Memorandum - Note de service

To/À:	Alain Pietroniro National Director National Hydrological Services Saskatoon, Saskatchewan
From/De:	Rob Caldwell Manager Great Lakes - St. Lawrence Regulation Office National Hydrological Services – East Cornwall, Ontario
Date/Date:	4 May 2017
Subject/Objet:	Great Lakes Water Levels Information

Very wet net basin supplies were received across the Great Lakes – St. Lawrence River basin last month, and April was marked by fast-rising water levels on lakes Superior and Michigan-Huron, and especially Lake Ontario. The wet conditions extended to the Ottawa River basin, leading to record high flows and flooding both on Lake Ontario and the St. Lawrence River downstream.

The monthly mean water level of Lake Superior was 15 cm above its period-of-record (1918-2016) average for April, but 7 cm lower than last year. Lake Michigan-Huron's mean level was 28 cm above average last month, but 11 cm lower than the level recorded a year ago in April. Lake St. Clair was 43 cm above its April average, but 2 cm below the level of last year. Lake Erie's level was 42 cm above average and 4 cm above that of last April. Lake Ontario's monthly mean level rose sharply to 47 cm above average last month, 24 cm higher than the level was a year ago. This was the 9th highest April monthly mean on record, and the highest since 1998.

Lake Superior, which rises by 8 cm on average (1918-2016) in April, rose 13 cm last month, its 11th highest April rise. This was despite above-average outflows. Lake Michigan-Huron rose 18 cm, its 14th highest rise, while it normally rises by 11 cm in April. Lake St. Clair's level rose 7 cm in April, close to its typical rise of 10 cm. Lake Erie rose 12 cm in April, close to its average rise of 13 cm. Lake Ontario rose 44 cm, its 3rd highest April rise, and more than double its typical rise of 21 cm. This was the result of the 2nd highest net total supplies since 1900, and despite above-average outflows.

Lake Superior's beginning-of-May level was 19 cm above the 1918-2016 average, but the same as last year's level. Higher beginning-of-May levels have been recorded on Lake

Superior in 11 years since 1918. Lake Michigan-Huron's beginning-of-May level was 31 cm above average, but 6 cm lower than last year. Higher beginning-of-May levels have been recorded on Lake Michigan-Huron in 23 years since 1918. Lake St. Clair began May 44 cm above average and 1 cm higher than last year at this time. Lake Erie was 43 cm above average at the start of May and 6 cm higher than at this time last year. Higher beginning-of-May levels have been recorded on Lake Erie during 11 years since 1918, most recently in 1998. Lake Ontario's level began May at 55 cm above average and 40 cm higher than last year at this time. Higher beginning-of-May levels have been recorded on Lake Ontario during 5 years since 1918, most recently in 1993.

All of the lakes are currently at least 30 cm above their chart datum level.

Relative to their beginning-of-month levels and assuming average water supply conditions, all of the Great Lakes are expected to rise.

The following table compares the levels of the lakes to their long-term averages and last year's levels.

Great Lakes Water Levels Comparison

Lake	April Monthly Mean Level		Beginning-of-May Level	
	Compared to Monthly Average (1918-2016)	Compared to One Year Ago	Compared to Beginning-of-Month Average (1918-2016)	Compared to One Year Ago
Superior	15 cm above	7 cm below	19 cm above	same
Michigan-Huron	28 cm above	11 cm below	31 cm above	6 cm below
St. Clair	43 cm above	2 cm below	44 cm above	1 cm above
Erie	42 cm above	4 cm above	43 cm above	6 cm above
Ontario	47 cm above	24 cm above	55 cm above	40 cm above

Figures 1 and 2 show the difference from average of the water supplies received in each of the Great Lakes for the past three and six months, respectively (the gray bars show the historical maxima and minima for these periods). Figures 1 and 2 together indicate that water supply conditions have been above average overall during the past three months, as well as during the past six months.

The outflow from Lake Superior is expected to be 2,060 m^3/s in May, 410 m^3/s below the flow prescribed by Plan 2012, and is 2 percent below the long-term average (1900-2016) for the month. This will be achieved by passing maximum flows through the hydropower plants and maintaining the equivalent of two gates open at the Compensating Works. The International Lake Superior Board of Control recently requested and received approval from the International Joint Commission to temporarily deviate from Plan 2012, and outflows of Lake Superior will be adjusted over the next several months to accommodate expected maintenance at the hydropower plants, and reduce the potential for adverse consequences of high and fluctuating flows and water levels in the St. Marys Rapids.

The daily outflows from Lake Ontario in April averaged 7,610 m^3/s, which was 7 percent above the April long-term average (1900-2016). Plan 2014 was followed throughout April. Lake Ontario outflows were adjusted operationally a total of 24 times during the month, due in response to very high Lake Ontario levels and a record Ottawa River freshet resulting from heavy snowmelt and rainfalls. From 1 April until noon on 5 April, the rule curve flow was followed. Thereafter, two dozen operational adjustments to Lake Ontario outflows were made in response to highly variable Ottawa River and local tributary flows, and in accordance with the Plan 2014 "F-limit", which attempts to minimize and balance flooding on Lake Ontario and along the St. Lawrence River. As a result, flows again varied considerably throughout much of the month, ranging from 25 percent below to 16 percent above the average for the month. From 23 to 29 April, flows were increased six times by a total of 20 percent of the average flow last month. Lake Ontario levels had reached or surpassed criterion H14 upper trigger levels for eight days starting on 21 April. This allows the International Lake Ontario – St. Lawrence River Board to deviate from the regulation plan and release outflows to provide all possible relief to riparians living along the shorelines of the entire Lake Ontario – St. Lawrence River system. However, major deviations were not undertaken as high levels were instead managed by continuing to follow the Plan 2014 F limit and balancing water levels upstream and downstream to minimize flood and erosion impacts to the extent possible.

