Flow-Conditioned Parameter Grids:

A CONUS Hydrologic Parameter Dataset For Mechanistic, Statistical, and Machine Learning Models

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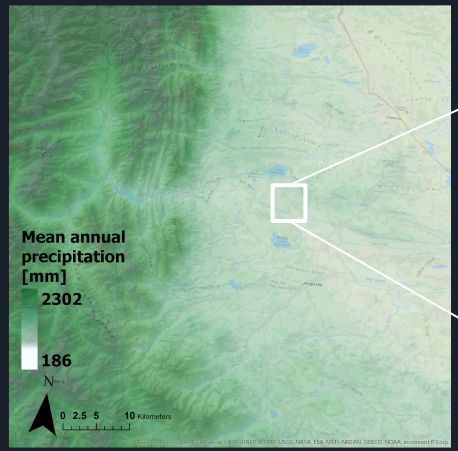
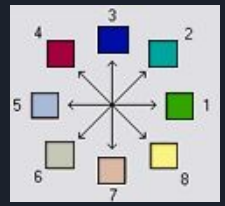
What is a Flow-Conditioned Parameter Grid?

A simple way to pre-compute the upstream average of continuous or categorical variables using a flow direction grid.

Parameter grid (precipitation)



Accumulated by flow direction

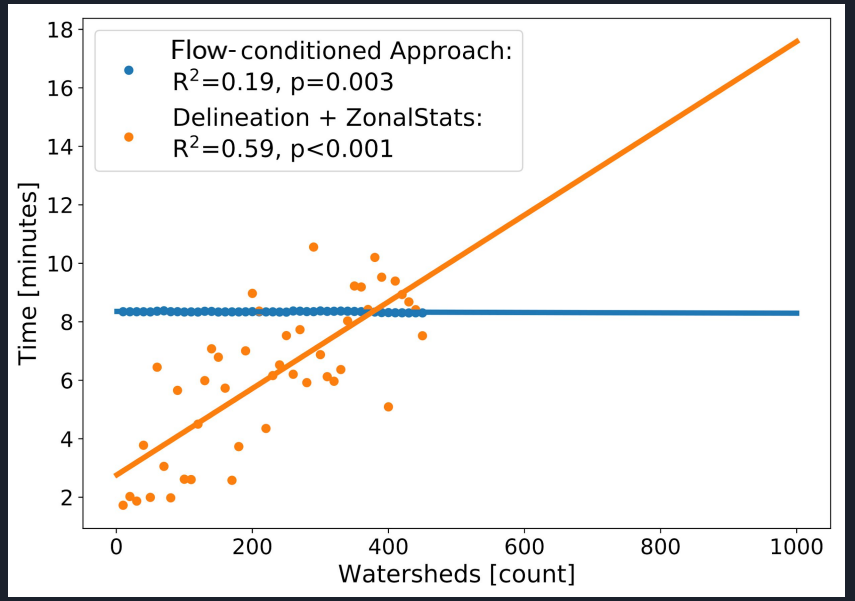


Normalized by upstream area

How are FCPGs Useful?

Rapidly parameterize machine learning, statistical, and mechanistic hydrologic (or other!) models.

As watershed count increases, delineation and zonal statistics approach takes increasingly long while query time for FCGPs remains relatively constant no matter the number of watersheds queried.



The CONUS Pilot FCPG Dataset

Flow accumulations based on the U.S. Geological Survey National Hydrography Dataset Plus (NHD+) Medium Resolution (30 m) flow direction grids.

Basin characteristics produced :

Mean upstream:

- Elevation: NHD+ Medium Res. (EPA, 2018)
- Slope
- Latitude
- Minimum air temperature: Daymet 30 year monthly mean (Thornton et al., 2018)
- Maximum air temperature: Daymet 30 year monthly mean (Thornton et al., 2018)
- Precipitation: Daymet 30 year annual mean (Thornton et al., 2018)
- Land cover: North America Land Cover Dataset (CEC, 2015)

How to Use FCPGs?

Query watershed pour points directly from FCPGs via Cloud Optimized GeoTiffs (COG).

Web service and USGS StreamStats point and click interface coming soon...

```
import rasterio as rs

url = 'http://path/to/some/cog/daymet_annual_prcp_fcpg_cog.tif'
x = -1106211.1 # horizontal coordinate
y = 2318491.8 # vertical coordinate

xy = (x,y)
band = 1

with rs.open(url) as ds:
    for i in ds.sample([xy],band):
        print('Mean Annual Upstream Precipitation: %s mm'%i[0])
```

```
Mean Annual Upstream Precipitation: 344.01492 mm
```

Build Your Own FCPGs!

```
import FCPGtools as fc

fc.tauDrainDir(upstreamFDR, upstreamFDRTau) # reclassify flow directions
fc.tauFlowAccum(upstreamFDRTau,upstreamFAC, cores=4) # generate flow accumulation grid
fc.resampleParam(P,upstreamFDRTau, # resample parameter data to match flow direction grid
                 Pupstream)
accumParams = fc.accumulateParams(usLCbinary,upstreamFDRTau,
                                  testFolder,cores = 4) # accumulate parameter grids
upstream_cpgs = fc.make_fcpgs(accumParams,upstreamFAC,testFolder) # generate FCPGs!
```

Software Release in Review:

Barnhart, T.B., Sando, R., Siefken, S.A., McCarthy, P.M., and Rea, A.H., 2020, Flow-Conditioned Parameter Grid Tools: U.S. Geological Survey Software Release, DOI: https://doi.org/10.5066/P9FPZUI0 (not yet active)

References

CEC. (2015). Land Cover 30m, 2015 (Landsat and RapidEye). Retrieved from http://www.cec.org/tools-and-resources/map-files/land-cover-30m-2015-landsat-and-rapideye

EPA. (2018). NHDPlus (National Hydrography Dataset Plus). Retrieved from https://www.epa.gov/waterdata/nhdplus-national-hydrography-dataset-plus

Thornton, P. E., Thornton, M. M., Mayer, B. W., Wei, Y., Devarakonda, R., Vose, R. S., & Cook, R. B. (2018). Daymet: Daily Surface Weather Data on a 1-km Grid for North America, Version 3. ORNL Distributed Active Archive Center. https://doi.org/10.3334/ORNLDAAC/1328

Support

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