

2019 05 27

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Dear Mr. Johnston:

IMPACTS OF LAKE MANITOBA AND LAKE ST. MARTIN OUTLET CHANNELS PROJECT ON DOWNSTREAM WATER LEVELS

Enclosed are results of updated simulated water level impacts on Lake Winnipeg and downstream locations resulting from the proposed Lake Manitoba and Lake St. Martin Outlet Channels Project (LMB/LSM Project). This information is being provided in response to your May 17th, 2019 request for updated information to be used in your environmental review submission.

As a matter of record: Manitoba Infrastructure has provided us with updated data for the LMB/LSM Project on May 17th, 2019. Manitoba Hydro has not analyzed that data to determine its accuracy or whether it reasonably quantifies the modified inflows that can be expected into Lake Winnipeg with the Project. Manitoba Hydro expresses no opinion on the need for or merits of the LMB/LSM Project and has performed no studies or analysis on the impacts of the proposed LMB/LSM on the environment generally. We have performed a limited analysis confined strictly to the use of our model described herein.

Summary of Results

Note the results using updated time series of changes to Lake Winnipeg inflows as a result of the LMB/LSM Channels Project (provided by Manitoba Infrastructure on May 17th) are virtually unchanged from the original analysis summarized in my May 2nd, 2019 letter. The summary data is unchanged but are included here again for completeness.

Table 1 summarizes estimated changes to flood peak levels for historic floods on Lake Winnipeg and the Nelson River as a result of the proposed LMB/LSM Project. Also included in the table for context are historic actual peak elevations and average water levels for the time of year that the peak occurred.

Table 1. Summary of estimated changes to flood peak levels.

Location	Historic Peak Elevation (date of peak) (m)	Average Water Level at this Time of Year (m)	Simulated Peak Level with Existing System (m)	Simulated Peak Level with LMB/LSM Project (m)	Change in Peak Level due to LMB/SLM Project (m)
Lake Winnipeg	218.51 (July-2011)	217.76	218.51	218.58	0.07
Cross Lake¹	209.16 (Aug-2011)	207.92	209.16	209.22	0.06
Split Lake	169.23 (Aug-2005)	167.24	169.18	169.19	0.01
	169.39 (May-2017)	167.10	169.39	169.39	0.00

Notes: 1. Post Cross Lake weir (1991)

Attachment 1 and the file “LMB-LSM-STUDY-Simulation_Results_RevisedOPS.xlsx” includes detailed results from the simulations.

Methodology

The simulations were performed using a water balance model to simulate Lake Winnipeg water levels and outflows and a Nelson River routing model to simulate water levels and river flows downstream of Lake Winnipeg. These models were originally developed to provide information to the Manitoba Clean Environment Commission (CEC), as part of its review of the Lake Winnipeg Regulation (WR) Project¹. Appendix 10 of Manitoba Hydro’s submission² to the CEC describes the underlying modelling methodology. In order to respond to this request, additional input and assumptions were used and are summarized below.

Key assumptions are as follows:

1. Historical flow record 1976 to 2018 for inflows to Lake Winnipeg, flows from the Churchill River Diversion and Nelson River Local Inflows. The starting year of 1976 was chosen because this was the year operation of Lake Winnipeg Regulation commenced (Manitoba Hydro records).
2. The time series of changes to Lake Winnipeg inflows as a result of the LMB/LSM Channels Project (provided by Manitoba Infrastructure on May 17th, 2019) was added

to Manitoba Hydro's record of historic Lake Winnipeg Total Inflow Available for Outflow to represent the Lake Winnipeg Total Inflow Available for Outflow case with the LMB/LSM Channels Project (i.e. the "with project case").

3. No change to Manitoba Hydro's operation of Lake Winnipeg Regulation when Lake Winnipeg water levels are within the power production range established in the LWR Interim WPA licence.
4. No change to Manitoba Hydro's operation of the Churchill River Diversion.

The results are based on simulations of Lake Winnipeg Regulation operations. As with any modelling exercise, simulations will not perfectly reflect historic or future conditions. However, the focus of this analysis is the difference in water levels attributable to the LSM/LMB Channels Project that can be expected under flood conditions. By differencing the results of the simulations, the impact of the change in inflows to Lake Winnipeg and therefore operational changes can be reasonably estimated by differencing simulation results.

Discussion on Results

- When Lake Winnipeg Levels are above 715 feet and Manitoba Hydro is operating at maximum discharge, outflow from the lake is restricted by the outflow capacity of the lake outlet and Lake Winnipeg Regulation outlet channels. Under these conditions, the level of Lake Winnipeg is the primary factor that influences outflows from the lake. To the extent that the LMB/LSM Channels Project increase inflows to Lake Winnipeg during flood and Lake Winnipeg levels are as a result higher, then the outflow from Lake Winnipeg will also be higher resulting in incremental increases to downstream peak water levels.
- The assumption that MH's operations will not change when Lake Winnipeg levels are within the power production range or CRD operations will not change is a simplifying assumption. Manitoba Hydro may alter its operation to anticipate and mitigate the effect of higher intensity Lake Winnipeg inflows due to the LMB/LSM Channels Project. The effect of this simplifying assumption is to slightly overstate the impacts on peak flood levels on Lake Winnipeg and downstream locations.
- Under some flood conditions, the duration of maximum Lake Winnipeg outflow operations are extended in the case with the LMB/LSM Channels Project, resulting in longer periods of higher water levels along the Nelson River.
- Aside from the flood peaks, water levels on Lake Winnipeg and downstream may differ slightly at other times of the year. However, the dominant factor influencing operation of LWR is the overall amount of water inflow to the system, which varies widely from year to year. The differences in water levels on Lake Winnipeg and water bodies downstream of Lake Winnipeg associated with the LSM/LMB Channels Project are not expected to be discernible in the context of existing water level variations.

Background

Manitoba Hydro regulates Lake Winnipeg outflow for power production purposes when the wind-eliminated water levels are between elevation 711 feet and 715 feet. When the lake level rises above elevation 715 feet Manitoba Hydro is required to affect maximum discharge from Lake Winnipeg. During periods when the level falls below elevation 711 feet, control of Lake Winnipeg outflow is under the direction of the Province of Manitoba Minister of Sustainable Development.

Manitoba Hydro operates the Churchill River Diversion (CRD) in accordance with the terms of the Interim CRD Water Power Act Licence and Approvals of the CRD Augmented Flow Program.

I trust this information will be of assistance to the environmental review process for the LMB/LSM Channels Project. Please contact me should you have questions.

Yours truly,

<original signed by>

/kdg/LMB-LSM_Channels_Project_Gawne_Johnston_20190527.docx

¹ Clean Environment Commission, Lake Winnipeg Regulation Report, 2015.

² Manitoba Hydro, Lake Winnipeg Regulation – A Document in Support of Manitoba Hydro's Request for a Final Licence under the Manitoba Water Power Act, 2014.

