Surface Water and Ocean Topography (SWOT) Mission

A Priori Datasets for SWOT Hydrology

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SWOT SDT Meeting, Toulouse, July 7-9
A Priori Datasets for Rivers

SWOT river vector products will be substantially improved if we have some knowledge about river characteristics prior to launch.

This information includes:
- Estimates of mean width, elevation, slope, river network, etc.
- Locations and boundaries of reaches likely to be measured
- Variations in water surface area over time

How will we get this information prior to launch?
A Priori Datasets for Rivers

1. Provide a system to allow dynamic recalculation of a priori river reach boundaries that can take in a large number of different variables, including:
   1. River centerline location
   2. River width
   3. River slope
   4. Tributary junctions/changes in basin area
   5. Braiding index
   6. Reservoir/Lake extents
   7. Dam locations
   8. Stream gauge locations
   9. SWOT swath boundaries
   Etc, etc.

2. Use this system to provide a preliminary set of a priori reach boundaries for the SWOT river vector product.

Note: there is also work being done on priors for discharge algorithms by Guy Schumann and Mike Durand, which will not be discussed here.
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Study area for preliminary work: A small area of South America

Figure by Christine Lion, UNC
Data Set #1: HydroSHEDS Streamlines and Flow Accumulations by Ed Beighley

Flow accumulation Beighley database

Note: this dataset is processed and ready to go for almost the entire globe south of 60N
Data Set #2: Global River Widths from Landsat (GRWL) by Allen and Pavelsky

Note: this dataset will be ready to go for all rivers >100 m globally by end of August
Combined GRWL/Beighley Product

Flow accumulation Beighley vs GRWL
Goals

1. Provide a system to allow dynamic recalculation of a priori river reach boundaries that can take in a large number of different variables, including:
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   Etc, etc.

   GRWL and Beighley combined will provide all of this.

2. Use this system to provide a preliminary set of a priori reach boundaries for the SWOT river vector product.
<table>
<thead>
<tr>
<th>Original regions (56°S to 60°N)</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>South America</td>
<td>Completed (May 2006)</td>
</tr>
<tr>
<td>Central America (Mexico and Caribbean)</td>
<td>Completed (March 2007)</td>
</tr>
<tr>
<td>Asia</td>
<td>Completed (March 2007)</td>
</tr>
<tr>
<td>Africa</td>
<td>Completed (October 2007)</td>
</tr>
<tr>
<td>Australasia</td>
<td>Completed (March 2008)</td>
</tr>
<tr>
<td>Europe and Middle East</td>
<td>Completed (October 2008)</td>
</tr>
<tr>
<td>North America (USA and Canada)</td>
<td>Completed (January 2009)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Appended regions (north of 60°N)</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Arctic (northern Canada)</td>
<td>Scheduled for December 2014</td>
</tr>
<tr>
<td>Scandinavia and Iceland</td>
<td>Scheduled for December 2014</td>
</tr>
<tr>
<td>Siberia</td>
<td>Scheduled for December 2014</td>
</tr>
<tr>
<td>Greenland</td>
<td>Scheduled for December 2014</td>
</tr>
</tbody>
</table>

Global River Widths from Landsat (GRWL)

Figure by George Allen, UNC
Sacramento River


Courtesy Claire Michaelovsky, JPL
A Priori Datasets for Lakes

Existing databases can provide fairly robust static estimates of lake area from Landsat:
  --Verpoorter et al., 2014
  --Sheng et al., in prep

What about multitemporal measurements of lake area?

Why do we need multitemporal measurements?
Dark Water

A priori data may be able to help us with the problem of dark water.

If we know that two areas of a lake are inundated simultaneously in an historical image, we can assume that they are inundated simultaneously in a SWOT image.

The question is, how much do we need to fear dark water?
PUBLIC ENEMY
FEAR OF A BLACK PLANET

THE COUNTERATTACK ON WORLD SUPREMACY... THE COUNTERATTACK ON WORLD SUPREMACY...
Questions

• We are currently using Landsat and SRTM, perhaps the most canonical satellite imagery and DEM. Are there better products that we could be using for these purposes?
• What should we do regarding DEMs north of 60N?
• How much should we rely on a priori data to help us with dark water? Are there other strategies we’re not thinking of?