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**THERMAL PROTECTION IN LIFE RAFTS:
ASSESSMENT OF OCCUPANT HEAT BALANCE
AND
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ENVIRONMENTAL CONDITION, RAFT FACTORS AND OCCUPANT FACTORS**

TR-2006-21

Mak, L.M. and Kuczora, A.

September 2006

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1.0 Introduction

The thermal protection in life rafts project is aimed to –

1. Assess and propose thermal protection requirements for unprotected life raft occupants in a ship abandonment situation, where after evacuating into a life raft, the occupants sit on the floor.
2. Develop and propose standard test methods to evaluate the thermal protection performance of life rafts.
3. Provide quantitative performance data and practical knowledge to stakeholders to support operational decision-making and inform the activities of vessel operators, marine emergency training providers and SAR planners.

The combined impact is to reduce the risk of hypothermia and improve survivability at sea.

The important environmental conditions, raft factors and occupant factors determined from literature research are summarized in this report, to enable the project team to select the range of key variables to study.

2.0 Environmental Conditions

Three maritime regions in Canada with major ferry services are examined in this report –

- Atlantic Region
- Great Lakes
- British Columbia

Most of the environmental data summarized in this report are obtained from the following sources:

- (1) Fisheries and Oceans Canada
 - (a) Marine Environmental Data Services (MEDS)
 - (b) Bedford Institute of Oceanography - Oceanographic Databases
- (2) Environment Canada
 - (a) Canadian Climate Normals and Averages 1971-2000.

The MEDS data is available online at <http://www.meds-sdmm.dfo-mpo.gc.ca/>. Its databases contain over 6 million observed wave spectra from 500 locations in Canada. Schock and Tominson (2002) gave a description of the MEDS data.

The Bedford Institute of Oceanography - Oceanographic Databases are available at http://www.mar.dfo-mpo.gc.ca/science/ocean/database/data_query.html.

The Environment Canada data is also available online at http://www.climate.weatheroffice.ec.gc.ca/climate_normals/index_e.html.

These data are supplemented by other published data, wherever necessary.

2.1 Atlantic Region

The major ferry routes in this region include -

1. Gulf ferry routes between Argentia, Newfoundland and North Sydney, Nova Scotia (See Figure 1)
2. Gulf ferry routes between Port aux Basques, Newfoundland and North Sydney, Nova Scotia (see Figure 1)
3. High speed ferry between Fortune, Newfoundland and St. Pierre et Miquelon (see Figure 2).
4. Intra-provincial ferry routes to various parts of Newfoundland and Labrador (see Figure 3)

The MacLaren Plansearch, The East Coast of Canada report, gives a description of the environmental data for this area.

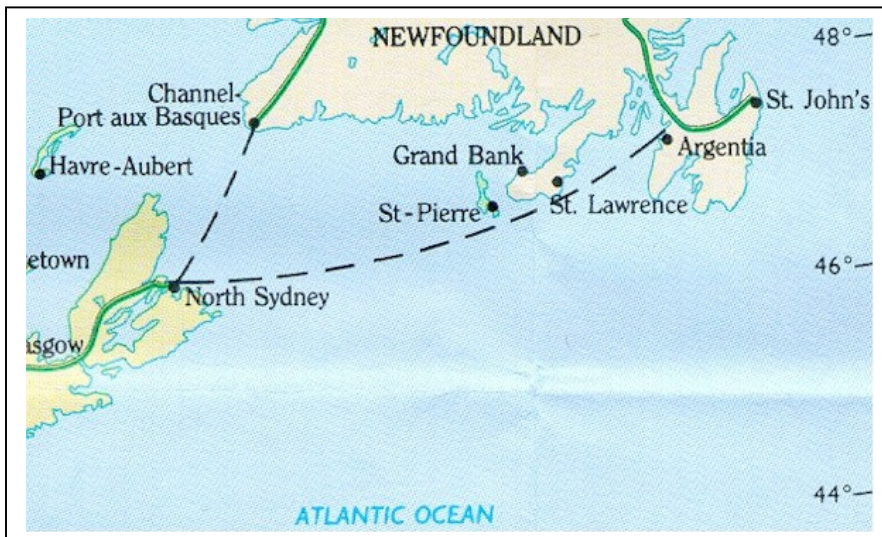


Figure 1. Ferry routes between Newfoundland and North Sydney

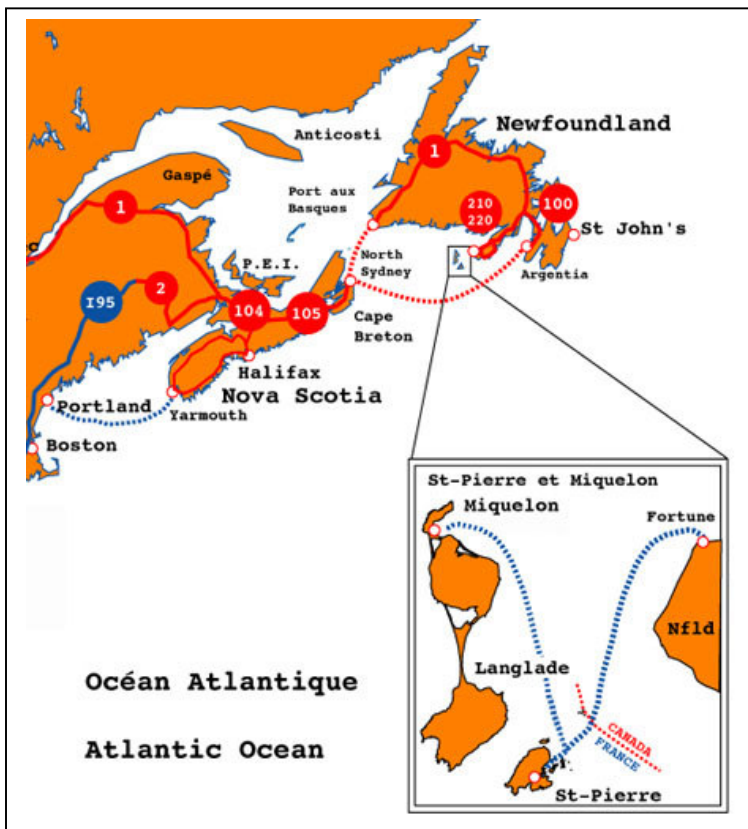


Figure 2. Ferry routes to St. Pierre et Miquelon

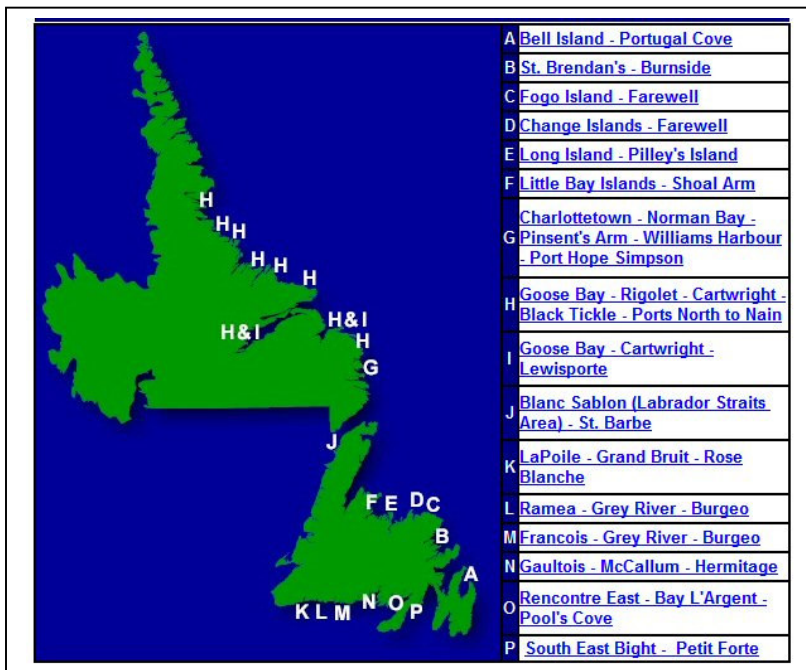


Figure 3. Newfoundland and Labrador intra-provincial ferry routes

The averaged monthly environmental data for the region where the Gulf ferries and ferries to St. Pierre et Miquelon operate are shown in Table 1. The referenced data can be found in Appendix A.

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Hs	3.3	2.9	2.9	2.7	2.2	2.2	1.9	1.5	1.9	2.4	2.6	3.2
Hs _{min}	0.7	0.6	0.5	0.4	0.5	0.4	0.5	0.3	0.3	0.3	0.5	0.7
Hs _{max}	8.8	7.8	8.5	6.7	6.0	4.9	4.8	4.0	5.3	10.1	6.5	7.5
T	7-10	6-8	8-10	7-9	7-8	7-8	6-8	0-4	6-8	6-8	7-9	7-9
Ta	-0.3	-1.4	0.7	3.8	7.2	11.2	15.7	17.8	15.7	11.4	7	2.2
Ta _{min}	-3.5	-4.3	-2.1	1.2	4.6	8.4	12.9	14.9	12.9	8.8	4.3	-0.9
Ta _{max}	2.8	1.6	3.4	6.2	9.8	14	18.4	20.6	18.4	14.1	9.6	5.3
Tw	2.5	2.5	2.5	0.72	6.05	10.03	15.07	15.73	12.91	9.21	3.67	2.31
Tw _{SD}	NA	NA	NA	0.51	1.91	1.28	0.64	1.09	1.86	1.06	2.36	1.6
Vw	22.2	21.8	20	17.1	14.1	13.1	13.0	14.5	15.7	18.9	20.4	21.4
Vw _{min}	0	0	0	0	0	0	0	0	0	0	0	0
Vw _{max}	70.0	95.9	77.9	73.4	55.0	49.0	42.0	60.0	53.0	63.0	95.3	85.0
Vc	NA	NA	NA	NA	0.12	0.05	0.04	0.10	0.07	0.10	0.11	0.07
Vc _{max}	NA	NA	NA	NA	0.53	0.43	0.4	0.43	0.36	0.42	0.64	0.40

Table 1. Environment data for Newfoundland and Labrador Gulf ferry routes

Where

Hs = Mean significant wave height [m]

Source: Marine Environmental Data Services 2006

T = Wave period with the highest percentage of occurrence [s]

Source: Marine Environmental Data Services 2006

Ta = Mean air temperature [C]

Source: The Green Lane, Canadian Climate Normals and Averages 1971-2000, Sable Island, Environment Canada,

Tw = Mean water surface temperature [C]

Source: Marine Environmental Data Services 2006 Shediak Station (see Figure 4) and L.D. Mortsch et. al (1985)

Vw = Mean wind speed at 20 m above mean sea level [knots]

Source: Marine Environmental Data Services 2006

Vc = Mean surface current speed [m/s]

Source: Bedford Institute of Oceanography - Oceanographic Databases

The geographic location of Shediac Station, where the mean water surface temperature was referenced is shown in Figure 4.

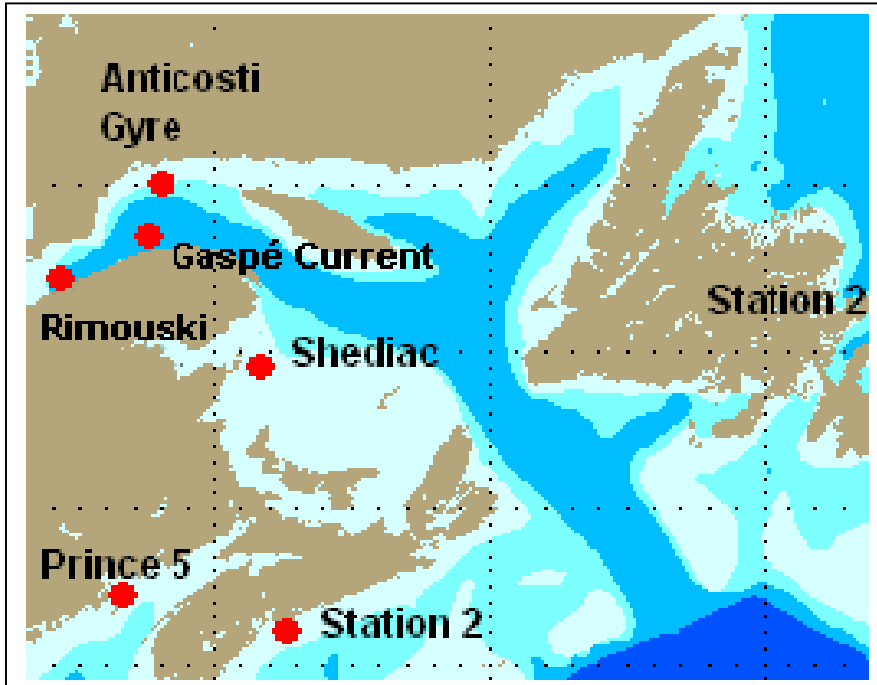


Figure 4. MEDS hydrographic data Shediac station

The averaged monthly environmental data for the region where the intra-provincial ferries operate are shown in Table 2. The ferry routes cover two environmental regions, Labrador Coast and North East Coast of Newfoundland. For the purpose of this report, Labrador Coast region data is used since it has more severe survival weather condition. The referenced data can be found in Appendix B.

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Hs	NA	NA	NA	NA	NA	1.3	1.3	1.5	2.1	2.9	2.9	NA
Hs _{min}	NA	NA	NA	NA	NA	0.7	0.2	0.4	0.3	0.5	0.8	NA
Hs _{max}	NA	NA	NA	NA	NA	2.3	5.5	5.7	7.3	9.4	7.1	NA
T	NA	NA	NA	NA	NA	5-7	5-9	5-9	7-9	8-9	8-9	NA
Ta	-18.5	-18.3	-12.3	-4.9	1	6.2	10.1	10.7	7	1.1	-5.1	-12.8
Ta _{min}	-23.1	-22.9	-17.3	-9.5	-3	1.4	5.2	5.7	3	-2.1	-8.3	-16.8
Ta _{max}	-14	-13.6	-7.3	-0.3	5.1	11	15.1	15.6	10.9	4.2	-1.8	-8.8
Tw	-0.12	0.66	0.55	-1.5	2.22	1.61	4.42	5.12	3.92	2.24	0.89	-0.48
Tw _{SD}	1.3	2.55	2.19	0	1.27	1.03	2.34	1.65	1.4	1.24	1.5	0.7
Vw	22.6	22.0	19.4	15.9	12.4	13.6	14.6	16.6	17.1	20.8	20.4	23
Vw _{min}	0	0	0	0	0	0	0	0	0	0	0	0
Vw _{max}	90	74	70	60	41	54	50	64	78	74	74	80
Vc	NA	NA	NA	NA	NA	NA	0.43	0.45	0.35	0.38	NA	NA
Vc _{max}	NA	NA	NA	NA	NA	NA	0.82	0.85	0.80	0.76	NA	NA

Table 2. Environment data for Newfoundland and Labrador intra-provincial ferry routes.

Where

Hs = Mean significant wave height [m]

Source: Marine Environmental Data Services 2006

T = Wave period with the highest percentage of occurrence [s]

Source: Marine Environmental Data Services 2006

Ta = Mean air temperature [C]

Source: The Green Lane, Canadian Climate Normals and Averages 1971-2000, Nain A, Environment Canada,

Tw = Mean water surface temperature [C]

Source: Bedford Institute of Oceanography - Oceanographic Databases Area LS21 and L.D. Mortsch et. al (1985)

Vw = Mean wind speed at 20 m above mean sea level [knots]

Source: Marine Environmental Data Services 2006

Vc = Mean surface current speed [m/s]

Source: Bedford Institute of Oceanography - Oceanographic Databases

The geographic location where the mean water surface temperature was referenced is shown in Figure 5.

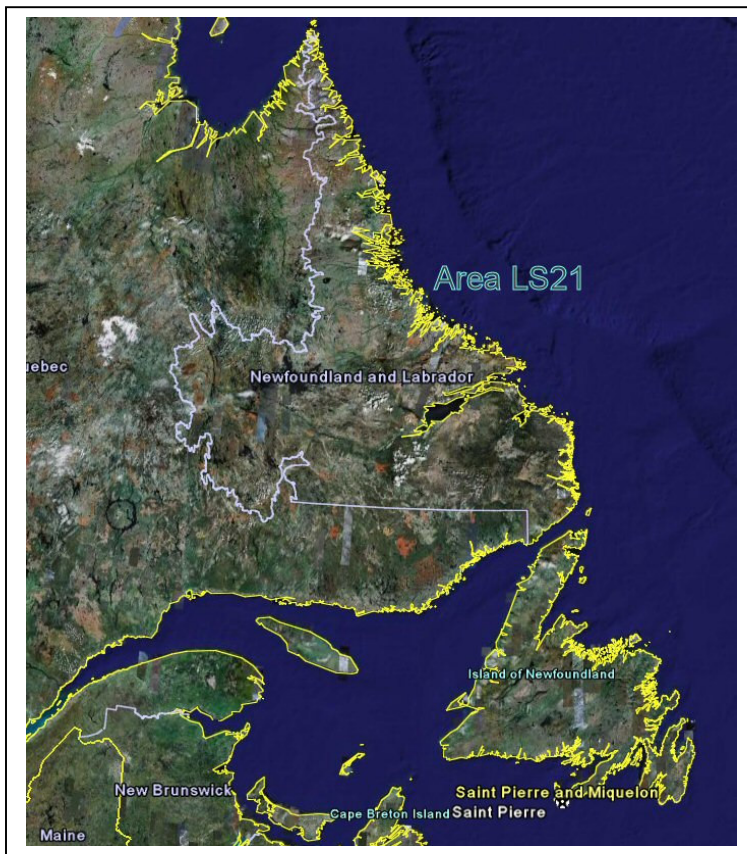


Figure 5. MEDS Area LS21

2.2 Great Lakes

The main ferry routes in Great Lakes region include those in Lake Superior, Lake Erie, Lake Ontario, Lake Huron and Lake Michigan (see Figure 6). The MacLaren Plansearch, The Great Lakes report gives a description of the environmental data for this region.

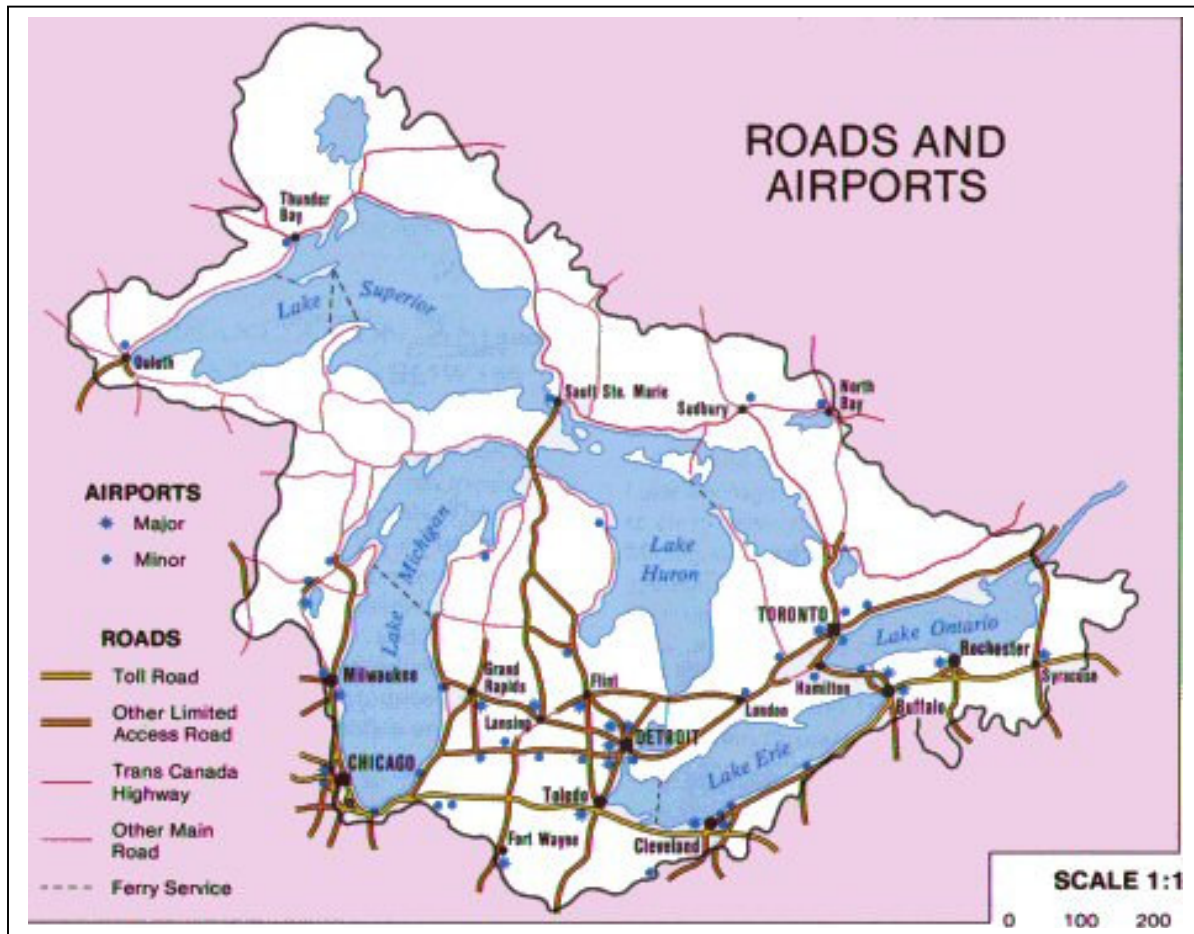


Figure 6. Great Lake region ferry routes

The averaged monthly environmental data for Lake Superior Centre is shown in Table 3. The environment data for Lake Superior is divided into three regions – west, centre and east. The referenced data for all three regions can be found in Appendix C.

The averaged monthly environmental data for Lake Erie is shown in Table 4. The reference data for all three regions can be found in Appendix D.

The averaged monthly environmental data for Lake Huron North is shown in Table 5. The environment data for Lake Huron is divided into two regions – north and south. The referenced data for all two regions can be found in Appendix E.

The averaged monthly environmental data for Lake Ontario is shown in Table 6. The referenced can be found in Appendix F.

The averaged monthly environmental data for Lake Michigan is shown in Table 7. The referenced data can be found in Appendix G.

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Hs	1.0	0.9	0.9	0.7	0.7	0.6	0.5	0.6	1.0	1.2	1.2	1.0
Hs _{min}	0	0	0	0	0	0	0	0	0	0.1	0.1	0.1
Hs _{max}	5.3	5.1	6.3	4.4	4.9	4.4	3.4	3.9	7.7	7.5	6.2	5.3
T	4-5	0-5	0-5	0-4	0-4	0-4	0-4	0-4	0-5	0-5	0-5	0-5
Ta	-10.1	-8.6	-3.4	3.7	11.5	15.5	18.3	18	13.1	7.2	0.4	-6.5
Ta _{min}	-14.2	-13	-8	-1.4	5.3	9.5	12.4	12.7	8.4	3.1	-2.7	-10
Ta _{max}	-5.8	-0.4	1.3	8.7	17.5	21.4	24.1	23.3	17.8	11.2	3.6	-2.8
Tw	2.6	1.4	0.9	1.1	2.3	5.3	10.9	15.4	14.3	9.5	6.5	4.5
Tw _{SD}	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Vw	12.9	13.2	13.6	11.2	10.9	10.1	9.2	10.0	12.8	15.2	16.1	13.7
Vw _{min}	0	0	0	0	0	0	0	0	0	0	0	0
Vw _{max}	41.0	45.1	39.1	38.1	38.1	41.0	35.0	35.0	46.1	57.2	58.1	44.1
Vc	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Vc _{max}	NA	NA	NA	NA	NA	NA	NA	NA	0.44	NA	NA	NA

Table 3. Environment data for Lake Superior Centre

Where

Hs = Mean significant wave height [m]

Source: Marine Environmental Data Services 2006

T = Wave period with the highest percentage of occurrence [s]

Source: Marine Environmental Data Services 2006

Ta = Mean air temperature [C]

Source: The Green Lane, Canadian Climate Normals and Averages 1971-2000, Sault Saint Marie, Environment Canada,

Tw = Mean water surface temperature [C]

Source: National Oceanic and Atmospheric Administration, CoastWatch Great Lakes Node.

Vw = Mean wind speed at 20 m above mean sea level [knots]

Source: Marine Environmental Data Services 2006

Vc = Mean surface current speed [m/s]

Source: Great Lakes Coastal Forecasting System, GLCFS NOWCAST

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Hs	1.3	1.1	1.1	1.1	0.9	0.8	0.7	0.7	0.8	1.0	1.2	1.2
Hs _{min}	0	0	0	0	0	0	0	0	0	0	0	0
Hs _{max}	7.0	4.7	5.9	5.3	5.6	4.1	3.8	3.1	3.9	4.4	4.9	5.3
T	4-6	0-5	0-5	0-5	0-5	0-5	0-4	0-5	0-5	0-5	0-6	0-6
Ta	-4.8	-3.7	1	7.4	13.8	18.6	21	20.2	16.1	10	4.1	-1.8
Ta _{min}	-8.6	-7.9	-3.7	2	7.8	12.6	15.2	14.6	10.7	4.9	0.3	-5.3
Ta _{max}	-0.9	0.6	5.6	12.9	19.9	24.5	26.8	25.8	21.5	15.1	7.8	1.7
Tw	2.4	1.7	1.4	3.7	9.8	17.5	22.2	23.4	21.1	15.8	10.7	5.5
Tw _{SD}	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Vw	15.2	13.8	14.0	14.1	11.7	10.7	10.1	10.3	11.5	13.3	14.9	14.9
Vw _{min}	0	0	0	0	0	0	0	0	0	0	0	0
Vw _{max}	58.1	43.0	53.1	44.1	40.0	38.1	35.0	32.1	39.1	42.0	40.0	44.1
Vc	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Vc _{max}	NA	NA	NA	NA	NA	NA	NA	NA	0.38	NA	NA	NA

Table 4. Environmental data for Lake Erie

Where

Hs = Mean significant wave height [m]

Source: Marine Environmental Data Services 2006

T = Wave period with the highest percentage of occurrence [s]

Source: Marine Environmental Data Services 2006

Ta = Mean air temperature [C]

Source: The Green Lane, Canadian Climate Normals and Averages 1971-2000, St. Thomas, Environment Canada,

Tw = Mean water surface temperature [C]

Source: National Oceanic and Atmospheric Administration, CoastWatch Great Lakes Node.

Vw = Mean wind speed at 20 m above mean sea level [knots]

Source: Marine Environmental Data Services 2006

Vc = Mean surface current speed [m/s]

Source: Great Lakes Coastal Forecasting System, GLCFS NOWCAST

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Hs	1.2	1.0	1.0	1.0	0.9	0.8	0.8	0.8	0.9	1.1	1.3	1.2
Hs _{min}	0.0	0.0	0.0	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.1
Hs _{max}	7.7	6.9	6.4	6.4	7.5	6.7	6.1	4.5	6.0	6.7	7.1	9.2
T	0-5	0-5	0-5	0-5	0-5	0-5	0-5	0-5	0-5	0-5	0-5	0-5
Ta	-5.8	-5.6	-1.2	5.3	11.3	16.2	19.7	19.3	15.3	9.5	3.5	-2.4
Ta _{min}	-9.4	-9.5	-5.4	0.8	6.1	11.1	14.9	14.8	11	5.7	0.5	-5.4
Ta _{max}	-2.2	-1.7	3	9.8	16.6	21.4	24.5	23.8	19.6	13.3	6.5	0.7
Tw	3.1	1.3	0.9	1.7	4.6	11.2	17.2	19.7	17.8	12.4	8.4	5.7
Tw _{SD}	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Vw	15.4	14.4	14.8	14.7	13.3	12.0	11.7	12.0	13.3	14.4	16.1	15.8
Vw _{min}	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Vw _{max}	62.0	59.1	65.1	55.0	52.1	52.1	48.0	41.0	45.1	48.1	61.0	55.0
Vc	NA	NA	NA	NA	NA	NA	0.23	0.17	NA	NA	NA	NA
Vc _{max}	NA	NA	NA	NA	NA	NA	NA	NA	0.37	NA	NA	NA

Table 5. Environmental data for Lake Huron North

Where

Hs = Mean significant wave height [m]

Source: Marine Environmental Data Services 2006

T = Wave period with the highest percentage of occurrence [s]

Source: Marine Environmental Data Services 2006

Ta = Mean air temperature [C]

Source: The Green Lane, Canadian Climate Normals and Averages 1971-2000, Owen Sound, Environment Canada,

Tw = Mean water surface temperature [C]

Source: National Oceanic and Atmospheric Administration, CoastWatch Great Lakes Node.

Vw = Mean wind speed at 20 m above mean sea level [knots]

Source: Marine Environmental Data Services 2006

Vc = Mean surface current speed [m/s]

Source: National Oceanic and Atmospheric Administration and Great Lakes Coastal Forecasting System, GLCFS NOWCAST

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Hs	0.6	0.5	0.5	0.4	0.3	0.3	0.3	0.3	0.3	0.4	0.5	0.5
Hs _{min}	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Hs _{max}	4.9	7.1	5.1	5.3	3.6	3.0	2.9	2.4	2.9	4.0	4.9	4.5
T	0-4	0-4	0-4	0-4	0-4	0-4	0-4	0-4	0-4	0-4	0-4	0-4
Ta	-7.1	-5.9	-0.6	6.7	13.7	18.7	21.6	20.6	15.9	9.3	3.2	-3.5
Ta _{min}	-11.5	-10.3	-5	2	8.7	13.7	16.6	15.7	11.3	5.1	-0.2	-7.3
Ta _{max}	-2.6	-1.4	3.8	11.4	18.7	23.6	26.6	25.4	20.4	13.5	6.7	0.4
Tw	3.3	1.9	1.7	2.6	6.1	13.8	19.5	21.8	19.3	13.4	8.6	5.5
Tw _{SD}	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Vw	9.6	9.0	8.8	8.4	6.8	6.0	5.9	5.8	6.7	7.9	9.4	9.5
Vw _{min}	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Vw _{max}	52.1	45.1	44.1	49.0	36.0	34.0	32.1	41.0	38.0	39.1	48.0	42.0
Vc	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Vc _{max}	NA	NA	NA	NA	NA	NA	NA	NA	0.40	NA	NA	NA

Table 6. Environmental data for Lake Ontario

Where

Hs = Mean significant wave height [m]

Source: Marine Environmental Data Services 2006

T = Wave period with the highest percentage of occurrence [s]

Source: Marine Environmental Data Services 2006

Ta = Mean air temperature [C]

Source: The Green Lane, Canadian Climate Normals and Averages
1971-2000, Belleville, Environment Canada,

Tw = Mean water surface temperature [C]

Source: National Oceanic and Atmospheric Administration, CoastWatch
Great Lakes Node.

Vw = Mean wind speed at 20 m above mean sea level [knots]

Source: Marine Environmental Data Services 2006

Vc = Mean surface current speed [m/s]

Source: Great Lakes Coastal Forecasting System, GLCFS NOWCAST

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Hs	1.2	1.1	0.9	0.7	0.5	0.5	0.5	0.6	0.7	0.9	1.1	1.2
Hs _{min}	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1
Hs _{max}	7.2	6.1	11.4	4.8	3.4	3.0	2.7	3.3	5.0	4.7	5.5	6.0
T	4-5	0-5	0-4	0-4	0-4	0-4	0-4	0-4	0-4	0-4	0-5	4-5
Ta	-6.3	-3.7	1.61	7.3	13.4	19.1	22.2	21.4	17.2	10.8	3.6	-3.2
Ta _{min}	-10.3	-7.6	-2.6	2.4	7.8	13.5	17.2	16.7	12.3	5.9	-0.6	-7
Ta _{max}	-2.2	0.3	5.9	12.2	18.9	24.6	27.3	26.2	22.2	15.7	7.6	0.6
Tw	3.1	1.7	1.6	2.5	5.5	12.3	18.7	20.9	18.8	13.2	8.9	5.6
Tw _{SD}	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Vw	15.1	14.1	12.9	11.2	9.3	8.4	8.2	9.2	10.8	12.1	14.3	14.9
Vw _{min}	1.0	1.9	1.0	0.0	1.0	0.0	1.0	0.0	0.0	1.0	1.9	1.9
Vw _{max}	54.0	49.0	46.1	41.0	31.1	27.0	31.1	32.1	40.0	39.1	47.0	44.1
Vc	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Vc _{max}	NA	NA	NA	NA	NA	NA	NA	NA	0.55	NA	NA	NA

Table 7. Environmental data for Lake Michigan

Where

Hs = Mean significant wave height [m]

Source: Marine Environmental Data Services 2006

T = Wave period with the highest percentage of occurrence [s]

Source: Marine Environmental Data Services 2006

Ta = Mean air temperature [C]

Source: The Green Lane, Canadian Climate Normals and Averages
1971-2000, Milwaukee, Environment Canada,

Tw = Mean water surface temperature [C]

Source: National Oceanic and Atmospheric Administration, CoastWatch
Great Lakes Node.

Vw = Mean wind speed at 20 m above mean sea level [knots]

Source: Marine Environmental Data Services 2006

Vc = Mean surface current speed [m/s]

Source: Great Lakes Coastal Forecasting System, GLCFS NOWCAST

A map showing the cities (Sault Ste Marie, Owen Sound, St. Thomas, Belleville and Milwaukee) where the average air temperature was reference is in Figure 7.



Figure 7. Ontario map

2.3 West Coast of Canada

The major ferry routes in this region are shown in Figure 8. The MacLaren Plansearch, The West Coast of Canada report gives a description of the environmental data for this region.



Figure 8. West coast ferry route

The averaged monthly environmental data for British Columbia is shown in Table 8. The referenced data for this region can be found in Appendix H.

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Hs	3.8	3.5	2.9	2.8	2.2	1.9	1.5	1.6	2.0	2.9	3.9	4.0
Hs _{min}	0.9	0.8	1.0	0.8	0.5	0.6	0.5	0.5	0.5	0.5	0.2	0.9
Hs _{max}	11.2	10.5	9.8	7.8	6.4	5.5	4.2	4.7	5.7	11.0	12.8	11.3
T	12-13	11-13	9-13	9-13	9-11	9-11	6-10	7-10	9-11	9-13	9-13	9-13
Ta	4.4	5.5	6.6	8.2	10.5	12.4	14	14.3	13	9.6	6.5	4.6
Ta _{min}	1.8	2.5	3.1	4.4	6.8	8.7	9.8	10.1	8.8	6.1	3.8	2.1
Ta _{max}	7	8.4	10.1	12	14.1	16.1	18.1	18.5	17.2	13.1	9.2	7
Tw	6.9	7.0	7.8	9.2	11.2	13.5	15.5	15.8	13.9	11.1	8.9	7.5
Tw _{SD}	0.84	0.76	0.74	0.76	0.71	0.85	0.94	1.29	1.07	0.71	0.73	0.71
Vw	21.2	19.4	16.4	15.7	14.2	11.9	12.2	12.7	13.2	17.8	22.0	21.4
Vw _{min}	1.8	1.3	0.5	0.2	0.4	0.0	0.3	0.0	0.7	0.9	3.4	0.4
Vw _{max}	46.4	47.7	47.5	45.3	33.4	34.5	27.4	40.5	39.0	50.5	52.9	49.9
Vc	NA	NA	NA	NA	NA	NA	0.43	0.39	NA	NA	NA	NA
Vc _{max}	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Table 8. Environmental data for British Columbia

Where

Hs = Mean significant wave height [m]

Source: Marine Environmental Data Services 2006

T = Wave period with the highest percentage of occurrence [s]

Source: Marine Environmental Data Services 2006

Ta = Mean air temperature [C]

Source: The Green Lane, Canadian Climate Normals and Averages 1971-2000, Milwaukee, Environment Canada,

Tw = Mean water surface temperature [C]

Source: Marine Environmental Data Services 2006 near Race Rocks

Vw = Mean wind speed at 20 m above mean sea level [knots]

Source: Marine Environmental Data Services 2006

Vc = Mean surface current speed [m/s]

Source: National Oceanic and Atmospheric Administration, National Data Buoy Center, Northwest Straits / Puget Sound Recent Marine Data.

The location where mean water surface temperature was obtained was at latitude 48° 31'N and longitude 123° 10'W, near Race Rocks (see Figure 9). The current was obtained near the same location using National Data Buoy Center, Moored Buoy 46088 (see Figure 10).

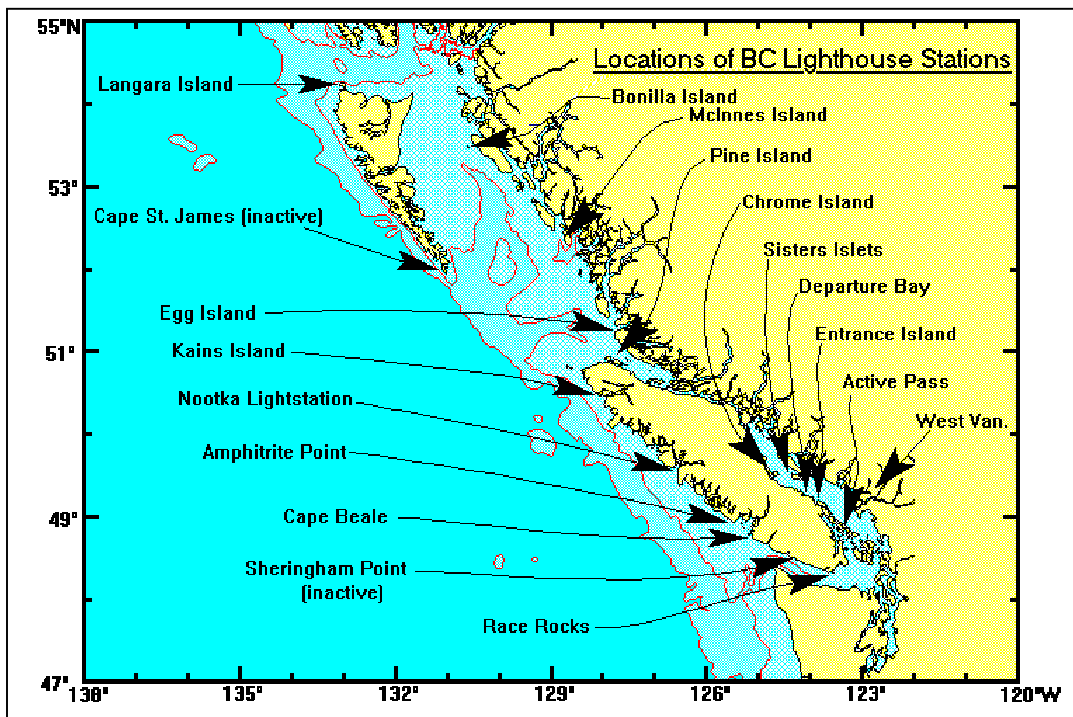


Figure 9. Location (Race Rocks) where sea surface temperature was referenced

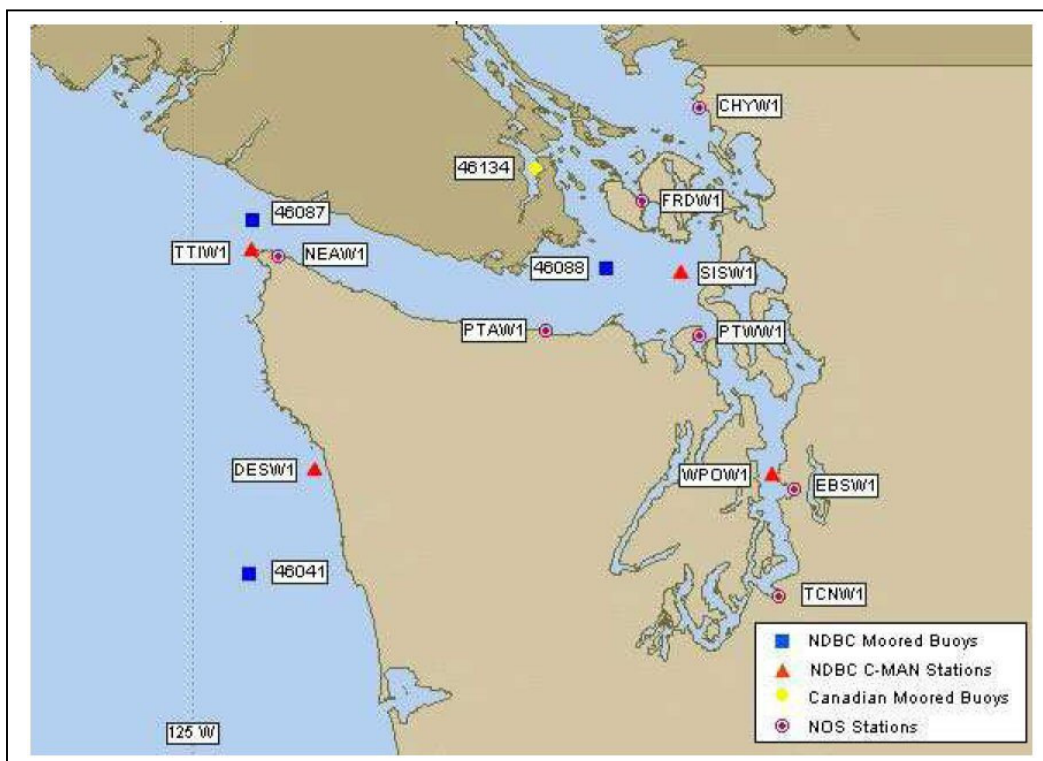


Figure 10. Location of National Data Buoy Center, Moored Buoy 46088

3.0 Raft Factors and Occupant Factors

The following life raft variables and occupant variables are intended to be studied, in order to understand the heat loss mechanisms and their relative effects.

3.1 Raft Factors

Floor wetness

The floor of a life raft is typically wet in an evacuation situation due to wave spray. Occupants sitting or lying on the wet floor are likely to experience increased heat loss from direct contact with the cold ocean water and wet clothing.

Floor insulation

Typical life raft construction consists of either an air-filled inflatable floor or a non-inflatable floor. With the former, occupants are required to inflate the floor when they enter the life raft. These forms of insulation provide a thermal barrier between the occupant and the cold ocean water when they sit or lie on the floor. CORD studied the thermal performance of an arctic life raft with occupants wearing an immersion suit. They reported that canopy and direct contact are the most significant means of heat loss.

Canopy entrance

The canopy entrance can be opened, closed or partially opened. With a closed canopy entrance, the heat produced by the occupants may help to slow down the cooling of the life raft internal environment. However, it would reduce ventilation and thus air quality. With a partially or fully opened canopy entrance, the heat produced by the occupants may be lost to the environment. CORD reported that the canopy is the area of largest heat loss. Improvement with canopy will have the greatest effect on the raft temperature. Any warming effect from occupants is lost if the raft is not insulated. Wind speed has significant effect on raft thermal resistance. Other factors such as wind direction, number of occupants and occupant position has little effect.

