

# SWOT River Products

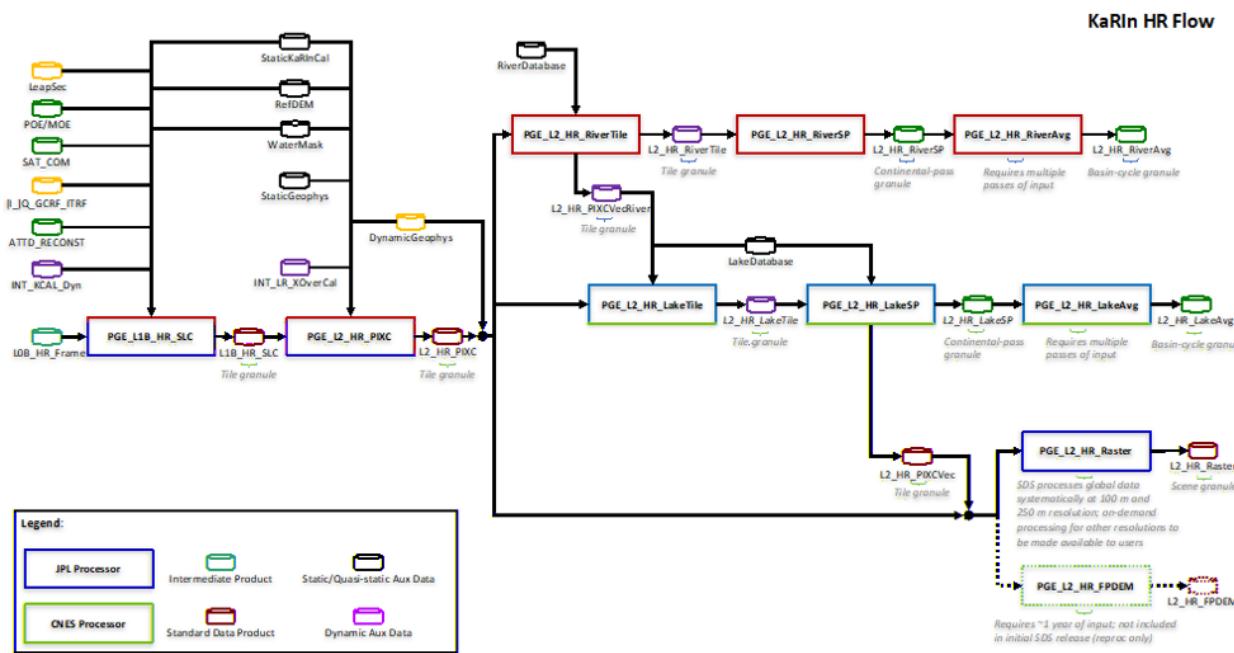
Mark Hagemann, Ohio State University

6/17/2019

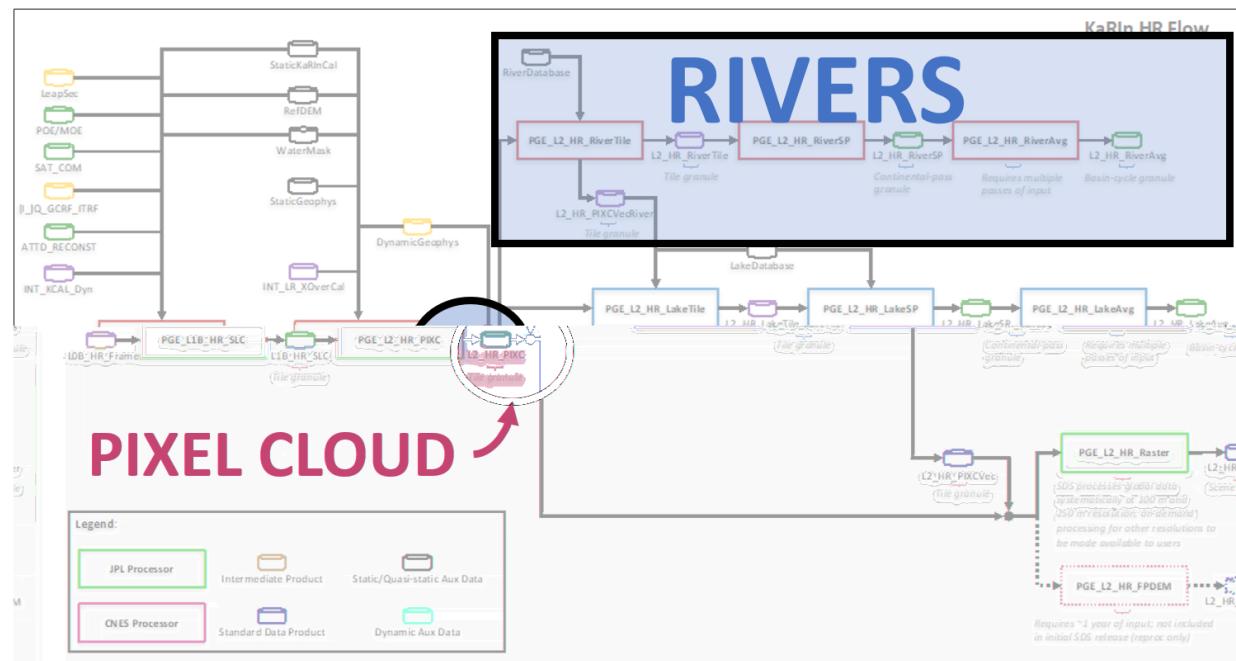
# Overview