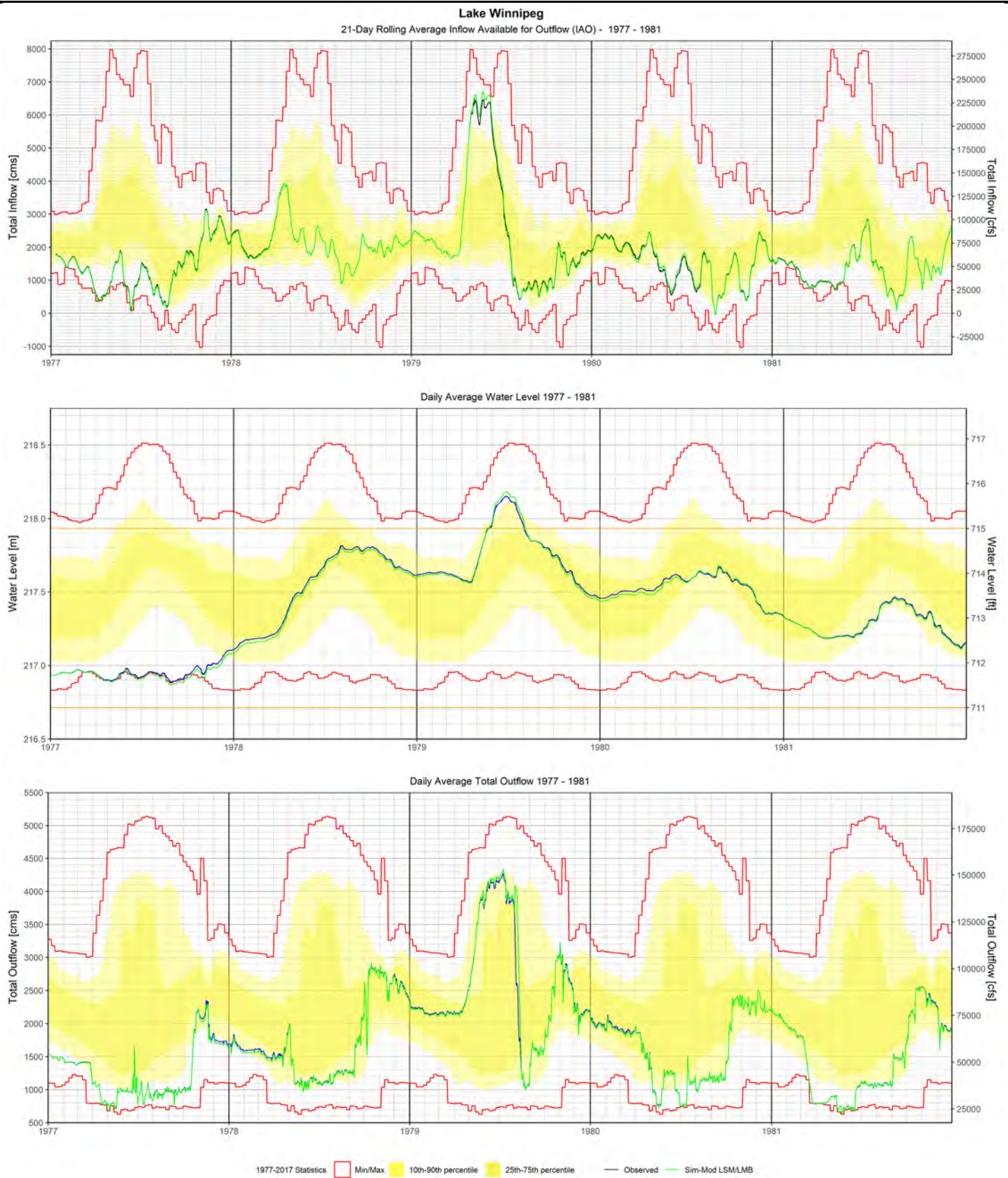


Figure 1: Lake Winnipeg 1977-1981

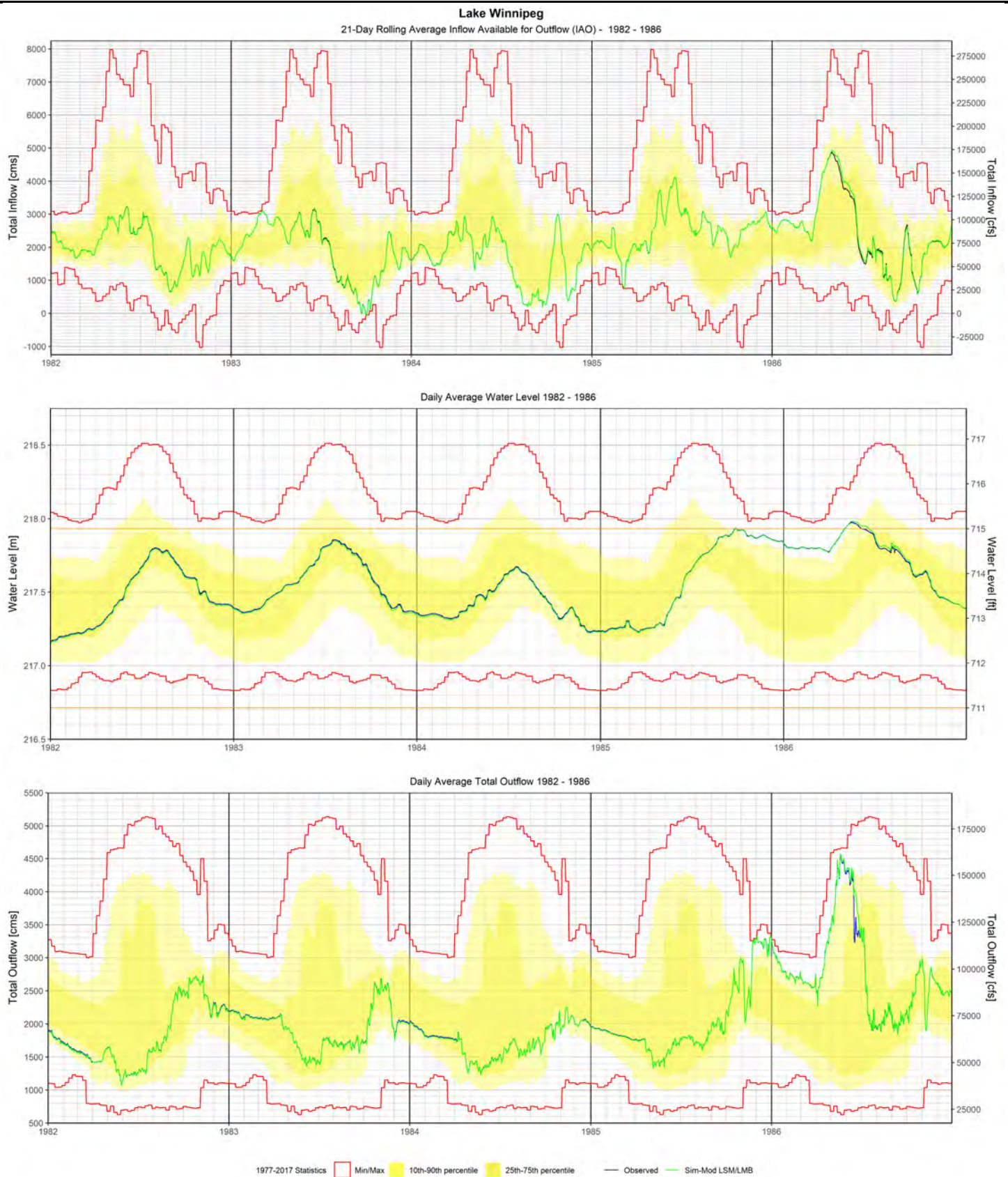


Figure 2: Lake Winnipeg 1982-1986

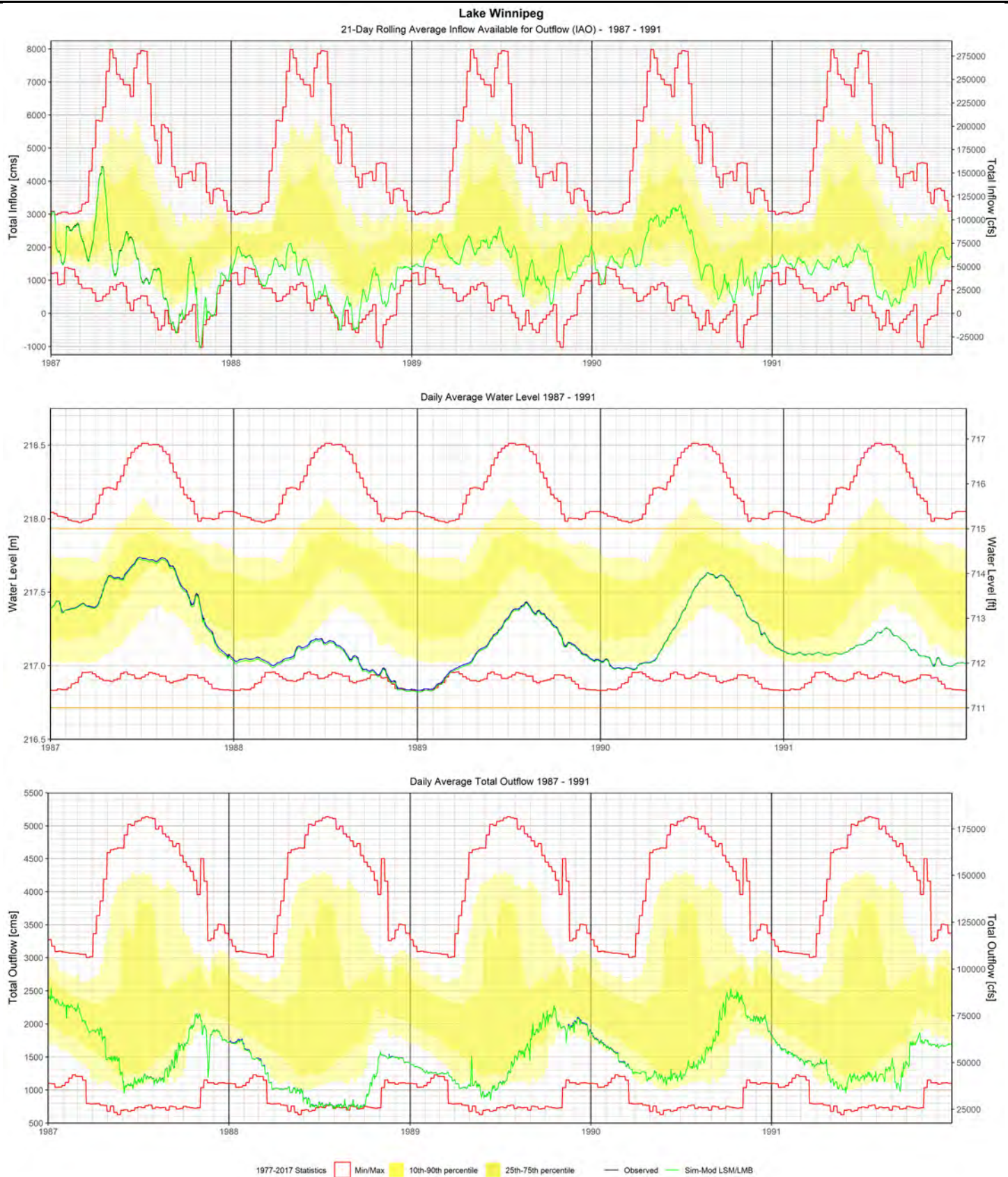


