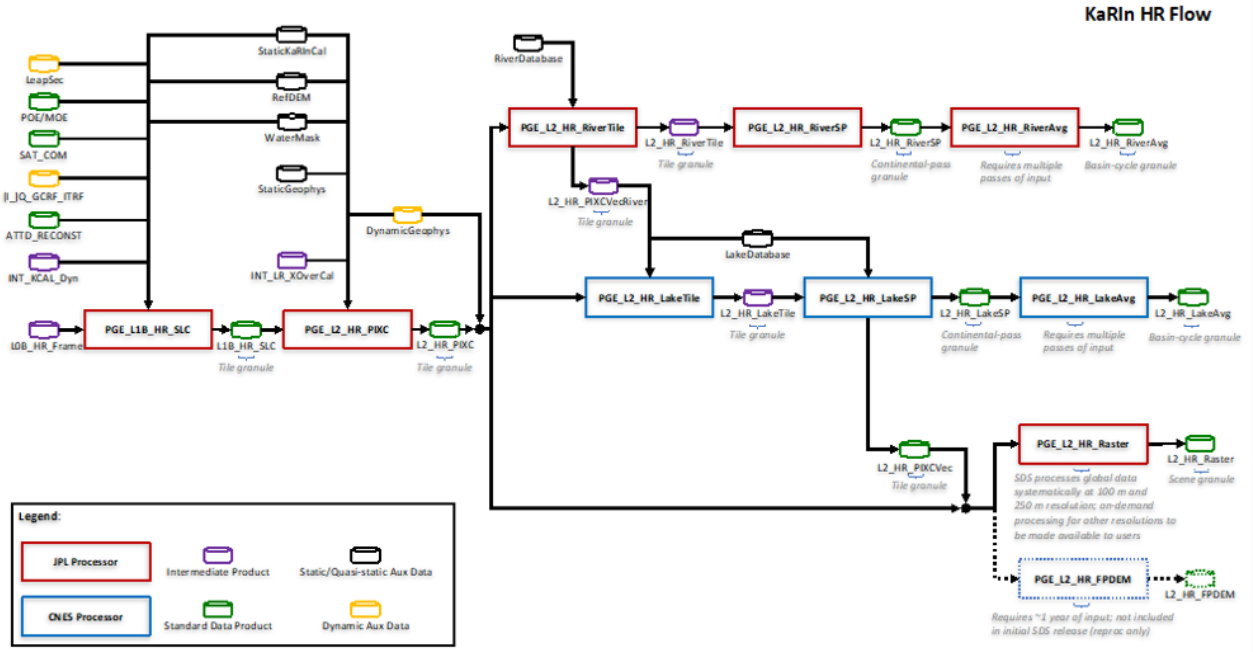
SWOT River Products

Mark Hagemann, Ohio State University
6/17/2019

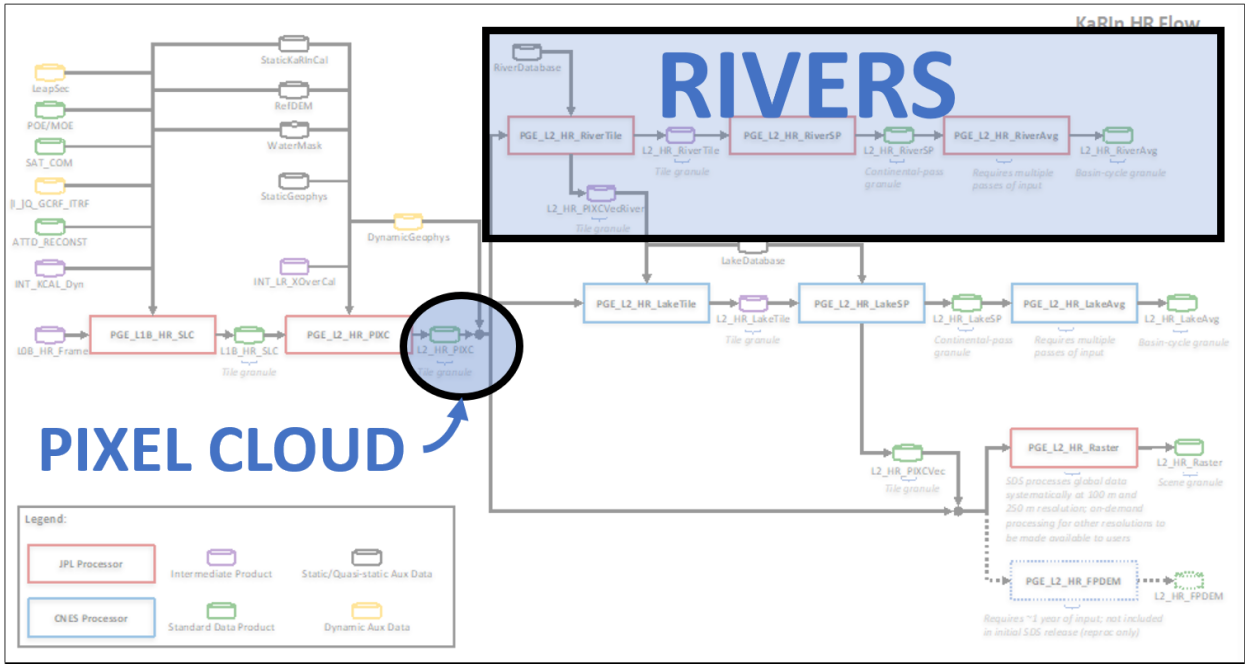
Overview

1. Short illustration of PIXC –> river products
2. Interactive demo using example river products
3. Discussion

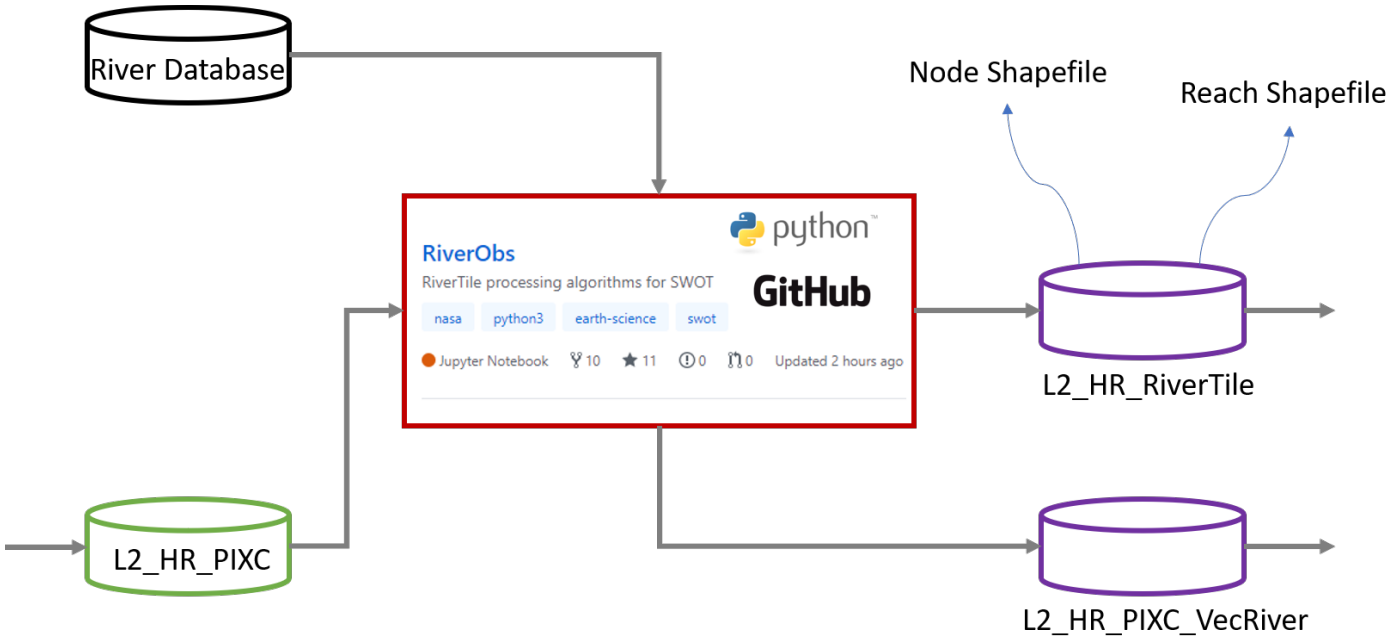
HR Processing Flow



HR Processing Flow



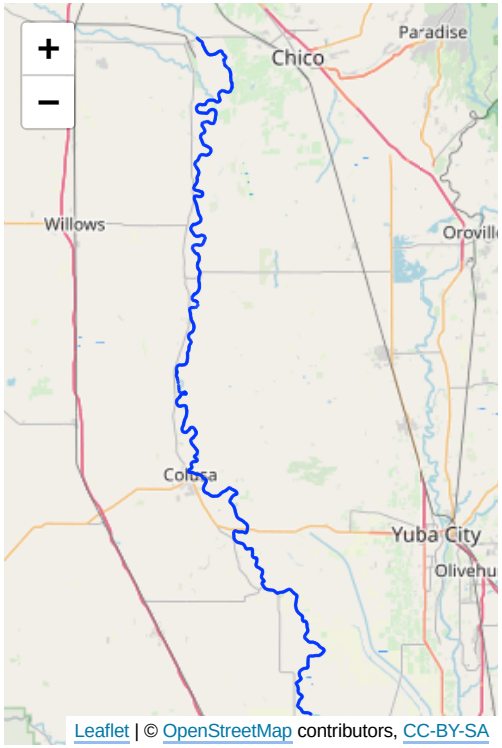
