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Water Prediction Node Implementation and Opportunities

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Office of Water Prediction | National Water Center | CIROH

Overview

- WPN website
- WPN data catalog
- Enabling qualitative FIM evaluation
- Next steps



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WPN services

Content



Learning resources

Tutorials

The [tutorials page](#) contains a list of interactive [google colab](#) notebooks that provide detailed walkthroughs of ways to use Water Prediction Node data products as well links to other pages on this site where topics related to remote sensing and hydrological forecasting are discussed. The tutorials are a great way to quickly learn how to download and begin analyzing the data in the [data catalog](#).

Data Guide (Coming soon)

The data guide will provide an in-depth overview of the data available in the data catalog.



Data catalog



in viirs-1-day   



Assets

- > thumbnail
- > image

Collection

viirs-1-day

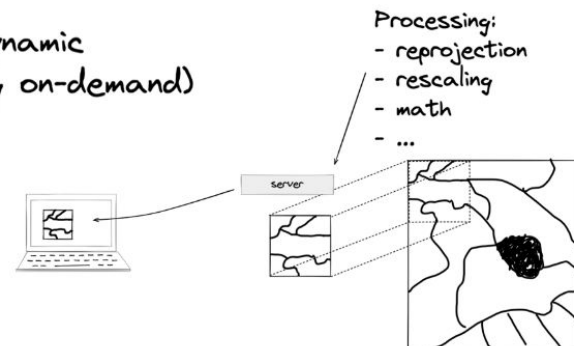
VIIRS 1-day composite flood maps collection

8/24/2023, 12:00:00 AM UTC until present

Data services

Web map tile serving:

Dynamic
(rendering on-demand)



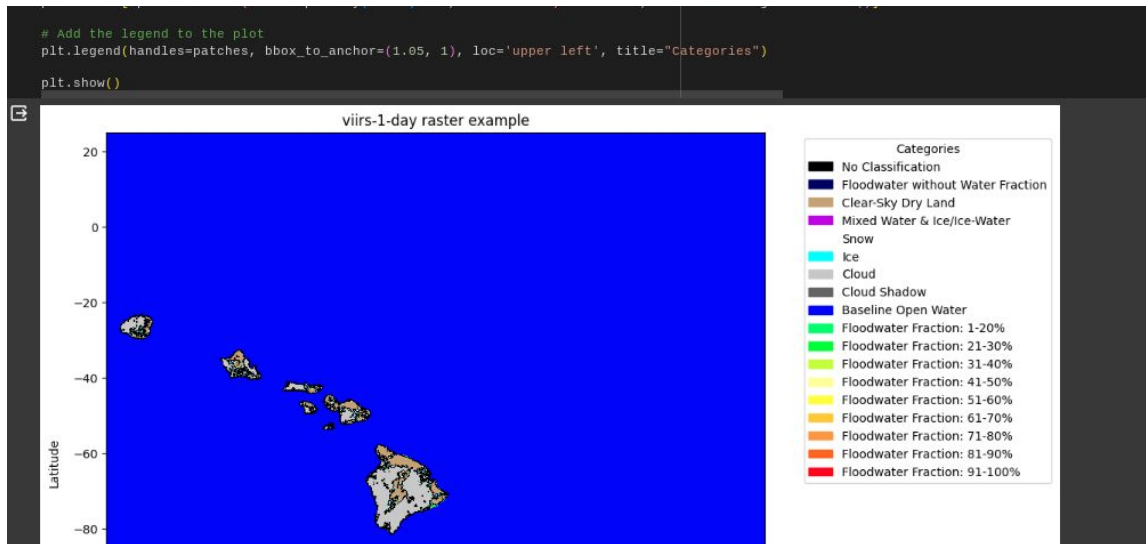
Tools:

In [4]: `agreement_map.gval.cat_plot(title="Agreement Map")`

WPN content

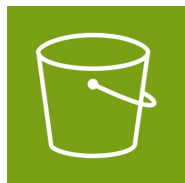
Downloading data from the data catalog

This is an interactive tutorial demonstrating how to search for, visualize, and download data from the Water Prediction Node data catalog using python.



Am currently working on a tutorial covering how USGS 3-DEP DEM are used in creating the flowlines for the NWM hydrofabric

Hosting WPN content in 2024



Amazon Simple Storage Service (Amazon S3)



Amazon Cloudfront

waternode.ciroh.org



Amazon Route 53



AWS Certificate Manager (ACM)



Water Prediction Node
NOAA COASTWATCH



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[Tutorials](#)

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[Data Guide \(Coming soon\)](#)

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Data catalog - design considerations

- Prioritize cloud native formats
 - Other formats can be created on the fly as needed or stored in archival storage
- Enable search and bulk download using python or R
- Have an reduced assurance, experimental catalog and a public catalog
- Attempt to pass-through data hosted elsewhere when appropriate
 - Filtering protocols can be put into place to only index relevant data



The screenshot shows the header of the "Water Prediction Node" by NOAA Coastwatch, with the NOAA and CIROH logos. Below the header is a navigation bar with icons for back, forward, and search. The main content area is titled "Description" and states "The geospatial asset catalog of the Water Prediction Node." Below this is a "Catalog" section with a "1" icon and a grid view icon. The first entry is "viirs-1-day", described as "VIIRS 1-day composite flood maps collection", with a date range of "8/24/2023, 12:00:00 AM UTC until present".