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

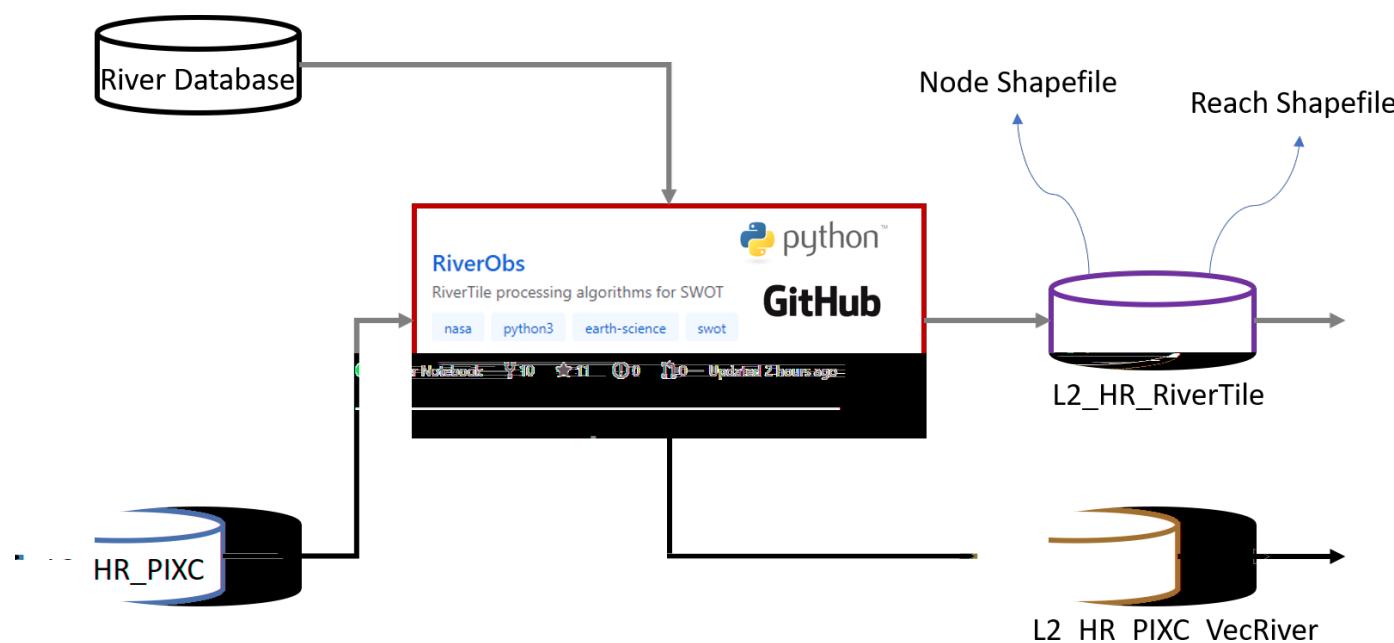
# HR Processing Flow



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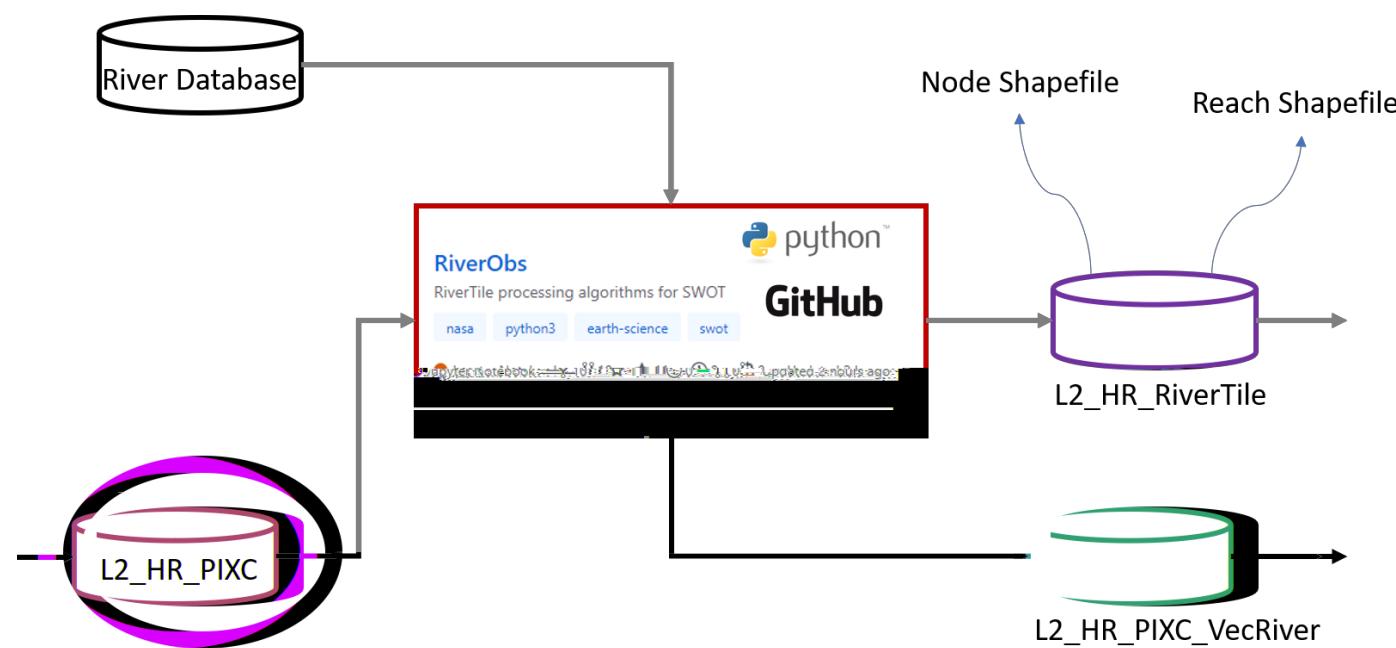


