

Devils Lake, North Dakota

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The Devils Lake Basin is a closed basin within the Red River of the North watershed in northeastern North Dakota. It has been generally rising since 1940, but during the 1990's the rate of rise increased dramatically. From 1993 to 2000 the lake level increased about 23 feet inundating neighborhoods and farmland in the area. In 1992 the lake occupied an area of about 45,000 acres; By 2000 the lake area increased to around 118,000 acres causing flood damages exceeding \$300 million.

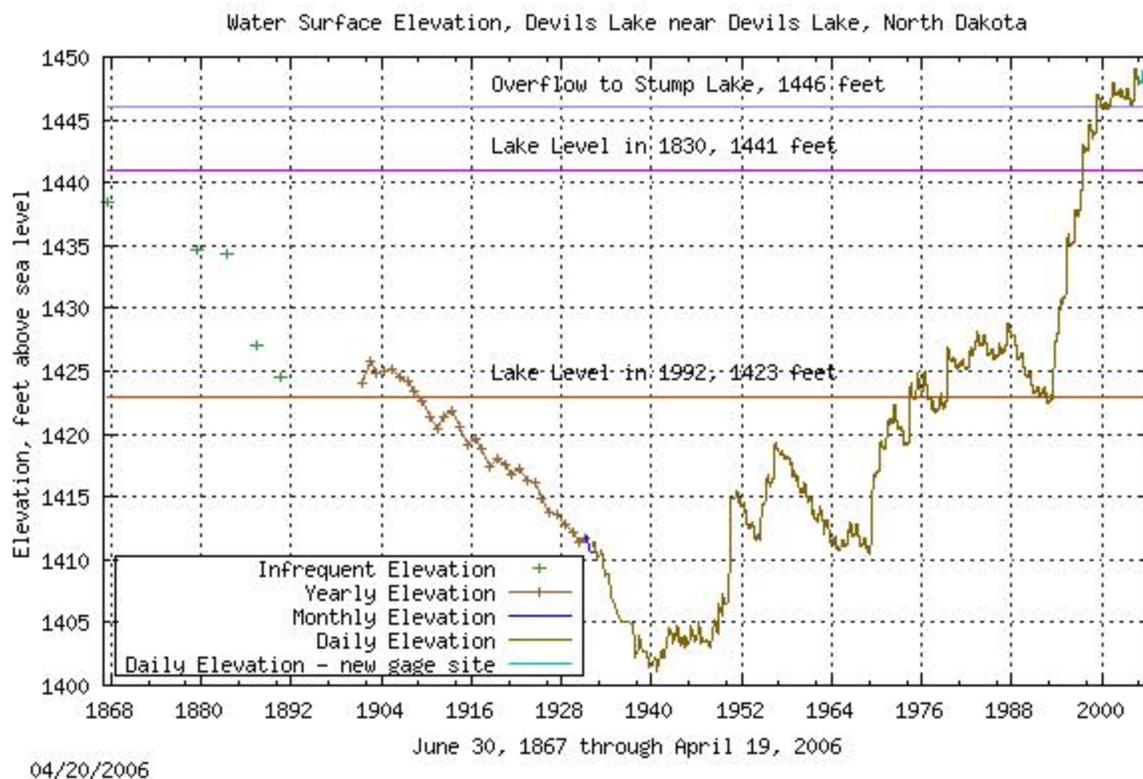


Figure 1. Devils Lake elevation from 1867 to 2006 (Image courtesy of the USGS).

Since 2000 Devils Lake has been spilling into nearby Stump Lake causing it to rise. At first the volume of water spilled was small, but in the spring of 2004 Devils Lake rose sharply and began spilling more water into Stump Lake. Stump Lake rose 24 feet by Spring, 2006 causing flooding problems of it's own. The lake area increased from 8,143 acres to 12,356 acres. For more details please visit the [USGS Devils Lake website](#).