3.2 Occupant Factors

Clothing

In a ferry evacuation situation, life raft occupants will only be wearing ordinary clothing and life jackets. The clothing provides little, if any, protection against wetness and heat loss. In contrast, in an offshore evacuation situation, occupants will be wearing immersion suits. They provide protection against wetness and a higher degree of protection against heat loss.

Direct contact area

The occupant, if not injured and in sufficiently good condition, will be sitting inside the life raft. The direct contact area will be the buttock and the back. If injured or in poor condition, the occupant will likely be lying on the floor on his back. The direct contact areas include head, back, buttock and limbs.

4.0 Conclusions

The environmental conditions for three maritime regions in Canada, Newfoundland and Labrador, Great Lakes and British Columbia, with major ferry services are summarized in this report. Also, the main life raft and occupant variables that would contribute to variation in heat loss are discussed.

The most severe wave condition is found in Newfoundland and Labrador and British Columbia, where the mean significant wave height is above 3 m. The wave period is typically higher in British Columbia, ranging from 9 to 13 seconds as compared to 6 to 9 seconds in Newfoundland and Labrador. The mildest wave condition is found in the Great Lakes.

The coldest mean air temperature is found in Newfoundland and Labrador, where it can be as low as -18 C. The highest mean air temperature is found in the Great Lakes, around 21 C.

The lowest mean water surface temperature is found in Newfoundland and Labrador, around -1.5 C. The highest mean water surface temperature is found in the Great Lakes, around 23 C.

The highest mean wind velocity, around 23 knots (or 11.5 m/s), is found in Newfoundland and Labrador and British Columbia.

The highest mean current velocity is found in Newfoundland and Labrador and British Columbia, around 0.45 m/s.

5.0 Acknowledgements

The project team would like to thank National Search and Rescue Secretariat SAR New Initiatives Fund for their financial support on this project, and Transport Canada for sponsoring this project.

6.0 References

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Appendix A

Environmental Data

For

Newfoundland and Labrador Gulf Ferry Routes

9-19

SIGNIFICANT WAVE HEIGHT STATISTICS EAST COAST AREA 9 - SOUTH WEST COAST



PERCENTAGE FREQUENCY OF OCCURRENCE BY DIRECTION
Annual
ODGP

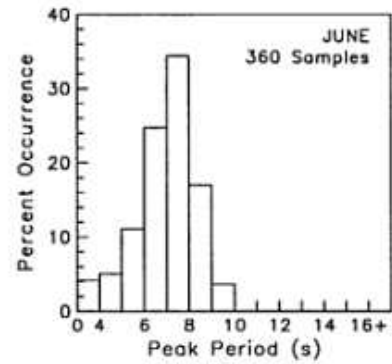
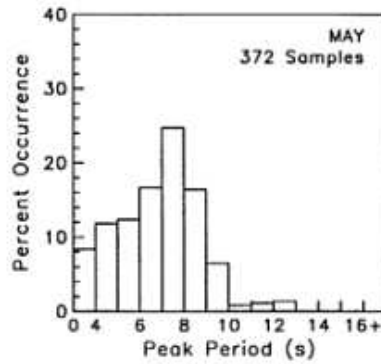
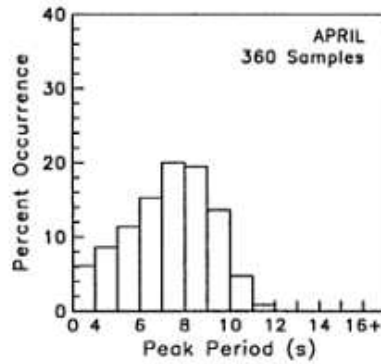
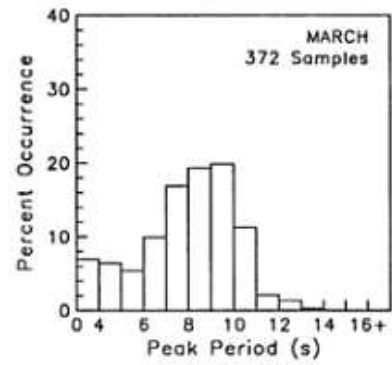
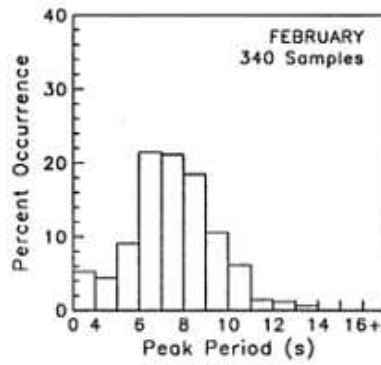
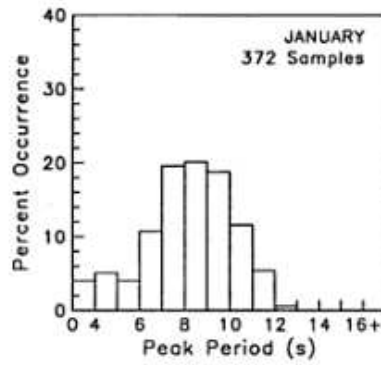
	Direction - coming from								Total	Num Obs
	N	NE	E	SE	S	SW	W	NW		
0.0 - < 0.5 m	0.1	0.0	-	0.1	0.1	0.4	0.2	-	0.9	38
0.5 - < 1.0 m	0.7	0.4	0.5	0.7	1.0	2.5	2.1	0.8	8.7	381
1.0 - < 1.5 m	1.0	0.9	1.3	1.2	1.4	4.4	3.7	1.3	15.1	664
1.5 - < 2.0 m	1.1	0.8	1.3	1.4	1.3	5.5	4.4	1.7	17.8	770
2.0 - < 2.5 m	0.9	1.2	0.9	1.0	1.9	4.9	3.5	1.8	18.1	767
2.5 - < 3.0 m	0.8	0.7	0.8	0.5	1.2	4.8	3.0	1.4	12.9	565
3.0 - < 3.5 m	0.4	0.3	0.5	0.4	1.1	3.1	2.2	0.8	8.8	387
3.5 - < 4.0 m	0.2	0.3	0.4	0.3	1.1	2.1	1.9	0.5	8.8	298
4.0 - < 4.5 m	0.2	0.3	0.5	0.3	0.8	1.3	1.4	0.2	4.7	207
4.5 - < 5.0 m	0.0	0.2	0.3	0.2	0.5	1.1	1.0	0.2	3.4	151
5.0 - < 5.5 m	-	0.1	0.3	0.0	0.3	0.7	0.5	0.1	2.0	89
5.5 - < 6.0 m	-	0.1	0.0	0.0	0.1	0.4	0.4	0.1	1.2	51
6.0 - < 6.5 m	-	-	0.1	-	0.1	0.3	0.2	0.0	0.7	32
6.5 - < 7.0 m	-	-	-	-	0.0	0.1	0.2	-	0.3	14
7.0 - + m	-	-	0.1	0.1	-	0.2	0.3	-	0.7	32
Total	5.4	5.2	8.9	8.2	10.7	31.5	25.0	9.1	100.0	4384

MONTHLY DATA STATISTICS
ODGP

	Mean	Std Dev	Med	Max	Min	Upper 95% Lim		Lower 95% Lim		Most Freq Dir	Num Obs
						m	m	m	m		
January	3.3	1.8	2.9	8.8	0.7	6.5	1.1	SW	372		
February	2.9	1.3	2.5	7.8	0.6	5.3	0.9	SW	340		
March	2.9	1.3	2.8	8.5	0.5	5.2	0.9	SW	372		
April	2.7	1.3	2.4	6.7	0.4	5.1	1.0	SW	360		
May	2.2	1.1	1.9	6.0	0.5	4.4	0.8	SW	372		
June	2.2	0.9	2.1	4.9	0.4	3.8	0.6	SW	360		
July	1.9	0.7	1.8	4.8	0.6	3.1	1.0	SW	372		
August	1.5	0.7	1.3	4.0	0.3	2.9	0.4	SW	372		
September	1.9	1.0	1.7	5.3	0.3	3.8	0.6	W	360		
October	2.4	1.4	2.0	10.1	0.3	4.7	0.9	W	372		
November	2.6	1.2	2.4	8.5	0.5	4.8	0.8	W	360		
December	3.2	1.4	2.9	7.5	0.7	5.9	1.1	W	372		
Annual	2.5	1.3	2.2	10.1	0.3	4.9	0.8	SW	4384		

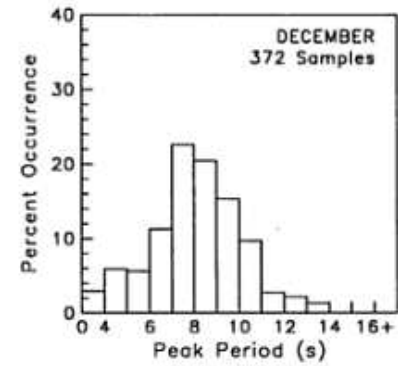
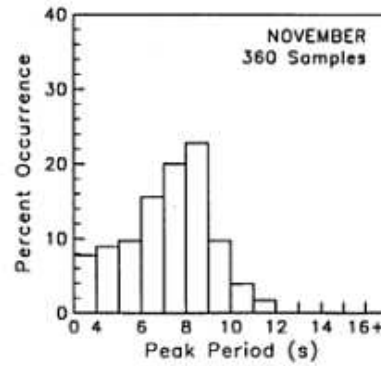
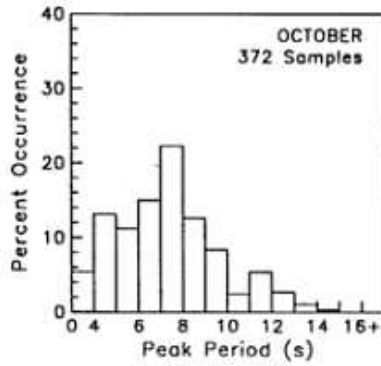
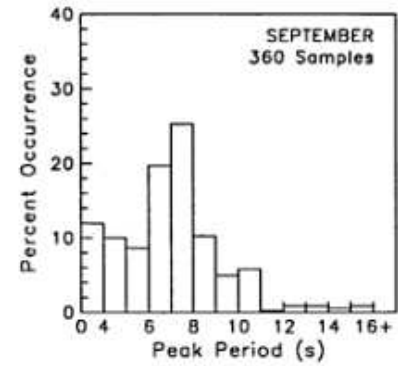
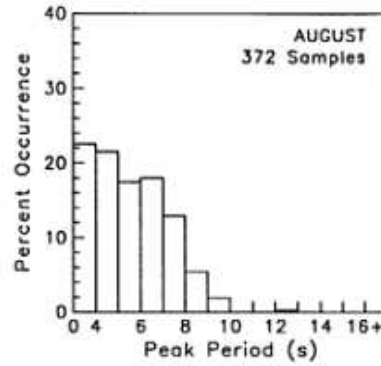
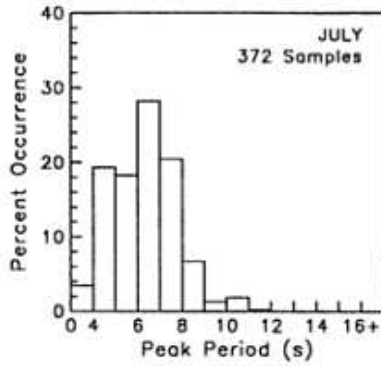
9-17

MONTHLY WAVE STATISTICS EAST COAST AREA 9 - SOUTH WEST COAST



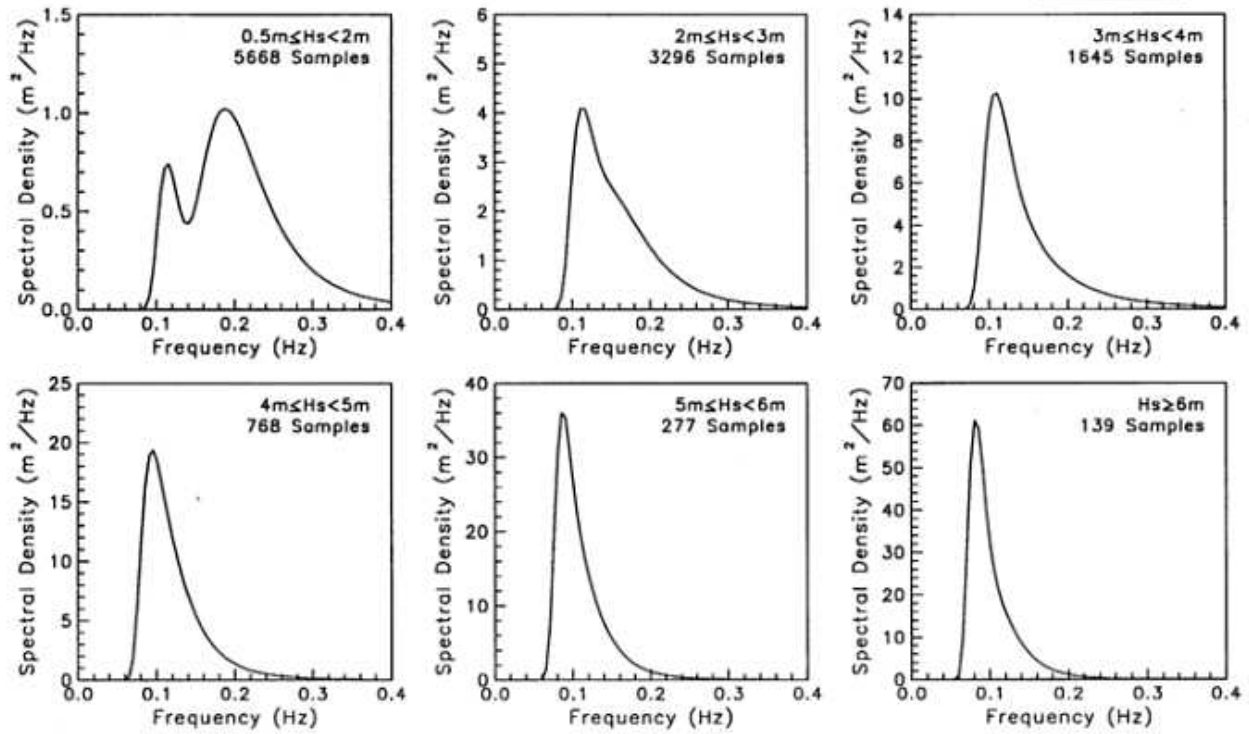
9-18

MONTHLY WAVE STATISTICS EAST COAST AREA 9 - SOUTH WEST COAST



9-21

MOST PROBABLE SPECTRA
EAST COAST AREA 9 – SOUTH WEST COAST
ODGP



Environment
CanadaEnvironnement
Canada

Canadian Climate Normals 1971-2000

The minimum number of years used to calculate these Normals is indicated by a [code](#) for each element. A "+" beside an extreme date indicates that this date is the first occurrence of the extreme value. Values and dates in bold indicate all-time extremes for the location.

NOTE!! Data used in the calculation of these Normals may be subject to further quality assurance checks. This may result in minor changes to some values presented here.

SABLE ISLAND NOVA SCOTIA

Latitude: 43° 55' N**Longitude:** 60° 0' W**Elevation:** 05.00 m**Climate ID:** 8204700**WMO ID:** 71600**TC ID:** WSA

Temperature:	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year	Code
Daily Average (°C)	-0.3	-1.4	0.7	3.8	7.2	11.2	15.7	17.8	15.7	11.4	7	2.2	7.6	B
Standard Deviation	1.2	1.2	1	1	1.2	0.9	1	0.9	0.9	0.8	1	1.4	1.5	B
Daily Maximum (°C)	2.8	1.6	3.4	6.2	9.8	14	18.4	20.6	18.4	14.1	9.6	5.3	10.3	B
Daily Minimum (°C)	-3.5	-4.3	-2.1	1.2	4.6	8.4	12.9	14.9	12.9	8.8	4.3	-0.9	4.8	B
Extreme Maximum (°C)	14.5	12.8	13.7	13.9	17.8	21.7	29.6	27.8	27	22.8	18.9	15.6		
Date (yyyy/dd)	1983/12	1919/16	1993/14	1901/22+	1931/30	1907/29	1986/24	1951/27	1983/07	1961/04	1921/01+	1968/05		
Extreme Minimum (°C)	-19.4	-18.3	-13.6	-8.9	-8.3	0.6	3	4.4	0.6	-1.2	-7.8	-16.7		
Date (yyyy/dd)	1920/31	1914/12	1994/03	1916/15	1914/03	1992/04	1991/05	1987/28	1980/29	1984/14+	1921/25+	1933/29		
Precipitation:														
Rainfall (mm)	113.3	82.8	102.9	99.9	99.5	117.3	95.2	106.8	119	140.3	142.8	124		B
Snowfall (cm)	32.9	27.9	20.2	7.1	0.4	0	0	0	0	0	3.8	18.9		B
Precipitation (mm)	146.4	110.9	124	107.1	99.9	117.3	95.2	106.8	119	140.3	147	145.3		B
Average Snow Depth (cm)	2	2	1	0	0	0	0	0	0	0	0	0	0	B
Median Snow Depth (cm)	0	1	0	0	0	0	0	0	0	0	0	0	0	B
Snow Depth at Month-end (cm)	2	3	0	0	0	0	0	0	0	0	0	1		B
Extreme Daily Rainfall (mm)	99.3	52.2	87.6	66	99.6	140.7	85.3	155.7	99.2	166.1	84.8	77.5		
Date (yyyy/dd)	1894/30	1989/23	1899/07	1897/11	1969/23	1919/12	1895/10	1892/21	1982/17	1950/04	1927/06	1964/18		
Extreme Daily Snowfall (cm)	61	45.7	45.7	27.4	15.2	0	0	0	0	0.2	25.4	66		
Date (yyyy/dd)	1897/24	1892/04	1959/28	1992/06	1959/24	1891/01+	1891/01+	1891/01+	1891/01+	1985/29	1955/26	1934/11		
Extreme Daily Precipitation (mm)	99.3	53.3	87.6	66	99.6	140.7	85.3	155.7	99.2	166.1	84.8	78.2		
Date (yyyy/dd)	1894/30	1892/04	1899/07	1897/11	1969/23	1919/12	1895/10	1892/21	1982/17	1950/04	1927/06	1964/18		
Extreme Snow Depth (cm)	60	41	25	24	3	0	0	0	0	0	25	20		
Date (yyyy/dd)	1989/05	1971/24	1955/05+	1992/06	1959/25	1955/01+	1955/01+	1955/01+	1955/01+	1955/01+	1955/27	1993/24		
Days with Maximum Temperature:														
<= 0 °C	8.4	9.7	5	0.04	0	0	0	0	0	0	0.08	3.6		B
> 0 °C	22.6	18.6	26	30	31	30	31	31	30	31	29.9	27.4		B
> 10 °C	1.2	0.27	0.42	2.2	14.6	28.3	31	31	30	27.6	14.3	4.5		B
> 20 °C	0	0	0	0	0	0.17	6.3	18.6	6.9	0.2	0	0		B
> 30 °C	0	0	0	0	0	0	0	0	0	0	0	0		B
> 35 °C	0	0	0	0	0	0	0	0	0	0	0	0		B
Days with Minimum Temperature:														
> 0 °C	6.5	3.4	8.3	20.7	30.4	30	31	31	30	30.6	27	12.8		B
<= 2 °C	28.3	27.3	28.5	19.5	3.6	0.04	0	0	0.08	0.88	8.1	24		B
<= 0 °C	24.5	24.9	22.7	9.3	0.56	0	0	0	0	0.4	3	18.2		B
< -2 °C	19.1	19.6	14	2	0.08	0	0	0	0	0	0.8	11.8		B
< -10 °C	1.7	2.6	0.42	0	0	0	0	0	0	0	0	0.44		B
< -20 °C	0	0	0	0	0	0	0	0	0	0	0	0		B
< -30 °C	0	0	0	0	0	0	0	0	0	0	0	0		B
Days with Rainfall:														
>= 0.2 mm	11.9	9.2	12.6	14.4	14.2	13.4	12.8	11.5	12.6	15.5	17.7	15.3		B
>= 5 mm	7	5.2	6.4	6.4	5.6	6.3	4.8	5	5.6	6.2	7.7	7		B
>= 10 mm	4.5	3	4	3.6	3.4	4	3.1	3.4	3.6	4.3	4.8	4.4		B
>= 25 mm	0.81	0.65	0.62	0.64	0.96	1.2	0.79	0.96	1.2	1.8	1.4	1.1		B

Shediac - Temperature (C°)

Mean, Standard Deviation and Number of Observations

	January			February			March			April			May			June		
Depth (m)	Mean	S.D.	#Obs	Mean	S.D.	#Obs	Mean	S.D.	#Obs	Mean	S.D.	#Obs	Mean	S.D.	#Obs	Mean	S.D.	#Obs
0	-	-	-	-	-	-	-	-	-	0.72	0.51	12	6.05	1.91	18	10.03	1.28	19
10	-	-	-	-	-	-	-1.6	0	1	0.43	0.37	12	4.72	1.54	10	8.56	1.69	17
20	-	-	-	-	-	-	-	-	-	0.14	0.56	11	3.12	1.19	9	5.4	1.97	16
30	-	-	-	-	-	-	-	-	-	-0.35	0.82	10	1.58	0.9	10	2.59	0.68	15
40	-	-	-	-	-	-	-	-	-	-0.6	0.54	10	0.86	0.55	8	1.12	0.49	15
50	-	-	-	-	-	-	-	-	-	-0.62	0.43	10	0.18	0.6	9	-0.07	0.91	15
60	-	-	-	-	-	-	-	-	-	-0.48	0.34	9	-0.11	0.8	4	-0.46	0.56	14
70	-	-	-	-	-	-	-	-	-	-0.27	0.2	9	-0.03	0.56	8	-0.45	0.49	14
80	-	-	-	-	-	-	-	-	-	-0.18	0.17	9	-0.07	0.5	6	-0.26	0.45	6
90	-	-	-	-	-	-	-	-	-	-	-	-	-0.01	0	2	-0.9	0	1
100	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

	July			August			September			October			November			December		
Depth (m)	Mean	S.D.	#Obs	Mean	S.D.	#Obs	Mean	S.D.	#Obs	Mean	S.D.	#Obs	Mean	S.D.	#Obs	Mean	S.D.	#Obs
0	15.07	0.64	12	15.73	1.09	12	12.91	1.86	45	9.21	1.06	24	3.67	2.36	5	2.31	1.6	12
10	13.77	1.28	12	14.24	1.23	7	12.14	2.3	39	9.32	1.33	18	3.67	2.36	5	2.31	1.59	14
20	6.63	1.67	12	10.76	1.56	7	10.03	2.78	41	8.97	0.57	16	3.6	2.32	5	2.24	1.51	14
30	3.01	0.84	12	5.9	2.16	7	6.39	3.12	41	7.73	1.03	19	3.5	2.27	4	2.23	1.43	14
40	1.08	0.53	11	2.56	1.61	7	3.35	2.71	38	5.73	1.54	17	3.67	2.37	4	2.37	1.38	14
50	0.32	0.54	11	1.13	0.65	7	1.67	2	39	3.24	2.02	19	3.16	1.36	4	2.65	1.24	14
60	-0.04	0.4	11	0.59	0.2	6	0.76	1.09	37	1.56	1.36	18	2.41	0.71	4	2.9	1.2	14
70	-0.24	0.12	11	0.23	0.28	6	0.23	0.48	33	0.91	0.72	19	1.78	0.61	4	2.64	0.61	12
80	-0.32	0.01	3	0.1	0.11	4	0.33	0.44	19	0.62	0.45	7	1.7	0.94	3	2.4	0	2
90	-	-	-	0.2	0	1	0.59	1.05	4	-	-	-	-	-	-	-	-	-
100	-	-	-	-	-	-	-0.02	0.12	3	-	-	-	-	-	-	-	-	-

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[Temperature Contour Plot](#)

9-8

ANNUAL WIND SPEED STATISTICS

EAST COAST AREA 9 - SOUTH WEST COAST



PERCENTAGE FREQUENCY OF OCCURRENCE BY DIRECTION

Annual

	Direction - coming from								Total	Num Obs
	N	NE	E	SE	S	SW	W	NW		
0.0 - < 5.0 kts	2.2	0.3	0.5	0.4	0.6	0.5	0.8	0.4	5.8	1417
5.0 - < 10.0 kts	1.4	1.1	1.8	1.5	2.8	2.5	3.5	1.6	15.9	3909
10.0 - < 15.0 kts	1.8	1.2	2.0	1.5	3.1	3.5	4.8	2.2	19.9	4888
15.0 - < 20.0 kts	1.6	1.2	1.8	1.3	2.9	3.3	5.0	2.7	20.0	4901
20.0 - < 25.0 kts	1.3	0.9	1.4	0.8	1.9	2.5	3.5	2.3	14.6	3587
25.0 - < 30.0 kts	0.9	0.6	1.0	0.6	1.1	1.3	2.9	1.5	9.8	2414
30.0 - < 35.0 kts	0.6	0.5	0.7	0.4	0.7	0.7	2.1	1.0	6.7	1653
35.0 - < 40.0 kts	0.2	0.3	0.4	0.2	0.4	0.4	1.3	0.6	3.8	926
40.0 - < 45.0 kts	0.1	0.1	0.2	0.1	0.2	0.2	0.7	0.3	1.9	454
45.0 - < 50.0 kts	0.0	0.1	0.1	0.1	0.1	0.1	0.3	0.1	0.8	201
50.0 - < 55.0 kts	0.0	0.0	0.1	0.0	0.0	0.0	0.3	0.1	0.5	126
55.0 - + kts	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.2	57
Total	10.1	6.4	9.9	7.0	13.7	15.0	25.0	12.8	100.0	24533

MONTHLY DATA STATISTICS

	Std				Upper			Most	Num
	Mean	Dev	Med	Max	Min	95% Lim	95% Lim		
	kts	kts	kts	kts	kts	kts	kts	Dir	Obs
January	22.2	11.3	21.0	70.0	0.0	43.0	5.0	W	1875
February	21.8	11.5	20.0	95.9	0.0	43.0	5.0	W	2174
March	20.0	10.8	18.7	77.9	0.0	40.0	5.0	W	2134
April	17.1	9.4	16.0	73.4	0.0	35.0	4.0	W	2305
May	14.1	8.6	13.0	55.0	0.0	30.0	2.0	W	2552
June	13.1	7.9	12.0	49.0	0.0	28.0	2.0	S	2240
July	13.0	7.4	12.0	42.0	0.0	26.0	2.0	SW	1964
August	14.5	8.0	14.0	60.0	0.0	30.0	2.0	W	1885
September	16.7	8.6	15.0	53.0	0.0	32.0	5.0	W	1872
October	18.9	9.6	18.0	63.0	0.0	35.0	5.0	W	1885
November	20.4	10.5	19.0	98.3	0.0	40.0	5.0	W	1966
December	21.4	10.9	20.0	88.0	0.0	40.0	5.0	W	1812
Annual	17.6	10.2	16.0	98.3	0.0	38.1	4.0	W	24684

Reference Height: 20 m above mean sea level

Department of Fisheries and Oceans -Ocean Sciences
Ocean Data Inventory
03-Aug-2006 14:57

Query: 1434

Latitude	Longitude	Moor Depth M	Date	Days	Max Speed m/s	Mean Speed m/s	Current Dir T	Mid Freq Var			Low Freq Var			QC	Event Spec
								Major m/s	Minor m/s	Dir T	Major m/s	Minor m/s	Dir T		
- 45 N	57 W-														
45 4.9 N	57 34.73 W	18	MAY1997	29	0.528	0.118	130	0.125	0.092	318	0.081	0.041	325	1	MCM_97003_1254_7134_1800
			JUN1997	30	0.430	0.051	184	0.141	0.102	326	0.097	0.023	336	1	
			JUL1997	31	0.400	0.044	141	0.101	0.092	306	0.036	0.026	342	1	
			AUG1997	31	0.430	0.097	136	0.102	0.085	303	0.033	0.017	332	1	
			SEP1997	30	0.360	0.070	134	0.099	0.083	307	0.042	0.026	349	1	
			OCT1997	31	0.424	0.096	137	0.120	0.089	303	0.052	0.019	316	1	
			NOV1997	30	0.636	0.113	155	0.145	0.113	305	0.074	0.043	309	1	
			DEC1997	10	0.398	0.071	169	0.114	0.097	304	0.061	0.023	312	1	
		68	MAY1997	29	0.406	0.097	135	0.123	0.063	328	0.076	0.010	320	1	MCM_97003_1254_6409_1800
			JUN1997	30	0.377	0.040	162	0.141	0.050	327	0.118	0.012	323	1	
			JUL1997	31	0.316	0.030	138	0.104	0.055	332	0.057	0.016	317	1	
			AUG1997	31	0.400	0.085	146	0.102	0.055	333	0.064	0.011	325	1	
			SEP1997	30	0.427	0.079	140	0.112	0.054	326	0.074	0.019	323	1	
			OCT1997	31	0.400	0.100	140	0.130	0.053	324	0.095	0.012	320	1	
			NOV1997	30	0.496	0.105	143	0.142	0.064	324	0.107	0.020	318	1	
			DEC1997	10	0.453	0.028	156	0.171	0.053	326	0.138	0.016	323	1	
		133	MAY1997	29	0.319	0.024	159	0.072	0.041	329	0.035	0.009	321	1	MCM_97003_1254_6410_1800
			JUN1997	30	0.389	0.021	185	0.108	0.042	327	0.080	0.012	323	1	
			JUL1997	31	0.325	0.016	194	0.067	0.034	332	0.030	0.009	327	1	
			AUG1997	31	0.255	0.015	186	0.059	0.033	327	0.030	0.007	324	1	
			SEP1997	30	0.278	0.032	160	0.081	0.033	329	0.056	0.010	324	1	
			OCT1997	31	0.319	0.024	179	0.073	0.038	326	0.045	0.009	319	1	
			NOV1997	30	0.479	0.030	158	0.107	0.049	329	0.070	0.010	323	2	
			DEC1997	10	0.389	0.033	166	0.104	0.044	335	0.055	0.008	322	1	
		183	MAY1997	29	0.302	0.014	138	0.055	0.045	73	0.013	0.009	312	1	MCM_97003_1254_9328_1800
			JUN1997	30	0.360	0.004	135	0.051	0.043	66	0.014	0.009	298	1	
			JUL1997	31	0.305	0.016	106	0.052	0.045	66	0.010	0.010	89	1	
			AUG1997	31	0.270	0.011	122	0.056	0.043	59	0.015	0.010	275	1	
			SEP1997	30	0.238	0.011	75	0.045	0.036	61	0.014	0.008	271	1	
			OCT1997	31	0.273	0.014	54	0.069	0.036	62	0.016	0.010	82	1	
			NOV1997	30	0.322	0.013	111	0.072	0.052	56	0.021	0.012	287	1	
			DEC1997	10	0.328	0.012	136	0.071	0.051	58	0.018	0.014	328	1	

Appendix B

Environmental Data

For

Newfoundland and Labrador Intra-provincial Ferry Routes

16-19

SIGNIFICANT WAVE HEIGHT STATISTICS EAST COAST AREA 16 - LABRADOR COAST



PERCENTAGE FREQUENCY OF OCCURRENCE BY DIRECTION Annual ODGP

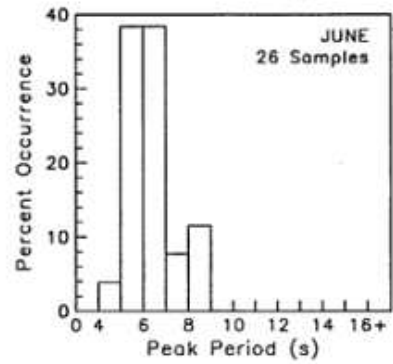
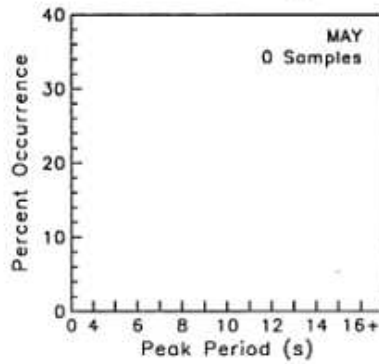
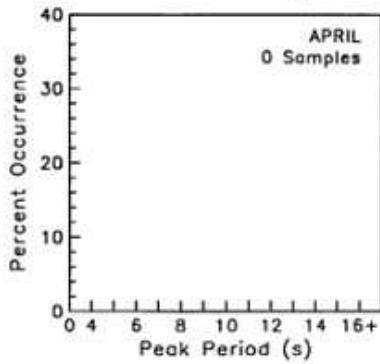
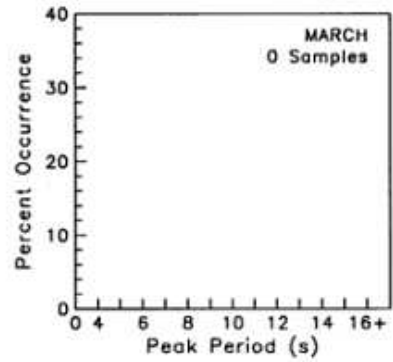
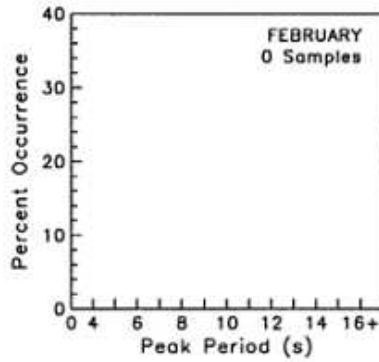
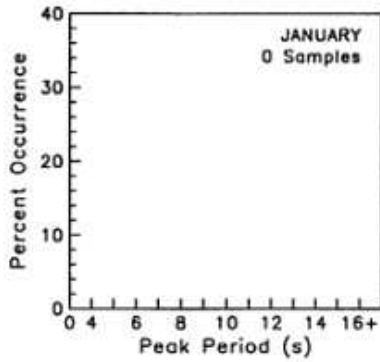
	Direction - coming from								Total	Num Obs
	N	NE	E	SE	S	SW	W	NW		
0.0 - < 0.5 m	0.5	0.8	0.2	0.2	0.1	0.1	0.8	0.3	3.0	113
0.5 - < 1.0 m	2.4	1.5	1.8	1.0	0.9	1.8	0.7	1.7	11.2	418
1.0 - < 1.5 m	3.5	1.5	1.9	2.1	2.0	2.4	2.1	3.5	19.1	713
1.5 - < 2.0 m	3.7	1.5	1.0	1.3	1.3	1.5	2.0	5.0	17.3	647
2.0 - < 2.5 m	3.0	1.2	0.8	0.9	0.8	1.1	1.4	3.4	12.5	467
2.5 - < 3.0 m	3.3	1.3	0.9	0.5	0.3	0.5	1.1	3.3	11.1	417
3.0 - < 3.5 m	2.1	1.8	0.9	0.4	0.3	0.3	1.0	2.0	8.4	314
3.5 - < 4.0 m	1.6	1.4	0.4	0.3	0.1	0.1	0.3	1.7	5.8	218
4.0 - < 4.5 m	0.8	0.7	0.2	0.1	0.1	0.1	0.4	1.1	3.5	131
4.5 - < 5.0 m	0.8	0.7	0.3	0.2	0.1	0.1	0.2	0.8	2.9	109
5.0 - < 5.5 m	0.4	0.5	0.1	0.1	0.1	-	0.1	0.5	1.7	64
5.5 - < 6.0 m	0.4	0.3	0.0	0.0	-	-	0.1	0.8	1.4	53
6.0 - < 6.5 m	0.3	0.3	-	-	-	-	0.1	0.4	1.0	39
6.5 - < 7.0 m	0.2	0.1	-	-	-	-	-	0.2	0.4	14
7.0 - + m	0.3	-	-	-	-	-	-	0.3	0.6	23
Total	23.0	13.3	8.3	7.0	5.8	7.6	10.4	24.6	100.0	3740

MONTHLY DATA STATISTICS Waverider

	Mean	Std Dev	Med	Max	Min	Upper	Lower	Most	Num Obs
						95% Lim	95% Lim	Freq Dir	
	m	m	m	m	m	m	m	from	
January	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-	0
February	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-	0
March	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-	0
April	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-	0
May	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-	0
June	1.3	0.5	1.1	2.3	0.7	2.2	0.7	-	26
July	1.3	0.7	1.1	5.5	0.2	2.7	0.5	-	1011
August	1.5	0.8	1.3	5.7	0.4	3.0	0.8	-	2331
September	2.1	1.1	1.8	7.3	0.3	4.3	0.8	-	2136
October	2.9	1.4	2.6	9.4	0.8	5.5	1.1	-	1247
November	2.9	1.2	2.5	7.1	0.8	5.1	1.3	-	145
December	0.0	0.0	2.5	0.0	0.0	5.1	1.3	-	0
Annual	1.9	1.2	1.6	9.4	0.2	4.3	0.6	-	6696

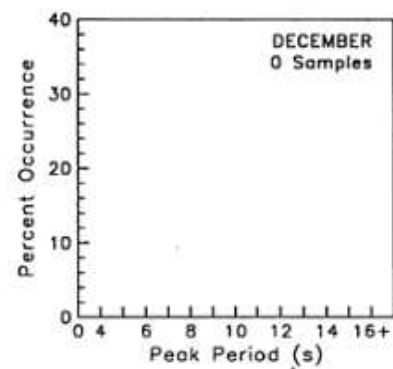
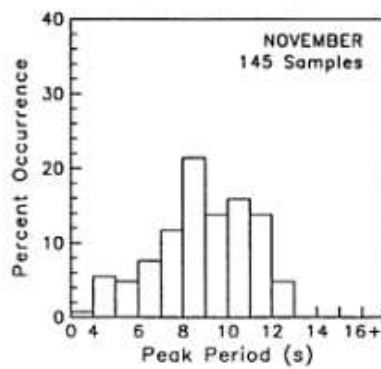
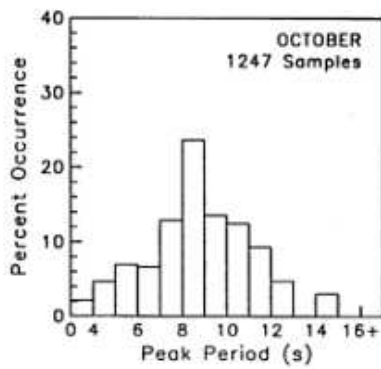
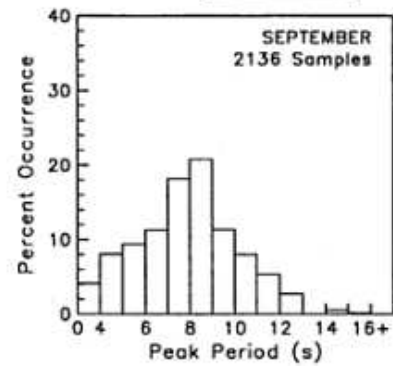
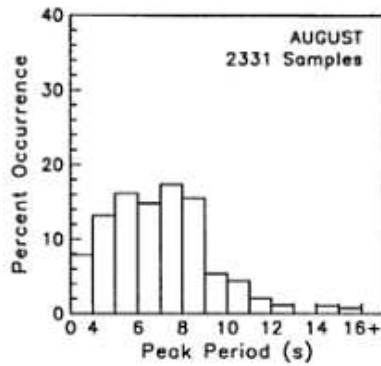
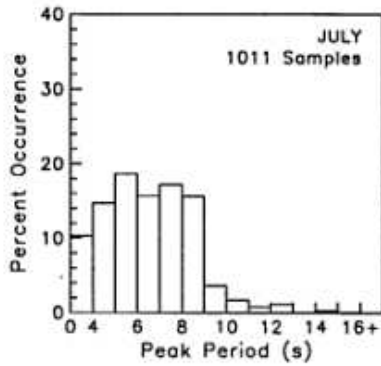
16-17

MONTHLY WAVE STATISTICS EAST COAST AREA 16 - LABRADOR COAST



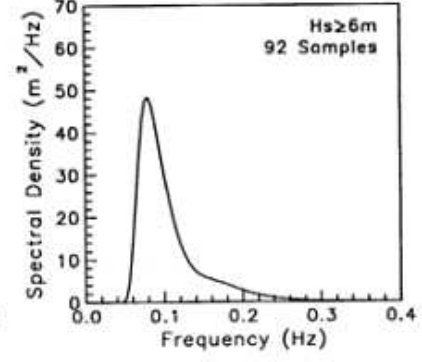
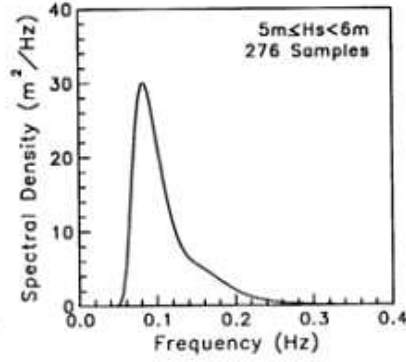
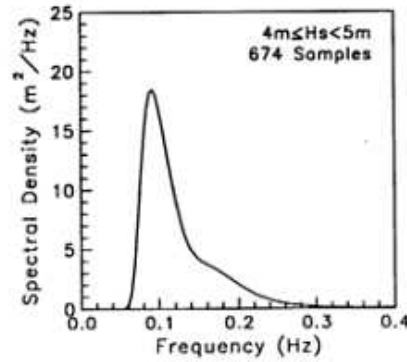
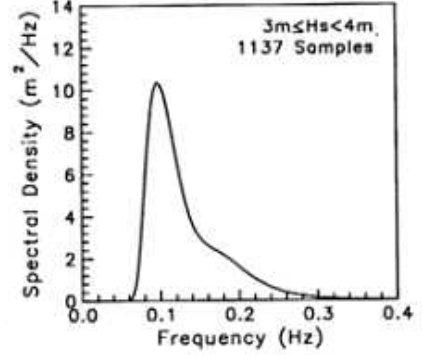
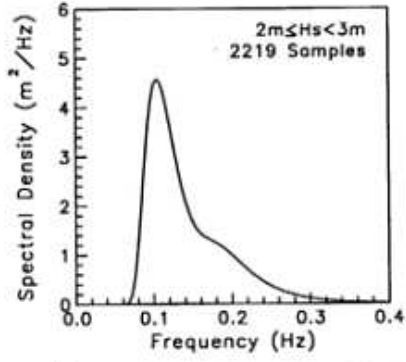
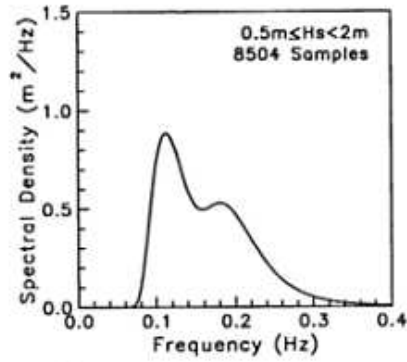
16-18

MONTHLY WAVE STATISTICS EAST COAST AREA 16 - LABRADOR COAST



16-21

MOST PROBABLE SPECTRA EAST COAST AREA 16 - LABRADOR COAST Waverider



Environment
CanadaEnvironnement
Canada

Canadian Climate Normals 1971-2000

The minimum number of years used to calculate these Normals is indicated by a [code](#) for each element. A "+" beside an extreme date indicates that this date is the first occurrence of the extreme value. Values and dates in bold indicate all-time extremes for the location.