# HR Processing: PIXC → river products

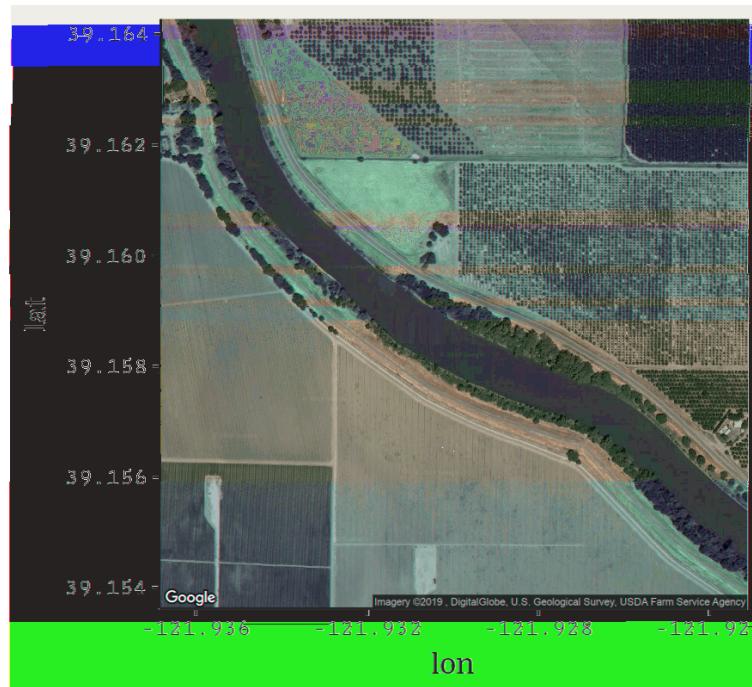




# Pixel Cloud

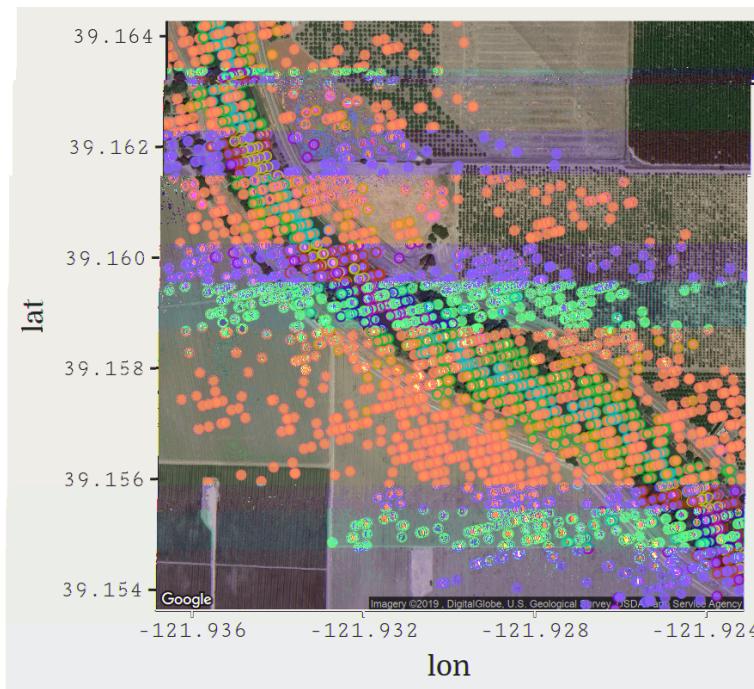


# Pixel Cloud



- Zoom in to a small section of Sacramento

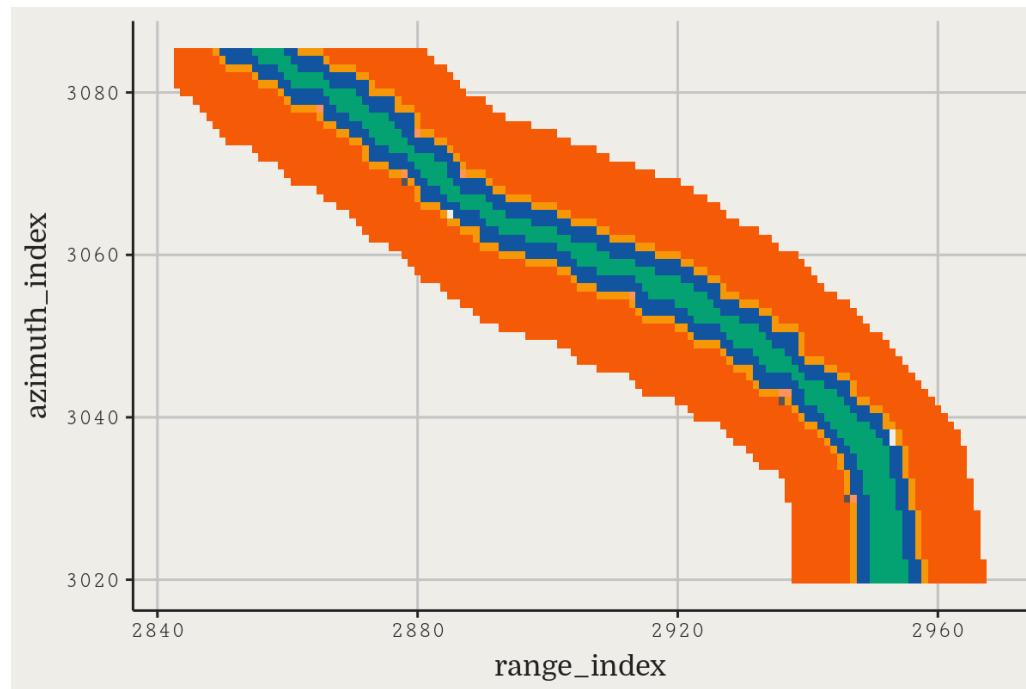
# Pixel Cloud



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

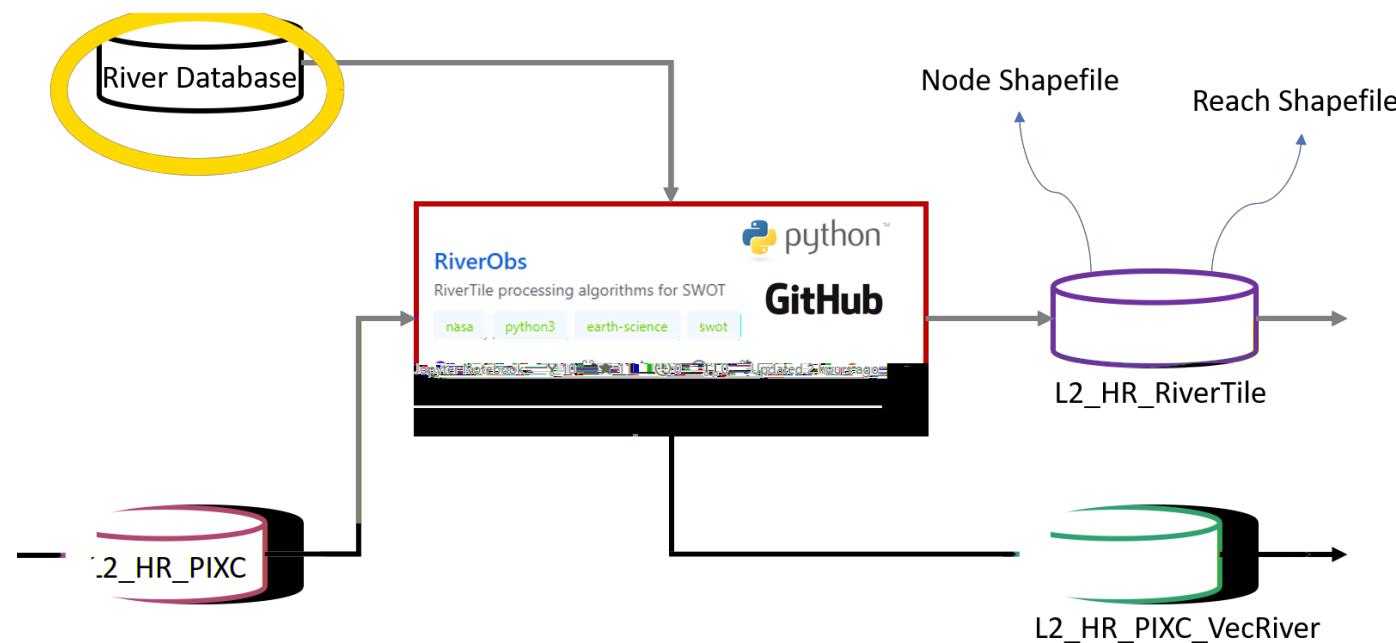
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# Pixel Cloud