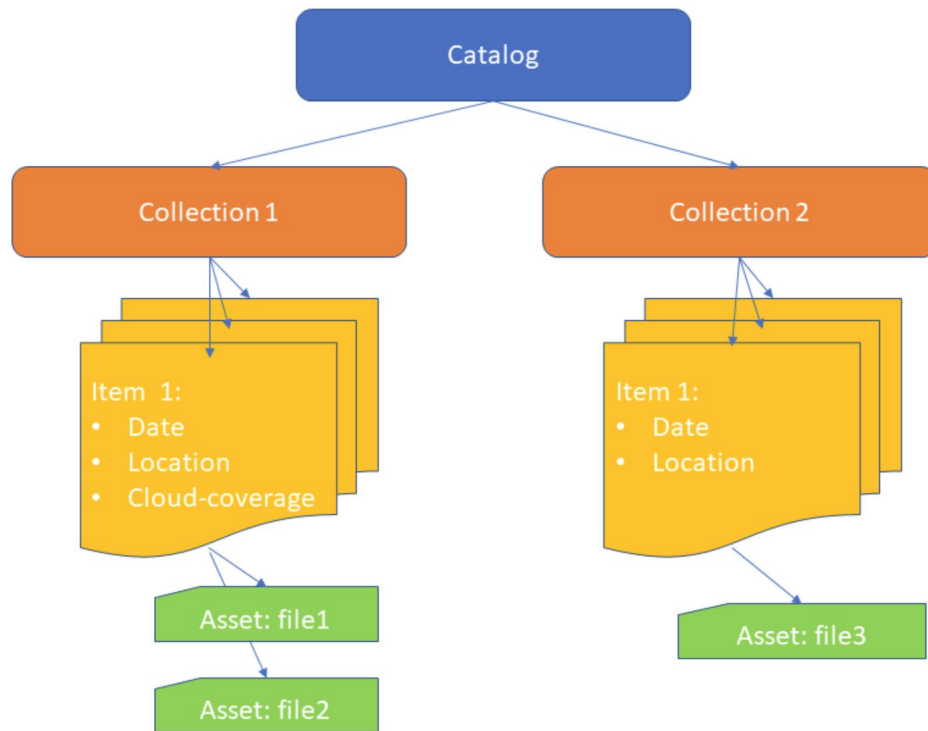
What is STAC

- STAC is a mature way of cataloging, searching, and interacting with geospatial data whose main goal is improving discoverability
- STAC already has many data providers that are exposing geospatial data via the STAC specification
 - Microsoft Planetary computer
 - ESA
 - USGS
- The STAC specification allows for a federated approach to sharing STAC items and assets similar to ERDDAP



The structure of a STAC catalog

- Everything is a json object
- Catalogs are the top level object
- Catalogs can contain other catalogs or collections
- Collections contain items
- Assets in items are extremely flexible. Could be a tiff or netcdf file served by a request to a THREDDS or ERRDAP server
- Catalogs served by STAC servers become STAC API's capable of being dynamically searched



Experimental data catalog - authentication



Private Data Catalog Access Token

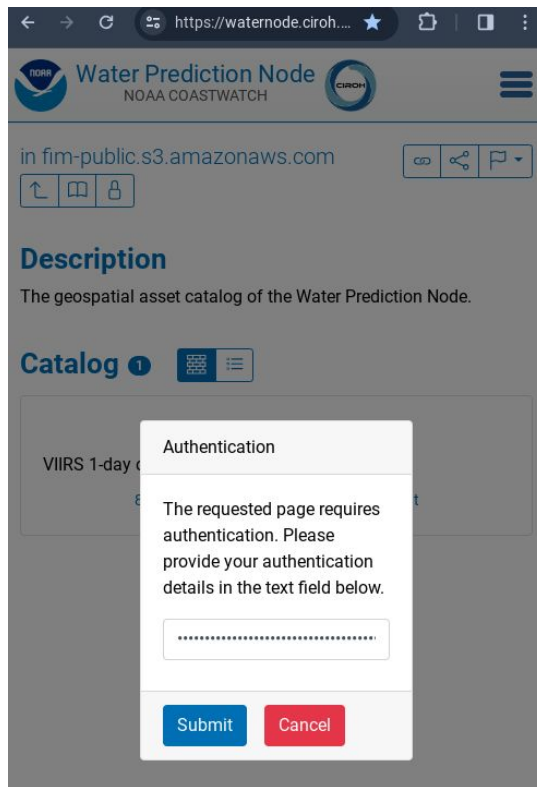
Use the below to register for an Water Prediction Node account and to obtain a data access token good for N days:

SIGN IN OR REGISTER

Data Access Token:

eyJraWQlOiJ4ejJsNnR5bXBpVWwmczazVjRkloVGhOMlpVVEZHb21oYkdXU05SszFFPSlslmFsZyl6lJTMjU2In0.eyJzdWliOiIiXGZGfMmYtG40S1jNzZmLTRhNTctOGMxYi1hYmFjNWUzZDE5YTAiLCJpc3MiOiJodHRwczpCL1wvY29nbmI0by1pZHAudXMZWFZdC0xLmFtYXpvcjY2b21cL3VzLWVhc3QtMV9Sem1TcVdCUFAiLCJ2ZXJzaW9uIjoyLCJjbGllbnRfaWQlOiJubmlkZDsc20wa29sOHA5OXRhcmw5c3FwliwiZXZlbnRfaWQlOiI2NmYyM2VlM0Z2mXLRmMDYtOGVjNy0zZDRlMmEyZGE0ZUWUilCJ0b21ib91c2U0iJhY2Nlc3MiLCJzY29wZSI6ImF3cy5jb2duaXRvLnNpZ25pb51c2VYlMfKbWlG9wZW5pZCslmF1dGhfdGltZSI6MTcwNDgyNDUxO0wiZXhwIjoxNzA0ODI4MTE4LCJpYXQiOiE3MDQ4MjQ1MTgsImpp0aSI6ImM5ODUzYjEwLW50WQNGFkZS04ZjZlLTJiY2RkNm1Z2TfjYSlslmVzZXJhYm91IjoZLHlsYW5ibGVln0.mCBWEmrKxS2ToAVev3zej8Rpg_6_-

Ye81JP4_MWb2zMgqcsF2Qqv1aNXrk8PLtbn2TtAQ-K-hSD-fJ5ckhbMpUpeAqhn20AUgyUvbnRnjKWIFcvNKvYFTgo3KuK7YBOU9A3SdsBdlUfsOnKQYxRWsPASpRITuuz5tE7RDsW3yHkTcd-uuwOjoBM6vnKIECF9RAoobYygKiAEq1uafGSLtqFSbm6Bly_Phj8JGkU8srMS6f_QPLc2T1pua1LU04CteL0qa6MJM3UrhUURP7XMYLQMDSDJ1A_d6-j8dNQby2jIH_qBXHrySatV4KnmKD7D4Fig1JYH7Dib_B-P75vJg



Sign in with your username and password

Username

Password

[Forgot your password?](#)

Sign in

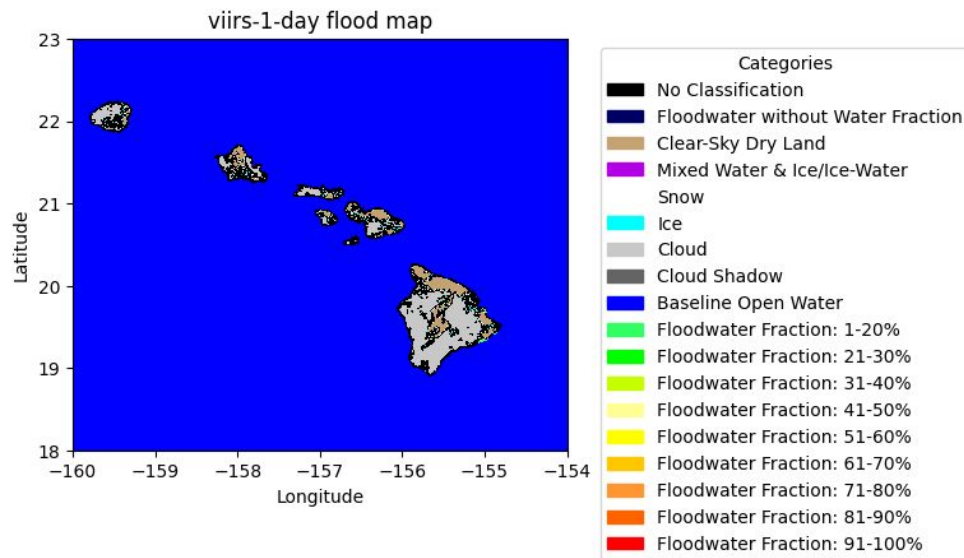
Need an account? [Sign up](#)

Authentication should be ready soon and will enable an experimental catalog.