NOTE!! Data used in the calculation of these Normals may be subject to further quality assurance checks. This may result in minor changes to some values presented here.

NAIN A NEWFOUNDLAND

Latitude: 56° 33' NLongitude: 61° 40' WElevation: 06.70 mClimate ID: 8502800WMO ID: 71902TC ID: YDP

<u>Temperature:</u>	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year	Cod
Daily Average (°C)	-18.5	-18.3	-12.3	-4.9	1	6.2	10.1	10.7	7	1.1	-5.1	-12.8	-3	C
Standard Deviation	3.2	3.7	2.8	2.5	1.7	1.5	1.3	1.1	1.1	1.9	2.6	3.2	1.4	C
Daily Maximum (°C)	-14	-13.6	-7.3	-0.3	5.1	11	15.1	15.6	10.9	4.2	-1.8	-8.8	1.3	C
Daily Minimum (°C)	-23.1	-22.9	-17.3	-9.5	-3	1.4	5.2	5.7	3	-2.1	-8.3	-16.8	-7.3	C
Extreme Maximum (°C)	15.7	7.6	12.1	14.5	25.6	33.3	33.3	32.7	26.1	19.4	11.7	6.7		
Date (yyyy/dd)	1990/12	2000/27	1999/29	1987/18	1950/31	1999/24	2000/31	2000/01	1927/03+	1975/06	1927/03	1951/04		
Extreme Minimum (°C)	-42.5	-38.3	-37	-31.1	-17.5	-6.7	-2.8	-2.8	-6.7	-19	-24.4	-41.5		
Date (yyyy/dd)	1995/27	1950/06+	1992/02	1943/12	1992/05	1952/17	1933/02	1941/04+	1929/24	1986/26	1951/25+	1990/22		
<u>Precipitation:</u>														
Rainfall (mm)	1.3	0.9	4.2	12.7	28.4	63.9	86.8	69.2	74.2	37.9	15.3	5.7		C
Snowfall (cm)	77.2	55.3	82.5	58.7	28.8	16	0	0	2.6	26.9	63.8	80.3		C
Precipitation (mm)	78.4	56.2	86.6	71.5	57.3	79.9	86.8	69.2	76.8	64.9	79	86.2		C
Average Snow Depth (cm)	69	84	104	95	26	0	0	0	0	1	15	47	37	D
Median Snow Depth (cm)	66	86	104	95	22	0	0	0	0	0	13	46	36	D
Snow Depth at Month-end (cm)	76	92	113	65	2	0	0	0	0	2	29	58	36	D
Extreme Daily Rainfall (mm)	11	5.6	31.6	35.6	45.7	42.2	54.1	65.8	63.8	39.4	43.2	53.1		
Date (yyyy/dd)	1997/07	1940/14	1988/11	1995/23	1970/18	1929/26	1928/30	1953/17	1932/24	1998/02	1998/03	1927/18		
Extreme Daily Snowfall (cm)	103.4	49.8	90.7	64.4	24	36.1	0	0	25.9	26.6	49.6	61		
Date (yyyy/dd)	1988/06	1987/11	1943/13	1989/07	1988/23	1997/01	1927/01+	1927/01+	1943/27	1990/19	1987/06	1949/29		
Extreme Daily Precipitation (mm)	103.4	49.8	90.7	64.4	45.7	48	54.1	65.8	63.8	39.4	49.6	61		
Date (yyyy/dd)	1988/06	1987/11	1943/13	1989/07	1970/18	1989/29	1928/30	1953/17	1932/24	1998/02	1987/06	1949/29		
Extreme Snow Depth (cm)	298	245	275	285	242	18	0	0	2	22	130	267		
Date (yyyy/dd)	1990/02	1985/16+	1985/26+	1985/18+	1985/01	1992/01	1985/01+	1985/01+	1992/30	1989/07	1989/24	1989/22+		
<u>Days with Maximum Temperature:</u>														
<= 0 °C	30.2	27.1	27.3	16.2	2.7	0	0	0	0	3.4	19.8	28.7	155.2	C
> 0 °C	0.85	1.2	3.7	13.9	28.3	30	31	31	30	27.6	10.3	2.3	210.1	C
> 10 °C	0.1	0	0.05	0.4	3.5	14.5	23.6	26.6	16.3	2	0	0	86.9	C
> 20 °C	0	0	0	0	0.19	2.5	6	5.9	1	0	0	0	15.6	C
> 30 °C	0	0	0	0	0	0.14	0.2	0.1	0	0	0	0	0.44	C
> 35 °C	0	0	0	0	0	0	0	0	0	0	0	0	0	C
<u>Days with Minimum Temperature:</u>														
> 0 °C	0.05	0	0.1	1.5	6.3	20.8	30.4	30.6	25.8	9.5	0.85	0.24	126	C
<= 2 °C	31	28.3	31	29.8	30	20.1	2.2	2.3	11	28	29.9	31	274.4	C
<= 0 °C	31	28.3	30.9	28.5	24.7	9.2	0.6	0.45	4.2	21.5	29.2	30.8	239.2	C
< -2 °C	30.9	28.2	30.3	25.9	15.7	1.7	0.05	0	0.95	13.4	26.6	30	203.5	C
< -10 °C	29.7	26.9	26	14.1	1.7	0	0	0	0	1.1	11	25.2	135.6	C
< -20 °C	22.8	19.8	11	1.7	0	0	0	0	0	0	0.6	10.8	66.7	C
< -30 °C	3.8	3	0.3	0	0	0	0	0	0	0	0	0.76	7.8	C
<u>Days with Rainfall:</u>														
>= 0.2 mm	0.48	0.5	1.2	3.1	7.1	12.7	13.6	12.9	13.5	8.1	2.1	1.1		C
>= 5 mm	0.1	0.05	0.11	0.76	1.7	4.4	5.1	4.1	5.3	2.9	0.81	0.43		C
>= 10 mm	0.05	0	0.11	0.33	0.67	2.1	3.1	2.6	2.4	1	0.48	0.24		C
>= 25 mm	0	0	0.05	0.05	0.1	0.19	0.63	0.35	0.24	0.14	0.19	0		C

Sea Surface Temperature

AREA_NAME	DEPTH	MONTH	MAX_TEMPERATURE	AVG_TEMPERATURE	STDDEV_TEMPERATURE
LS21	0	1	3.25	-0.12	1.3
LS21	0	2	3.52	0.66	2.55
LS21	0	3	3.1	0.55	2.19
LS21	0	4	-1.5	-1.5	0
LS21	0	5	3.12	2.22	1.27
LS21	0	6	4.34	1.61	1.03
LS21	0	7	10.59	4.42	2.34
LS21	0	8	9.39	5.12	1.65
LS21	0	9	7.44	3.92	1.4
LS21	0	10	5.2	2.24	1.24
LS21	0	11	5.1	0.89	1.5
LS21	0	12	1.44	-0.48	0.7

16-8

ANNUAL WIND SPEED STATISTICS

EAST COAST AREA 16 - LABRADOR COAST



PERCENTAGE FREQUENCY OF OCCURRENCE BY DIRECTION

Annual

	Direction - coming from								Total	Num Obs
	N	NE	E	SE	S	SW	W	NW		
0.0 - < 5.0 kts	2.2	0.3	0.4	0.4	0.5	0.4	0.5	0.4	5.0	1274
5.0 - <10.0 kts	1.8	1.2	1.5	1.5	2.2	1.7	2.2	1.8	13.9	3568
10.0 - <15.0 kts	2.9	1.4	1.9	2.4	3.4	2.8	3.1	2.8	20.7	5315
15.0 - <20.0 kts	2.5	1.3	1.8	2.3	3.9	2.5	3.3	3.3	20.8	5353
20.0 - <25.0 kts	2.2	0.9	1.0	1.8	3.0	1.8	2.7	3.1	18.2	4182
25.0 - <30.0 kts	1.4	0.6	0.6	0.9	1.8	0.8	1.8	2.1	9.9	2533
30.0 - <35.0 kts	1.1	0.4	0.4	0.6	0.7	0.5	1.1	1.8	8.4	1643
35.0 - <40.0 kts	0.6	0.2	0.2	0.3	0.3	0.3	0.7	1.0	3.6	928
40.0 - <45.0 kts	0.3	0.2	0.1	0.1	0.1	0.1	0.3	0.7	1.9	492
45.0 - <50.0 kts	0.1	0.1	0.0	0.0	0.0	0.1	0.2	0.2	0.8	195
50.0 - <55.0 kts	0.1	0.1	0.0	0.0	0.0	0.0	0.1	0.2	0.5	131
55.0 - + kts	0.1	0.0	0.0	0.0	0.0	0.0	0.1	0.2	0.4	106
Total	15.3	6.7	7.7	10.2	15.8	10.8	18.2	17.4	100.0	25701

MONTHLY DATA STATISTICS

	Mean	Std Dev	Med	Max	Min	Upper			Freq	Num Obs
						95% Lim	95% Lim	Most Dir		
	kts	kts	kts	kts	kts	kts	kts			
January	22.6	12.4	21.0	90.0	0.0	44.0	5.9	NW	1382	
February	22.0	12.4	20.0	74.0	0.0	44.0	5.0	W	446	
March	19.4	11.2	18.0	70.0	0.0	40.0	5.0	NW	943	
April	15.9	10.4	13.0	60.0	0.0	37.0	3.0	NW	549	
May	12.4	7.5	12.0	41.0	0.0	28.0	0.0	S	421	
June	13.6	8.1	13.0	54.0	0.0	28.0	2.0	N	1889	
July	14.6	7.8	14.0	50.0	0.0	28.0	3.0	S	4049	
August	18.8	8.3	18.0	84.0	0.0	31.0	4.0	S	4126	
September	19.1	10.1	18.0	78.0	0.0	37.0	5.0	S	4372	
October	20.8	10.4	20.0	74.0	0.0	40.0	6.0	W	3912	
November	20.4	10.8	19.2	74.0	0.0	40.0	5.0	W	2223	
December	23.0	11.4	23.0	80.0	0.0	43.0	6.0	W	1571	
Annual	18.3	10.1	17.0	90.0	0.0	37.0	4.2	NW	25843	

Reference Height: 20 m above mean sea level

Department of Fisheries and Oceans -Ocean Sciences
Ocean Data Inventory
17-Aug-2006 10:11

Query: 1444

Latitude	Longitude	Moor Depth M	Date	Days	Max Speed m/s	Mean Speed m/s	Current Dir T	Mid Freq Var			Low Freq Var			QC	Event Spec
								Major m/s	Minor m/s	Dir T	Major m/s	Minor m/s	Dir T		
- 52 N	51 W-														
52 29.57 N	51 19.05 W	202	NOV1991	14	0.522	0.237	141	0.139	0.054	319	0.115	0.035	323	1	MCM_91052_SP1_1607_3600
			DEC1991	31	0.529	0.251	141	0.108	0.096	330	0.071	0.046	324	1	
			JAN1992	31	0.550	0.145	141	0.111	0.071	316	0.103	0.058	317	1	
			FEB1992	29	0.578	0.214	141	0.118	0.070	319	0.111	0.052	319	1	
			MAR1992	31	0.625	0.280	139	0.128	0.061	321	0.120	0.037	321	1	
			APR1992	30	0.460	0.215	141	0.100	0.052	321	0.092	0.032	321	1	
			MAY1992	31	0.378	0.204	139	0.074	0.040	323	0.067	0.023	324	1	
			JUN1992	30	0.443	0.258	139	0.077	0.044	320	0.068	0.033	320	1	
			JUL1992	13	0.422	0.275	138	0.079	0.035	310	0.055	0.012	312	1	
		302	NOV1991	14	0.398	0.185	140	0.141	0.042	314	0.104	0.024	316	1	MCM_91052_SP1_5569_3600
			DEC1991	31	0.477	0.207	141	0.092	0.057	321	0.077	0.026	322	1	
			JAN1992	31	0.439	0.104	141	0.094	0.054	318	0.088	0.038	319	1	
			FEB1992	29	0.453	0.161	139	0.103	0.044	321	0.096	0.025	321	1	
			MAR1992	31	0.582	0.242	140	0.136	0.043	318	0.129	0.024	318	1	
			APR1992	30	0.401	0.161	141	0.083	0.036	320	0.075	0.020	320	1	
			MAY1992	31	0.247	0.167	140	0.034	0.021	314	0.026	0.008	314	1	
		502	NOV1991	14	0.426	0.143	145	0.187	0.041	319	0.118	0.024	320	1	MCM_91052_SP1_5572_3600
			DEC1991	31	0.423	0.177	143	0.093	0.048	325	0.086	0.022	326	1	
			JAN1992	31	0.377	0.109	143	0.079	0.044	321	0.076	0.020	325	1	
			FEB1992	29	0.357	0.133	140	0.085	0.038	331	0.083	0.026	331	1	
			MAR1992	31	0.511	0.194	142	0.106	0.032	322	0.108	0.013	322	1	
			APR1992	30	0.329	0.115	140	0.072	0.023	318	0.072	0.013	320	1	
			MAY1992	31	0.256	0.116	141	0.052	0.023	323	0.055	0.010	326	1	
			JUN1992	30	0.340	0.148	142	0.062	0.021	322	0.062	0.008	325	1	
52 45.41 N	51 43.08 W	31	JUL1991	24	0.821	0.429	149	0.116	0.077	29	0.097	0.039	20	1	MCM_91912_4_1562_1800
			AUG1991	31	0.853	0.451	151	0.126	0.116	35	0.102	0.087	9	1	
			SEP1991	30	0.802	0.354	149	0.130	0.123	86	0.068	0.060	319	1	
			OCT1991	25	0.755	0.383	151	0.126	0.111	32	0.094	0.082	10	1	
		195	JUL1991	24	0.473	0.230	143	0.072	0.042	322	0.062	0.021	327	1	MCM_91912_4_10135_1800
			AUG1991	31	0.517	0.241	144	0.068	0.054	307	0.049	0.021	322	1	
			SEP1991	30	0.438	0.214	143	0.065	0.053	306	0.041	0.025	316	1	
			OCT1991	25	0.677	0.260	143	0.090	0.059	338	0.072	0.026	342	1	
		450	JUL1991	24	0.383	0.172	141	0.084	0.033	317	0.072	0.012	325	1	MCM_91912_4_9078_1800

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SIGNIFICANT WAVE HEIGHT STATISTICS EAST COAST AREA 14 - NORTH EAST COAST



PERCENTAGE FREQUENCY OF OCCURRENCE BY DIRECTION Annual ODGP

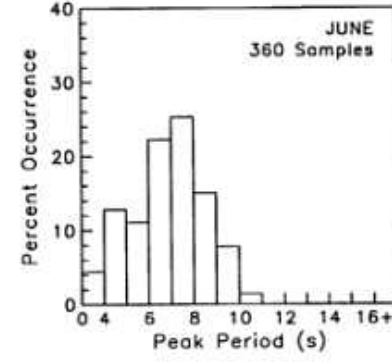
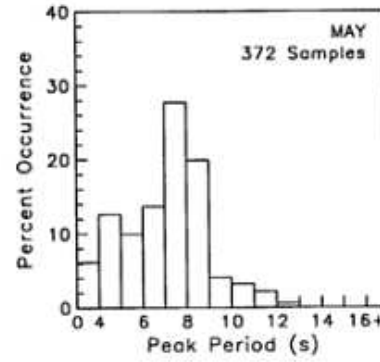
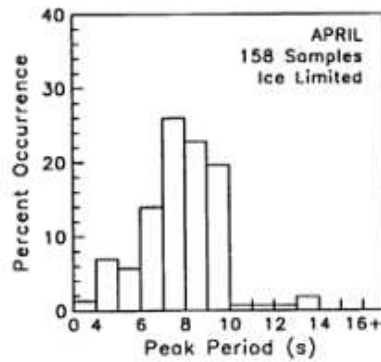
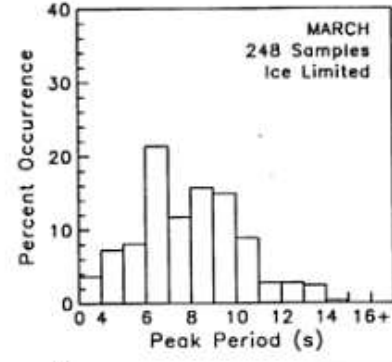
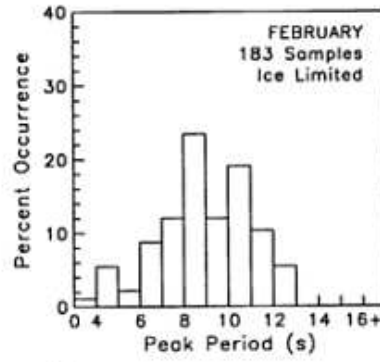
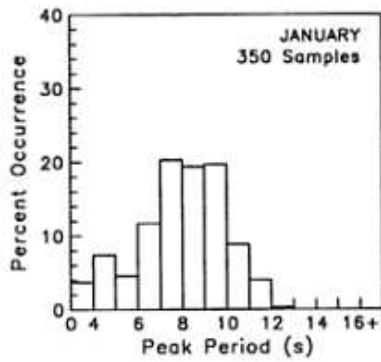
	Direction - coming from								Total	Num Obs
	N	NE	E	SE	S	SW	W	NW		
0.0 - < 0.5 m	0.1	0.1	0.1	0.1	-	0.2	0.0	-	0.5	20
0.5 - < 1.0 m	0.8	0.7	0.5	0.3	0.8	1.9	0.7	0.5	8.2	241
1.0 - < 1.5 m	2.1	1.3	1.5	1.0	1.8	4.4	2.0	1.7	15.7	609
1.5 - < 2.0 m	2.1	1.5	1.0	0.8	1.9	5.4	2.9	1.7	17.2	667
2.0 - < 2.5 m	2.9	1.1	0.8	0.5	2.1	4.2	2.2	2.4	16.0	622
2.5 - < 3.0 m	2.5	1.4	0.9	0.4	1.8	3.0	2.3	2.1	14.3	558
3.0 - < 3.5 m	1.4	1.0	0.3	0.2	1.8	2.3	1.9	1.6	10.1	392
3.5 - < 4.0 m	1.4	0.7	0.2	0.3	0.7	1.3	1.1	1.4	8.9	289
4.0 - < 4.5 m	1.1	0.3	0.1	0.1	0.7	0.7	0.5	1.0	4.5	178
4.5 - < 5.0 m	0.8	0.1	0.1	0.2	0.4	0.8	0.4	0.7	3.1	120
5.0 - < 5.5 m	0.6	0.1	0.0	0.1	0.2	0.5	0.2	0.7	2.5	97
5.5 - < 6.0 m	0.4	-	0.1	-	0.0	0.2	0.1	0.3	1.1	44
6.0 - < 6.5 m	0.1	-	-	-	0.0	0.2	0.2	0.2	0.7	28
6.5 - < 7.0 m	0.1	-	-	-	-	0.1	0.1	0.1	0.3	12
7.0 - + m	0.3	-	-	-	0.0	0.1	0.1	0.2	0.7	28
Total	18.4	8.3	5.1	3.9	12.0	24.9	14.7	14.7	100.0	3879

MONTHLY DATA STATISTICS ODGP

	Std				Min	Upper		Most	Num
	Mean	Dev	Med	Max		95%	95%		
	m	m	m	m	m	Lim	Lim	Dir	Obs
January	2.9	1.4	2.7	7.3	0.4	5.6	1.0	SW	350
February	2.6	1.3	2.3	7.7	0.5	4.9	0.7	NE	183
March	1.8	0.9	1.6	5.1	0.2	3.3	0.4	SW	248
April	2.4	1.1	2.4	5.8	0.6	4.3	0.9	N	158
May	2.2	0.9	1.9	6.3	0.8	3.8	1.0	SW	372
June	2.2	0.9	2.1	5.5	0.7	4.0	1.0	SW	360
July	1.8	0.8	1.7	3.7	0.6	2.9	0.9	SW	372
August	1.6	0.8	1.4	4.3	0.3	3.0	0.5	SW	372
September	2.3	1.1	1.9	7.4	0.6	4.1	0.9	N	360
October	2.9	1.0	2.7	6.1	1.3	5.0	1.5	N	372
November	3.4	1.2	3.2	7.4	1.5	5.5	1.8	NW	360
December	4.0	1.6	3.8	10.6	1.1	6.7	1.8	NW	372
Annual	2.5	1.3	2.2	10.8	0.2	5.0	0.9	SW	3879

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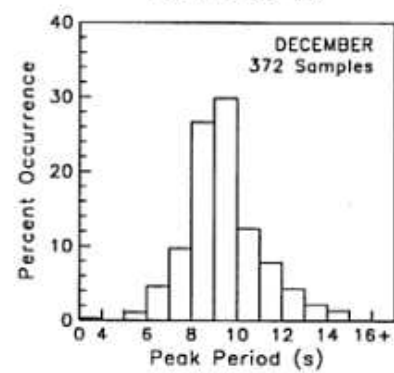
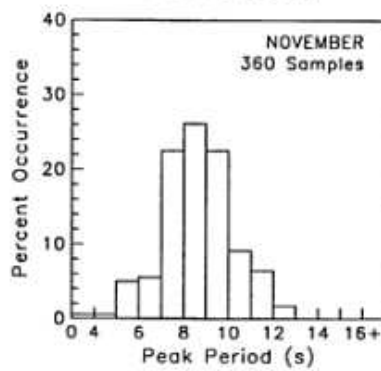
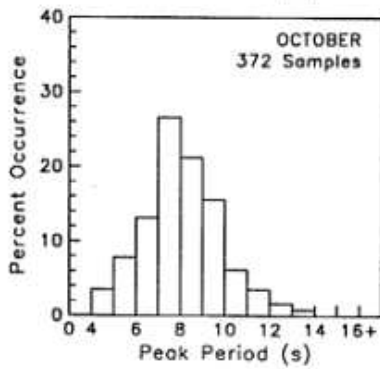
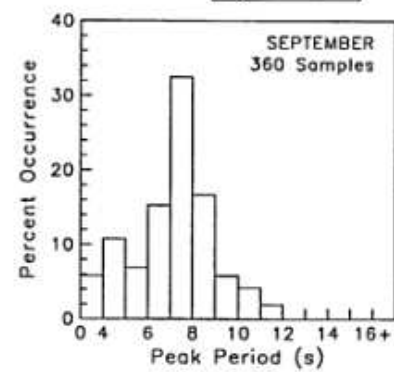
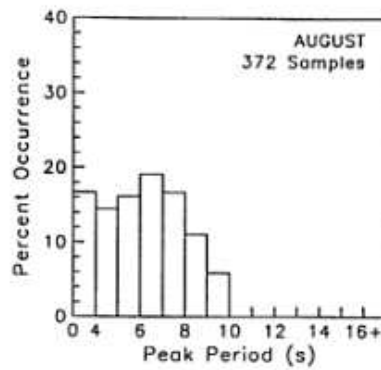
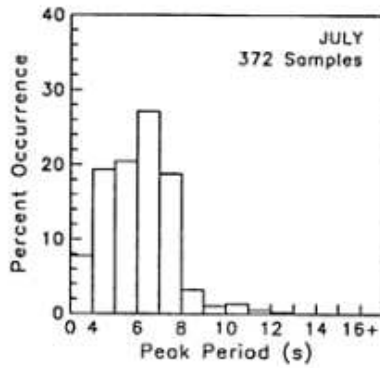
MONTHLY WAVE STATISTICS EAST COAST AREA 14 - NORTH EAST COAST



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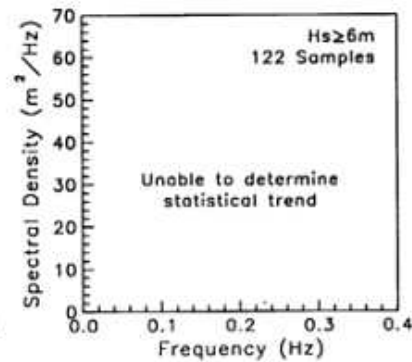
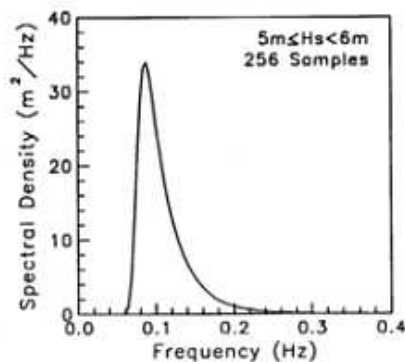
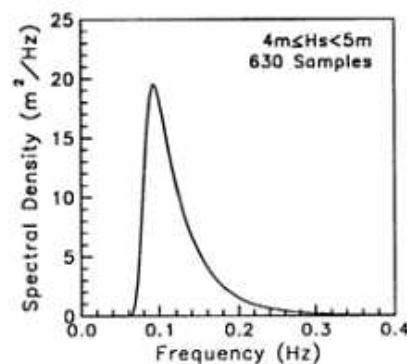
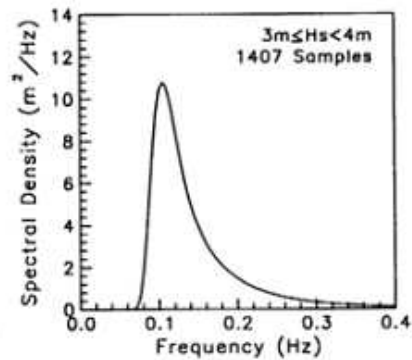
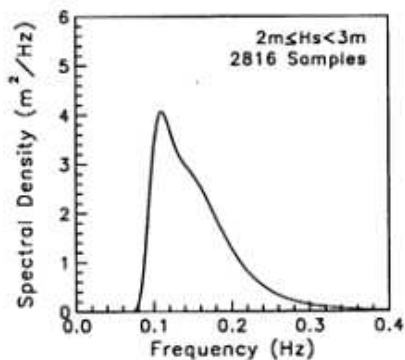
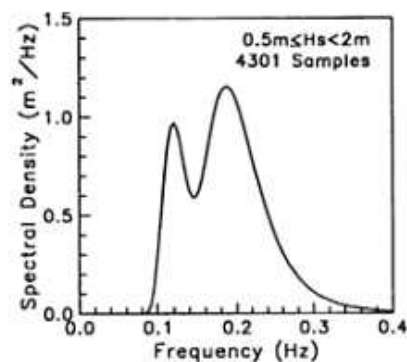
MONTHLY WAVE STATISTICS

EAST COAST AREA 14 - NORTH EAST COAST



14-21

MOST PROBABLE SPECTRA EAST COAST AREA 14 — NORTH EAST COAST ODGP



14-8

ANNUAL WIND SPEED STATISTICS

EAST COAST AREA 14 - NORTH EAST COAST



PERCENTAGE FREQUENCY OF OCCURRENCE BY DIRECTION

Annual

	Direction - coming from								Total	Num Obs
	N	NE	E	SE	S	SW	W	NW		
0.0 - < 5.0 kts	2.5	0.4	0.5	0.4	0.8	0.8	0.5	0.4	6.2	1533
5.0 - < 10.0 kts	2.2	1.4	1.4	1.5	2.8	2.7	2.6	1.8	18.2	4025
10.0 - < 15.0 kts	2.9	1.8	1.7	1.9	4.2	4.0	3.5	2.4	22.2	5508
15.0 - < 20.0 kts	2.6	1.4	1.3	1.8	3.9	4.0	3.8	2.1	20.4	5070
20.0 - < 25.0 kts	2.1	0.9	0.7	1.0	2.5	2.6	2.7	1.9	14.4	3589
25.0 - < 30.0 kts	1.5	0.5	0.4	0.6	1.4	1.5	2.0	1.3	9.3	2314
30.0 - < 35.0 kts	1.1	0.3	0.2	0.3	0.8	0.8	1.2	0.9	5.5	1359
35.0 - < 40.0 kts	0.6	0.2	0.1	0.2	0.3	0.4	0.7	0.6	3.1	781
40.0 - < 45.0 kts	0.3	0.1	0.1	0.1	0.2	0.2	0.4	0.3	1.8	388
45.0 - < 50.0 kts	0.2	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.8	156
50.0 - < 55.0 kts	0.1	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.3	75
55.0 - + kts	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.2	48
Total	15.9	8.9	8.5	7.7	18.8	17.1	17.5	11.8	100.0	24844

MONTHLY DATA STATISTICS

	Std				Upper		Lower	Most	Num Obs
	Mean	Dev	Med	Max	Min	95% Lim	95% Lim	Freq Dir	
	kts	kts	kts	kts	kts	kts	kts	from	
January	19.7	10.9	18.0	50.0	0.0	40.0	4.0	W	1900
February	18.4	10.4	17.0	78.5	0.0	38.0	3.0	W	2308
March	17.2	9.7	16.0	70.0	0.0	35.0	4.0	W	2509
April	15.6	8.9	14.2	65.0	0.0	32.0	3.9	N	2116
May	14.2	8.2	13.0	75.0	0.0	30.0	3.0	N	1837
June	13.7	7.9	13.0	54.0	0.0	28.0	2.0	S	1520
July	13.6	7.1	13.0	42.0	0.0	25.0	3.0	S	2008
August	14.5	8.0	14.0	70.0	0.0	30.0	2.0	S	2293
September	16.3	8.6	15.0	55.0	0.0	31.0	4.0	SW	2287
October	18.5	9.8	17.7	82.0	0.0	36.0	5.0	W	2585
November	20.7	10.9	20.0	78.0	0.0	40.0	5.0	W	2079
December	20.7	11.0	19.0	62.9	0.0	41.0	5.0	W	1746
Annual	17.0	9.7	15.0	82.0	0.0	35.0	4.0	W	24844

Reference Height: 20 m above mean sea level

Appendix C

Environmental Data

For

Lake Superior

7-19

SIGNIFICANT WAVE HEIGHT STATISTICS GREAT LAKES AREA 7 - LAKE SUPERIOR CENTRE



PERCENTAGE FREQUENCY OF OCCURRENCE BY DIRECTION Annual WES

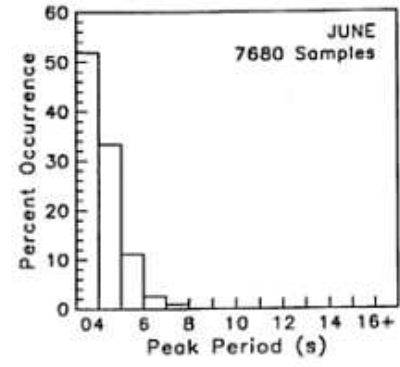
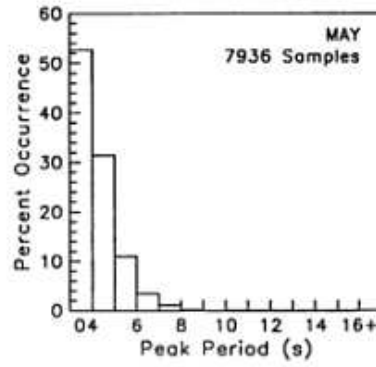
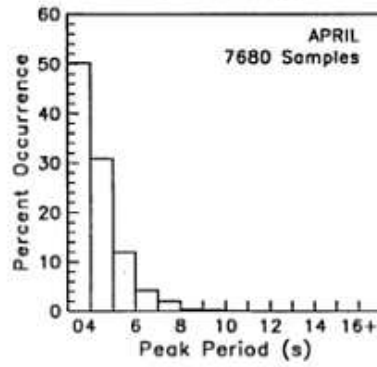
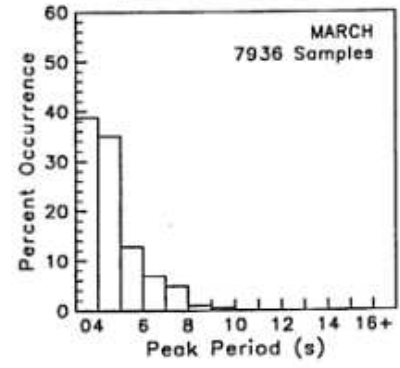
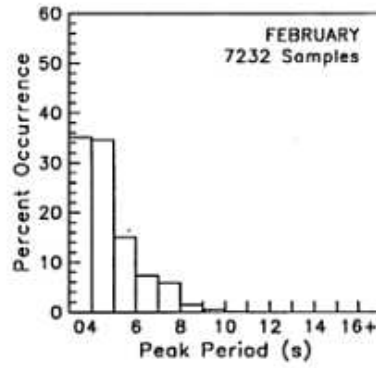
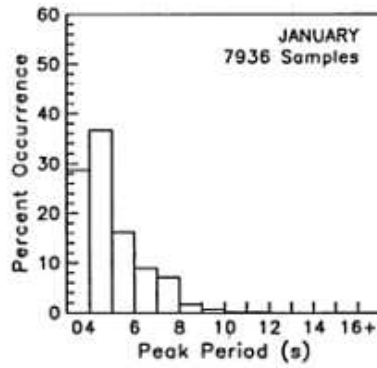
	Direction - Coming From								Num	
	N	NE	E	SE	S	SW	W	NW	Total	Obs
0.0 - < 0.5 m	3.0	2.8	1.4	2.1	4.0	4.5	4.1	2.8	24.7	23075
0.5 - < 1.0 m	4.3	5.5	3.8	3.8	7.0	7.1	8.7	8.9	48.7	43872
1.0 - < 1.5 m	1.0	0.7	0.8	1.0	3.5	3.5	4.0	1.5	15.8	14794
1.5 - < 2.0 m	0.2	0.4	0.2	0.3	1.8	1.8	1.8	0.8	8.4	5995
2.0 - < 2.5 m	0.0	0.0	0.0	0.1	0.8	0.7	0.7	0.0	2.5	2338
2.5 - < 3.0 m	-	0.0	0.0	0.0	0.8	0.5	0.4	0.0	1.5	1406
3.0 - < 3.5 m	-	-	-	0.0	0.4	0.3	0.2	-	1.0	914
3.5 - < 4.0 m	-	-	-	0.0	0.3	0.2	0.1	-	0.8	551
4.0 - < 4.5 m	-	-	-	-	0.2	0.1	0.0	-	0.3	313
4.5 - < 5.0 m	-	-	-	-	0.1	0.1	0.0	-	0.2	188
5.0 - < 5.5 m	-	-	-	-	0.1	0.1	0.0	-	0.1	119
5.5 - < 6.0 m	-	-	-	-	0.0	0.0	0.0	-	0.1	58
6.0 - < 6.5 m	-	-	-	-	0.0	0.0	0.0	-	0.0	42
6.5 - < 7.0 m	-	-	-	-	0.0	0.0	0.0	-	0.0	23
7.0 - + m	-	-	-	-	0.0	0.0	0.0	-	0.0	18
Total	8.5	9.4	5.9	7.2	18.4	18.9	19.8	11.9	100.0	93504

MONTHLY DATA STATISTICS WES

	Mean	Std Dev	Med	Max	Min	Upper	Lower	Most	Num Obs
						95% Lim	95% Lim	Freq Dir from	
January	1.0	0.7	0.8	5.3	0.0	2.3	0.3	W	7938
February	0.9	0.6	0.7	5.1	0.0	2.1	0.3	W	7232
March	0.9	0.6	0.7	6.3	0.0	2.1	0.3	W	7938
April	0.7	0.5	0.8	4.4	0.0	1.8	0.2	S	7680
May	0.7	0.4	0.8	4.9	0.0	1.5	0.2	S	7938
June	0.8	0.4	0.8	4.4	0.0	1.4	0.2	S	7680
July	0.5	0.3	0.5	3.4	0.0	1.1	0.2	SW	7938
August	0.8	0.4	0.8	3.9	0.0	1.4	0.2	S	7938
September	1.0	0.8	0.7	7.7	0.0	2.8	0.2	SW	7680
October	1.2	1.1	0.9	7.5	0.1	3.8	0.3	S	7938
November	1.2	1.0	0.9	8.2	0.1	3.3	0.4	W	7680
December	1.0	0.7	0.8	5.3	0.1	2.5	0.3	W	7938
Annual	0.9	0.7	0.7	8.2	0.0	2.2	0.2	W	93504

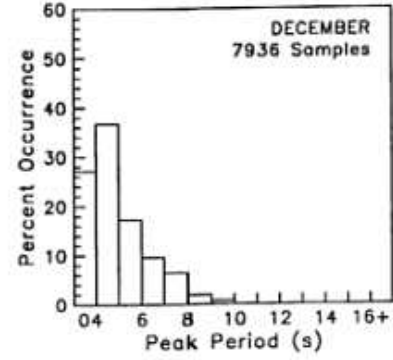
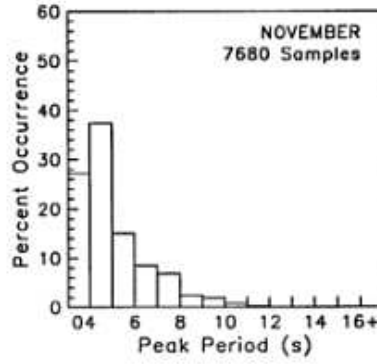
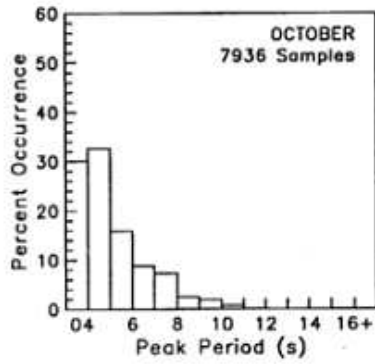
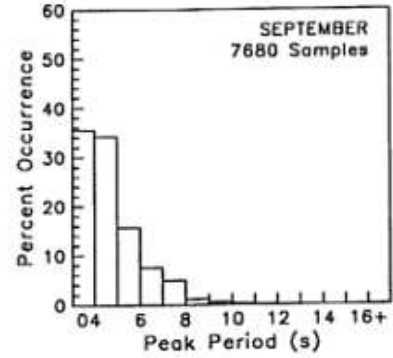
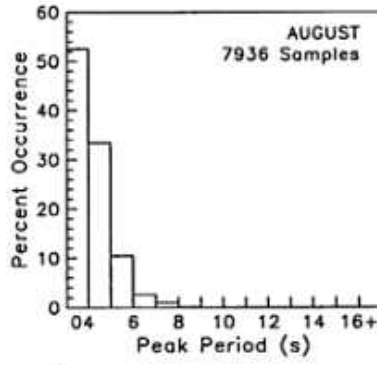
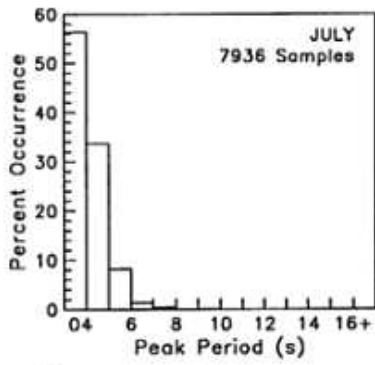
7-17

MONTHLY WAVE STATISTICS GREAT LAKES AREA 7 - LAKE SUPERIOR CENTRE



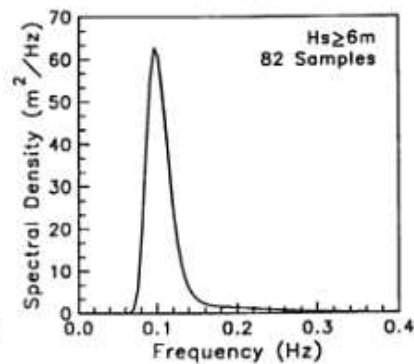
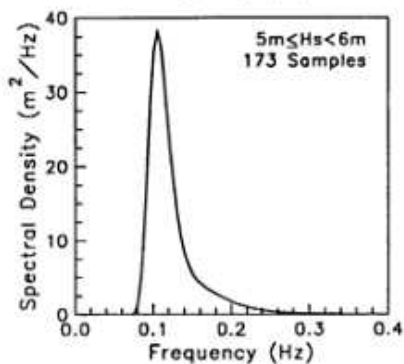
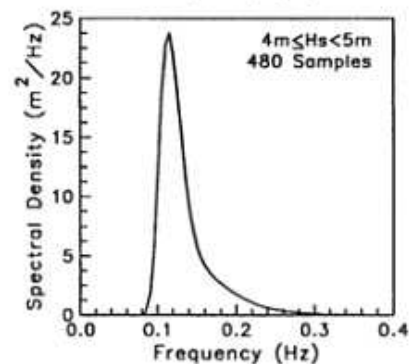
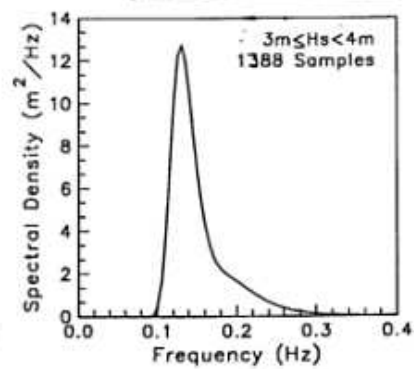
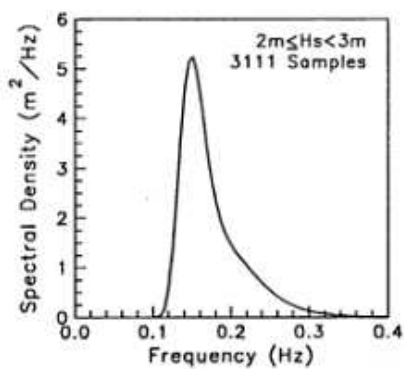
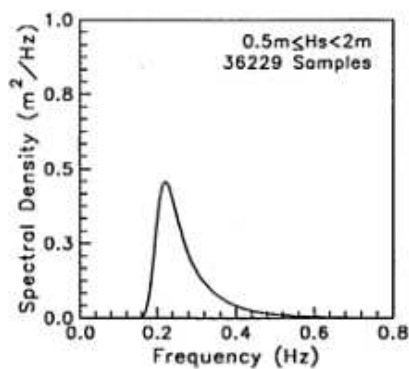
7-18

MONTHLY WAVE STATISTICS GREAT LAKES AREA 7 - LAKE SUPERIOR CENTRE



7-21

MOST PROBABLE SPECTRA GREAT LAKES AREA 7 - LAKE SUPERIOR CENTRE WES





Environment
Canada

Environnement
Canada

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Canadian Climate Normals 1971-2000

The minimum number of years used to calculate these Normals is indicated by a [code](#) for each element. A "+" beside an extreme date indicates that this date is the first occurrence of the extreme value. Values and dates in bold indicate all-time extremes for the location.

NOTE!! Data used in the calculation of these Normals may be subject to further quality assurance checks. This may result in minor changes to some values presented here.

