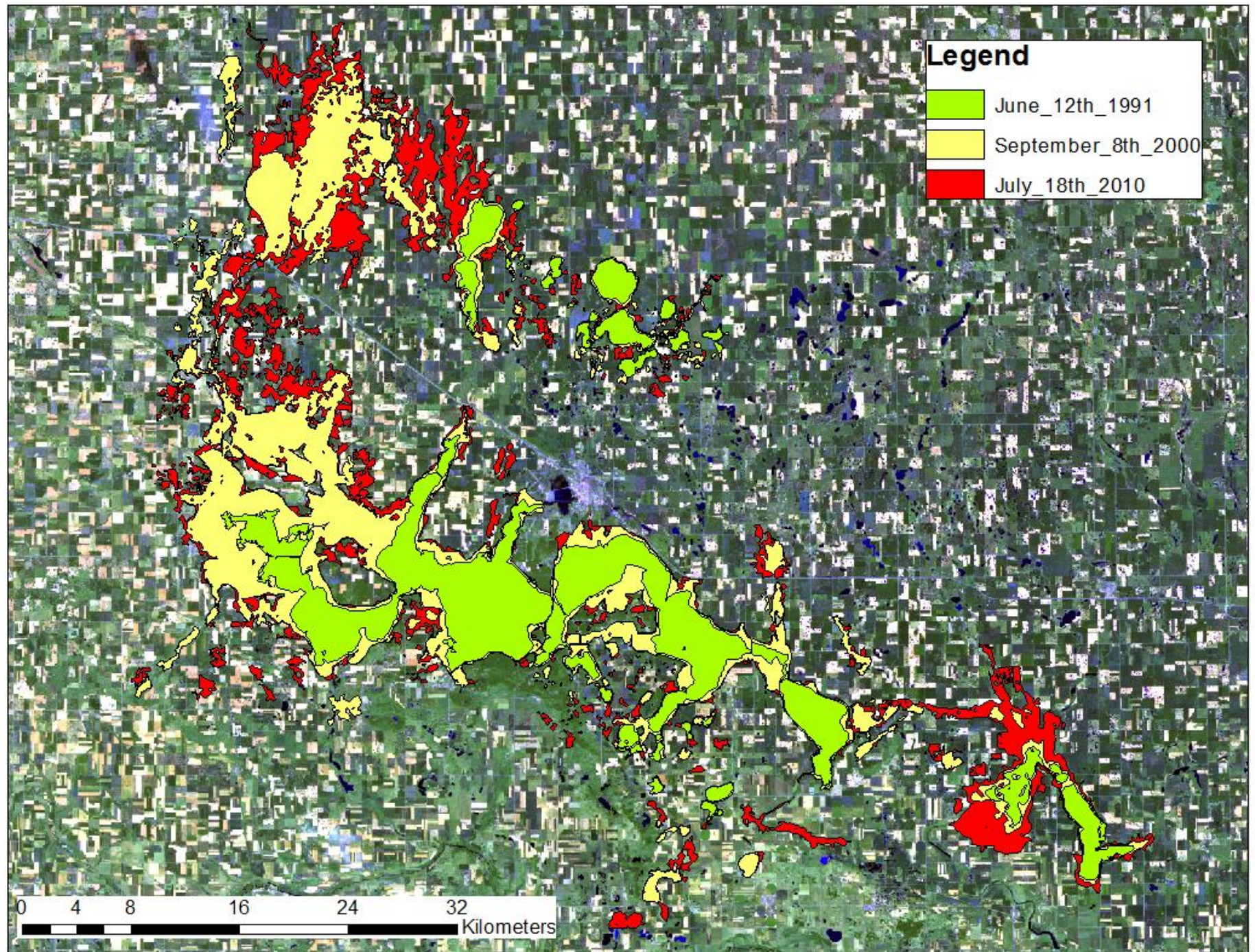
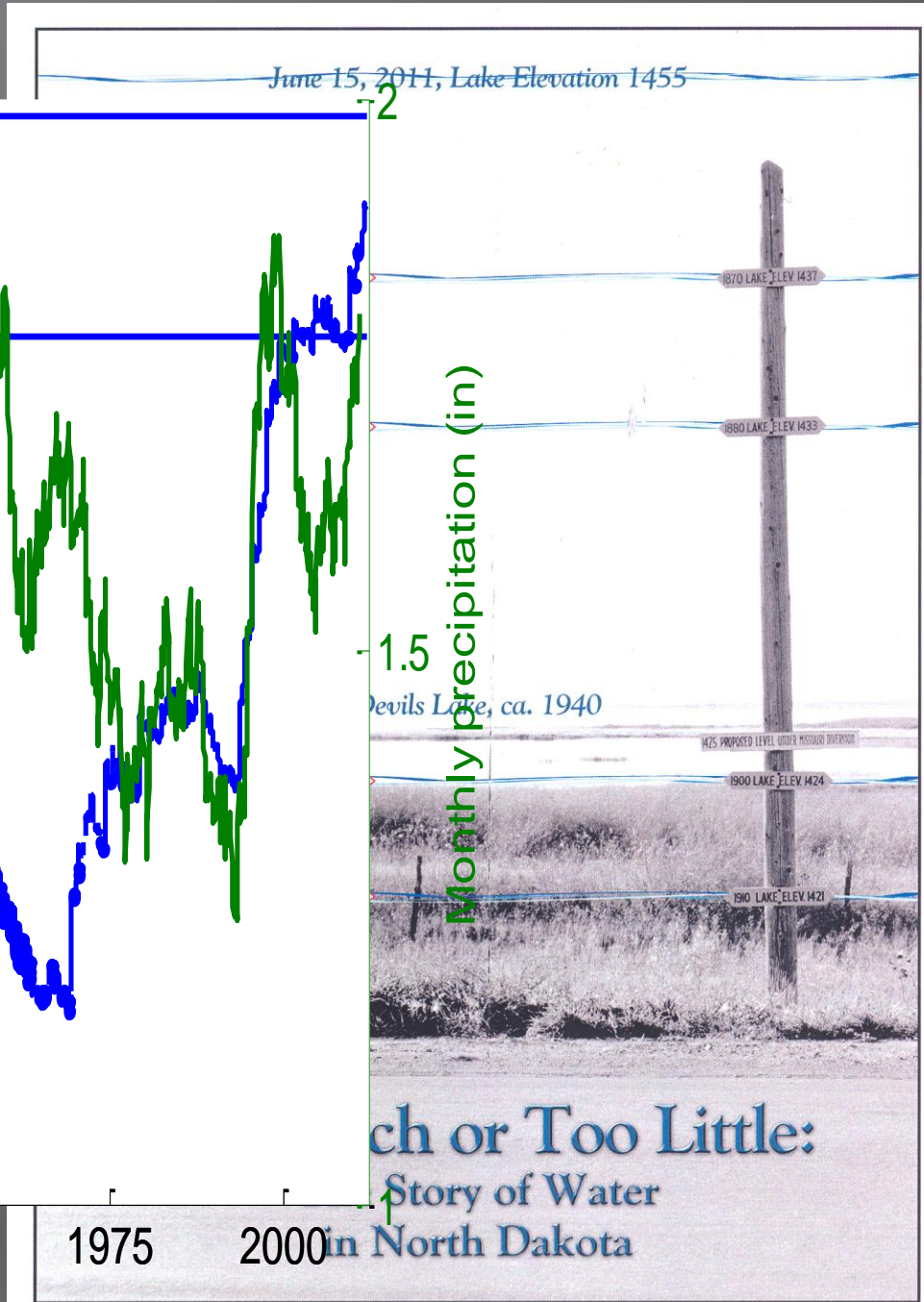
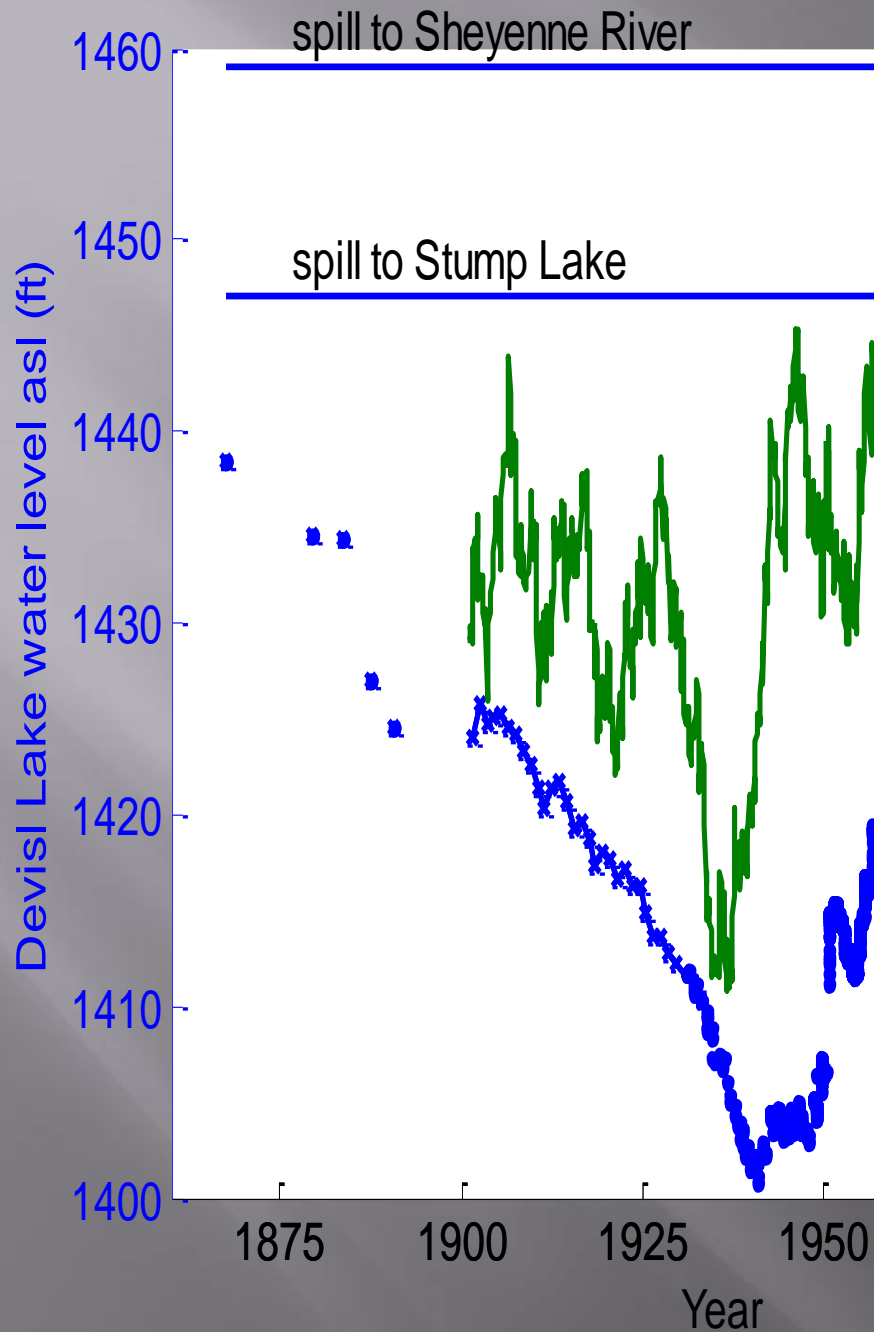


