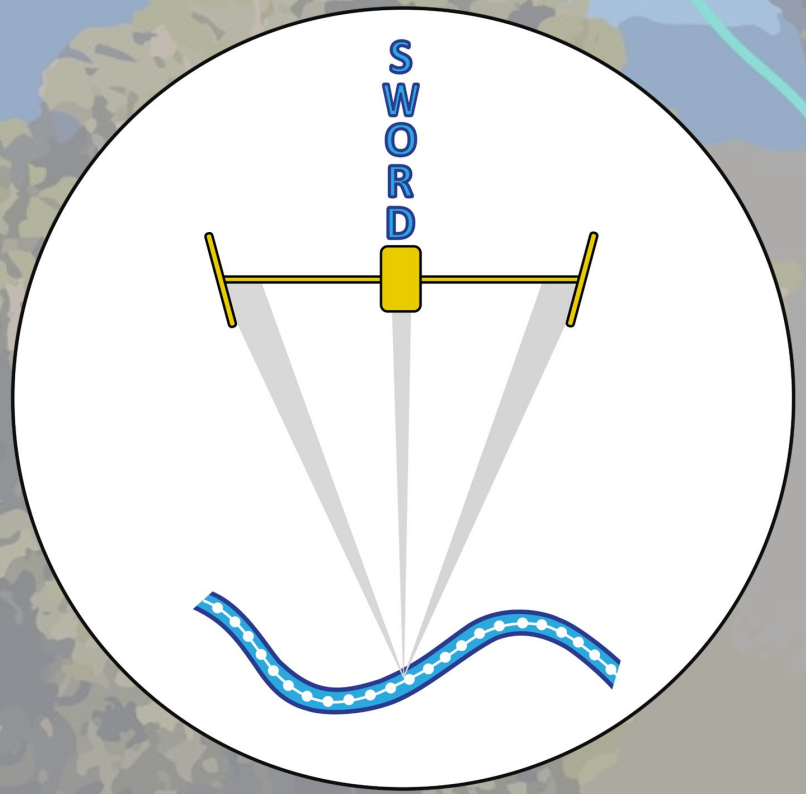
SWOT **R**iver **D**atabase (**SWORD**)