SAULT STE MARIE 2 ONTARIO

Latitude: 46° 31' N

Longitude: 84° 19' W

Elevation: 211.80 m

Climate ID: 6057590

WMO ID:

TC ID:

Temperature:	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year	Code
Daily Average (°C)	-10.1	-8.6	-3.4	3.7	11.5	15.5	18.3	18	13.1	7.2	0.4	-6.5		A
Standard Deviation	2.8	2.9	2.2	1.9	2.1	1.6	1.4	1.4	1.2	1.8	1.7	3		A
Daily Maximum (°C)	-5.8	-4	1.3	8.7	17.5	21.4	24.1	23.3	17.8	11.2	3.6	-2.8		A
Daily Minimum (°C)	-14.2	-13	-8	-1.4	5.3	9.5	12.4	12.7	8.4	3.1	-2.7	-10		A
Extreme Maximum (°C)	7.2	12	19	30	32	33.5	36	34	32.8	26.7	19.5	15		
Date (yyyy/dd)	1973/18	2000/23	1995/14	1990/25	1993/10	1994/17	1988/08	1988/02	1976/08	1968/16	1990/02+	2001/05		
Extreme Minimum (°C)	-35	-32.5	-33.9	-17.2	-6.7	-2	1.7	0	-3.5	-7.8	-21.7	-34.5		
Date (yyyy/dd)	1982/10	1981/12	1972/03	1972/07	1966/07	1980/10	1972/05	1985/08	1993/30	1976/26	1964/30	1993/26		
Precipitation:														
Rainfall (mm)	7.9	5.2	26.6	50.3	67.5	81	77.5	92.3	102.1	88.3	53.1	13.8	665.5	A
Snowfall (cm)	93.4	47.9	37.6	17.2	0.5	0	0	0	0	9.5	41.5	97.3	345	A
Precipitation (mm)	101.2	53.1	64.2	67.5	67.9	81	77.5	92.3	102.2	97.8	94.7	111.1	1010.5	A
Average Snow Depth (cm)					0	0	0	0	0	0				C
Median Snow Depth (cm)					0	0	0	0	0	0				C
Snow Depth at Month-end (cm)					0	0	0	0	0	0				C
Extreme Daily Rainfall (mm)	18.4	21.1	48	43.8	81	84.8	41.9	95.3	72.4	54.4	41.7	30.2		
Date (yyyy/dd)	1980/16	1966/09	1976/26	1980/08	1970/30	1961/22	1958/04	1968/21	1985/02	2001/13	1963/22	1971/10		
Extreme Daily Snowfall (cm)	35.6	22.9	30.5	28.2	5.1	0	0	0	2.5	15.2	22	60		
Date (yyyy/dd)	1972/25	1968/02	1976/12	1991/09	1963/21+	1958/01+	1958/01+	1958/01+	1965/25	1972/17	1984/01	1995/08		
Extreme Daily Precipitation (mm)	35.6	22.9	48	43.8	81	84.8	41.9	95.3	72.4	56.1	46.7	60		
Date (yyyy/dd)	1972/25	1968/02	1976/26	1980/08	1970/30	1961/22	1958/04	1968/21	1985/02	1959/24	1963/22	1995/08		
Extreme Snow Depth (cm)	102	106	104	63	3	0	0	0	0	15	36	120		
Date (yyyy/dd)	1996/31	1996/11	1996/03+	1996/01	1996/01	1961/01+	1961/01+	1961/01+	1961/01+	1969/28	1966/05	1995/11		
Days with Maximum Temperature:														
<= 0 °C	25.9	20.8	12.3	2.1	0	0	0	0	0	0.21	8.1	20.9		A
> 0 °C	5.1	7.5	18.7	27.9	31	30	31	31	30	30.8	21.9	10.1		A
> 10 °C	0	0	2	12.1	26.5	29.6	31	31	28.5	17	3.2	0.11		A
> 20 °C	0	0	0	1.1	10.3	18.6	25.4	24.4	8.7	1	0	0		A
> 30 °C	0	0	0	0	0.25	0.7	1.2	0.53	0.14	0	0	0		A
> 35 °C	0	0	0	0	0	0	0.08	0	0	0	0	0		A
Days with Minimum Temperature:														
> 0 °C	0.14	0.85	3.3	11.6	25.7	29.7	31	31	29.1	22.5	8.6	1.7		A
<= 2 °C	31	28.2	29.9	23.3	9.8	1.5	0.04	0	3	13	25.2	30.6		A
<= 0 °C	30.9	27.4	27.7	18.4	5.3	0.29	0	0	0.9	8.5	21.4	29.4		A
< -2 °C	29.6	25.6	24.1	11.7	1.3	0	0	0	0.05	3	15.1	26.1		A
< -10 °C	20.9	18.1	10.6	1.1	0	0	0	0	0	0	2.9	14.3		A
< -20 °C	7	5.3	0.96	0	0	0	0	0	0	0	0.08	3.3		A
< -30 °C	0.62	0.19	0	0	0	0	0	0	0	0	0	0.08		A

Days with Rainfall:														
>= 0.2 mm	1.8	1.6	4.3	7.9	11	11.9	11.3	12.9	14.6	14.3	8.6	3.2	103.6	A
>= 5 mm	0.6	0.48	1.6	3.1	4.6	5	4.9	5.2	6.5	5.6	3.3	0.97	41.8	A
>= 10 mm	0.3	0.1	0.86	1.7	2.3	2.8	2.7	3	3.5	3.2	1.8	0.43	22.8	A
>= 25 mm	0	0	0.03	0.28	0.41	0.6	0.53	0.85	0.64	0.34	0.33	0.07	4.1	A
Days With Snowfall:														
>= 0.2 cm	20.2	14.3	10.5	4.4	0.4	0	0	0	0.13	2.9	11.3	18.7	82.8	A
>= 5 cm	6.5	3.4	2.5	1.1	0	0	0	0	0	0.63	3	7	24.2	A
>= 10 cm	2.6	1	0.83	0.45	0	0	0	0	0	0.27	0.9	3	9	A
>= 25 cm	0.2	0	0.07	0.03	0	0	0	0	0	0	0	0.23	0.53	A
Days with Precipitation:														
>= 0.2 mm	20.9	15.1	13.7	11.1	11.2	11.9	11.3	12.9	14.6	16	17.8	20.7	177.3	A
>= 5 mm	7.1	4	3.9	4.3	4.6	5	4.9	5.2	6.5	6.5	6.4	7.9	66.2	A
>= 10 mm	2.9	1.2	1.8	2.1	2.3	2.8	2.7	3	3.5	3.6	2.8	3.5	32.4	A
>= 25 mm	0.2	0	0.17	0.31	0.41	0.6	0.53	0.85	0.64	0.34	0.37	0.3	4.7	A
Days with Snow Depth:														
>= 1 cm					0.12	0	0	0	0					C
>= 5 cm					0	0	0	0	0					C
>= 10					0	0	0	0	0					C
>= 20					0	0	0	0	0					C
Degree Days:														
Above 24 °C	0	0	0	0	0	0.4	1.4	0.8	0.1	0	0	0		A
Above 18 °C	0	0	0	0.1	5	18.5	40.3	41.8	8.5	0.2	0	0		A
Above 15 °C	0	0	0	0.8	18.5	54	102.9	106	27.8	1.7	0	0		A
Above 10 °C	0	0	0.2	7.7	77.9	165.1	249.3	253.8	109.8	21	1	0.1		A
Above 5 °C	0	0	4.4	41.8	195.1	310.7	404.2	408.7	244.6	94.6	13.4	0.6		A
Above 0 °C	1.3	6	31.8	134.2	344.8	460.6	559.2	563.7	394.2	226.3	66.7	8.9		A
Below 0 °C	309.1	245.5	128.5	19.2	0.1	0	0	0	0	1.5	53.6	210.6		A
Below 5 °C	462.8	381	256.1	76.8	5.4	0.1	0	0	0.4	24.7	150.3	357.3		A
Below 10 °C	617.8	522.4	406.8	192.8	43.1	4.3	0	0.1	15.6	106.2	287.9	511.8		A
Below 15 °C	772.8	663.8	561.6	335.8	138.7	43.4	8.7	7.3	83.6	241.9	436.9	666.7		A
Below 18 °C	865.8	748.6	654.6	425.2	218.2	97.9	39.1	36.1	154.4	333.4	526.9	759.7		A

Created : 2002-06-21

Modified : 2004-02-25

Reviewed : 2004-02-25

Url of this page : http://www.climate.weatheroffice.ec.gc.ca/climate_normals/results_e.html

The Green Lane™,
Environment Canada's World Wide Web Site.



Mean water surface temperature

	Year	Day	Sup.	Mich.	Huron	Erie	Ont.
Jan		Avg	2.6	3.1	3.1	2.4	3.3
Feb		Avg	1.4	1.7	1.3	1.7	1.9
Mar		Avg	0.9	1.6	0.9	1.4	1.7
Apr		Avg	1.1	2.5	1.7	3.7	2.6
May		Avg	2.3	5.5	4.6	9.8	6.1
Jun		Avg	5.3	12.3	11.2	17.5	13.8
Jul		Avg	10.9	18.7	17.2	22.2	19.5
Aug		Avg	15.4	20.9	19.7	23.4	21.8
Sep		Avg	14.3	18.8	17.8	21.1	19.3
Oct		Avg	9.5	13.2	12.4	15.8	13.4
Nov		Avg	6.5	8.9	8.4	10.7	8.6
Dec		Avg	4.5	5.6	5.7	5.5	5.5

7-8

ANNUAL WIND SPEED STATISTICS

GREAT LAKES AREA 7 - LAKE SUPERIOR CENTRE



PERCENTAGE FREQUENCY OF OCCURRENCE BY DIRECTION

Annual
WES

	Direction - Coming From								Num	
	N	NE	E	SE	S	SW	W	NW	Total	Obs
0.0 - < 5.0 kts	0.7	0.7	0.6	0.9	0.9	0.9	0.7	0.8	6.3	5891
5.0 - < 10.0 kts	3.4	3.9	2.3	4.1	4.0	4.5	4.8	3.8	30.8	28585
10.0 - < 15.0 kts	5.8	5.7	3.1	3.8	4.0	5.9	7.3	7.4	43.0	40167
15.0 - < 20.0 kts	1.5	1.1	0.5	0.8	0.8	1.3	1.5	1.7	8.9	8353
20.0 - < 25.0 kts	0.7	0.5	0.2	0.4	0.5	0.7	0.7	0.9	4.6	4256
25.0 - < 30.0 kts	0.7	0.5	0.2	0.5	0.6	0.7	0.7	0.8	4.7	4354
30.0 - < 35.0 kts	0.2	0.2	0.0	0.3	0.3	0.3	0.2	0.2	1.8	1473
35.0 - < 40.0 kts	0.0	0.0	0.0	0.1	0.1	0.1	0.0	0.0	0.3	249
40.0 - < 45.0 kts	0.0	0.0	-	0.1	0.0	0.0	0.0	0.0	0.1	134
45.0 - < 50.0 kts	0.0	-	-	0.0	0.0	0.0	0.0	-	0.0	35
50.0 - < 55.0 kts	-	-	-	0.0	-	-	0.0	-	0.0	3
55.0 - + kts	-	-	-	0.0	-	-	0.0	-	0.0	2
Total	13.0	12.5	7.0	10.8	11.1	14.3	15.8	15.7	100.0	93504

MONTHLY DATA STATISTICS

WES

	Mean	Std Dev	Med	Max	Min	Upper	Lower	Most	Num
						95% Lim	95% Lim		
	kts	kts	kts	kts	kts	kts	kts	freq	Obs
January	12.9	6.2	12.0	41.0	0.0	26.0	4.0	NW	7936
February	13.2	6.2	12.0	45.1	0.0	27.0	4.0	N	7232
March	13.6	6.6	12.0	39.1	0.0	27.9	5.0	NE	7936
April	11.2	5.3	11.0	38.1	0.0	22.9	4.0	NE	7680
May	10.9	4.7	11.0	38.1	0.0	19.0	4.0	NE	7936
June	10.1	4.5	8.9	41.0	0.0	17.1	4.0	W	7680
July	9.2	3.7	8.9	36.0	0.0	14.9	4.0	W	7936
August	10.0	4.2	8.9	35.0	0.0	17.1	4.0	SW	7936
September	12.8	6.4	11.0	46.1	0.0	26.0	4.0	SW	7680
October	15.2	7.9	13.0	57.2	0.0	31.1	6.0	SW	7936
November	16.1	7.8	14.0	56.1	0.0	31.1	7.0	NW	7680
December	13.7	6.3	13.0	44.1	0.0	27.0	6.0	W	7936
Annual	12.4	6.3	11.0	58.1	0.0	26.0	4.0	W	93504

Reference Height: 10 m above mean sea level

[Back to GLCFS HomePage](#)

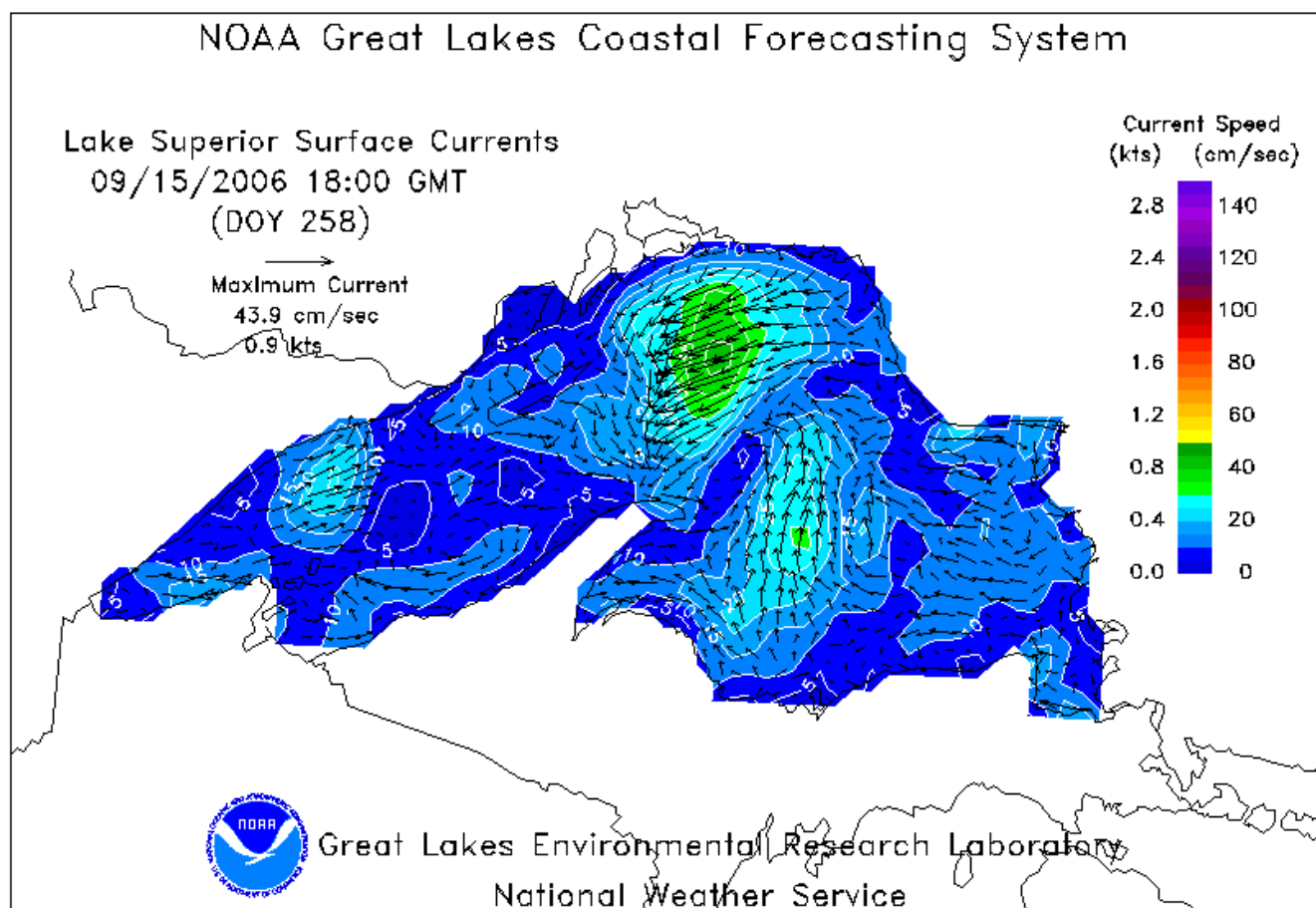
Jump To: Nowcast Products...



Jump To: Forecast Products...



Lake Superior Surface Currents													
Animation (-24 to 00)	Java	FLC	00	-03	-06	-09	-12	-15	-18	-21	-24		
Animation (-48 to -24)	Java	FLC	-27	-30	-33	-36	-39	-42	-45	-48			



6-19

SIGNIFICANT WAVE HEIGHT STATISTICS GREAT LAKES AREA 6 - LAKE SUPERIOR EAST



PERCENTAGE FREQUENCY OF OCCURRENCE BY DIRECTION Annual WES

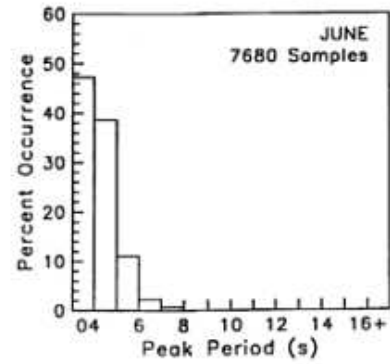
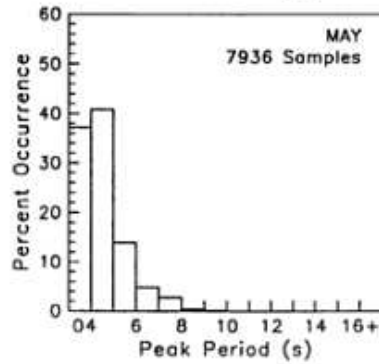
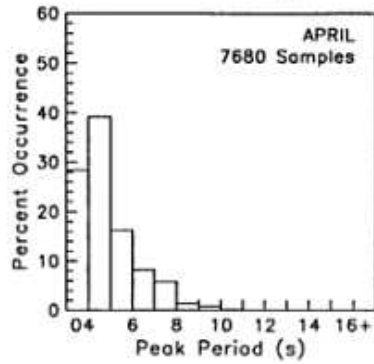
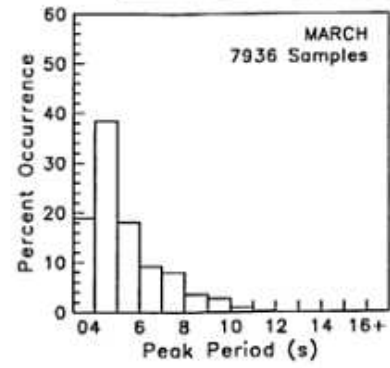
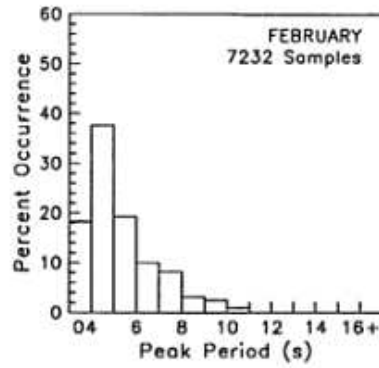
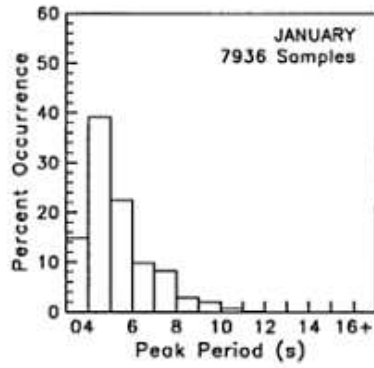
	Direction - Coming From								Num	
	N	NE	E	SE	S	SW	W	NW	Total	Obs
0.0 - < 0.5 m	2.5	2.3	1.1	1.2	3.0	2.3	1.6	2.1	16.1	15024
0.5 - < 1.0 m	7.0	5.8	3.0	2.8	6.3	5.3	5.0	5.9	41.2	38486
1.0 - < 1.5 m	3.4	2.1	0.4	0.3	3.2	2.9	2.5	3.8	18.6	17415
1.5 - < 2.0 m	2.0	0.8	0.2	0.2	1.3	1.4	1.2	2.2	9.3	8588
2.0 - < 2.5 m	1.3	0.4	0.1	0.0	0.2	1.2	0.8	1.3	5.3	4983
2.5 - < 3.0 m	1.1	0.3	0.0	0.0	0.0	0.4	0.4	1.0	3.3	3087
3.0 - < 3.5 m	0.9	0.3	0.0	-	0.0	0.1	0.1	0.8	2.2	2073
3.5 - < 4.0 m	0.7	0.2	-	-	-	0.0	0.0	0.5	1.5	1403
4.0 - < 4.5 m	0.8	0.1	-	-	-	0.0	0.0	0.3	1.0	975
4.5 - < 5.0 m	0.4	0.1	-	-	-	0.0	0.0	0.2	0.8	587
5.0 - < 5.5 m	0.3	0.0	-	-	-	-	0.0	0.1	0.4	357
5.5 - < 6.0 m	0.2	0.0	-	-	-	-	-	0.0	0.2	170
6.0 - < 6.5 m	0.1	0.0	-	-	-	-	-	0.0	0.1	105
6.5 - < 7.0 m	0.1	0.0	-	-	-	-	-	0.0	0.1	75
7.0 - + m	0.1	0.0	-	-	-	-	-	0.0	0.1	78
Total	20.5	12.4	4.8	4.6	13.9	13.7	11.8	18.3	100.0	93504

MONTHLY DATA STATISTICS WES

	Mean	Std Dev	Med	Max	Min	Upper	Lower	Most	Num Obs
						95% Lim	95% Lim	Freq Dir from	
January	1.6	1.1	1.2	10.1	0.1	4.0	0.4	NW	7936
February	1.5	1.2	1.1	8.6	0.1	4.2	0.4	NW	7232
March	1.5	1.2	1.1	8.5	0.1	4.3	0.4	N	7936
April	1.2	0.9	0.8	8.2	0.1	3.1	0.3	N	7880
May	0.9	0.7	0.7	5.2	0.0	2.4	0.3	N	7936
June	0.8	0.5	0.6	3.8	0.1	1.8	0.2	N	7680
July	0.7	0.5	0.6	4.1	0.0	1.6	0.2	N	7936
August	0.7	0.5	0.6	3.8	0.1	1.7	0.2	N	7936
September	1.0	0.8	0.8	4.3	0.1	2.3	0.3	N	7680
October	1.2	0.9	0.9	6.8	0.0	3.1	0.3	S	7936
November	1.5	1.1	1.1	10.5	0.1	3.7	0.4	NW	7680
December	1.5	1.1	1.2	9.2	0.1	3.9	0.4	NW	7936
Annual	1.2	1.0	0.8	10.5	0.0	3.2	0.3	N	93504

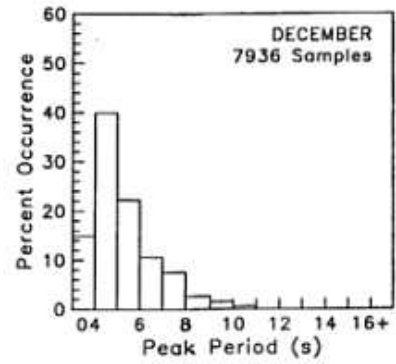
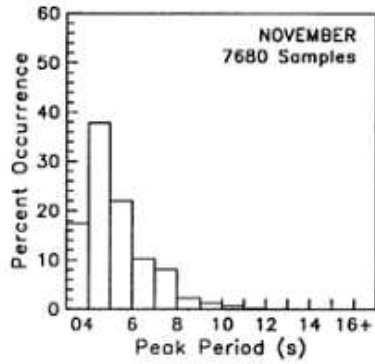
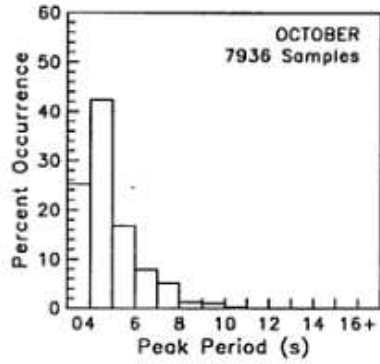
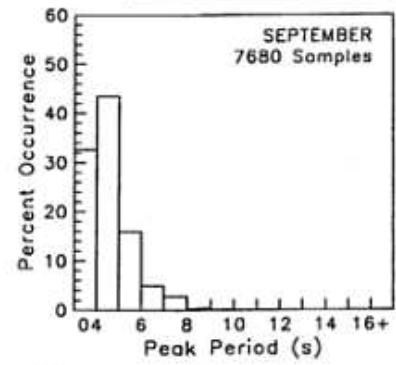
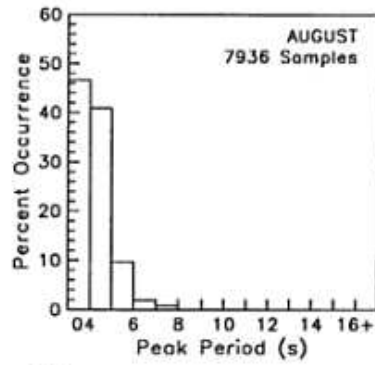
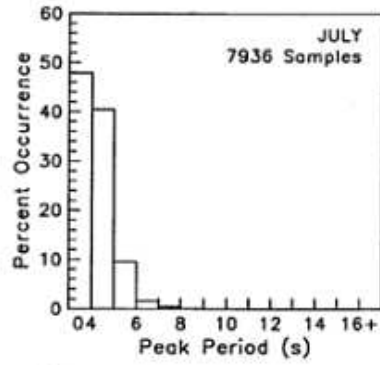
6-17

MONTHLY WAVE STATISTICS GREAT LAKES AREA 6 - LAKE SUPERIOR EAST



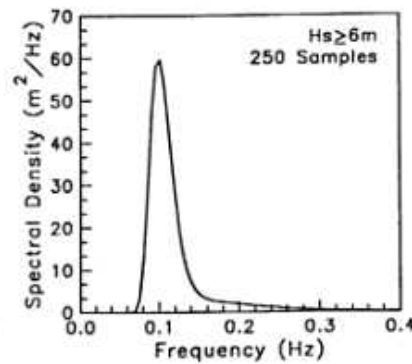
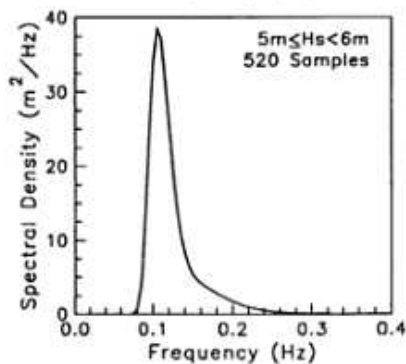
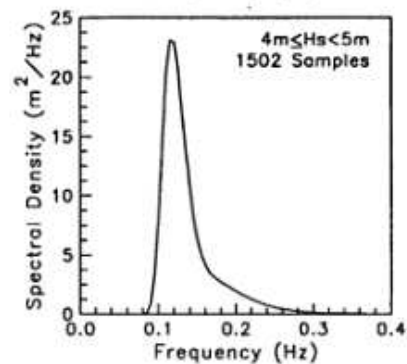
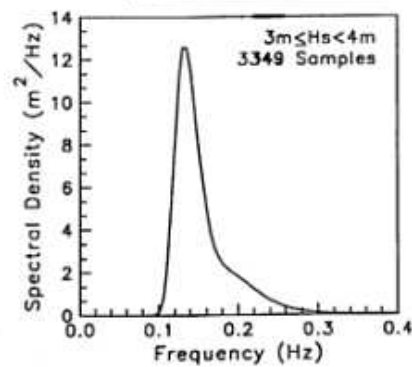
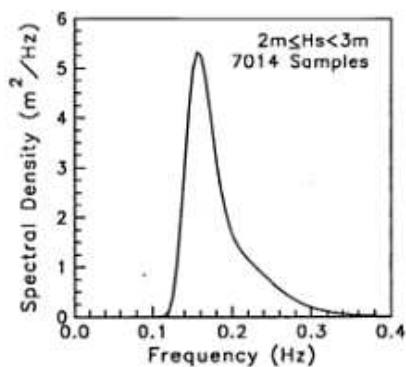
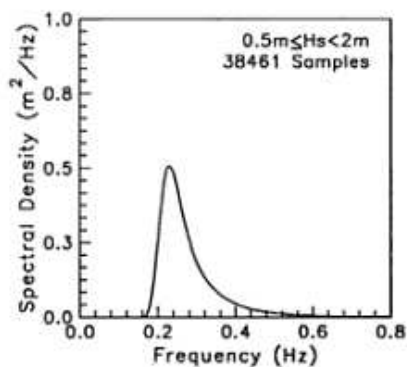
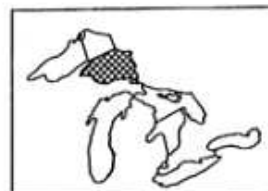
6-18

MONTHLY WAVE STATISTICS GREAT LAKES AREA 6 - LAKE SUPERIOR EAST



6-21

MOST PROBABLE SPECTRA GREAT LAKES AREA 6 — LAKE SUPERIOR EAST WES



6-8

ANNUAL WIND SPEED STATISTICS GREAT LAKES AREA 6 - LAKE SUPERIOR EAST



PERCENTAGE FREQUENCY OF OCCURRENCE BY DIRECTION Annual WES

	Direction - Coming From								Total	Num Obs
	N	NE	E	SE	S	SW	W	NW		
0.0 - < 5.0 kts	0.3	0.3	0.3	0.3	0.3	0.2	0.3	0.3	2.2	2038
5.0 - <10.0 kts	3.1	3.1	2.1	1.7	2.9	2.9	3.2	2.7	21.7	20279
10.0 - <15.0 kts	5.3	6.3	2.7	2.6	6.7	6.0	6.0	5.1	40.7	38101
15.0 - <20.0 kts	2.0	1.4	0.3	0.4	2.2	1.9	1.7	1.9	11.8	11046
20.0 - <25.0 kts	1.2	0.6	0.2	0.2	1.2	1.0	0.6	1.0	6.1	5687
25.0 - <30.0 kts	2.1	0.8	0.2	0.2	2.1	1.5	1.1	1.4	9.3	8686
30.0 - <35.0 kts	1.7	0.4	0.1	0.1	1.2	0.9	0.7	1.0	6.0	5634
35.0 - <40.0 kts	0.5	0.0	0.0	0.0	0.2	0.2	0.1	0.2	1.3	1221
40.0 - <45.0 kts	0.2	0.0	-	0.0	0.1	0.1	0.0	0.0	0.5	474
45.0 - <50.0 kts	0.2	0.0	-	0.0	0.0	0.0	0.0	0.0	0.3	257
50.0 - <55.0 kts	0.0	0.0	-	-	0.0	0.0	0.0	0.0	0.1	49
55.0 - + kts	0.0	-	-	-	0.0	-	-	0.0	0.0	32
Total	16.7	13.0	5.7	5.5	16.8	14.8	13.9	13.6	100.0	93504

MONTHLY DATA STATISTICS WES

	Mean	Std Dev	Med	Max	Min	Upper 95% Lim	Lower 95% Lim	Most Freq Dir	Num Obs
	kts	kts	kts	kts	kts	kts	kts		
January	16.8	9.4	15.9	76.0	1.0	34.9	7.9	W	7936
February	16.2	9.4	14.9	66.0	0.0	34.9	7.0	N	7232
March	16.2	9.3	14.9	62.0	1.0	34.9	7.9	N	7936
April	15.2	7.5	13.0	54.0	0.0	26.9	7.0	N	7680
May	13.4	6.5	12.0	43.0	1.0	27.0	5.0	N	7936
June	12.1	5.7	11.0	41.0	0.0	25.0	5.0	S	7680
July	11.4	5.0	11.0	39.1	0.0	22.9	5.0	SW	7936
August	12.0	5.5	11.0	40.0	1.0	24.1	5.0	S	7936
September	14.3	7.0	13.0	46.1	0.0	26.9	7.0	S	7680
October	16.5	8.3	14.0	56.0	1.0	32.0	7.0	S	7936
November	16.1	8.7	14.9	69.0	0.0	34.0	7.9	SW	7680
December	16.7	9.1	15.9	65.1	1.0	34.9	7.9	W	7936
Annual	15.6	8.2	13.0	76.0	0.0	32.0	7.0	S	93504

Reference Height: 10 m above mean sea level

8-19

SIGNIFICANT WAVE HEIGHT STATISTICS GREAT LAKES AREA 8 - LAKE SUPERIOR WEST



PERCENTAGE FREQUENCY OF OCCURRENCE BY DIRECTION Annual WES

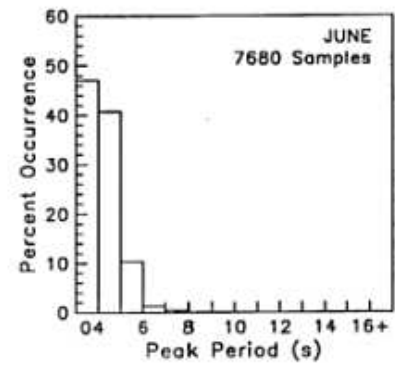
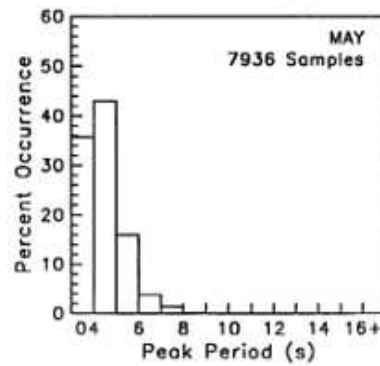
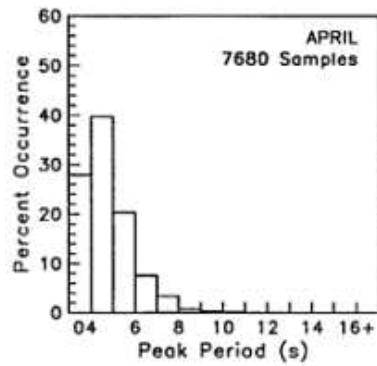
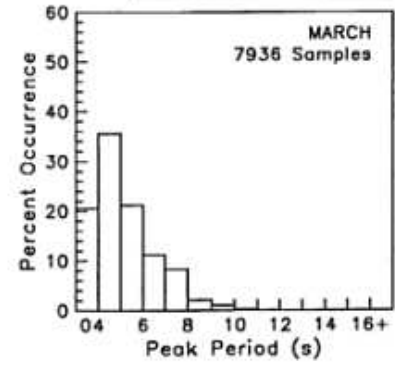
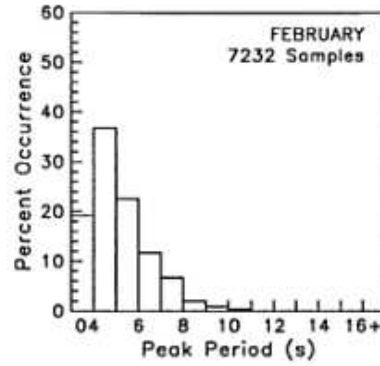
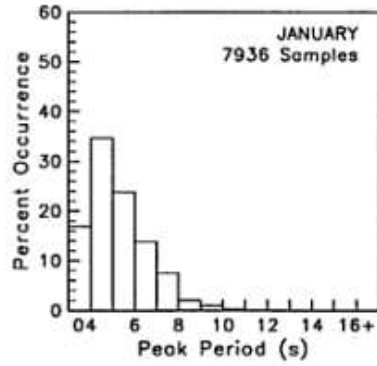
	Direction - Coming From								Num	
	N	NE	E	SE	S	SW	W	NW	Total	Obs
0.0 - < 0.5 m	2.3	3.2	4.2	3.8	2.6	2.9	5.6	3.0	27.3	25517
0.5 - < 1.0 m	4.0	4.8	5.7	3.1	2.2	3.7	10.5	5.3	39.2	36833
1.0 - < 1.5 m	1.7	1.8	2.1	0.8	0.4	1.0	5.1	2.8	15.5	14499
1.5 - < 2.0 m	1.0	0.7	0.9	0.2	0.1	0.4	2.8	1.8	7.8	7278
2.0 - < 2.5 m	0.5	0.4	0.3	0.0	0.0	0.1	1.6	1.2	4.2	3942
2.5 - < 3.0 m	0.4	0.2	0.2	0.0	-	0.0	1.2	0.7	2.7	2558
3.0 - < 3.5 m	0.3	0.1	0.2	0.0	-	0.0	0.6	0.2	1.4	1324
3.5 - < 4.0 m	0.2	0.1	0.1	-	-	0.0	0.4	0.1	0.9	830
4.0 - < 4.5 m	0.1	0.0	0.1	-	-	-	0.3	0.0	0.5	448
4.5 - < 5.0 m	0.0	0.0	0.0	-	-	-	0.1	0.0	0.3	243
5.0 - < 5.5 m	0.0	0.0	0.0	-	-	-	0.1	0.0	0.1	121
5.5 - < 6.0 m	0.0	0.0	0.0	-	-	-	0.0	0.0	0.1	58
6.0 - < 6.5 m	0.0	-	0.0	-	-	-	0.0	0.0	0.0	30
6.5 - < 7.0 m	-	-	0.0	-	-	-	0.0	-	0.0	13
7.0 - + m	-	-	0.0	-	-	-	0.0	-	0.0	8
Total	10.4	11.4	13.9	7.5	5.3	8.2	28.3	15.1	100.0	93504

MONTHLY DATA STATISTICS WES

	Mean	Std Dev	Med	Max	Min	Upper	Lower	Most	Num Obs
						95% Lim	95% Lim		
January	1.3	0.9	1.0	7.7	0.1	3.1	0.3	W	7938
February	1.2	0.9	0.9	6.5	0.1	3.1	0.3	W	7232
March	1.2	1.0	0.9	8.9	0.1	3.3	0.3	W	7936
April	0.9	0.7	0.7	5.6	0.1	2.3	0.3	E	7880
May	0.7	0.5	0.6	4.6	0.0	1.7	0.2	E	7936
June	0.6	0.4	0.5	4.5	0.1	1.3	0.2	W	7880
July	0.5	0.4	0.4	3.9	0.0	1.2	0.2	W	7936
August	0.6	0.4	0.5	3.5	0.0	1.2	0.2	W	7936
September	0.6	0.6	0.6	5.7	0.1	1.9	0.2	W	7880
October	1.0	0.6	0.7	8.9	0.1	2.6	0.3	W	7936
November	1.3	1.0	1.0	6.6	0.1	3.2	0.3	W	7880
December	1.3	0.9	0.9	6.7	0.1	3.2	0.3	W	7936
Annual	0.9	0.8	0.7	8.9	0.0	2.6	0.2	W	93504

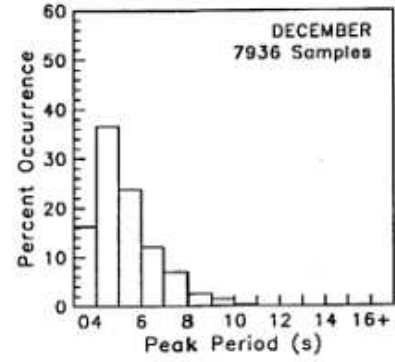
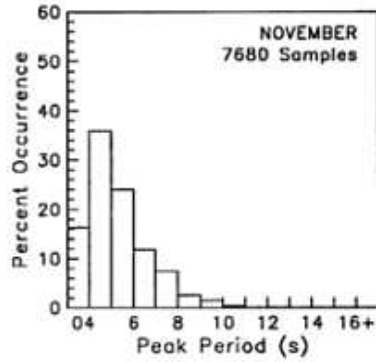
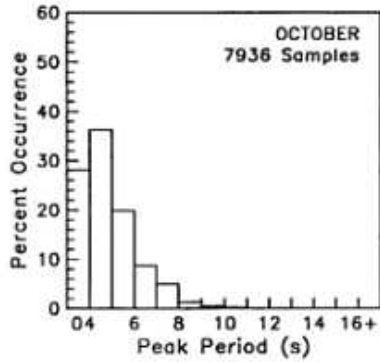
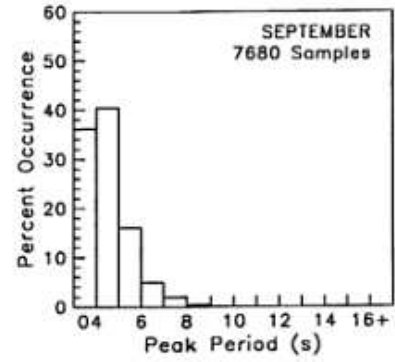
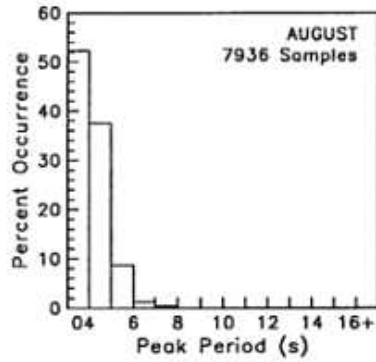
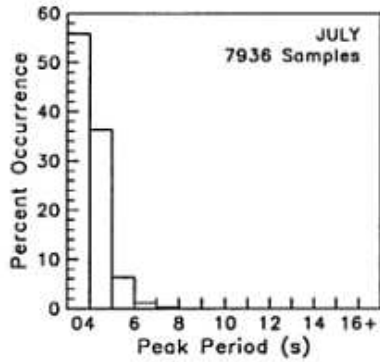
8-17