Montreal Harbour levels generally rose quickly throughout the first three weeks of April following a significant thaw event marked by thunderstorms and rainfall. After 20 April, levels were relatively stable as downstream levels were maintained as per the F limit. Daily levels at Montreal varied with flow and weather, ranging from a low of 7.00 m on 2 April to a high of 8.53 m on 30 April.

The recent observed and forecasted ranges of monthly mean levels on the Great Lakes are shown in the attached figures and tables.

This information has been prepared under the auspices of the bi-national Coordinating Committee on Great Lakes Basic Hydraulic and Hydrologic Data by the Great Lakes - St. Lawrence Regulation Office, Environment and Climate Change Canada, and the Detroit District, U.S. Army Corps of Engineers.

cc: e-mail list

GREAT LAKES WATER LEVELS

COMPARISON OF PAST, PRESENT, AND PROBABLE FUTURE LEVELS
(Referred to metres, International Great Lakes Datum 1985)

Location	Monthly Water Level Apr 2016	Monthly Water Level Mar 2017	Monthly Water Level Apr 2017	Probable Levels May 2017
Lake Superior	183.48	183.39	183.41	183.56
Lake Huron	176.77	176.53	176.66	176.78
Lake St. Clair	175.49	175.29	175.47	175.51
Lake Erie	174.60	174.48	174.64	174.74
Lake Ontario	75.11	75.00	75.35	75.55
Montreal Harbour at Jetty No.1	7.80	6.97	8.14	7.57

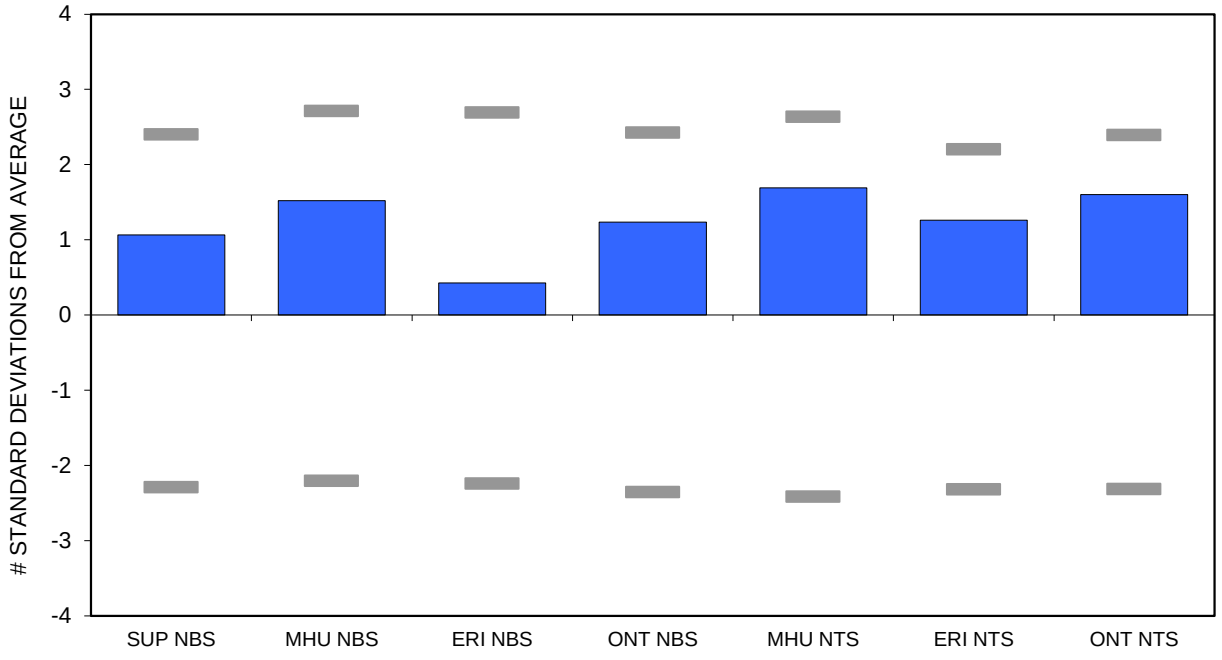
GREAT LAKES WATER LEVELS FORECAST

Forecast Beginning 1 MAY 2017
Monthly Mean Water Level IGLD 1985 (m above Chart Datum IGLD 1985)
For Exceedence Probability Shown

