

River and Basin Profiler: a module for extracting watershed boundaries, river centerlines, and catchment statistics

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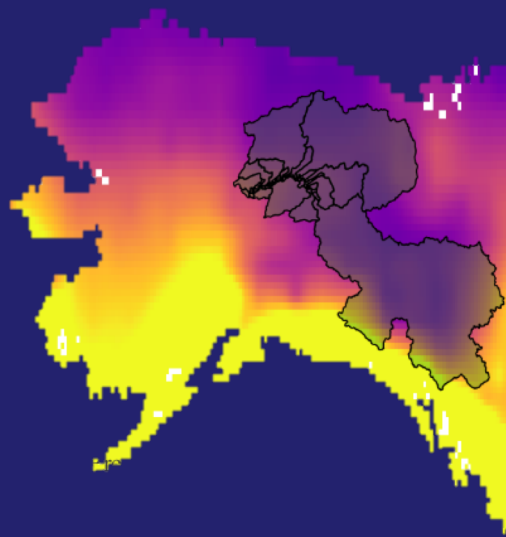
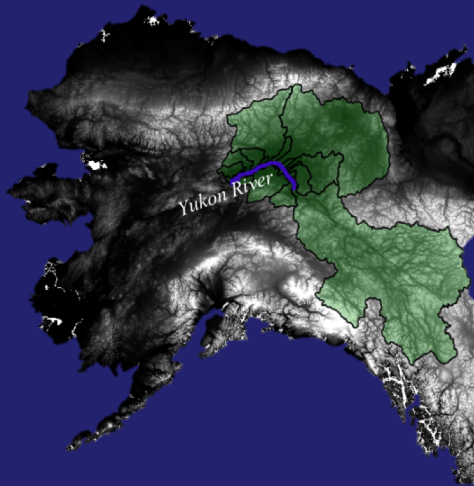
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Abstract

Watersheds serve as natural spatial boundaries whose characteristics are often indicators of the hydrologic processes within them. Watershed characteristics are frequently used as predictors, parameters, or proxies in models of hydrologic and ecologic dynamics. Developments in DEMs over the past decade have resulted in elevation data spanning the globe that allows watershed delineation at arbitrary locations. In tandem, satellite-based observations and large-scale modeling efforts provide many sources of near-global watershed characteristics, e.g. topography, soil types, vegetation, climate, permafrost extent, and many more. However, with growing data availability comes a growing need for tools that can rapidly query and summarize them. We developed River and Basin Profiler (RaBPro), a Python module providing a pipeline to delineate drainage basins for any point on Earth and calculate watershed statistics for practically any geospatial raster dataset. RaBPro makes use of the MERIT-Hydro or HydroBASINS datasets to define watershed polygons, which can be exported in GeoJSON or ESRI shapefile format for further use in GIS software. RaBPro will also generate streamlines and river elevation profiles. Finally, RaBPro calculates statistics over delineated basins using Google Earth Engine (GEE). By taking advantage of GEE's vast dataset archive and distributed computing system, RaBPro can quickly compute many statistics over even very large basins efficiently and without the need for storing large geo-rasters locally. Additionally, users may upload their own datasets to GEE and create custom statistic functions.

RaBPro: A Module for Profiling Rivers and Basins



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AGU FALL
MEETING



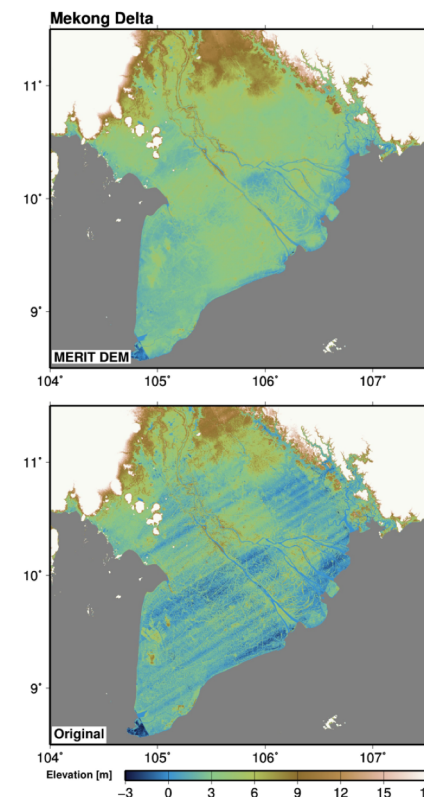
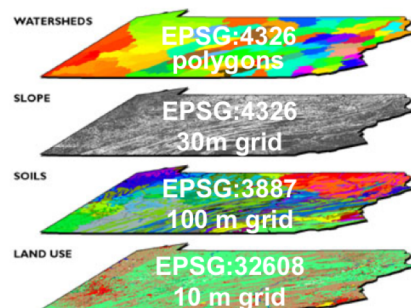