MONTHLY WAVE STATISTICS GREAT LAKES AREA 8 - LAKE SUPERIOR WEST



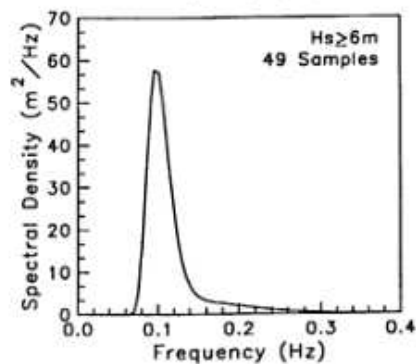
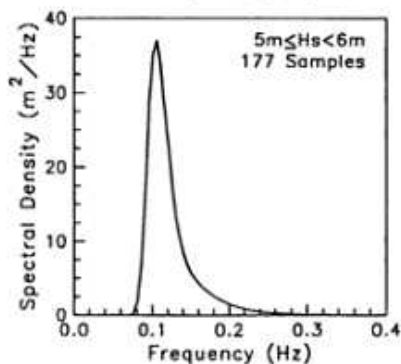
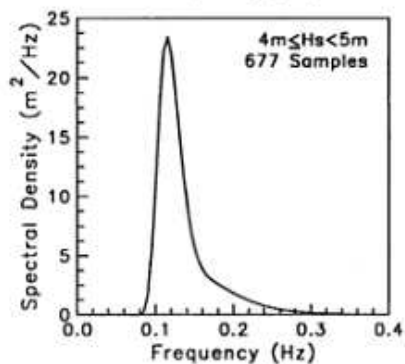
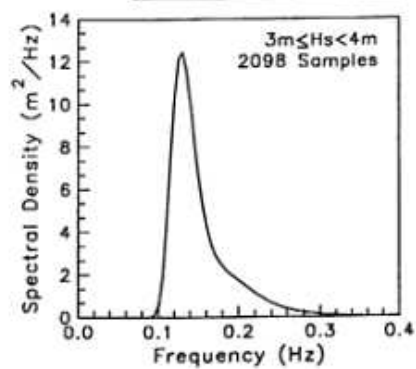
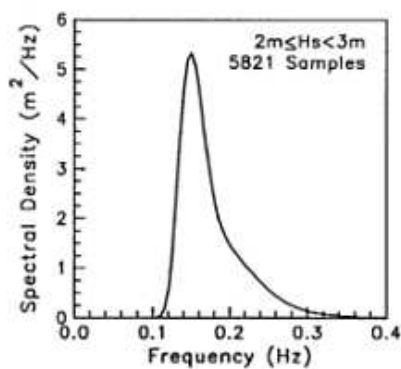
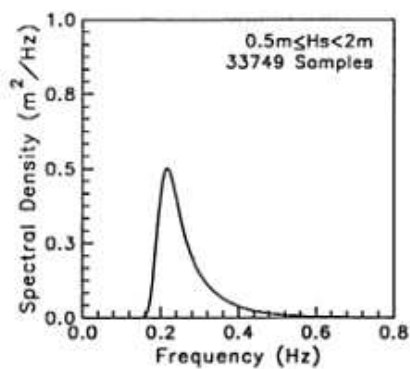
8-18

MONTHLY WAVE STATISTICS GREAT LAKES AREA 8 - LAKE SUPERIOR WEST



8-21

MOST PROBABLE SPECTRA GREAT LAKES AREA 8 — LAKE SUPERIOR WEST WES



8-8

ANNUAL WIND SPEED STATISTICS

GREAT LAKES AREA 8 - LAKE SUPERIOR WEST



PERCENTAGE FREQUENCY OF OCCURRENCE BY DIRECTION

Annual
WES

	Direction - Coming From								Num	
	N	NE	E	SE	S	SW	W	NW	Total	Obs
0.0 - < 5.0 kts	0.9	1.1	1.4	1.3	1.1	1.0	1.4	1.4	9.5	8929
5.0 - <10.0 kts	2.9	3.3	4.9	3.8	3.6	3.8	7.3	4.8	34.5	32243
10.0 - <15.0 kts	3.0	2.8	5.2	2.7	3.0	3.8	8.3	5.2	34.0	31760
15.0 - <20.0 kts	1.1	0.8	1.2	0.5	0.6	1.0	2.8	2.3	10.1	9425
20.0 - <25.0 kts	0.6	0.3	0.5	0.2	0.3	0.5	1.6	1.2	5.2	4877
25.0 - <30.0 kts	0.6	0.2	0.5	0.1	0.3	0.4	1.4	1.3	4.7	4435
30.0 - <35.0 kts	0.2	0.1	0.2	0.0	0.1	0.1	0.5	0.4	1.8	1514
35.0 - <40.0 kts	0.0	0.0	0.0	-	0.0	0.0	0.1	0.0	0.2	230
40.0 - <45.0 kts	0.0	0.0	0.0	-	-	0.0	0.0	0.0	0.1	65
45.0 - <50.0 kts	0.0	0.0	0.0	-	-	0.0	0.0	0.0	0.0	23
50.0 - <55.0 kts	-	-	0.0	-	-	-	0.0	-	0.0	3
55.0 - + kts	-	-	-	-	-	-	-	-	0.0	0
Total	9.3	8.5	13.9	8.7	8.9	10.7	23.4	18.7	100.0	93504

MONTHLY DATA STATISTICS

WES

	Mean	Std Dev	Med	Max	Min	Upper 95% Lim	Lower 95% Lim	Most Freq Dir	Num Obs
	kts	kts	kts	kts	kts	kts	kts		
January	14.8	7.4	13.0	49.0	1.0	27.9	5.0	W	7936
February	14.3	7.4	12.0	47.0	1.0	27.9	5.0	W	7232
March	14.2	7.8	12.0	54.0	0.0	28.9	5.0	W	7936
April	11.9	5.9	11.0	39.1	1.0	24.1	4.0	E	7680
May	10.4	4.9	10.1	40.0	0.0	18.0	4.0	E	7936
June	8.9	4.1	8.9	33.0	0.0	14.9	2.9	W	7680
July	8.3	4.0	7.9	33.0	0.0	14.9	2.9	W	7936
August	8.7	4.1	7.9	32.1	0.0	14.9	2.9	W	7936
September	10.8	5.3	10.1	45.1	0.0	21.9	4.0	W	7680
October	12.8	6.7	11.0	47.0	0.0	26.0	4.0	W	7936
November	14.5	7.4	13.0	48.0	1.0	27.9	5.0	W	7680
December	14.5	7.4	13.0	49.0	1.0	27.9	5.0	W	7936
Annual	12.0	6.8	11.0	54.0	0.0	26.0	4.0	W	93504

Reference Height: 10 m above mean sea level

Appendix D

Environmental Data

For

Lake Erie

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SIGNIFICANT WAVE HEIGHT STATISTICS

GREAT LAKES AREA 2 - LAKE ERIE



PERCENTAGE FREQUENCY OF OCCURRENCE BY DIRECTION

Annual

WES

	Direction - Coming From								Total	Num Obs
	N	NE	E	SE	S	SW	W	NW		
0.0 - < 0.5 m	1.4	3.5	2.4	1.5	4.4	8.9	3.4	1.4	24.9	23282
0.5 - < 1.0 m	1.6	3.2	2.2	1.4	6.1	8.7	5.9	3.1	32.3	30180
1.0 - < 1.5 m	0.2	1.9	0.8	0.8	4.3	5.9	4.6	1.5	19.8	18506
1.5 - < 2.0 m	0.0	1.1	0.3	0.3	2.9	4.4	3.4	0.2	12.6	11821
2.0 - < 2.5 m	-	0.3	0.1	0.1	0.8	2.5	1.9	0.0	5.8	5408
2.5 - < 3.0 m	-	0.1	0.0	0.0	0.2	1.3	1.2	0.0	2.8	2612
3.0 - < 3.5 m	-	0.0	0.0	0.0	0.0	0.5	0.6	0.0	1.2	1084
3.5 - < 4.0 m	-	0.0	0.0	-	0.0	0.2	0.2	-	0.4	373
4.0 - < 4.5 m	-	0.0	0.0	-	-	0.1	0.1	-	0.2	143
4.5 - < 5.0 m	-	-	-	-	-	0.0	0.0	-	0.1	64
5.0 - < 5.5 m	-	-	-	-	-	0.0	0.0	-	0.0	19
5.5 - < 6.0 m	-	-	-	-	-	0.0	0.0	-	0.0	7
6.0 - < 6.5 m	-	-	-	-	-	0.0	-	-	0.0	4
6.5 - < 7.0 m	-	-	-	-	-	-	-	-	0.0	0
7.0 - + m	-	-	-	-	-	0.0	-	-	0.0	1
Total	3.2	10.0	5.8	4.1	18.7	30.5	21.4	8.3	100.0	93504

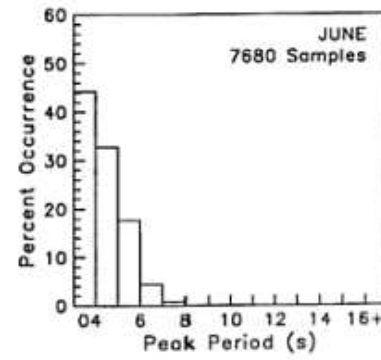
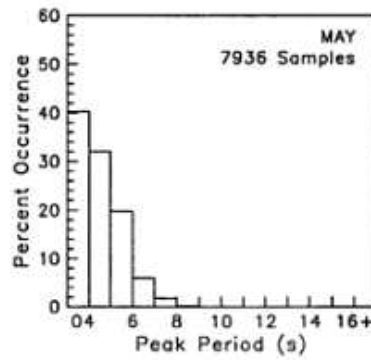
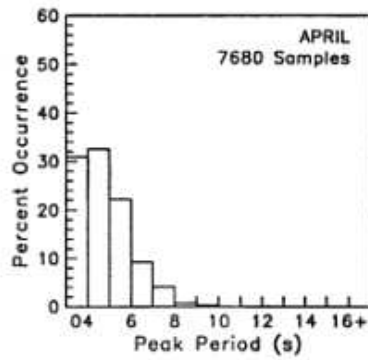
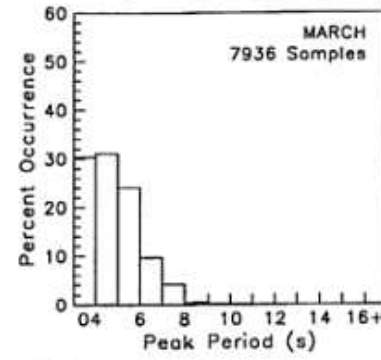
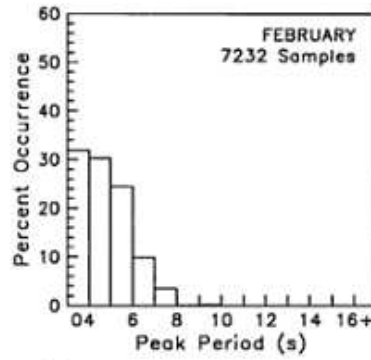
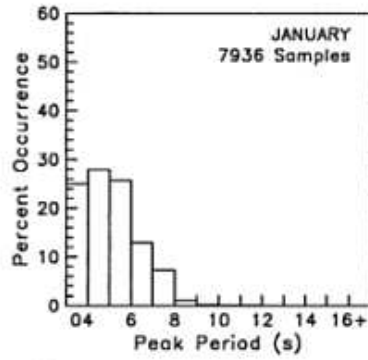
MONTHLY DATA STATISTICS

WES

						Upper	Lower	Most	Num Obs
						95%	95%	Freq	
	Mean	Std Dev	Med	Max	Min	Lim	Lim	Dir	
	m	m	m	m	m	m	m	fram	
January	1.3	0.9	1.1	7.0	0.0	3.0	0.2	SW	7936
February	1.1	0.7	0.9	4.7	0.0	2.4	0.2	SW	7232
March	1.1	0.8	0.9	5.9	0.0	2.6	0.2	W	7936
April	1.1	0.8	0.9	5.3	0.0	2.7	0.2	W	7680
May	0.9	0.6	0.7	5.6	0.0	2.1	0.1	SW	7936
June	0.8	0.6	0.6	4.1	0.0	1.9	0.1	SW	7680
July	0.7	0.5	0.6	3.8	0.0	1.7	0.1	SW	7936
August	0.7	0.5	0.6	3.1	0.0	1.7	0.1	SW	7936
September	0.8	0.6	0.7	3.9	0.0	1.9	0.2	SW	7680
October	1.0	0.7	0.9	4.4	0.0	2.3	0.2	SW	7936
November	1.2	0.8	1.1	4.9	0.0	2.6	0.2	SW	7680
December	1.2	0.8	1.1	5.3	0.0	2.7	0.3	SW	7936
Annual	1.0	0.7	0.8	7.0	0.0	2.4	0.2	SW	83504

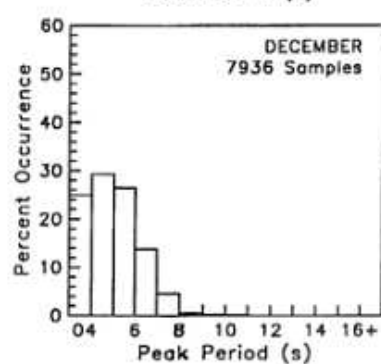
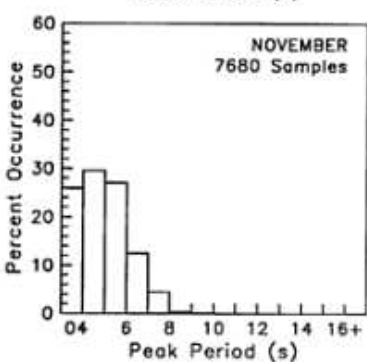
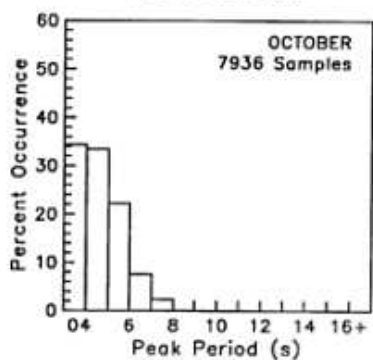
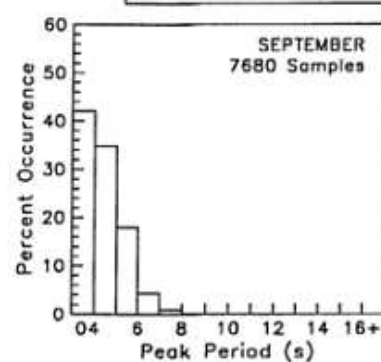
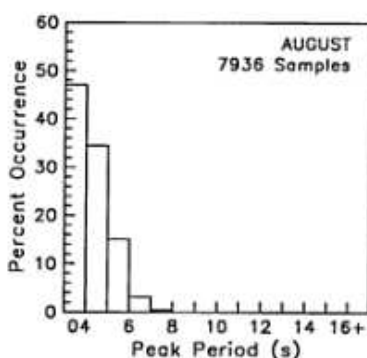
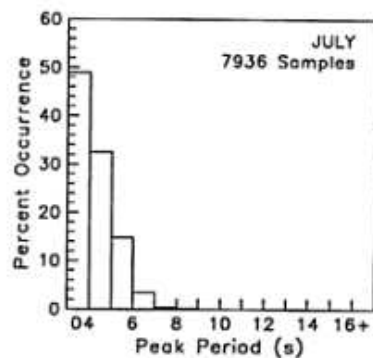
2-17

MONTHLY WAVE STATISTICS GREAT LAKES AREA 2 - LAKE ERIE



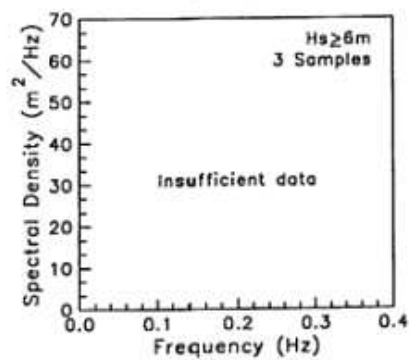
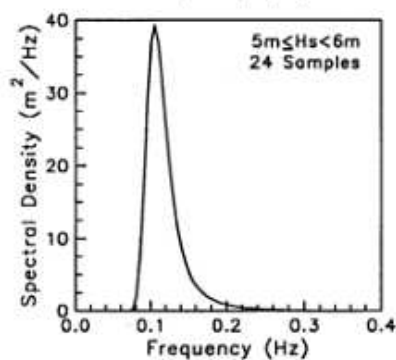
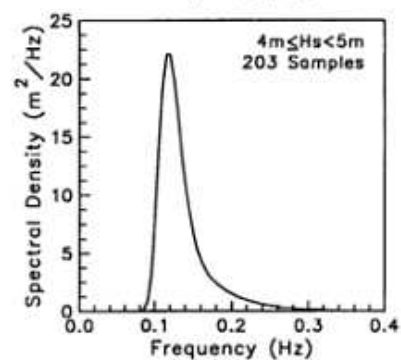
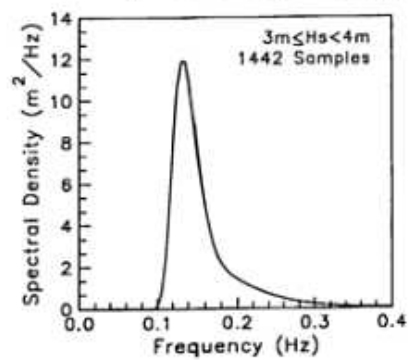
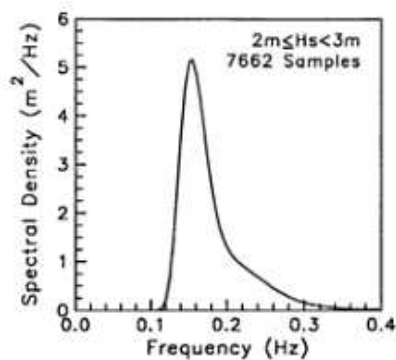
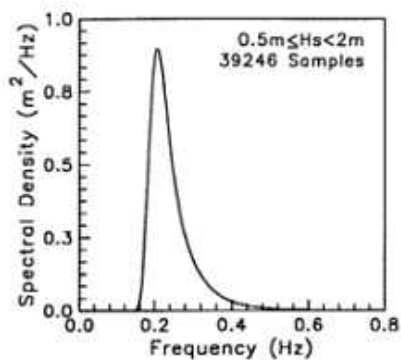
2-18

MONTHLY WAVE STATISTICS GREAT LAKES AREA 2 - LAKE ERIE



2-21

MOST PROBABLE SPECTRA GREAT LAKES AREA 2 - LAKE ERIE WES



Environment
CanadaEnvironnement
Canada[\[français\]](#) [\[Back\]](#)

Canadian Climate Normals 1971-2000

The minimum number of years used to calculate these Normals is indicated by a [code](#) for each element. A "+" beside an extreme date indicates that this date is the first occurrence of the extreme value. Values and dates in bold indicate all-time extremes for the location.

NOTE!! Data used in the calculation of these Normals may be subject to further quality assurance checks. This may result in minor changes to some values presented here.

ST THOMAS WPCP ONTARIO

Latitude: 42° 46' N**Longitude:** 81° 12' W**Elevation:** 209.10 m**Climate ID:** 6137362**WMO ID:****TC ID:**

Temperature:	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year	Code
Daily Average (°C)	-4.8	-3.7	1	7.4	13.8	18.6	21	20.2	16.1	10	4.1	-1.8	8.5	C
Standard Deviation	2.7	2.6	1.9	1.4	2.1	1.3	1.1	1.3	0.8	1.5	1.4	3	1	C
Daily Maximum (°C)	-0.9	0.6	5.6	12.9	19.9	24.5	26.8	25.8	21.5	15.1	7.8	1.7	13.4	C
Daily Minimum (°C)	-8.6	-7.9	-3.7	2	7.8	12.6	15.2	14.6	10.7	4.9	0.3	-5.3	3.5	C
Extreme Maximum (°C)	14.5	18.5	24.5	29.5	32.5	38	37	34.5	32.5	26	21.5	18.5		
Date (yyyy/dd)	1995/14	2000/26	1998/30	1990/25	1988/30	1988/25	1987/20	1988/02+	1983/10	1995/12+	1990/01	1982/03		
Extreme Minimum (°C)	-31	-30	-23.5	-16	-3	1	6	0	-2	-7	-13.5	-27.5		
Date (yyyy/dd)	1984/16	1994/10	1986/08	1982/07	1983/10	1980/17+	1988/02	1982/29	1991/28	1988/31	1987/21	1989/24		
Precipitation:														
Rainfall (mm)	36.8	37.2	51.5	81.4	83.2	101.8	86.4	87.7	96.8	83.2	89.4	61.3	896.7	C
Snowfall (cm)	38.1	27	16.9	3.5	0	0	0	0	0	0.3	6.9	27.3	120	C
Precipitation (mm)	74.9	64.2	68.4	85	83.2	101.8	86.4	87.7	96.8	83.5	96.3	88.5	1016.6	C
Extreme Daily Rainfall (mm)	43.5	40.4	32	55.8	65.4	77.4	50	57	89.6	72	52.2	34.4		
Date (yyyy/dd)	1994/27	1984/13	1985/31	2000/20	1982/27	1984/17	1988/16	1990/28	1983/16	1995/05	1992/12	1983/11		
Extreme Daily Snowfall (cm)	25	24	21.5	12	0	0	0	0	0	2.5	16.4	28		
Date (yyyy/dd)	1982/31	1995/05	1993/04	1982/05	1980/01+	1980/01+	1980/01+	1980/01+	1980/01+	1993/31	1987/20	1985/26		
Extreme Daily Precipitation (mm)	43.5	40.4	32	55.8	65.4	77.4	50	57	89.6	72	52.2	34.4		
Date (yyyy/dd)	1994/27	1984/13	1985/31	2000/20	1982/27	1984/17	1988/16	1990/28	1983/16	1995/05	1992/12	1983/11		
Extreme Snow Depth (cm)	48	27	19	4	0	0	0	0	0	0	9	27		
Date (yyyy/dd)	1999/13	1985/12+	1993/05	1994/07+	1983/21+	1983/01+	1983/01+	1983/01+	1983/01+	1983/01+	1996/27+	1989/30		
Days with Maximum Temperature:														
<= 0 °C	16.2	13	5.5	0.3	0	0	0	0	0	0	1.5	11		C
> 0 °C	14.8	15.3	25.5	29.7	31	30	31	31	30	31	28.5	20		C
> 10 °C	0.58	1.1	7.1	20.5	30.2	30	31	31	30	26	9.4	1.9		C
> 20 °C	0	0	0.65	3.2	14	25.6	30.6	29.5	18.4	4.4	0.1	0		C
> 30 °C	0	0	0	0	0.2	1.8	3.5	1.7	0.14	0	0	0		C
> 35 °C	0	0	0	0	0	0.05	0.19	0	0	0	0	0		C
Days with Minimum Temperature:														
> 0 °C	2.8	2.9	7.4	18.4	29.1	30	31	31	29.7	25.9	13.9	5.1		C
<= 2 °C	30.3	27.4	27	16.4	4.5	0.2	0	0.1	1.1	10	20.7	29		C
<= 0 °C	28.2	25.3	23.7	11.6	2	0	0	0.05	0.3	5.1	16.1	25.9		C
< -2 °C	24.1	20.9	17.6	5	0.05	0	0	0	0	1.3	8.5	19.2		C
< -10 °C	11.6	9.8	3.7	0.15	0	0	0	0	0	0	0.43	7.1		C
< -20 °C	2.2	1.6	0.35	0	0	0	0	0	0	0	0	0.62		C
< -30 °C	0.1	0	0	0	0	0	0	0	0	0	0	0		C
Days with Rainfall:														
>= 0.2 mm	6.1	6	9.7	14.9	13.1	11.6	12.8	11.4	14	14.1	13.6	8.8	135.9	C
>= 5 mm	2.4	2.3	3.5	5.4	4.8	5.4	5.1	4.8	5.2	4.9	5.7	3.6	53	C
>= 10 mm	1.1	1.1	1.8	2.4	2.7	3.2	2.9	3	3.2	2.8	3.1	2.1	29.1	C

>= 25 mm	0.3	0.25	0.3	0.4	0.57	1.1	0.67	0.71	0.76	0.52	0.67	0.48	6.7	C
Days With Snowfall:														
>= 0.2 cm	9.6	7.3	4.1	1.3	0	0	0	0	0	0.19	2.5	7.3	32.2	C
>= 5 cm	2.6	1.9	1.3	0.25	0	0	0	0	0	0	0.38	2.1	8.5	C
>= 10 cm	0.95	0.8	0.55	0.05	0	0	0	0	0	0	0.1	0.57	3	C
>= 25 cm	0.05	0	0	0	0	0	0	0	0	0	0	0.05	0.1	C
Days with Precipitation:														
>= 0.2 mm	14.8	11.9	12.4	15.9	13.1	11.6	12.8	11.4	14	14.1	15.5	14.6	162	C
>= 5 mm	5	4.2	5	5.7	4.8	5.4	5.1	4.8	5.2	5	6	5.9	61.8	C
>= 10 mm	2.1	2.1	2.4	2.5	2.7	3.2	2.9	3	3.2	2.8	3.2	2.6	32.6	C
>= 25 mm	0.35	0.3	0.3	0.4	0.57	1.1	0.67	0.71	0.76	0.52	0.67	0.52	6.9	C
Degree Days:														
Above 24 °C	0	0	0	0	0	2.3	6.8	3.3	0.5	0	0	0		C
Above 18 °C	0	0	0	1	12.4	54	100.1	80.8	26.3	0.8	0	0		C
Above 15 °C	0	0	0.6	4.7	39.9	117.4	186.9	162.3	69	7.4	0.2	0.1		C
Above 10 °C	0	0.1	5.5	27	131.7	256.9	341.9	315.5	187.6	51.1	6.7	0.9		C
Above 5 °C	1.8	2.1	24.2	98.5	273.9	406.6	496.9	470.5	334.4	159.5	40.3	7.3		C
Above 0 °C	18.9	22.4	83.5	226.5	428.7	556.6	651.9	625.5	484.4	310	132.3	40.3		C
Below 0 °C	160	125.9	53	3.2	0	0	0	0	0	0	10.2	95.4		C
Below 5 °C	297.9	246.7	148.8	25.3	0.2	0	0	0	0	4.5	68.2	217.5		C
Below 10 °C	451	385.8	285	103.7	12.9	0.3	0	0	3.3	51.1	184.6	366.1		C
Below 15 °C	606	526.9	435.1	231.4	76.2	10.8	0.1	1.7	34.6	162.3	328.1	520.2		C
Below 18 °C	699	611.6	527.5	317.7	141.6	37.4	6.3	13.2	82	248.8	417.9	613.1		C



[Important Notices](#)

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Reviewed : 2004-02-25

Url of this page : http://www.climate.weatheroffice.ec.gc.ca/climate_normals/results_e.html

The Green Lane™,
Environment Canada's World Wide Web Site.



Mean water surface temperature

	Year	Day	Sup.	Mich.	Huron	Erie	Ont.
Jan		Avg	2.6	3.1	3.1	2.4	3.3
Feb		Avg	1.4	1.7	1.3	1.7	1.9
Mar		Avg	0.9	1.6	0.9	1.4	1.7
Apr		Avg	1.1	2.5	1.7	3.7	2.6
May		Avg	2.3	5.5	4.6	9.8	6.1
Jun		Avg	5.3	12.3	11.2	17.5	13.8
Jul		Avg	10.9	18.7	17.2	22.2	19.5
Aug		Avg	15.4	20.9	19.7	23.4	21.8
Sep		Avg	14.3	18.8	17.8	21.1	19.3
Oct		Avg	9.5	13.2	12.4	15.8	13.4
Nov		Avg	6.5	8.9	8.4	10.7	8.6
Dec		Avg	4.5	5.6	5.7	5.5	5.5

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ANNUAL WIND SPEED STATISTICS GREAT LAKES AREA 2 - LAKE ERIE



PERCENTAGE FREQUENCY OF OCCURRENCE BY DIRECTION Annual WES

	Direction - Coming From								Total	Num Obs
	N	NE	E	SE	S	SW	W	NW		
0.0 - < 5.0 kts	1.1	1.4	1.4	1.7	1.7	3.4	1.8	1.0	13.4	12508
5.0 - < 10.0 kts	1.6	2.4	2.1	1.8	3.5	4.1	2.6	1.9	19.9	18599
10.0 - < 15.0 kts	2.1	3.7	1.9	2.0	5.7	6.5	6.0	3.6	31.5	29427
15.0 - < 20.0 kts	0.8	1.9	0.5	0.8	3.1	3.6	4.2	1.9	16.7	15844
20.0 - < 25.0 kts	0.4	1.1	0.2	0.5	2.6	3.2	3.5	1.5	12.9	12089
25.0 - < 30.0 kts	0.1	0.3	0.0	0.1	1.1	1.2	1.2	0.4	4.3	4059
30.0 - < 35.0 kts	0.0	0.1	0.0	0.0	0.3	0.3	0.3	0.1	1.0	951
35.0 - < 40.0 kts	-	0.0	-	0.0	0.1	0.0	0.1	0.0	0.2	184
40.0 - < 45.0 kts	-	0.0	-	0.0	0.0	0.0	0.0	0.0	0.1	52
45.0 - < 50.0 kts	-	-	-	-	-	0.0	0.0	-	0.0	8
50.0 - < 55.0 kts	-	-	-	-	0.0	0.0	-	-	0.0	2
55.0 - + kts	-	-	-	-	-	0.0	-	-	0.0	1
Total	6.0	10.9	6.0	6.9	18.0	22.3	19.7	10.3	100.0	93504

MONTHLY DATA STATISTICS WES

		Std				Upper	Lower	Most	
	Mean	Dev	Med	Max	Min	95%	95%	Freq	Num
	kts	kts	kts	kts	kts	Lim	Lim	Dir	Obs
						kts	kts	from	
January	15.2	7.7	14.9	58.1	0.0	27.9	2.9	W	7936
February	13.8	6.9	13.0	43.0	0.0	25.0	2.9	W	7232
March	14.0	7.2	13.0	53.1	0.0	28.0	2.9	W	7936
April	14.1	7.7	13.0	44.1	0.0	27.0	1.9	W	7680
May	11.7	6.9	11.0	40.0	0.0	22.9	0.9	W	7936
June	10.7	6.3	10.1	38.1	0.0	20.9	0.9	SW	7680
July	10.1	6.0	10.1	35.0	0.0	20.9	0.9	SW	7936
August	10.3	6.2	10.1	32.1	0.0	20.9	0.9	SW	7936
September	11.5	6.5	11.0	39.1	0.0	21.9	0.9	S	7680
October	13.3	7.0	13.0	42.0	0.0	25.0	1.9	S	7936
November	14.9	7.2	14.9	40.0	0.0	27.0	2.9	SW	7680
December	14.9	7.2	14.9	44.1	0.0	27.0	2.9	SW	7936
Annual	12.9	7.2	13.0	58.1	0.0	25.0	1.9	SW	93504

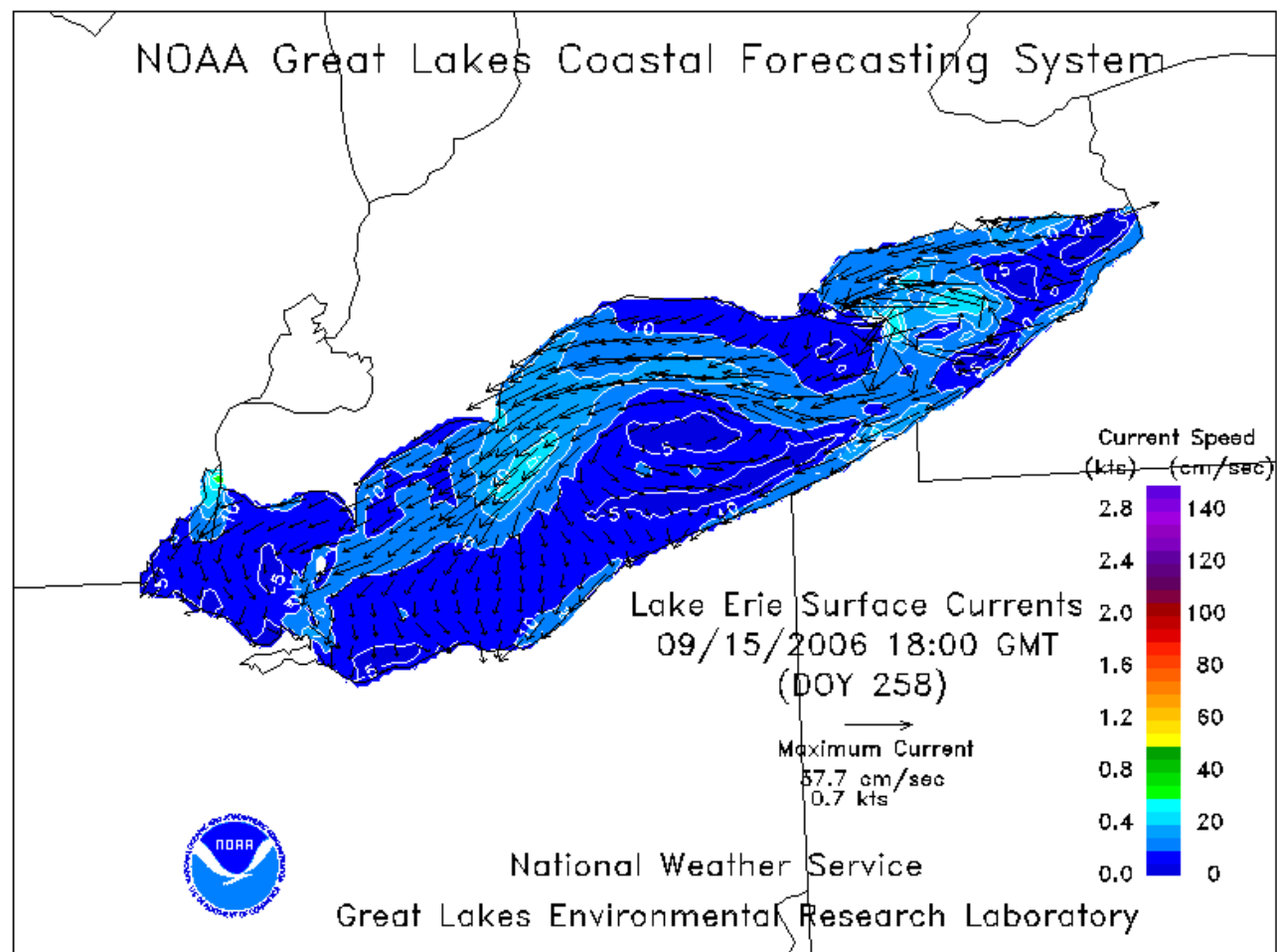
Reference Height: 10 m above mean sea level

[Back to GLCFS HomePage](#)

Jump To: Nowcast Products...

Jump To: Forecast Products...

Lake Erie Surface Currents													
Animation (-24 to 00)	Java	FLC	00	-03	-06	-09	-12	-15	-18	-21	-24		
Animation (-48 to -24)	Java	FLC	-27	-30	-33	-36	-39	-42	-45	-48			



Appendix E

Environmental Data

For

Lake Huron

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SIGNIFICANT WAVE HEIGHT STATISTICS GREAT LAKES AREA 4 - LAKE HURON NORTH



PERCENTAGE FREQUENCY OF OCCURRENCE BY DIRECTION Annual WES

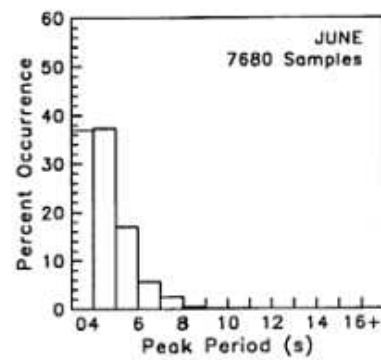
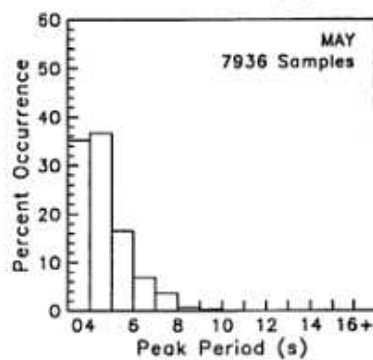
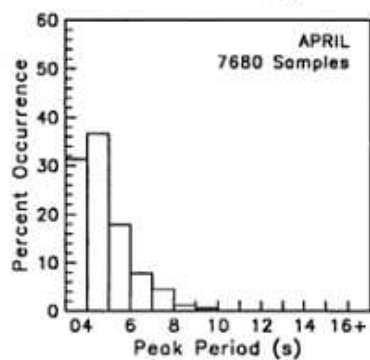
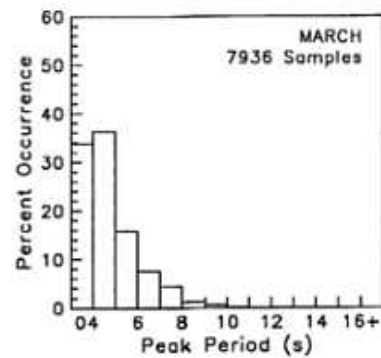
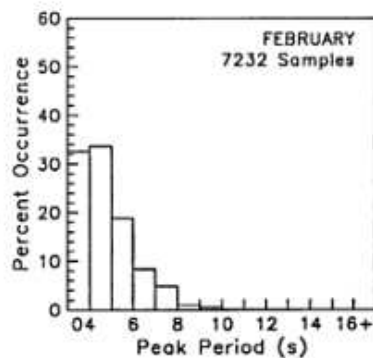
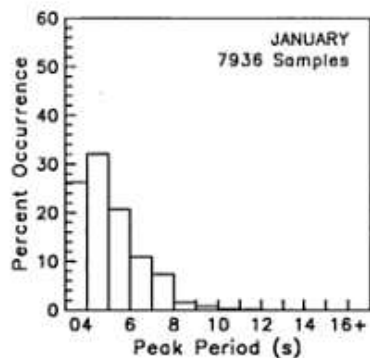
	Direction - Coming From								Total	Num Obs
	N	NE	E	SE	S	SW	W	NW		
0.0 - < 0.5 m	2.2	1.5	1.6	1.5	3.0	3.2	3.1	3.4	19.5	18250
0.5 - < 1.0 m	4.0	6.4	2.8	3.2	5.4	6.7	6.0	8.1	42.8	39838
1.0 - < 1.5 m	0.5	1.5	0.5	1.1	2.7	3.7	2.8	4.6	17.4	16301
1.5 - < 2.0 m	0.1	0.5	0.3	0.5	1.7	2.7	1.8	2.4	10.0	9382
2.0 - < 2.5 m	0.0	0.1	0.1	0.2	1.0	1.5	0.9	1.2	4.8	4532
2.5 - < 3.0 m	0.0	0.0	0.0	0.0	0.5	0.9	0.6	0.5	2.6	2439
3.0 - < 3.5 m	-	0.0	0.0	0.0	0.3	0.5	0.4	0.2	1.4	1268
3.5 - < 4.0 m	-	0.0	-	-	0.2	0.3	0.2	0.1	0.7	666
4.0 - < 4.5 m	-	0.0	-	-	0.1	0.2	0.1	0.0	0.4	370
4.5 - < 5.0 m	-	-	-	-	0.1	0.1	0.1	0.0	0.2	218
5.0 - < 5.5 m	-	-	-	-	0.0	0.1	0.0	0.0	0.1	115
5.5 - < 6.0 m	-	-	-	-	0.0	0.0	0.0	0.0	0.1	69
6.0 - < 6.5 m	-	-	-	-	0.0	0.0	0.0	-	0.0	35
6.5 - < 7.0 m	-	-	-	-	0.0	0.0	-	-	0.0	12
7.0 - + m	-	-	-	-	0.0	0.0	0.0	-	0.0	9
Total	8.8	10.0	5.2	6.5	15.0	19.8	16.0	20.5	100.0	93504

MONTHLY DATA STATISTICS WES

	Std				Upper			Most	Num Obs
	Mean	Dev	Med	Max	Min	95% Lim	95% Lim	Freq Dir from	
January	1.2	0.9	0.9	7.7	0.0	3.0	0.3	NW	7938
February	1.0	0.8	0.8	6.9	0.0	2.5	0.2	NW	7232
March	1.0	0.8	0.8	6.4	0.0	2.6	0.2	NW	7938
April	1.0	0.8	0.8	6.4	0.1	2.5	0.2	NW	7680
May	0.9	0.7	0.7	7.6	0.0	2.3	0.2	SW	7938
June	0.8	0.6	0.7	6.7	0.0	2.0	0.2	SW	7680
July	0.8	0.5	0.7	6.1	0.0	1.9	0.2	SW	7938
August	0.8	0.5	0.7	4.6	0.0	1.8	0.2	SW	7938
September	0.9	0.7	0.8	6.0	0.0	2.2	0.3	SW	7680
October	1.1	0.8	0.8	6.7	0.0	2.7	0.2	SW	7938
November	1.3	1.0	0.9	7.1	0.0	3.2	0.3	NW	7680
December	1.2	0.9	0.9	9.2	0.1	3.0	0.3	NW	7938
Annual	1.0	0.8	0.8	9.2	0.0	2.5	0.2	NW	93504

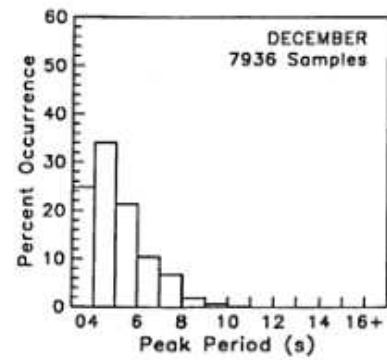
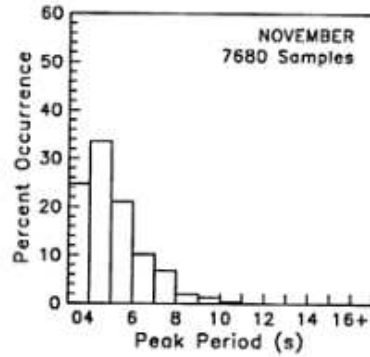
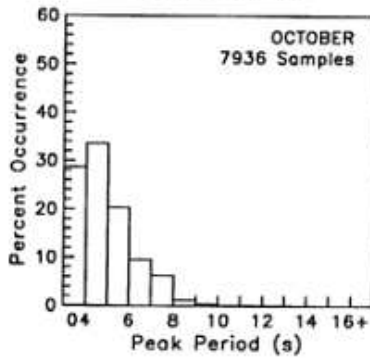
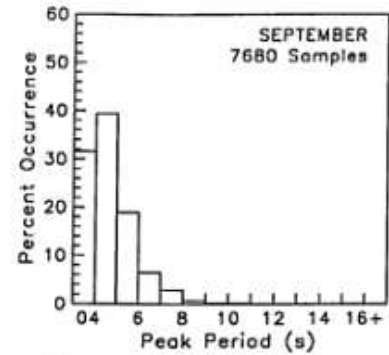
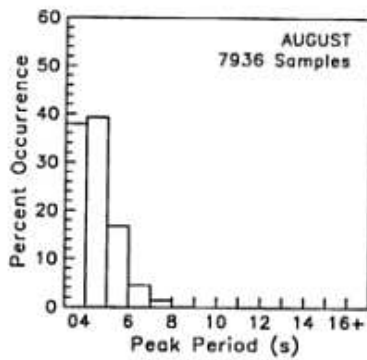
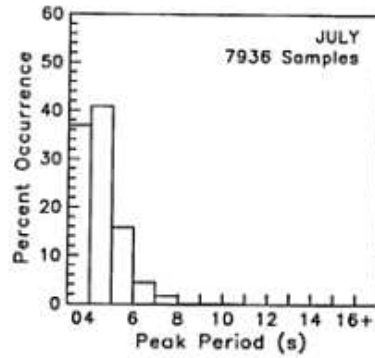
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MONTHLY WAVE STATISTICS GREAT LAKES AREA 4 - LAKE HURON NORTH



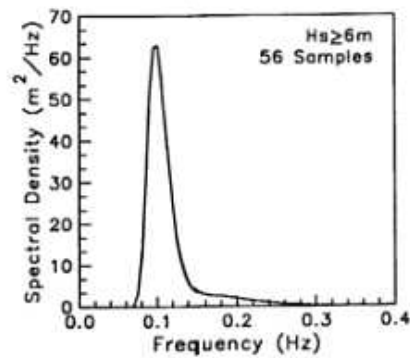
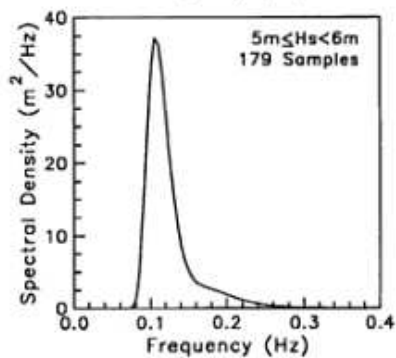
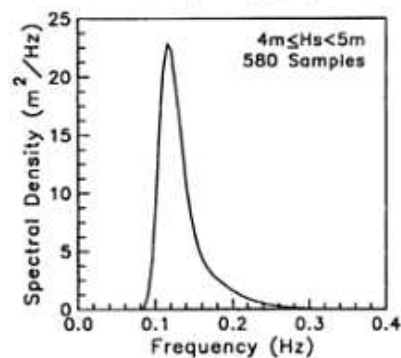
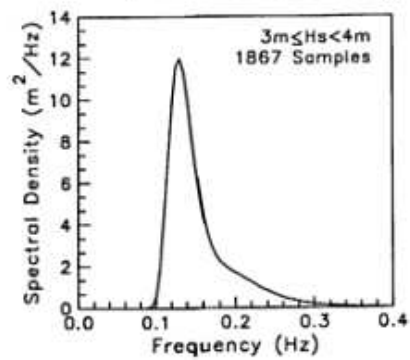
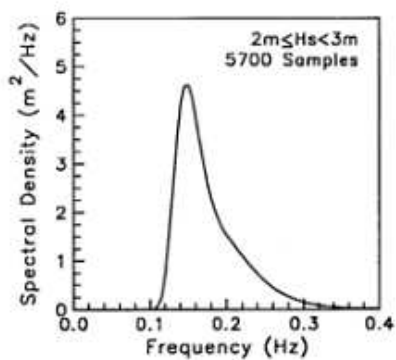
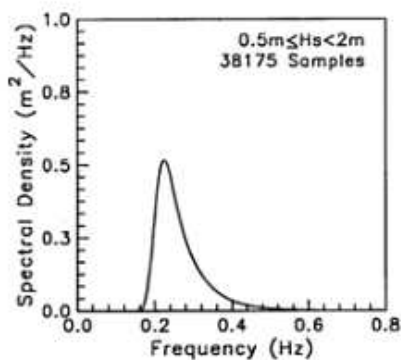
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MONTHLY WAVE STATISTICS GREAT LAKES AREA 4 - LAKE HURON NORTH



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MOST PROBABLE SPECTRA GREAT LAKES AREA 4 - LAKE HURON NORTH WES



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Canadian Climate Normals 1971-2000

The minimum number of years used to calculate these Normals is indicated by a [code](#) for each element. A "+" beside an extreme date indicates that this date is the first occurrence of the extreme value. Values and dates in bold indicate all-time extremes for the location.

