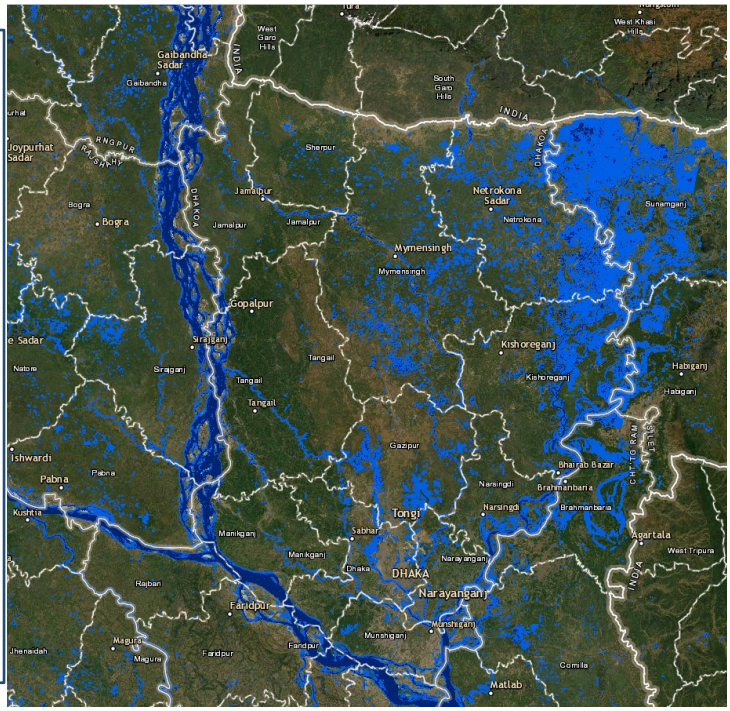
HydroSAR – Hydro30 Surface Water Extent

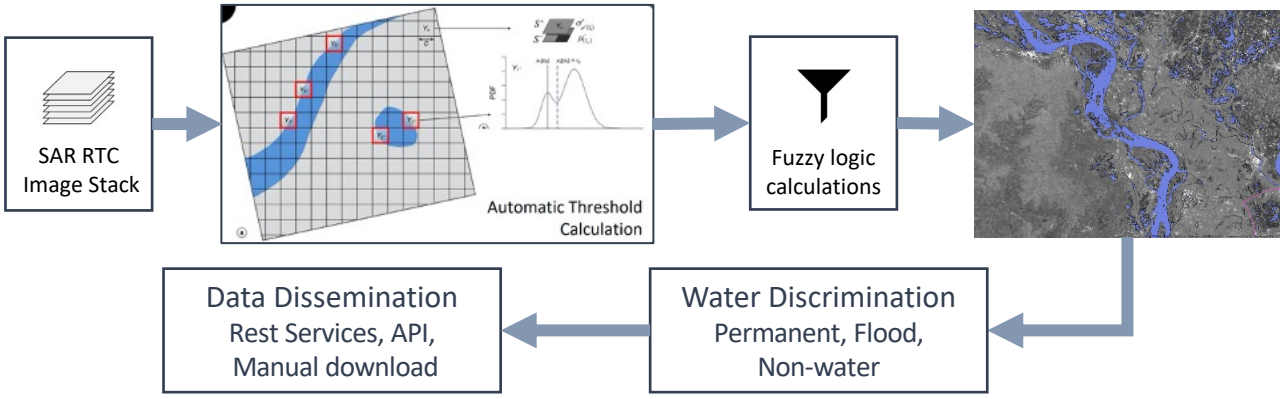
Quick Guide

Why a SAR-based Surface Water Extent?

The Synthetic Aperture Radar (SAR) on the Sentinel-1 satellites transmits microwave signals in two polarizations at the Earth's surface. The signal is partially scattered back toward the sensor based on the characteristics of the surface. The signal collected at the sensor measures and discriminates ground features based on their roughness and moisture content. Rougher surfaces, such as trees, vegetation, and other structures appear brighter in the image whereas smoother surfaces, such as water, appear dark. Using this information, a dynamic thresholding technique followed by post-processing steps produces an automated assessment of the location of surface water present during the overpass.



How is the surface water extent created?



Impact on Use:

Surface water extents offer routine ***quantitative assessments*** of all "visible" surface water to the SAR sensor at a 30 m resolution.

- The algorithm is available for all available overpasses within 6 hours of overpass.
- Ancillary products can be used to further filter the output.

Things to keep in mind:

SAR measurements are affected by satellite incidence angle to terrain, moisture content of scene, steep terrain (beam blockage), etc.

- In areas of complex terrain, smaller water features may not be viewable to the sensor due to angle or resolution.
- Strong wind can change the surface roughness of water, preventing the algorithm from a correct water detection.
- Large vegetation/tree canopy can block areas of surface water from being visible to the sensor.