HR Processing: PIXC –> river products



5/30

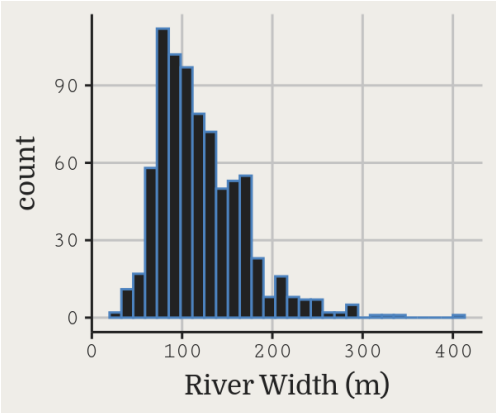
Sacramento River Simulations

Where do PIXC's come from?



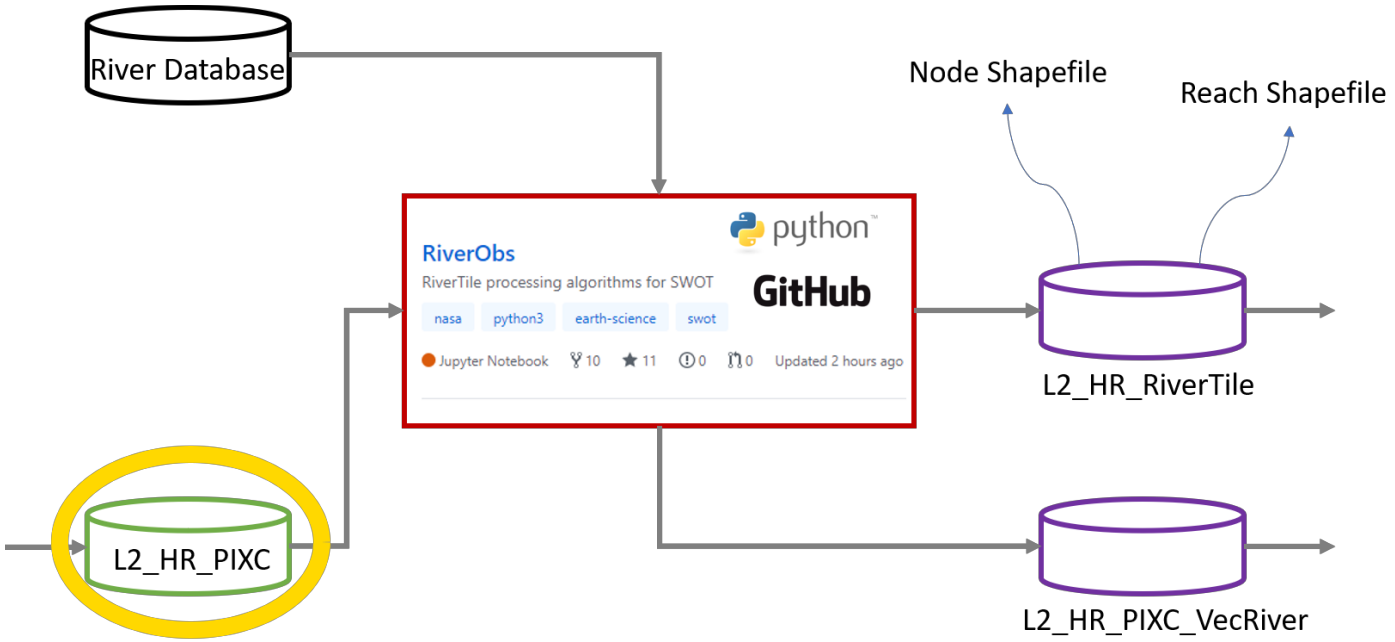
Workflow:

- Observrvations –> bathymetry, historic flow conditions
- HEC-RAS model –> water levels
- SLC simulator, PIXC processor –> Pixel clouds
  - Multiple passes
  - Multiple cycles



