Update: A Priori River Database

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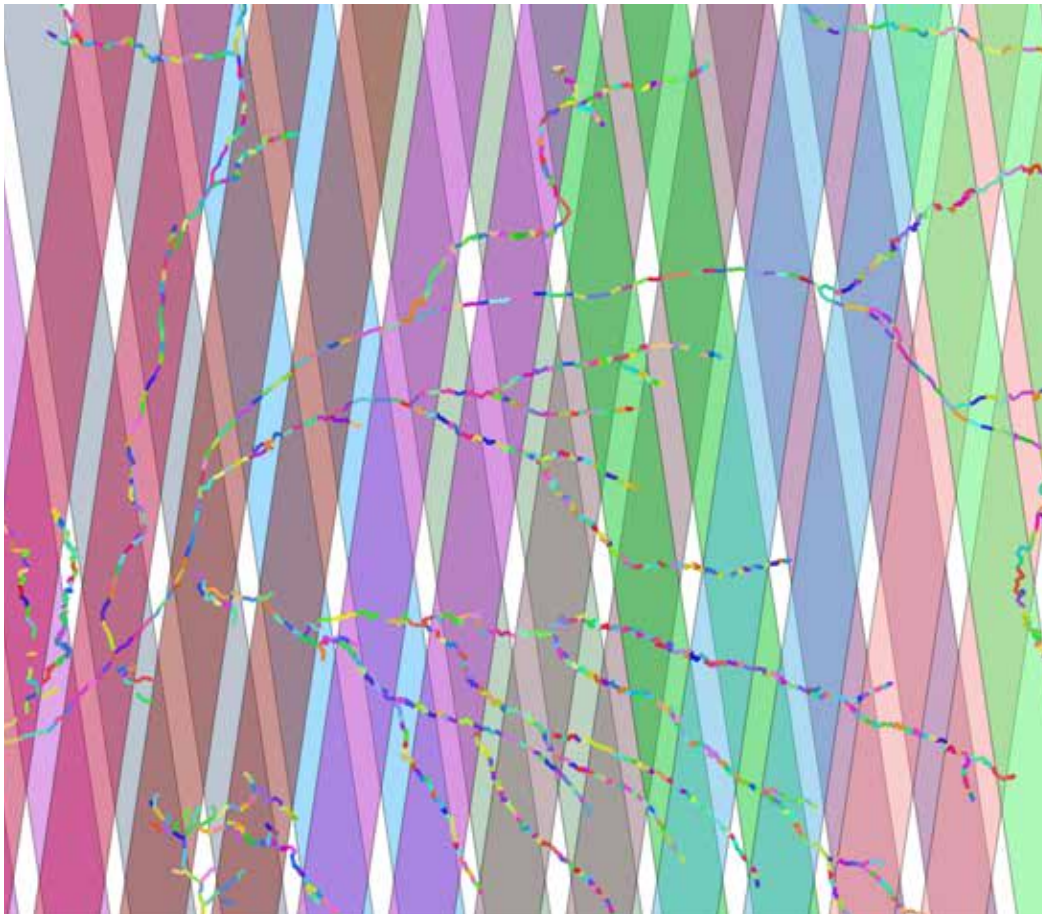
Existing A Priori River Databases