Figure 3: Lake Winnipeg 1987-1991

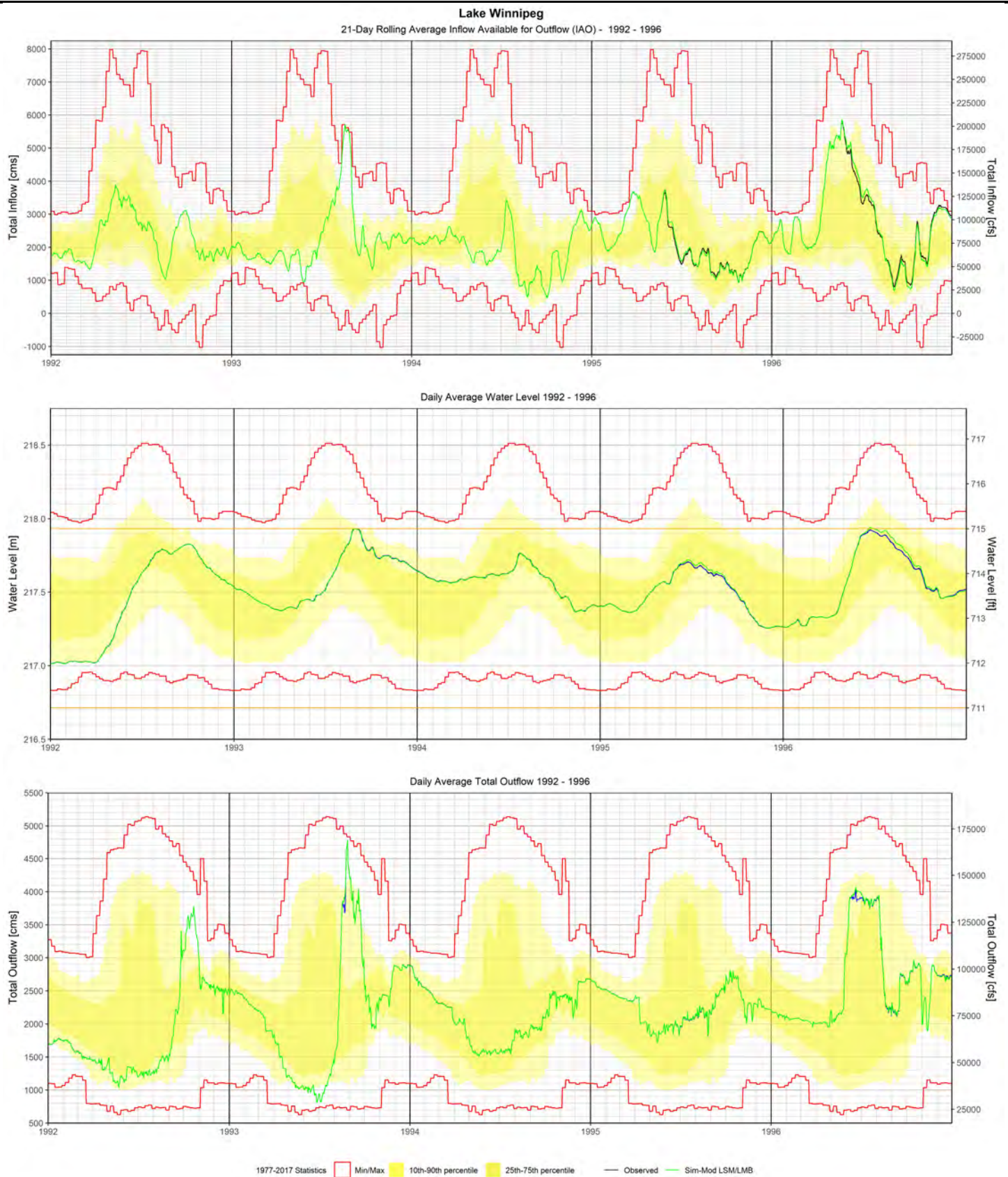


Figure 4: Lake Winnipeg 1992-1996

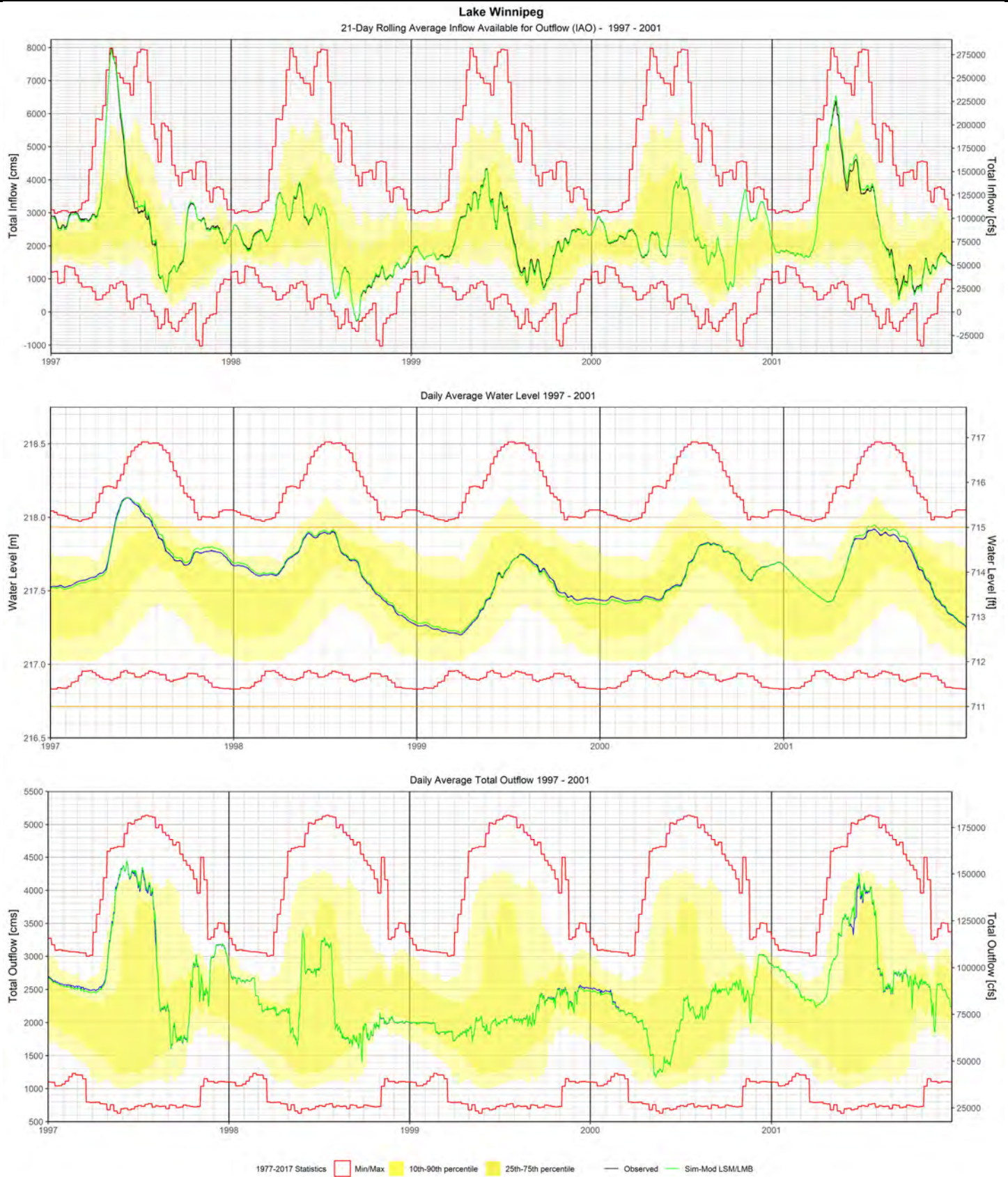


Figure 5: Lake Winnipeg 1997-2001