6/30

Pixel Cloud



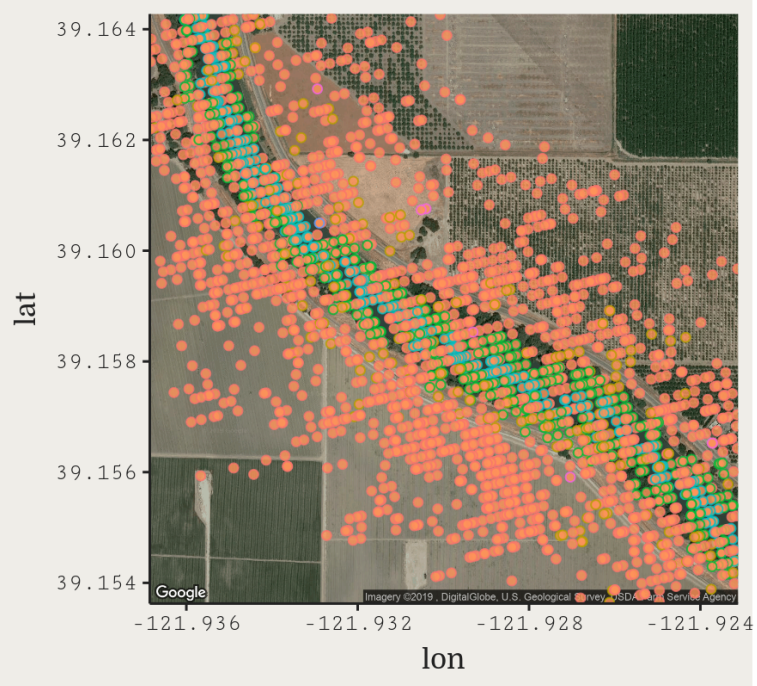
7/30

Pixel Cloud

- Zoom in to a small section of Sacramento

8/30

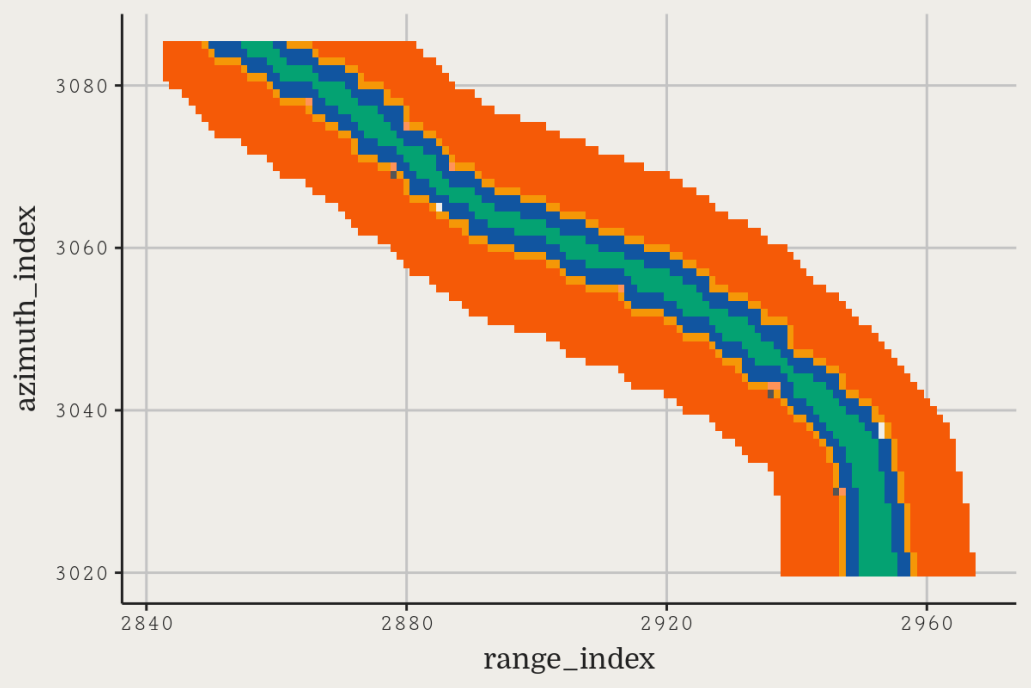
Pixel Cloud



- Already geolocated
- Already classified
- Contains height, area, water fraction, etc.

9/30

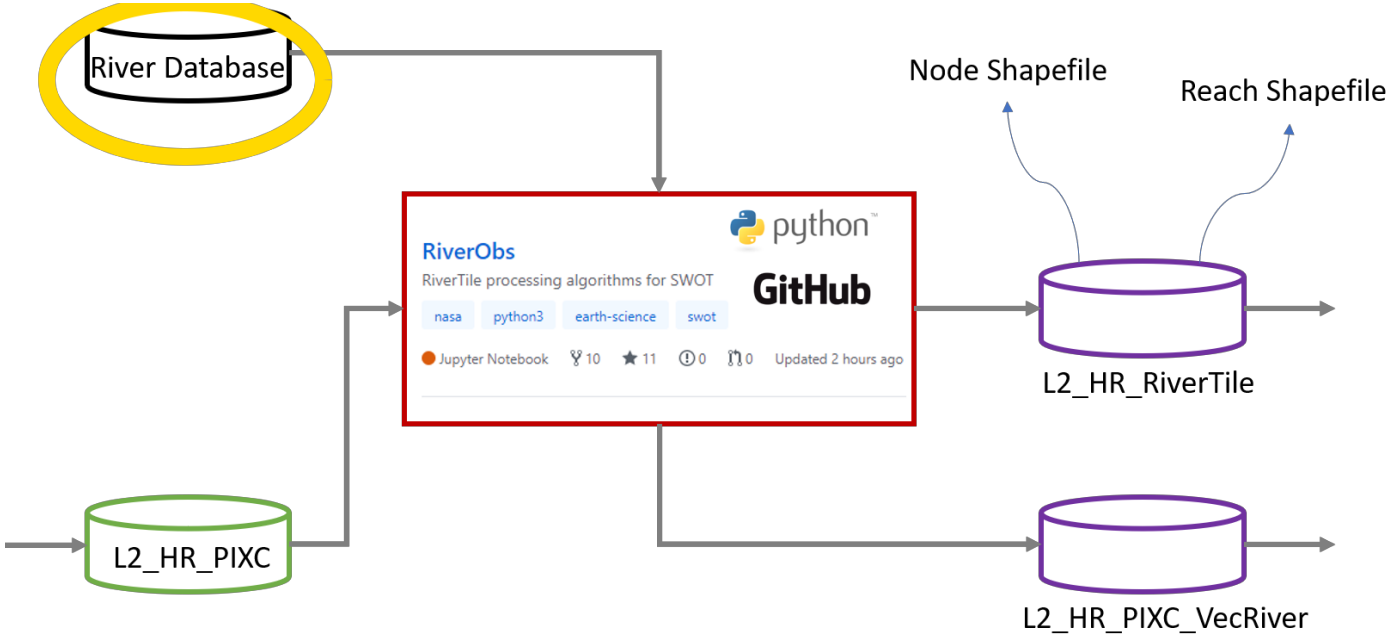
Pixel Cloud



- Pixel cloud in slant plane (looks like pixels!)