NOTE!! Data used in the calculation of these Normals may be subject to further quality assurance checks. This may result in minor changes to some values presented here.

OWEN SOUND MOE * ONTARIO

Latitude: 44° 34' N**Longitude:** 80° 55' W**Elevation:** 178.90 m**Climate ID:** 6116132**WMO ID:****TC ID:**

* This station meets [WMO standards](#) for temperature and precipitation.

Temperature:	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year	Code
Daily Average (°C)	-5.8	-5.6	-1.2	5.3	11.3	16.2	19.7	19.3	15.3	9.5	3.5	-2.4	7.1	A
Standard Deviation	2.7	2.8	2.3	1.8	1.7	1.5	1.3	1.3	1.1	1.6	1.6	2.6	0.9	A
Daily Maximum (°C)	-2.2	-1.7	3	9.8	16.6	21.4	24.5	23.8	19.6	13.3	6.5	0.7	11.3	A
Daily Minimum (°C)	-9.4	-9.5	-5.4	0.8	6.1	11.1	14.9	14.8	11	5.7	0.5	-5.4	2.9	A
Extreme Maximum (°C)	15.5	18.5	24.5	30.5	31.7	35	34	34	31.7	28.3	22	18.5		
Date (yyyy/dd)	1995/14	2000/26	1990/15	1990/28	1977/21	2000/10	1993/05	1988/02+	1973/04	1971/01	1978/05	1982/03		
Extreme Minimum (°C)	-30	-34	-27.5	-15	-4.4	0	4.4	3.3	-1.1	-5.6	-15.5	-24		
Date (yyyy/dd)	1994/16	1979/18	1984/08	1965/03	1966/07	1966/01	1972/05	1971/24	1965/27	1965/29	1995/29	1989/22		
Precipitation:														
Rainfall (mm)	23.8	19.9	39.8	61.6	71.8	76.3	72.6	88.6	105.2	86.5	73.9	32.9	752.8	A
Snowfall (cm)	110.9	58.1	37.6	8.7	0.2	0	0	0	0	2.3	35.5	93.9	347.2	A
Precipitation (mm)	134.8	78	77.4	70.2	72	76.3	72.6	88.6	105.2	88.8	109.4	126.9	1100.1	A
Snow Depth at Month-end (cm)	21													D
Extreme Daily Rainfall (mm)	43.2	42.4	43	52.5	37.4	75.5	72.4	75.7	50	45.2	44	30		
Date (yyyy/dd)	1974/26	1997/21	1990/11	2000/20	1999/17	2000/10	1980/14	1968/19	1983/20	1988/01	1990/05	1984/28		
Extreme Daily Snowfall (cm)	57	29	42	20.8	3	0	0	0	0	13	29	62		
Date (yyyy/dd)	1999/06	1995/13	1985/04+	1975/03	1976/03	1965/01+	1965/01+	1965/01+	1965/26+	1997/22	1976/30+	1995/10		
Extreme Daily Precipitation (mm)	57	46.4	49.6	52.5	37.4	75.5	72.4	75.7	50	45.2	44	62		
Date (yyyy/dd)	1999/06	1997/21	1985/04	2000/20	1999/17	2000/10	1980/14	1968/19	1983/20	1988/01	1990/05	1995/10		
Extreme Snow Depth (cm)	78	60	58	8	0	0	0	0	0	2	34	88		
Date (yyyy/dd)	1999/07	1982/04	1982/05+	1993/02+	1983/01+	1983/01+	1983/01+	1983/01+	1983/01+	1992/18	1991/05	1995/12		
Days with Maximum Temperature:														
<= 0 °C	20.4	17.1	10.6	1.2	0	0	0	0	0	0	2.7	13.1	65	A
> 0 °C	10.6	11.2	20.4	28.8	31	30	31	31	30	31	27.3	17.9	300.2	A
> 10 °C	0.27	0.57	3.8	12.4	26.5	29.7	31	31	29.5	21.6	6.5	1.2	194.1	A
> 20 °C	0	0	0.31	2.1	8.3	17.1	27	25.5	12.8	3.5	0.07	0	96.7	A
> 30 °C	0	0	0	0.03	0.1	0.93	1.8	1	0.23	0	0	0	4.1	A
> 35 °C	0	0	0	0	0	0	0	0	0	0	0	0	0	A
Days with Minimum Temperature:														
> 0 °C	1.7	2	5.1	15.8	29.6	30	31	31	29.9	27.5	15.1	5.2	223.9	A
<= 2 °C	30.4	27.7	28.7	20.1	4.7	0.1	0	0	0.73	7.5	20.8	29.2	169.7	A
<= 0 °C	29.3	26.3	25.9	14.2	1.4	0	0	0	0.13	3.5	14.9	25.8	141.4	A
< -2 °C	26.4	23.5	20.2	6.5	0.1	0	0	0	0	0.43	7.6	20.3	105	A
< -10 °C	13.6	12.6	6.9	0.17	0	0	0	0	0	0	0.34	6.5	40.1	A
< -20 °C	1.8	1.9	0.52	0	0	0	0	0	0	0	0	0.37	4.6	A
< -30 °C	0	0.07	0	0	0	0	0	0	0	0	0	0	0.07	A
Days with Rainfall:														

>= 0.2 mm	4	3.6	6.5	12	11.9	11.7	10.6	11.4	14.4	16.4	12.5	6.2	121.1	A
>= 5 mm	1.4	1.3	2.6	4.1	4.9	4.5	4.1	5	6.4	6.1	5.1	2.5	48.1	A
>= 10 mm	0.83	0.63	1.3	1.9	2.5	2.5	2.3	3	3.7	3	2.6	1.1	25.3	A
>= 25 mm	0.17	0.1	0.13	0.27	0.4	0.6	0.6	0.77	0.8	0.2	0.28	0.13	4.5	A
Days With Snowfall:														
>= 0.2 cm	18.8	12.8	8.4	2.4	0.07	0	0	0	0	0.63	6.5	15.4	64.9	A
>= 5 cm	7.6	4.6	2.4	0.57	0	0	0	0	0	0.13	2.5	6	23.7	A
>= 10 cm	3.6	1.4	0.83	0.13	0	0	0	0	0	0.07	1.1	3	10.1	A
>= 25 cm	0.47	0.07	0.2	0	0	0	0	0	0	0	0.14	0.4	1.3	A
Days with Precipitation:														
>= 0.2 mm	21.7	15.5	13.7	13.4	11.9	11.7	10.6	11.4	14.4	16.7	17.4	20.1	178.4	A
>= 5 mm	9.1	6	5.1	4.8	4.9	4.5	4.1	5	6.4	6.3	7.8	8.5	72.6	A
>= 10 mm	4.5	2.1	2.2	2.1	2.5	2.5	2.3	3	3.7	3.1	3.8	4.3	36.1	A
>= 25 mm	0.67	0.17	0.37	0.27	0.4	0.6	0.6	0.77	0.8	0.2	0.43	0.53	5.8	A
Degree Days:														
Above 24 °C	0	0	0	0	0	0.8	3.8	3	0.5	0	0	0	8.2	A
Above 18 °C	0	0	0	1.1	6.4	27.6	70.9	62.8	20	1.7	0	0	190.4	A
Above 15 °C	0	0	0.3	3.7	20.3	68.6	148.1	137.3	54.3	7.8	0.1	0.1	440.4	A
Above 10 °C	0	0.1	2.8	17.2	77	189.4	301.3	289.5	163.8	48.4	5.7	0.5	1095.7	A
Above 5 °C	0.8	1.6	14.2	61	198.4	337.2	456.3	444.5	309.2	147.6	34.2	4.5	2009.4	A
Above 0 °C	11.9	13.9	53.8	166.8	351.5	487.2	611.3	599.5	459.2	295.2	118.4	30.3	3198.8	A
Below 0 °C	190.9	171.6	92.9	8.1	0	0	0	0	0	0	14	104.5	581.9	A
Below 5 °C	334.8	300.6	208.3	52.3	1.9	0	0	0	0	7.5	79.8	233.7	1218.9	A
Below 10 °C	489	440.4	351.9	158.6	35.6	2.3	0	0	4.6	63.2	201.3	384.7	2131.4	A
Below 15 °C	644	581.7	504.4	295.1	133.8	31.5	1.8	2.8	45.1	177.6	345.7	539.3	3302.6	A
Below 18 °C	737	666.5	597.2	382.5	212.9	80.4	17.6	21.3	100.8	264.5	435.6	632.2	4148.3	A



[Important Notices](#)

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 Modified : 2004-02-25
 Reviewed : 2004-02-25
 Url of this page : http://www.climate.weatheroffice.ec.gc.ca/climate_normals/results_e.html

The Green Lane™,
 Environment Canada's World Wide Web Site.

Canada

Mean water surface temperature

	Year	Day	Sup.	Mich.	Huron	Erie	Ont.
Jan		Avg	2.6	3.1	3.1	2.4	3.3
Feb		Avg	1.4	1.7	1.3	1.7	1.9
Mar		Avg	0.9	1.6	0.9	1.4	1.7
Apr		Avg	1.1	2.5	1.7	3.7	2.6
May		Avg	2.3	5.5	4.6	9.8	6.1
Jun		Avg	5.3	12.3	11.2	17.5	13.8
Jul		Avg	10.9	18.7	17.2	22.2	19.5
Aug		Avg	15.4	20.9	19.7	23.4	21.8
Sep		Avg	14.3	18.8	17.8	21.1	19.3
Oct		Avg	9.5	13.2	12.4	15.8	13.4
Nov		Avg	6.5	8.9	8.4	10.7	8.6
Dec		Avg	4.5	5.6	5.7	5.5	5.5

4-8

ANNUAL WIND SPEED STATISTICS GREAT LAKES AREA 4 - LAKE HURON NORTH



PERCENTAGE FREQUENCY OF OCCURRENCE BY DIRECTION Annual WES

	Direction - Coming From								Total	Num Obs
	N	NE	E	SE	S	SW	W	NW		
0.0 - < 5.0 kts	0.4	0.4	0.2	0.3	0.4	0.4	0.4	0.4	3.0	2773
5.0 - < 10.0 kts	3.1	3.1	1.9	2.2	2.6	3.1	2.9	3.2	22.1	20649
10.0 - < 15.0 kts	5.0	6.8	2.5	2.6	3.2	5.6	5.0	8.9	39.5	36902
15.0 - < 20.0 kts	1.2	2.9	1.0	1.3	1.6	3.1	1.9	3.8	17.0	15889
20.0 - < 25.0 kts	0.5	1.4	0.6	0.7	0.9	1.7	1.3	2.3	9.4	8812
25.0 - < 30.0 kts	0.3	0.7	0.3	0.5	0.6	1.1	0.8	1.3	5.6	5270
30.0 - < 35.0 kts	0.1	0.2	0.2	0.2	0.3	0.5	0.3	0.6	2.4	2224
35.0 - < 40.0 kts	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.6	562
40.0 - < 45.0 kts	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.3	307
45.0 - < 50.0 kts	-	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	91
50.0 - < 55.0 kts	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	31
55.0 - + kts	-	0.0	0.0	-	0.0	0.0	0.0	-	0.0	14
Total	10.6	15.5	8.9	8.1	9.7	15.8	12.8	20.7	100.0	93504

MONTHLY DATA STATISTICS WES

	Mean	Std Dev	Med	Max	Min	Upper	Lower	Most	Num Obs
						95% Lim	95% Lim	Freq Dir	
	kts	kts	kts	kts	kts	kts	kts	from	
January	15.4	8.1	13.0	62.0	0.0	31.1	5.0	NW	7938
February	14.4	7.3	12.0	59.1	0.0	28.9	5.0	NW	7232
March	14.6	7.9	12.0	65.1	0.0	28.9	5.0	NE	7938
April	14.7	7.4	12.0	55.0	0.0	28.9	5.0	NW	7680
May	13.3	6.6	12.0	52.1	0.0	26.0	5.0	NW	7938
June	12.0	5.9	11.0	52.1	0.0	21.9	5.0	SW	7680
July	11.7	5.3	11.0	48.0	0.0	21.9	5.0	SW	7938
August	12.0	5.3	12.0	41.0	0.0	21.9	5.0	SW	7938
September	13.3	6.0	12.0	45.1	0.0	25.0	5.0	NW	7680
October	14.4	6.9	12.0	48.1	0.0	27.9	5.0	NW	7938
November	16.1	8.2	13.0	61.0	0.0	32.0	5.0	NW	7680
December	15.8	8.0	13.0	55.0	0.0	31.1	5.0	NW	7938
Annual	14.0	7.1	12.0	65.1	0.0	27.9	5.0	NW	93504

Reference Height: 10 m above mean sea level

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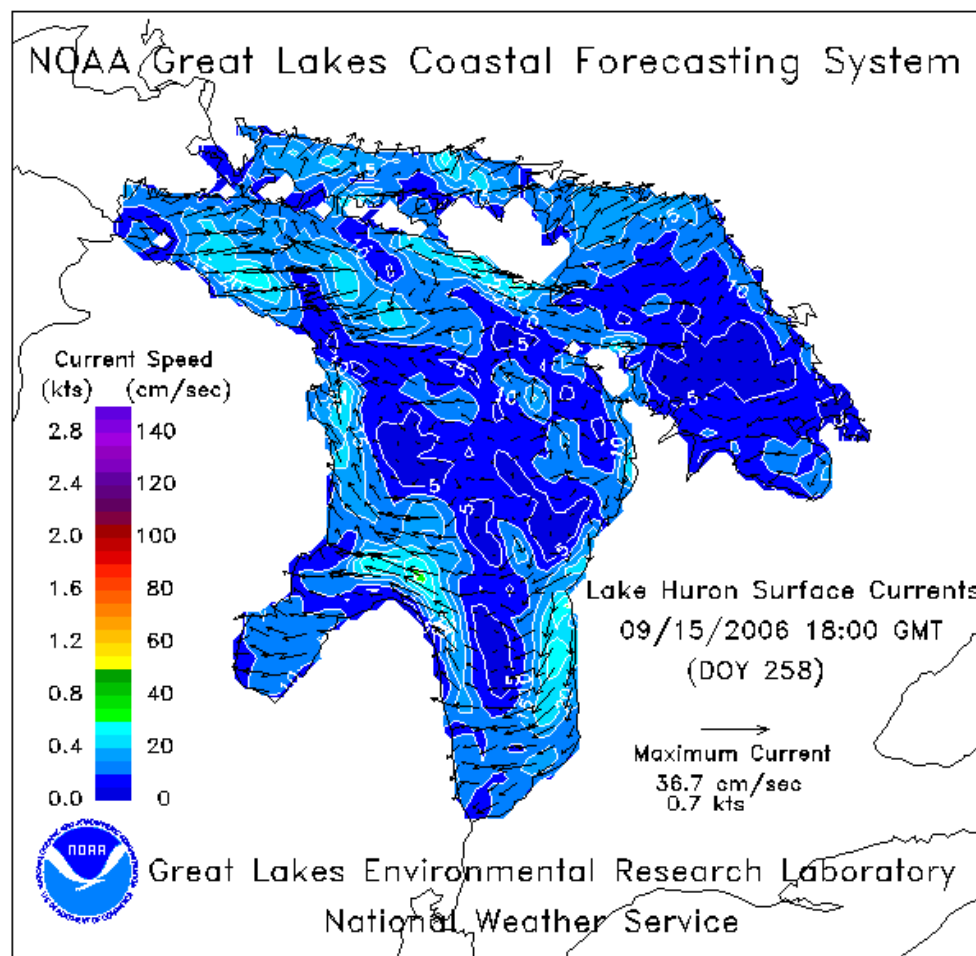
Jump To: Nowcast Products...



Jump To: Forecast Products...



Lake Huron Surface Currents													
Animation (-24 to 00)	Java	FLC	00	-03	-06	-09	-12	-15	-18	-21	-24		
Animation (-48 to -24)	Java	FLC	-27	-30	-33	-36	-39	-42	-45	-48			



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SIGNIFICANT WAVE HEIGHT STATISTICS GREAT LAKES AREA 3 - LAKE HURON SOUTH



PERCENTAGE FREQUENCY OF OCCURRENCE BY DIRECTION Annual WES

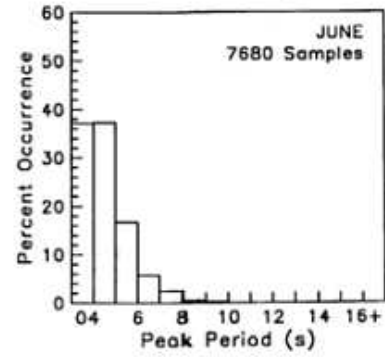
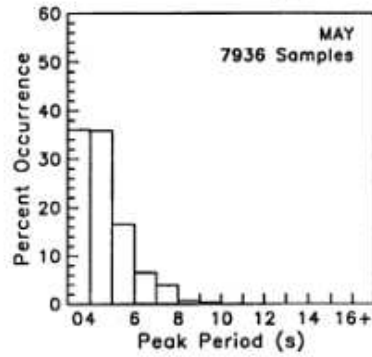
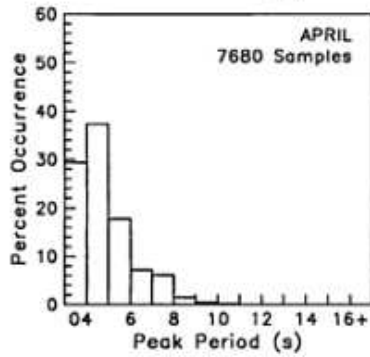
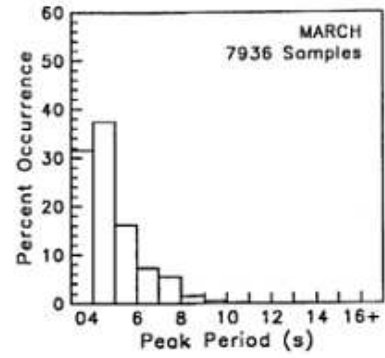
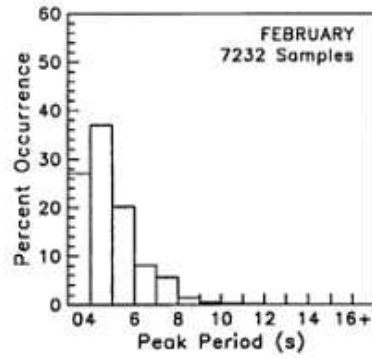
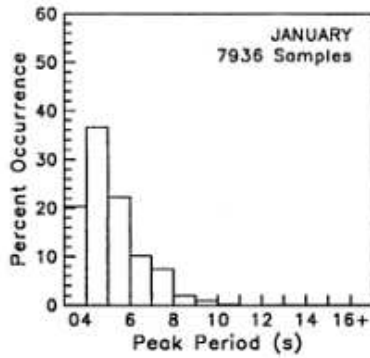
	Direction - Coming From								Total	Num Obs
	N	NE	E	SE	S	SW	W	NW		
0.0 - < 0.5 m	2.5	2.1	2.0	1.7	2.2	2.7	2.7	3.5	19.4	18184
0.5 - < 1.0 m	3.7	3.8	3.1	3.2	4.9	5.8	5.8	8.7	37.0	34574
1.0 - < 1.5 m	1.9	1.2	0.7	0.8	3.3	3.4	2.8	3.8	17.7	16528
1.5 - < 2.0 m	0.8	0.8	0.3	0.2	2.3	3.0	1.8	2.4	11.4	10634
2.0 - < 2.5 m	0.2	0.1	0.0	0.0	1.2	2.0	1.1	1.3	6.1	5697
2.5 - < 3.0 m	0.0	0.0	0.0	0.0	0.5	1.4	0.8	0.9	3.6	3379
3.0 - < 3.5 m	0.0	0.0	-	0.0	0.2	0.8	0.5	0.5	2.1	1990
3.5 - < 4.0 m	0.0	0.0	-	0.0	0.1	0.5	0.3	0.3	1.2	1161
4.0 - < 4.5 m	0.0	0.0	-	0.0	0.0	0.3	0.2	0.2	0.7	824
4.5 - < 5.0 m	-	-	-	-	0.0	0.2	0.1	0.1	0.4	357
5.0 - < 5.5 m	-	-	-	-	0.0	0.1	0.1	0.1	0.2	196
5.5 - < 6.0 m	0.0	-	-	-	0.0	0.0	0.0	0.0	0.1	74
6.0 - < 6.5 m	-	-	-	-	0.0	0.0	0.0	0.0	0.1	58
6.5 - < 7.0 m	-	-	-	-	0.0	0.0	0.0	0.0	0.0	28
7.0 - + m	-	-	-	-	0.0	0.0	0.0	0.0	0.0	26
Total	9.2	7.7	6.1	5.8	14.8	20.3	16.2	19.9	100.0	93504

MONTHLY DATA STATISTICS WES

	Std					Upper	Lower	Most	Num Obs
	Mean	Dev	Med	Max	Min	95% Lim	95% Lim	Freq Dir from	
January	1.4	1.0	1.2	8.7	0.1	3.8	0.3	NW	7938
February	1.2	0.9	0.9	8.3	0.0	3.1	0.2	NW	7232
March	1.2	0.9	0.9	8.6	0.0	3.1	0.2	NW	7938
April	1.2	0.9	0.9	7.2	0.0	3.2	0.2	NW	7680
May	1.0	0.8	0.7	8.1	0.1	2.8	0.2	SW	7938
June	0.9	0.7	0.7	7.5	0.0	2.3	0.2	SW	7680
July	0.8	0.6	0.7	4.9	0.1	2.1	0.2	SW	7938
August	0.8	0.6	0.7	6.0	0.0	2.0	0.2	SW	7938
September	1.0	0.7	0.8	5.3	0.1	2.5	0.2	SW	7680
October	1.2	0.9	0.9	8.8	0.0	2.9	0.2	SW	7938
November	1.4	1.0	1.1	7.8	0.1	3.4	0.3	NW	7680
December	1.4	1.0	1.1	7.5	0.1	3.3	0.3	NW	7938
Annual	1.1	0.9	0.8	8.7	0.0	2.9	0.2	SW	93504

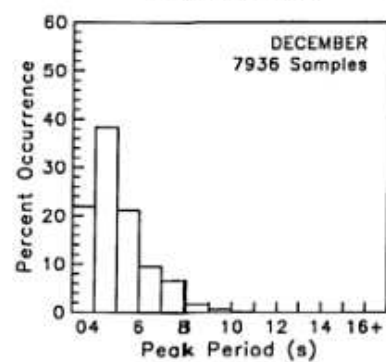
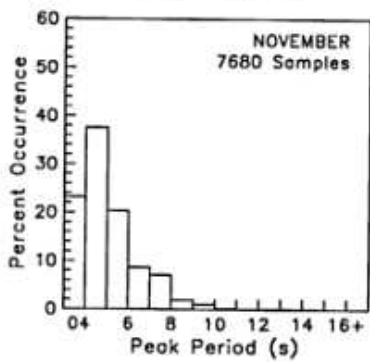
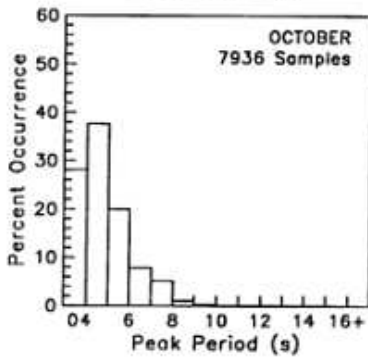
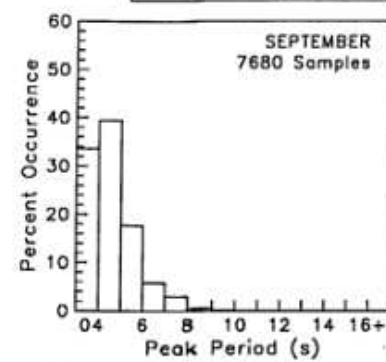
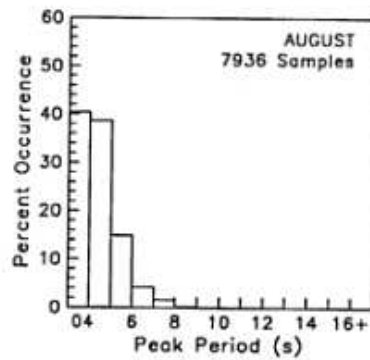
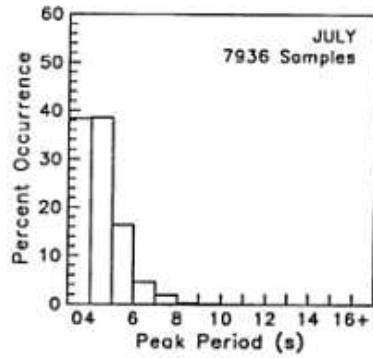
3-17

MONTHLY WAVE STATISTICS GREAT LAKES AREA 3 - LAKE HURON SOUTH



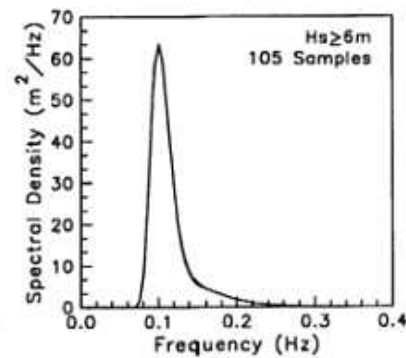
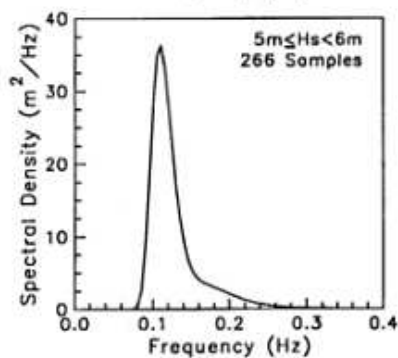
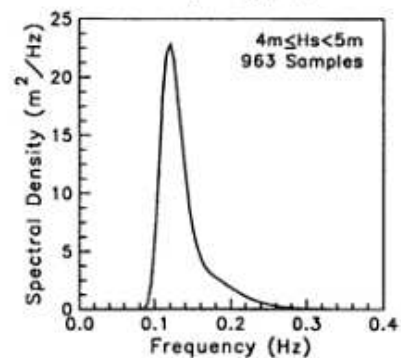
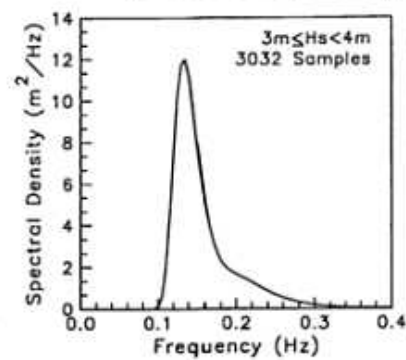
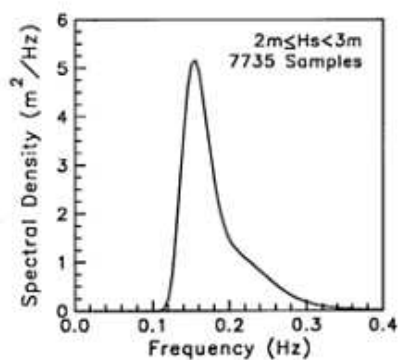
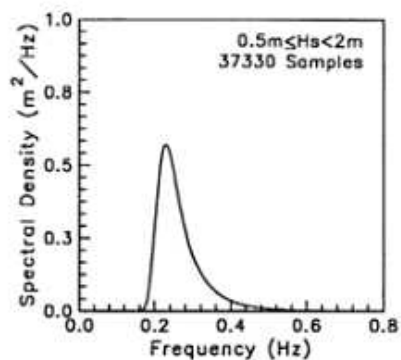
3-18

MONTHLY WAVE STATISTICS GREAT LAKES AREA 3 - LAKE HURON SOUTH



3-21

MOST PROBABLE SPECTRA GREAT LAKES AREA 3 - LAKE HURON SOUTH WES



3-8

ANNUAL WIND SPEED STATISTICS GREAT LAKES AREA 3 - LAKE HURON SOUTH



PERCENTAGE FREQUENCY OF OCCURRENCE BY DIRECTION Annual WES

	Direction - Coming From								Total	Num Obs
	N	NE	E	SE	S	SW	W	NW		
0.0 - < 5.0 kts	0.2	0.2	0.1	0.2	0.3	0.2	0.2	0.2	1.5	1449
5.0 - <10.0 kts	3.3	3.3	2.4	3.4	3.7	3.7	3.7	3.2	26.8	25070
10.0 - <15.0 kts	3.2	3.4	2.5	3.1	4.6	4.2	4.8	3.8	29.1	27238
15.0 - <20.0 kts	1.6	1.5	1.3	1.3	2.9	2.9	2.8	2.1	16.2	15184
20.0 - <25.0 kts	1.1	1.2	0.9	0.6	2.0	2.5	2.2	1.8	12.3	11517
25.0 - <30.0 kts	0.5	0.7	0.6	0.3	1.5	1.8	1.5	1.1	7.9	7407
30.0 - <35.0 kts	0.2	0.4	0.3	0.1	0.8	1.0	0.8	0.5	4.0	3788
35.0 - <40.0 kts	0.0	0.1	0.1	0.0	0.2	0.3	0.2	0.1	1.0	978
40.0 - <45.0 kts	0.0	0.0	0.0	0.0	0.1	0.2	0.1	0.1	0.6	568
45.0 - <50.0 kts	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.2	181
50.0 - <55.0 kts	-	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	90
55.0 - + kts	-	0.0	0.0	-	0.0	0.0	0.0	0.0	0.1	58
Total	10.2	10.7	8.2	9.0	16.0	17.1	16.1	12.6	100.0	93504

MONTHLY DATA STATISTICS WES

	Std				Upper 95%		Lower 95%	Most Freq	Num Obs
	Mean kts	Dev kts	Med kts	Max kts	Min kts	Lim kts	Lim kts	Dir from	
January	18.1	9.1	17.1	75.0	0.0	34.0	6.0	NW	7936
February	18.4	8.7	14.9	85.1	0.0	32.0	5.0	NW	7232
March	16.2	9.0	14.0	70.2	0.0	33.0	5.0	NE	7936
April	16.3	8.9	14.0	85.1	0.0	33.0	5.0	W	7680
May	14.0	7.7	12.0	61.0	0.0	28.9	5.0	SW	7936
June	12.6	6.7	11.0	57.2	0.0	26.0	5.0	SW	7680
July	12.0	6.1	11.0	49.0	0.0	24.1	5.0	SW	7936
August	12.3	6.1	11.0	51.1	1.0	24.1	5.0	SW	7936
September	13.8	7.1	12.0	53.1	1.0	27.9	5.0	S	7680
October	15.6	7.8	14.0	53.1	0.0	30.1	6.0	S	7936
November	17.4	8.8	15.9	71.1	0.0	33.0	6.0	S	7680
December	17.6	8.6	17.1	76.1	1.0	33.0	6.0	S	7936
Annual	15.2	8.2	13.0	78.1	0.0	31.1	5.0	SW	93504

Reference Height: 10 m above mean sea level

Appendix F

Environmental Data

For

Lake Ontario

1-19

SIGNIFICANT WAVE HEIGHT STATISTICS GREAT LAKES AREA 1 - LAKE ONTARIO



PERCENTAGE FREQUENCY OF OCCURRENCE BY DIRECTION Annual WES

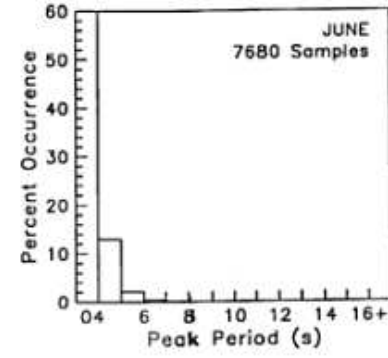
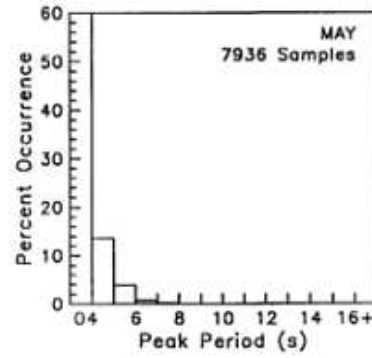
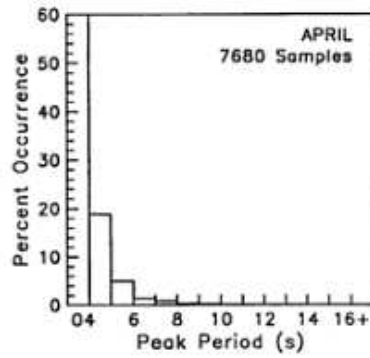
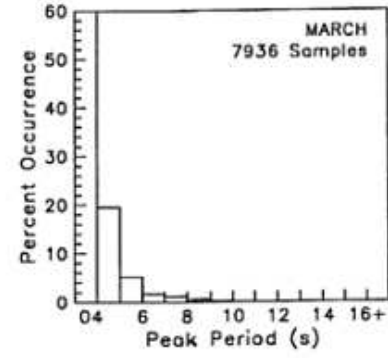
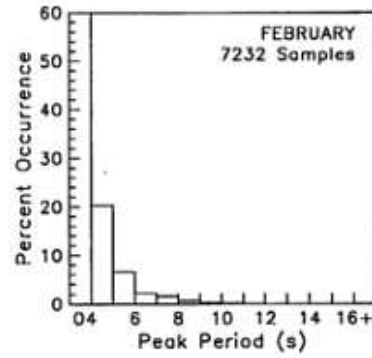
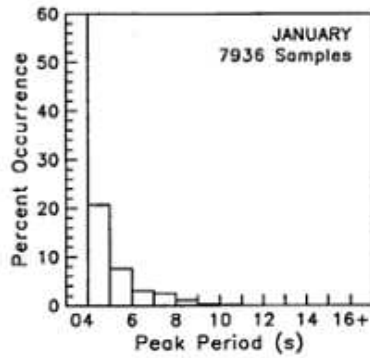
	Direction - Coming From								Total	Num Obs
	N	NE	E	SE	S	SW	W	NW		
0.0 - < 0.5 m	3.6	3.2	2.6	1.8	5.3	25.4	21.9	4.0	67.9	63462
0.5 - < 1.0 m	1.5	2.8	0.6	0.6	2.8	8.0	8.0	2.4	22.9	21369
1.0 - < 1.5 m	0.1	0.2	0.0	0.1	1.0	1.8	1.9	1.0	6.1	5675
1.5 - < 2.0 m	0.0	0.1	-	0.0	0.4	0.7	0.7	0.2	1.9	1821
2.0 - < 2.5 m	-	-	-	-	0.1	0.3	0.2	0.0	0.7	600
2.5 - < 3.0 m	-	-	-	-	0.0	0.2	0.1	0.0	0.3	292
3.0 - < 3.5 m	-	-	-	-	0.0	0.1	0.0	0.0	0.1	95
3.5 - < 4.0 m	-	-	-	-	0.0	0.1	0.0	0.0	0.1	57
4.0 - < 4.5 m	-	-	-	-	-	0.0	0.0	-	0.0	28
4.5 - < 5.0 m	-	-	-	-	-	0.0	0.0	-	0.0	15
5.0 - < 5.5 m	-	-	-	-	-	0.0	-	-	0.0	5
5.5 - < 6.0 m	-	-	-	-	-	-	-	-	0.0	0
6.0 - < 6.5 m	-	-	-	-	-	0.0	-	-	0.0	3
6.5 - < 7.0 m	-	-	-	-	-	0.0	-	-	0.0	1
7.0 - + m	-	-	-	-	-	0.0	-	-	0.0	1
Total	5.3	6.2	3.4	2.5	9.6	34.5	30.8	7.6	100.0	93504

MONTHLY DATA STATISTICS WES

	Mean m	Std Dev m	Med m	Max m	Min m	Upper	Lower	Most	Num Obs
						95% Lim m	95% Lim m	Freq Dir from	
January	0.6	0.6	0.4	4.9	0.0	1.7	0.0	SW	7938
February	0.5	0.5	0.4	7.1	0.0	1.5	0.0	SW	7232
March	0.5	0.5	0.3	5.1	0.0	1.4	0.0	W	7938
April	0.4	0.4	0.3	5.3	0.0	1.2	0.0	SW	7680
May	0.3	0.3	0.2	3.6	0.0	1.0	0.0	SW	7936
June	0.3	0.3	0.2	3.0	0.0	0.8	0.0	SW	7680
July	0.3	0.3	0.2	2.9	0.0	0.8	0.0	SW	7936
August	0.3	0.3	0.2	2.4	0.0	0.8	0.0	SW	7936
September	0.3	0.3	0.2	2.9	0.0	1.0	0.0	W	7680
October	0.4	0.4	0.3	4.0	0.0	1.2	0.0	SW	7936
November	0.5	0.5	0.4	4.9	0.0	1.5	0.0	W	7680
December	0.5	0.5	0.4	4.5	0.0	1.5	0.0	SW	7936
Annual	0.4	0.4	0.3	7.1	0.0	1.2	0.0	SW	93504

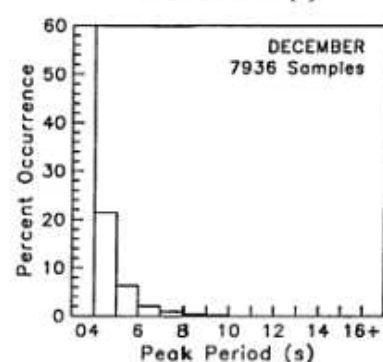
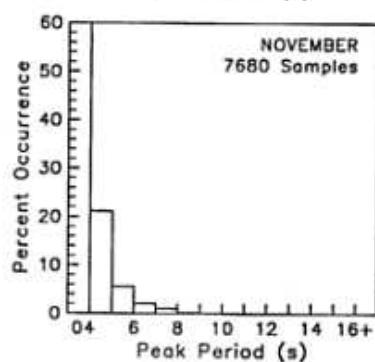
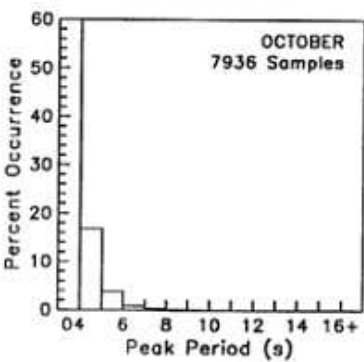
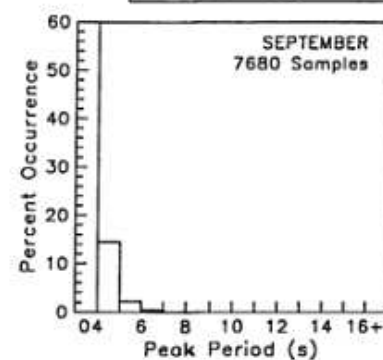
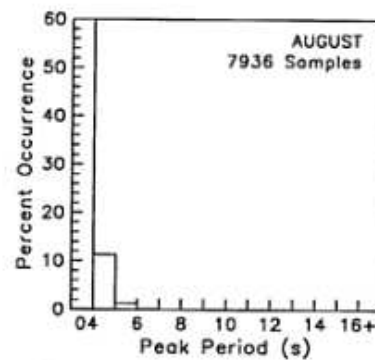
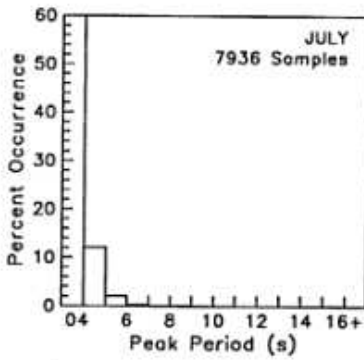
1-17

MONTHLY WAVE STATISTICS GREAT LAKES AREA 1 - LAKE ONTARIO



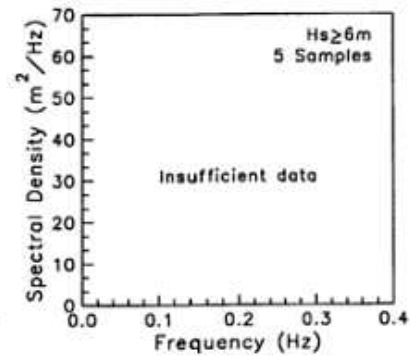
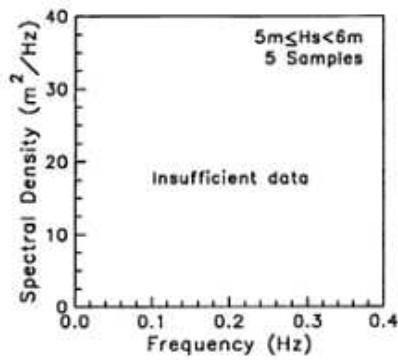
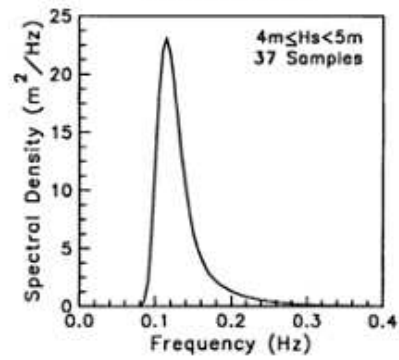
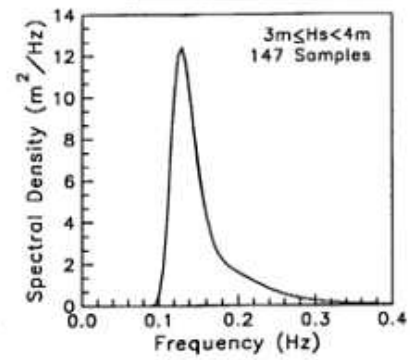
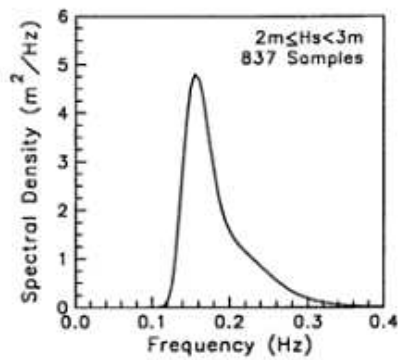
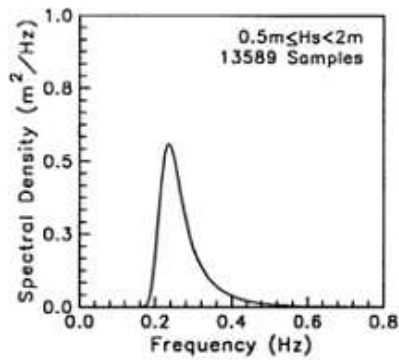
1-18

MONTHLY WAVE STATISTICS GREAT LAKES AREA 1 - LAKE ONTARIO



1-21

MOST PROBABLE SPECTRA
GREAT LAKES AREA 1 - LAKE ONTARIO
WES




 Environment
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 Environnement
Canada

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Canadian Climate Normals 1971-2000

The minimum number of years used to calculate these Normals is indicated by a [code](#) for each element. A "+" beside an extreme date indicates that this date is the first occurrence of the extreme value. Values and dates in bold indicate all-time extremes for the location.