MONTH	5%	50%	95%
	LAKE SUPERIOR		
MAY	183.61 (0.41)	183.56 (0.36)	183.53 (0.33)
JUNE	183.74 (0.54)	183.64 (0.44)	183.56 (0.36)
JULY	183.81 (0.61)	183.68 (0.48)	183.59 (0.39)
AUGUST	183.84 (0.64)	183.70 (0.50)	183.59 (0.39)
SEPTEMBER	183.84 (0.64)	183.68 (0.48)	183.56 (0.36)
OCTOBER	183.82 (0.62)	183.64 (0.44)	183.49 (0.29)
	(CHART DATUM 183.20 IGLD 1985)		
	LAKE HURON		
MAY	176.82 (0.82)	176.78 (0.78)	176.74 (0.74)
JUNE	176.94 (0.94)	176.84 (0.84)	176.76 (0.76)
JULY	177.01 (1.01)	176.87 (0.87)	176.76 (0.76)
AUGUST	177.01 (1.01)	176.86 (0.86)	176.72 (0.72)
SEPTEMBER	176.97 (0.97)	176.82 (0.82)	176.64 (0.64)
OCTOBER	176.94 (0.94)	176.74 (0.74)	176.55 (0.55)
	(CHART DATUM 176.00 IGLD 1985)		
	LAKE ST. CLAIR		
MAY	175.60 (1.20)	175.51 (1.11)	175.44 (1.04)
JUNE	175.66 (1.26)	175.54 (1.14)	175.42 (1.02)
JULY	175.68 (1.28)	175.54 (1.14)	175.38 (0.98)
AUGUST	175.66 (1.26)	175.48 (1.08)	175.32 (0.92)
SEPTEMBER	175.58 (1.18)	175.40 (1.00)	175.24 (0.84)
OCTOBER	175.50 (1.10)	175.31 (0.91)	175.13 (0.73)
	(CHART DATUM 174.40 IGLD 1985)		

MONTH	5%		50%		95%	
			LAKE ERIE			
MAY	174.82	(1.32)	174.74	(1.24)	174.68	(1.18)
JUNE	174.88	(1.38)	174.72	(1.22)	174.60	(1.10)
JULY	174.86	(1.36)	174.68	(1.18)	174.51	(1.01)
AUGUST	174.78	(1.28)	174.58	(1.08)	174.42	(0.92)
SEPTEMBER	174.68	(1.18)	174.48	(0.98)	174.30	(0.80)
OCTOBER	174.60	(1.10)	174.36	(0.86)	174.18	(0.68)
			(CHART DATUM 173.50 IGLD 1985)			
			LAKE ONTARIO			
MAY	75.68	(1.48)	75.55	(1.35)	75.44	(1.24)
JUNE	75.71	(1.51)	75.49	(1.29)	75.34	(1.14)
JULY	75.62	(1.42)	75.37	(1.17)	75.18	(0.98)
AUGUST	75.42	(1.22)	75.19	(0.99)	74.97	(0.77)
SEPTEMBER	75.19	(0.99)	74.97	(0.77)	74.80	(0.60)
OCTOBER	75.05	(0.85)	74.79	(0.59)	74.62	(0.42)
			(CHART DATUM 74.20 IGLD 1985)			
			MONTREAL HARBOUR			
MAY	8.72	(3.17)	7.57	(2.02)	6.93	(1.38)
JUNE	8.00	(2.45)	7.06	(1.51)	6.57	(1.02)
JULY	7.29	(1.74)	6.76	(1.21)	6.34	(0.79)
AUGUST	6.98	(1.43)	6.51	(0.96)	6.07	(0.52)
SEPTEMBER	6.96	(1.41)	6.44	(0.89)	5.99	(0.44)
OCTOBER	7.03	(1.48)	6.28	(0.73)	5.82	(0.27)
			(CHART DATUM 5.55 IGLD 1985)			

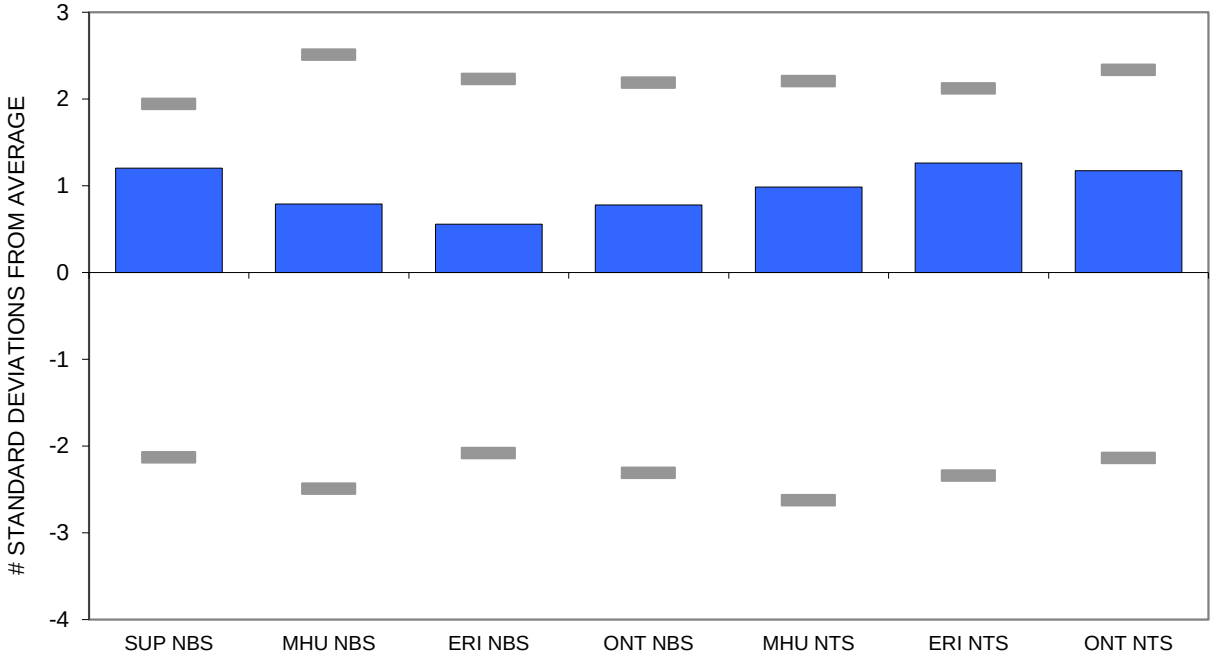
FIGURE 1: 3-MONTH AVERAGE NET BASIN SUPPLIES & NET TOTAL SUPPLIES
FEB 2017-APR 2017 COMPARED TO FEB-APR AVERAGE (1900-2016)