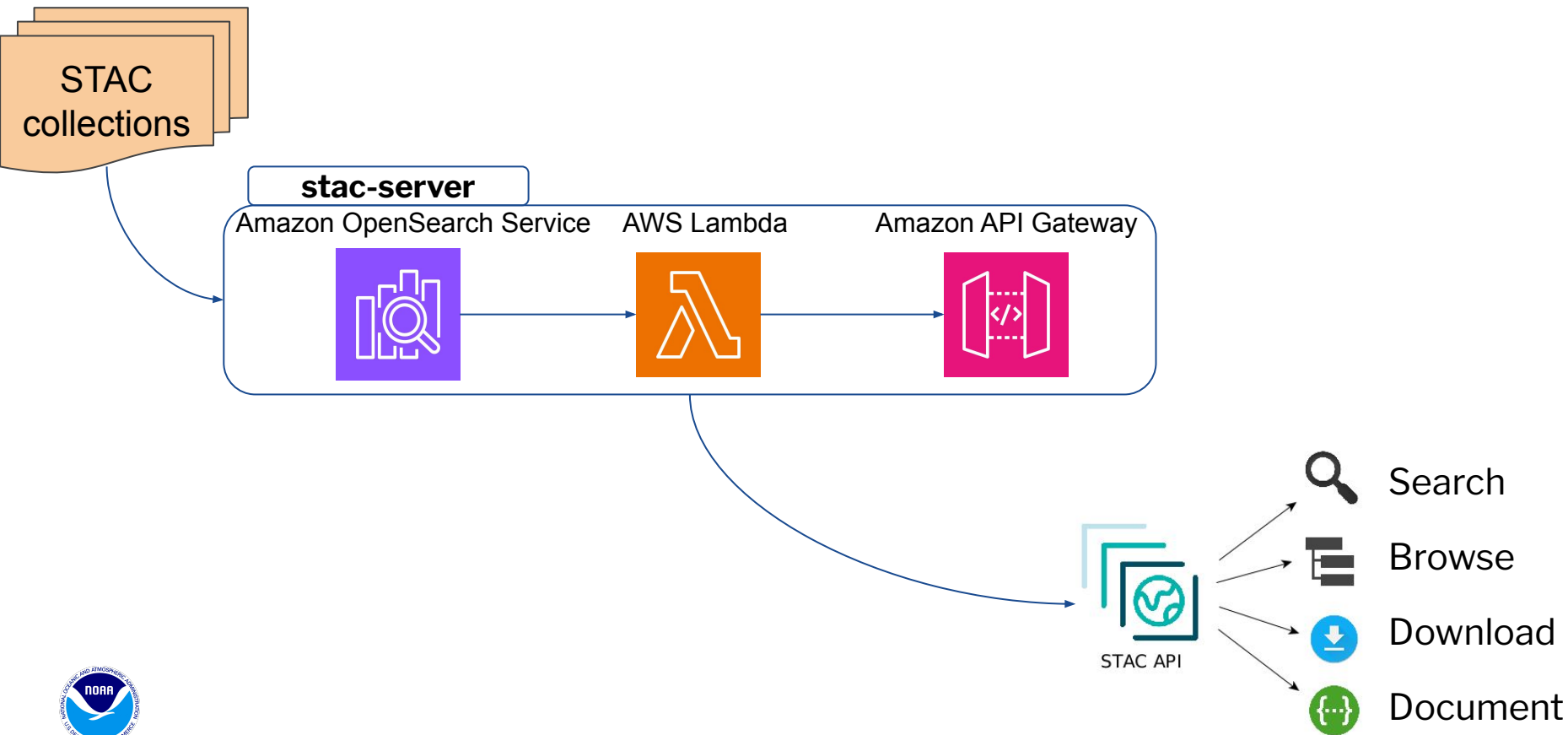


WPN data catalog additions in 2024

- Expand archiving of STAR VIIRS and ABI flood maps
- Work with WPOD remote sensing and snow desk to upload their remote sensing products
 - Baseline inundated extents
 - SAR flood maps
 - River ice
- STAR soil moisture (SMOP)
- STAR vegetation indices (NDVI and vegetation condition index)