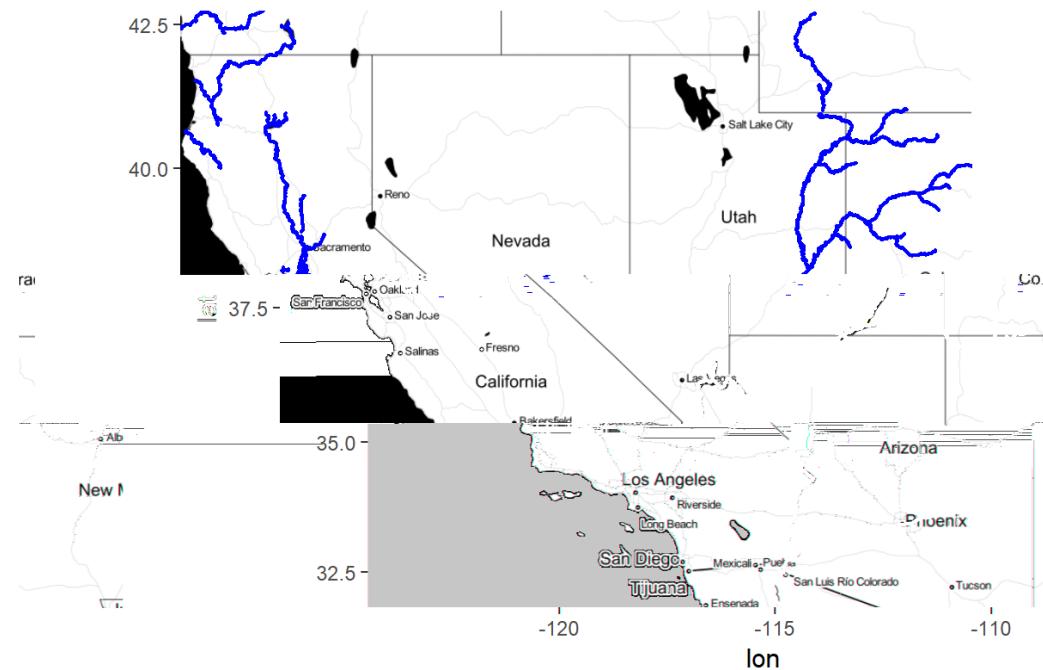


- Pixel cloud in slant plane (looks like pixels!)

