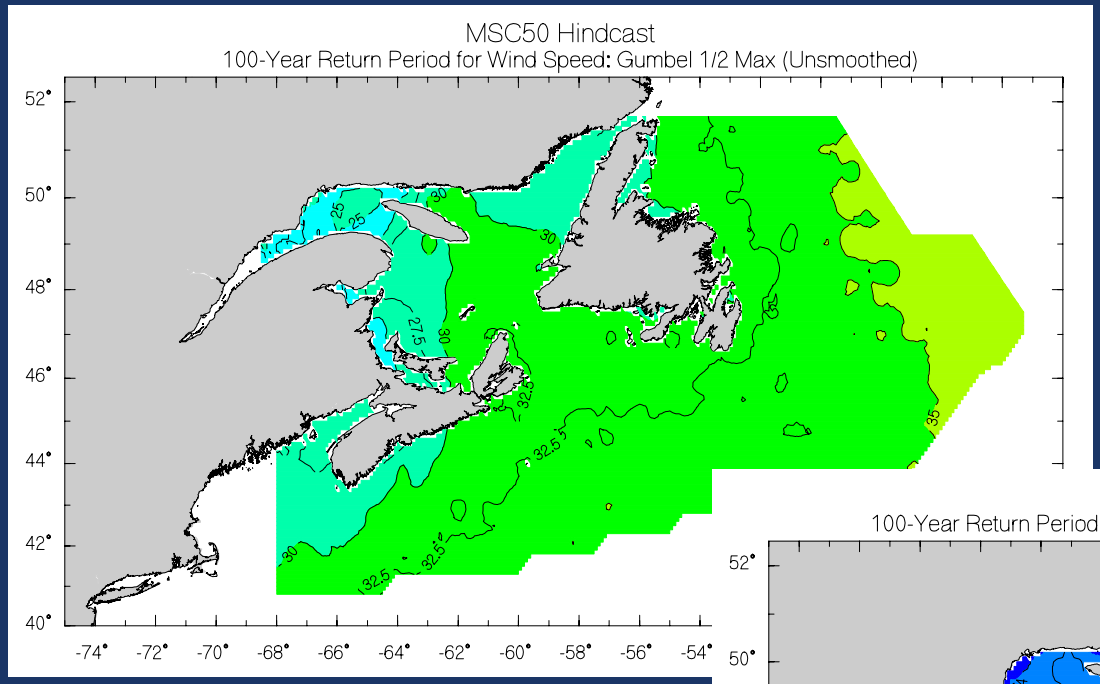
Reanalysis Products: Wave Atlas

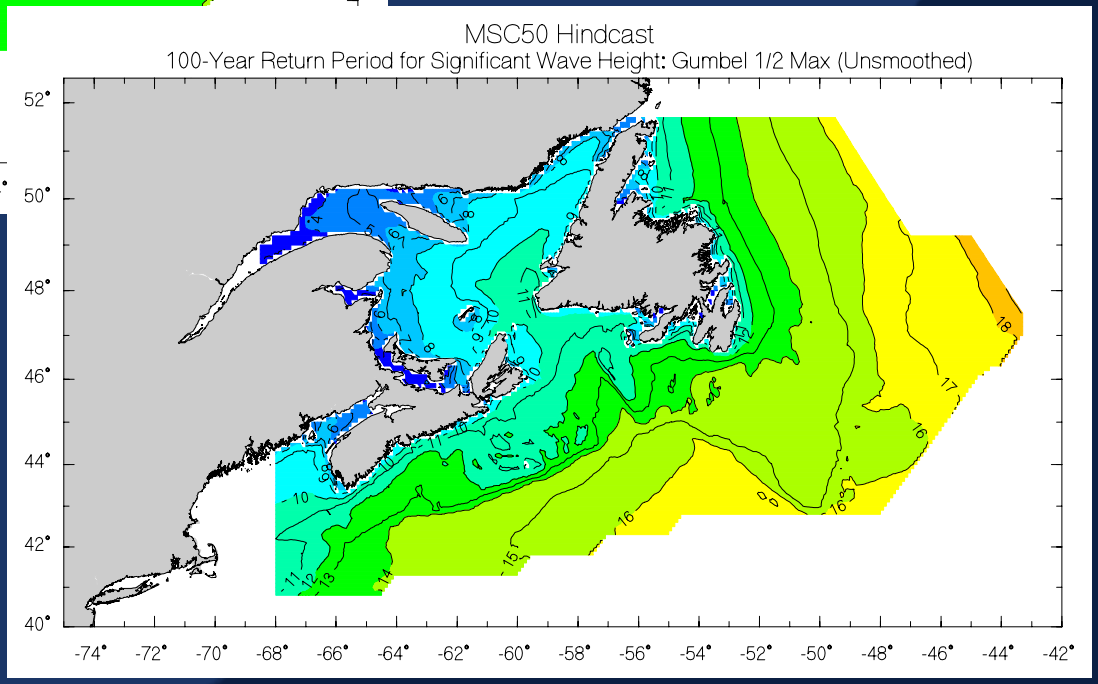


Reanalysis Products: Wave Atlas

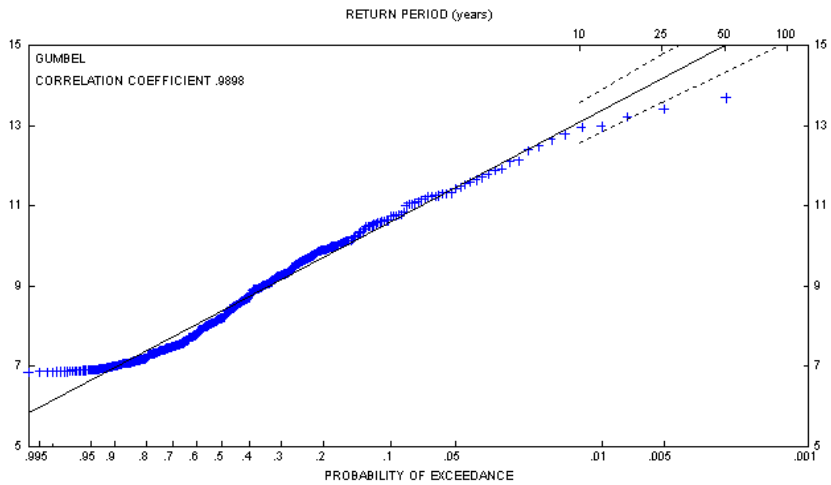


Reanalysis Products: Extremes





Reanalysis Products: Extremes at Hibernia

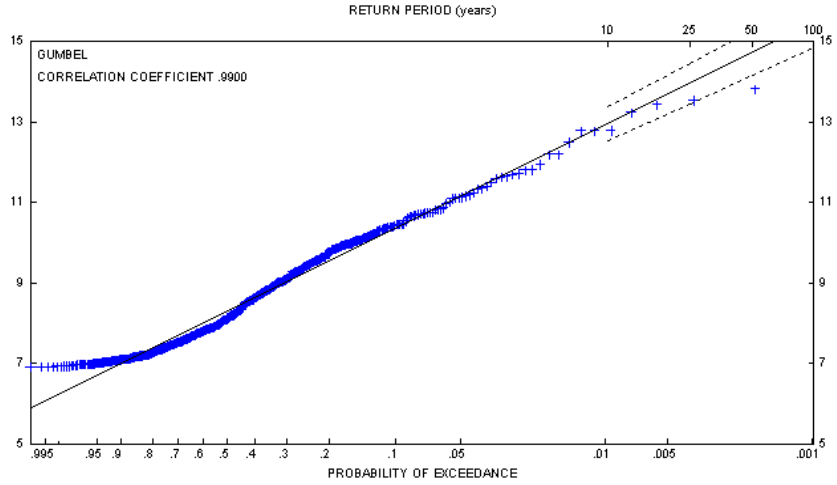


AE GPT 5622: Significant Wave Height (m) (Peak values)
Max 13.704 * 0.5 = 6.852; 399 storms in 51 years

Gumbel Parameters: Location 7.949632, Scale 1.179588

Period	Prob.	Gumbel	lcl	ucl
10.0	0.0127820	13.08	12.58	13.59
25.0	0.0051128	14.17	13.57	14.77
50.0	0.0025564	14.99	14.32	15.66
100.0	0.0012782	15.81	15.07	16.54

AES40



M6 GPT 11226: Significant Wave Height (m) (Peak values)
Max 13.822 * 0.5 = 6.911; 533 storms in 52 years

Gumbel Parameters: Location 7.918212, Scale 1.089068

Period	Prob.	Gumbel	lcl	ucl
10.0	0.0097561	12.96	12.53	13.38
25.0	0.0039024	13.96	13.46	14.45
50.0	0.0019512	14.71	14.16	15.27
100.0	0.0009756	15.47	14.86	16.08