Tamlin Pavelsky
Elizabeth Altenau
September 15, 2021
SWOT Science Team Meeting

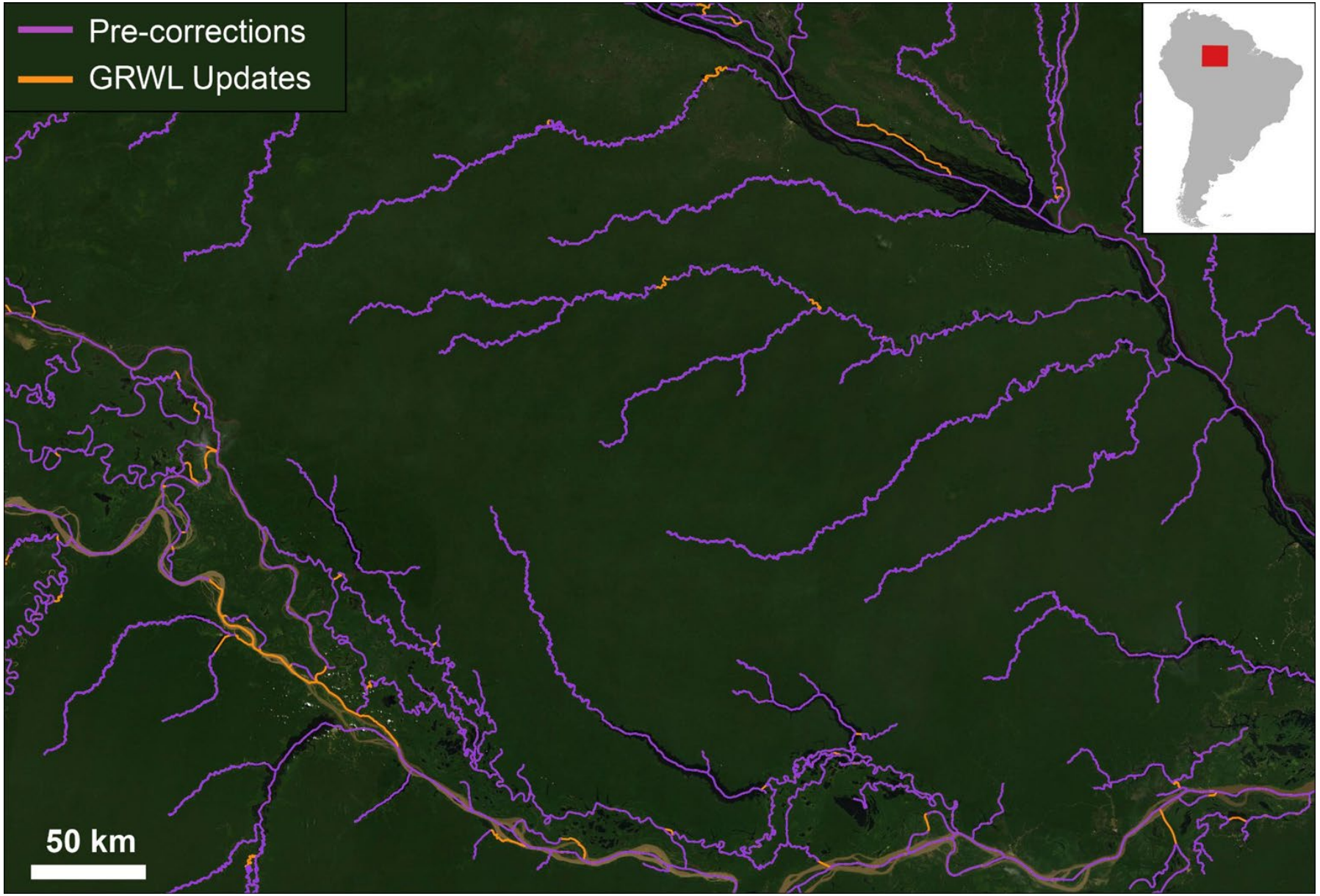
SWORD Philosophy & Goals

- Primary goal: provide a global vector framework for SWOT river data products.
  - Static in time, except for updates at reprocessings
  - Represents most rivers as single threads
    - if you want to work on a particular highly complex reach, we'd recommend building your own bespoke vector product
  - Includes network topology for most reaches
    - Exceptions: some canals, deltas, and multichannel areas
- Two Linked Databases: Reach and Node
  - Reaches are ~10 km long on average
  - Nodes are ~200 m long
  - Reaches are made up of sets of nodes
- Format: both NetCDF and Shapefile

SWORD Development

1. **GRWL Updates**
   - Improvements to GRWL centerline connectivity.
2. **Merging Databases**
   - Attaching attributes from different global datasets to GRWL.
3. **Reach Definition**
   - Defininting ~10 km reaches and ~200 m nodes.
4. **Topology Definition**
   - Creating a consistent, global structure for ordering reaches and nodes.

GRWL Updates



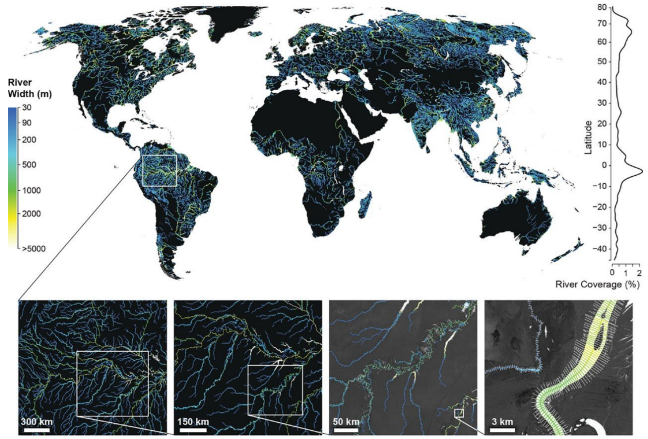
Updates to GRWL's centerlines were needed in order to improve connectivity.

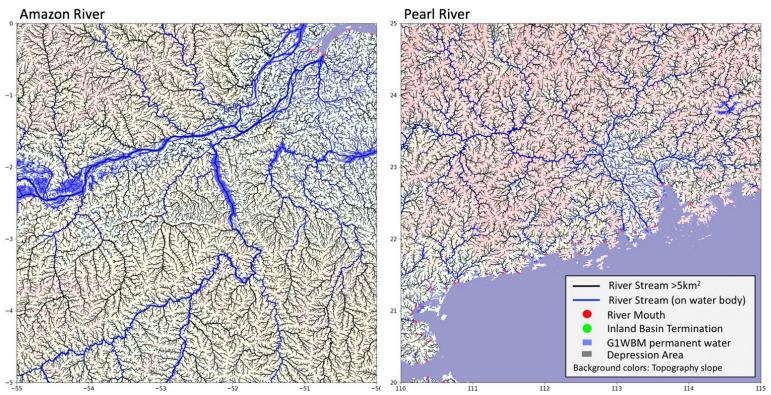
A Google Earth Engine application was used to manually identify areas that needed to be connected in the GRWL network.