# Prior Reach, Node database

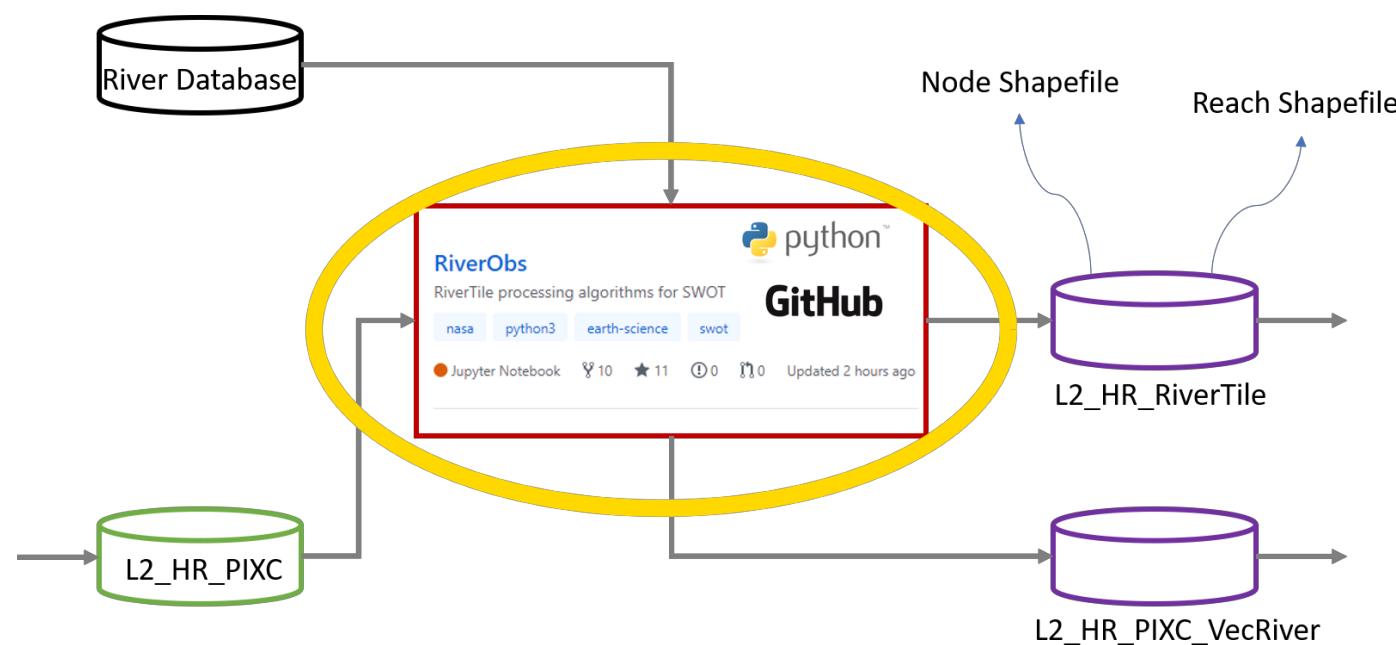


# Prior Reach, Node database



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

# RiverObs



# RiverObs

## RiverObs

RiverTile processing algorithms for SWOT

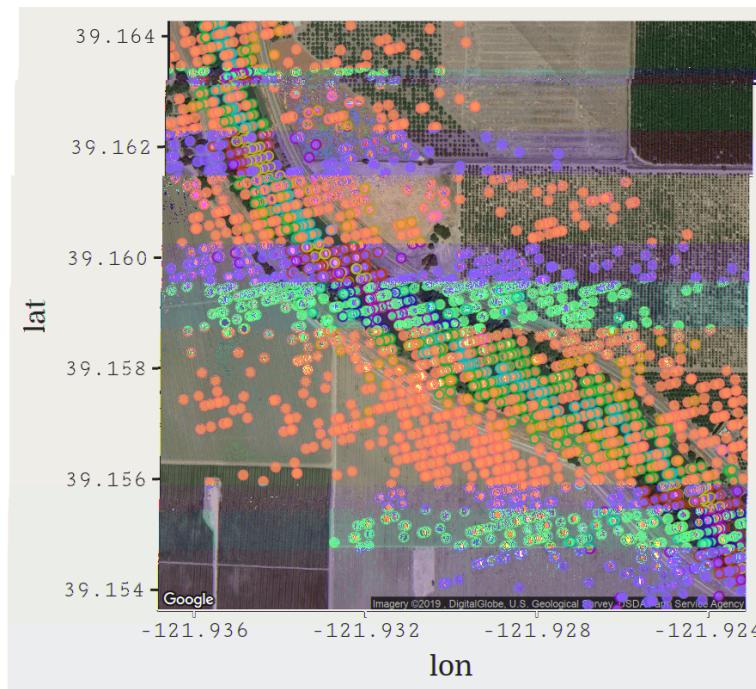
nasa python3 earth-science swot

● Jupyter Notebook 10 ⚡ 11 ★ 11 ⓘ 0 Updated 2 hours ago

- 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

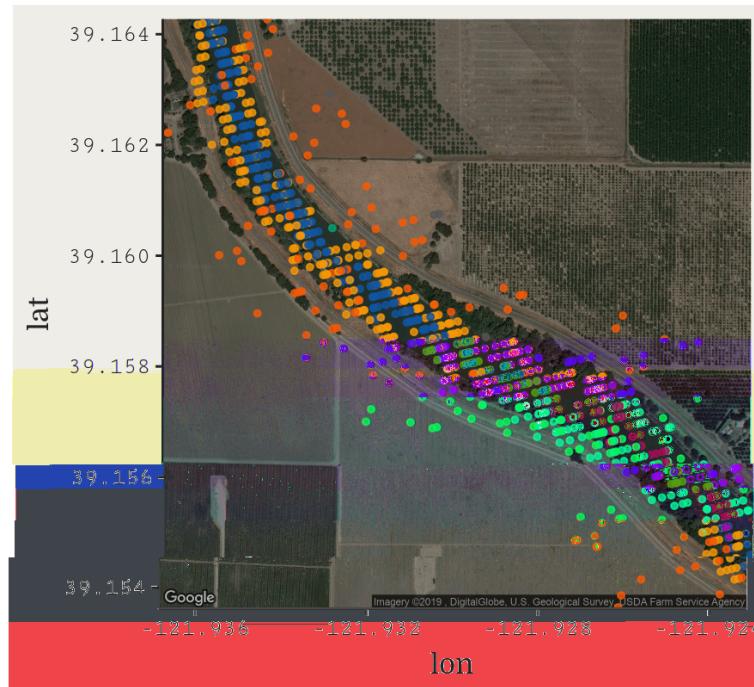
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# Returning to example



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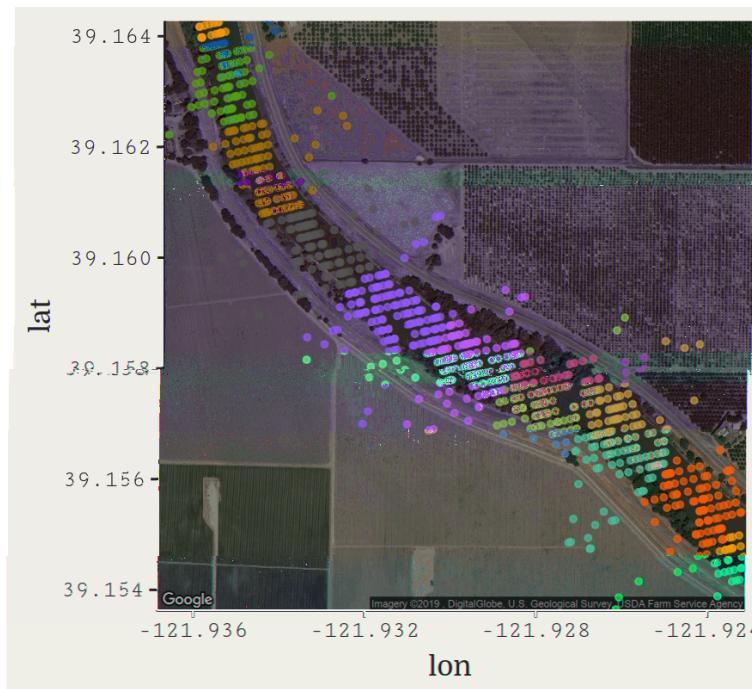
# RiverObs Processing



- Only deal with water pixels
- segment into disjoint features

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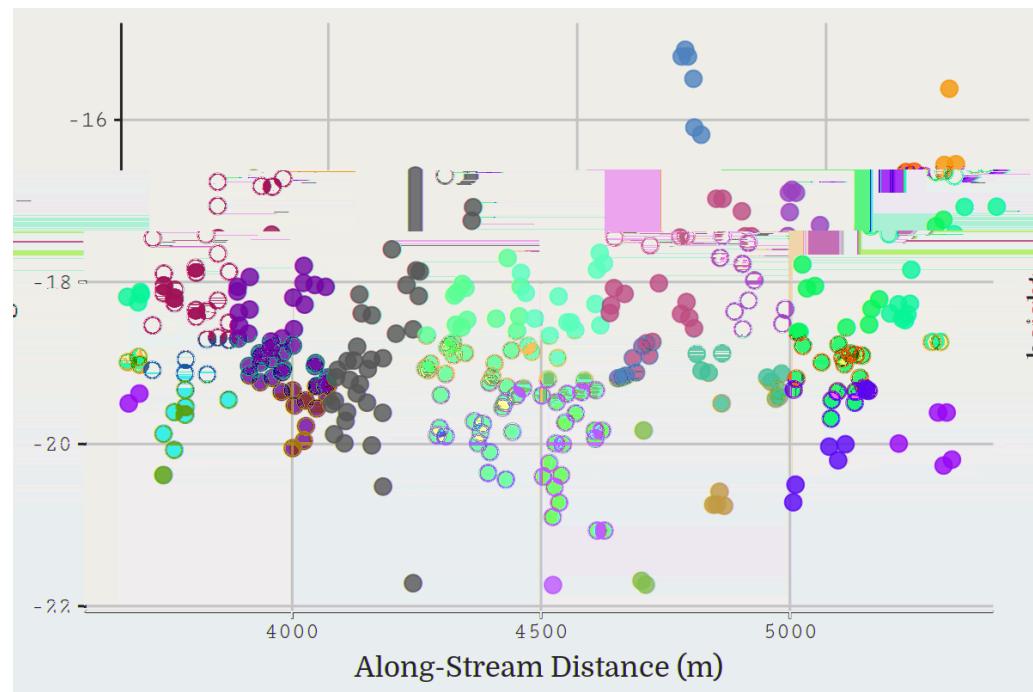
# RiverObs processing