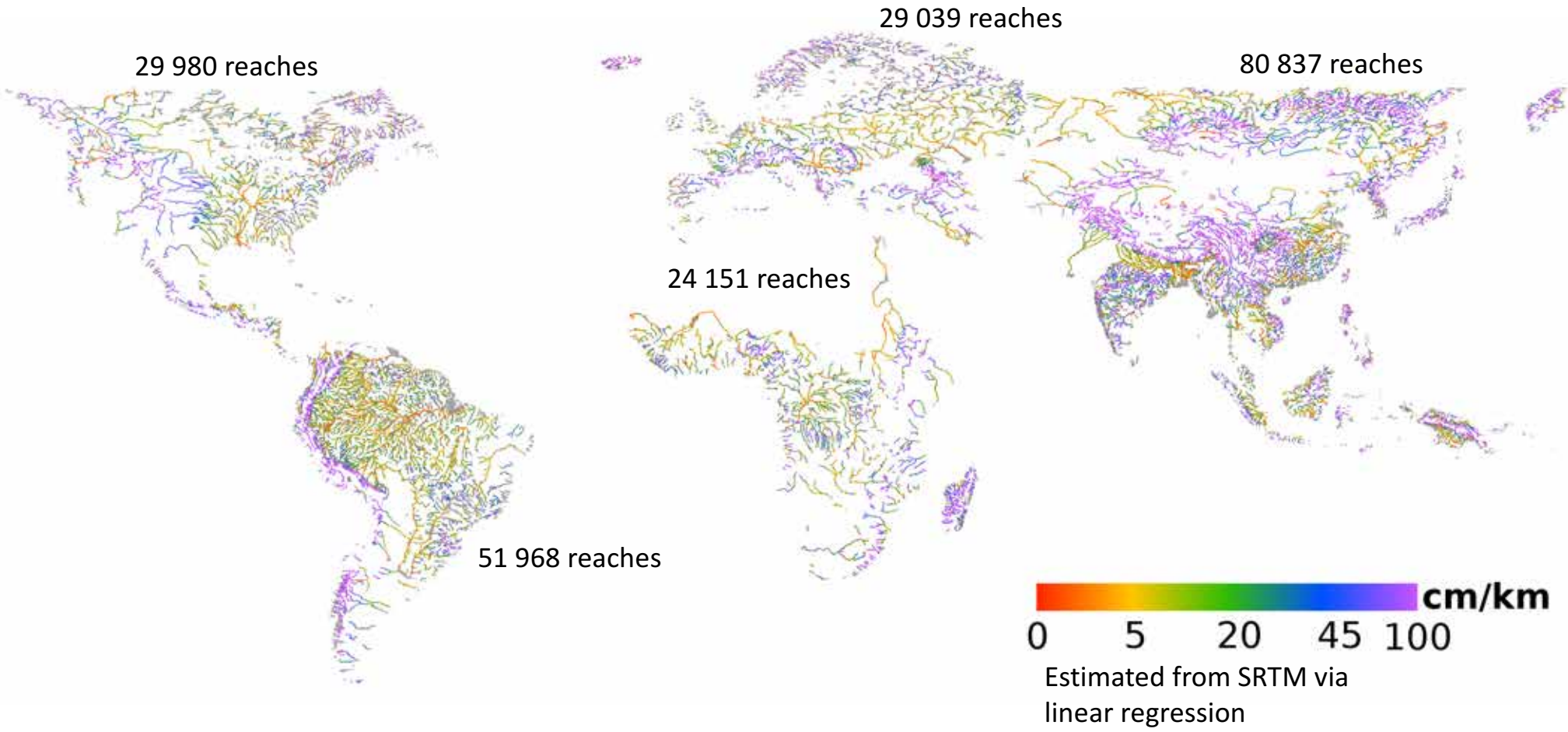
- Created by merging of UNC's Global River Width from Landsat (GRWL) with SRTM/HydroSHEDs, keeping GRWL resolution (~30m). Also contains dams and reservoirs from GRanD
- Converted from points to lines during reach definition
- Vector point and line formats (shp, netCDF/hdf5)
- Variables described in READMEs:
  - Variables from GRWL: width, number of channels, flags (river, lake, estuary, canal)
  - Variables from SRTM: elevation (wrt EGM96), flow accumulation
  - SWOT observation: number of observations, orbits, day
  - Reaches: slope, mean width, length of reach
  - Discharge-related variables added to reaches

Reaches

Reaches defined based on SWOT orbits, and drainage area, with nominal 10 km length

