A 3D hydrodynamic model for Bay of Quinte

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Objectives

- Assess spatial and temporal variability of hydrodynamic conditions, residence time of water masses using models
- Application of ELCOM (a 3D model)- can be coupled to CAEDYM (not done yet- a major exercise)
- Comparison of model results with observations (temperature- done in this study) to do- water levels, currents
- Lake Ontario-Bay exchange flows to assess its influence beyond HB?
ELCOM --- stands for the Estuary and Lake Coastal Ocean Model

- three-dimensional Model
- z-level
- Free surface flow
- Inflows/outflows
- Met forcing from observations
- Can be combined with CAEDYM (ecosystem model)
Model resolution
150 m by 150 m
39 vertical layers 0.65 m thick

Lake Ontario open boundary-
Can use existing LO model output
Some runs are done with using Kingston gauge and LO temp

<table>
<thead>
<tr>
<th>River</th>
<th>Low</th>
<th>Mean</th>
<th>High</th>
<th>Low</th>
<th>Mean</th>
<th>High</th>
</tr>
</thead>
<tbody>
<tr>
<td>Trent</td>
<td>81.5</td>
<td>132.6</td>
<td>215.5</td>
<td>28.5</td>
<td>61.0</td>
<td>130.7</td>
</tr>
<tr>
<td>Moria</td>
<td>17.5</td>
<td>30.0</td>
<td>51.4</td>
<td>2.5</td>
<td>8.3</td>
<td>27.7</td>
</tr>
<tr>
<td>Salmon</td>
<td>5.9</td>
<td>10.4</td>
<td>18.3</td>
<td>0.5</td>
<td>2.4</td>
<td>11.2</td>
</tr>
<tr>
<td>Napanee</td>
<td>5.2</td>
<td>9.0</td>
<td>15.7</td>
<td>0.7</td>
<td>2.3</td>
<td>7.4</td>
</tr>
<tr>
<td>Wilton</td>
<td>0.8</td>
<td>1.4</td>
<td>2.4</td>
<td>0.1</td>
<td>0.2</td>
<td>0.8</td>
</tr>
<tr>
<td>Total</td>
<td>117.4</td>
<td>194.9</td>
<td>323.9</td>
<td>32.7</td>
<td>76.1</td>
<td>184.8</td>
</tr>
</tbody>
</table>
Contours of (a) modeled and (b) observed temperature profile timeseries at Big Bay (BB). The ELCOM output is every 0.65 m, Tidbits are mounted at 0.2, 0.5, 1.2, 1.7, 2.2, 2.7, 3.0, 3.3, 3.8, 4.3 m depth, both are plotted every 15 min.
Comparison with DFO data (HB)

Weak stratification - model picks up well

Currents at Glenora (2 layer structure)
Concentration of passive conservative tracers released from:
(a) TR, (b) MR, (c) SR, (d) NR, (e) WC
(b) at the end of simulation period on 29 Oct. 2004
Water-retention contour plot at the end of simulation period, 170-day run
Future work

• Provide mean exchange flows between segments (for George’s segment model)
• We are not very sure if temperature differences between lake (cooler) and bay (warmer) have any role in exchange of material
• If there is sufficient interest and resources, deploy some water level gauges, current meters and validate model results
• Shallow embayment - obviously - sediment recycling will be a major issue-
  • Run this model using IPCC climate projections
  • Issues of error propagation - one example is Lake-wide model coupling with Bay model
  • TP can be modelled in the lines of Dave Schwab (spatially detailed with limited concern for transformations) or coupling with CAEDYM (resources and data needs are concerns)