MONITORING WATER QUALITY IN DEVILS LAKE AND BEYOND

Xiaodong Zhang, Kate Overmoe, Chris Pedergast
Department of Earth System Science and Policy,
University of North Dakota





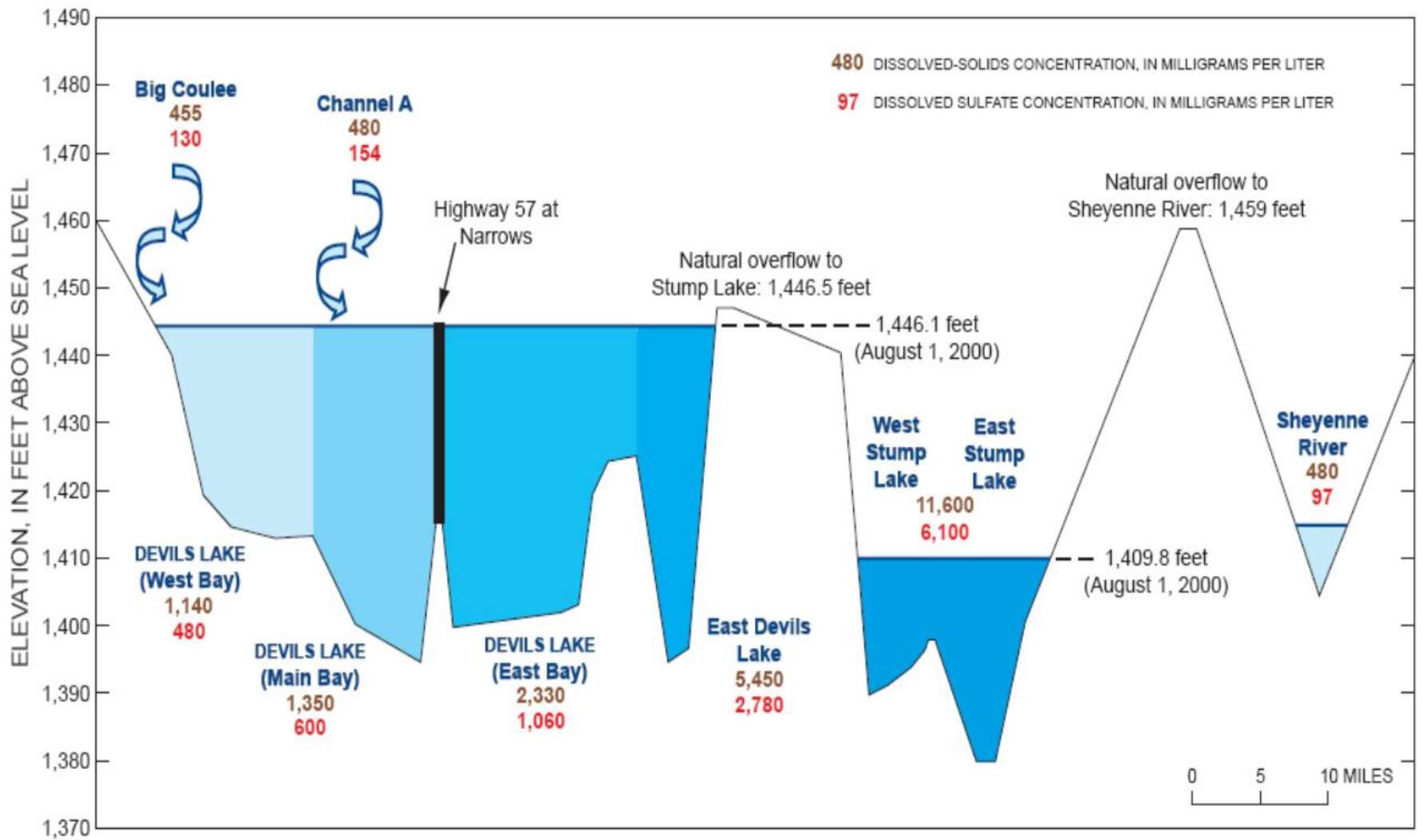


June 15, 2011, Lake Elevation 1455

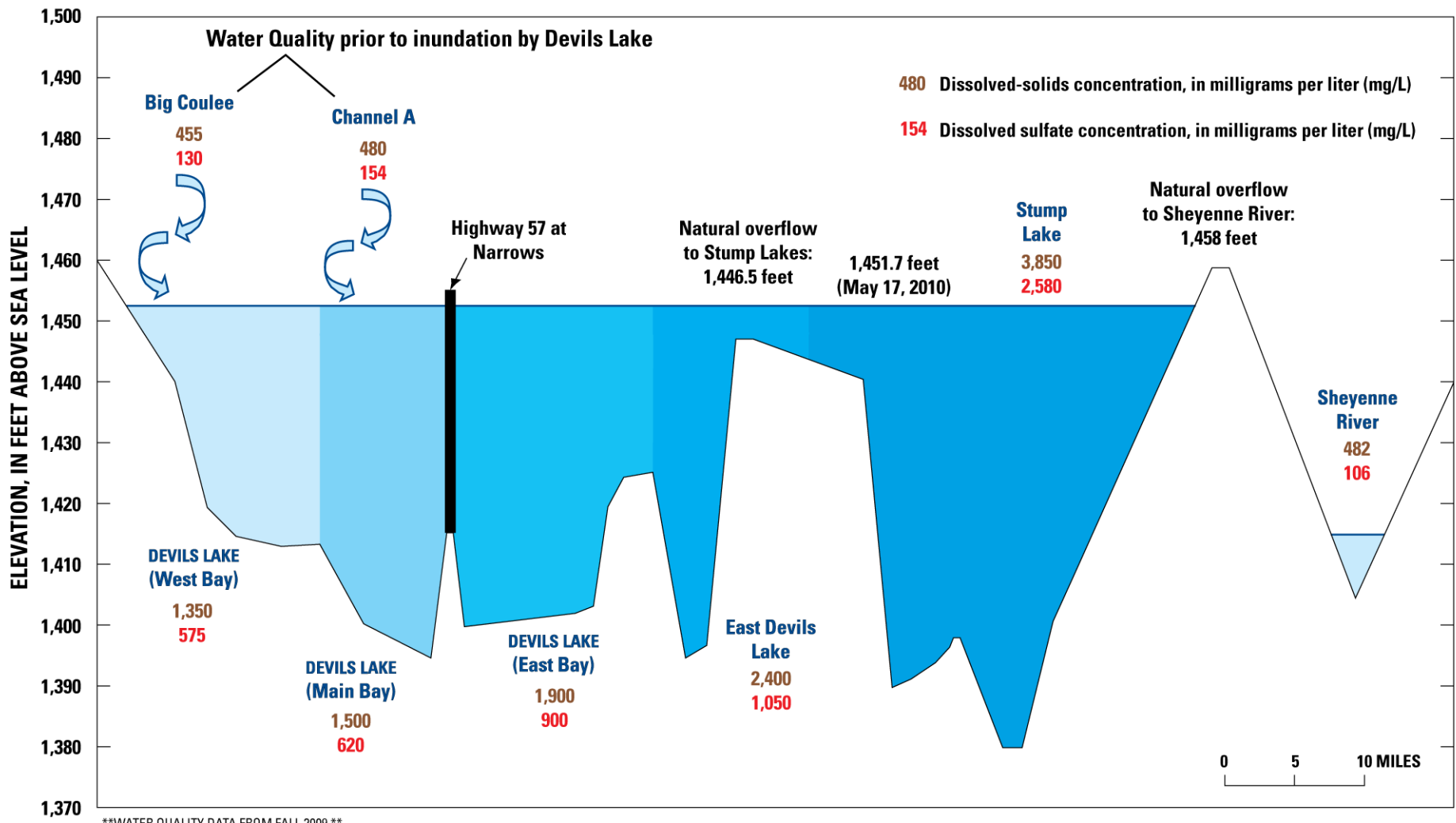
Monthly precipitation (in)