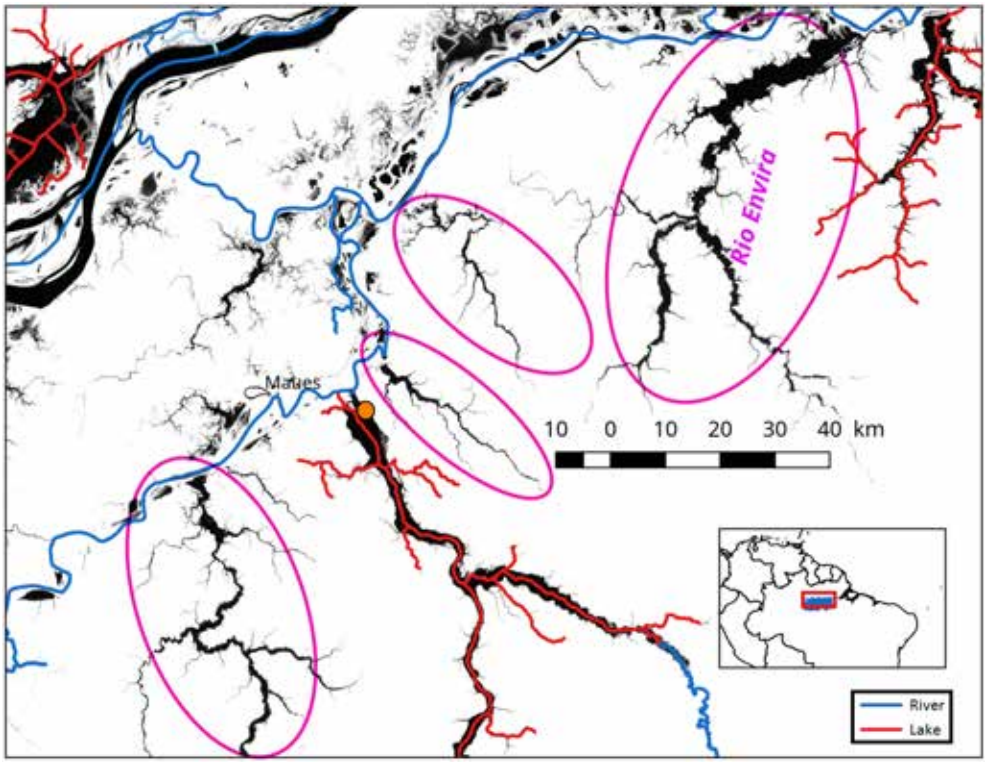


Slopes and global river reaches

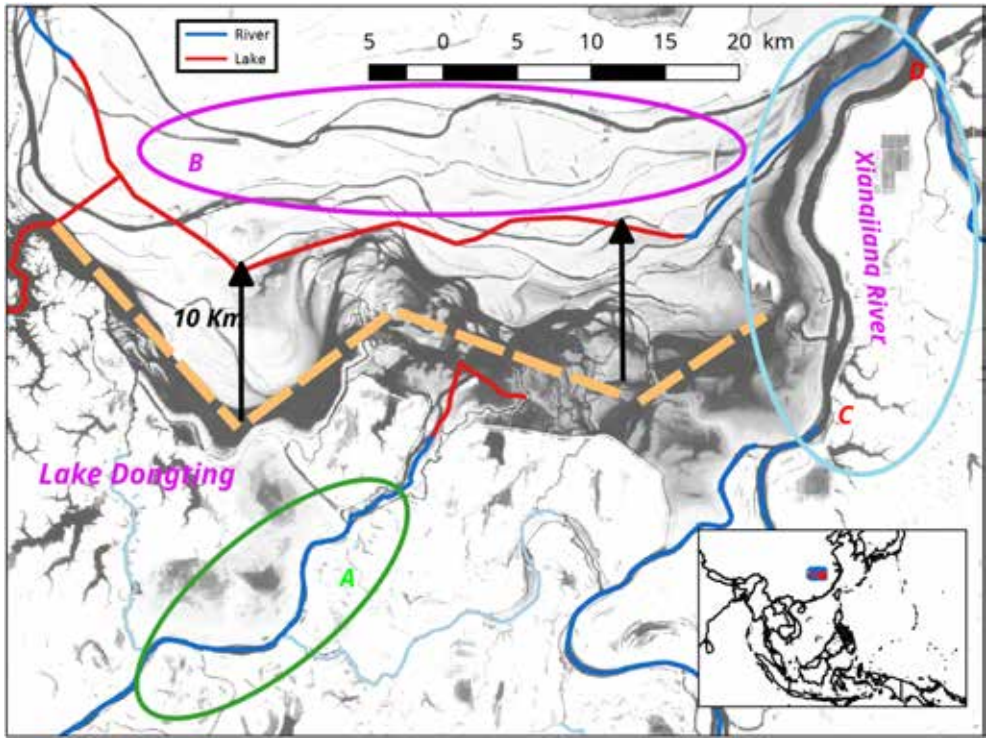


Problems in Complex Flow Environments

Amazon Floodplain



Dongting Lake



In complex flow environments with highly seasonal dynamics like the Amazon Floodplain and Dongting Lake, the current database is not always complete. The solution is multitemporal analysis, which is under development at UNC (**see poster by Xiao Yang**)

Other Issues to Address

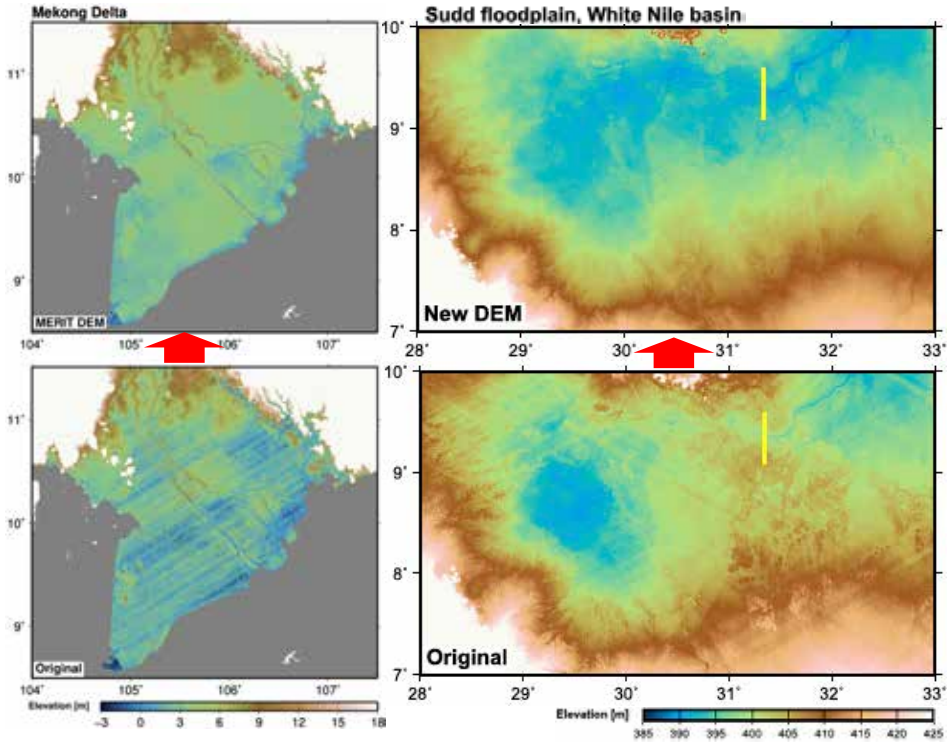
- Need to complete dataset north of 60N
- Missing values for the number of channels in each cross-section/reach
- network topology currently only in the point dataset
- Need to separate individual channels that are of sufficient length to measure separately
- Ideally, identify more rivers 50-100 m wide before launch
- Fix problems with reach numbering scheme and connectivity (~5% of reaches)
- Finalize assessment of whether each reach is likely to be SWOT-observable (based on width, slope, layover, etc)

Advances from the MERIT DEM

Dai Yamazaki has developed a new, high-accuracy global DEM.