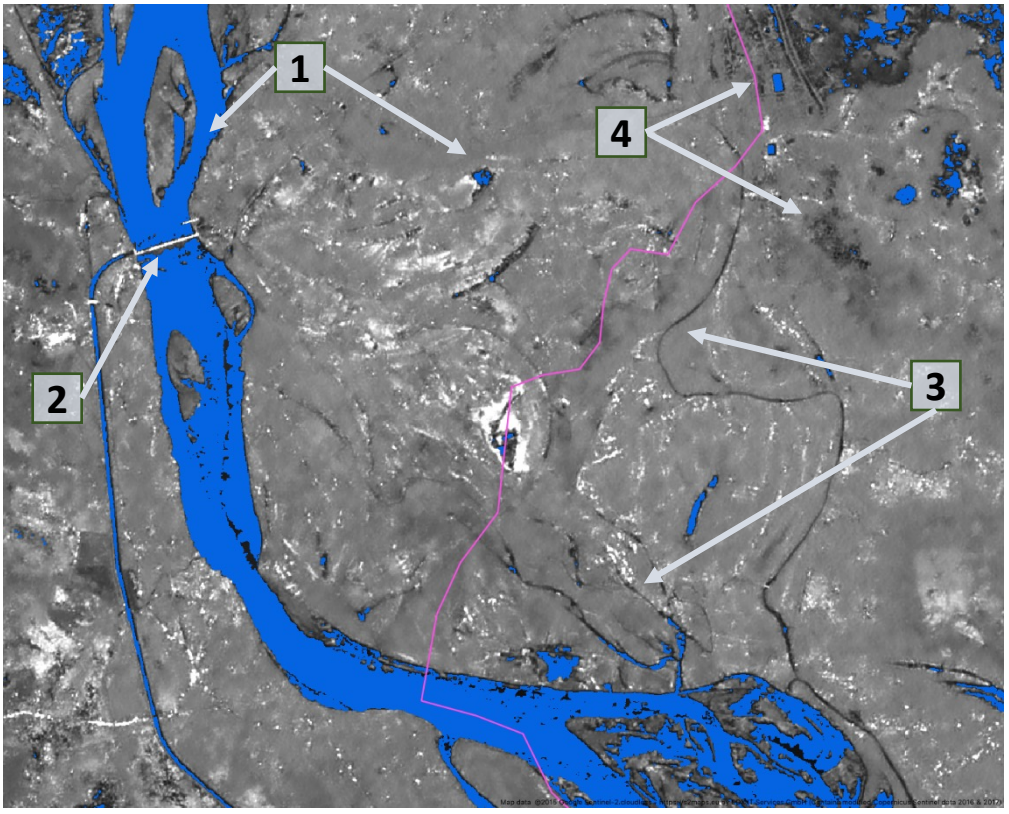
HydroSAR – Hydro30 Surface Water Extent

Quick Guide

Interpretation

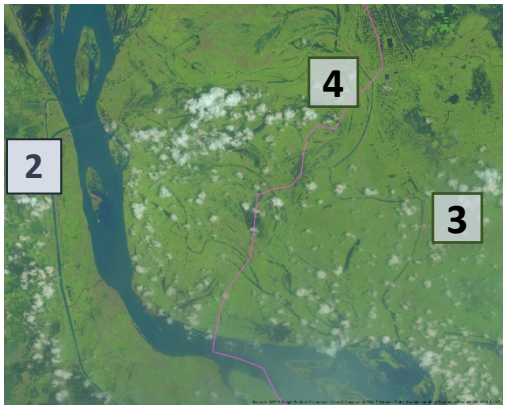
Surface Water Extent layer shown over the Sentinel-1 Co-pol (VV) from 2 August 2020 at 000333 UTC.

1. **HYDRO30 Water Extent** product (no permanent water layer shown)
2. **Object** (bridge) interrupting the water extent detection
3. **Mixed Pixels along narrow rivers**: Resolution cannot detect water either due to vegetation or size of waterbody
4. **Mixed Pixels in Cropland**: Flooding in undulating terrain or cropland can lead to partially inundated pixels that appear darkened but are not dark enough to be detected as standing water

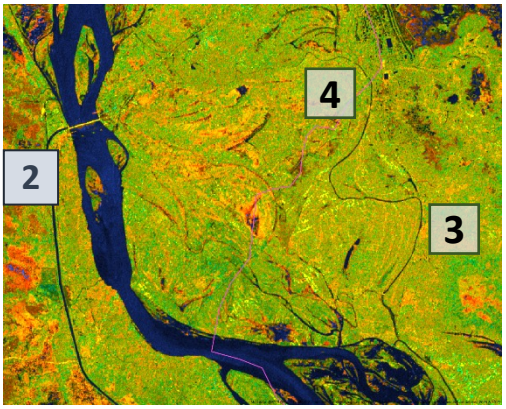


Comparison to other products:

Sentinel-2 SWIR (left) and Sentinel-1 SAR RGB (right) with the same domain and numbering as above. The optical product shows areas that are partially inundated but were not detected by the water extent algorithm. This reinforces the recommendation of using ancillary datasets (satellite or local sources) when available as well as the SAR RGB to help with interpretation.

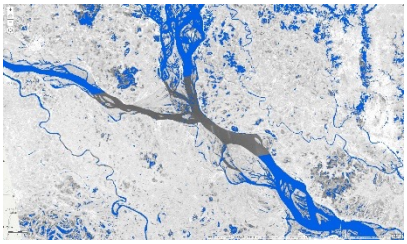


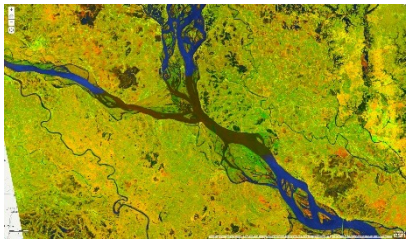
ESA Sentinel-2 SWIR - False Color RGB
2 August 2020 – 082354 UTC



ESA Sentinel-1 - ASF SAR RGB
2 August 2020 – 000333 UTC

Caveats





Calibration errors when processing Sentinel-1 granules *sometimes affect* the input co-pol (VV) and cross-pol (VH) images. This will interfere with the production of products such as the water extent (gap in the retrieval) and SAR RGB products (coloration change as compared to surrounding area).

Resources

Alaska Satellite Facility Data Recipes
https://asf.alaska.edu/how-to/data-recipes/data-recipe-tutorials-2/

QG Version 2 – August 2021