1.5

Devils Lake, ca. 1940



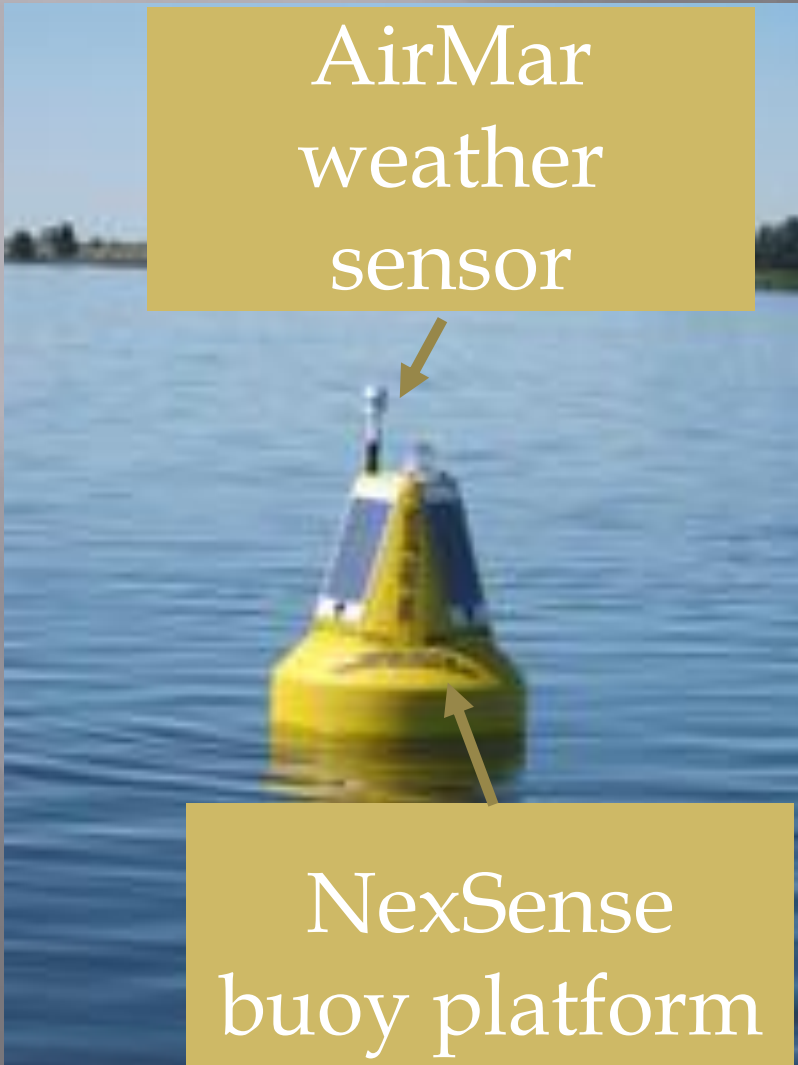
2000



**WATER QUALITY DATA FROM FALL 2009 **

Buoy system to monitor the water quality in real time

AirMar
weather
sensor



NexSense
buoy platform

YSI Sonde



Sensor
package

Launched on Sept 7 and
retrieved on Nov 22



Measurements

- ▣ Weather parameters
 - Air temperature
 - Wind speeds & directions
 - Atmospheric pressure
- ▣ Water parameters
 - Total dissolved solids
 - Turbidity
 - Chlorophyll concentration
 - Salinity
 - Water temperature
- ▣ GPS
 - Latitude and longitude
 - Altitude (does not work well without calibration)

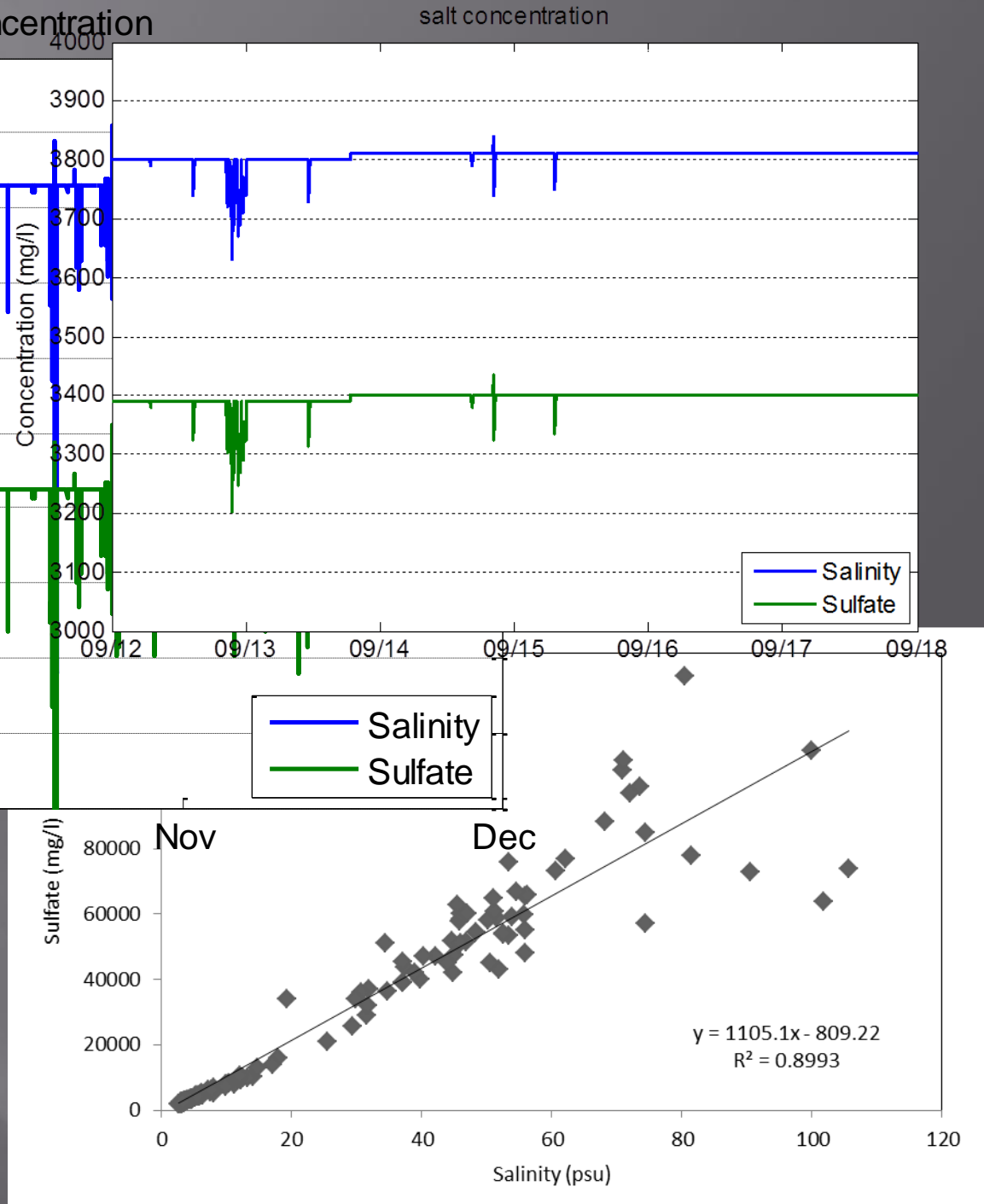
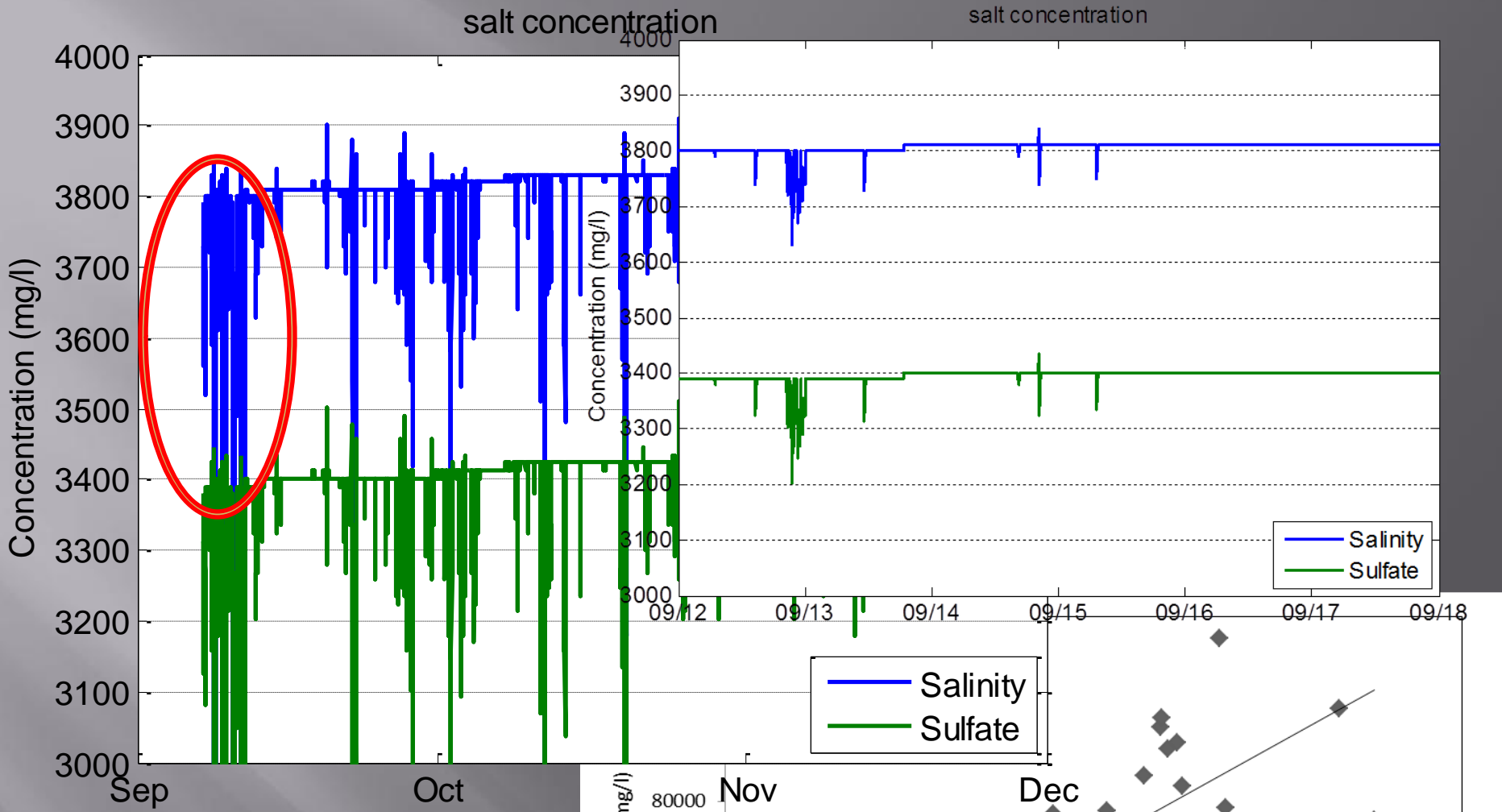
Real time measurement and access

