

Report to the St. Mary and Milk Rivers Technical Working Group

Brief Assessment of USGS Transboundary Geospatial Fabric (TGF)

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Compatibility of TGF dataset with Global Water Futures (GWF) Hydrological Modelling Workflows

In the following table, the compatibility of various Global Water Futures (GWF, <https://gwf.usask.ca>) hydrological modelling workflows with the Transboundary Geospatial Fabric (TGF, <https://doi.org/10.5066/P971JAGF>) is assessed.

Table 1. Compatibility of GWF hydrological modelling workflows with the Transboundary Geospatial Fabric (TGF) covering transboundary waters of Canada and US. DOI: <https://doi.org/10.5066/P971JAGF>.

#	Model	Component	Channel Length	Channel Slope ¹	Channel Width	HRU Area	Upstream/Downstream Connectivity ²	HRU/Segment Correspondence	Compatibility	Comments
1	mizuRoute ³	IRF-UH ⁴ method	✓	✓	○	○	✓	✓	✓	
2		KWT ⁵ method	✓	✓	○	○	✓	✓	✓	River width values could improve accuracy.
3	MESH ⁶	CLASS ⁷	○	○	○	✓	○	○	✓	
4		SVS ⁸	○	○	○	✓	○	○	✓	
5		WatRoute RTE ⁹	✓	✓	○	✓	✓	✗	✗	The HRU/segment correspondence should be corrected for RTE.
6	SUMMA ¹⁰	—	○	○	○	✓	○	○	✓	
7	HYPE ¹¹	Hydrology	○	○	○	✓	○	○	✓	
8		Routing	✓	✓	○	○	✓	✓	✓	River width values are optional.

¹ DOI: <https://doi.org/10.5066/P971JAGF>, segment slope values are available in the "National Hydrologic Model's United States-Canada Transboundary Geospatial Fabric Parameter Database"

² DOI: <https://doi.org/10.5066/P971JAGF>, "tosegment" values are available in the attribute table of TGF's "nsegment" linestring database

³ DOI: <https://doi.org/10.5194/gmd-9-2223-2016>

⁴ Impulse Response Function – Unit Hydrograph

⁵ Kinematic Wave Tracking

⁶ Modélisation Environnementale communautaire - Surface Hydrology, DOI: <https://doi.org/10.5194/hess-11-1279-2007>

⁷ Canadian Land Surface Scheme, see Soulis et al. (2005)

⁸ Soil-Vegetation-Snow, DOI: <https://doi.org/10.1175/JHM-D-20-0249.1>

⁹ Link to manual: <http://www.civil.uwaterloo.ca/watflood/downloads/manual.pdf>

¹⁰ Structure for Unifying Multiple Modeling Alternatives, DOI: <https://doi.org/10.1002/2015WR017198> and <https://cwarhm.readthedocs.io/en/latest>

¹¹ Hydrological Predictions for the Environment; HYPE's requirements are consulted with Dr. Dayal Wijayaratne (Post-Doctoral Fellow at UCalgary, dayal.wijayaratne@ucalgary.ca)

Available
Missing
Not Needed/Optional



Compatible
Not Compatible
Compatible with adjustments



Extra Notes

- Complete metadata of the available features in TGF dataset are available in the following: <https://doi.org/10.5066/P971JAGF>,
- The available sub-basins are divided into left-/right-bank areas. Dissolving them into single sub-basins could be done by post-processing the TGF geofabric with a few lines of script. This step is required for *MESH* model setup,
- Several “Points of Interest” (POIs) are visible in the river network of TGF. The presence of POIs can cause some discrepancies between HRU and river segment correspondence. The following figure shows an example (see the highlighted line):