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

# Node Height Aggregation

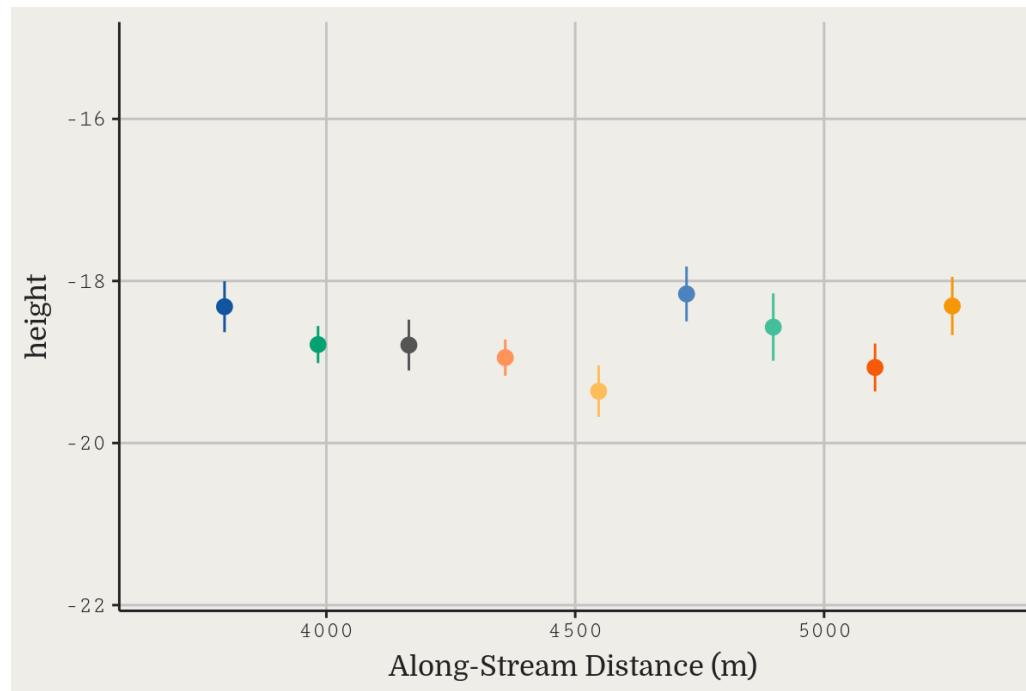
Pixel heights (interior water only)



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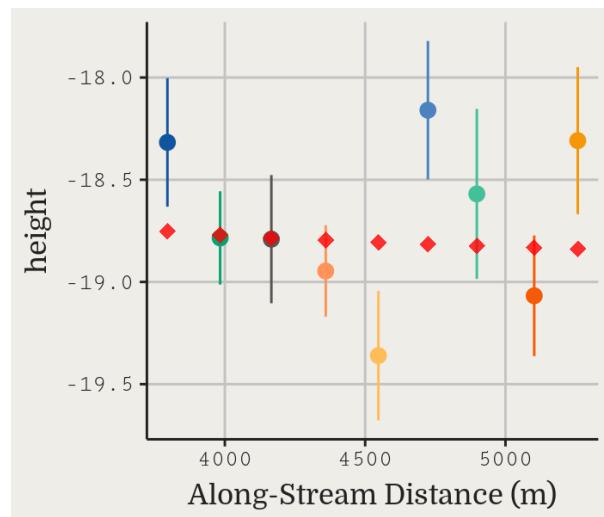
# Node Height Aggregation

Resulting node heights (with 1-sigma uncertainty)



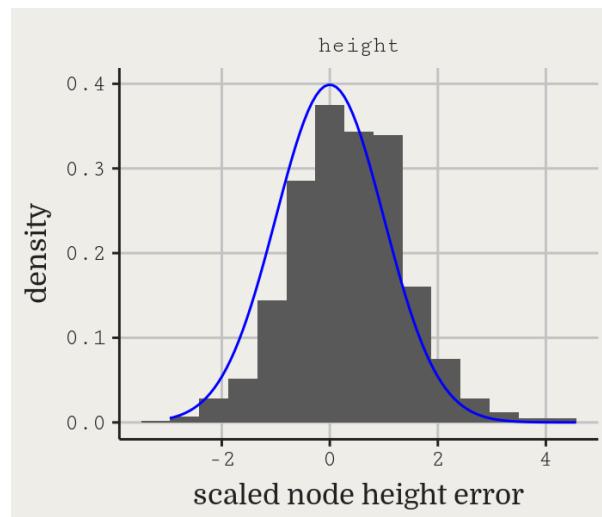
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# Aside: Uncertainty Validation



- 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

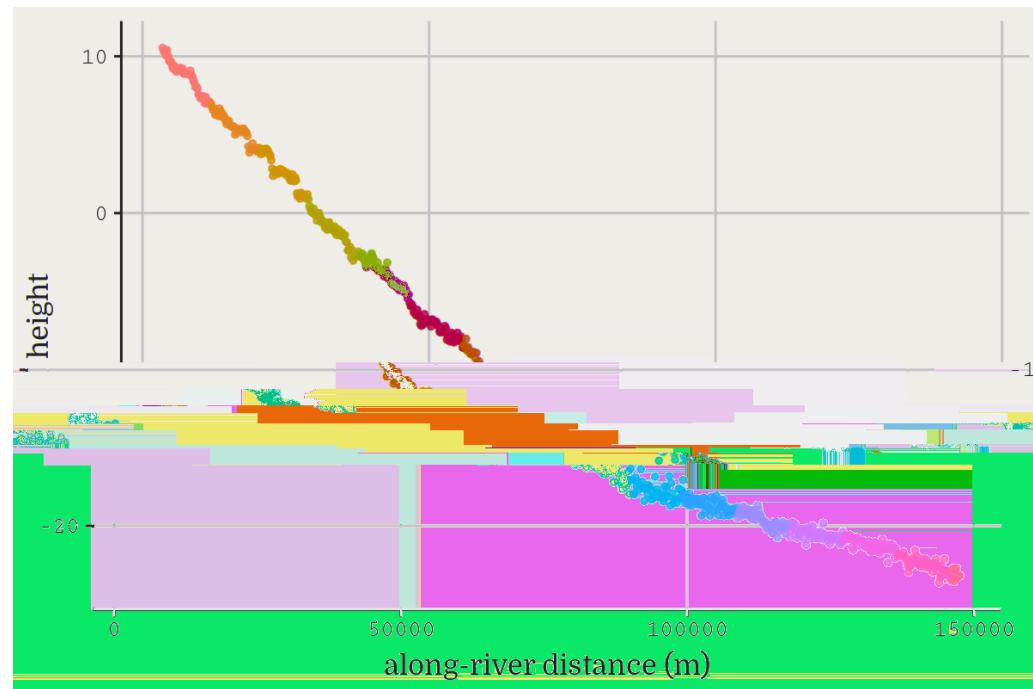


- Scaling these errors by estimated  $1\sigma$  uncertainty produces *empirical* distribution with *theoretical* standard deviation = 1.
- Compare empirical histogram to theoretical distribution curve (assuming Gaussian)
- Height estimates perform very well
- Width and area estimates are close but not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

