

# SWOT meets GRDC: Assigning SWORD nodes to in situ stations from the Global Runoff Data Centre



## Mission and Scope

The Global Runoff Data Centre is an international data centre operating under the auspices of the World Meteorological Organization (WMO) at the German Federal Institute of Hydrology (BfG). Established in 1988, to support the research on global and climate change and integrated water resources management, GRDC holds the most substantive collection of quality assured in situ river discharge data on a global scale. Primary data providers of river discharge data and associated metadata are the National Meteorological and Hydrological Services (NMHS) of member states of the WMO.

Currently, the GRDC contains river discharge data collected at daily or monthly intervals from more than 11,200 stations in 160 countries. The time series are up to 200 years old, with an average record length of 40 years. GRDC has been actively supporting the calibration and validation of satellite-based data, thereby strengthening the bridge between in-situ monitoring and satellite-derived data products.

This includes support for the Surface Water and Ocean Topography (SWOT) satellite mission, which enhance observations of river water surface elevation, width, and slope. SWOT is designed to observe global earth's rivers with estimates of river discharge for rivers wider than 100 m. 95% of the global rivers will be observed at least once every 21 days, giving a submonthly resolution of data points. The SWOT River Database (SWORD) (Altenau et al., 2021), combines multiple global river- and satellite-related datasets to define the nodes and reaches that will constitute SWOT river vector data products.

Each SWORD node can be identified and accessed via its individual SWORD ID, which provides valuable information about the node's topology and type. The scope of this poster is to present a reliable connection between the location of SWORD nodes and GRDC in-situ stations. This product is vital for the combination of both datasets and to calibrate the output of the SWOT satellite mission.

## Workflow: Assignment of SWORD nodes to GRDC stations

### 1) via distance

In order to identify matching SWORD nodes via distance, a buffer is created around each GRDC station. We use the original coordinates and the pourpoint corrected dataset (Färber et al. 2025) to be able to locate each GRDC station to the next river. If a buffer contains SWORD nodes, all distances are checked and the nearest node to the GRDC station is selected. Duplicates are filtered out by distance.

### 2) via river names

To assure that the nodes have been assigned correctly, river names from SWORD and GRDC are compared. Using the Jaro-Winkler method, a fuzzy word matching method, river names are automatically checked.