1 STANDARD DEVIATION (m^3/s):

SUP NBS	MHU NBS	ERI NBS	ONT NBS	MHU NTS	ERI NTS	ONT NTS
745	1388	496	420	1464	869	959

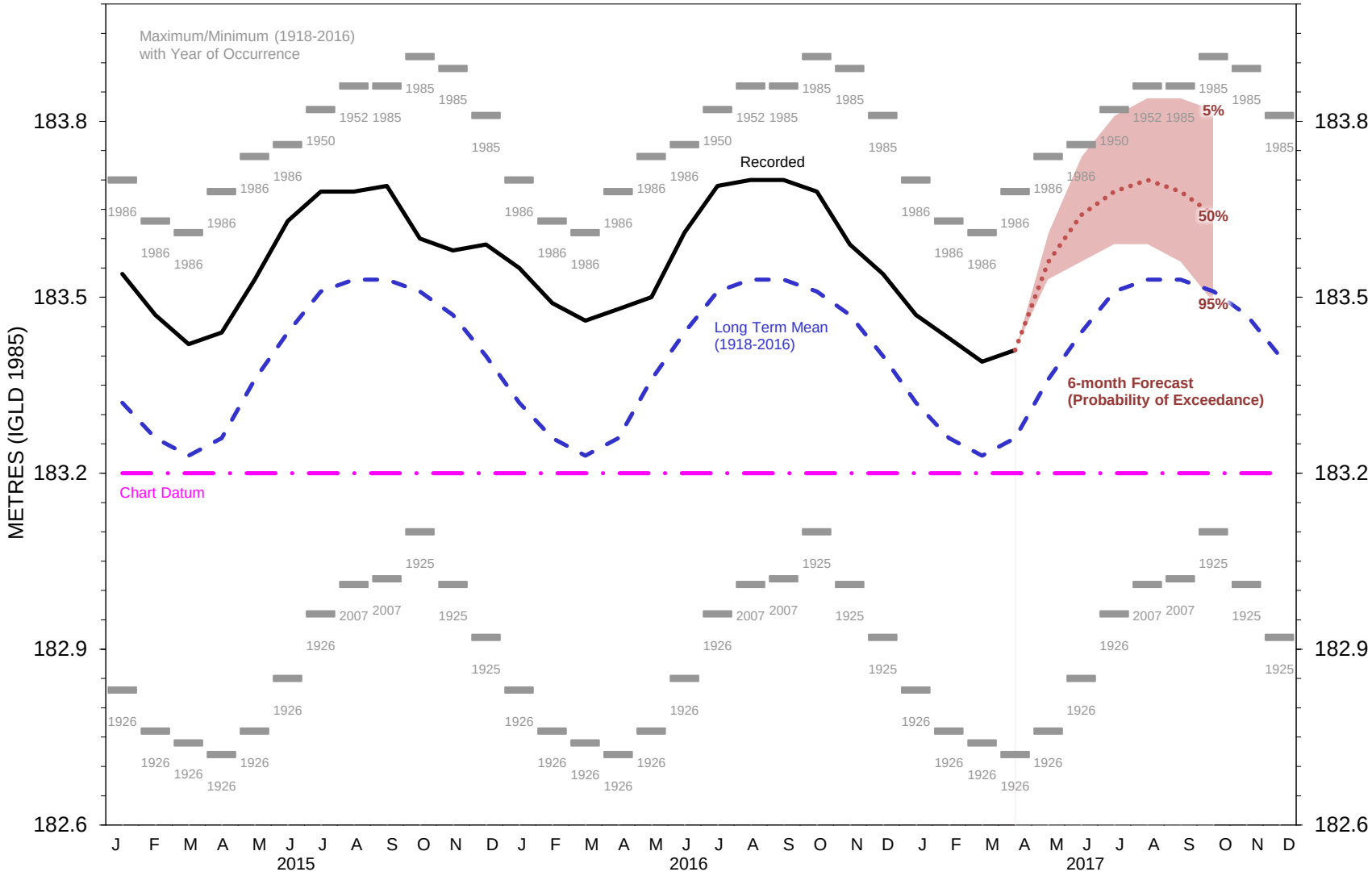
FIGURE 2: 6-MONTH AVERAGE NET BASIN SUPPLIES & NET TOTAL SUPPLIES
NOV 2016-APR 2017 COMPARED TO NOV-APR AVERAGE (1900-2016)