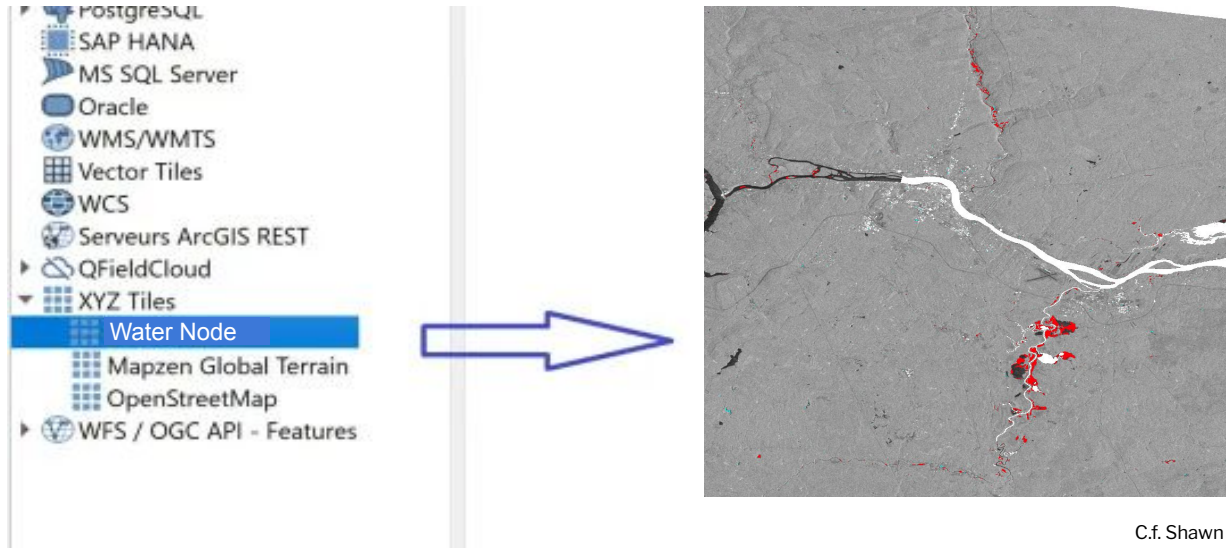
WPN data catalog architecture in 2024



Qualitative FIM evaluation



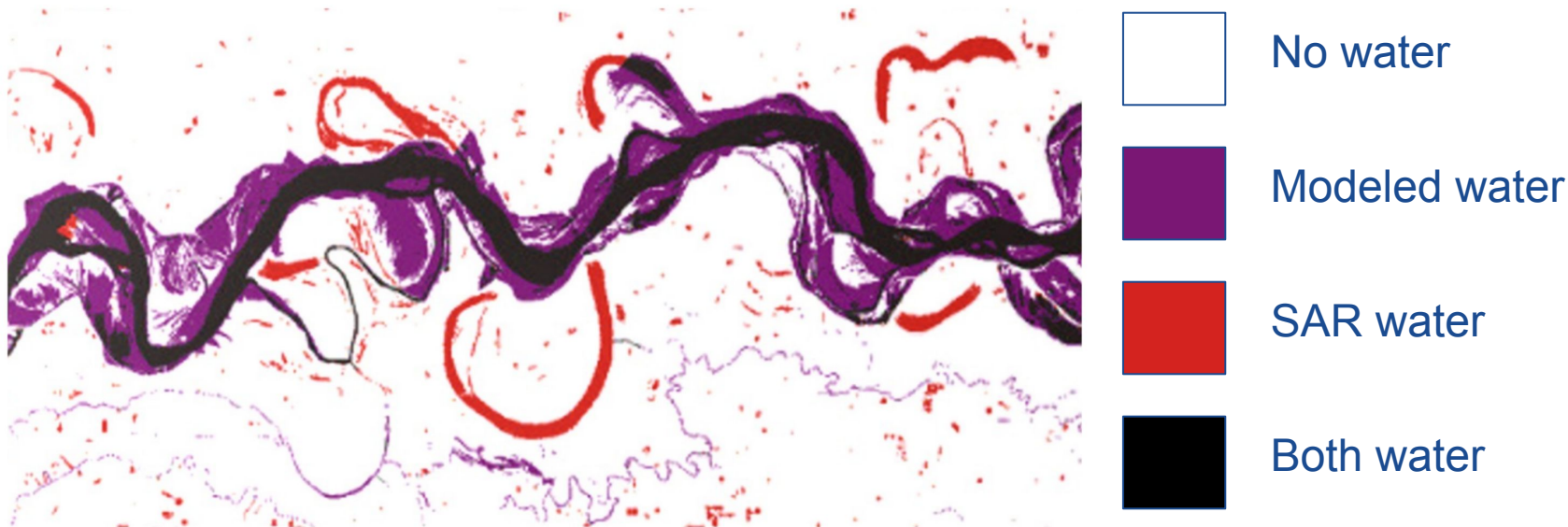
Qualitative FIM evaluation - raster tile serving



C.f. Shawn Carter

A web map tile service providing easy import of remotely sensed flood map layers into GIS software being used by FIM modelers is the first step

Flood map comparison layer using raster agreement maps



$$pair(x, y) = z$$

$$szudzik(x, y) = \begin{cases} x^2 + x + y, & \text{if } x \geq y \\ y^2 + x, & \text{otherwise} \end{cases}$$

Benchmark	Candidate	Agreement
1	0	2
1	2	5
2	0	6
2	2	8

Flood agreement map creation as a Water Prediction Node tool

Inspired by:

OpenTopography's DEM differencing tool

1. Vertical Differencing Datasets and Coordinate System ⓘ

Select a dataset for vertical differencing:

Manawatu - Whanganui, New Zealand 2015-2016 (12/27/2015 - 12/17/2016) ▼

☐ Reference dataset:
☒ Compare dataset:

Dataset:
Manawatu - Whanganui, New Zealand 2022-2023
Manawatu - Whanganui, New Zealand 2015-2016

Survey Date:
Horizontal Coordinates:
Vertical Coordinates:
Units:
07/02/2022 - 11/01/2023
NZTM2000 NZGD2000 Meters [EPSG: 2193]
NZVD2016 [EPSG: 7893]
meter
12/27/2015 - 12/17/2016
NZTM2000 NZGD2000 [EPSG: 2193]
NZVD2016 [EPSG: 7839]
meter

Data Selection Coordinates: ☐ Manually enter selection coordinates (in the horizontal coordinate system listed above)

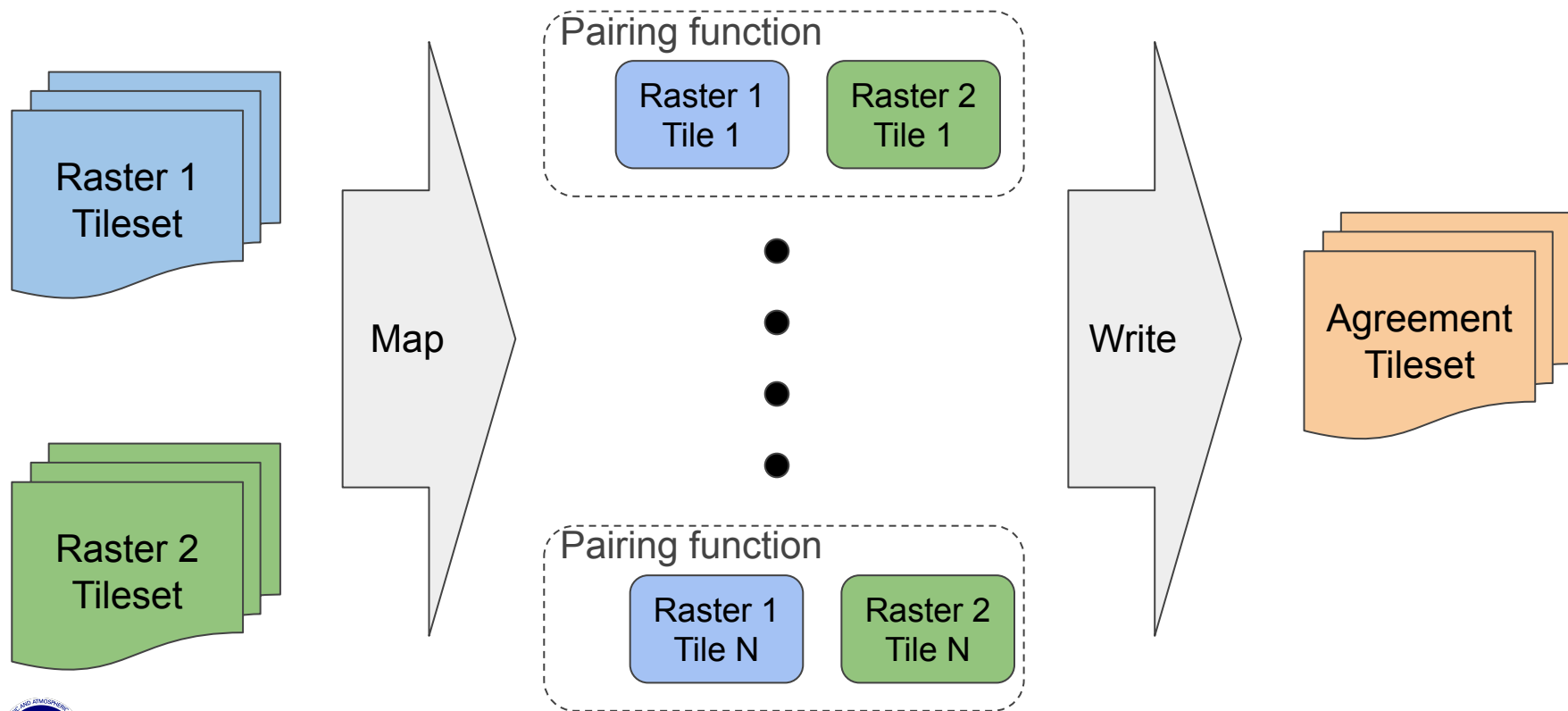
ⓘ **Choose Return Classification** ☐ Ground