MERIT DEM (Multi-Error-Removed Improved-Terrain DEM) [Yamazaki et al., 2017, GRL]

→Applied multi-component error removal to SRTM3 and AW3D DEMs.
The MERIT DEM has global coverage (N90-S60, beyond SRTM domain).



Global 3” DEM by multi-error removal:

- Speckle Noise
- Stripe Noise
- Absolute Bias
- Tree height bias

Highest-ever vertical accuracy
as a freely-available global DEM

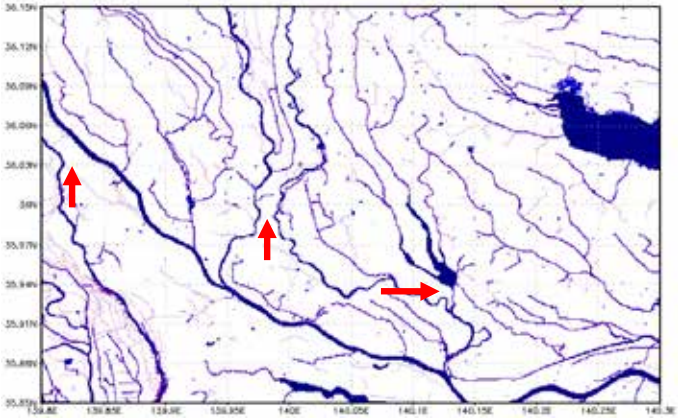
Data available online since June 2017
http://hydro.iis.u-tokyo.ac.jp/~yamadai/MERIT_DEM/index.html

→We used MERIT DEM as a baseline topo for hydrography delineation.

Slide courtesy Dai Yamazaki

Automated hydrography delineation

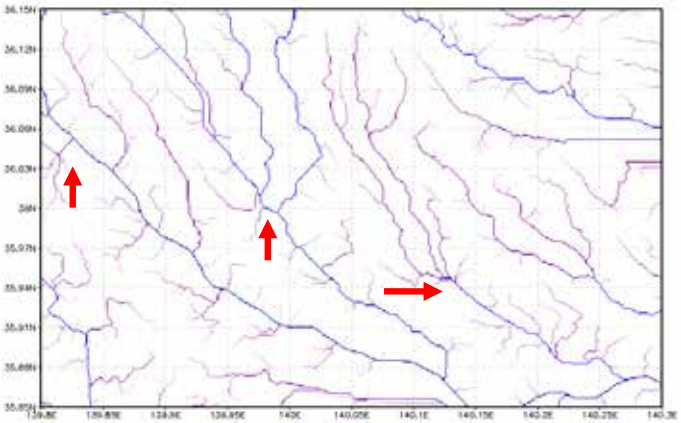
Tone, Kinu, Kokai-gawa river in Japan



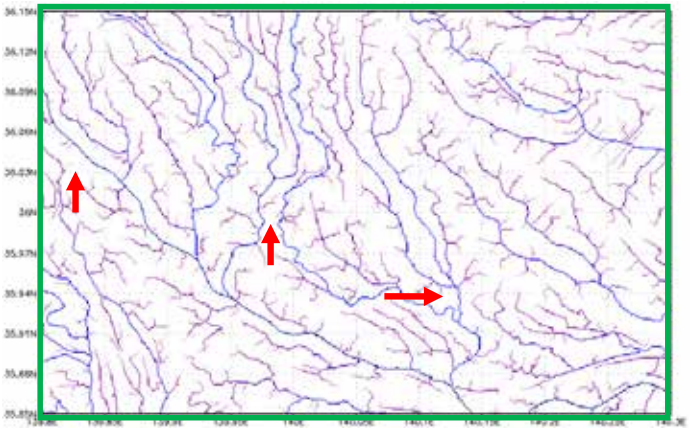
National Water Map

Algorithm successfully automated
(though minimum modification is still needed)

New DEM + Recent water body maps
works very well to capture small channels.