NOTE!! Data used in the calculation of these Normals may be subject to further quality assurance checks. This may result in minor changes to some values presented here.

BELLEVILLE * **ONTARIO**

Latitude: 44° 9' N

Longitude: 77° 23' W

Elevation: 76.20 m

Climate ID: 6150689

WMO ID:
TC ID:

* This station meets **WMO standards** for temperature and precipitation.

Temperature:	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year	Code
Daily Average (°C)	-7.1	-5.9	-0.6	6.7	13.7	18.7	21.6	20.6	15.9	9.3	3.2	-3.5	7.7	A
Standard Deviation	2.9	2.8	2.2	1.6	1.8	1.3	1.1	1.1	1.2	1.5	1.4	3	0.8	A
Daily Maximum (°C)	-2.6	-1.4	3.8	11.4	18.7	23.6	26.6	25.4	20.4	13.5	6.7	0.4	12.2	A
Daily Minimum (°C)	-11.5	-10.3	-5	2	8.7	13.7	16.6	15.7	11.3	5.1	-0.2	-7.3	3.2	A
Extreme Maximum (°C)	13.9	13	23	29	35	35.6	40	36.1	35	28.3	22.2	16.5		
Date (yyyy/dd)	1967/25	1984/24+	1998/28+	1990/25	1962/17	1964/30	1936/09	1948/26	1953/02	1877/01	1938/07	1982/03		
Extreme Minimum (°C)	-37.8	-39.4	-29.4	-17.2	-7.2	0	6.1	3.3	-1.7	-10	-22.2	-34.4		
Date (yyyy/dd)	1942/10	1934/09	1948/06	1923/01	1956/05	1945/01	1929/20+	1934/30+	1947/23	1933/26	1936/30	1871/21		
Precipitation:														
Rainfall (mm)	33.2	28	47.9	67.7	73.9	70.9	52.7	80.7	86.4	75.4	75.7	43.4	735.9	A
Snowfall (cm)	40.7	28.4	25.4	6.9	0.4	0	0	0	0	0.6	11.5	41.8	155.7	A
Precipitation (mm)	74	56.4	73.3	74.6	74.3	70.9	52.7	80.7	86.4	76	87.3	85.2	891.6	A
Average Snow Depth (cm)	14	16	8	1	0	0	0	0	0	0		7		A
Median Snow Depth (cm)	14	15	7	0	0	0	0	0	0	0		6		A
Snow Depth at Month-end (cm)	15	11	1	0	0	0	0	0	0	0	1	11		A
Extreme Daily Rainfall (mm)	51.1	64.3	53.2	51.1	76.5	82.6	106.2	88.4	103.9	64.8	69.6	68.6		
Date (yyyy/dd)	1929/18	1878/23	1980/21	1870/18	1883/22	1889/01	1921/18	1941/31	1869/09	1955/14	1993/27	1884/06		
Extreme Daily Snowfall (cm)	35.1	38.1	63.5	18.8	10.6	0	0	0	0	11.4	35.6	40.6		
Date (yyyy/dd)	1948/02	1947/06	1870/17	1975/03	1977/08	1866/01+	1866/01+	1866/01+	1866/01+	1868/22	1956/25	1872/20+		
Extreme Daily Precipitation (mm)	55.4	67.3	63.5	51.1	76.5	82.6	106.2	88.4	103.9	64.8	69.6	68.6		
Date (yyyy/dd)	1871/16	1878/23	1870/17	1870/18	1883/22	1889/01	1921/18	1941/31	1869/09	1955/14	1993/27	1884/06		
Extreme Snow Depth (cm)	61	63	48	25	5	0	0	0	0	8	18	63		
Date (yyyy/dd)	1977/29+	1985/17	1971/11+	1971/01	1963/01	1961/01+	1961/01+	1961/01+	1961/01+	1969/22	1997/16+	1992/12		
Days with Maximum Temperature:														
<= 0 °C	18.9	16.1	7.6	0.43	0	0	0	0	0	0	2.3	12.9	58.3	A
> 0 °C	12.1	12.2	23.4	29.6	31	30	31	31	30	31	27.7	18.1	307	A
> 10 °C	0.2	0.27	4.2	16.6	29.8	30	31	31	29.9	23	6.8	1	203.8	A
> 20 °C	0	0	0.1	1.7	11.6	24.3	30.1	29.1	15.4	1.8	0.03	0	114.1	A
> 30 °C	0	0	0	0	0.2	1.1	3.2	1.3	0.23	0	0	0	6.1	A
> 35 °C	0	0	0	0	0	0	0.03	0	0	0	0	0	0.03	A
Days with Minimum Temperature:														
> 0 °C	1.8	2.1	6	19.7	30.6	30	31	31	29.8	26.2	14	3.8	225.8	A
<= 2 °C	30.6	27.8	28.4	15.9	1.6	0.03	0	0	0.73	9.2	20.9	29.7	164.8	A
<= 0 °C	29.2	26.2	25	10.3	0.43	0	0	0	0.23	4.8	16	27.2	139.5	A
< -2 °C	26.6	23.5	19.2	4.9	0.03	0	0	0	0	1.3	9.3	22.5	107.4	A
< -10 °C	16.9	14.3	6	0.17	0	0	0	0	0	0	0.6	10	47.9	A
< -20 °C	4.4	2.5	0.47	0	0	0	0	0	0	0	0	1.2	8.5	A
< -30 °C	0.27	0.03	0	0	0	0	0	0	0	0	0	0.07	0.37	A

Days with Rainfall:														
>= 0.2 mm	5.2	4.6	7.5	10.6	11.9	11.5	9.1	10.6	11.5	12.7	11.1	7.3	113.8	A
>= 5 mm	2.2	1.8	3.1	4.6	4.7	4.6	3.2	4.6	4.9	5	4.5	2.8	45.9	A
>= 10 mm	1	0.9	1.5	2.6	2.6	2.4	1.5	2.7	3.1	2.3	2.4	1.4	24.4	A
>= 25 mm	0.27	0.17	0.33	0.3	0.43	0.43	0.23	0.77	0.63	0.33	0.5	0.17	4.6	A
Days With Snowfall:														
>= 0.2 cm	11.4	8.6	6.3	1.9	0.07	0	0	0	0	0.17	3.6	9.5	41.5	A
>= 5 cm	2.4	2	1.8	0.53	0.03	0	0	0	0	0.03	0.83	2.7	10.3	A
>= 10 cm	1.1	0.6	0.7	0.17	0.03	0	0	0	0	0	0.3	1.2	4.1	A
>= 25 cm	0.03	0.03	0.03	0	0	0	0	0	0	0	0	0.13	0.22	A
Days with Precipitation:														
>= 0.2 mm	14.8	11.7	12.2	11.8	12	11.5	9.1	10.6	11.5	12.7	13.8	14.5	146.3	A
>= 5 mm	4.6	3.8	4.8	5.1	4.8	4.6	3.2	4.6	4.9	5	5.3	5.5	56.1	A
>= 10 mm	2.3	1.7	2.4	2.9	2.6	2.4	1.5	2.7	3.1	2.3	2.9	2.6	29.4	A
>= 25 mm	0.4	0.27	0.4	0.3	0.43	0.43	0.23	0.77	0.63	0.37	0.53	0.3	5.1	A
Days with Snow Depth:														
>= 1 cm	26.3	24.3	15.3	2.1	0	0	0	0	0	0		18.5		C
>= 5 cm	22.7	21.2	12.6	1.3	0	0	0	0	0	0		14.6		C
>= 10	18.8	16.9	9.2	0.78	0	0	0	0	0	0		9		C
>= 20	10.4	10.7	4.5	0.11	0	0	0	0	0	0		4		C
Degree Days:														
Above 24 °C	0	0	0	0	0.1	2	9.7	5.1	0.8	0	0	0	17.6	A
Above 18 °C	0	0	0	0.4	11.2	52.2	115.1	89.5	24	0.4	0	0	292.9	A
Above 15 °C	0	0	0	2.6	35.7	117.9	204.8	173.4	63	4.6	0	0	601.9	A
Above 10 °C	0	0	1	19.2	127.6	260	359.7	327.2	179.4	43.3	3.9	0.1	1321.3	A
Above 5 °C	0.6	0.5	12.2	83.1	270.9	409.8	514.7	482.2	325.8	141.9	31.8	3	2276.3	A
Above 0 °C	11	14.1	60.2	206.1	425.6	559.8	669.7	637.2	475.8	288.3	115.9	27.3	3490.8	A
Below 0 °C	230.8	179.9	78.3	4.3	0	0	0	0	0	0.1	18.6	134.9	646.8	A
Below 5 °C	375.3	307.6	185.3	31.2	0.3	0	0	0	0	8.7	84.5	265.7	1258.6	A
Below 10 °C	529.8	448.4	329.1	117.4	12	0.2	0	0	3.6	65	206.7	417.8	2130	A
Below 15 °C	684.7	589.7	483.2	250.7	75.1	8.1	0.1	1.3	37.3	181.4	352.8	572.7	3237	A
Below 18 °C	777.7	674.7	576.1	338.6	143.6	32.5	3.4	10.4	88.3	270.2	442.8	665.7	4023.7	A

[Important Notices](#)

Created : 2002-06-21
 Modified : 2004-02-25
 Reviewed : 2004-02-25
 Url of this page : http://www.climate.weatheroffice.ec.gc.ca/climate_normals/results_e.html

The Green Lane™,
 Environment Canada's World Wide Web Site.



Mean water surface temperature

	Year	Day	Sup.	Mich.	Huron	Erie	Ont.
Jan		Avg	2.6	3.1	3.1	2.4	3.3
Feb		Avg	1.4	1.7	1.3	1.7	1.9
Mar		Avg	0.9	1.6	0.9	1.4	1.7
Apr		Avg	1.1	2.5	1.7	3.7	2.6
May		Avg	2.3	5.5	4.6	9.8	6.1
Jun		Avg	5.3	12.3	11.2	17.5	13.8
Jul		Avg	10.9	18.7	17.2	22.2	19.5
Aug		Avg	15.4	20.9	19.7	23.4	21.8
Sep		Avg	14.3	18.8	17.8	21.1	19.3
Oct		Avg	9.5	13.2	12.4	15.8	13.4
Nov		Avg	6.5	8.9	8.4	10.7	8.6
Dec		Avg	4.5	5.6	5.7	5.5	5.5

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ANNUAL WIND SPEED STATISTICS GREAT LAKES AREA 1 - LAKE ONTARIO



PERCENTAGE FREQUENCY OF OCCURRENCE BY DIRECTION Annual WES

	Direction - Coming From								Total	Num Obs
	N	NE	E	SE	S	SW	W	NW		
0.0 - < 5.0 kts	3.7	4.0	3.2	3.1	5.0	5.7	5.1	3.7	33.5	31340
5.0 - <10.0 kts	3.0	3.8	2.5	1.7	4.9	6.5	6.7	4.3	33.2	31066
10.0 - <15.0 kts	2.0	2.9	1.3	0.9	3.2	4.8	8.0	3.3	24.2	22593
15.0 - <20.0 kts	0.4	0.5	0.1	0.1	0.7	0.9	1.8	0.8	5.3	4951
20.0 - <25.0 kts	0.1	0.1	0.0	0.0	0.3	0.3	0.4	0.2	1.4	1298
25.0 - <30.0 kts	0.1	0.1	0.0	0.0	0.4	0.4	0.6	0.2	1.7	1622
30.0 - <35.0 kts	0.0	0.0	-	0.0	0.2	0.1	0.2	0.0	0.6	515
35.0 - <40.0 kts	0.0	-	-	-	0.0	0.0	0.0	0.0	0.1	78
40.0 - <45.0 kts	-	-	-	-	0.0	0.0	0.0	0.0	0.0	32
45.0 - <50.0 kts	-	-	-	-	0.0	0.0	0.0	-	0.0	7
50.0 - <55.0 kts	-	-	-	-	0.0	-	0.0	-	0.0	2
55.0 - + kts	-	-	-	-	-	-	-	-	0.0	0
Total	9.3	11.3	7.1	5.9	14.6	18.5	20.8	12.4	100.0	93504

MONTHLY DATA STATISTICS WES

	Mean	Std Dev		Med	Max	Min	Upper 95%	Lower 95%	Most Freq	Num Obs
		kts	kts				Lim	Lim	Dir from	
January	9.6	7.2	8.9	52.1	0.0	25.0	0.0	0.0	W	7936
February	9.0	8.6	7.9	45.1	0.0	22.9	0.0	0.0	W	7232
March	8.8	6.3	7.9	44.1	0.0	20.0	0.0	0.0	W	7936
April	8.4	6.0	7.0	49.0	0.0	18.0	0.0	0.0	W	7680
May	6.8	5.0	6.0	36.0	0.0	15.9	0.0	0.0	SW	7936
June	6.0	4.5	5.0	34.0	0.0	14.0	0.0	0.0	SW	7680
July	5.9	4.4	5.0	32.1	0.0	14.0	0.0	0.0	SW	7936
August	5.8	4.4	5.0	41.0	0.0	14.0	0.0	0.0	SW	7936
September	6.7	5.3	6.0	36.0	0.0	15.9	0.0	0.0	SW	7680
October	7.9	5.9	7.0	39.1	0.0	18.0	0.0	0.0	W	7936
November	9.4	6.8	7.9	48.0	0.0	24.1	0.0	0.0	W	7680
December	9.5	6.8	8.9	42.0	0.0	24.1	0.0	0.0	W	7936
Annual	7.8	6.0	7.0	52.1	0.0	18.0	0.0	0.0	W	93504

Reference Height: 10 m above mean sea level

[Back to GLCFS HomePage](#)

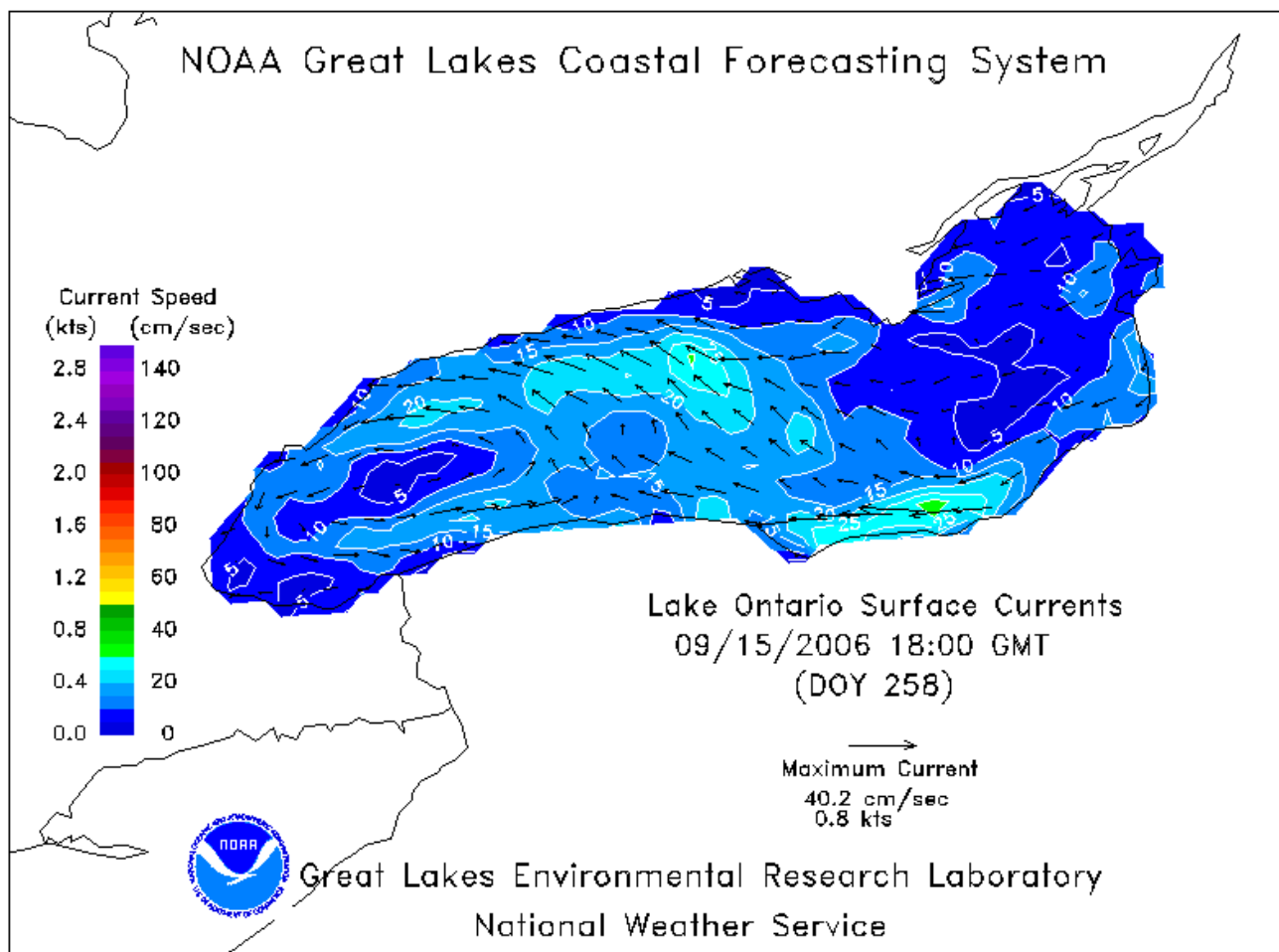
Jump To: Nowcast Products...



Jump To: Forecast Products...



Lake Ontario Surface Currents													
Animation (-24 to 00)	Java	FLC	00	-03	-06	-09	-12	-15	-18	-21	-24		
Animation (-48 to -24)	Java	FLC	-27	-30	-33	-36	-39	-42	-45	-48			



Appendix G

Environmental Data

For

Lake Michigan

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SIGNIFICANT WAVE HEIGHT STATISTICS GREAT LAKES AREA 5 - LAKE MICHIGAN



PERCENTAGE FREQUENCY OF OCCURRENCE BY DIRECTION Annual WES

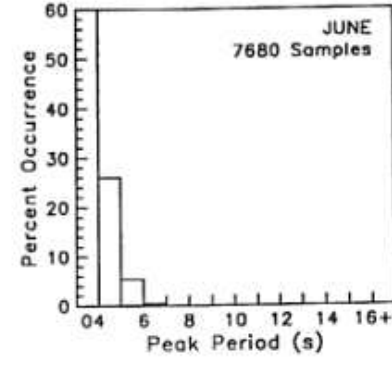
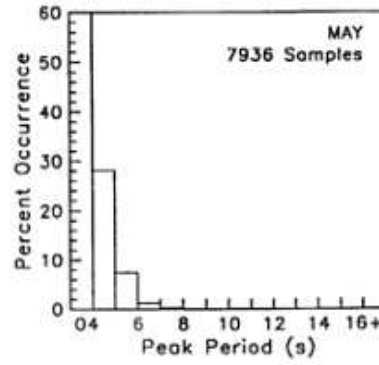
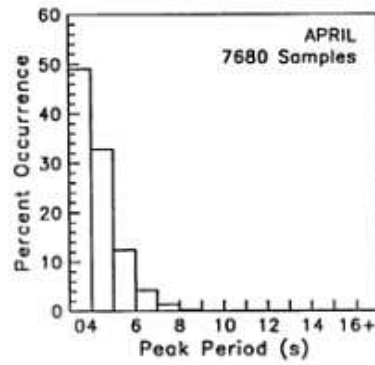
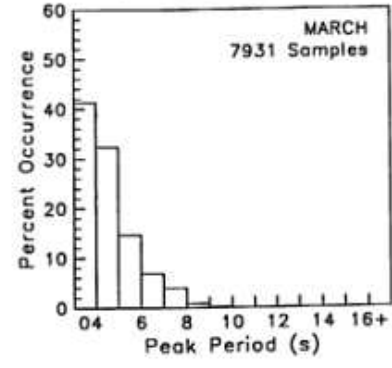
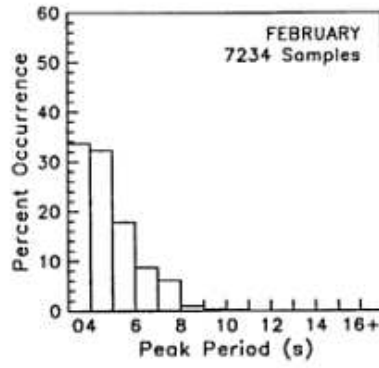
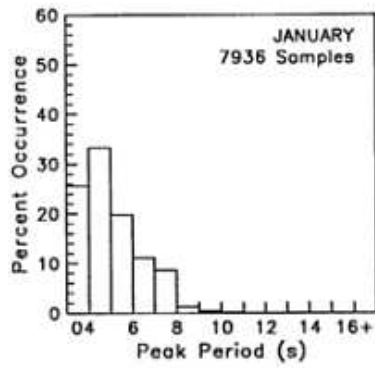
	Direction - Coming From								Num	
	N	NE	E	SE	S	SW	W	NW	Total	Obs
0.0 - < 0.5 m	5.0	2.2	3.4	2.6	3.6	5.9	5.3	7.5	35.6	33245
0.5 - < 1.0 m	5.6	1.8	2.9	3.0	4.3	6.2	4.8	7.1	35.7	33401
1.0 - < 1.5 m	1.8	0.2	0.2	0.3	2.1	3.1	2.5	3.6	13.7	12829
1.5 - < 2.0 m	0.6	0.0	0.0	0.0	1.1	2.0	1.4	2.0	7.1	6669
2.0 - < 2.5 m	0.1	0.0	-	-	0.4	1.2	0.9	1.3	3.9	3665
2.5 - < 3.0 m	0.0	-	-	-	0.1	0.7	0.4	0.7	2.0	1863
3.0 - < 3.5 m	0.0	-	-	-	0.0	0.4	0.2	0.4	1.1	1031
3.5 - < 4.0 m	0.0	-	-	-	0.0	0.2	0.1	0.2	0.5	470
4.0 - < 4.5 m	0.0	-	-	-	0.0	0.1	0.0	0.1	0.2	185
4.5 - < 5.0 m	0.0	-	-	-	-	0.0	0.0	0.0	0.1	80
5.0 - < 5.5 m	0.0	-	-	-	-	0.0	0.0	0.0	0.0	37
5.5 - < 6.0 m	-	-	-	-	-	0.0	0.0	0.0	0.0	14
6.0 - < 6.5 m	-	-	-	-	-	0.0	0.0	0.0	0.0	6
6.5 - < 7.0 m	-	-	-	-	-	-	-	0.0	0.0	3
7.0 - + m	-	-	-	-	-	0.0	-	0.0	0.0	3
Total	13.2	4.1	6.5	6.0	11.7	19.6	15.9	22.9	100.0	93501

MONTHLY DATA STATISTICS WES

	Mean m	Std Dev m	Med m	Max m	Min m	Upper	Lower	Most	Num Obs
						95% Lim m	95% Lim m	Freq Dir from	
January	1.2	0.9	0.9	7.2	0.1	3.1	0.3	NW	7936
February	1.1	0.8	0.8	6.1	0.1	2.8	0.2	NW	7234
March	0.9	0.7	0.7	11.4	0.1	2.4	0.2	NW	7931
April	0.7	0.6	0.5	4.8	0.0	1.8	0.2	NW	7680
May	0.5	0.4	0.4	3.4	0.0	1.3	0.1	SW	7936
June	0.5	0.4	0.4	3.0	0.0	1.2	0.1	SW	7680
July	0.5	0.3	0.4	2.7	0.0	1.2	0.1	SW	7936
August	0.6	0.4	0.4	3.3	0.0	1.4	0.1	SW	7936
September	0.7	0.5	0.6	5.0	0.0	1.7	0.2	NW	7680
October	0.9	0.7	0.7	4.7	0.1	2.3	0.2	NW	7936
November	1.1	0.8	0.8	5.5	0.1	2.7	0.3	NW	7680
December	1.2	0.8	0.9	6.0	0.1	2.9	0.3	NW	7936
Annual	0.8	0.7	0.6	11.4	0.0	2.3	0.2	NW	93501

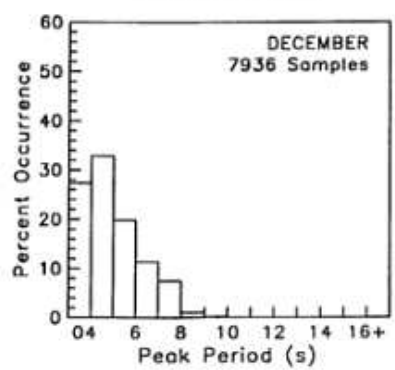
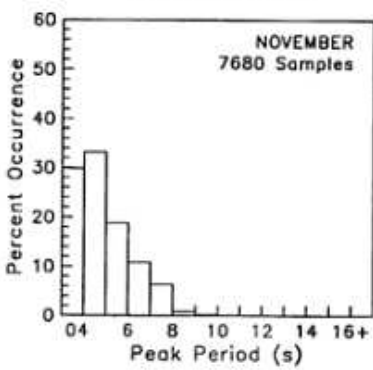
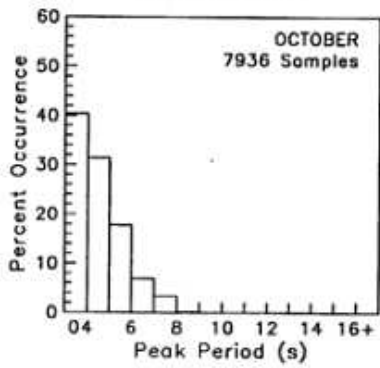
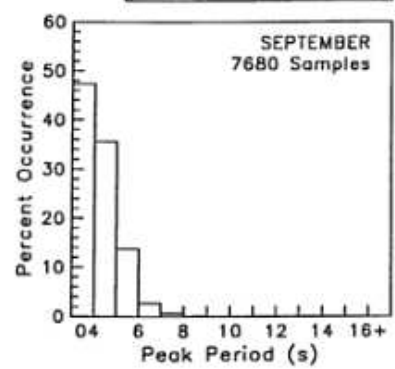
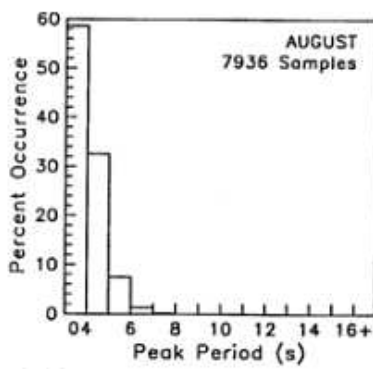
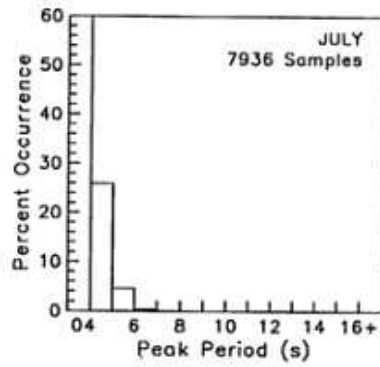
5-17

MONTHLY WAVE STATISTICS GREAT LAKES AREA 5 - LAKE MICHIGAN



5-18

MONTHLY WAVE STATISTICS GREAT LAKES AREA 5 - LAKE MICHIGAN



Wisconsin State Climatology Office**MILWAUKEE CLIMATE NORMALS: A COMPARISON***Source: Climatology of the United States No. 81***Current Normals 1971-2000**

---	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
MAX													
TEMP (F)	28.0	32.5	42.6	53.9	66.0	76.3	81.1	79.1	71.9	60.2	45.7	33.1	55.9
MIN TEMP (F)	13.4	18.3	27.3	36.4	46.2	56.3	62.9	62.1	54.1	42.6	31.0	19.4	39.2
AVG TEMP (F)	20.7	25.4	34.9	45.2	56.1	66.3	72.0	70.6	63.0	51.4	38.4	26.2	47.5
HEAT DEG DAYS	1384	1124	948	611	318	86	13	18	134	443	808	1200	7087
COOL DEG DAYS	0	0	0	5	27	114	222	180	63	5	0	0	616
PRECIP (in)	1.85	1.65	2.59	3.78	3.06	3.56	3.58	4.03	3.30	2.49	2.70	2.22	34.81

1921-1950 normals**MILWAUKEE AIRPORT**

--	JAN	FEB	MAR	APR.	MAY	JUN	JULY	AUG.	SEP	OCT	NOV	DEC	ANNUAL
MAX													
TEMP (F)	29.2	31.8	40.8	52.8	63.9	75.1	81.2	79.2	71.8	60.3	44.7	32.7	55.3
MIN													
TEMP (F)	14.5	16.6	25.7	35.8	44.7	54.7	61.4	60.5	53.3	42.4	29.9	18.7	38.2
AVG													
TEMP (F)	21.9	24.2	33.3	44.3	54.3	64.9	71.3	69.9	62.6	51.4	37.3	25.7	46.8
HEAT													
DEG													
DAYS	1336	1142	983	621	351	109	20	32	134	428	831	1218	7205
PRECIP													
(in)	1.58	1.27	2.19	2.39	2.98	3.22	2.43	2.62	3.33	1.97	2.11	1.48	27.57

CITY OFFICE

--	JAN	FEB	MAR	APR.	MAY	JUN	JULY	AUG.	SEP	OCT	NOV	DEC	ANNUAL
MAX													
TEMP (F)	30.0	32.1	40.9	52.3	63.3	74.1	80.1	78.2	71.0	59.9	45.0	33.2	55.0
MIN													
TEMP (F)	16.0	18.0	27.0	37.2	46.2	56.6	64.4	63.6	56.5	45.3	32.0	20.3	40.3
AVG													
TEMP (F)	23.0	25.1	34.0	44.8	54.8	65.4	72.3	70.9	63.8	52.6	38.5	26.8	47.7

HEAT DEG DAYS	1302	1117	961	606	335	100	11	24	112	397	795	1184	6944
PRECIP (in)	1.75	1.42	2.37	2.61	2.92	3.25	2.37	2.90	3.36	2.07	2.28	1.57	28.87
1931-1960 normals													
-- MAX	JAN.	FEB	MAR	APR.	MAY	JUN	JULY	AUG.	SEP	OCT	NOV	DEC	ANNUAL
TEMP (F)	28.3	30.2	38.8	53.1	63.9	73.9	78.9	77.7	70.7	60.1	44.1	32.0	54.3
MIN													
TEMP (F)	12.8	14.6	23.2	34.1	42.9	52.6	58.4	57.8	49.9	39.9	27.5	17.1	35.9
AVG													
TEMP (F)	20.6	22.4	31.0	43.6	53.4	63.3	68.7	67.8	60.3	50.0	35.8	24.6	45.1
HEAT DEG DAYS	1376	1193	1054	642	372	135	43	47	174	471	876	1252	7635
PRECIP (in)	1.83	1.40	2.31	2.53	3.16	3.64	2.95	3.06	2.72	2.10	2.18	1.63	29.51
1941-1970 normals													
-- MAX	JAN	FEB	MAR	APR.	MAY	JUN	JULY	AUG.	SEP	OCT	NOV	DEC	ANNUAL
TEMP (F)	27.3	30.3	39.4	54.6	65.0	75.3	80.4	79.7	71.5	61.4	44.4	31.5	55.1
MIN													
TEMP (F)	11.4	14.6	23.4	34.7	43.3	53.6	59.3	58.7	50.7	40.6	28.5	16.8	36.3
AVG													
TEMP (F)	19.4	22.9	31.4	44.7	54.2	64.5	69.9	69.2	61.1	51.0	36.5	24.2	45.7
HEAT DEG DAYS	1414	1190	1042	609	348	90	15	36	140	440	855	1265	7444
COOL DEG DAYS	0	0	0	0	13	75	167	166	23	6	0	0	450
PRECIP (in)	1.63	1.13	2.24	2.76	2.88	3.58	3.41	2.68	3.02	1.98	2.01	1.75	29.07
1951-1980 normals													
-- MAX	JAN	FEB	MAR	APR.	MAY	JUN	JULY	AUG.	SEP	OCT	NOV	DEC	ANNUAL
TEMP (F)	26.0	30.1	39.2	53.5	64.8	75.0	79.8	78.4	71.2	59.9	44.7	32.0	54.6
MIN													
TEMP (F)	11.3	15.8	24.9	35.6	44.7	54.7	61.1	60.2	52.5	41.9	29.9	18.2	37.6
AVG													
TEMP (F)	18.7	23.0	32.1	44.6	54.8	64.9	70.5	69.3	61.9	50.9	37.3	25.1	46.1

HEAT DEG DAYS	1435	1176	1020	612	334	84	11	25	117	444	831	1237	7326
COOL DEG DAYS	0	0	0	0	18	81	182	158	24	7	0	0	470
PRECIP (in)	1.64	1.33	2.58	3.37	2.66	3.59	3.54	3.09	2.88	2.25	1.98	2.03	30.94
1961-1990 normals													
-- JAN.	JAN.	FEB	MAR	APR.	MAY	JUN	JULY	AUG.	SEP	OCT	NOV	DEC	ANNUAL
MAX TEMP (F)	26.1	30.1	40.4	52.9	64.3	74.9	79.9	77.8	70.6	58.7	44.7	31.2	54.3
MIN TEMP (F)	11.6	15.9	26.2	35.8	44.8	55.0	62.0	60.8	52.8	41.8	30.7	17.5	37.9
AVG TEMP (F)	18.9	23.0	33.3	44.4	54.6	65.0	70.9	69.3	61.7	50.3	37.7	24.4	46.1
HEAT DEG DAYS	1429	1176	983	618	338	82	14	27	123	456	819	1259	7324
COOL DEG DAYS	0	0	0	0	16	82	197	160	24	0	0	0	479
PRECIP (in)	1.60	1.45	2.67	3.50	2.84	3.24	3.47	3.53	3.38	2.41	2.51	2.33	32.93

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Latest revision: 30 March 2006

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URL Address: <http://www.aos.wisc.edu/~sco/stations/mke/mke-normals.html>

Mean water surface temperature

	Year	Day	Sup.	Mich.	Huron	Erie	Ont.
Jan		Avg	2.6	3.1	3.1	2.4	3.3
Feb		Avg	1.4	1.7	1.3	1.7	1.9
Mar		Avg	0.9	1.6	0.9	1.4	1.7
Apr		Avg	1.1	2.5	1.7	3.7	2.6
May		Avg	2.3	5.5	4.6	9.8	6.1
Jun		Avg	5.3	12.3	11.2	17.5	13.8
Jul		Avg	10.9	18.7	17.2	22.2	19.5
Aug		Avg	15.4	20.9	19.7	23.4	21.8
Sep		Avg	14.3	18.8	17.8	21.1	19.3
Oct		Avg	9.5	13.2	12.4	15.8	13.4
Nov		Avg	6.5	8.9	8.4	10.7	8.6
Dec		Avg	4.5	5.6	5.7	5.5	5.5

5-8

ANNUAL WIND SPEED STATISTICS GREAT LAKES AREA 5 - LAKE MICHIGAN



PERCENTAGE FREQUENCY OF OCCURRENCE BY DIRECTION Annual WES

	Direction - Coming From								Total	Num Obs
	N	NE	E	SE	S	SW	W	NW		
0.0 - < 5.0 kts	1.6	1.2	1.2	1.9	0.8	0.8	0.7	0.6	8.9	8269
5.0 - < 10.0 kts	6.9	3.9	4.1	4.8	3.3	4.0	4.1	3.7	34.8	32541
10.0 - < 15.0 kts	5.5	1.9	3.4	3.2	3.5	5.0	4.4	4.7	31.6	29535
15.0 - < 20.0 kts	2.0	0.4	1.0	0.8	1.9	2.7	2.1	2.3	13.2	12355
20.0 - < 25.0 kts	1.0	0.1	0.5	0.2	1.0	1.8	1.8	1.8	8.0	7511
25.0 - < 30.0 kts	0.2	0.0	0.1	0.0	0.4	0.7	0.5	0.6	2.5	2358
30.0 - < 35.0 kts	0.1	0.0	0.0	0.0	0.1	0.2	0.1	0.2	0.8	724
35.0 - < 40.0 kts	0.0	-	-	-	0.0	0.0	0.0	0.0	0.1	102
40.0 - < 45.0 kts	0.0	-	-	-	0.0	0.0	0.0	0.0	0.1	68
45.0 - < 50.0 kts	0.0	-	-	-	-	0.0	-	0.0	0.0	14
50.0 - < 55.0 kts	-	-	-	-	-	0.0	-	-	0.0	3
55.0 - + kts	-	-	-	-	-	-	-	-	0.0	0
Total	17.3	7.4	10.3	11.1	11.0	15.2	13.7	13.9	100.0	93501

MONTHLY DATA STATISTICS WES

	Mean	Std Dev	Med	Max	Min	Upper 95% Lim	Lower 95% Lim	Most Freq Dir	Num Obs
	kts	kts	kts	kts	kts	kts	kts		
January	15.1	7.0	14.0	54.0	1.0	27.9	6.0	W	7936
February	14.1	6.6	13.0	49.0	1.9	26.0	5.0	N	7234
March	12.9	6.3	12.0	46.1	1.0	24.1	4.0	N	7931
April	11.2	5.4	11.0	41.0	0.0	20.9	4.0	N	7680
May	9.3	4.4	8.9	31.1	1.0	17.1	2.9	SW	7936
June	8.4	4.1	7.9	27.0	0.0	15.9	2.9	SW	7680
July	8.2	3.9	7.9	31.1	1.0	15.9	2.9	SW	7936
August	9.2	4.5	7.9	32.1	0.0	18.0	2.9	SW	7936
September	10.8	5.1	10.1	40.0	0.0	20.0	4.0	N	7680
October	12.1	6.1	11.0	39.1	1.0	22.9	4.0	N	7936
November	14.3	6.6	14.0	47.0	1.9	26.0	5.0	N	7680
December	14.9	6.6	14.0	44.1	1.9	27.0	6.0	N	7936
Annual	11.7	6.2	10.1	54.0	0.0	22.9	4.0	N	93501

Reference Height: 10 m above mean sea level

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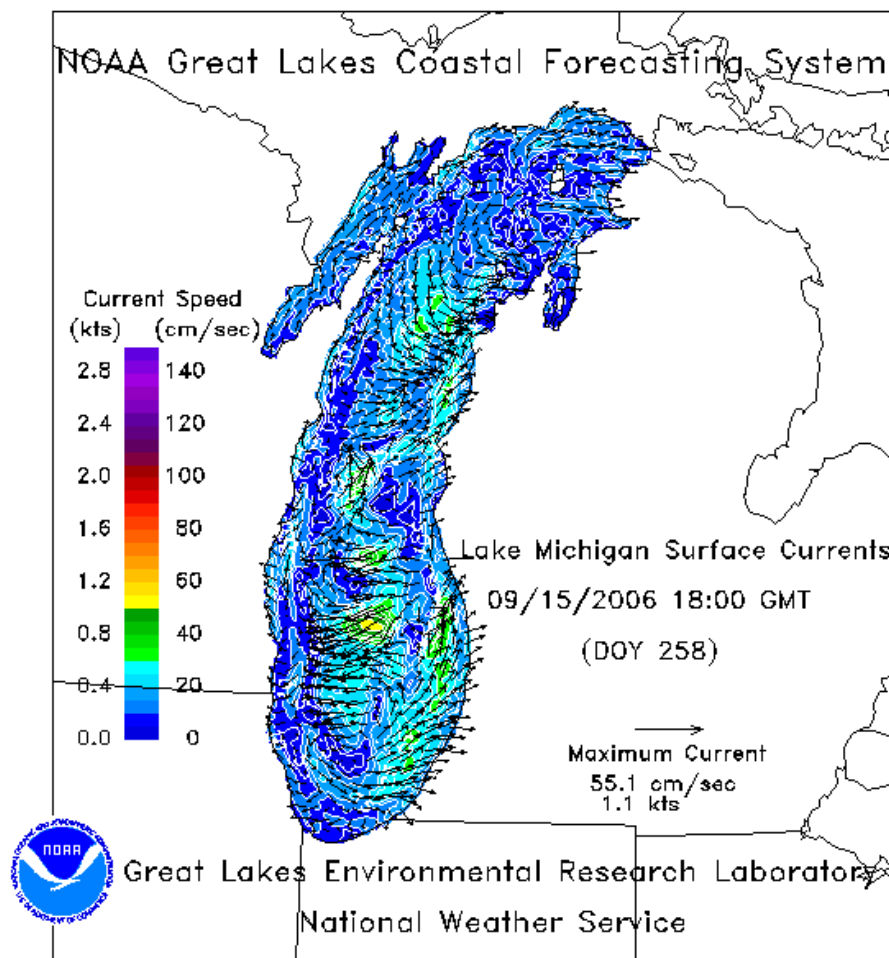
Jump To: Nowcast Products...