2. DEM Generation (TIN) ⓘ

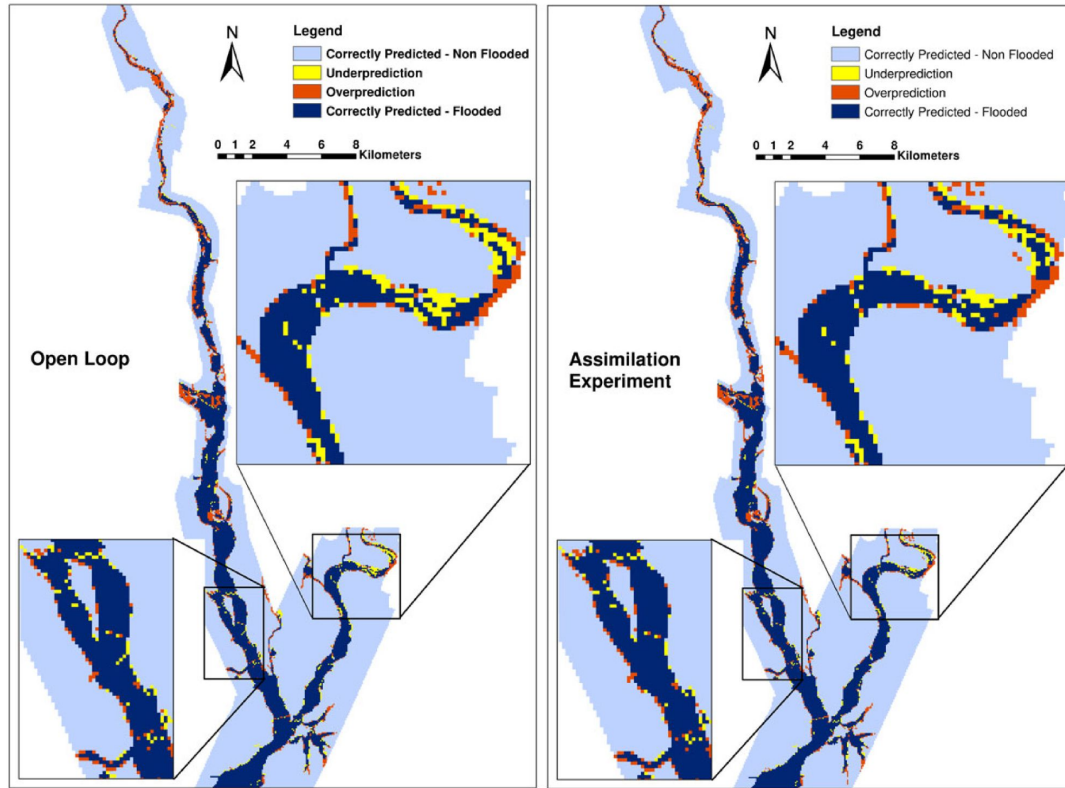
- User would input link to flood map in catalog
- HAND FIM maps would be generated using NWM discharges at time of flood map observation
- Agreement map would be computed and then automatically added to catalog along with NWM discharge files
- For larger streams, SWOT discharge estimates could also be used to provide an independent discharge to compare whole NWM FIM workflow against