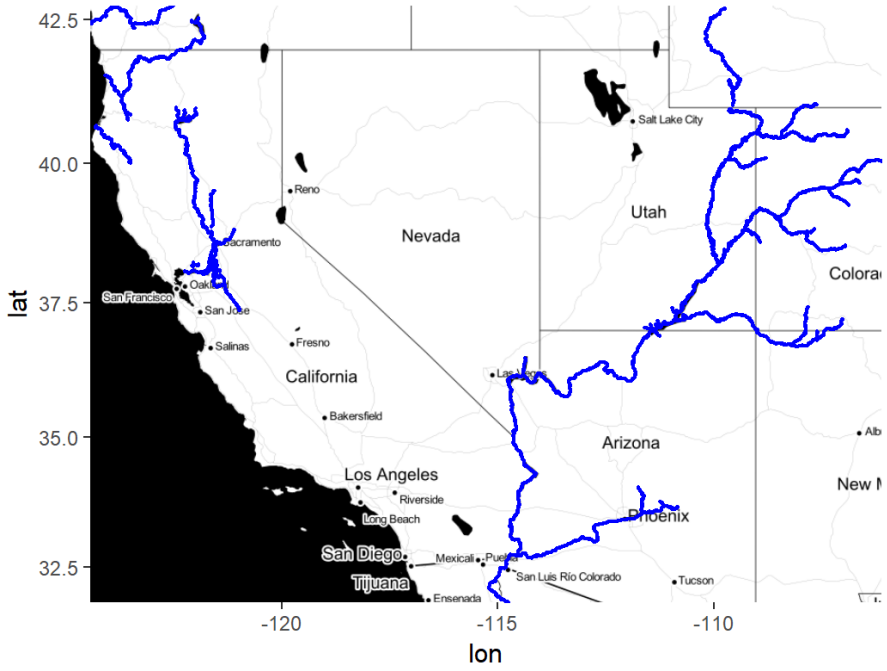
10/30

Prior Reach, Node database



11/30

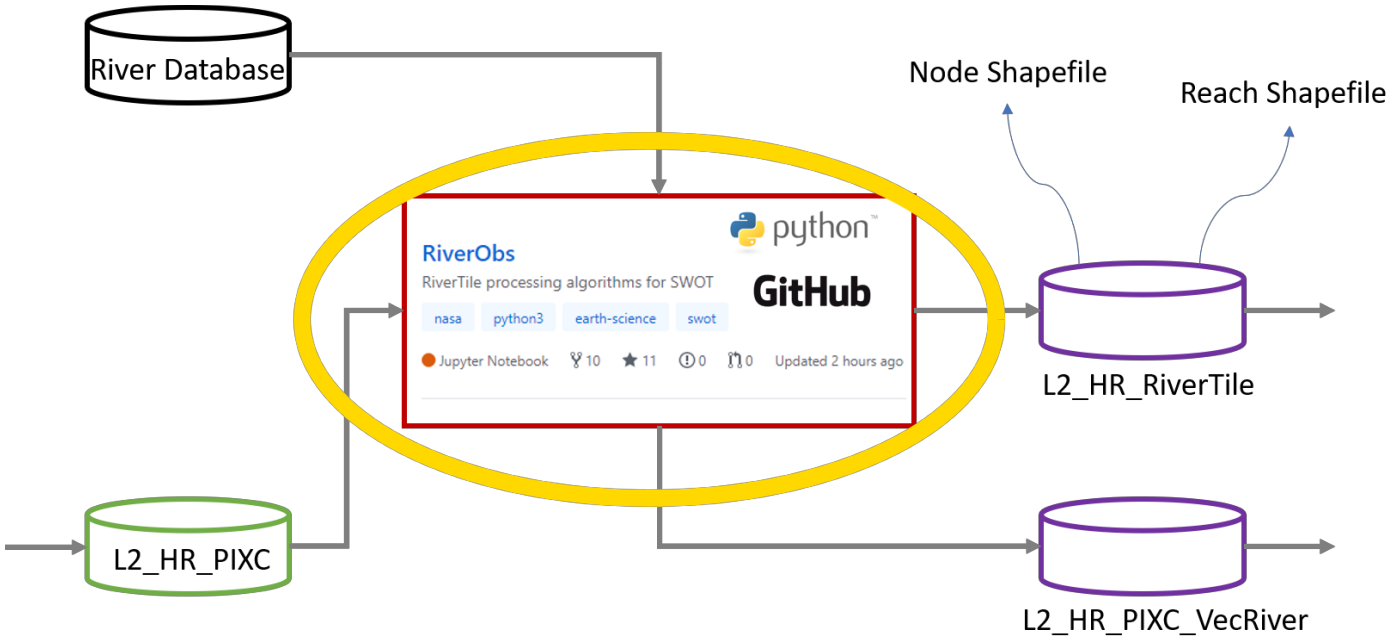
Prior Reach, Node database



- Freely available (thanks to Elizabeth, Renato, Tamlin)
- Get it here

12/30

RiverObs



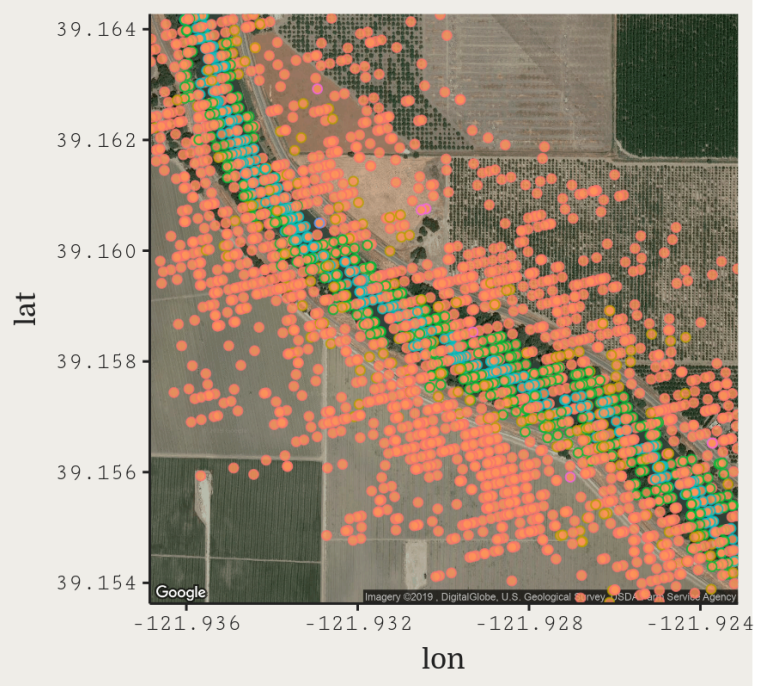
13/30

RiverObs

- Python modules, scripts for processing pixel clouds into river products
- Open-source, on GitHub (link)
- You can use it!*
    - *if you can get your hands on a pixel cloud