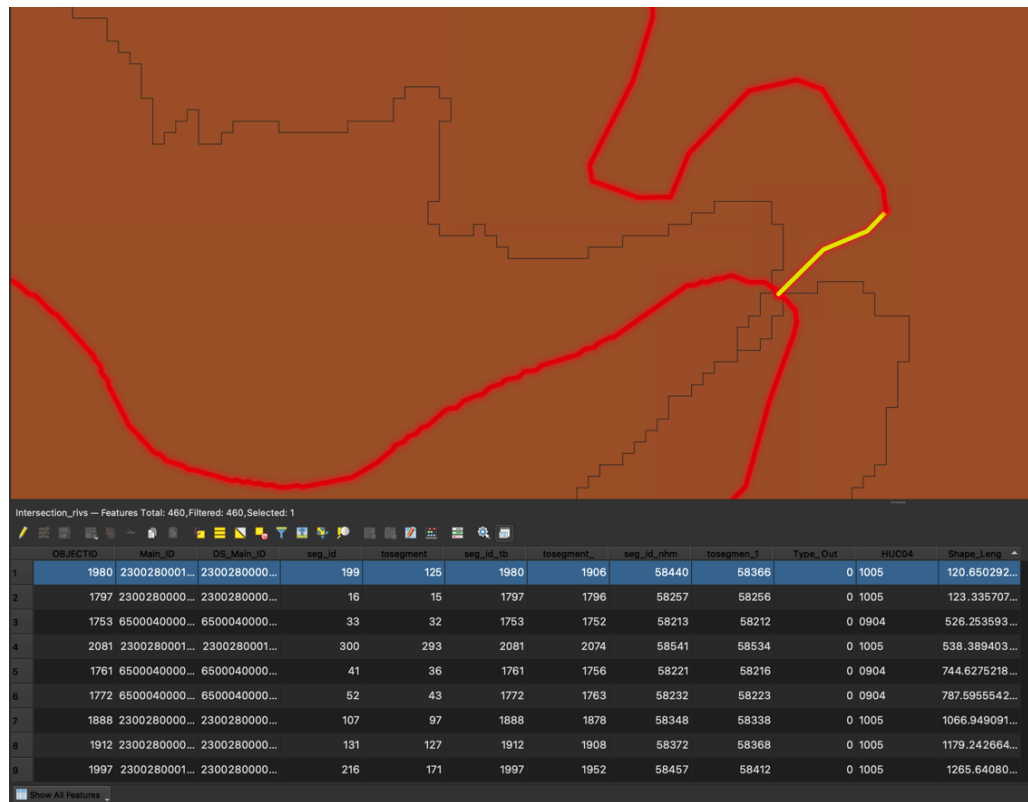
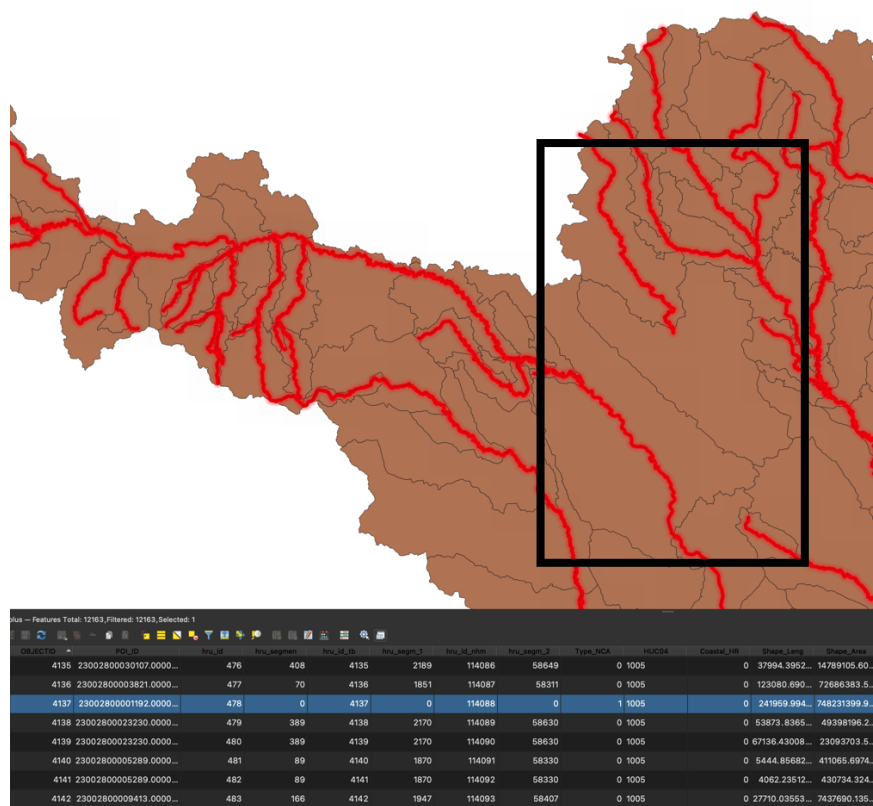