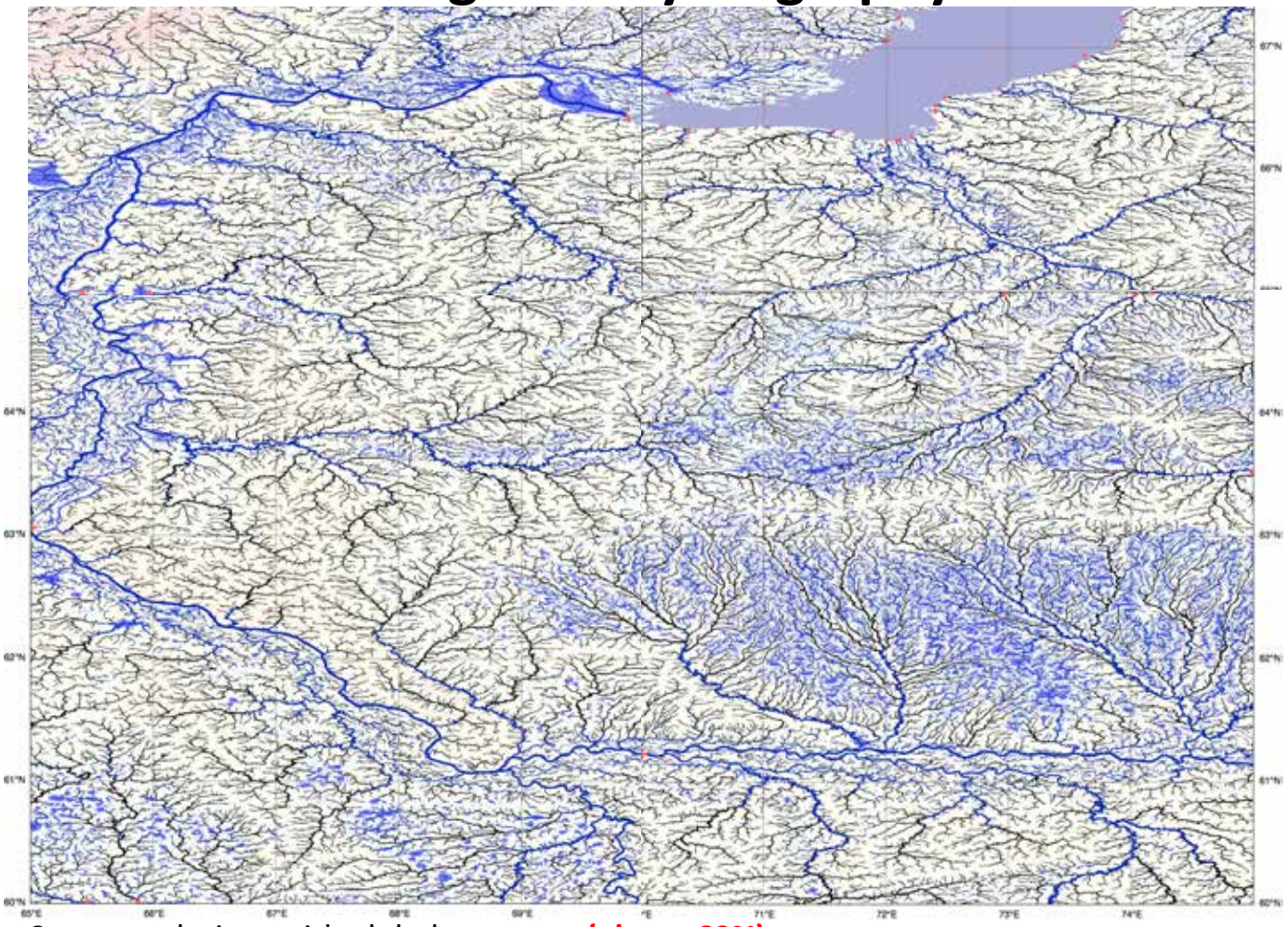
USGS HydroSHEDS



New Hydrography

Slide courtesy Dai Yamazaki

Product: A new global hydrography data



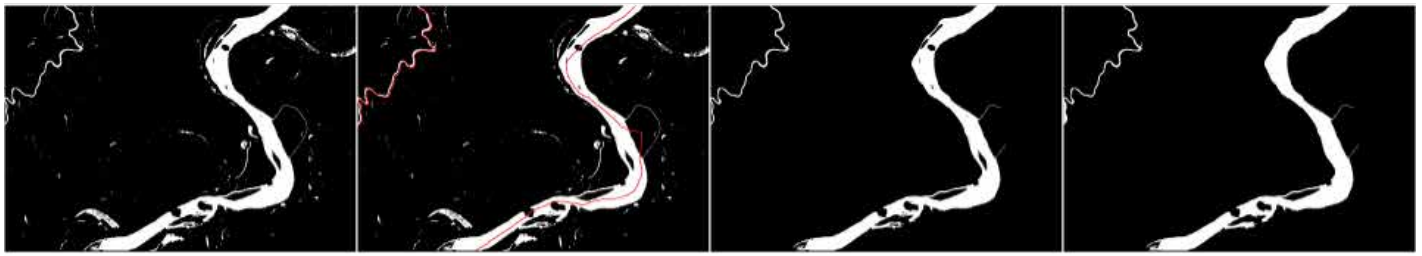
3-sec resolution, with global coverage **(above 60N)**

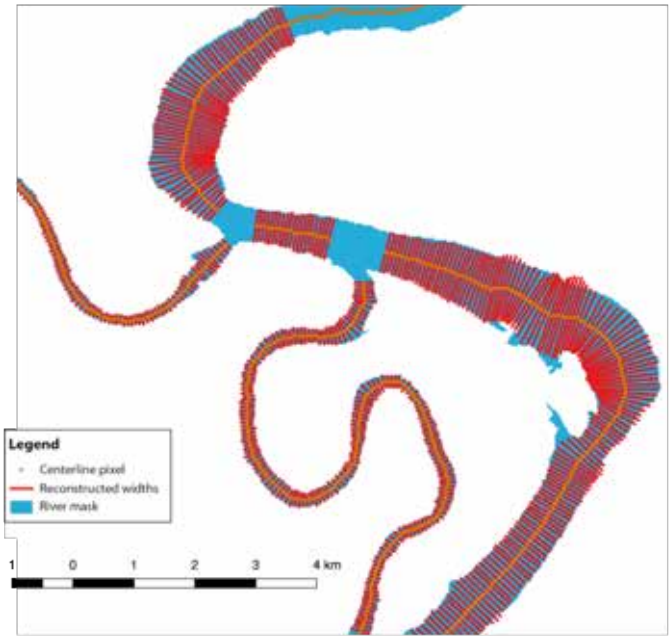