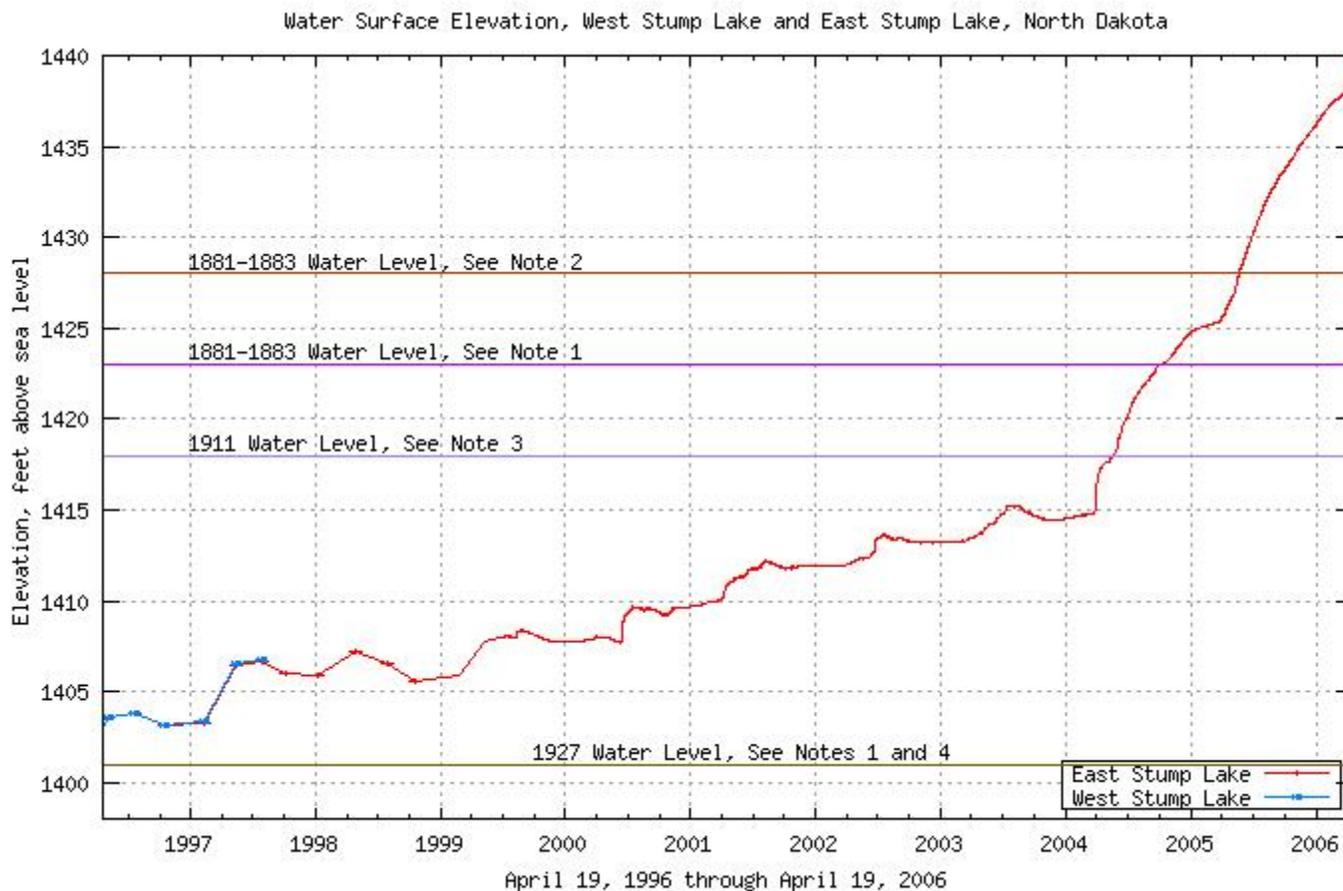


Figure 2. Stump Lake elevation from 1996 to 2006 (Image courtesy of the USGS).