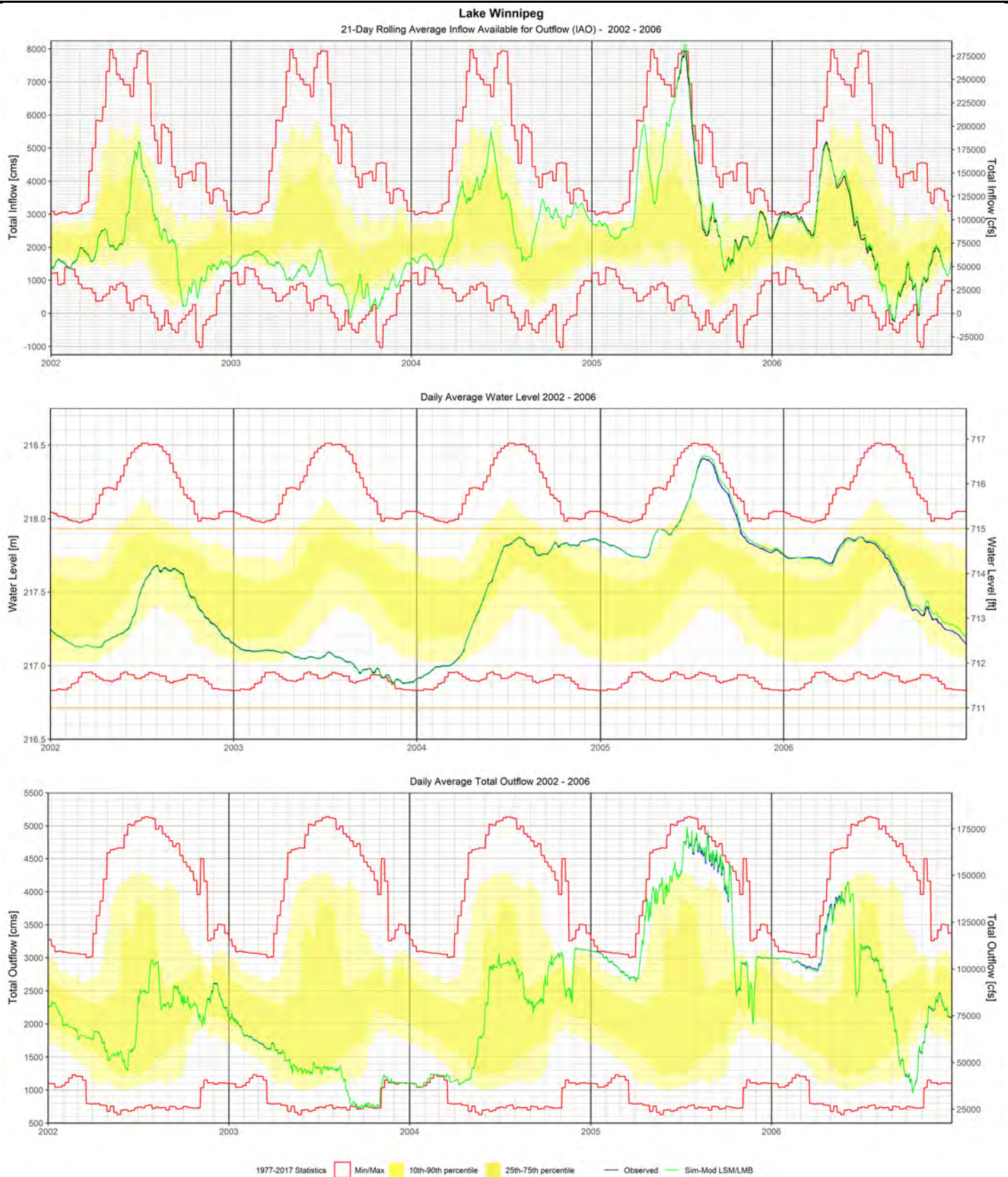


Figure 6: Lake Winnipeg 2002-2006

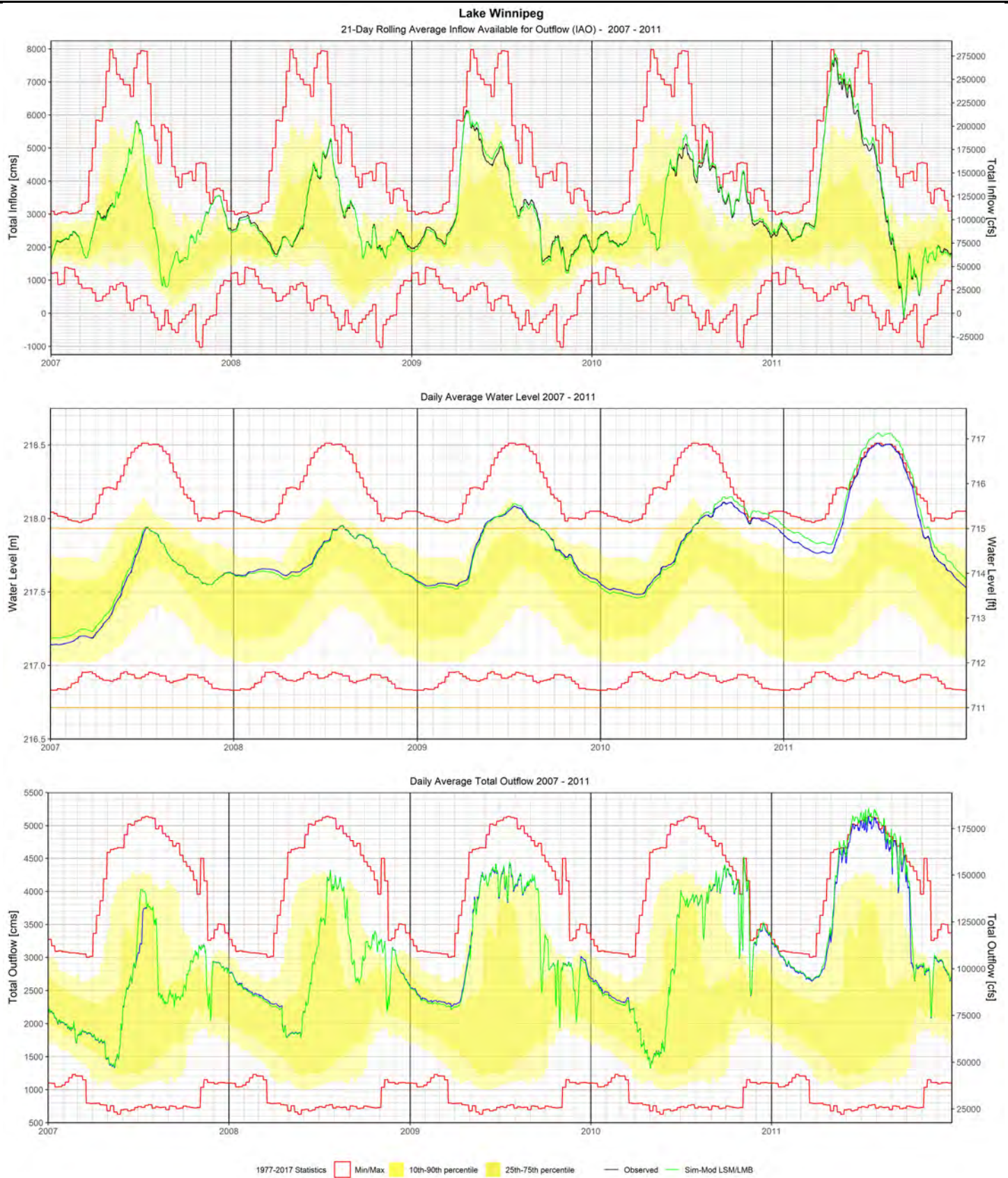


Figure 7: Lake Winnipeg 2007-2011