Jump To: Forecast Products...



Lake Michigan Surface Currents													
Animation (-24 to 00)	Java	FLC	00	-03	-06	-09	-12	-15	-18	-21	-24		
Animation (-48 to -24)	Java	FLC	-27	-30	-33	-36	-39	-42	-45	-48			



Appendix H

Environmental Data

For

British Columbia

2-19

SIGNIFICANT WAVE HEIGHT STATISTICS WEST COAST AREA 2 - QUEEN CHARLOTTE SOUND



PERCENTAGE FREQUENCY OF OCCURRENCE BY DIRECTION Annual ODGP

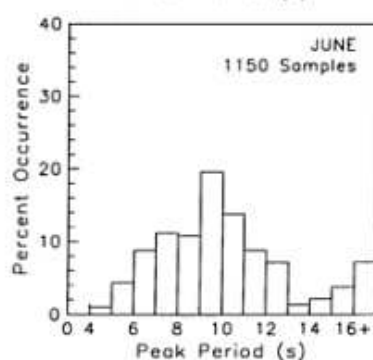
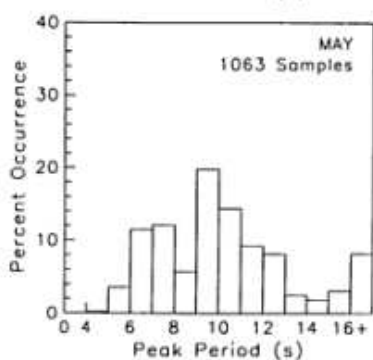
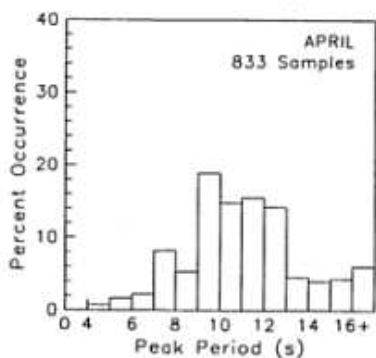
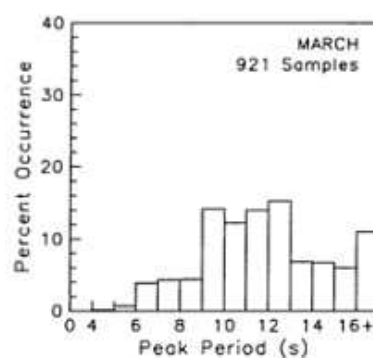
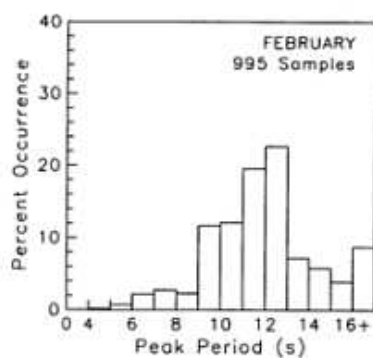
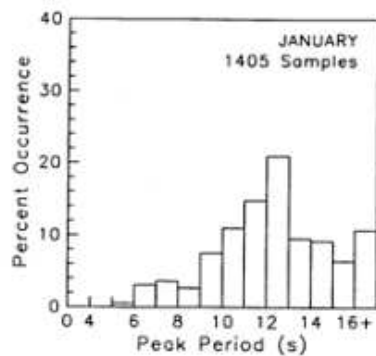
	Direction - Coming From								Total	Num Obs
	N	NE	E	SE	S	SW	W	NW		
0.0 m									0.4	37
>0.0 - < 0.5 m	0.2	0.2	0.4	0.4	0.2	0.8	1.5	0.5	4.3	375
0.5 - < 1.0 m	0.1	0.1	0.6	0.6	0.8	1.7	5.6	1.3	10.8	950
1.0 - < 1.5 m	0.0	0.1	0.3	0.7	1.0	2.8	8.8	2.4	16.0	1403
1.5 - < 2.0 m	0.1	0.0	0.2	0.7	1.5	2.9	5.9	1.8	13.1	1150
2.0 - < 2.5 m	0.0	0.0	0.2	0.4	1.8	3.2	3.6	1.0	10.3	905
2.5 - < 3.0 m	-	0.0	0.2	0.4	1.5	3.4	3.0	0.3	8.8	774
3.0 - < 3.5 m	-	0.0	0.1	0.4	1.0	3.3	2.2	0.2	7.2	631
3.5 - < 4.0 m	0.0	0.0	0.1	0.4	1.5	3.0	1.8	0.1	6.9	604
4.0 - < 4.5 m	0.0	0.0	0.0	0.3	1.4	2.7	1.5	0.0	6.0	522
4.5 - < 5.0 m	-	0.0	0.0	0.3	1.0	2.5	0.9	-	4.7	414
5.0 - < 5.5 m	-	0.0	0.0	0.1	0.9	1.4	0.5	-	2.9	251
5.5 - < 6.0 m	-	0.0	0.1	0.1	0.8	0.8	0.4	-	2.2	193
6.0 - < 6.5 m	-	-	0.0	0.1	0.6	0.9	0.1	-	1.7	145
6.5 - < 7.0 m	-	-	-	0.1	0.5	0.8	0.1	-	1.6	142
7.0 - + m	-	-	-	0.2	1.3	1.2	0.3	-	3.0	264
Total	0.5	0.6	2.1	5.2	15.7	31.5	36.3	7.7	100.0	8764

MONTHLY DATA STATISTICS Waverider/ODGP

	Mean	Std Dev	Med	Max	Min	Upper	Lower	Most Freq	Num Obs
						95% Lim	95% Lim		
January	3.6	1.7	3.7	11.2	0.9	6.6	1.5	SW	1405
February	3.5	1.7	3.1	10.5	0.6	6.8	1.3	W	995
March	2.9	1.1	2.7	9.8	1.0	4.9	1.6	S	921
April	2.8	1.3	2.5	7.8	0.8	5.6	1.2	SW	833
May	2.2	0.9	2.1	6.4	0.5	3.8	1.0	W	1063
June	1.9	0.8	1.8	5.5	0.6	3.3	0.9	SW	1150
July	1.5	0.5	1.4	4.2	0.5	2.5	0.8	W	1234
August	1.6	0.6	1.5	4.7	0.5	2.8	0.8	W	1224
September	2.0	1.0	1.8	6.7	0.6	4.1	0.9	W	1263
October	2.9	1.4	2.7	11.0	0.6	5.2	1.3	W	1545
November	3.9	1.6	3.7	12.8	0.2	6.7	1.7	SW	1482
December	4.0	1.7	3.7	11.3	0.9	7.3	1.7	SW	1509
Annual	2.8	1.6	2.4	12.8	0.2	5.9	1.0	W	14624

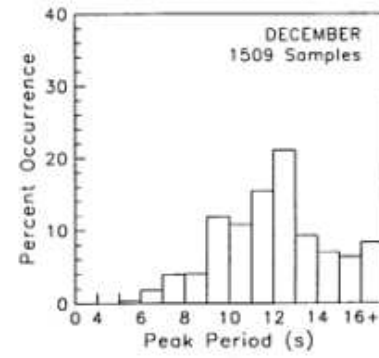
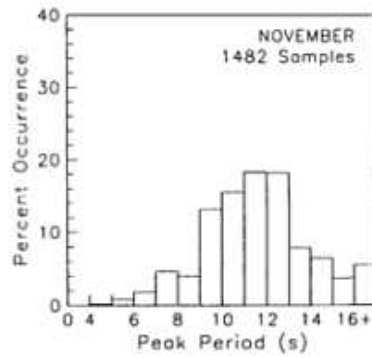
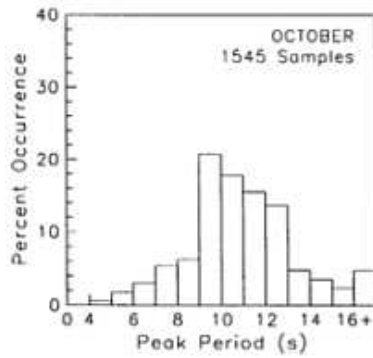
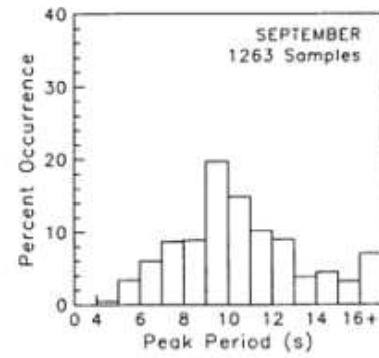
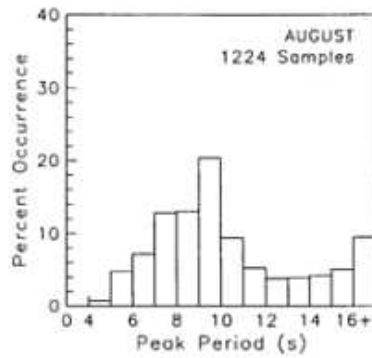
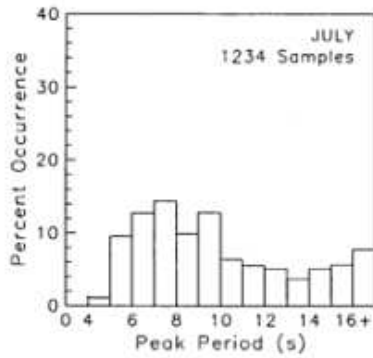
2-17

MONTHLY WAVE STATISTICS WEST COAST AREA 2 - QUEEN CHARLOTTE SOUND



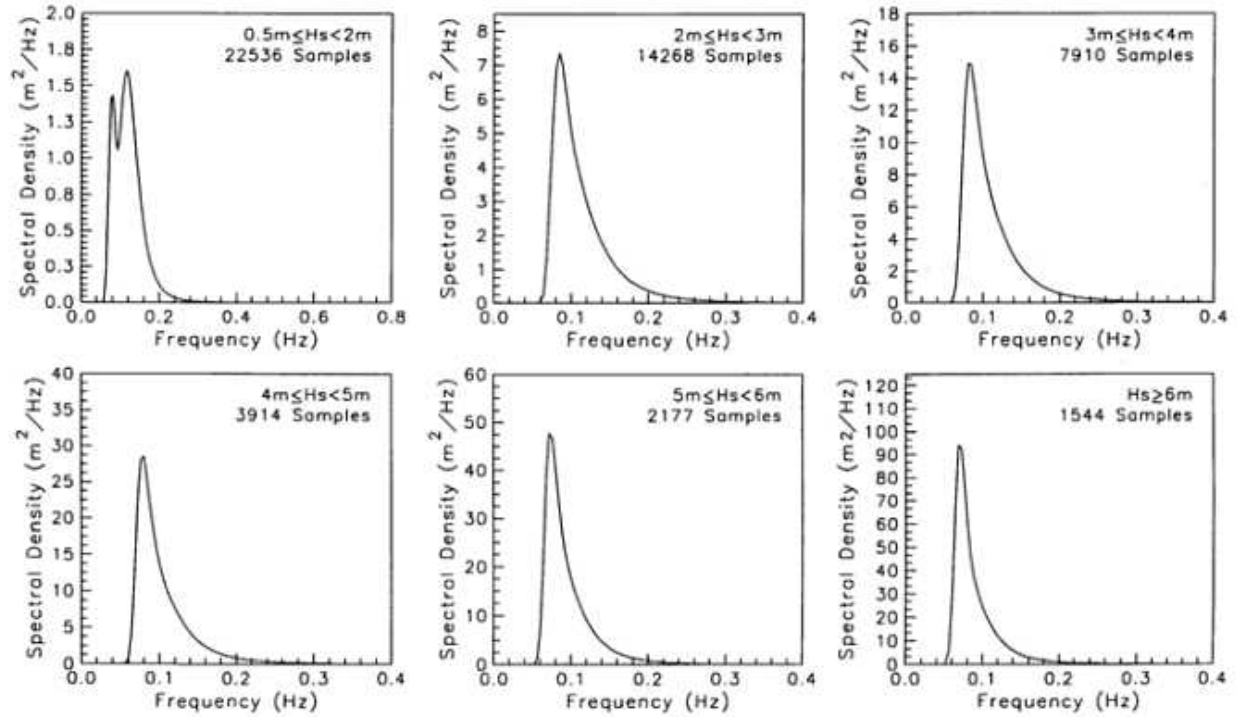
2-18

MONTHLY WAVE STATISTICS WEST COAST AREA 2 - QUEEN CHARLOTTE SOUND



2-21

MOST PROBABLE SPECTRA WEST COAST AREA 2 - QUEEN CHARLOTTE SOUND BUOY



Environment
CanadaEnvironnement
Canada

Canadian Climate Normals 1971-2000

The minimum number of years used to calculate these Normals is indicated by a [code](#) for each element. A "+" beside an extreme date indicates that this date is the first occurrence of the extreme value. Values and dates in bold indicate all-time extremes for the location.

NOTE!! Data used in the calculation of these Normals may be subject to further quality assurance checks. This may result in minor changes to some values presented here.

VICTORIA MARINE BRITISH COLUMBIA

Latitude: 48° 22' NLongitude: 123° 45' WElevation: 31.70 mClimate ID: 1018642WMO ID:TC ID:

<u>Temperature:</u>	<u>Jan</u>	<u>Feb</u>	<u>Mar</u>	<u>Apr</u>	<u>May</u>	<u>Jun</u>	<u>Jul</u>	<u>Aug</u>	<u>Sep</u>	<u>Oct</u>	<u>Nov</u>	<u>Dec</u>	<u>Year</u>	<u>Code</u>
Daily Average (°C)	4.4	5.5	6.6	8.2	10.5	12.4	14	14.3	13	9.6	6.5	4.6	9.1	C
Standard Deviation	1.6	1.5	1.2	0.9	0.7	0.7	0.7	0.7	0.8	0.7	1.5	1.6	0.6	C
Daily Maximum (°C)	7	8.4	10.1	12	14.1	16.1	18.1	18.5	17.2	13.1	9.2	7	12.6	C
Daily Minimum (°C)	1.8	2.5	3.1	4.4	6.8	8.7	9.8	10.1	8.8	6.1	3.8	2.1	5.7	C
Extreme Maximum (°C)	15.1	16.5	16	23.6	28.2	28.3	29.4	29.6	27.2	21.5	21.8	15.9		
Date (yyyy/dd)	1981/20	1992/25	1983/17+	1989/29	1983/28	1970/01	1972/03	1981/08	1974/20	1987/09	1989/03	1980/26		
Extreme Minimum (°C)	-10.6	-12.5	-6.2	-2.2	0	3.3	5	4.4	1.7	-2.8	-10.8	-13.9		
Date (yyyy/dd)	1969/23	1989/02	1989/03	1968/12	1975/24	1976/03+	1971/02	1973/18	1972/27	1971/28	1985/22	1968/29		
<u>Precipitation:</u>														
Rainfall (mm)	188.5	145.8	100.1	73.8	47	30.6	23.2	33.2	41.8	109.9	224.7	190.3	1208.8	C
Snowfall (cm)	9.6	4	2	0.4	0.1	0	0	0	0	0.2	3.6	7.1	27	C
Precipitation (mm)	198	149.8	102.1	74.2	47	30.6	23.2	33.2	41.8	110.1	228.4	197.4	1235.7	C
Average Snow Depth (cm)	1	0	0	0	0	0	0	0	0	0	0	0	0	C
Median Snow Depth (cm)	0	0	0	0	0	0	0	0	0	0	0	0	0	C
Snow Depth at Month-end (cm)	0	0	0	0	0	0	0	0	0	0	1	1		C
Extreme Daily Rainfall (mm)	94.9	119.9	106.7	57.4	27.1	25.9	42.7	61.9	39.4	44.7	92	100.8		
Date (yyyy/dd)	1982/23	1986/23	1972/05	1991/03	1990/31	1968/01	1972/12	1991/30	1967/10	1967/27	1990/09	1975/02		
Extreme Daily Snowfall (cm)	21.6	14.1	7.9	2.8	2	0	0	0	0	3.4	23.1	28		
Date (yyyy/dd)	1972/10	1989/17	1974/06	1972/06	1989/26	1967/01+	1967/01+	1967/01+	1967/01+	1991/28	1985/26	1984/29		
Extreme Daily Precipitation (mm)	94.9	119.9	106.7	57.4	27.1	25.9	42.7	61.9	39.4	44.7	92	100.8		
Date (yyyy/dd)	1982/23	1986/23	1972/05	1991/03	1990/31	1968/01	1972/12	1991/30	1967/10	1967/27	1990/09	1975/02		
Extreme Snow Depth (cm)	20	10	8	0	0	0	0	0	0	1	39	26		
Date (yyyy/dd)	1982/05	1986/15+	1971/04	1970/01+	1970/01+	1970/01+	1970/01+	1970/01+	1970/01+	1991/29	1985/27	1984/30		
<u>Days with Maximum Temperature:</u>														
<= 0 °C	0.86	0.18	0	0	0	0	0	0	0	0	0.4	1.2	2.7	C
> 0 °C	30.1	28.1	31	30	31	30	31	31	30	31	29.6	29.8	362.6	C
> 10 °C	3.8	7.6	15	22.3	30.2	30	31	31	30	28.1	10.7	3.6	243.2	C
> 20 °C	0	0	0	0.33	1.2	2.2	5.7	7	4.3	0.25	0.05	0	20.9	C
> 30 °C	0	0	0	0	0	0	0	0	0	0	0	0	0	C
> 35 °C	0	0	0	0	0	0	0	0	0	0	0	0	0	C
<u>Days with Minimum Temperature:</u>														
> 0 °C	21.8	22.7	26.7	29.3	31	30	31	31	30	30.6	26.3	22.4	332.7	C
<= 2 °C	16.1	12.2	11	5.2	0.33	0	0	0	0.05	1.6	8.5	15	69.8	C
<= 0 °C	9.2	5.6	4.3	0.71	0.05	0	0	0	0	0.4	3.7	8.6	32.6	C
< -2 °C	3.6	2	0.57	0	0	0	0	0	0	0.1	1.2	2.6	10	C
< -10 °C	0	0.14	0	0	0	0	0	0	0	0	0.05	0.19	0.38	C
< -20 °C	0	0	0	0	0	0	0	0	0	0	0	0	0	C
< -30 °C	0	0	0	0	0	0	0	0	0	0	0	0	0	C
<u>Days with Rainfall:</u>														
>= 0.2 mm	18.3	16.9	16.9	14.3	12.1	9.5	5.5	6.1	8.8	14.4	20.4	19.2	162.3	C
>= 5 mm	10.1	8.5	6.4	5.4	3.4	2.1	1.5	2	2.8	6.7	12.1	10	70.9	C
>= 10 mm	6.6	4.7	3.4	2.1	1.1	0.71	0.52	1.1	1.4	4	7.9	6.3	39.6	C
>= 25 mm	1.7	1.1	0.37	0.14	0.07	0	0.1	0.07	0.15	0.0	2.2	1.0	0.4	C

Average.txt

Annual cycle of sea surface temperature and salinity at Active Pass
Averages computed with a time base of 1956 through 1991
Latitude, Longitude = 48° 31'N, 123° 10'W

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
T average	6.9	7.0	7.8	9.2	11.2	13.5	15.5	15.8	13.9	11.1	8.9	7.5
T Std Dev	0.84	0.76	0.74	0.76	0.71	0.85	0.94	1.29	1.07	0.71	0.73	0.71
S average	27.9	28.0	28.0	27.7	26.2	23.8	22.7	23.8	25.4	27.3	27.6	27.9
S Std Dev	1.22	0.84	0.72	0.76	1.34	1.89	2.38	1.88	1.66	1.12	1.10	0.92

2-8

ANNUAL WIND SPEED STATISTICS WEST COAST AREA 2 - QUEEN CHARLOTTE SOUND



PERCENTAGE FREQUENCY OF OCCURRENCE BY DIRECTION Annual Wind Speed Statistics West Coast Area 2

	Direction - Coming From								Total	Num Obs
	N	NE	E	SE	S	SW	W	NW		
0.0 kts									0.0	2
30.0 - < 5.0 kts	0.6	0.4	0.6	0.6	0.7	0.8	0.7	0.8	5.3	770
5.0 - <10.0 kts	2.1	1.2	1.3	2.0	2.3	2.2	2.9	4.7	18.7	2740
10.0 - <15.0 kts	2.4	0.8	1.6	3.0	3.5	2.4	3.6	6.4	23.6	3464
15.0 - <20.0 kts	2.0	0.5	1.5	3.8	3.6	2.2	2.5	6.2	22.3	3266
20.0 - <25.0 kts	1.1	0.3	1.1	3.2	2.8	1.3	1.4	2.7	13.9	2040
25.0 - <30.0 kts	0.6	0.2	0.8	2.6	1.7	0.7	0.9	0.6	8.2	1202
30.0 - <35.0 kts	0.2	0.2	0.6	1.7	0.9	0.3	0.2	0.2	4.4	639
35.0 - <40.0 kts	0.1	0.1	0.5	1.4	0.3	0.1	0.0	0.0	2.8	377
40.0 - <45.0 kts	0.0	-	0.2	0.4	0.1	0.0	0.0	0.0	0.8	123
45.0 - <50.0 kts	-	-	0.0	0.1	0.0	-	0.0	-	0.2	33
50.0 - <55.0 kts	-	-	0.0	0.0	-	-	-	-	0.0	4
55.0 - + kts	-	-	-	-	-	-	-	-	0.0	0
Total	9.2	3.7	8.4	18.9	15.9	9.8	12.5	21.6	100.0	14660

MONTHLY DATA STATISTICS Wind Speed Statistics West Coast Area 2

	Mean	Std Dev	Med	Max	Min	Upper	Lower	Most	Num
						95% Lim	95% Lim		
	kts	kts	kts	kts	kts	kts	kts	Dir from	Obs
January	21.2	8.3	20.5	46.4	1.8	35.6	9.0	SE	1482
February	19.4	8.8	18.6	47.7	1.3	36.0	7.3	SE	1211
March	16.4	7.7	15.8	47.5	0.5	29.9	4.8	SE	1237
April	15.7	7.4	14.8	45.3	0.2	28.5	5.3	SE	1162
May	14.2	6.7	14.0	33.4	0.4	26.0	3.7	NW	1221
June	11.9	5.9	11.3	34.5	0.0	22.3	2.7	NW	1200
July	12.2	5.9	11.8	27.4	0.3	22.0	3.1	NW	1159
August	12.7	6.0	11.5	40.5	0.0	23.9	4.4	NW	1185
September	13.2	6.8	12.3	39.0	0.7	25.3	4.3	NW	1151
October	17.8	8.9	16.5	50.5	0.9	35.0	5.3	SE	1240
November	22.0	9.4	21.0	52.9	3.4	38.9	8.6	SE	1190
December	21.4	9.2	20.7	49.9	0.4	38.1	7.4	SE	1240
Annual	16.6	8.5	15.5	52.9	0.0	33.1	4.9	NW	14678

Winds: 20 m above mean sea level

Surface Current							
YYYY	MM	DD	hh	mm	DEP01	DIR01	speed (cm/s)
2006	8	29	14	0	1	121	22.1
2006	8	29	13	30	1	127	29.7
2006	8	29	13	0	1	141	39.7
2006	8	29	12	30	1	160	64.8
2006	8	29	12	0	1	170	85.6
2006	8	29	11	30	1	167	106.7
2006	8	29	11	0	1	169	113.2
2006	8	29	10	30	1	183	100.1
2006	8	29	10	0	1	181	90.1
2006	8	29	9	30	1	204	60.5
2006	8	29	9	0	1	210	73.8
2006	8	29	8	30	1	211	87.8
2006	8	29	8	0	1	215	97.6
2006	8	29	7	30	1	197	105.6
2006	8	29	7	0	1	189	120.2
2006	8	29	6	30	1	196	84
2006	8	29	6	0	1	192	73.1
2006	8	29	5	30	1	185	70
2006	8	29	5	0	1	135	39.8
2006	8	29	4	30	1	119	46.4
2006	8	29	4	0	1	111	53
2006	8	29	3	30	1	106	54.5
2006	8	29	3	0	1	105	58.1
2006	8	29	2	30	1	101	46.5
2006	8	29	2	0	1	95	32.9
2006	8	29	1	30	1	95	36.4
2006	8	29	1	0	1	98	42
2006	8	29	0	30	1	96	43.9
2006	8	29	0	0	1	106	43.9
2006	8	28	23	30	1	106	44.3
2006	8	28	23	0	1	99	39.3
2006	8	28	22	30	1	99	24.1
2006	8	28	22	0	1	83	8
2006	8	28	21	30	1	280	1.9
2006	8	28	21	0	1	308	10.1
2006	8	28	20	30	1	246	20.5
2006	8	28	20	0	1	279	16.1
2006	8	28	19	30	1	249	23
2006	8	28	19	0	1	257	40.1
2006	8	28	18	30	1	270	35.9
2006	8	28	18	0	1	279	37.1
2006	8	28	17	30	1	286	38.1
2006	8	28	17	0	1	310	37.8
2006	8	28	16	30	1	314	33.8
2006	8	28	16	0	1	315	24.2
2006	8	28	15	30	1	339	20.9
2006	8	28	15	0	1	313	14.8
2006	8	28	14	30	1	332	21.3
2006	8	28	14	0	1	330	6
2006	8	28	13	30	1	325	11.3

2006	8	28	13	0	1	52	6.3
2006	8	28	12	30	1	186	49.9
2006	8	28	12	0	1	179	66.3
2006	8	28	11	30	1	106	14.6
2006	8	28	11	0	1	352	4.6
2006	8	28	10	30	1	261	12
2006	8	28	10	0	1	243	29.4
2006	8	28	9	30	1	227	44.3
2006	8	28	9	0	1	231	50.4
2006	8	28	8	30	1	240	58.9
2006	8	28	8	0	1	246	66.3
2006	8	28	7	30	1	199	70.4
2006	8	28	7	0	1	200	57
2006	8	28	6	30	1	213	30.9
2006	8	28	6	0	1	329	13.3
2006	8	28	5	30	1	232	29.1
2006	8	28	5	0	1	241	32.4
2006	8	28	4	30	1	315	17.4
2006	8	28	4	0	1	181	3.3
2006	8	28	3	30	1	95	8.4
2006	8	28	3	0	1	83	23.9
2006	8	28	2	30	1	99	30.3
2006	8	28	2	0	1	91	16.8
2006	8	28	1	30	1	95	20.3
2006	8	28	1	0	1	107	18.1
2006	8	28	0	30	1	80	25.2
2006	8	28	0	0	1	116	17.3
2006	8	27	23	30	1	14	17.6
2006	8	27	23	0	1	77	7.1
2006	8	27	22	30	1	78	5.6
2006	8	27	22	0	1	167	0.6
2006	8	27	21	30	1	317	11.4
2006	8	27	21	0	1	266	21
2006	8	27	20	30	1	251	46.2
2006	8	27	20	0	1	252	56
2006	8	27	19	30	1	232	75.7
2006	8	27	19	0	1	227	73.7
2006	8	27	18	30	1	229	52.2
2006	8	27	18	0	1	234	50.6
2006	8	27	17	30	1	236	47.7
2006	8	27	17	0	1	244	42.3
2006	8	27	16	30	1	239	32.1
2006	8	27	16	0	1	237	16.1
2006	8	27	15	30	1	217	14.3
2006	8	27	15	0	1	87	3.7
2006	8	27	14	30	1	101	12.3
2006	8	27	14	0	1	74	5.7
2006	8	27	13	30	1	94	21
2006	8	27	13	0	1	91	15.6
2006	8	27	12	30	1	335	15.9
2006	8	27	12	0	1	333	7.4
2006	8	27	11	30	1	315	16.4

2006	8	27	11	0	1	298	11.4
2006	8	27	10	30	1	259	18.5
2006	8	27	10	0	1	261	21.1
2006	8	27	9	30	1	237	28.8
2006	8	27	9	0	1	227	40.8
2006	8	27	8	30	1	323	8.2
2006	8	27	8	0	1	224	70
2006	8	27	7	30	1	187	79.5
2006	8	27	7	0	1	202	59.6
2006	8	27	6	30	1	199	45.1
2006	8	27	6	0	1	207	30.4
2006	8	27	5	30	1	241	33.4
2006	8	27	5	0	1	287	42.2
2006	8	27	4	30	1	284	24.5
2006	8	27	4	0	1	250	19.3
2006	8	27	3	30	1	123	1.8
2006	8	27	3	0	1	96	7.9
2006	8	27	2	30	1	96	21.4
2006	8	27	2	0	1	82	14.8
2006	8	27	1	30	1	80	15.7
2006	8	27	1	0	1	66	16.8
2006	8	27	0	30	1	31	18.1
2006	8	27	0	0	1	78	5.6
2006	8	26	23	30	1	139	14.2
2006	8	26	23	0	1	164	35.6
2006	8	26	22	30	1	131	33.4
2006	8	26	22	0	1	266	10.4
2006	8	26	21	30	1	254	15.7
2006	8	26	21	0	1	226	20.3
2006	8	26	20	30	1	215	40.5
2006	8	26	20	0	1	217	56.5
2006	8	26	19	30	1	218	66.3
2006	8	26	19	0	1	233	51.6
2006	8	26	18	30	1	237	64
2006	8	26	18	0	1	232	63.5
2006	8	26	17	30	1	226	55.5
2006	8	26	17	0	1	227	46.2
2006	8	26	16	30	1	236	42.9
2006	8	26	16	0	1	239	41.4
2006	8	26	15	30	1	239	26.4
2006	8	26	15	0	1	224	11.7
2006	8	26	14	30	1	97	3.7
2006	8	26	14	0	1	101	8.6
2006	8	26	13	30	1	93	11.8
2006	8	26	13	0	1	90	16.7
2006	8	26	12	30	1	26	32.5
2006	8	26	12	0	1	17	28.2
2006	8	26	11	30	1	340	27
2006	8	26	11	0	1	356	25.8
2006	8	26	10	30	1	326	20.9
2006	8	26	10	0	1	297	3.4
2006	8	26	9	30	1	301	7.8

2006	8	26	9	0	1	235	10
2006	8	26	8	30	1	228	32
2006	8	26	8	0	1	213	43.4
2006	8	26	7	30	1	204	60.6
2006	8	26	7	0	1	192	57.7
2006	8	26	6	30	1	203	38.2
2006	8	26	6	0	1	217	30
2006	8	26	5	30	1	226	22.2
2006	8	26	5	0	1	237	29.9
2006	8	26	4	30	1	321	21
2006	8	26	4	0	1	241	16.9
2006	8	26	3	30	1	229	4.4
2006	8	26	3	0	1	329	7.5
2006	8	26	2	30	1	318	12.6
2006	8	26	2	0	1	348	4.6
2006	8	26	1	30	1	350	13.2
2006	8	26	1	0	1	349	19.7
2006	8	26	0	30	1	339	27.9
2006	8	26	0	0	1	351	6.8
2006	8	25	23	30	1	125	12.6
2006	8	25	23	0	1	165	14.8
2006	8	25	22	30	1	173	39.7
2006	8	25	22	0	1	181	55.9
2006	8	25	21	30	1	195	46.4
2006	8	25	21	0	1	187	61.5
2006	8	25	20	30	1	304	6.1
2006	8	25	20	0	1	250	18
2006	8	25	19	30	1	254	37.6
2006	8	25	19	0	1	232	52.3
2006	8	25	18	30	1	225	67.1
2006	8	25	18	0	1	231	70.7
2006	8	25	17	30	1	235	77.5
2006	8	25	17	0	1	226	54.2
2006	8	25	16	30	1	226	35.1
2006	8	25	16	0	1	238	47.9
2006	8	25	15	30	1	230	51
2006	8	25	15	0	1	229	39.8
2006	8	25	14	30	1	224	25.6
2006	8	25	14	0	1	200	8.8
2006	8	25	13	30	1	112	13.3
2006	8	25	13	0	1	103	9.4
2006	8	25	12	30	1	65	8.2
2006	8	25	12	0	1	95	14.4
2006	8	25	11	30	1	93	14.8
2006	8	25	11	0	1	353	10.1
2006	8	25	10	30	1	355	8
2006	8	25	10	0	1	353	11.7
2006	8	25	9	30	1	331	6
2006	8	25	9	0	1	20	6
2006	8	25	8	30	1	319	4.7
2006	8	25	8	0	1	226	8.5
2006	8	25	7	30	1	214	31.1

2006	8	25	7	0	1	190	51.7
2006	8	25	6	30	1	189	60.7
2006	8	25	6	0	1	214	45.3
2006	8	25	5	30	1	215	55.6
2006	8	25	5	0	1	214	45.3
2006	8	25	4	30	1	266	38.4
2006	8	25	4	0	1	249	30.4
2006	8	25	3	30	1	5	16.3
2006	8	25	3	0	1	49	21.1
2006	8	25	2	30	1	100	6.1
2006	8	25	2	0	1	328	15.8
2006	8	25	1	30	1	62	8.8
2006	8	25	1	0	1	355	8.7
2006	8	25	0	30	1	46	8.9
2006	8	25	0	0	1	68	10.6
2006	8	24	23	30	1	92	12.4
2006	8	24	23	0	1	68	20.1
2006	8	24	22	30	1	131	12.2
2006	8	24	22	0	1	167	19.1
2006	8	24	21	30	1	39	8.3
2006	8	24	21	0	1	194	51
2006	8	24	20	30	1	194	61.1
2006	8	24	20	0	1	70	3.2
2006	8	24	19	30	1	254	25.9
2006	8	24	19	0	1	239	48.3
2006	8	24	18	30	1	233	65.3
2006	8	24	18	0	1	231	68.6
2006	8	24	17	30	1	238	84
2006	8	24	17	0	1	233	89.3
2006	8	24	16	30	1	231	84.2
2006	8	24	16	0	1	225	74.9
2006	8	24	15	30	1	220	55.6
2006	8	24	15	0	1	231	54.6
2006	8	24	14	30	1	238	45.6
2006	8	24	14	0	1	269	38.7
2006	8	24	13	30	1	241	35.9
2006	8	24	13	0	1	257	11.1
2006	8	24	12	30	1	183	2.1
2006	8	24	12	0	1	115	11.9
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2006	7	24	16	30	1	220	95.1
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2006	7	24	6	30	1	199	38.2
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2006	7	18	9	0	1	241	69.3
2006	7	18	8	30	1	266	53.4
2006	7	18	8	0	1	272	52.7
2006	7	18	7	30	1	263	57.8
2006	7	18	7	0	1	175	4
2006	7	18	6	30	1	150	9.1
2006	7	18	6	0	1	111	15.9
2006	7	18	5	30	1	91	26.6
2006	7	18	5	0	1	85	29.6
2006	7	18	4	30	1	76	28.1
2006	7	18	4	0	1	88	29
2006	7	18	3	30	1	117	22.6
2006	7	18	3	0	1	126	25.6
2006	7	18	2	30	1	151	27
2006	7	18	2	0	1	174	32.2
2006	7	18	1	30	1	189	34
2006	7	18	1	0	1	205	43.5
2006	7	18	0	30	1	183	27
2006	7	18	0	0	1	156	26.1
2006	7	17	23	30	1	125	3.2
2006	7	17	23	0	1	291	8.4
2006	7	17	22	30	1	309	24.5
2006	7	17	22	0	1	290	34.2
2006	7	17	21	30	1	276	34.6
2006	7	17	21	0	1	285	26.2
2006	7	17	20	30	1	284	30.3
2006	7	17	20	0	1	277	33.7
2006	7	17	19	30	1	275	28
2006	7	17	19	0	1	286	21.6
2006	7	17	18	30	1	253	6.8
2006	7	17	18	0	1	176	4.9
2006	7	17	17	30	1	157	4.5
2006	7	17	17	0	1	149	4.4
2006	7	17	16	30	1	162	10.7
2006	7	17	16	0	1	179	18
2006	7	17	15	30	1	187	29.6
2006	7	17	15	0	1	192	47.8
2006	7	17	14	30	1	179	71.2
2006	7	17	14	0	1	201	10.6
2006	7	17	13	30	1	240	20.6
2006	7	17	13	0	1	246	46.5
2006	7	17	12	30	1	260	55.5
2006	7	17	12	0	1	248	64.1
2006	7	17	11	30	1	256	74.5
2006	7	17	11	0	1	253	96.8
2006	7	17	10	30	1	240	96.5
2006	7	17	10	0	1	233	114.6
2006	7	17	9	30	1	240	108.9

2006	7	17	9	0	1	230	79.3
2006	7	17	8	30	1	233	68.1
2006	7	17	8	0	1	251	45.8
2006	7	17	7	30	1	225	40.4
2006	7	17	7	0	1	186	30.7
2006	7	17	6	30	1	139	36.7
2006	7	17	6	0	1	106	39.1
2006	7	17	5	30	1	102	47.7
2006	7	17	5	0	1	94	56.3
2006	7	17	4	30	1	94	60.8
2006	7	17	4	0	1	93	71.3
2006	7	17	3	30	1	94	68.6
2006	7	17	3	0	1	85	80
2006	7	17	2	30	1	86	91.5
2006	7	17	2	0	1	90	68.4
2006	7	17	1	30	1	83	67.7
2006	7	17	1	0	1	83	52.5
2006	7	17	0	30	1	91	43.4
2006	7	17	0	0	1	97	34.2
2006	7	16	23	30	1	118	21.2
2006	7	16	23	0	1	132	16.3
2006	7	16	22	30	1	152	9.5
2006	7	16	22	0	1	293	22.5
2006	7	16	21	30	1	299	31.9
2006	7	16	21	0	1	268	38.3
2006	7	16	20	30	1	279	40.6
2006	7	16	20	0	1	270	51.4
2006	7	16	19	30	1	250	52
2006	7	16	19	0	1	249	45.7
2006	7	16	18	30	1	247	36.4
2006	7	16	18	0	1	223	19
2006	7	16	17	30	1	137	8.7
2006	7	16	17	0	1	59	13.2
2006	7	16	16	30	1	44	25.3
2006	7	16	16	0	1	30	27
2006	7	16	15	30	1	28	19.5
2006	7	16	15	0	1	40	3
2006	7	16	14	30	1	354	2.5
2006	7	16	14	0	1	286	1.8
2006	7	16	13	30	1	228	4
2006	7	16	13	0	1	198	2.1
2006	7	16	12	30	1	259	6.9
2006	7	16	12	0	1	276	21.7
2006	7	16	11	30	1	272	47.5
2006	7	16	11	0	1	262	72.5
2006	7	16	10	30	1	260	86
2006	7	16	10	0	1	263	73.9
2006	7	16	9	30	1	242	71
2006	7	16	9	0	1	242	55.9
2006	7	16	8	30	1	254	56.2
2006	7	16	8	0	1	253	49.8
2006	7	16	7	30	1	237	51.1

2006	7	16	7	0	1	220	41.9
2006	7	16	6	30	1	191	30.8
2006	7	16	6	0	1	175	43.9
2006	7	16	5	30	1	149	45.3
2006	7	16	5	0	1	127	56.9
2006	7	16	4	30	1	105	48.1
2006	7	16	4	0	1	100	65.5
2006	7	16	3	30	1	72	67.9
2006	7	16	3	0	1	86	76.9
2006	7	16	2	30	1	90	87.5
2006	7	16	2	0	1	79	68.2
2006	7	16	1	30	1	92	48.3
2006	7	16	1	0	1	108	38.9
2006	7	16	0	30	1	144	38.6
2006	7	16	0	0	1	130	17.3
2006	7	15	23	30	1	124	36.5
2006	7	15	23	0	1	113	32.2
2006	7	15	22	30	1	103	18.1
2006	7	15	22	0	1	137	5.6
2006	7	15	21	30	1	247	22.9
2006	7	15	21	0	1	273	36.1
2006	7	15	20	30	1	267	55.4
2006	7	15	20	0	1	265	78.1
2006	7	15	19	30	1	263	67.7
2006	7	15	19	0	1	267	64
2006	7	15	18	30	1	264	61.7
2006	7	15	18	0	1	255	57.1
2006	7	15	17	30	1	245	42
2006	7	15	17	0	1	223	20.8
2006	7	15	16	30	1	168	17.7
2006	7	15	16	0	1	131	16
2006	7	15	15	30	1	99	24.6
2006	7	15	15	0	1	75	31.9
2006	7	15	14	30	1	86	38.5
2006	7	15	14	0	1	99	45.9
2006	7	15	13	30	1	101	49
2006	7	15	13	0	1	91	42.2
2006	7	15	12	0	1	79	40.6
2006	7	15	11	30	1	75	25.8
2006	7	15	11	0	1	59	10.8
2006	7	15	10	30	1	317	8.6
2006	7	15	10	0	1	288	21.6
2006	7	15	9	30	1	265	26.3
2006	7	15	9	0	1	240	42.5
2006	7	15	8	30	1	244	57.4
2006	7	15	8	0	1	226	56.6
2006	7	15	7	30	1	208	49.7
2006	7	15	7	0	1	228	37.2
2006	7	15	6	30	1	224	8.5
2006	7	15	6	0	1	134	16.1
2006	7	15	5	30	1	125	22.4
2006	7	15	5	0	1	94	27.1

2006	7	15	4	30	1	79	37.2
2006	7	15	4	0	1	88	54.4
2006	7	15	3	30	1	82	64.1
2006	7	15	3	0	1	84	61.5
2006	7	15	2	30	1	94	95.1
2006	7	15	2	0	1	93	99.1
2006	7	15	1	30	1	92	99
2006	7	15	1	0	1	90	101.3
2006	7	15	0	30	1	82	102.3
2006	7	15	0	0	1	101	58.2