Unlike Hydrosheds v1, the new hydrography dataset from Yamazaki will be available north of 60N, including over the Ob' River Basin (shown here).

Slide courtesy Dai Yamazaki

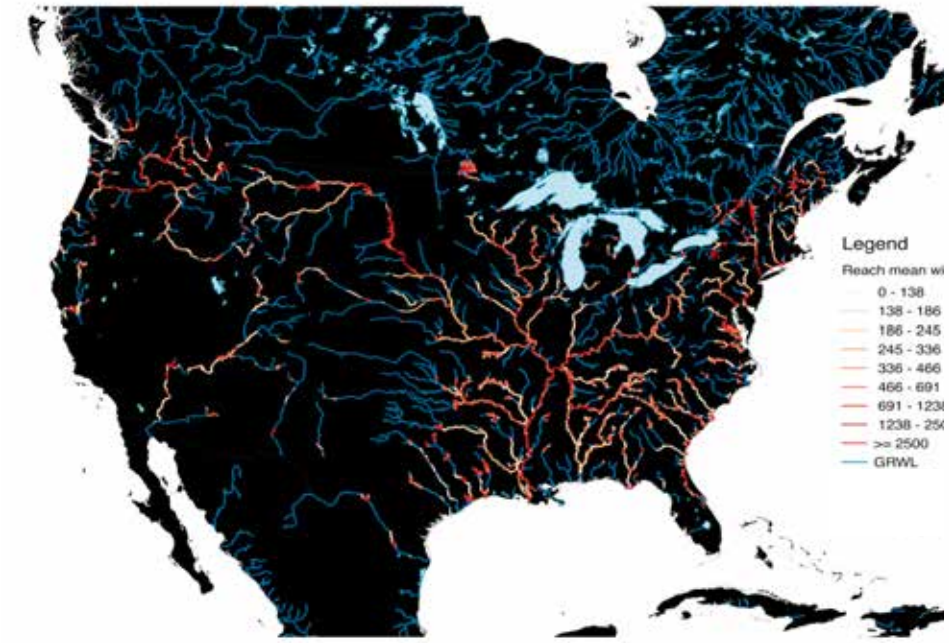
Global River Widths in Google Earth Engine