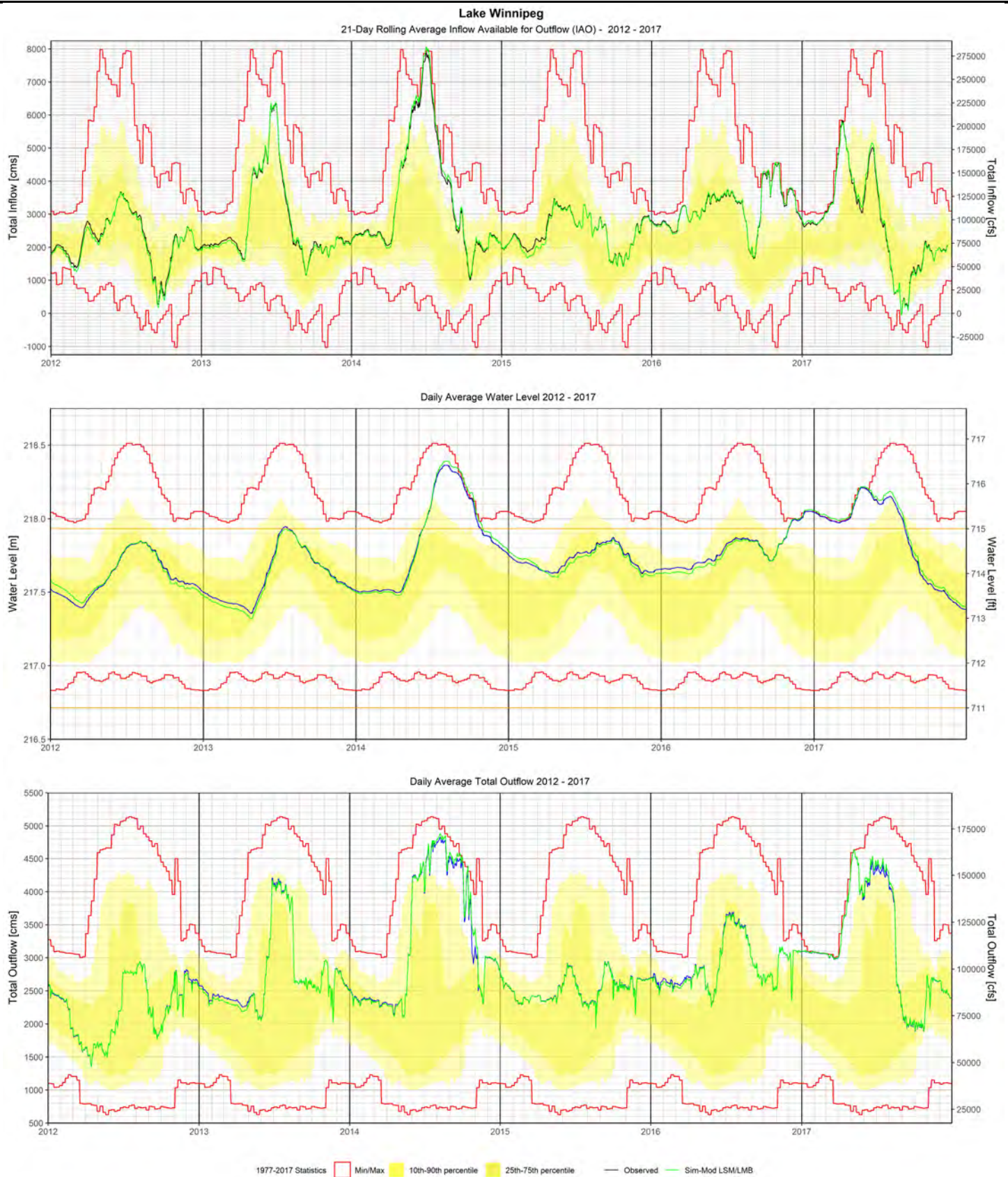


Figure 8: Lake Winnipeg 2012-2017

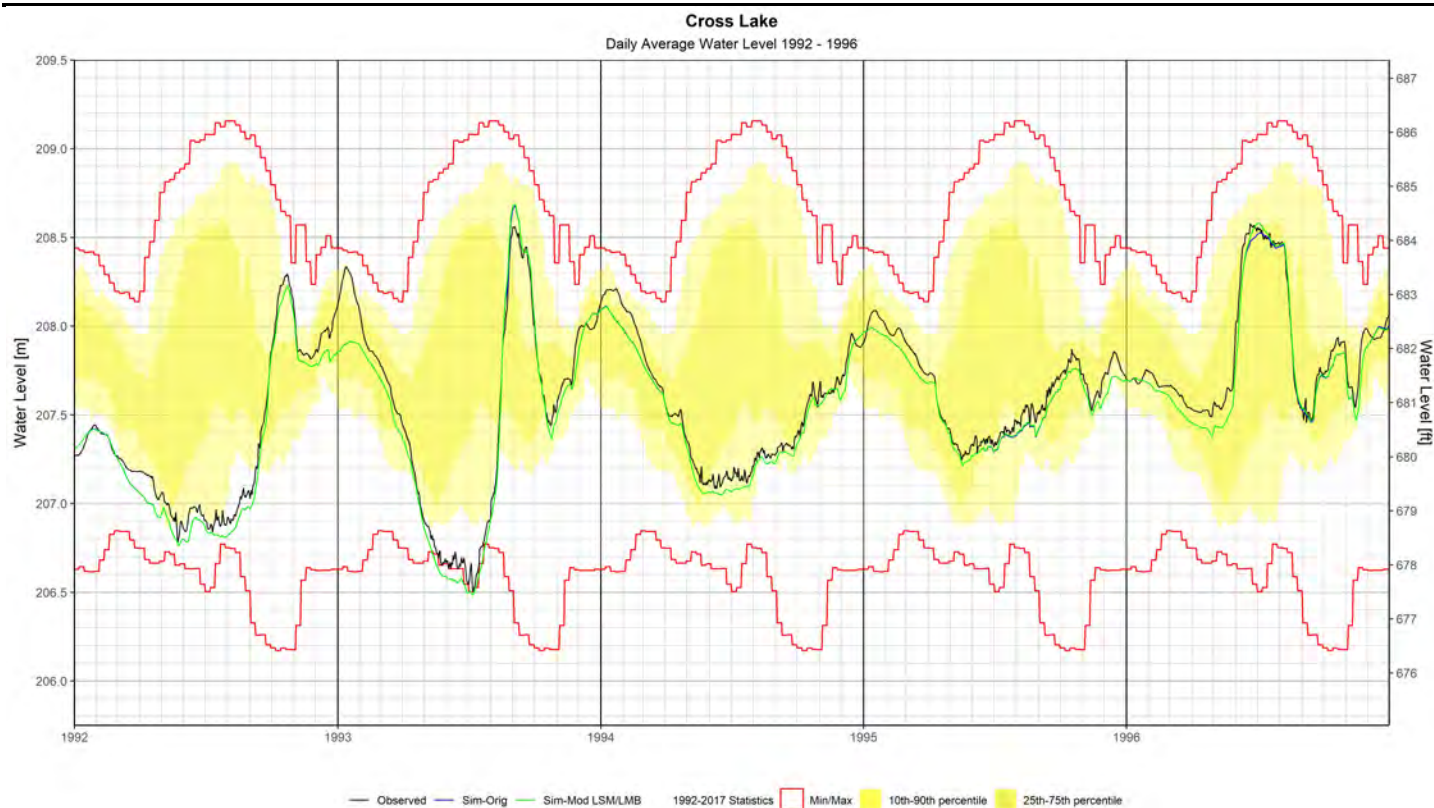


Figure 9: Cross Lake 1992-1996

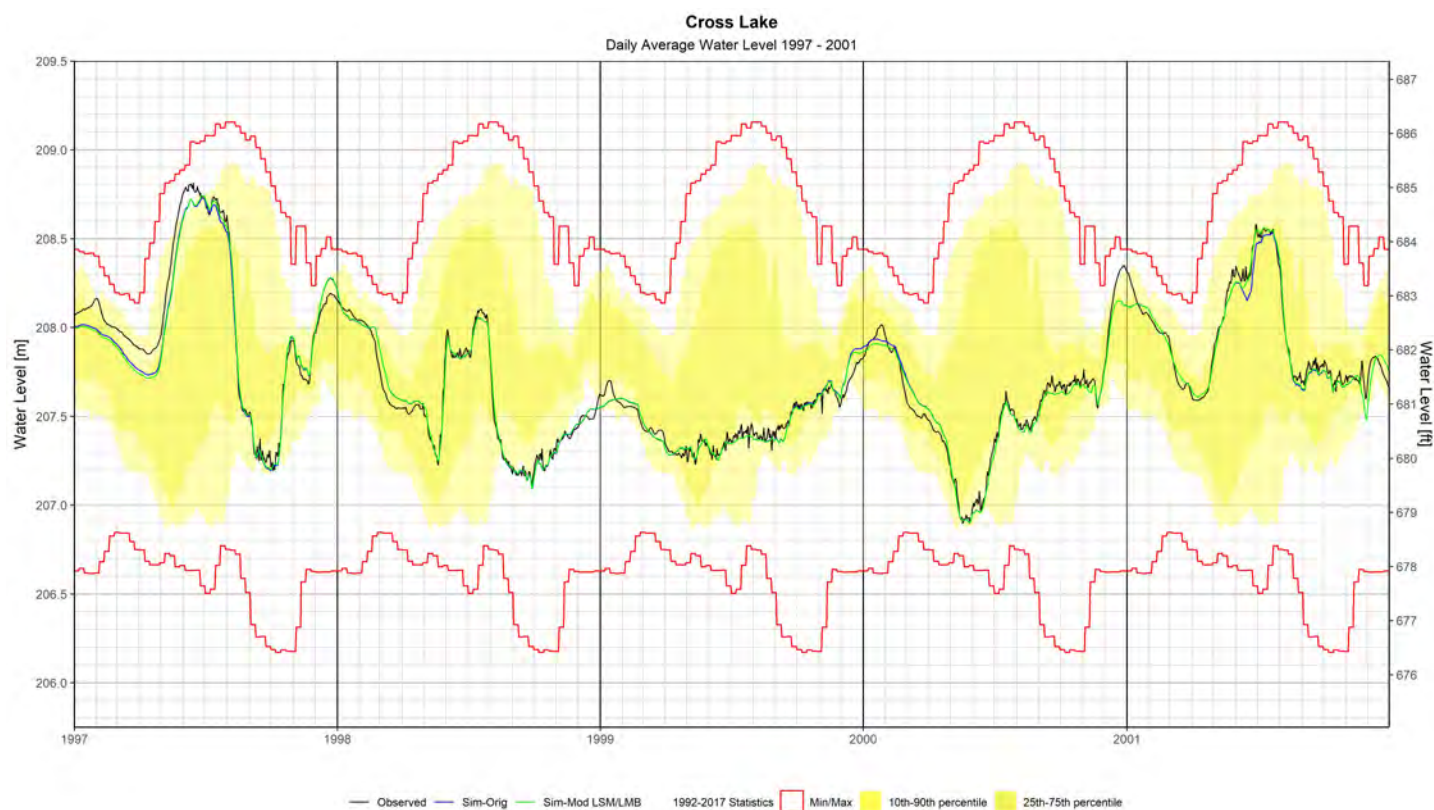