Measurements
are taken every
10 minutes

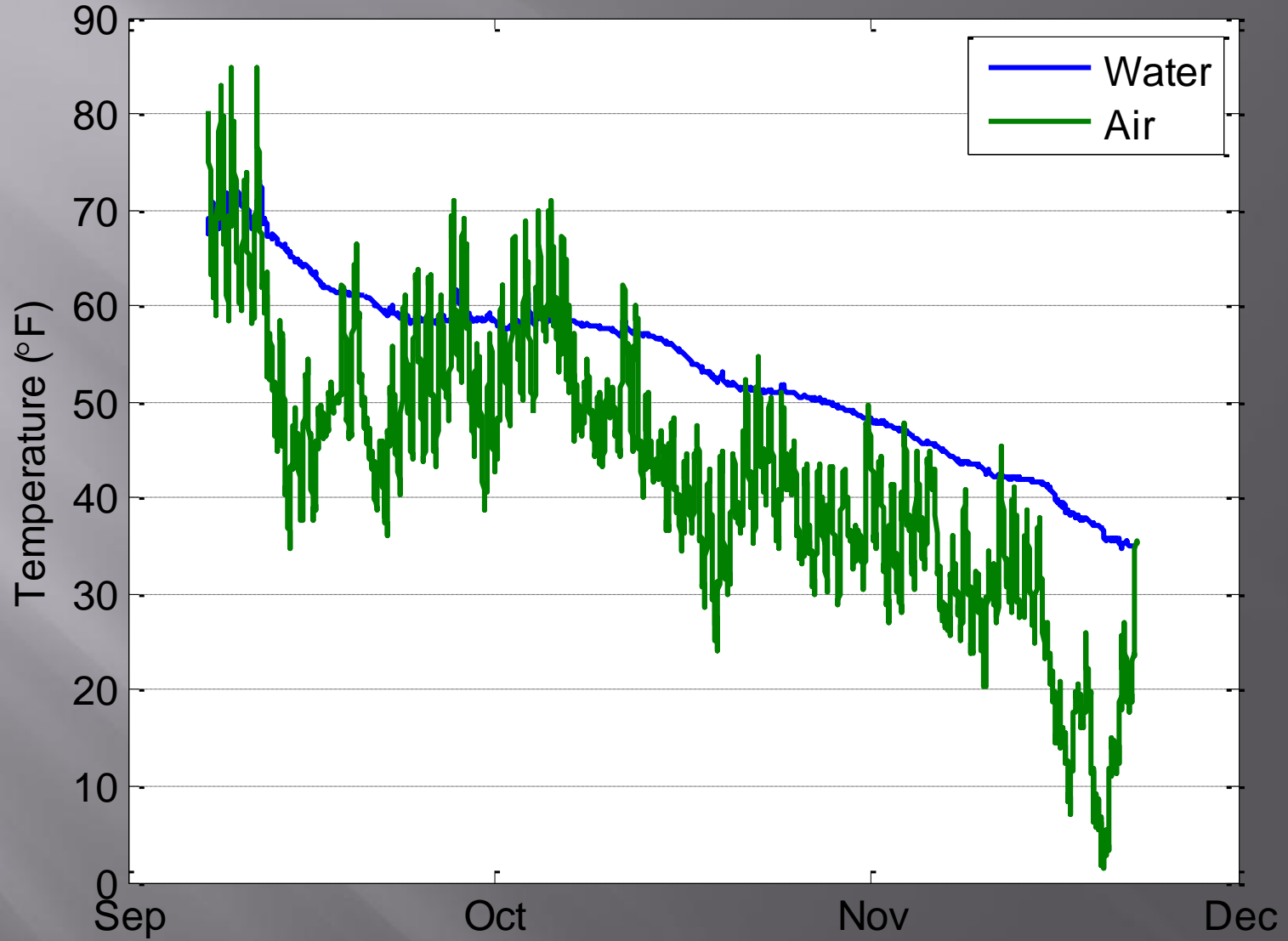
Data are
transfer to the
server every 30
minutes



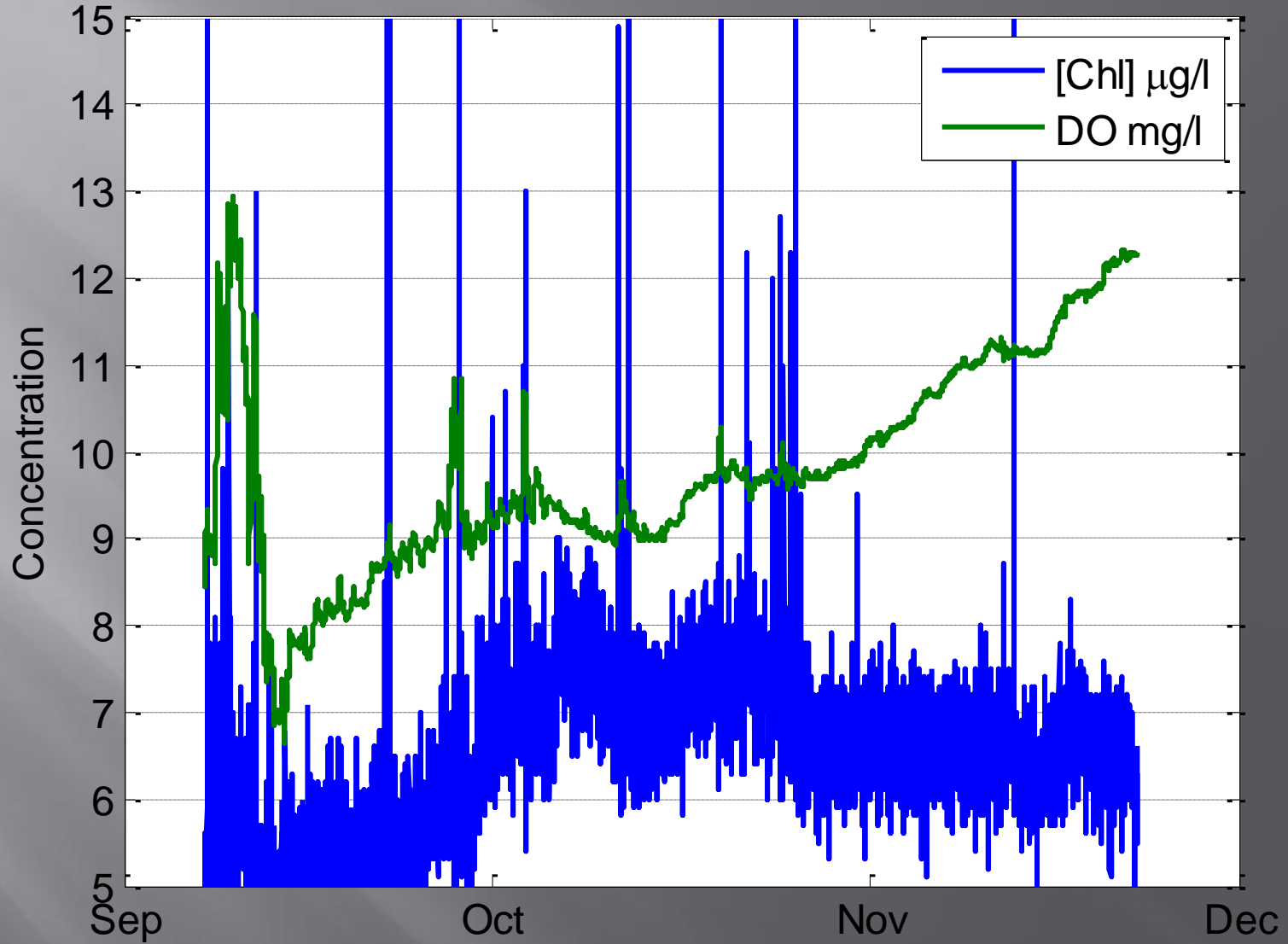
<http://v4.wqdata.com/webdblink/undessp.php>