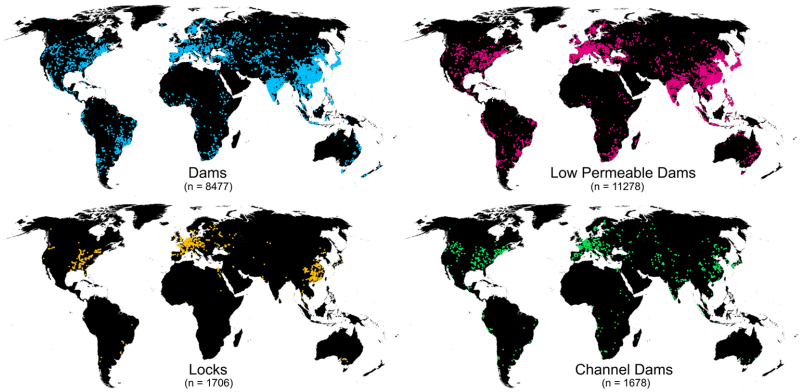
After the discontinuities were identified, they were run through an automatic script to connect them to the existing centerline network.

Merging Databases: Datasets

DATASET	ATTRIBUTE CONTRIBUTION
Global River Widths from Landsat (GRWL) (*Allen & Pavelsky, 2018*)	Provides river centerline locations at 30 m resolution and associated width, water body type, and number of channels attributes.
MERIT Hydro (*Yamazaki et al., 2019*)	Provides elevation and flow accumulation at 3 arc-second resolution (~90 m at the equator).
HydroBASINS (*Lehner & Grill, 2013*)	Provides Pfafstetter nested basin codes up to level 6.
Global River Obstruction Database (GROD) (*Whittemore et al., 2020, Yang et al., in review*)	Provides global locations of anthropogenic river obstructions along the GRWL river network.
Global Delta Maps (*Tessler et al., 2015*)	Provides the spatial extent of 48 of the world's largest river deltas.
SWOT Orbits (*https://www.aviso.altimetry.fr/en/missions/future-missions/swot/orbit.html*)	Provides polygons containing SWOT track coverage for each pass throughout the 21-day cycle orbit.
HydroFALLS (*http://wp.geog.mcgill.ca/hydrolab/hydrofalls/*)	Provides global locations of waterfalls and natural river obstructions.







Reach Definition

1) Divide Reaches at:

Basins

⬇

Tributaries

⬇

Dam/Lake Boundaries

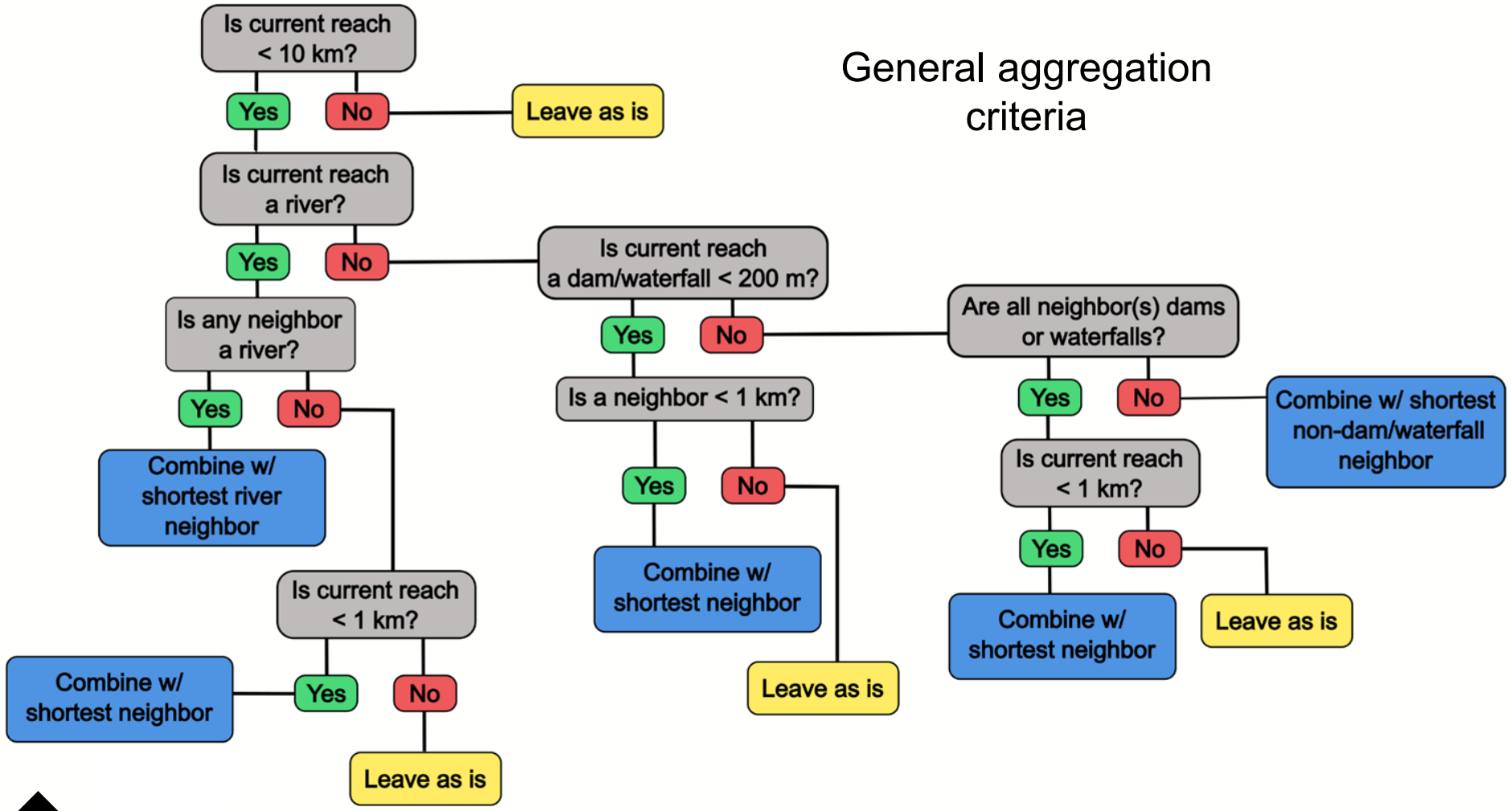
⬇

SWOT Orbits

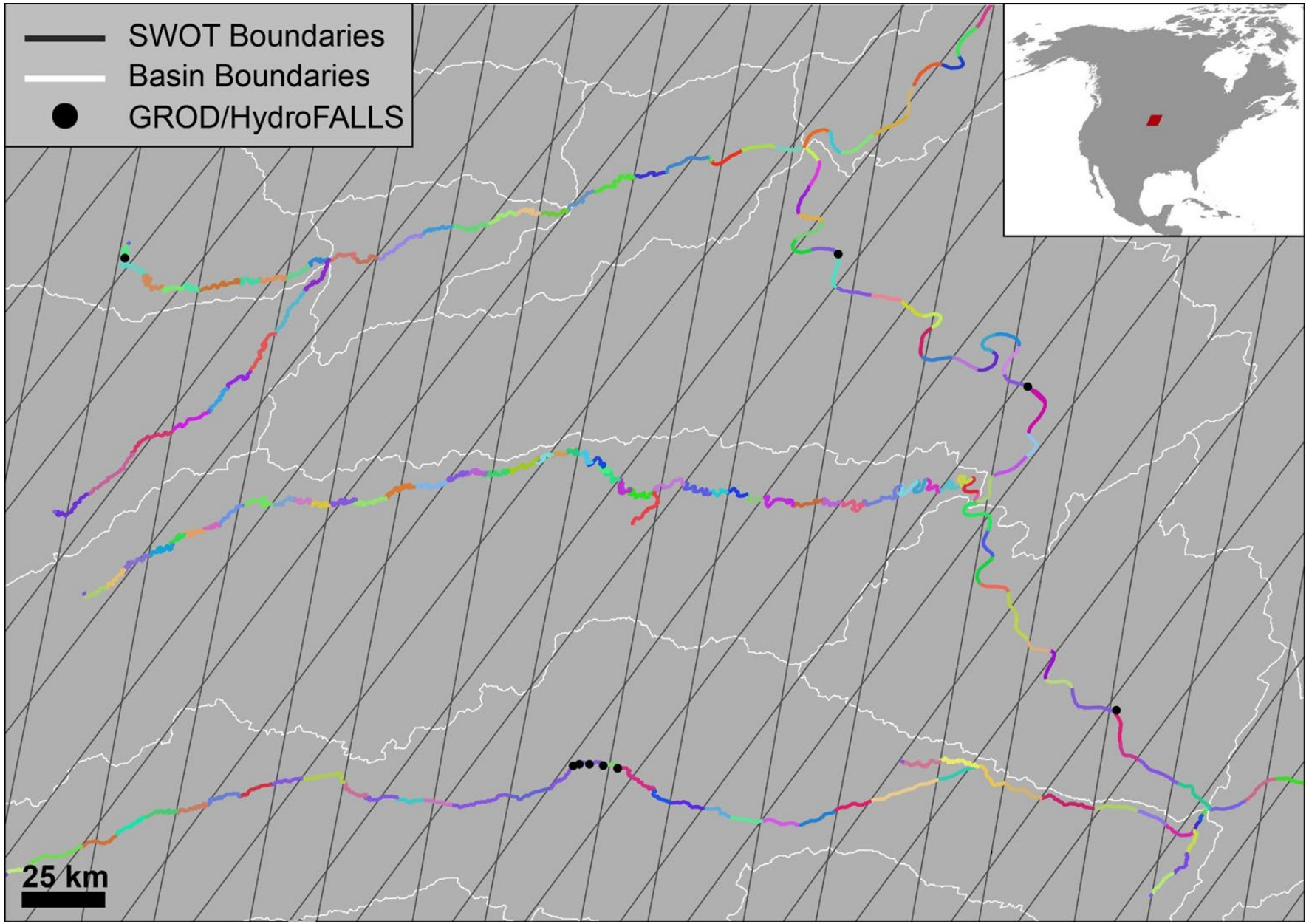
⬇