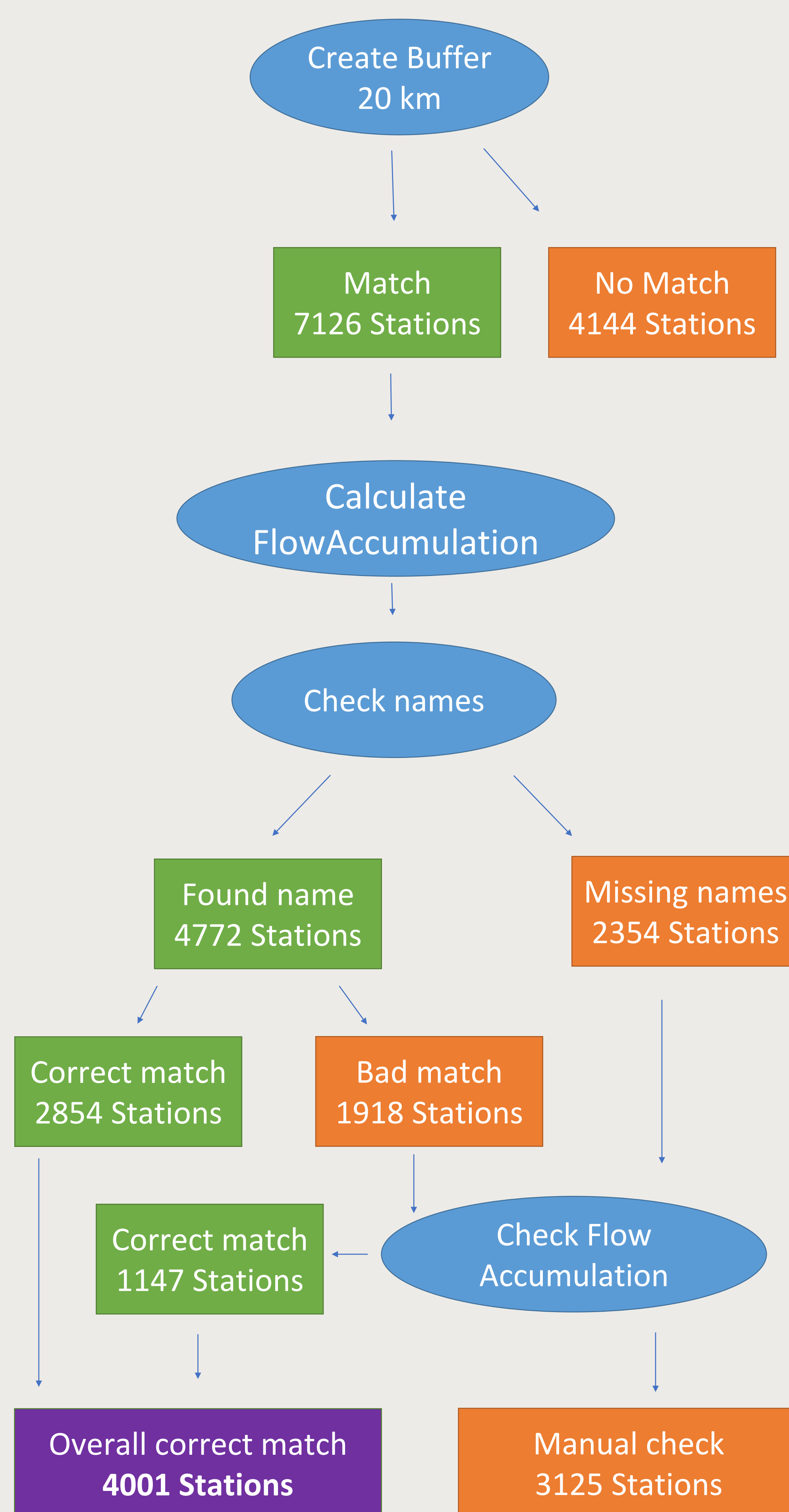
1. All well matching names are found
2. All bad name matched are found
3. Stations with missing names are found

### 3) via catchment area estimation

In addition to the above mentioned methods, catchment area estimations are compared.

- Each GRDC station provides catchment area information, one from the NMHS and one calculated catchment area.
- For each SWORD node location calculating the flow accumulation based on MERIT hydro raster is used to calculate the associated catchment area.

Both values are compared and stations with matching flow accumulation area are selected



### Sources of wrong assignment

There are various sources of error for the correct assignment of SWORD nodes to GRDC stations.

- One of the main challenges are the correct coordinates of GRDC stations. Using the pourpoint corrected coordinates results in a better detection of matching stations.
- Stations located on a downstream reach next to a major river might be falsely assigned (Figure 1).
- Different river names database: GRDC uses the GeoNames database for the assignment of river names (NGA Geographic Names Database (GNS), [www.nga.mil](http://www.nga.mil)).



Figure 1: Example of assignment errors due to distance

### Future steps

The workflow automatically detects SWORD nodes next to GRDC stations by distance, by comparing names and by using a flow accumulation approach. 4001 stations could be automatically identified. 3125 stations need a manual check.

The results will be published at the GRDC website and Zenodo after thorough discussion and input from the SWOT Science Team.

#### Data sources:

The data of the SWOT mission is available via the HYDROCRON webservice (<https://podaac.github.io/hydrocron/intro.html>). In situ discharge data is available via the GRDC data portal (<https://portal.grdc.bafg.de/>).

#### References:

Altenau, E.H., Pavelsky, T.M., Durand, M.T., Yang, X., Frasson, R.P.d.M. and Bendezu, L.: The Surface Water and Ocean Topography (SWOT) Mission River Database (SWORD): A Global River Network for Satellite Data Products: WRR, 57, <https://doi.org/10.1029/2021WR030054>.

Färber, C., Plessow, H., Mischel, S. A., Kratzert, F., Addor, N., Shalev, G., and Looser, U.: GRDC-Caravan: extending Caravan with data from the Global Runoff Data Centre, Earth Syst. Sci. Data, 17, 4613–4625, <https://doi.org/10.5194/essd-17-4613-2025>, 2025.