MSC50

Summary

- MSC50 provides a new high resolution wind and wave hindcast at higher temporal and spatial resolution than previous efforts
- When compared to AES40 the new hindcast reduces scatter by 43% compared to insitu data and 29% when compared to altimeter data while remaining unbiased across the 1-99th percentiles
- MSC50 represents a further advancement in the quest to reduce the uncertainty in wind and wave hindcasting

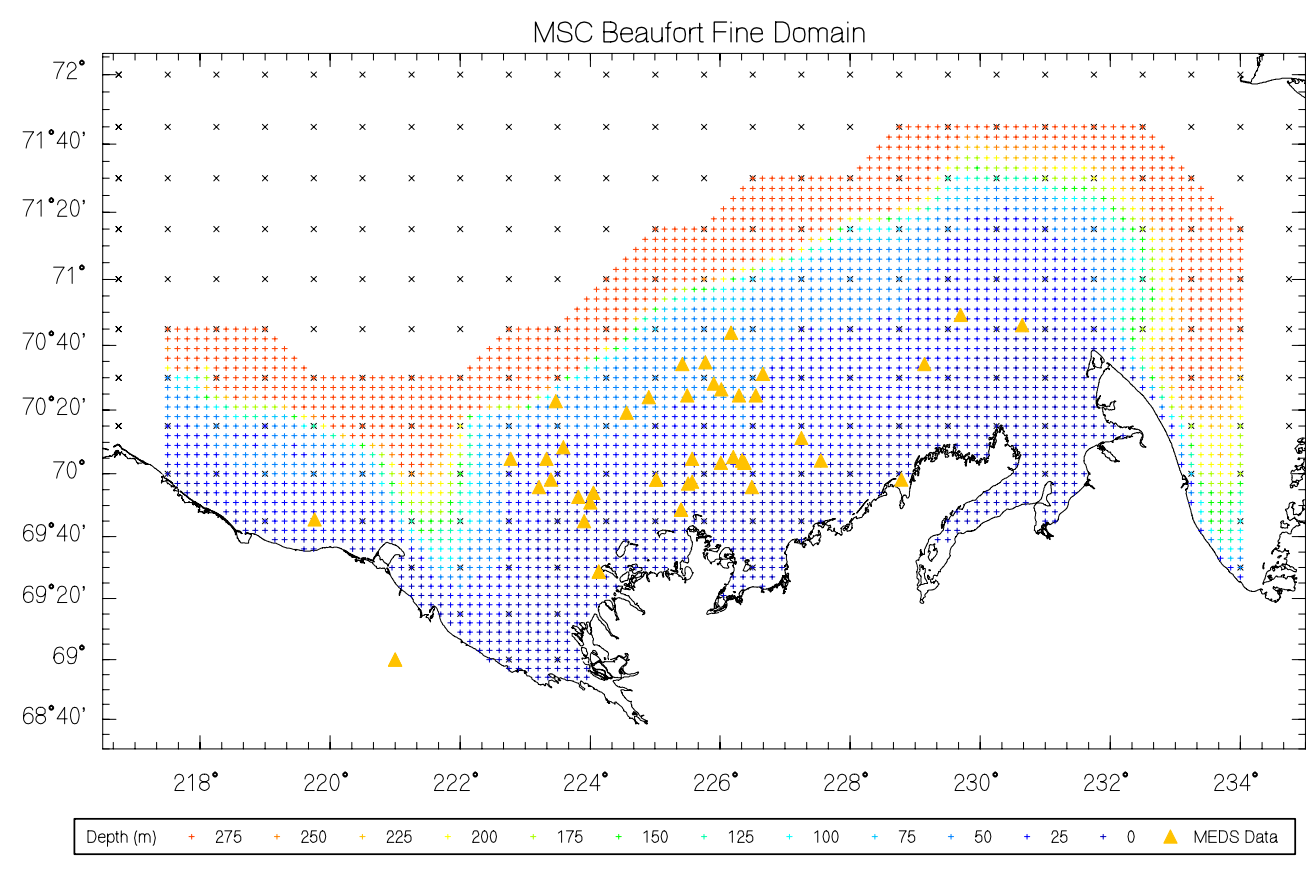
Come to the 10th Waves Workshop in Hawaii and see the MSC20B Wind and Wave Climatology

0.1-degree fine domain

Hindcast period 1986-2006

Archive of wind/wave fields and spectra in Canadian waters

Project start April 2006, complete April 2007



MSC20B Wind and Wave Climatology

- 0.1-degree fine domain
- Hindcast period 1986-2006
- Archive of wind/wave fields and spectra in Canadian waters
- Project start April 2006, complete April 2007