

WaterHackWeek2019

MetSim

A python library for
meteorological data simulation

Hi, I'm **Andrew Bennett**

Who am I?

- 3rd year PhD student in the Computational Hydrology Group at UW
- One of the primary authors of MetSim
- I'm interested in bringing state of the art data analysis techniques, tools, and workflows into hydrologic research
- My research primarily deals with methods for interpreting behavior of hydrologic systems

Get in touch:



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MetSim means Meteorology Simulator

Meteorology simulator

We have:

- Daily minimum temperature
- Daily maximum temperature
- Precipitation
- Wind speed

We want:

- SW Radiation
- LW Radiation
- Humidity
- ...

Forcing disaggregator

- Take daily variables and downscale them to sub-daily
- Need to figure out when min and max temperature
- How to divide precipitation throughout the day
- How much radiation incoming during night vs day

How do I get MetSim?

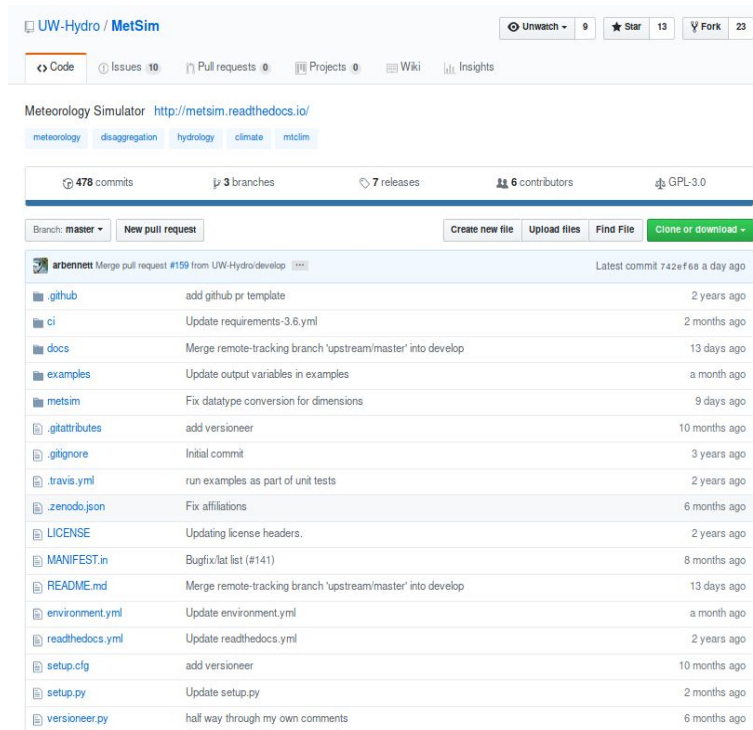
Install it:

```
pip install metsim
```

```
conda install -c conda-forge metsim
```