2) Aggregate Reaches <10 km

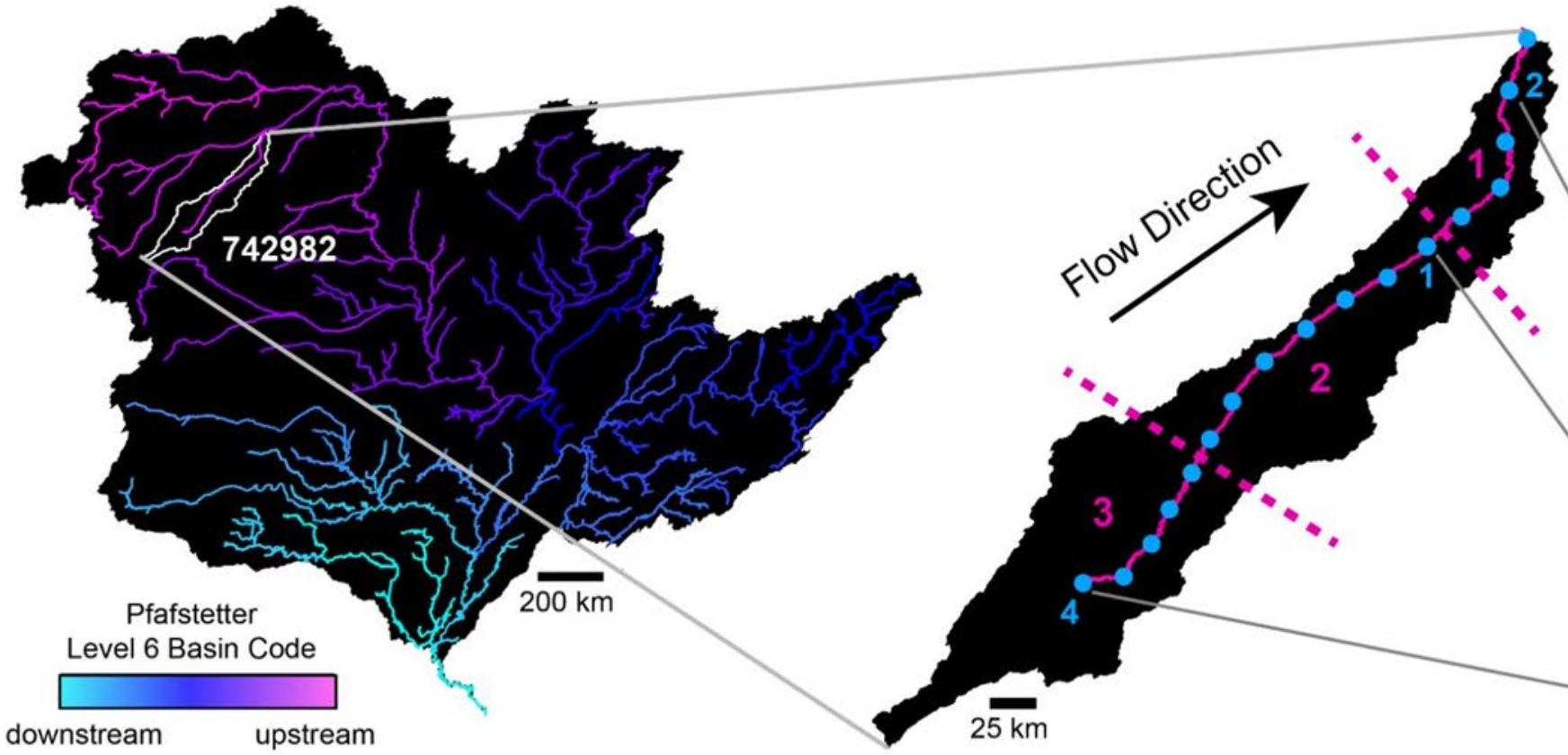
General aggregation criteria



Reach Definition



Topology: SWORD River ID Format



CBBBBBRRRRNNNT