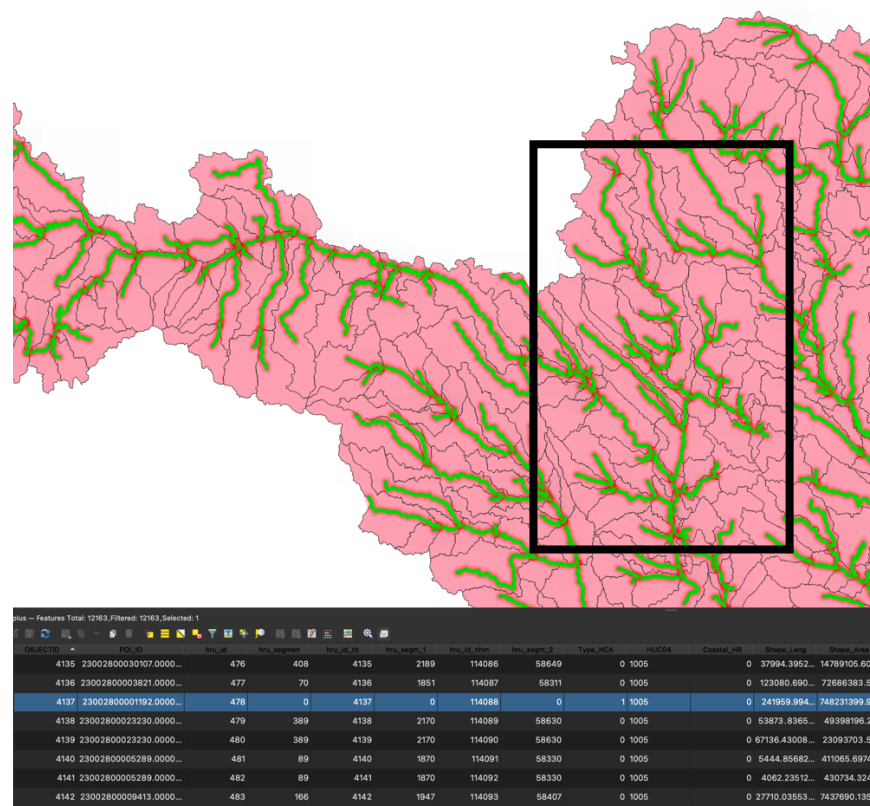
Figure 1. An example of a Point of Interest (POI) in the TGF dataset and how it divides river segments into smaller lines.

This could be corrected with some modifications on the geofabric, preferably with a few lines of script. It is worth mentioning that POIs are part of the NHD Plus HR dataset to provide extra information regarding flowlines. In the example above, the POI located upstream of the highlighted river segment represents a Canadian gauging station (see the relevant metadata for more information.)

- In the TGF dataset, a few sub-basins with significant areas are considered as non-contributing. For instance, in the figure below, the sub-basin shown in the middle of the black rectangle (left) has an area of approximately 750 km². In MERIT-Basins, on the other hand, the corresponding portion fully contributes to the St. Mary & Milk river systems.



TGF Dataset



MERIT-Basins Dataset

Figure 2. An example of non-contributing areas of the TGF dataset (left) and its corresponding region in the MERIT-Basins dataset (right).

The TGF geofabric dataset for the St. Mary & Milk river systems suggests a total non-contributing area of approximately 4,706 KM², whereas for MERIT-Basins, this value is around 110±20 km². In a separate attached document, the non-contributing areas of MERIT-Basins, TGF, USGS HUC12, and Canadian Agri-food and Agriculture Watersheds Project – 2013 geofabric datasets for the St. Mary & Milk river systems are assessed.

References

1. Soulis, E., Kouwen, N., Pietroniro, A., Seglenieks, F.R., Snelgrove, K.R., Pellerin, P., Shaw, D., and Martz, L, 2005, A Framework for Hydrological Modelling in MAGS.
2. Bock, A.E, Santiago,M., Wieczorek, M.E., Foks, S.S., Norton, P.A., and Lombard, M.A., 2020, Geospatial Fabric for National Hydrologic Modeling, version 1.1 (ver. 3.0, November 2021): U.S. Geological Survey data release, <https://doi.org/10.5066/P971JAGF>.