# *End Aside*

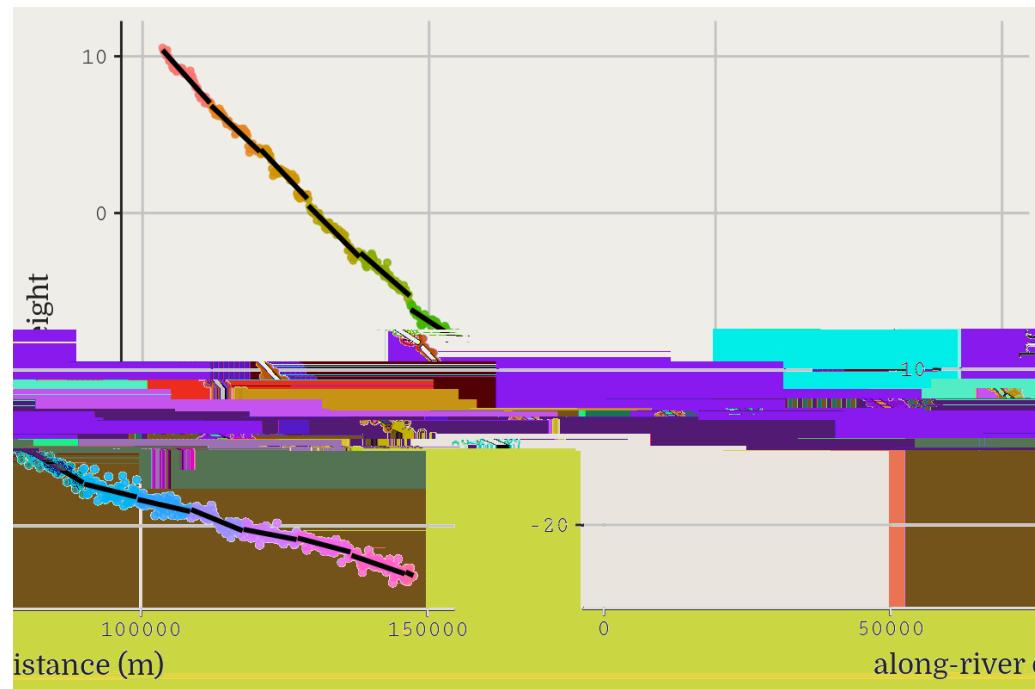
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# Aggregate Nodes to Reaches



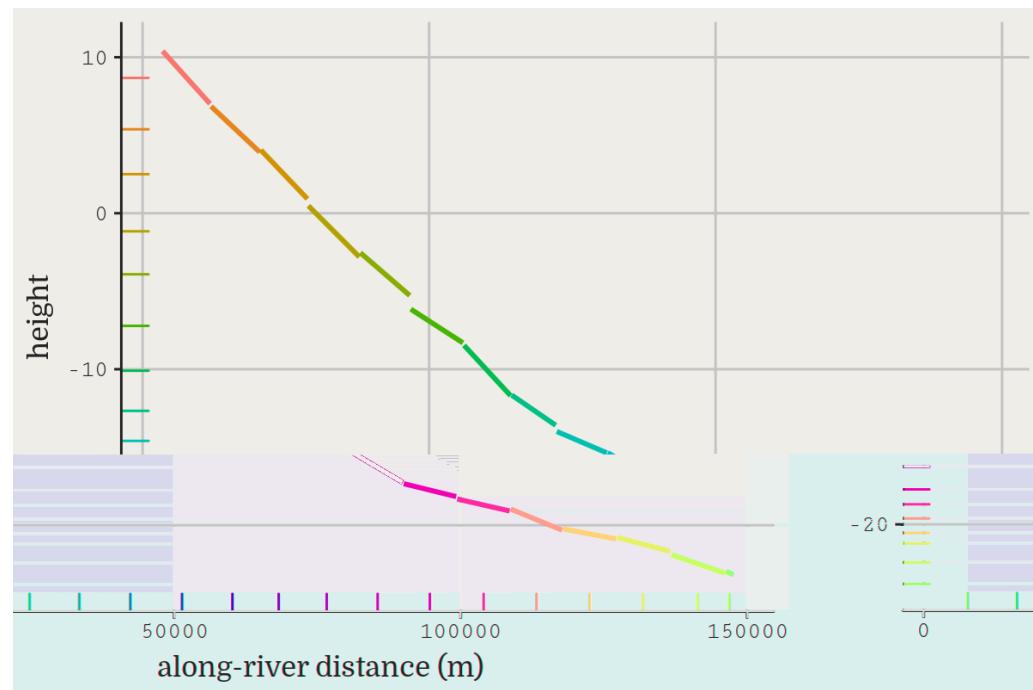
- All nodes' heights (as aggregated from pixels)
- Color denotes reach