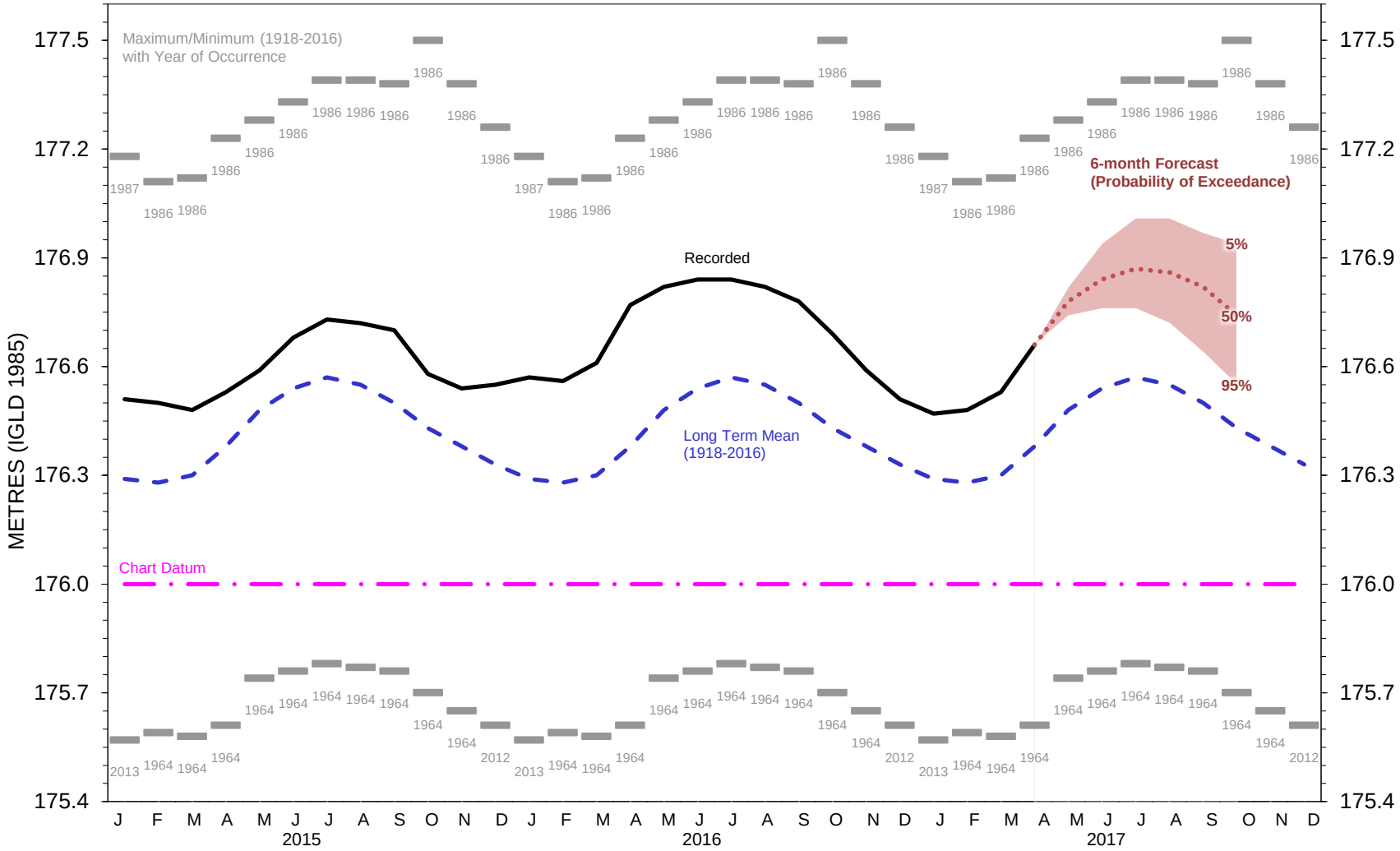
1 STANDARD DEVIATION (m^3/s):