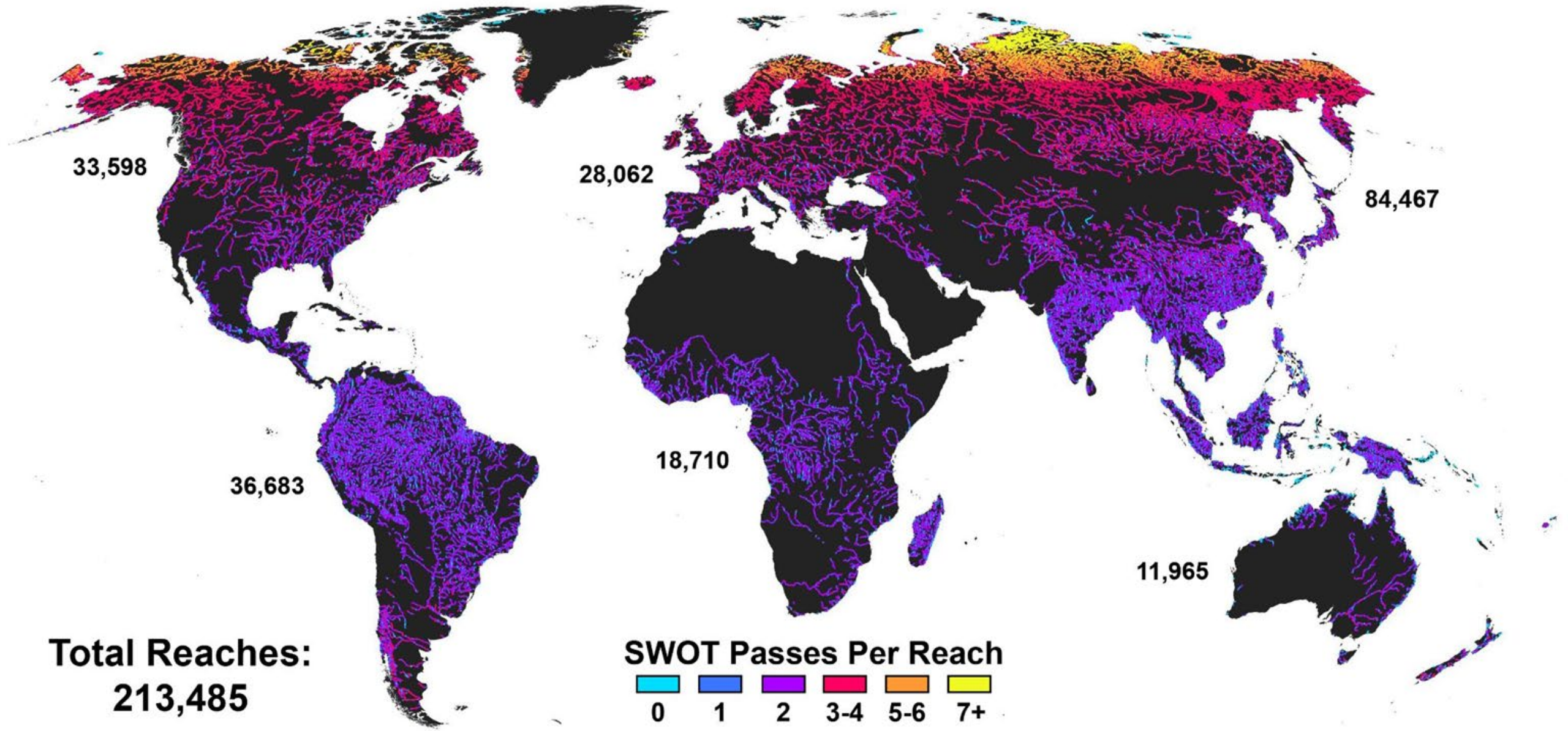
- C - Continent Digit (Pfafstetter L1)
- B - Pfafstetter Basin Codes (L2-L6)
- R - Reach Number
- N - Node Number
- T - Type