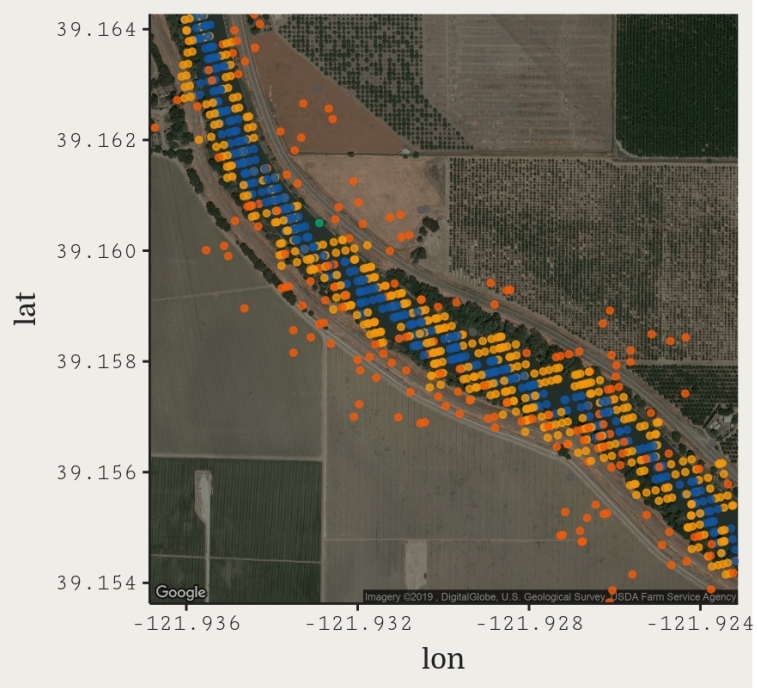
14/30

Returning to example



15/30

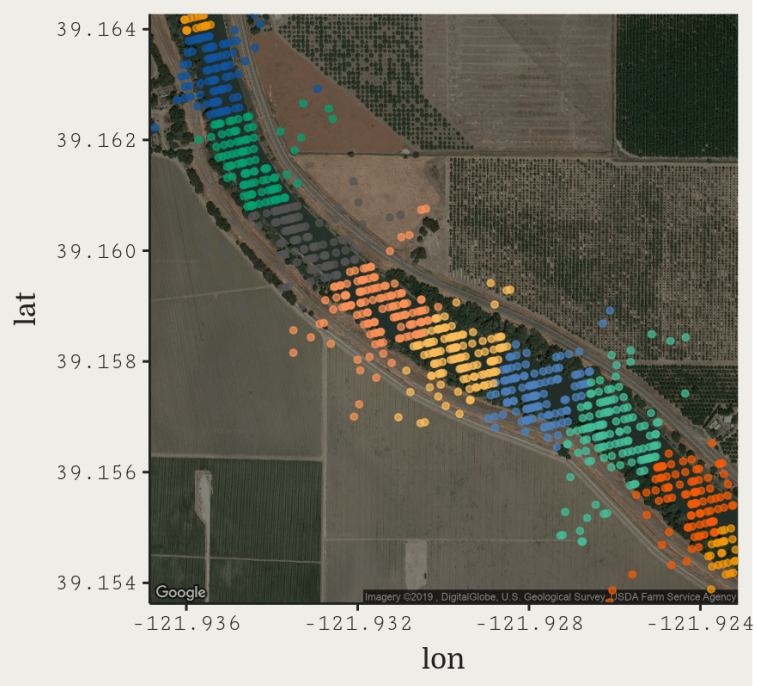
RiverObs Processing



- Only deal with water pixels
- segment into disjoint features

16/30

RiverObs processing

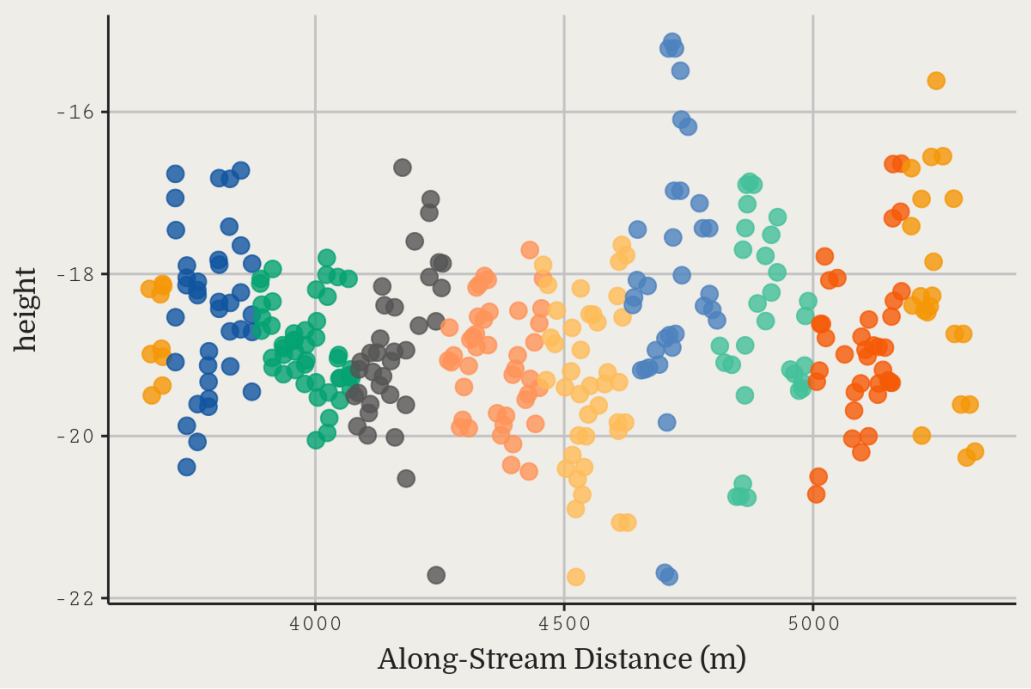


- Assign to nodes (using prior database)
- Improve geolocation (Not shown here, requires CNES module)