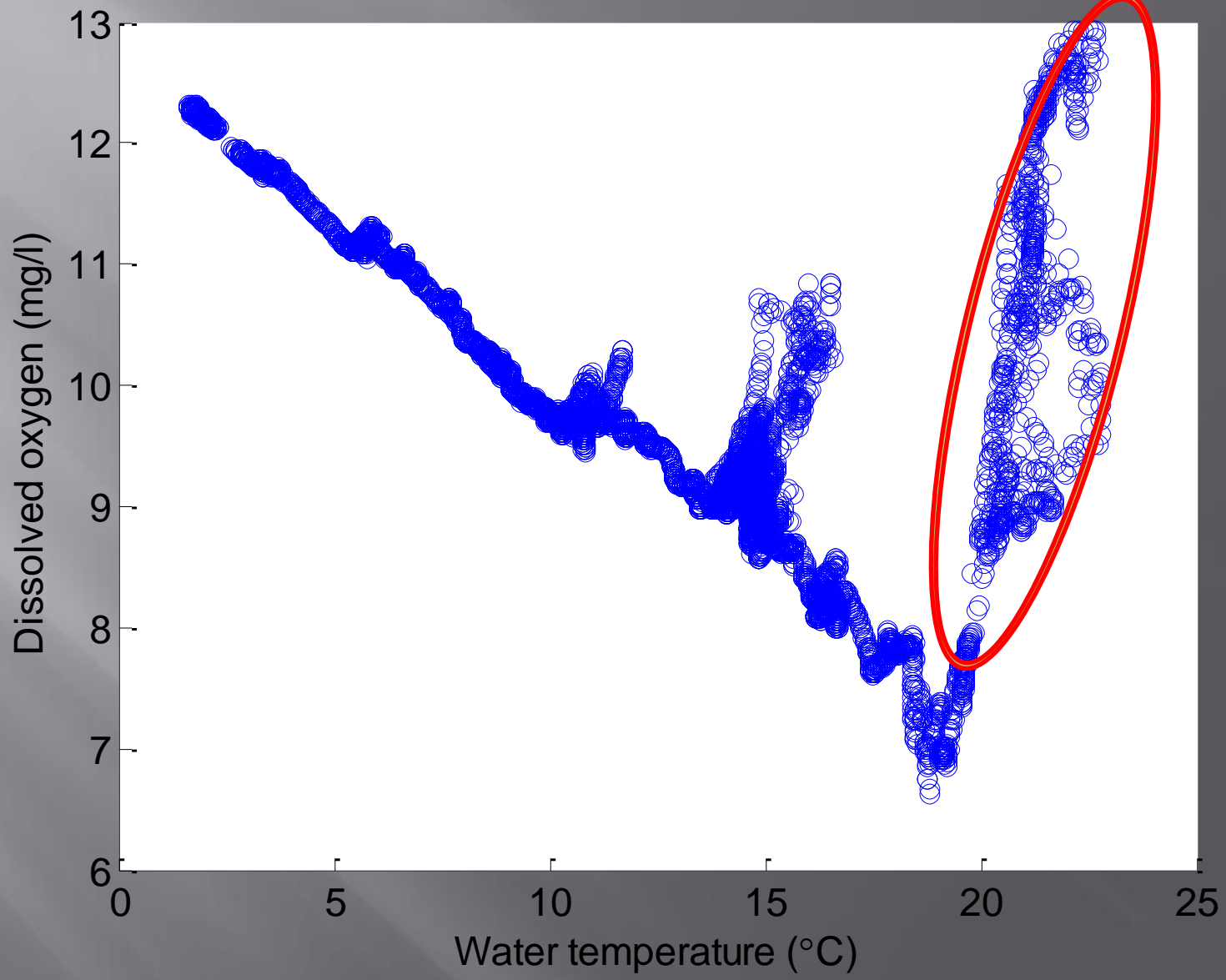


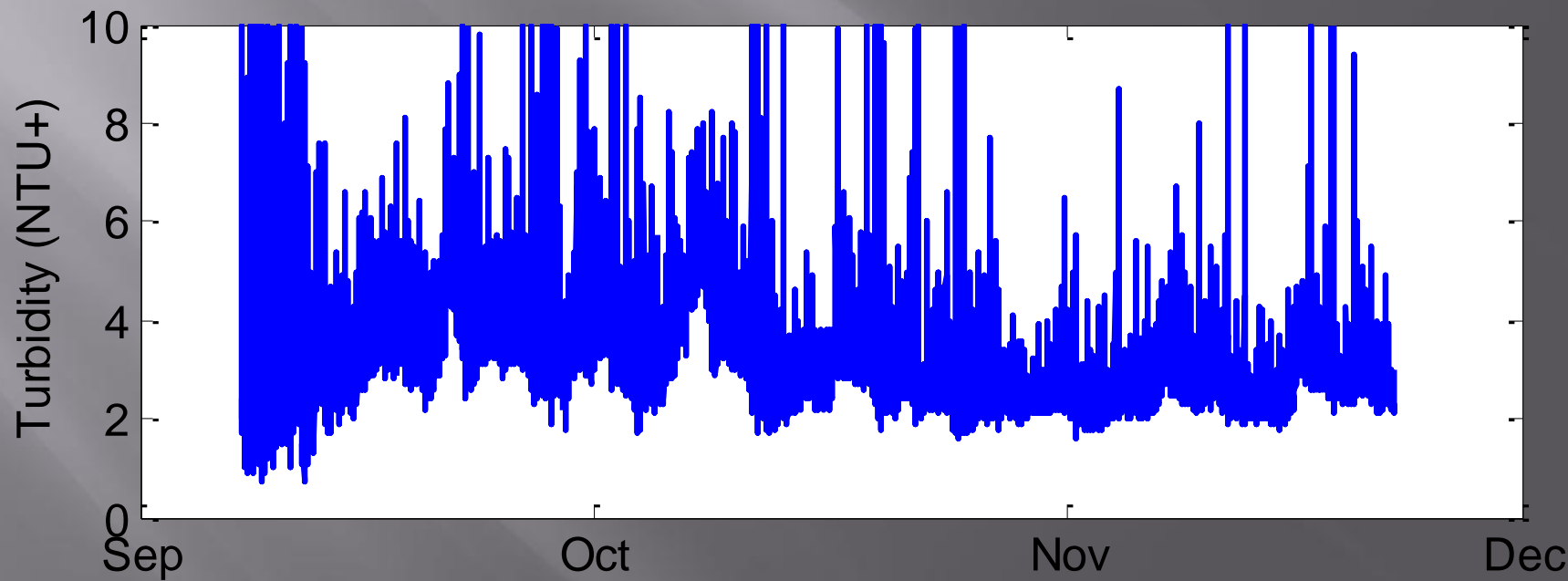
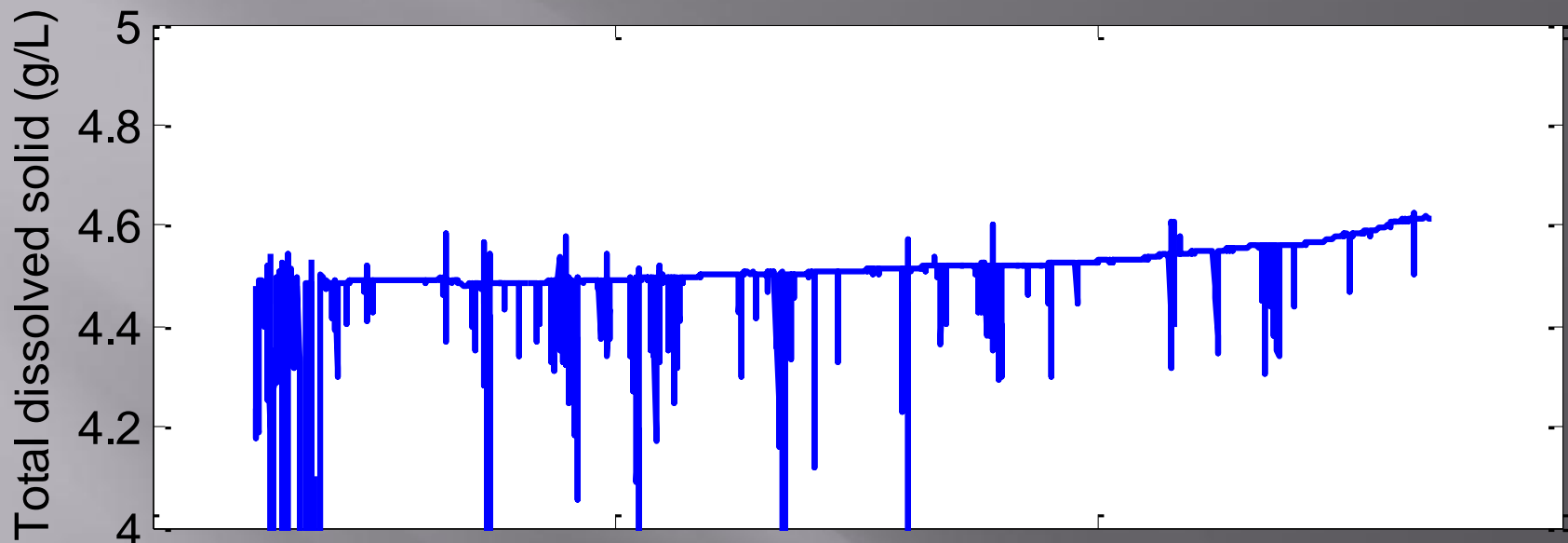
Temperature



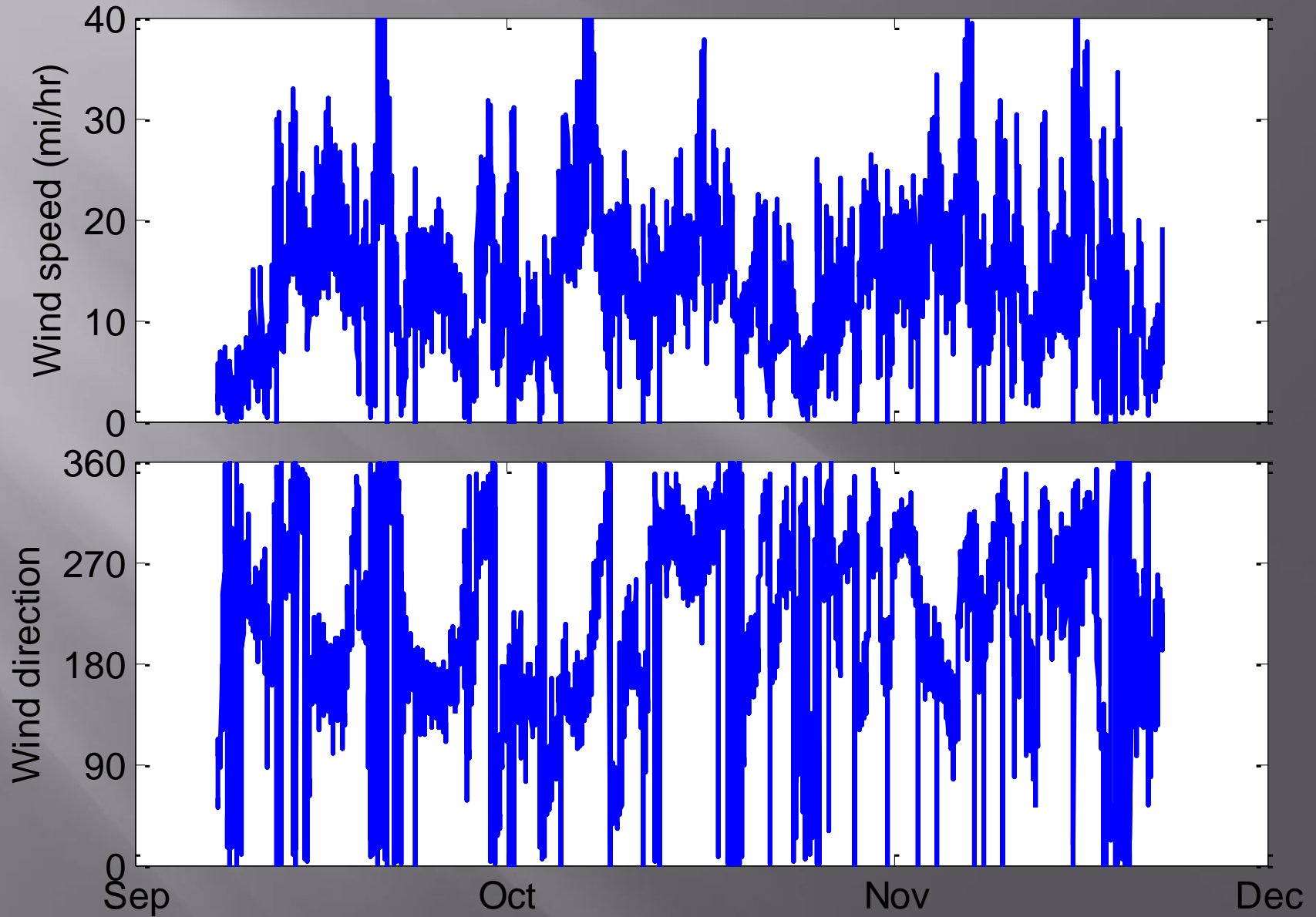
Chlorophyll and dissolved oxygen concentrations