Devils Lake

The North Central River Forecast Center (NCRFC) issues monthly long range probabilistic forecasts for the elevations of both Devils Lake and Stump Lake throughout the year. Starting in January these forecasts are for the period starting with the issuance date and extending through the end of the following September.

The probabilistic forecasts are based on an ensemble of hydrographs that are generated using the current soil, snow, river, and lake conditions in our hydrologic model as starting conditions. We then run our models out through the end of September using historical precipitation and temperature time series from the past 55 years of record. The following graph displays each of these traces.

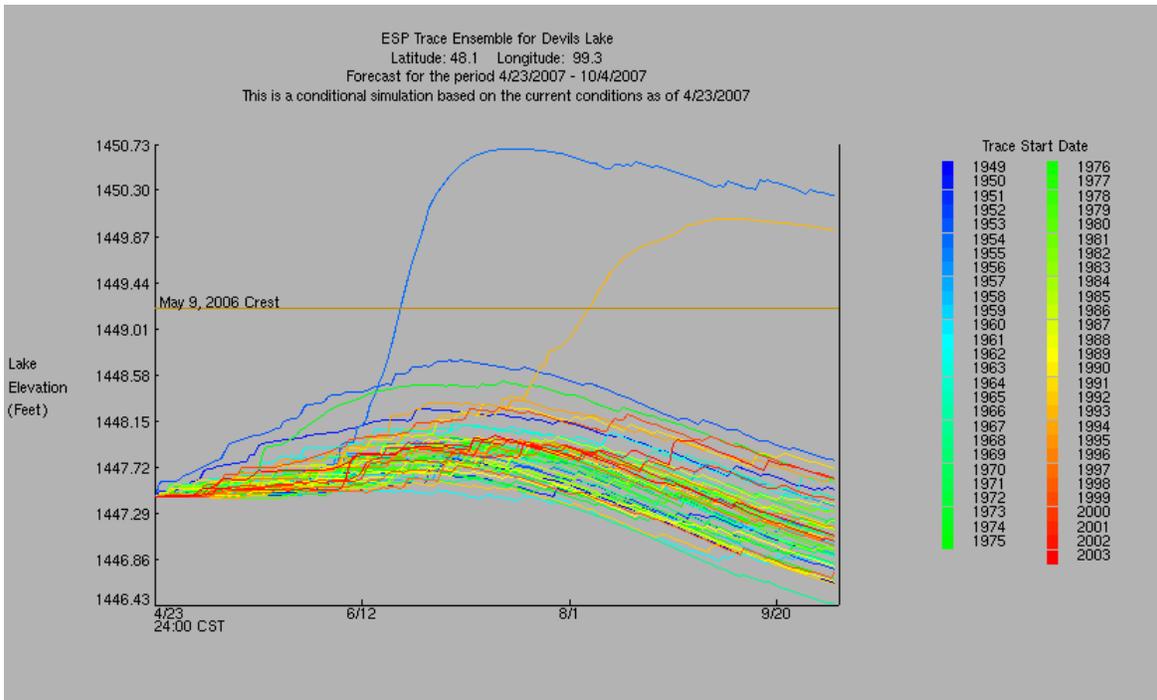


Figure 3. Hydrograph ensemble for Devils Lake elevation.