Figure 10: Cross Lake 1997-2001

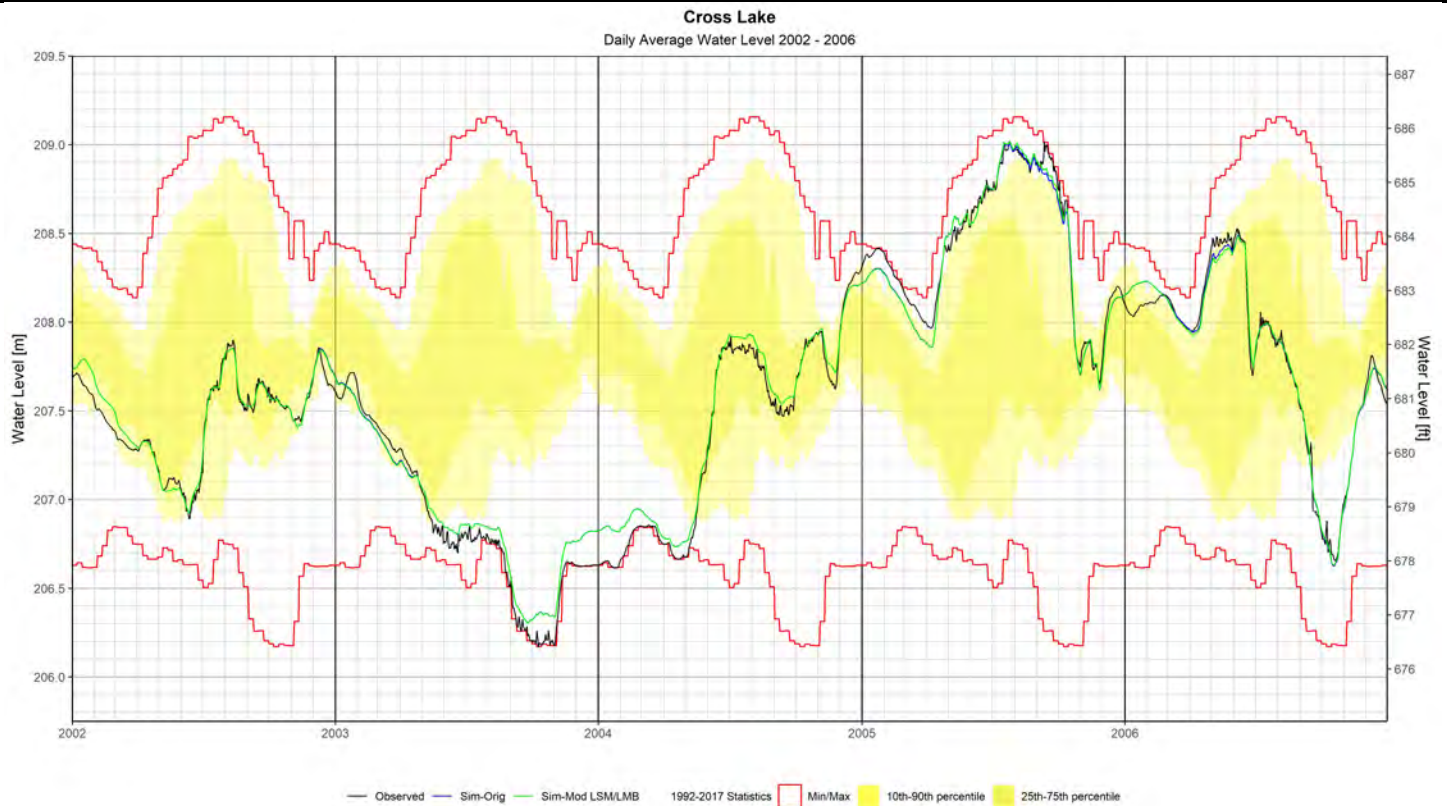


Figure 11: Cross Lake 2002-2006

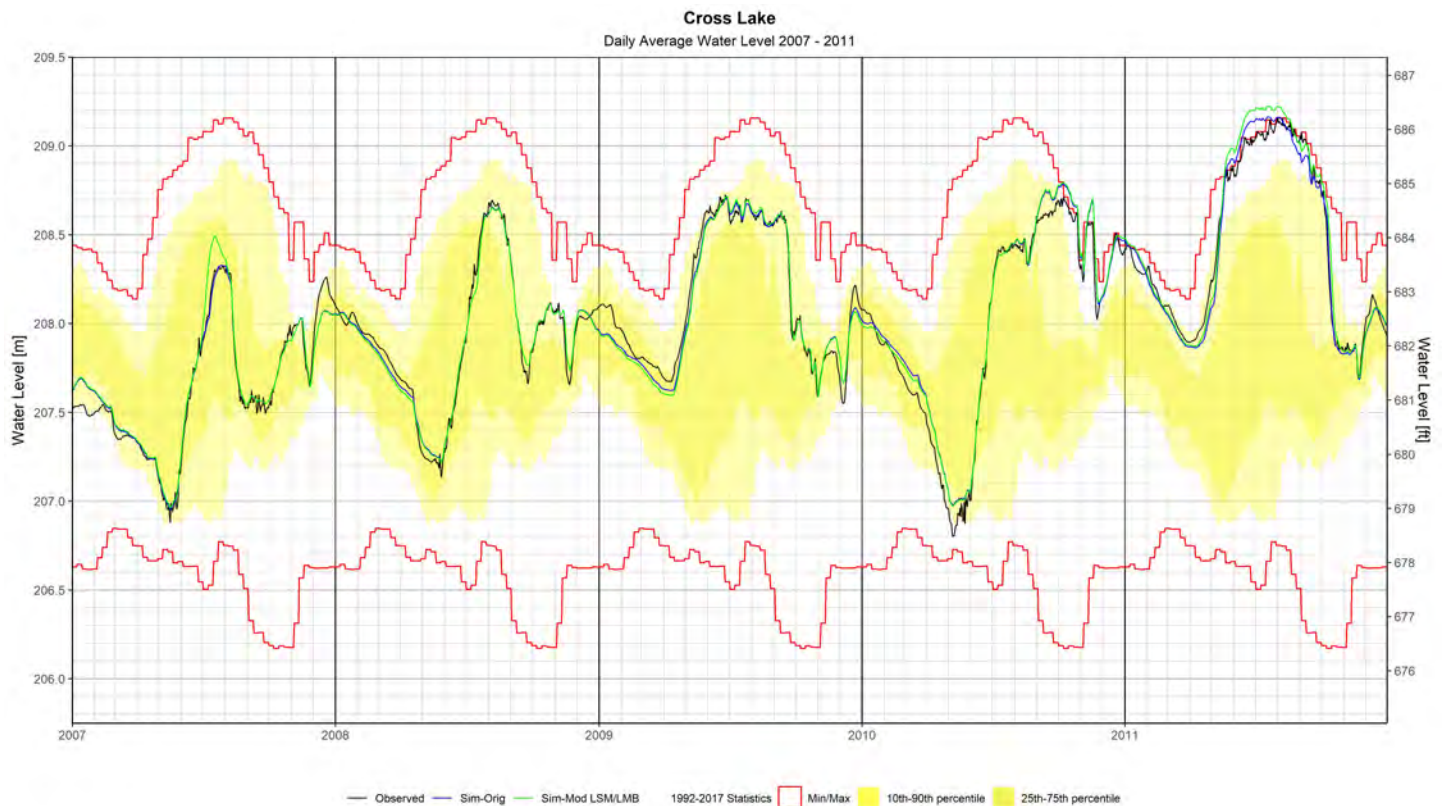
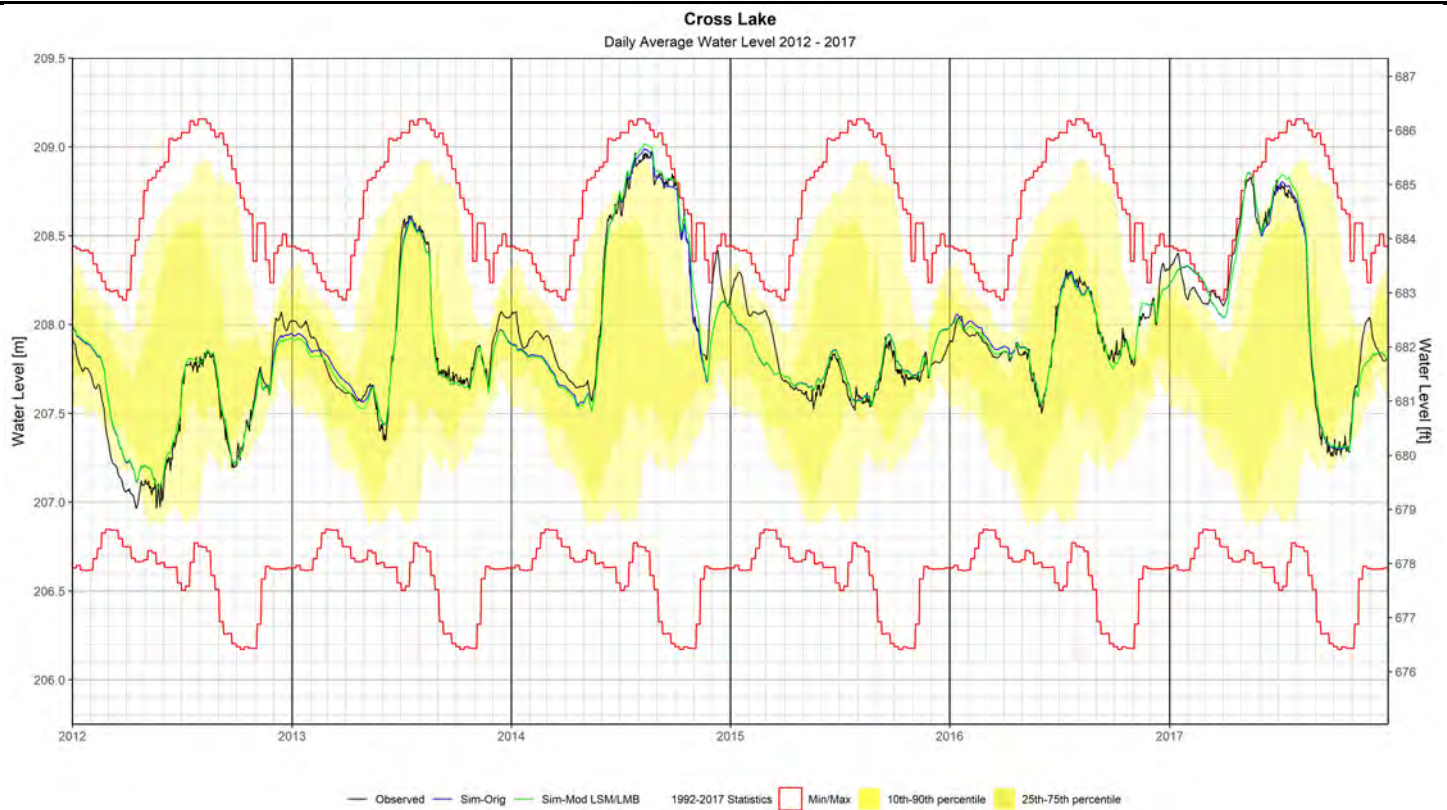