SUP NBS	MHU NBS	ERI NBS	ONT NBS	MHU NTS	ERI NTS	ONT NTS
514	1066	408	355	1209	816	920

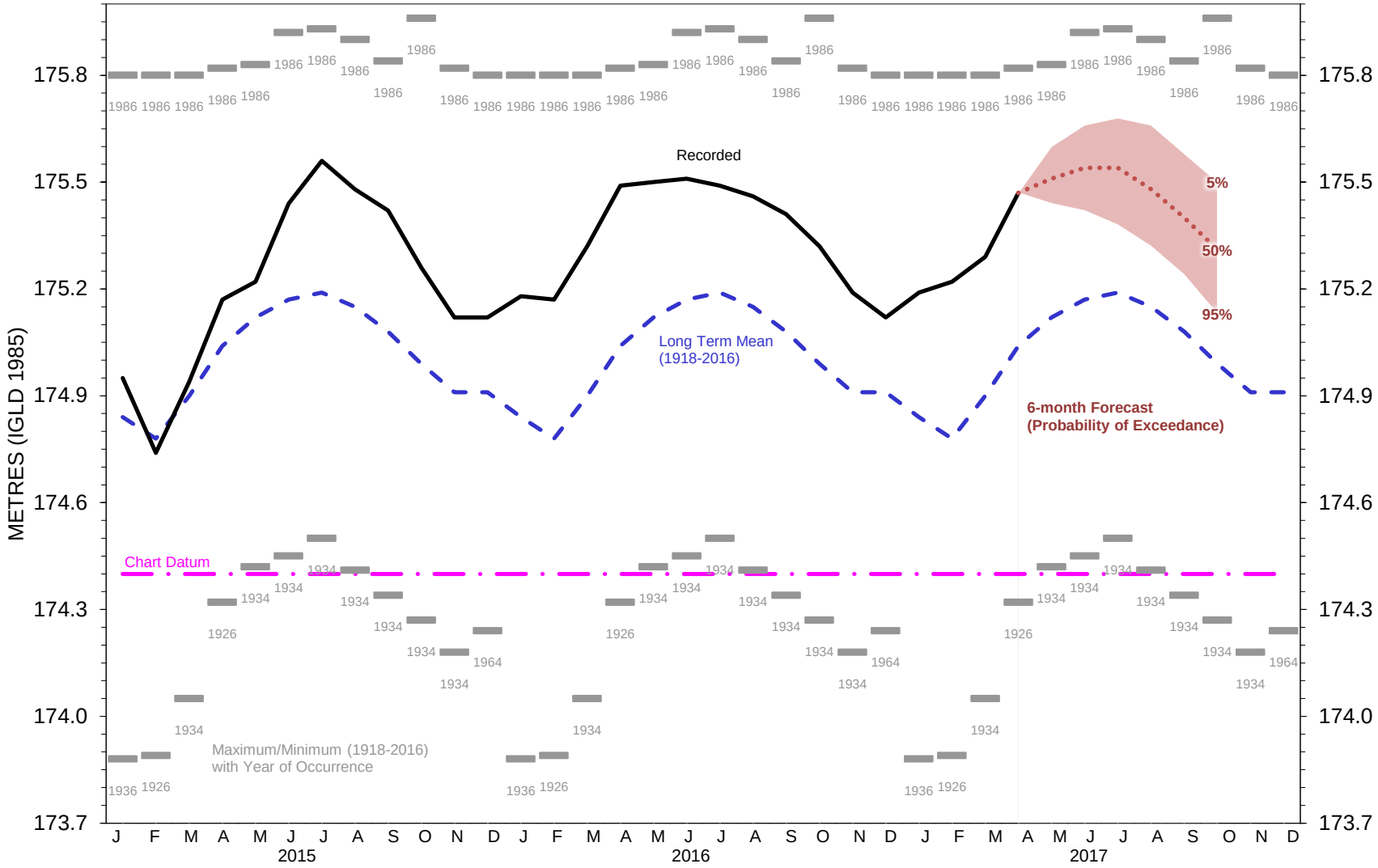
LAKE SUPERIOR MONTHLY MEAN LEVELS

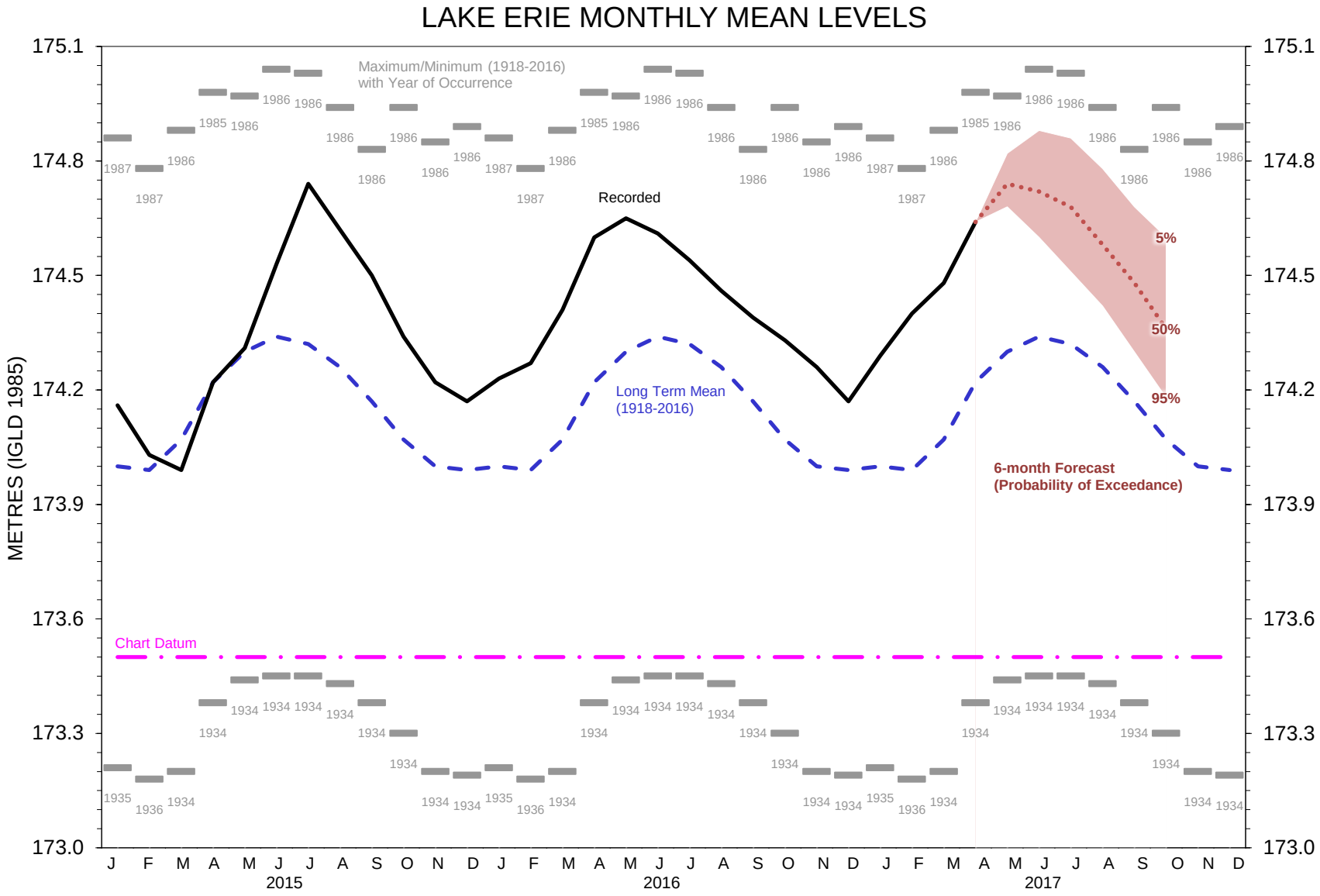


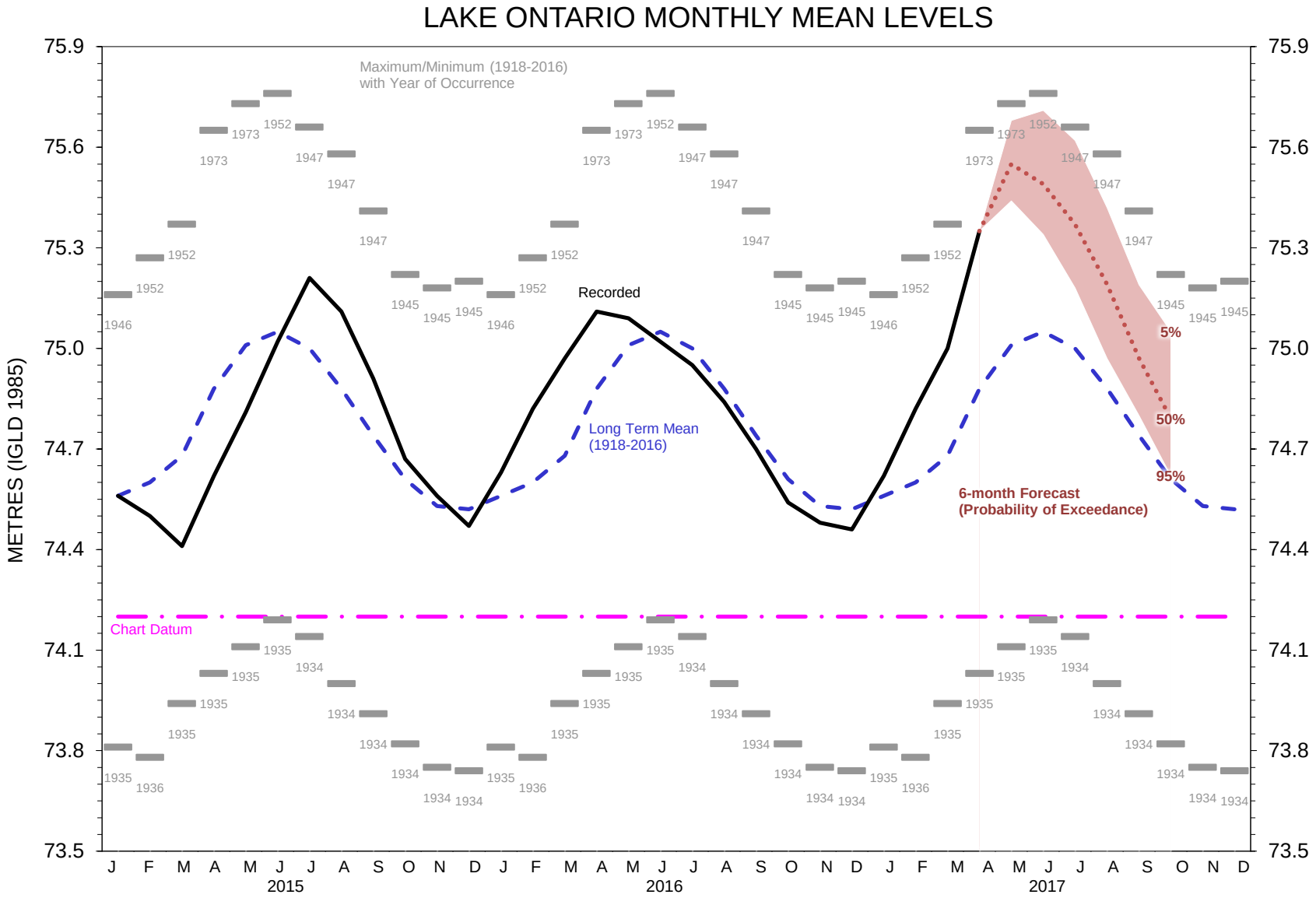
LAKE MICHIGAN-HURON MONTHLY MEAN LEVELS

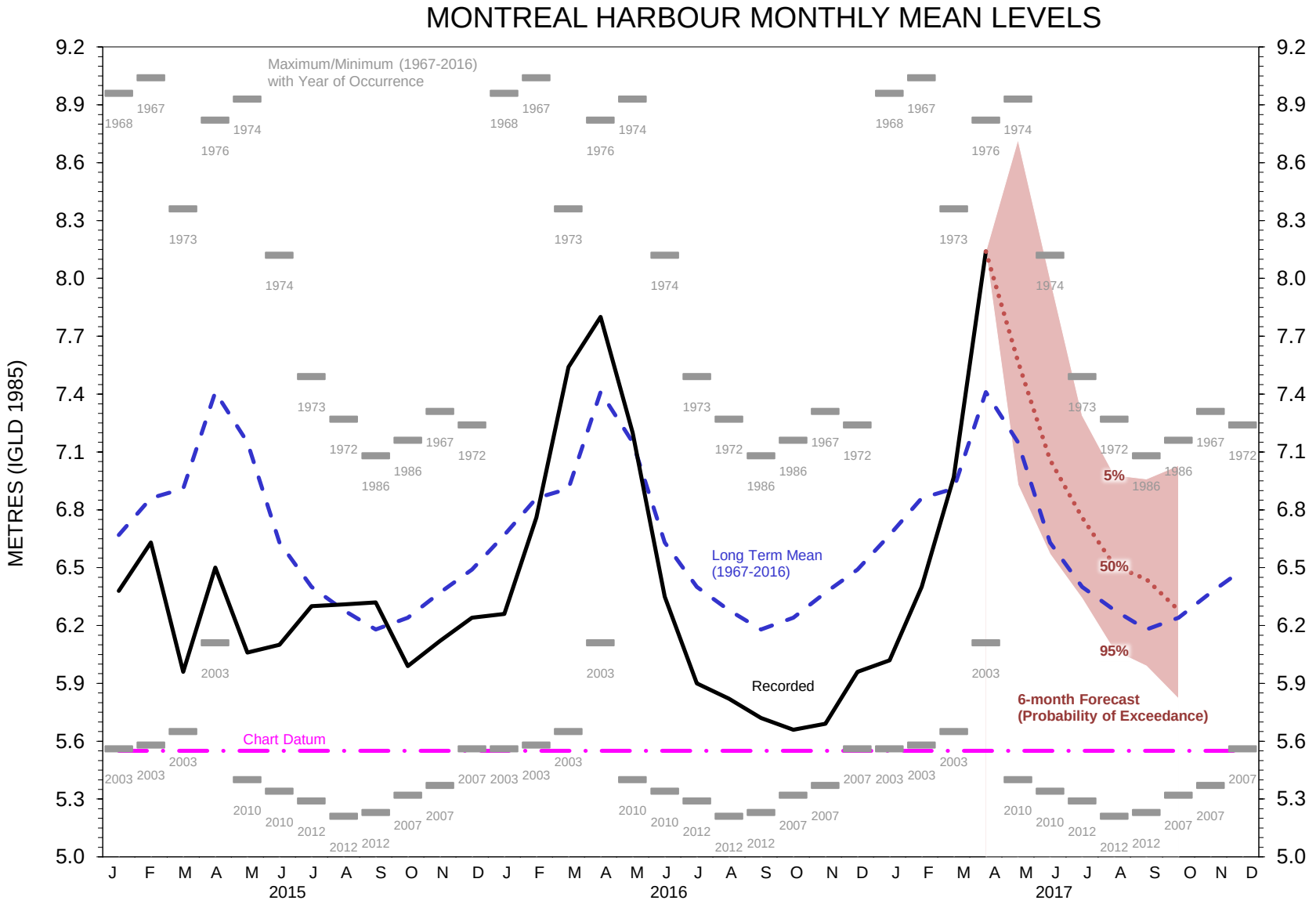


LAKE ST. CLAIR MONTHLY MEAN LEVELS




LAKE ERIE MONTHLY MEAN LEVELS
METRES (IGLD 1985)
175.1
174.8
174.5
174.2
173.9
173.6
173.3
173.0
Maximum/Minimum (1918-2016)
with Year of Occurrence
Recorded
Long Term Mean
(1918-2016)
Chart Datum
5%
50%
95%
6-month Forecast
(Probability of Exceedance)
J F M A M J J A S O N D J F M A M J J A S O N D J F M A M J J A S O N D
2015
2016
2017


LAKE ONTARIO MONTHLY MEAN LEVELS
METRES (IGLD 1985)
75.9
75.6
75.3
75.0
74.7
74.4
74.1
73.8
73.5
Maximum/Minimum (1918-2016)
with Year of Occurrence
Recorded
Long Term Mean
(1918-2016)
Chart Datum
6-month Forecast
(Probability of Exceedance)
5%
50%
95%
J F M A M J J A S O N D J F M A M J J A S O N D J F M A M J J A S O N D
2015
2016
2017


MONTREAL HARBOUR MONTHLY MEAN LEVELS
METRES (IGLD 1985)
Maximum/Minimum (1967-2016)
with Year of Occurrence
Long Term Mean
(1967-2016)
Recorded
Chart Datum
5%
50%
95%
6-month Forecast
(Probability of Exceedance)
2015
2016
2017