# Aggregate Nodes to Reaches



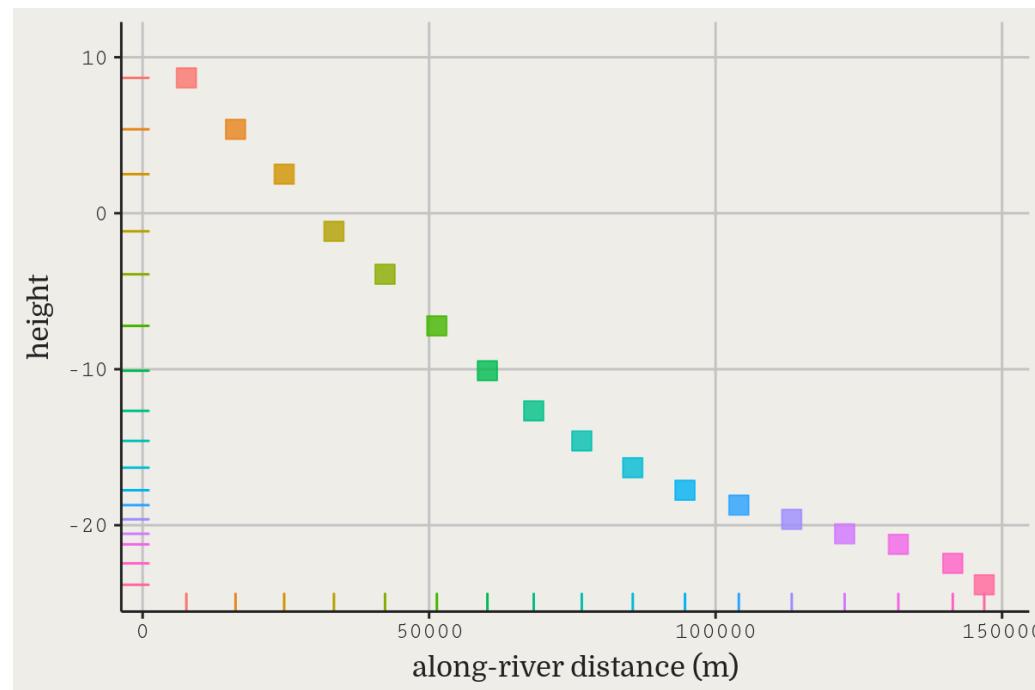
- Fit linear model to each reach

# Aggregate Nodes to Reaches



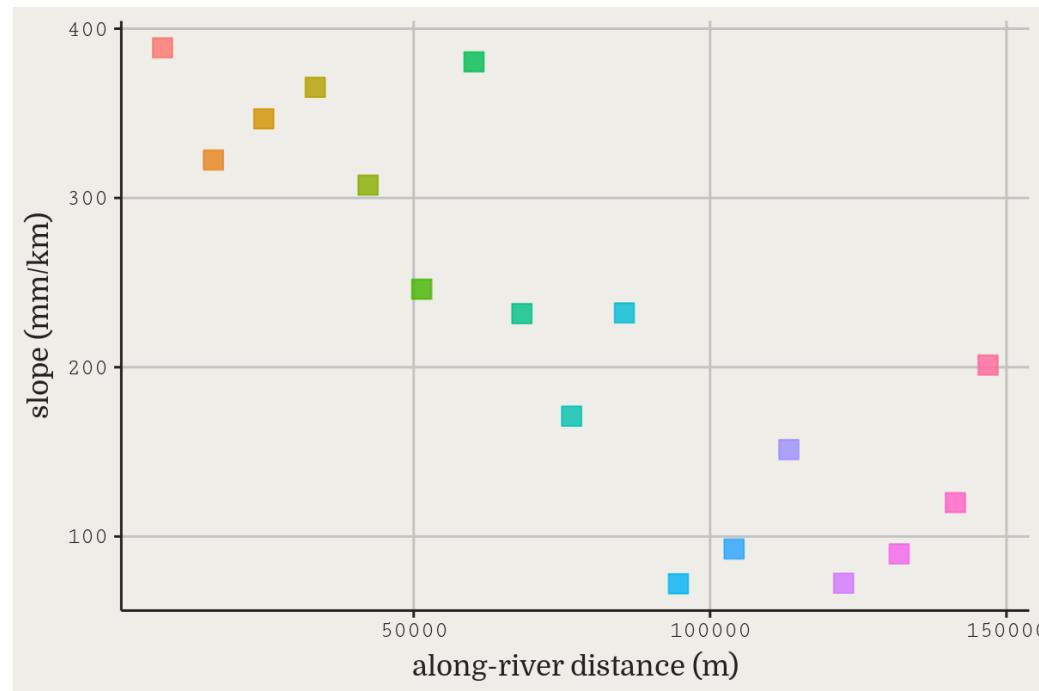
- Linear models determine reach **height** and **slope**

# Aggregate Nodes to Reaches



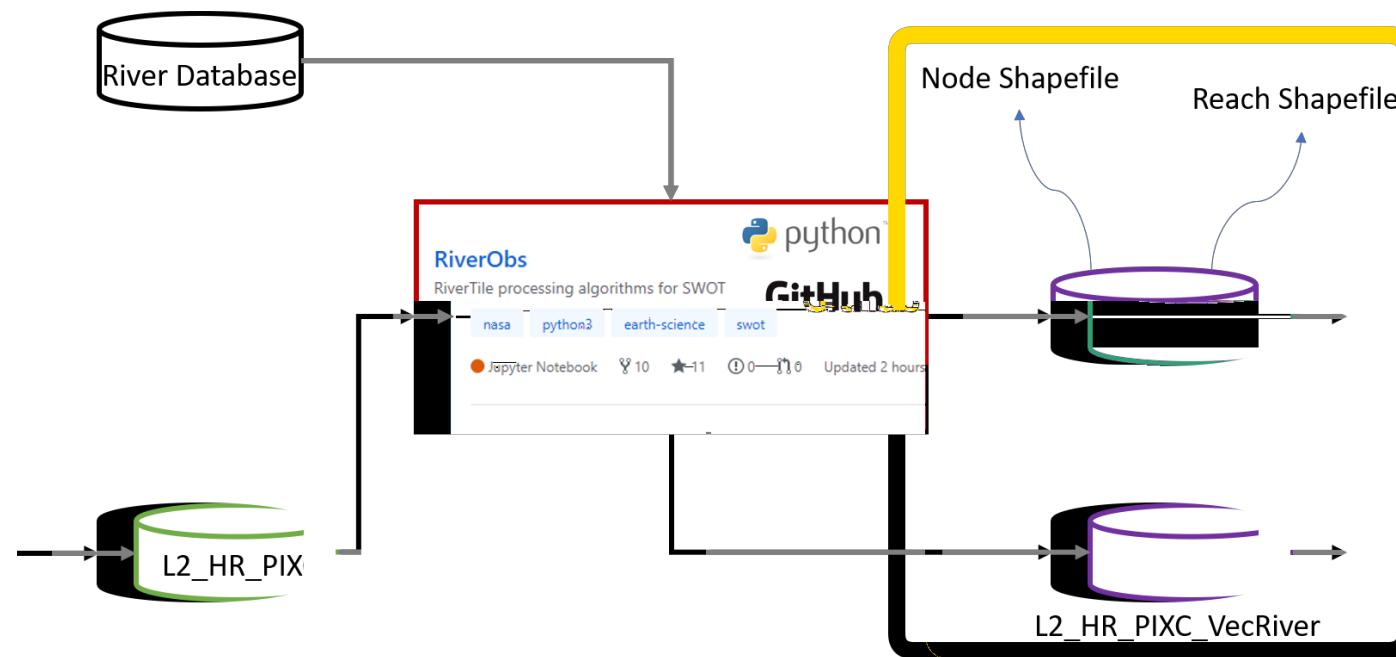
- Values from all nodes in reach aggregate to produce a single reach-average value

# Aggregate Nodes to Reaches



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

# Products



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

# Products: PIXCVec



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

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# Products: Interactive Demo

- Link: [bit.ly/riverproducts/](https://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.