Figure 12: Cross Lake 2007-2011

**Figure 13: Cross Lake 2012-2017**

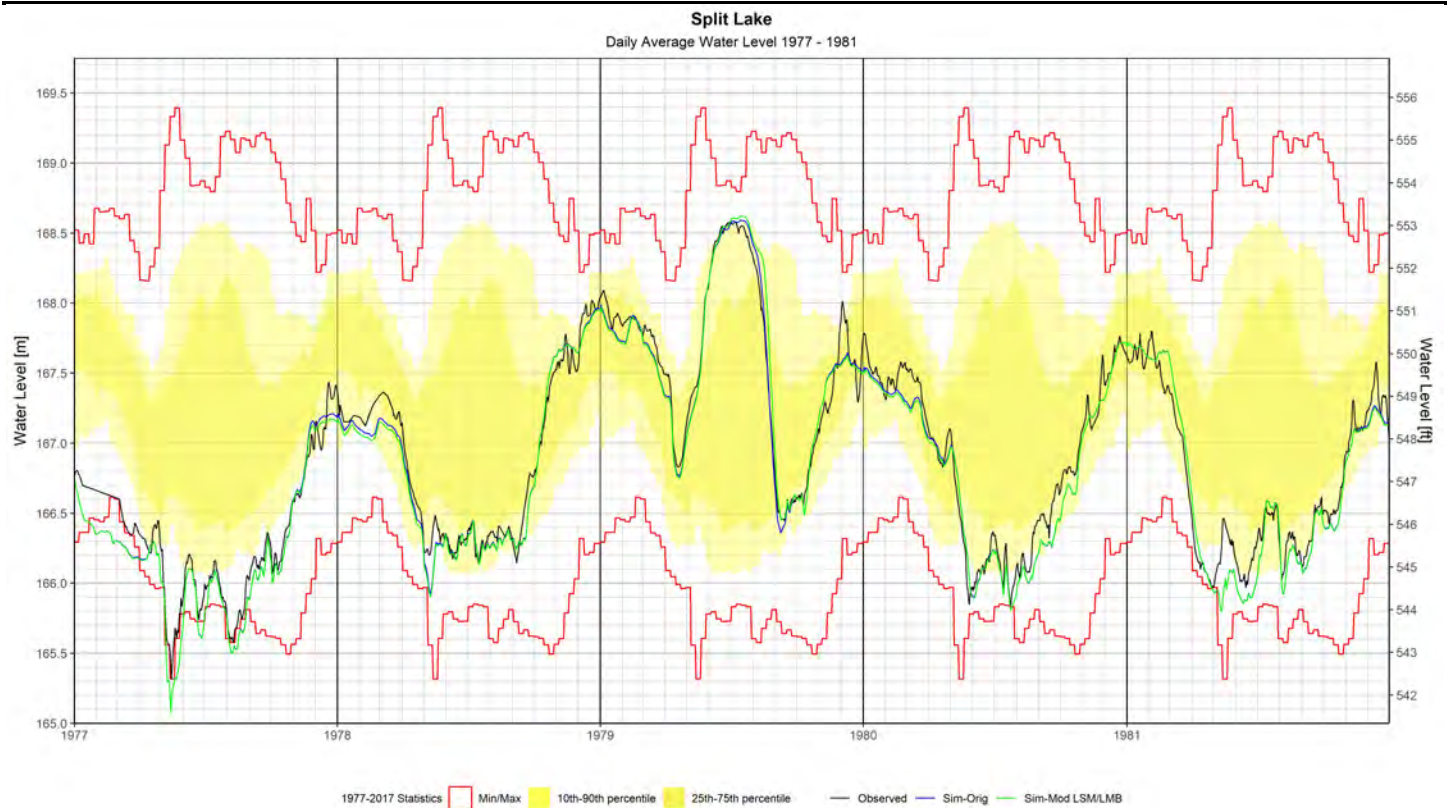


Figure 14: Split Lake 1977-1981



Figure 15: Split Lake 1982-1986

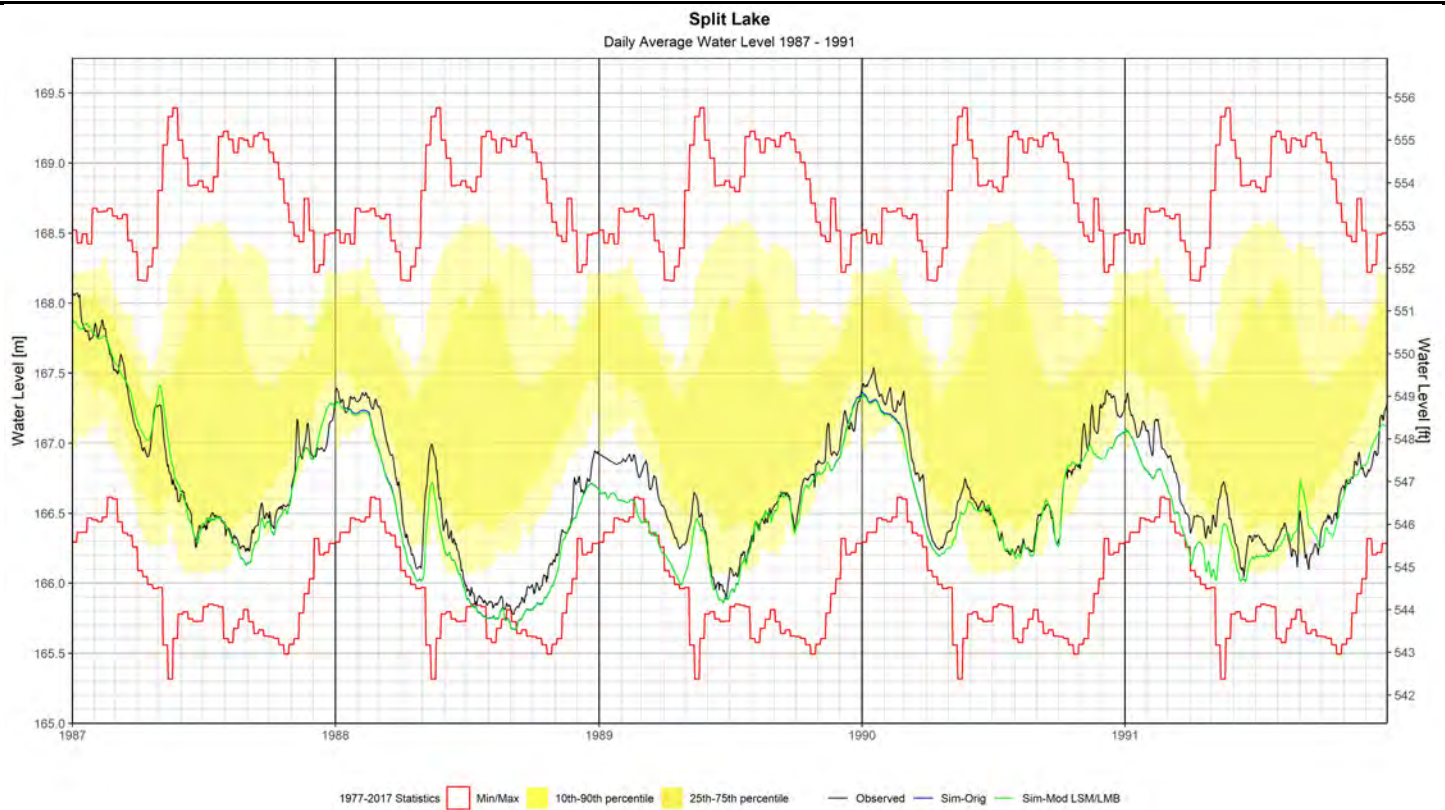


Figure 16: Split Lake 1987-1991

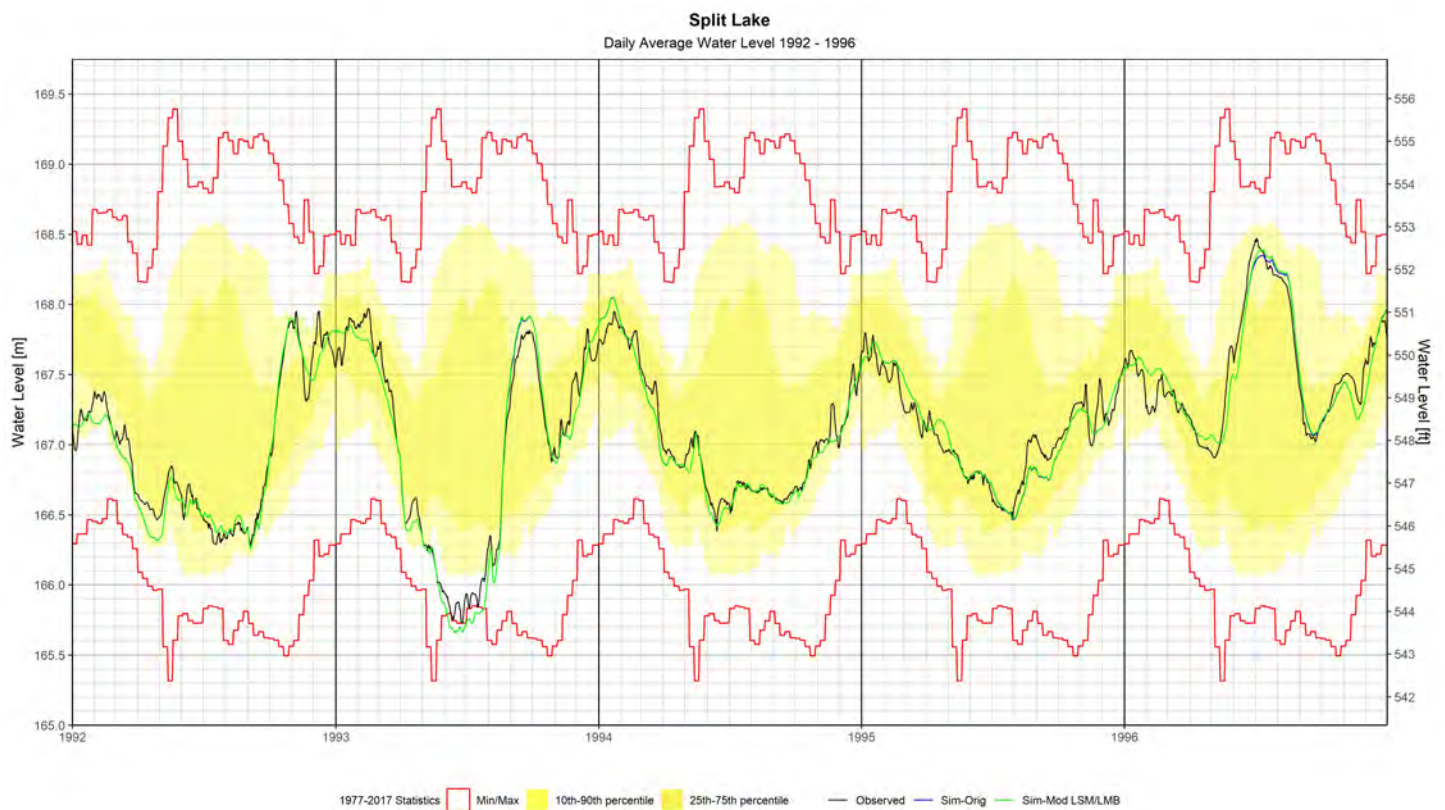