DEMS AND GLOBAL DATASETS

- Digital elevation models (DEMs) represent terrain using elevation data
- Recent advancements have led to global elevation data
- Similarly, satellite imaging and large-scale modelling have led to numerous near-global data sources for watershed characteristics
- Need global-scale tools to feed data to models
- Scale of new datasets poses new challenges



Google Earth Engine



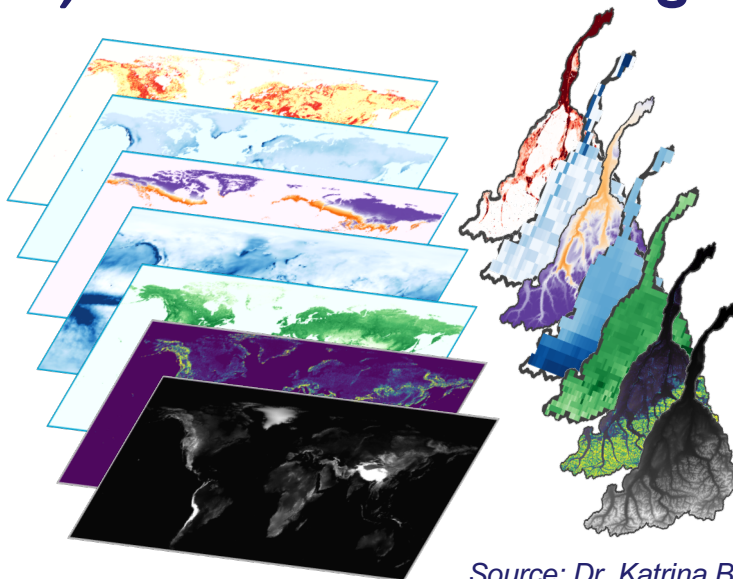
Source: MERIT DEM

SCIENCE
is SOCIETY



RaBPro: River and Basin Profiler

- Delineating basins and computing watershed stats across datasets become expensive
- RaBPro (River and Basin Profiler) is a Python module providing a pipeline to
 - delineate drainage basins
 - create elevation profiles
 - calculate watershed statistics
- Use Google Earth Engine (GEE) for fast and low-storage computation

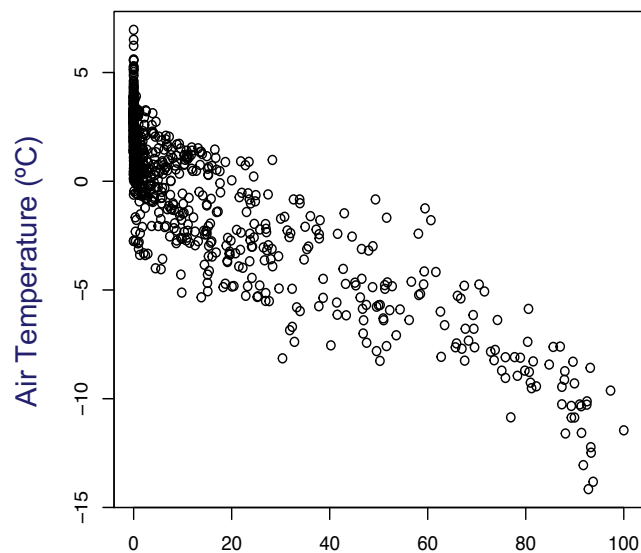


Source: Dr. Katrina Bennett

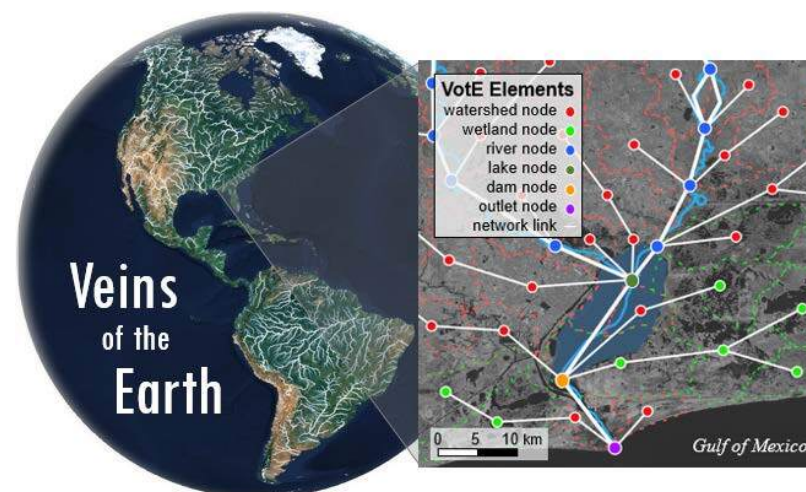


APPLICATIONS

- Permafrost hydrology: Investigating how Arctic permafrost and precipitation characteristics affect river processes
- Veins of the Earth (VotE): framework for mapping and modelling river networks on a global scale
- Many more!