Clone it:

```
git clone https://github.com/UW-Hydro/MetSim.git
```



UW-Hydro / MetSim

Unwatch 9 Star 13 Fork 23

Code Issues 10 Pull requests 0 Projects 0 Wiki Insights

Meteorology Simulator <http://metsim.readthedocs.io/>

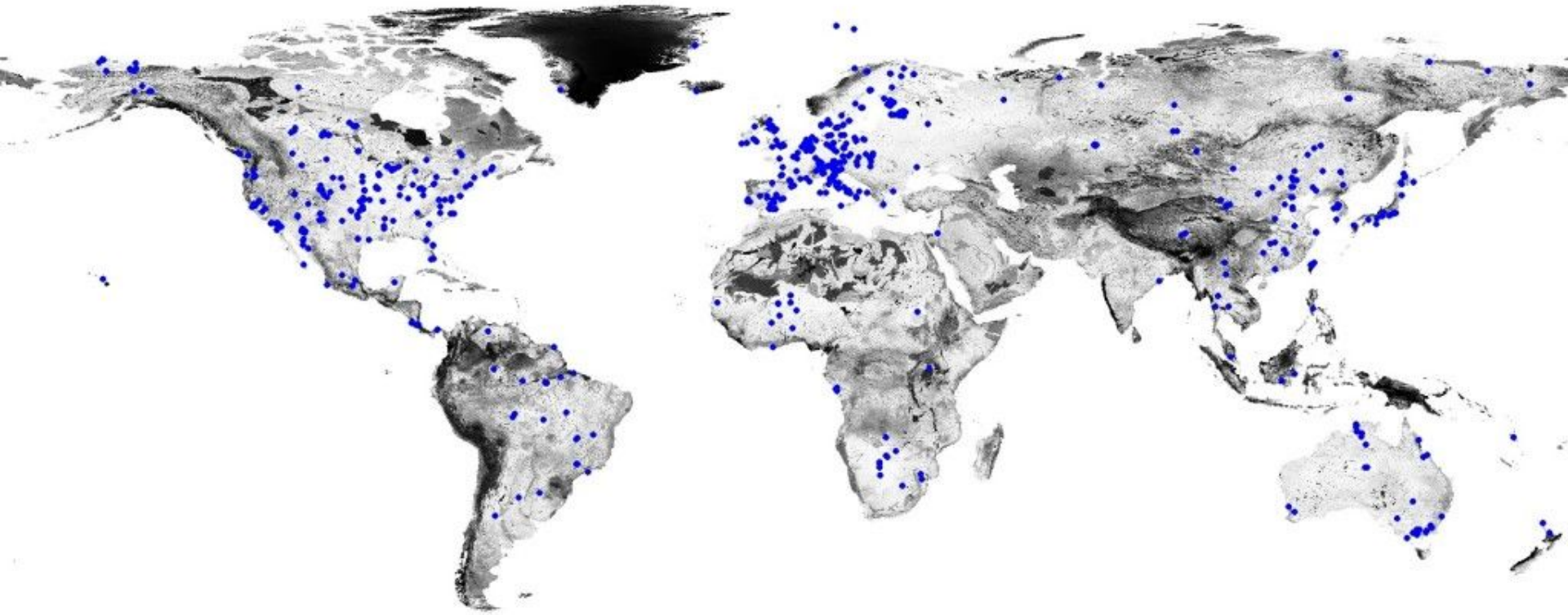
meteorology disaggregation hydrology climate mscim

478 commits 3 branches 7 releases 6 contributors GPL-3.0

Branch: master New pull request Create new file Upload files Find File Clone or download

		Latest commit 742ef68 a day ago
.github	add github pr template	2 years ago
ci	Update requirements-3.6.yml	2 months ago
docs	Merge remote-tracking branch 'upstream/master' into develop	13 days ago
examples	Update output variables in examples	a month ago
metsim	Fix datatype conversion for dimensions	9 days ago
.gitattributes	add versioneer	10 months ago
.gitignore	Initial commit	3 years ago
.travis.yml	run examples as part of unit tests	2 years ago
.zenodo.json	Fix affiliations	6 months ago
LICENSE	Updating license headers.	2 years ago
MANIFEST.in	Bugfix/lat list (#141)	8 months ago
README.md	Merge remote-tracking branch 'upstream/master' into develop	13 days ago
environment.yml	Update environment.yml	a month ago
readthedocs.yml	Update readthedocs.yml	2 years ago
setup.cfg	add versioneer	10 months ago
setup.py	Update setup.py	2 months ago
versioneer.py	half way through my own comments	6 months ago

Why do we need MetSim?