17/30

Node Height Aggregation

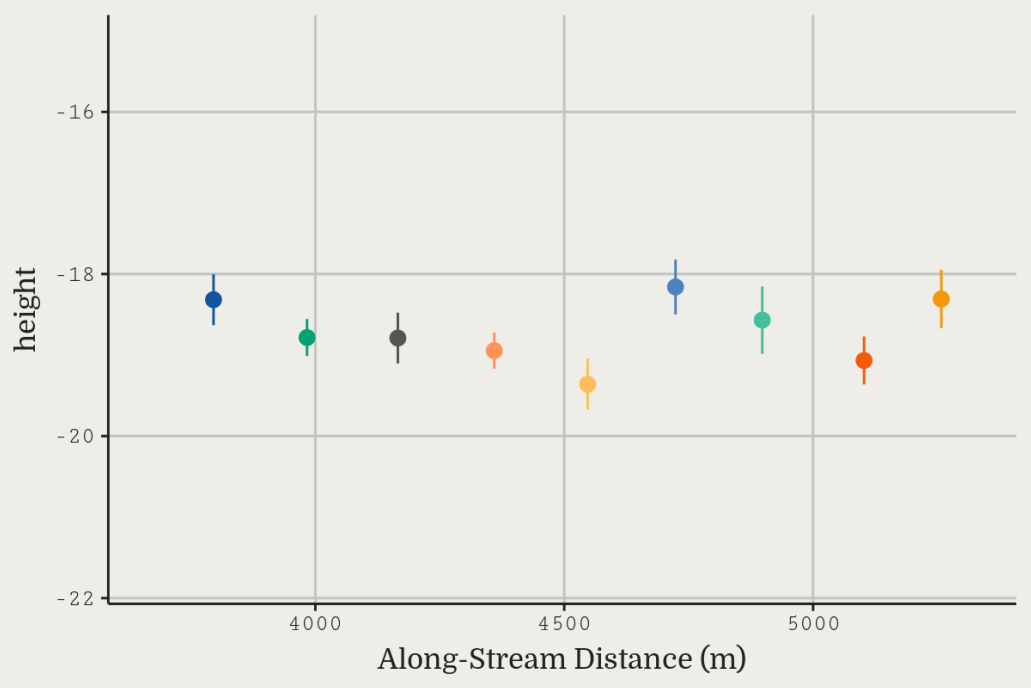
Pixel heights (interior water only)



18/30

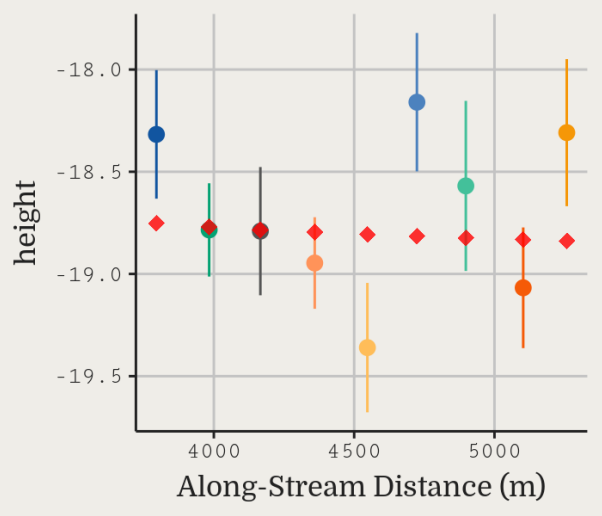
Node Height Aggregation

Resulting node heights (with 1-sigma uncertainty)



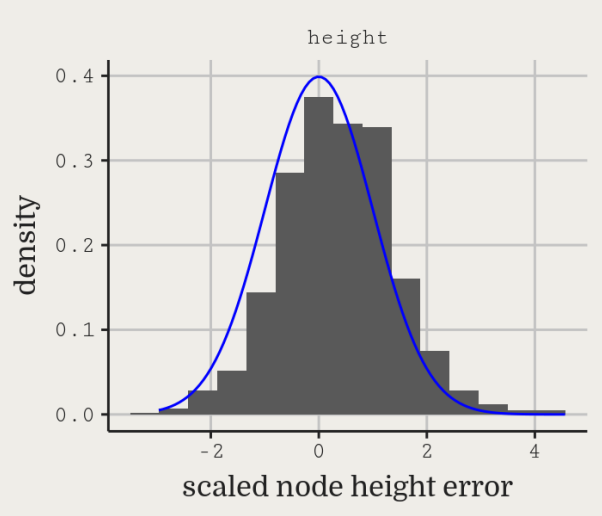
19/30

Aside: Uncertainty Validation



- Observations are supplied with *theoretical* (not empirical) uncertainty estimates
- Want to validate these estimates against empirical errors
  - Use synthetic node data from GDEM "Truth"
- Resulting errors (estimated - truth) form a validation dataset over entire set of nodes

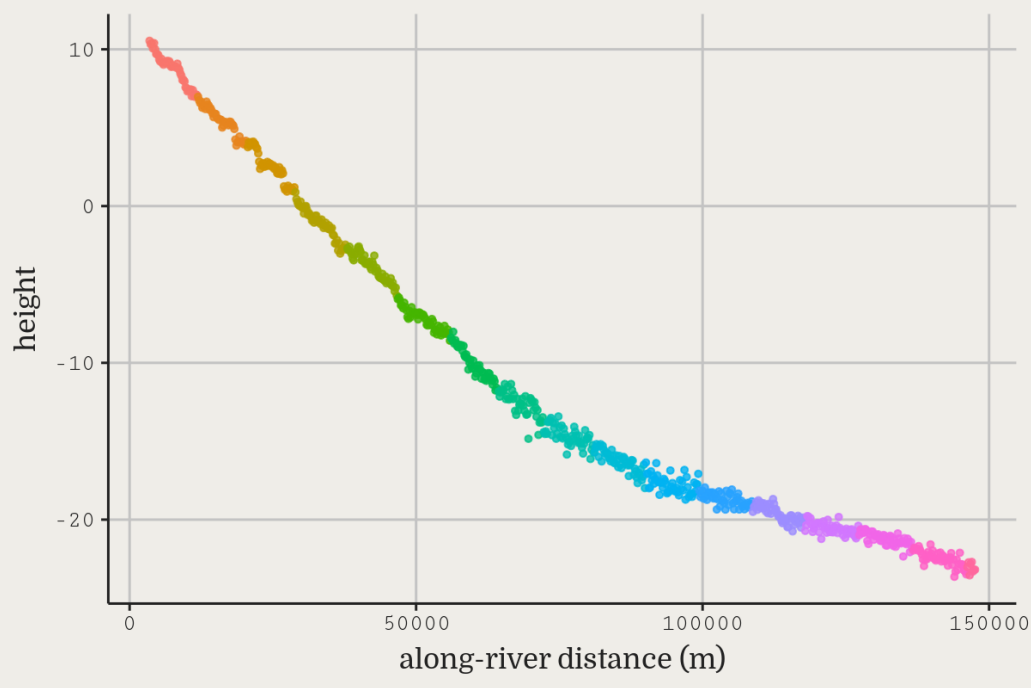
Aside: Uncertainty Validation



- Scaling these errors by estimated 1σ uncertainty produces *empirical* distribution with *theoretical* standard deviation = 1.
- Compare empirical histogram to theoretical distribution curve (assuming Gaussian)
- Height estimates peform very well
- Width and area estimates are close but not as good