74298200010021 *(node id)*
74298200011 *(reach id)*

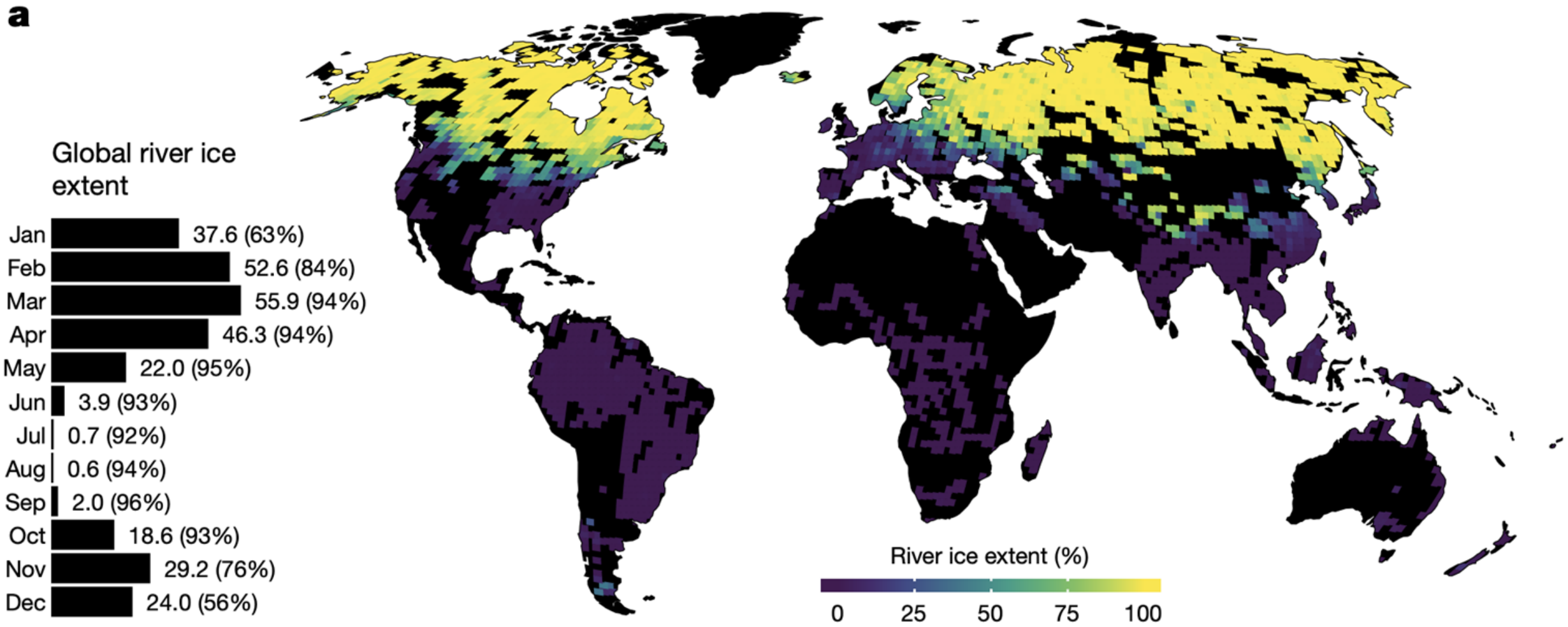
74298200020011 *(node id)*
74298200021 *(reach id)*