- Software similar to RivWidth implemented in GEE
- Allows automated width detection from any Landsat image (or Sentinel 2, etc)
- Capable of avoiding partial cloud cover and other obstructions
- GUI that could be distributed to Science Team under final development

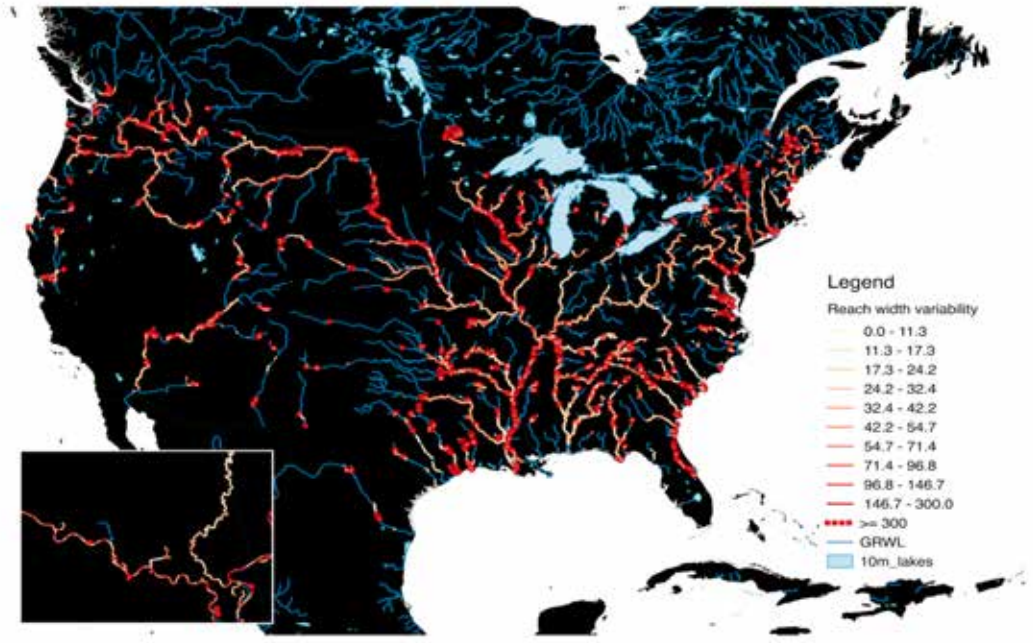




Multitemporal Patterns of River Width and Width Variability



Mean River Width, CONUS



River Width Variability, CONUS

The global, multitemporal width dataset will also address some additional limitations of static GRWL for SWOT purposes: Individual channels are mapped around most islands, problems in complex flow environments can be addressed using multitemporal data. However, limited to rivers wider than ~120 m (4 Landsat pixels).

Next Steps

- Evaluate new global hydrography dataset from Yamazaki (UNC)
- Complete global, multitemporal version of GRWL (UNC)
- Complete plan to define a priori reaches (e.g. Frasson et al., 2017, *WRR*)(UNC, OSU)
- Refine global network topology at the reach scale (UNC)
- Define a priori node dataset (OSU)
- Synthesize progress to create final a priori river datasets (UNC)

Objective: complete a final, global dataset in ~2 years.