Figure 17: Split Lake 1992-1996



Figure 18: Split Lake 1997-2001

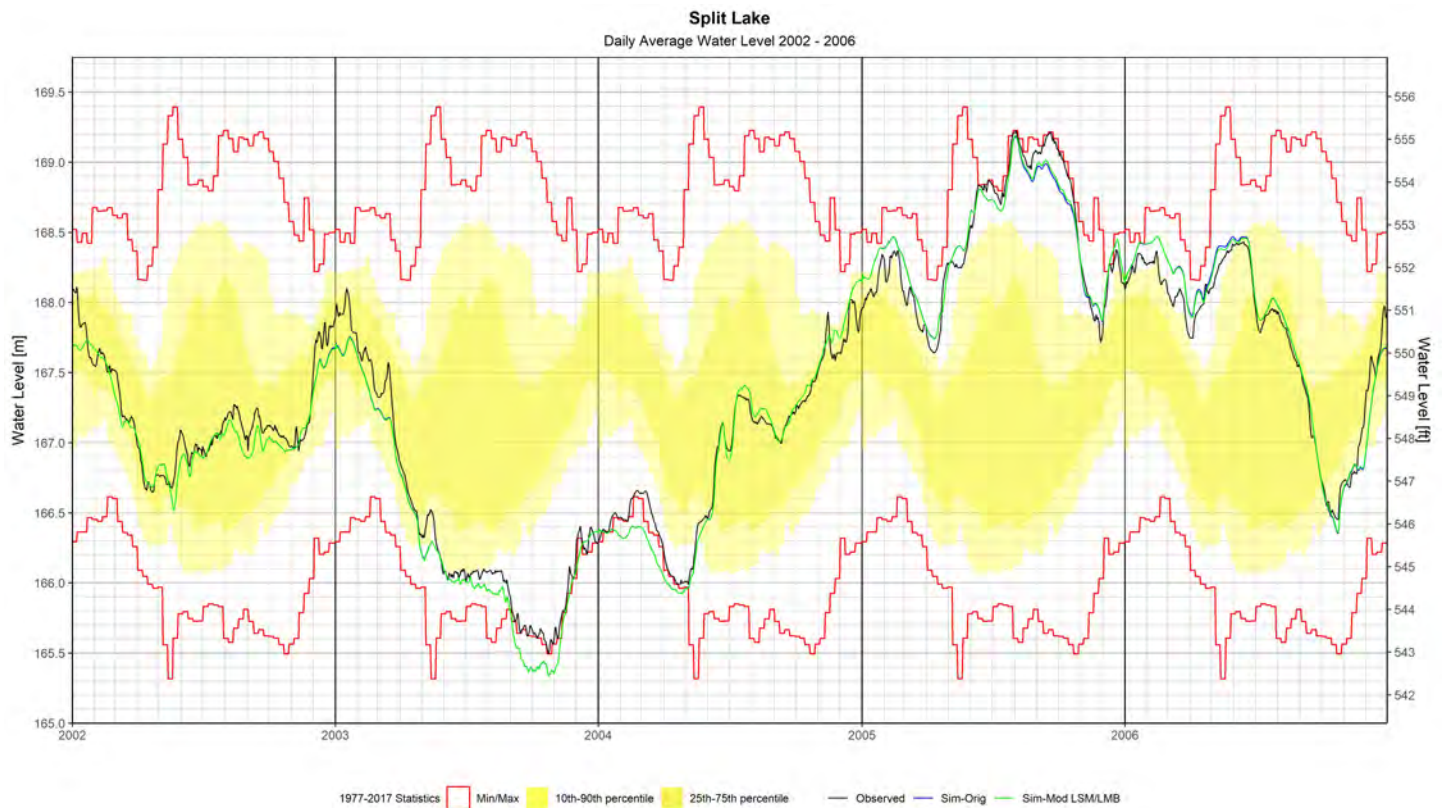


Figure 19: Split Lake 2002-2006

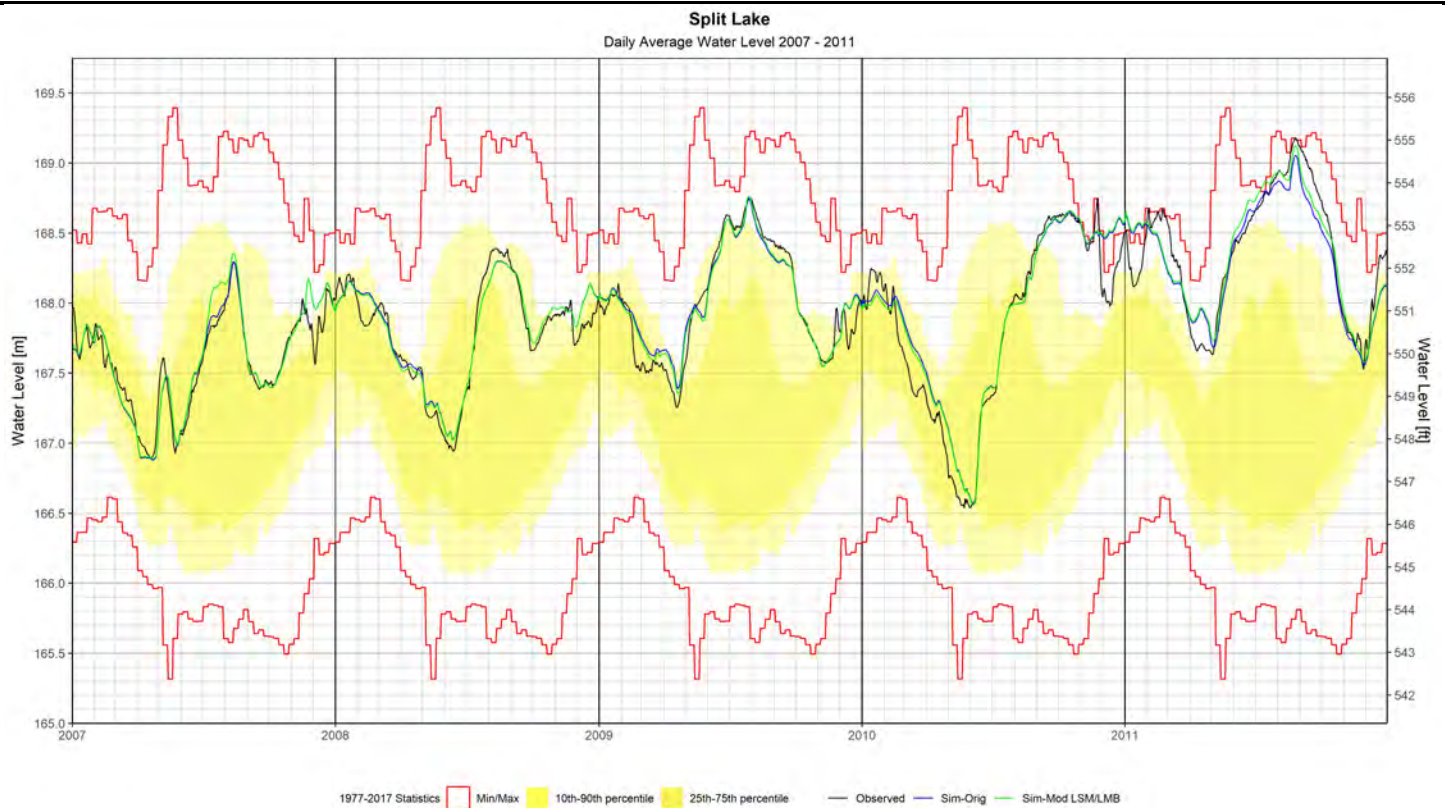


Figure 20: Split Lake 2007-2011

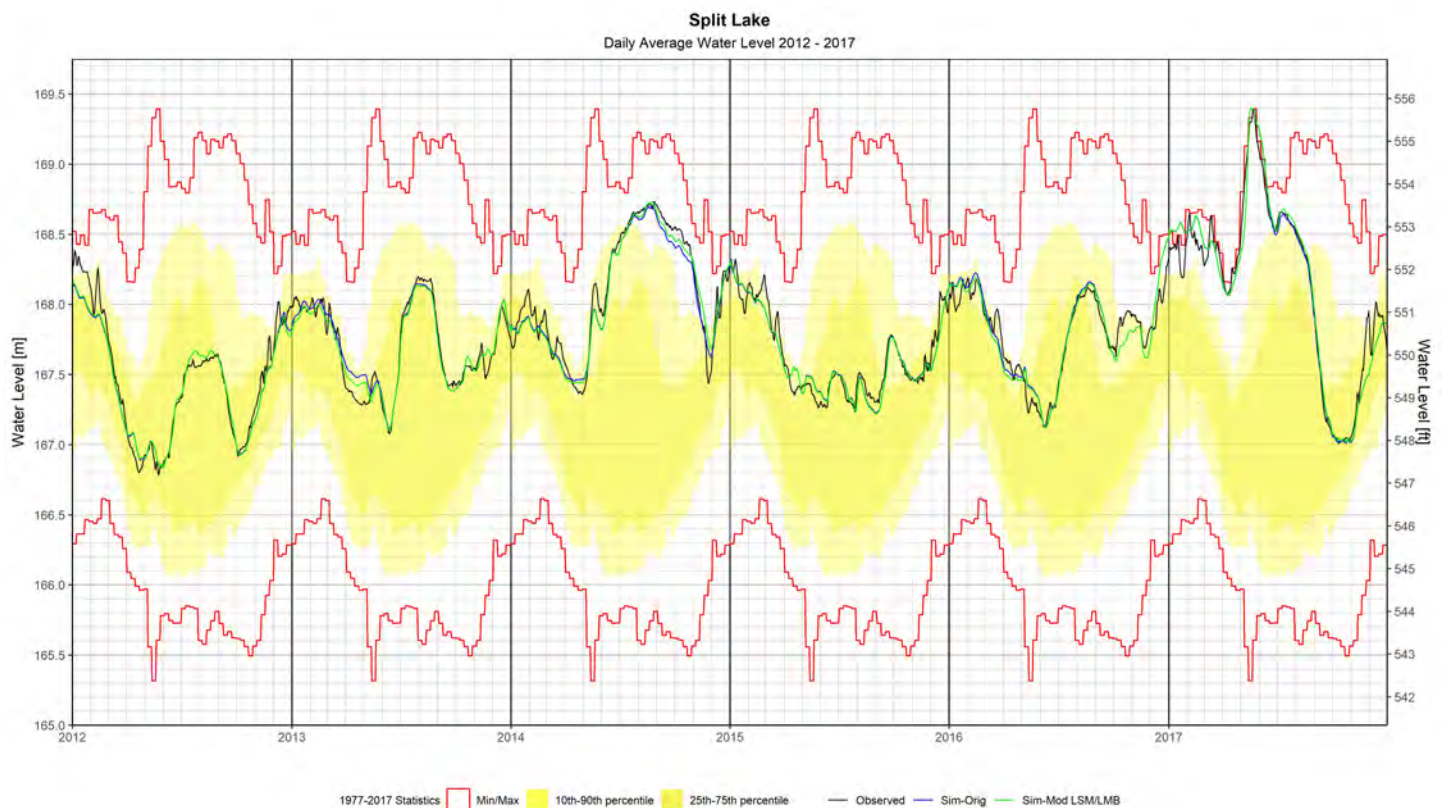


Figure 21: Split Lake 2012-2017