End Aside

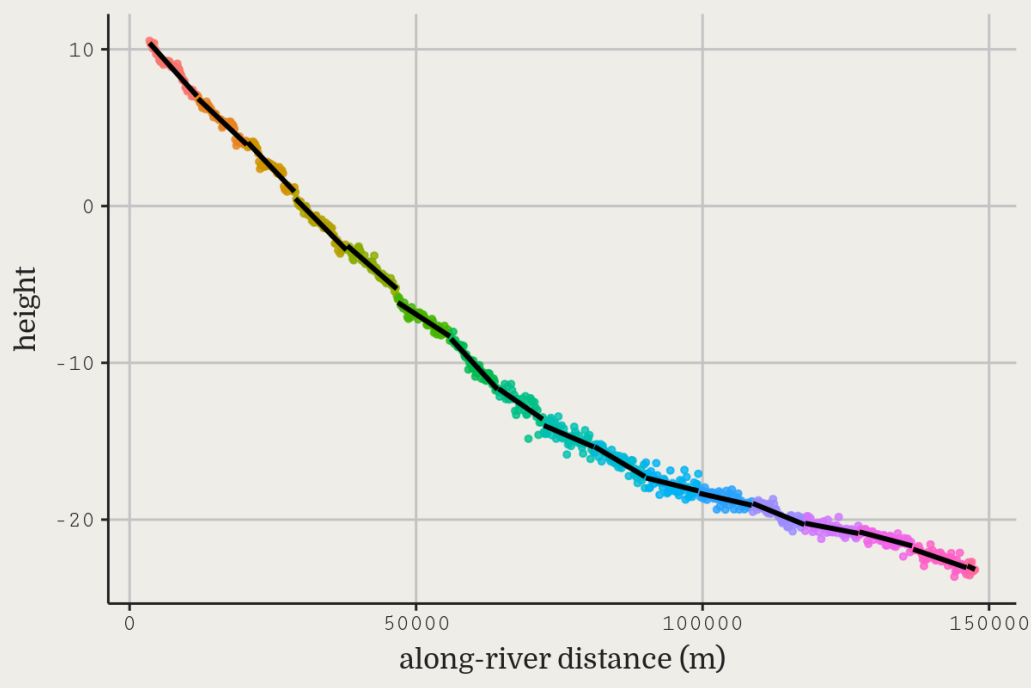
Aggregate Nodes to Reaches



- All nodes' heights (as aggregated from pixels)
- Color denotes reach

23/30

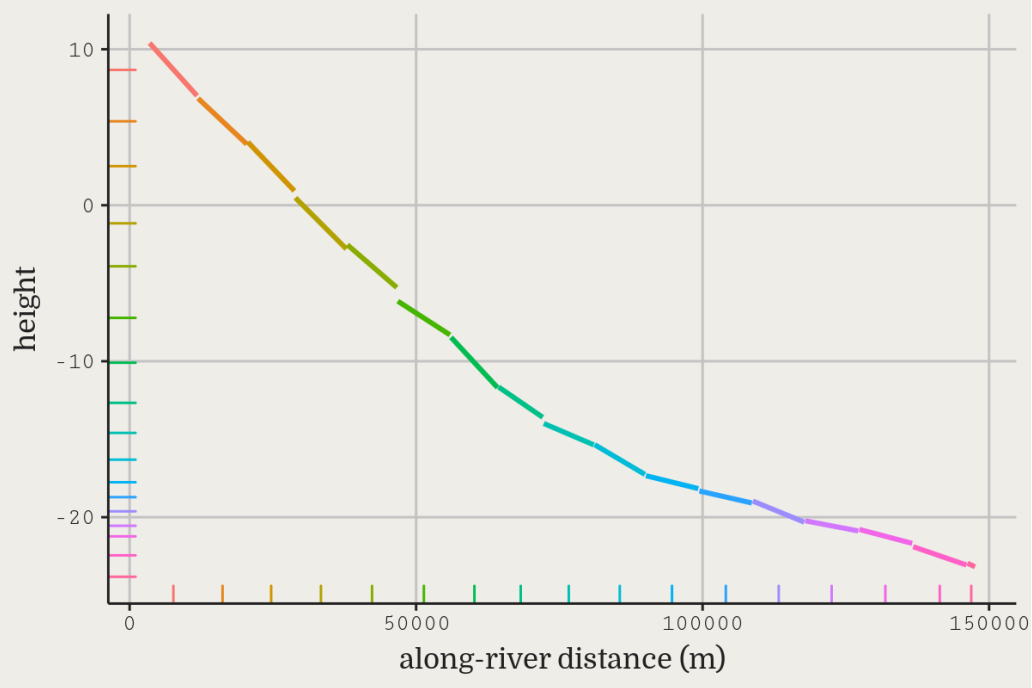
Aggregate Nodes to Reaches



- Fit linear model to each reach

24/30

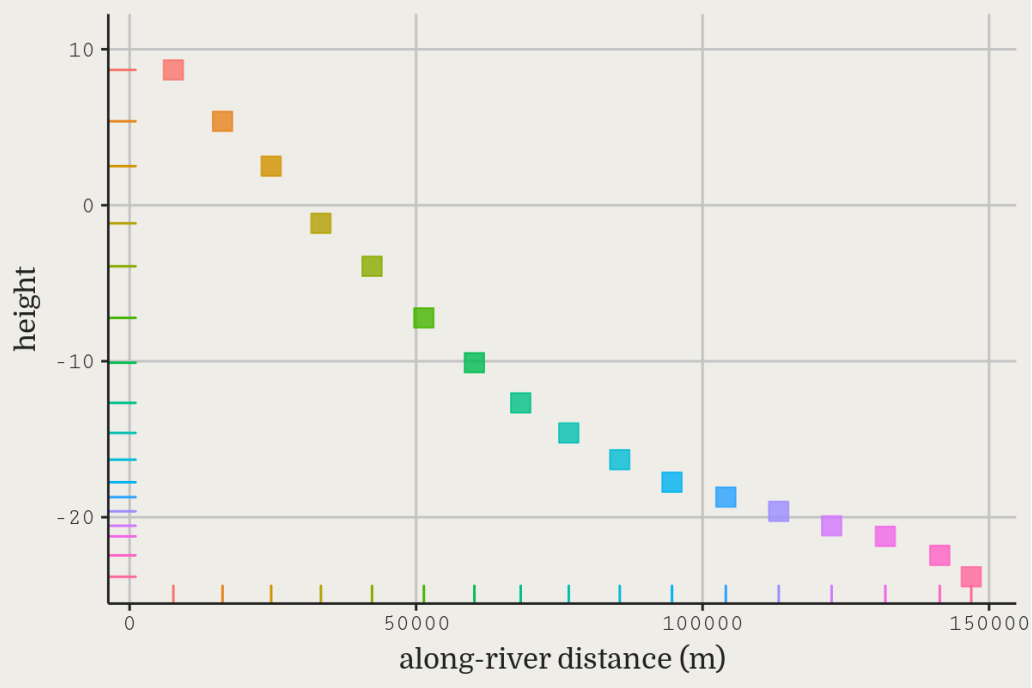
Aggregate Nodes to Reaches



- Linear models determine reach **height** and **slope**

25/30

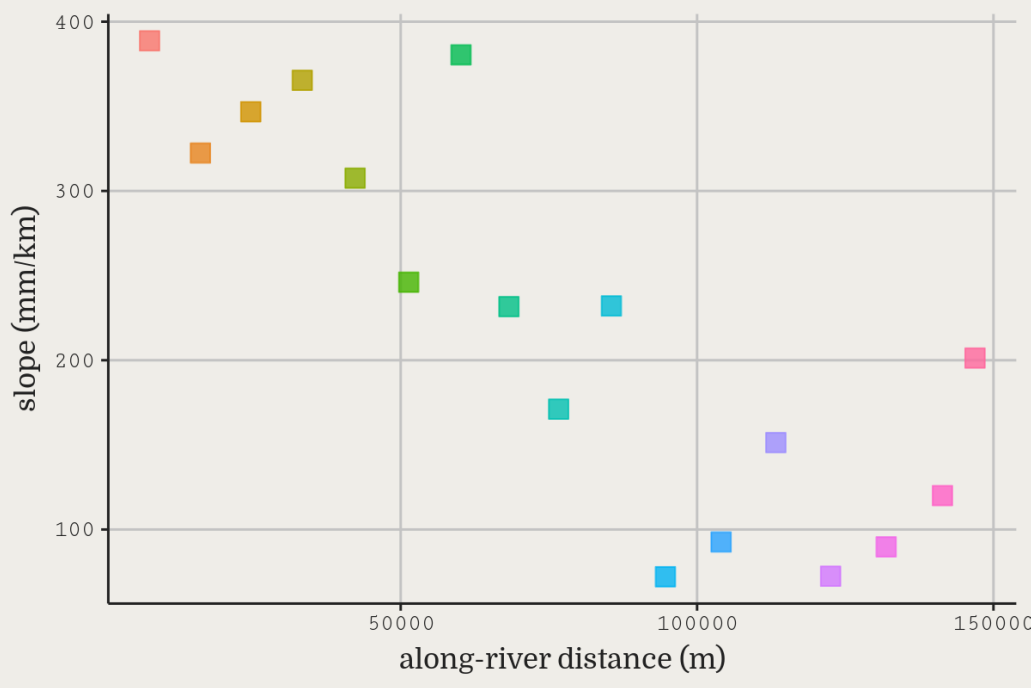
Aggregate Nodes to Reaches



- Values from all nodes in reach aggregate to produce a single reach-average value

26/30

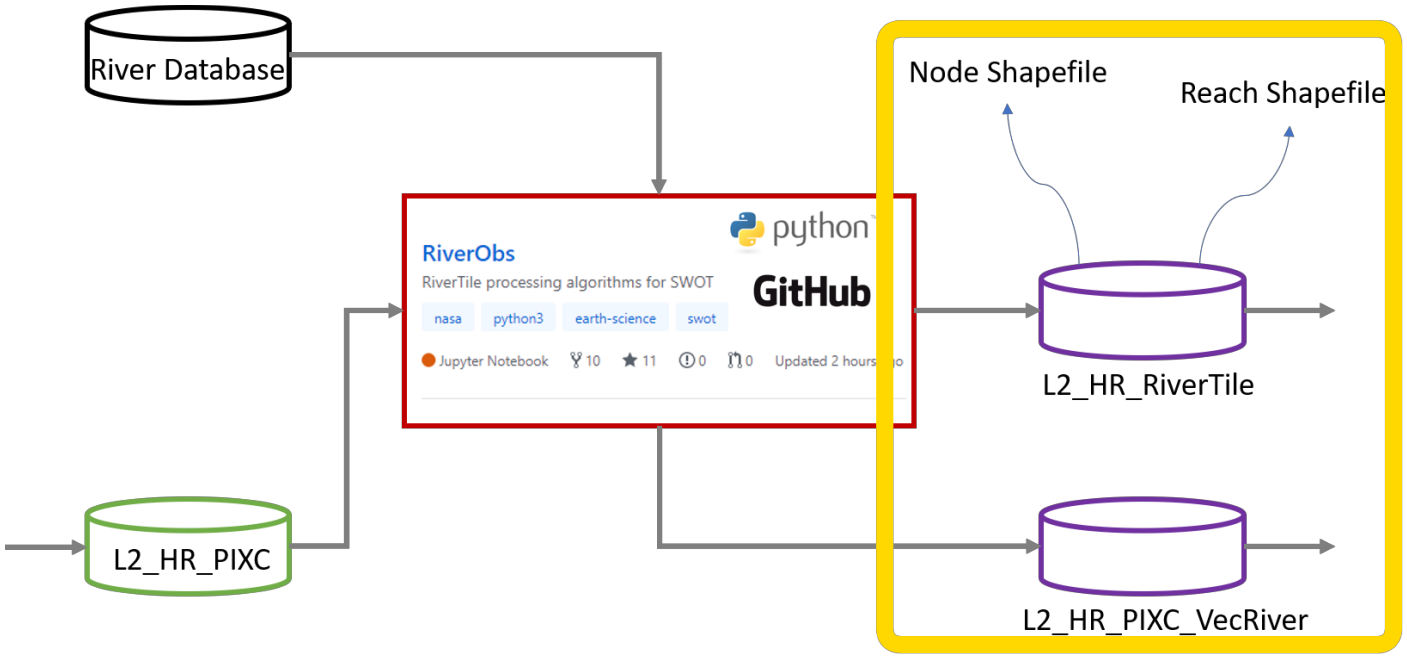
Aggregate Nodes to Reaches



- Values from all nodes in reach aggregate to produce a single reach-average value

27/30

Products



- We'll see them in action in a minute!

28/30

Products: PIXCVec

- PIXC is a standalone product
- PIXCVec works best joined to PIXC

29/30

Products: Interactive Demo

- **Link**: bit.ly/riverproducts/
- ***Disclaimers***:
  - Processor, products not finalized
  - Simulated data may contain artifacts
  - App is not a SWOT product and is only intended for demonstration purposes
- **Tips**:
  - If you get disconnected, just reload the page.
  - If the UI is slow, be patient–operations should be faster after the first one.

30/30