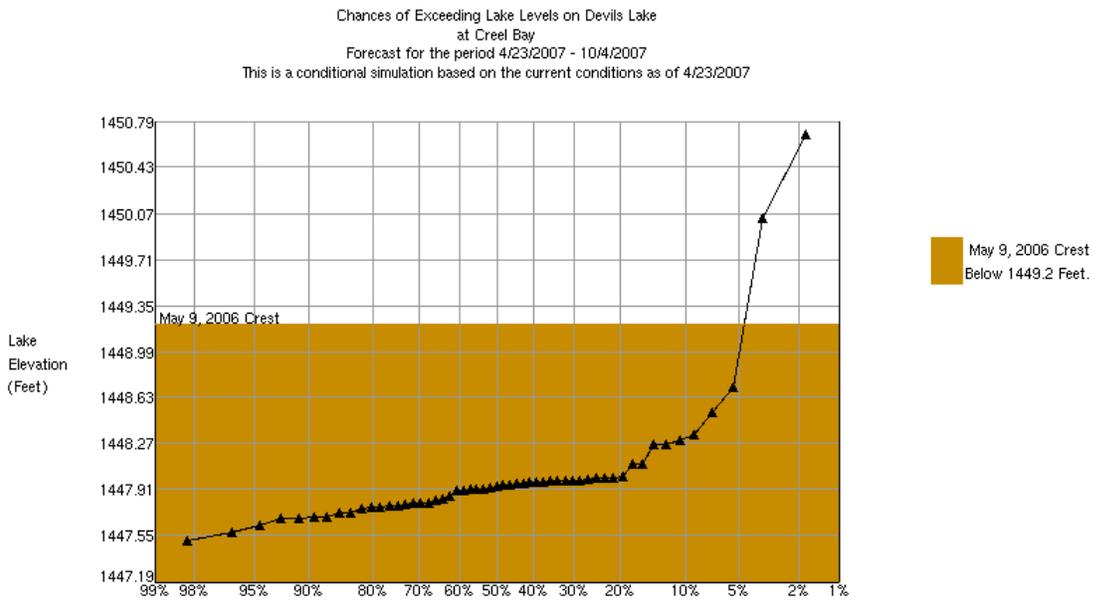


Figure 4. Exceedance probability graph for Devils Lake at Creel Bay.

Figure 3 shows most of the hydrographs not reaching last year's crest of 1449.2 ft. This is partly because the lake fell over two feet from that crest last year, and partly because of below normal precipitation last summer and fall.

The main concern with Devils Lake is how high it will rise this summer from spring snowmelt and rainfall runoff. If we take the maximum elevation from each of the hydrographs shown above, we can generate a probability distribution showing the likelihood of reaching a particular stage. This plot is shown in Figure 4.

Stump Lake

Stump Lake is rising and may soon catch up with Devils Lake. The following plot shows the simulated difference in elevation between Devils Lake and Stump Lake. Right now the elevation difference between the two lakes is about 2.0 feet, but by the end of the summer the lakes may be within about 0.5 feet of each other.