74298200030041 *(node id)*
74298200031 *(reach id)*

SWORD Passes per Cycle

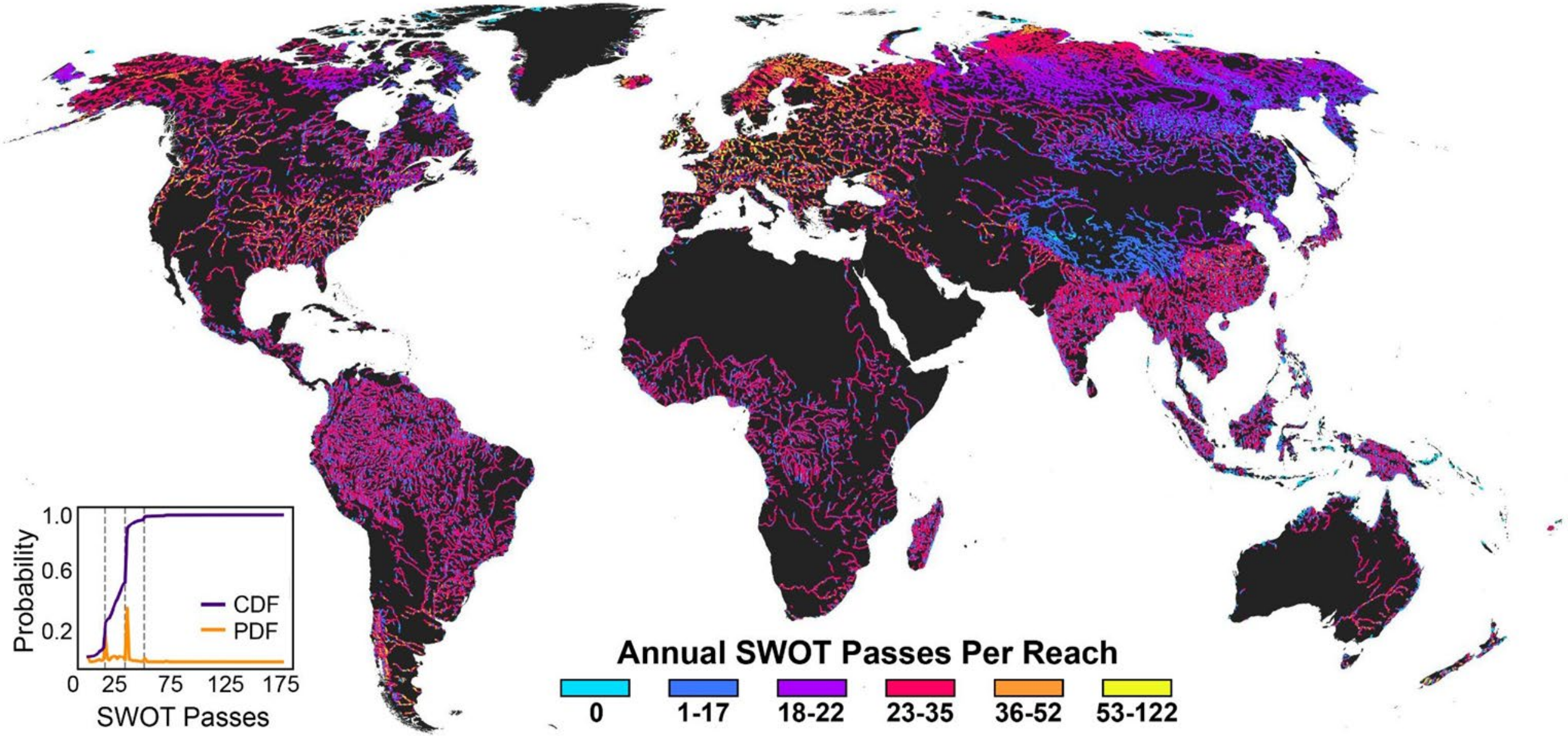


Climatological Global River Ice Extent Estimated from Landsat



Yang et al., *Nature*, 2020

SWORD Observations per Year



Updating SWORD

- Near-term work:
  - Paper led by Elizabeth Altenau published in *WRR* (https://doi.org/10.1029/2021WR030054)
  - Updating topology to account for large lakes (Jida Wang)
  - Updating channels for large deltas/estuaries (Marc Simard et al.)
  - Continuing minor topology fixes (>98% of reaches are now correct)
- After launch:
  - We will update SWORD based on actual SWOT data--if there are rivers that are observed by SWOT that aren't currently in SWORD, we will add them
  - We will update river location and topology
  - New updates will be applied at all reprocessings
- How can you access SWORD?
  - Current link: http://gaia.geosci.unc.edu/SWORD/SWORD_v11.zip