Parallelizing agreement map creation



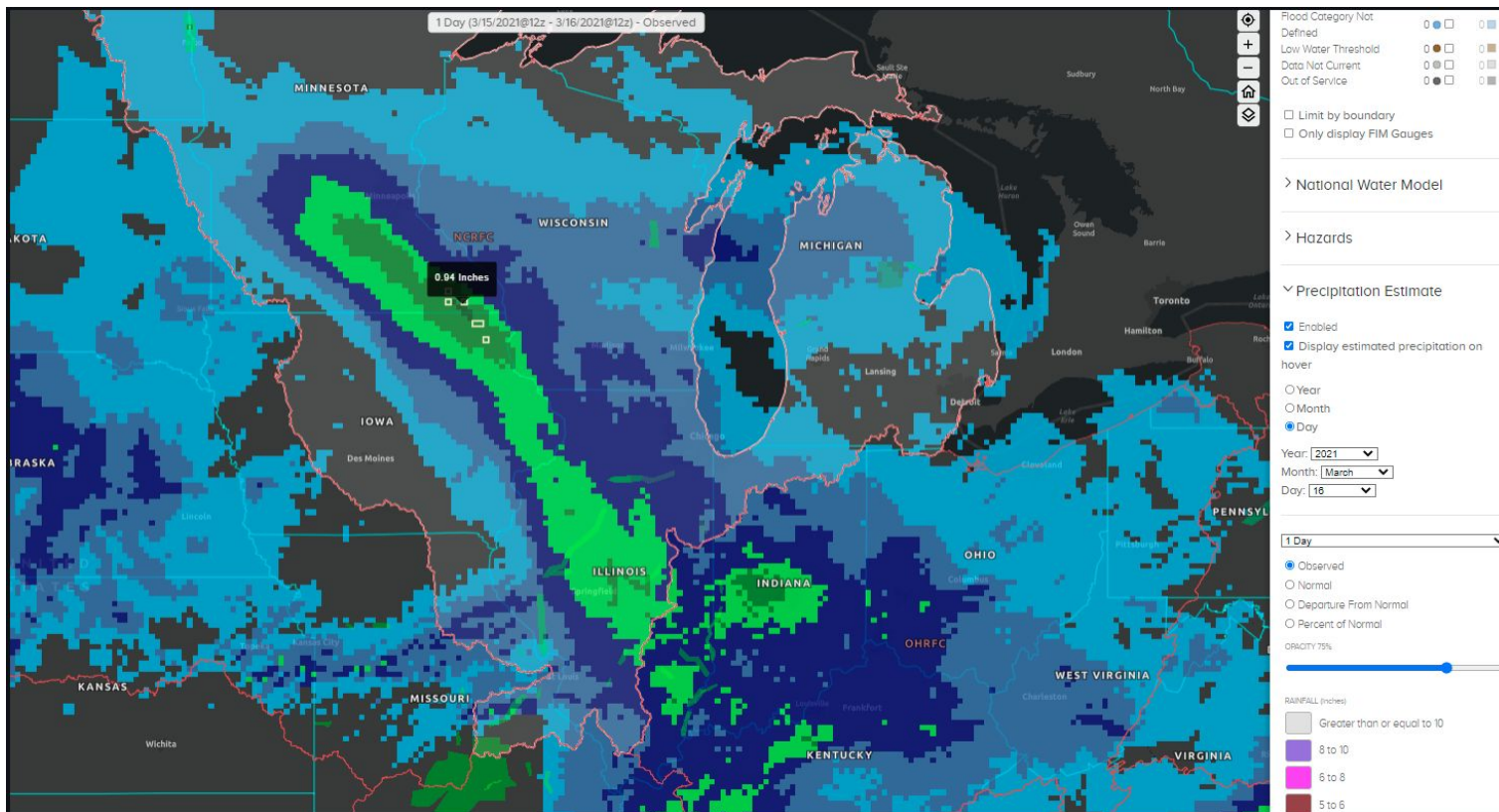
Next step: quantitative FIM evaluation



- Am collaborating with CIROH researchers at UA on a proposal to create probabilistic flood maps.
- If funded, this would allow us to develop methods to characterize the uncertainties associated with both remotely sensed and modeled FIM approaches
- Long term goal would be to assimilate remotely sensed maps into the NWC's modeled FIM

Next step: increased integration and collaboration

NWC NWPS platform:



Next step: Finish implementing core WPN capabilities

Authentication

Sign in with your username and password

Username

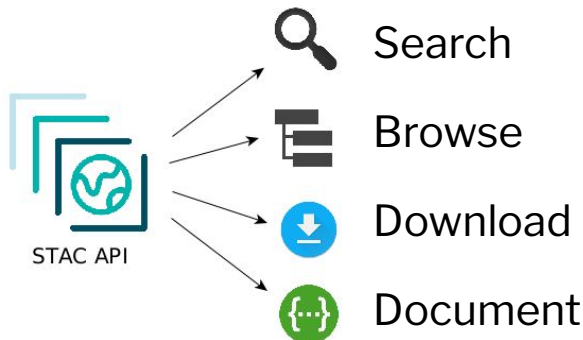
Password

[Forgot your password?](#)

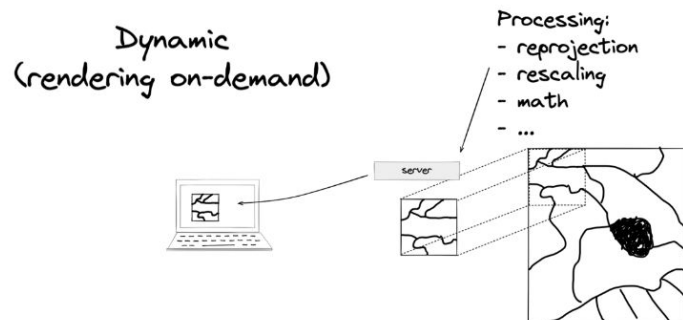
Sign in

Need an account? [Sign up](#)

Dynamic Data Catalog



Raster Tile Server



Water Prediction Node

Delivering Remote Sensing Data for US Inland Waters

- The Water Prediction Node was resourced in July, 2023 and has made progress on the near-term goals outlined at the 2023 Water Prediction Node Strategy Summit
- 2024 will see the implementation of the WPN core services (content, data catalog, data serving) in a “minimum viable” form
- The Water Prediction Node will continue to be integrated into the workflows at the NWC is focusing on providing maximum value to its stakeholders