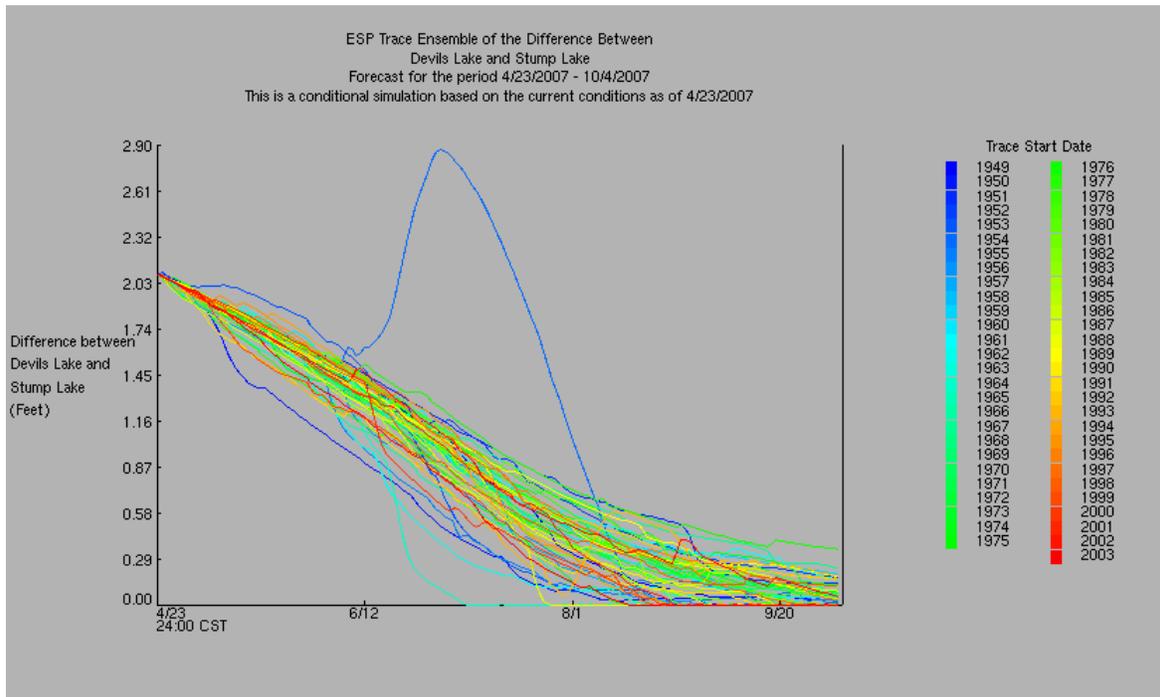


Figure 5. Hydrograph ensemble showing the difference in elevation between Devils Lake and Stump Lake.

Figure 6 shows the chances of the two lakes having the associated elevation difference between them. If we take the minimum elevation difference from each of the hydrographs shown above, we can generate a probability distribution showing the likelihood of reaching a particular elevation difference.

Chances that the difference between Devils Lake and
Stump Lake will reach a given value during the
forecast period 4/23/2007 - 9/30/2007
This is a conditional simulation based on the current conditions as of 4/23/2007

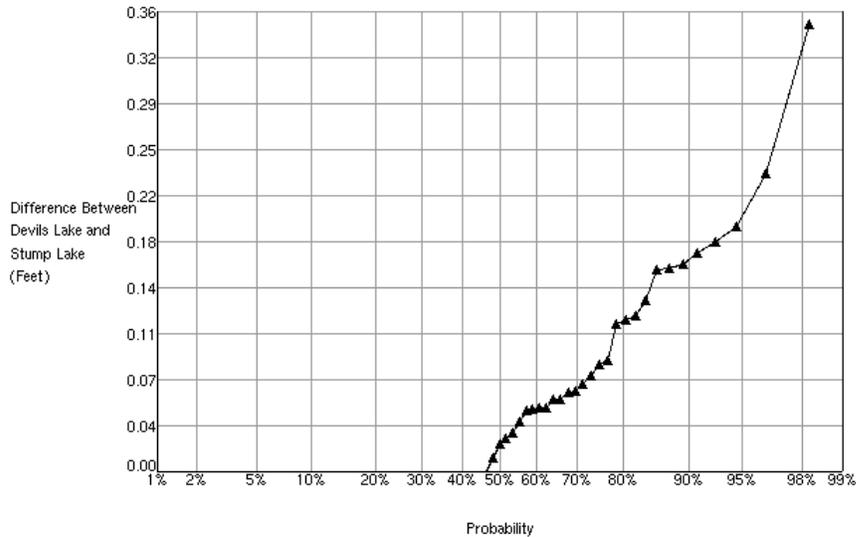


Figure 6. Graph showing the probability of the difference between Devils Lake and Stump Lake reaching certain values.

For example, Figure 6 shows a 50% probability that the elevation difference between Devils Lake and Stump Lake will reach zero. There is about a 20% chance of the difference falling to 0.2 ft between April 23rd and September 30th.

Forecast Assumptions

It is important to note the following limitations to these products:

- An average monthly lake evaporation curve is used to simulate evaporation from the lake. The same curve is used for every climate scenario we run.
- Since the pump that sends water from Devils Lake to the Sheyenne River wasn't operated last year, we turned it off for all of our simulations.
- We only simulate average lake elevations as measured at Creel Bay on Devils lake and the USGS gage on Stump Lake. Higher elevations may be experienced temporarily in western Devils Lake during spring runoff because that is where most of the runoff enters the lake.