Introduction

individual constituent model analysis task

- provide diagnostic support for the overall modeling initiative
- develop interim estimates of the magnitude of in-lake source/sink processes
- conducted for select constituents
  - dissolved organic carbon (DOC)
  - nitrate and nitrite (NO$_x$)
  - dissolved silica (Si)
  - soluble reactive phosphorus (SRP)
Analysis Utilizes

• previously tested 2-D hydrothermal model (Phase I project)
• previously calculated external loading rates (Phase I project)
• 2013 in-lake measurements of constituents (Phase I project)
• identified water quality signatures in in-lake constituents (Phase I project)
• run W2 version 3.7 with selected constituents, representing conservative substances
• adjust net loss rates to match in-lake patterns
Dissolved Organic Carbon (DOC) – Conservative

- upper waters – surface observations
- DOC acting conservative at shelf site (predictions track observations)
- DOC acting approximately conservative at pelagic sites, very small source of DOC at pelagic site (red arrow)
Nitrate and Nitrite (NO$_x$) – Conservative

- upper waters – surface sample
- model results show NO$_x$ not conservative in the upper waters (predictions do not track observations)
- phytoplankton growth is a known sink of NO$_x$ in the upper waters
Nitrate + Nitrite ($\text{NO}_x$) – 1st Order Loss

- upper waters – surface sample
- model results show $\text{NO}_x$ not conservative in the upper waters (predictions do not track observations)
- phytoplankton growth is a known sink of $\text{NO}_x$ in the upper waters
- calibrated to a first order loss rate of 0.008 day$^{-1}$ in upper waters
- significant loss process of $\text{NO}_x$ on the shelf and in the lake (red arrow)
- strong water quality signature that support model testing
upper waters – surface observations and model predictions
model results show that Si not conservative in the upper waters (predictions do not track observations)
diatom growth is a know sink of Si in the upper waters
Dissolved Silica (Si) - 1st Order Loss

- upper waters – surface observations and model predictions
- model results show that Si not conservative in the upper waters (predictions do not track observations)
- diatom growth is a known sink of Si in the upper waters
- calibrated to a first order loss rate of 0.04 day\(^{-1}\) in upper waters
- significant loss process of Si on the shelf and in the lake (red arrow)
- strong water quality signature that support model testing
Soluble Reactive P (SRP) - Conservative

- upper waters – surface observations and model predictions
- SRP not conservative in the upper waters (predictions do not track observations)
- SRP is the limiting nutrient for algal growth in freshwater systems
Soluble Reactive P (SRP) - 1st Order Loss

- upper waters – surface observations and model predictions
- SRP not conservative in the upper waters (predictions do not track observations)
- SRP is the limiting nutrient for algal growth in freshwater systems
- calibrated to a first order loss rate of 0.25 day⁻¹ in upper waters
- significant loss process of SRP on the shelf and in the lake (red arrow)
- loss processes on the shelf and lake are consistent with the lack of difference in chlorophyll between the shelf and lake
- strong water quality signature that support model testing
Summary

- DOC behaved close to conservative
- $\text{NO}_X$, Si and SRP do not behave conservatively
- first order loss rates for $\text{NO}_X$, Si and SRP more closely simulate observations
- three clear signatures most likely a result of algal growth that can integrated into model calibration
- loss processes on the shelf and lake are consistent with the lack of difference in chlorophyll between the shelf and lake
- The model analyses conducted, utilizing the W2/T transport submodel provides diagnostic support for the overall initiative