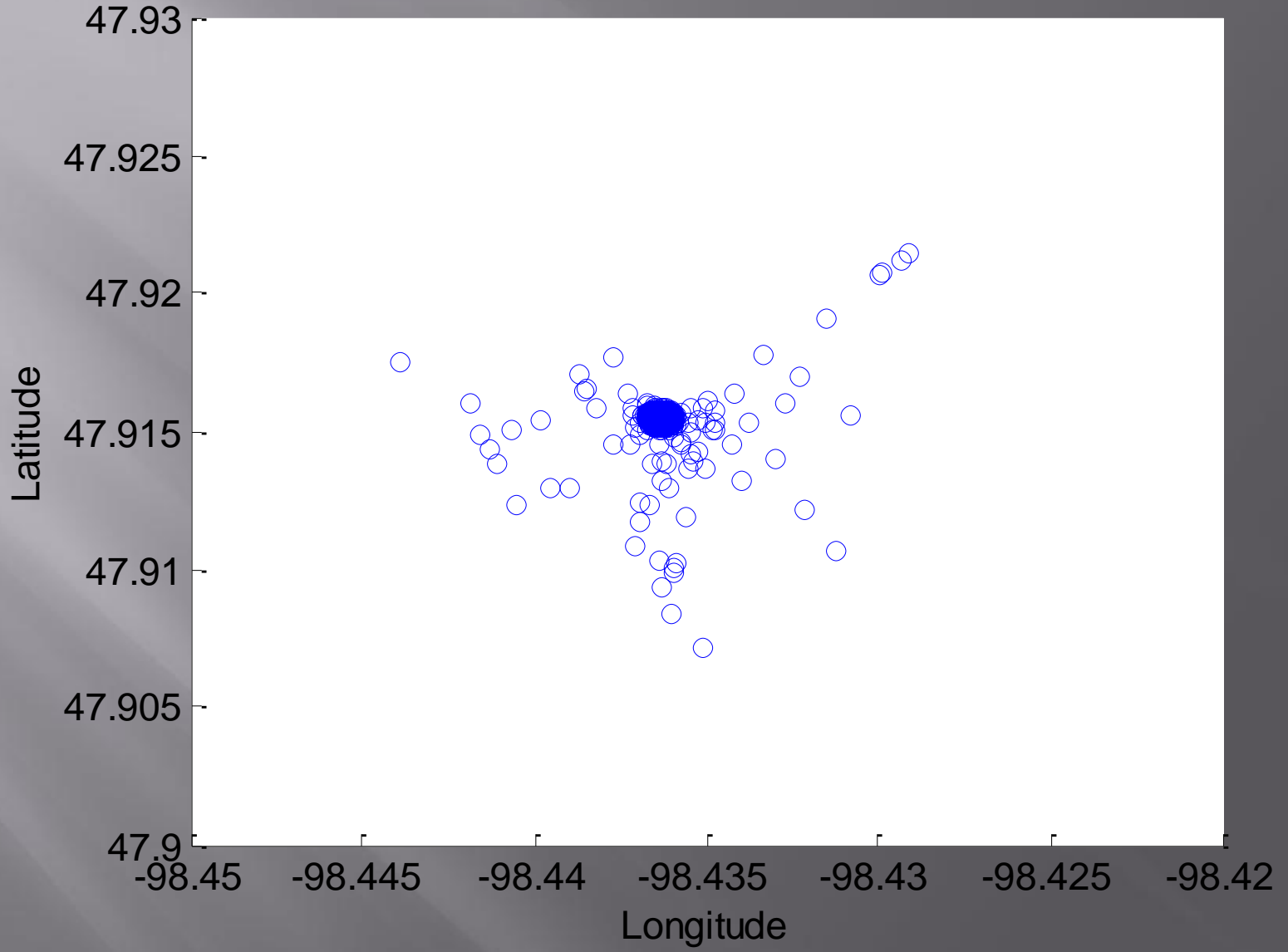




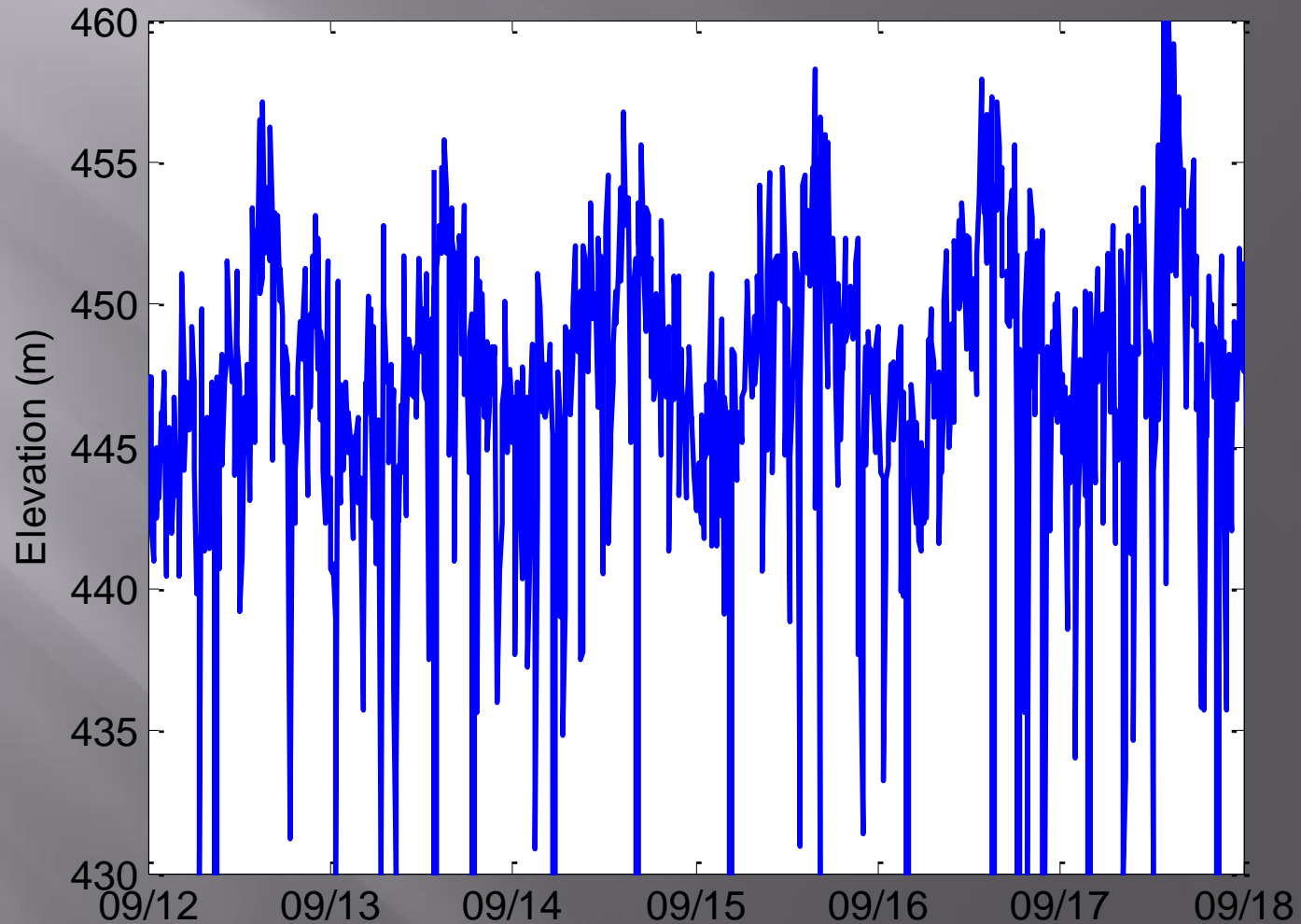


Wind





Problem with GPS elevation



Other water quality related studies

NUTRIENT ANALYSIS



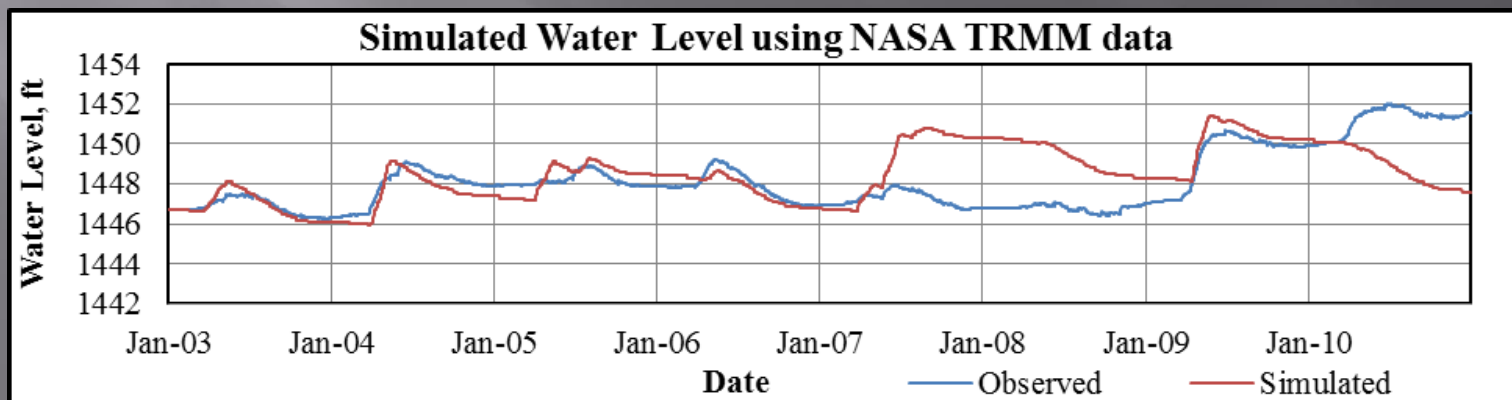
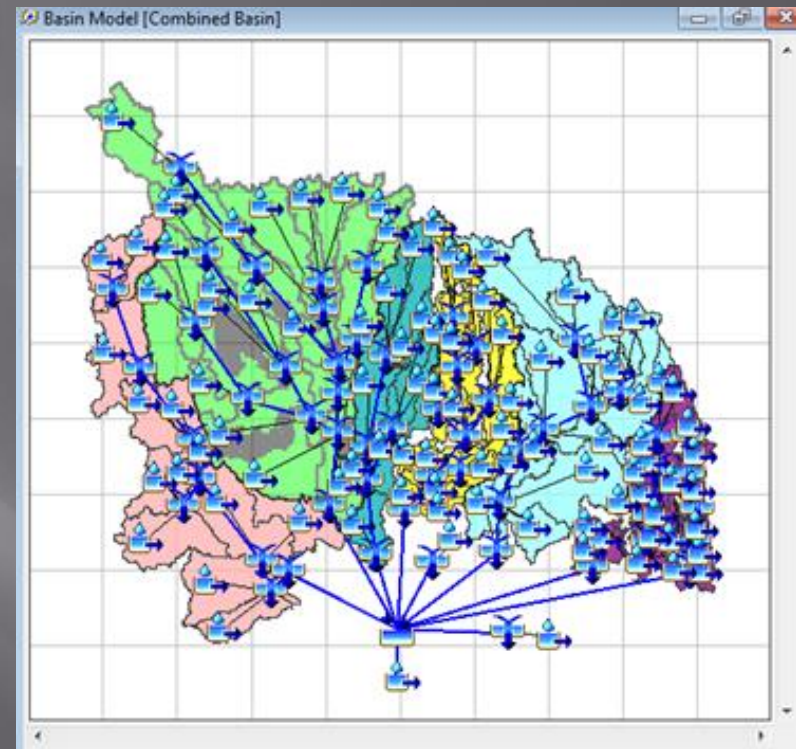
SECCHI DISK



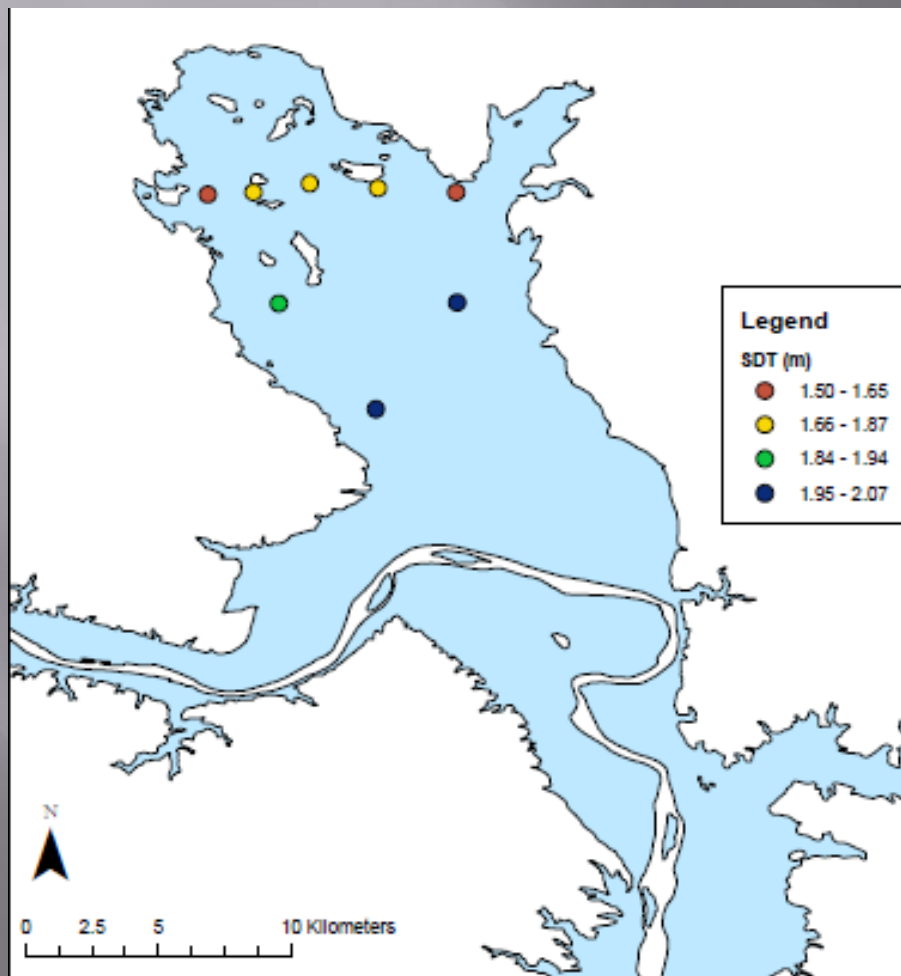
ISSAC image on Jan 19, 2012
Merging of 15 frames taken at
one frame/second



