H450-1343

OWPHydroTools

Python-based Tools for Retrieving and Evaluating National Water Model Streamflow Simulations

OWP | OFFICE OF WATER PREDICTION

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Data Overload!

The variety and complexity of tools available to retrieve and analyze large amounts of hydrological data can be overwhelming for domain and data scientists. OWPHydroTools is a collection of Python packages that provide high-level intuitive interfaces to retrieve and analyze observed data from USGS and simulated data from the National Water Model (NWM).

USGS NWIS Client

The NWIS client tool retrieves data from the USGS Instantaneous Values Web Service. This web service supplies observation data used to compare against model simulations. The client tool automatically parses, distributes, and caches requests for data from thousands of USGS sites in a single line of Python code. The example below retrieves streamflow data as a `pandas.DataFrame` in OWPHydroTools canonical format.

```
observations = USGS_client.get(
    sites=["01030350", "01013500"],
    startDT="2021-09-01T01:00",
    endDT="2021-09-01T18:00"
)
```

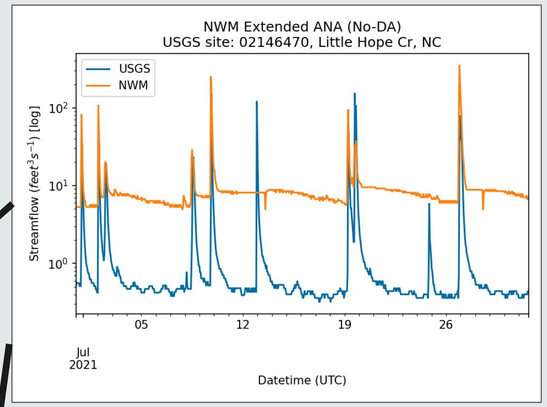
https://waterservices.usgs.gov/rest/IV-Service.html

National Water Model Output Client

The National Water Model (NWM) Client tool retrieves data from file-based sources of NWM data. This tool automatically retrieves, parses, and caches NWM NetCDF data, returning results as pandas.DataFrames.. The code snippet below retrieves short range forecasts for all NWM channel features that correspond to a USGS streamflow gage location. The data source defaults to Google Cloud Platform, but can be used with other data stores.

```
forecasts = NWM_client.get(
    configuration="short_range",
    reference_time="20210901T00Z"
)
```

Construct continental-scale hydrological model evaluations



Criterion: >= 10 feet^{3}s^{-1} in a day

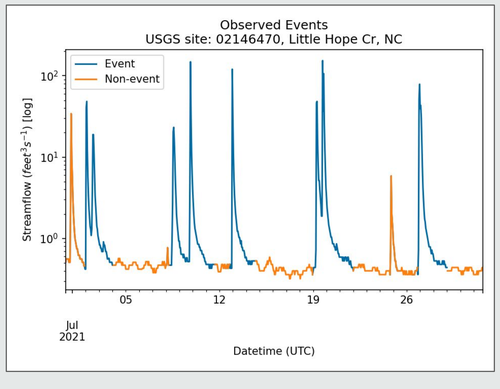
Metric	Value
POD	0.778
POFD	0.087
POFA	0.222
FBI	1.000
CSI	0.636
ETS	0.528
NNSE	0.268

Contingency Table	Count
True Positives	7
False Positives	2
False Negatives	2
True Negatives	21

Event ID	Peak Discharge Error (%)	Time of Peak Error (hours)	Volumetric Discharge Error (%)
0	122.27	-1.00	147.65
1	69.18	-1.00	182.46
2	-38.37	-11.00	45.97
3	345.25	-1.00	345.95

"Event" Detection

Event detection is a signal processing technique used to identify interesting features in time series data. In this example, we applied event detection to identify rainfall-driven runoff events in observed and simulated streamflow time series. Learn more here: https://github.com/jarq6c/little_hope/blob/main/event_detection.ipynb



Metrics

OWPHydroTools includes a variety of model skill metrics that are specific interest to hydrological validation and forecast verification. We designed this methods with compatibility in mind. Users familiar with `sklearn` or `scipy` should find these metrics easy to use.

Available Metrics	
Probability of Detection	Probability of False Detection
Probability of False Alarm	Frequency Bias
Threat Score	Equitable Threat Score
Mean Squared Error	Nash-Sutcliffe Efficiency

Duplicate These Results!

https://github.com/jarq6c/little_hope/tree/main/AGU_2021

Install and Contribute!

Regina, J. A., & Raney, A. (2021). OWPHydroTools (Version 2.1.1) [Computer software]. https://github.com/noaa-owp/hydrotools

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