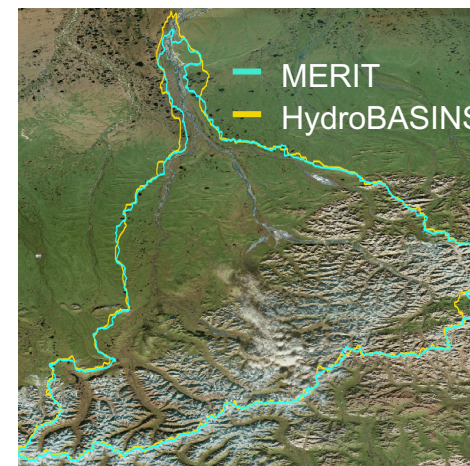
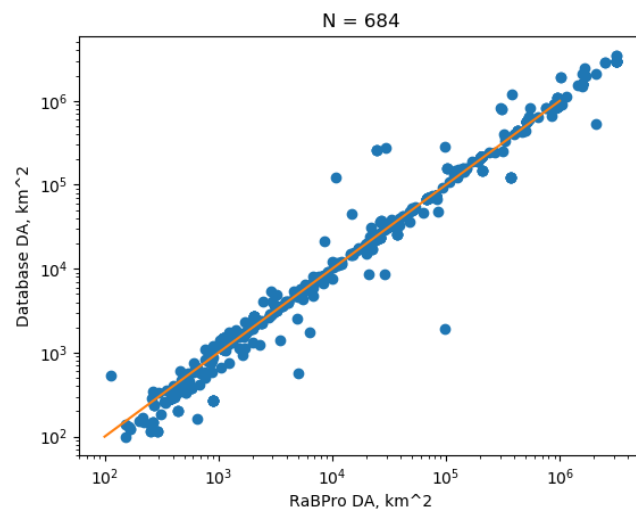


Obu et al. 2019 Permafrost (%)
Source: Dr. Katrina Bennett

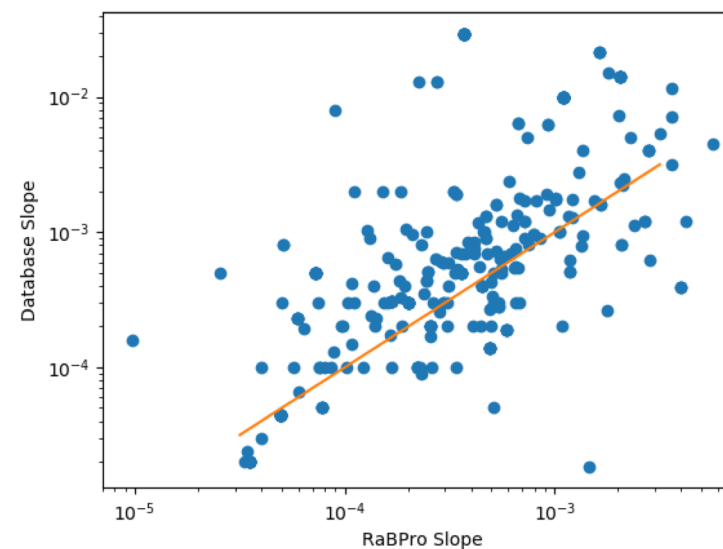
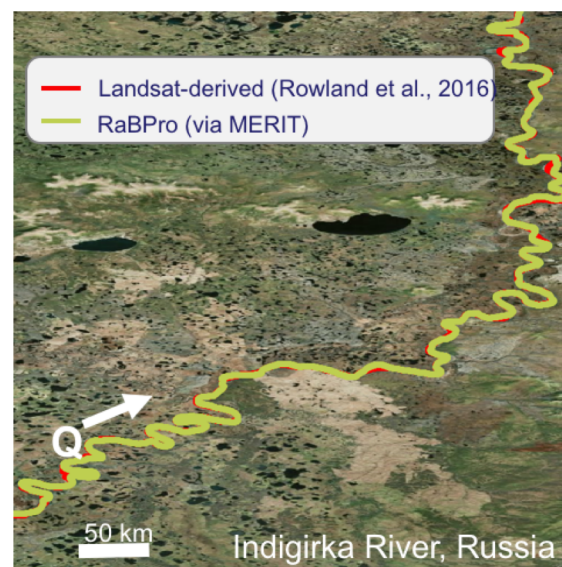




OUTPUTS



Sag River Basin,
~14,900 km²



CONCLUSIONS & ACKNOWLEDGEMENTS

- RaBPro is a module for analyzing watersheds, with several demonstrated applications.
- Available for installation through Pip and Anaconda.
- GitHub: <https://github.com/jonschwenk/rabpro>
- Questions: tz2294@columbia.edu
- Many thanks to Dr. Jemma Stachelek and Dr. Katrina Bennett for their contributions!

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