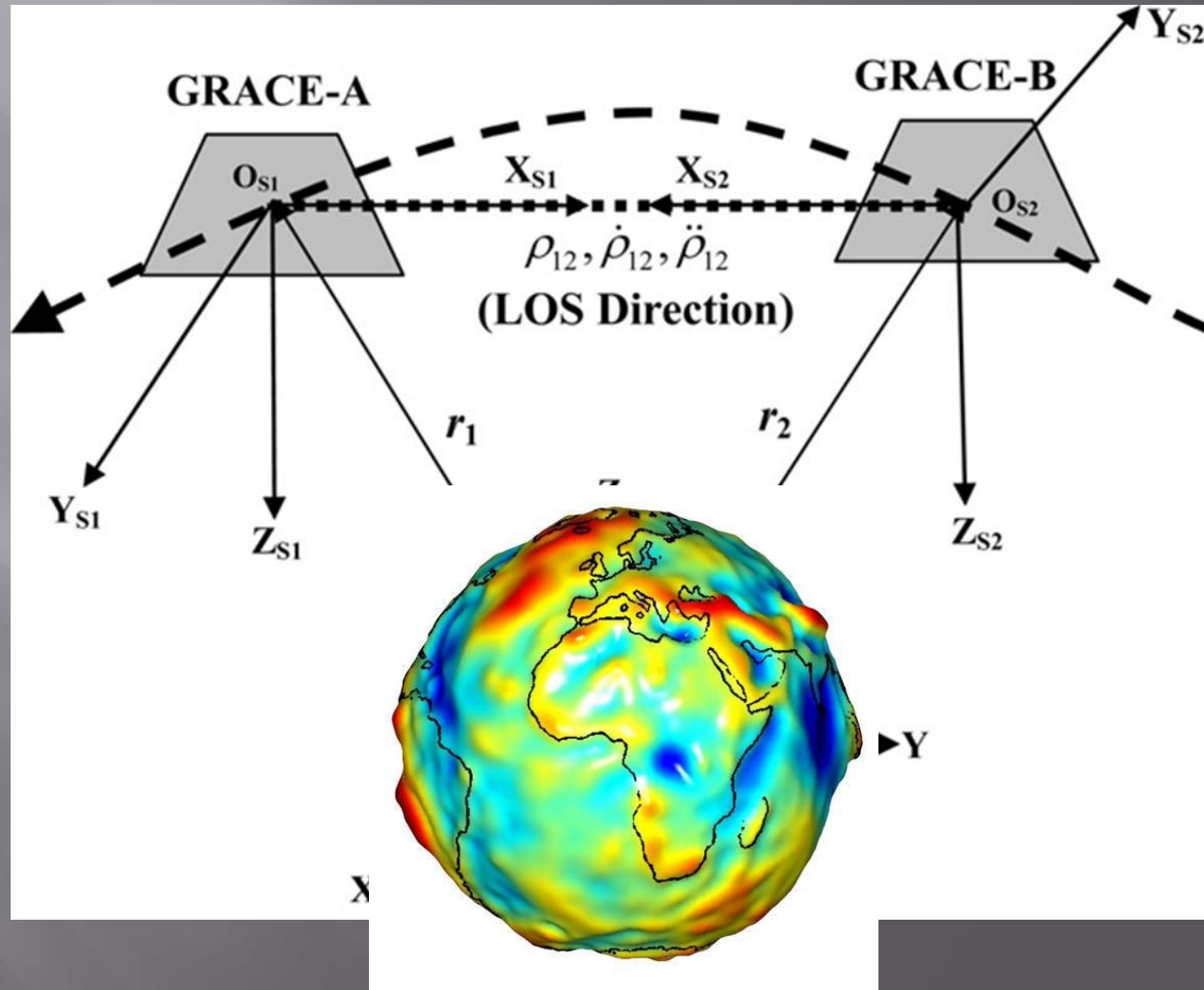
Hydrological Modeling of Devils Lake



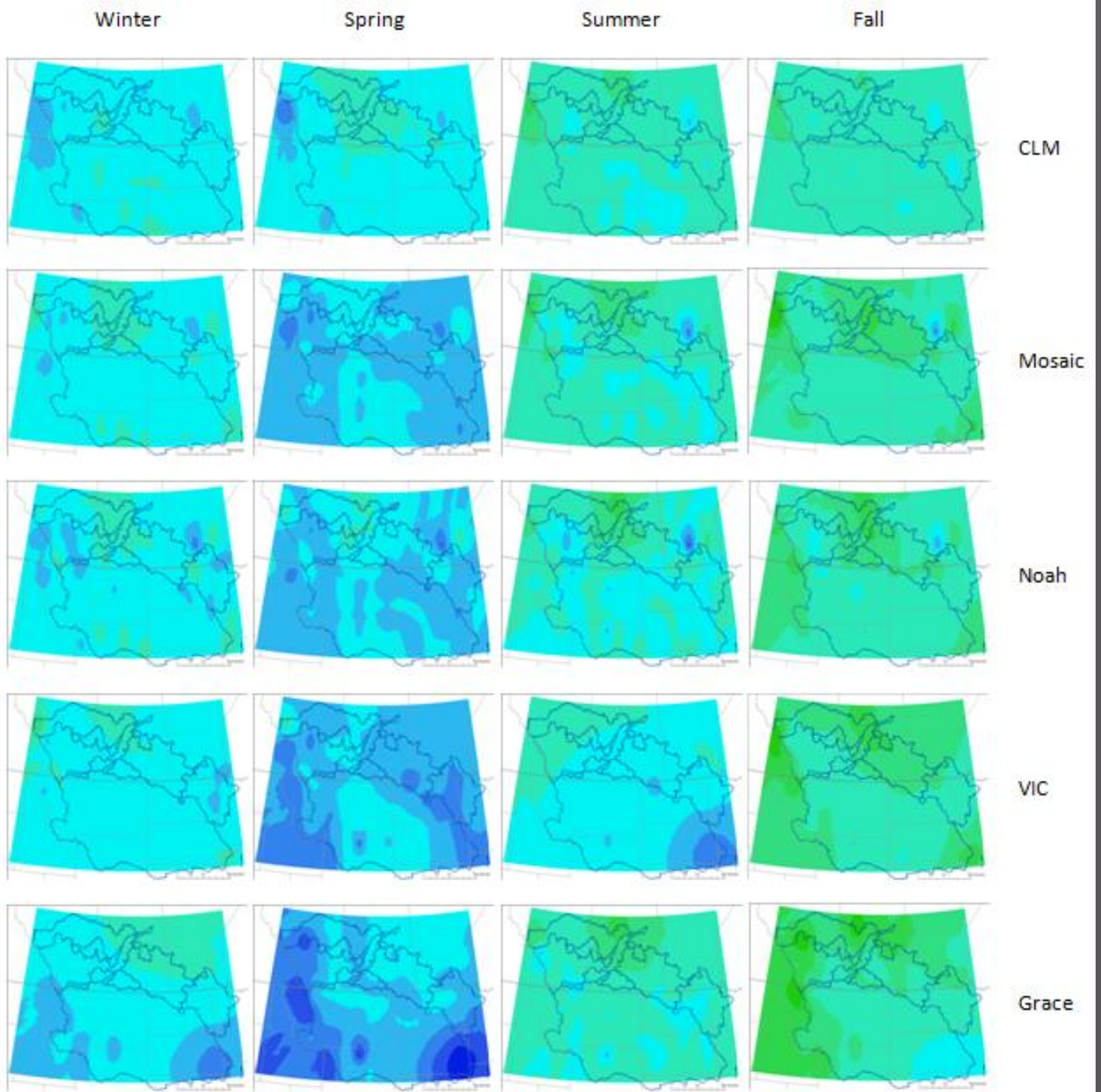
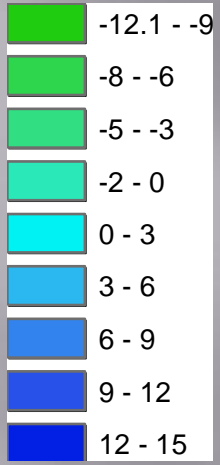
Assessment of water quality of North Dakota



Gravity Recovery and Climate Experiment

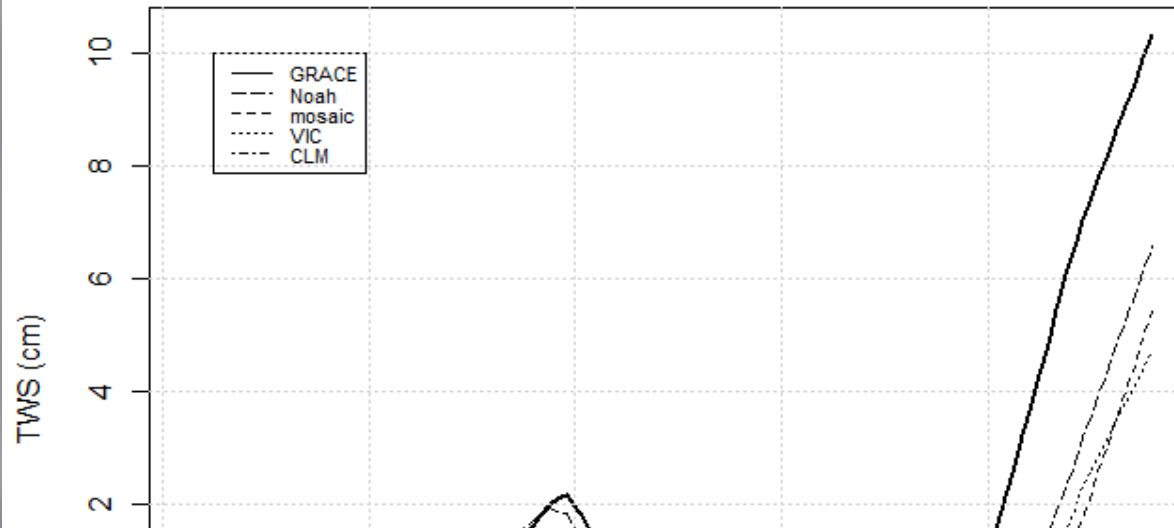


Water anomalies for each dataset (cm)

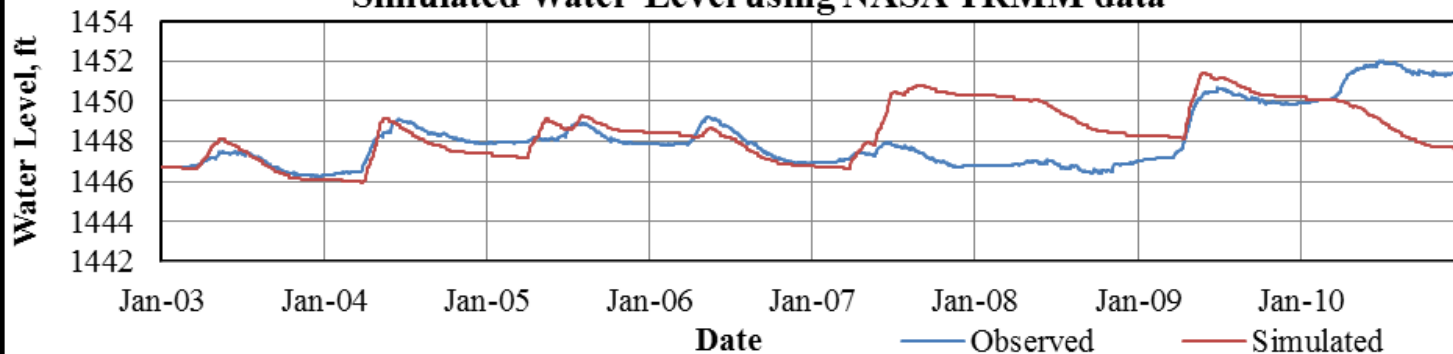


Both GRACE and four models indicate increased water content in recent years

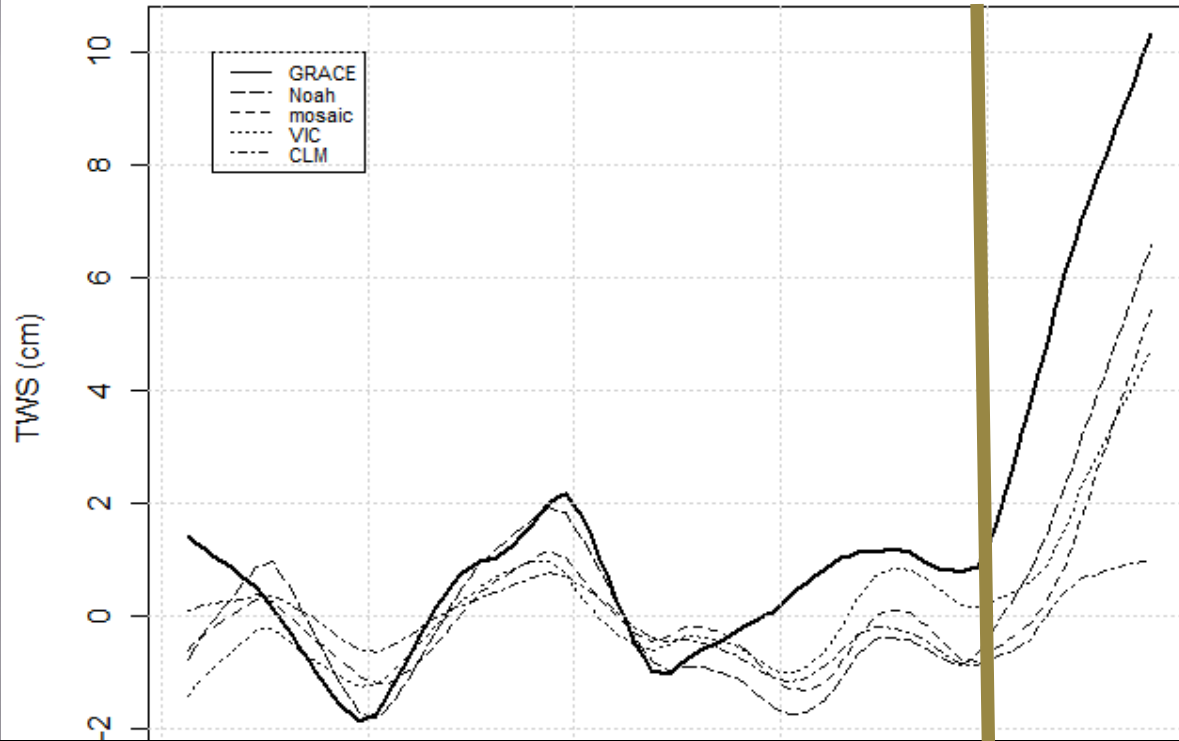
Time Series Trend (GRACE VS GLDAS)



Simulated Water Level using NASA TRMM data



Time Series Trend (GRACE VS GLDAS)



Simulated Water Level using NASA TRMM data