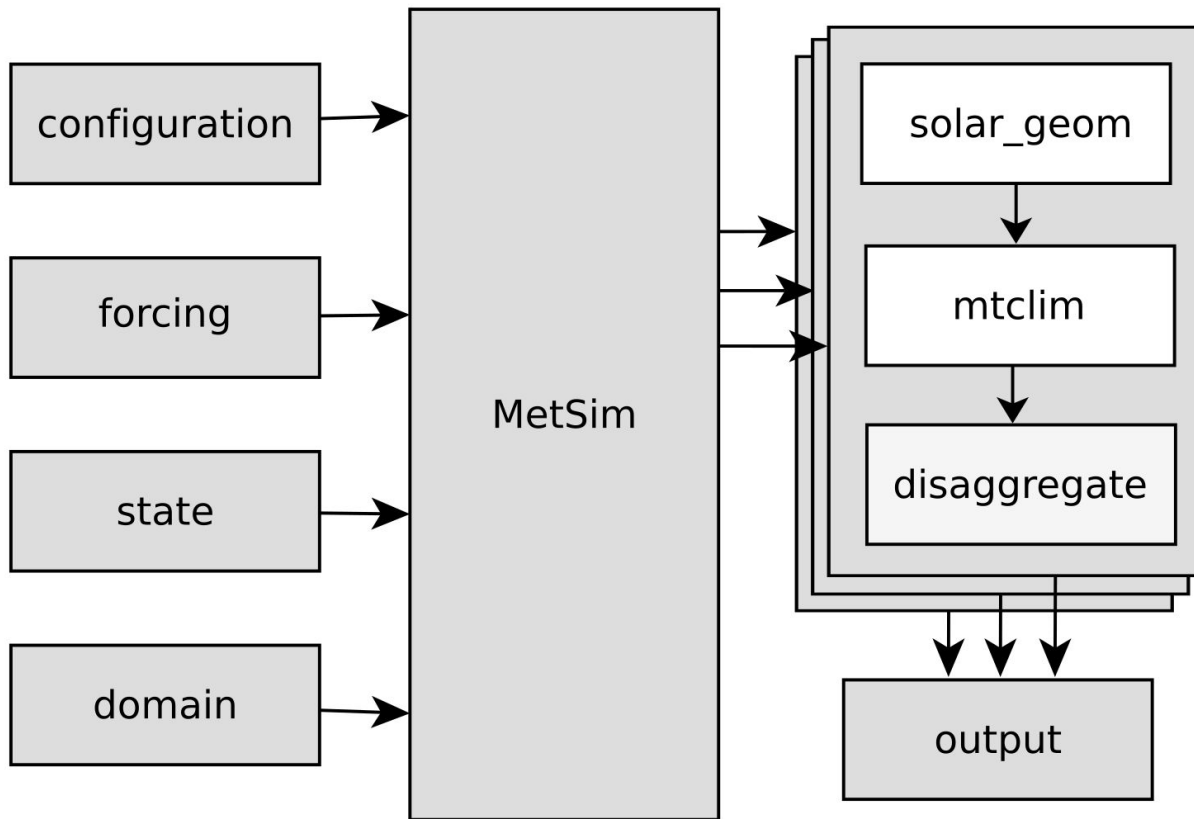


What should **you** get out of this tutorial?

1. **Familiarity** with what MetSim is and does
2. Skills to use MetSim in both **command line** and **scripting use**
3. Skills to **create your own datasets** to be compatible with MetSim
4. Some nifty **coding tools** and **tricks**

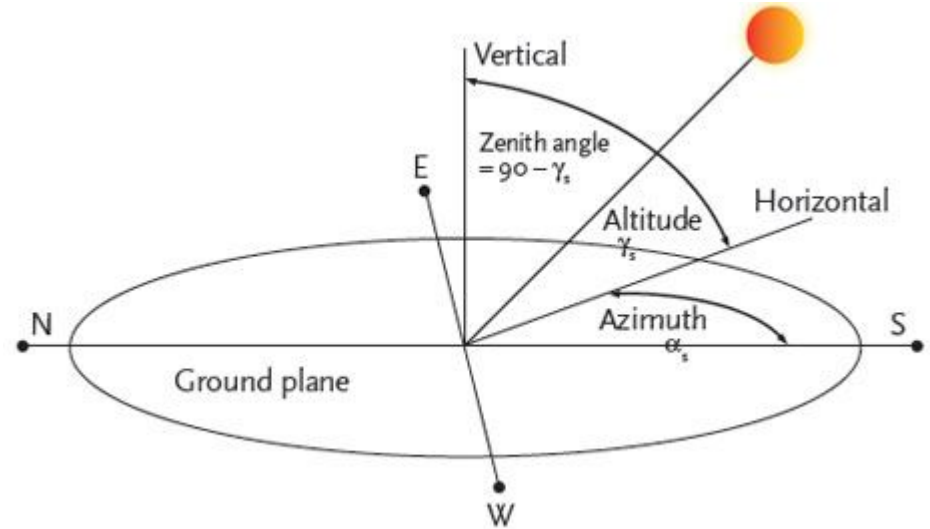
**What
does
MetSim
actually do?**

Architecture



Solar geometry

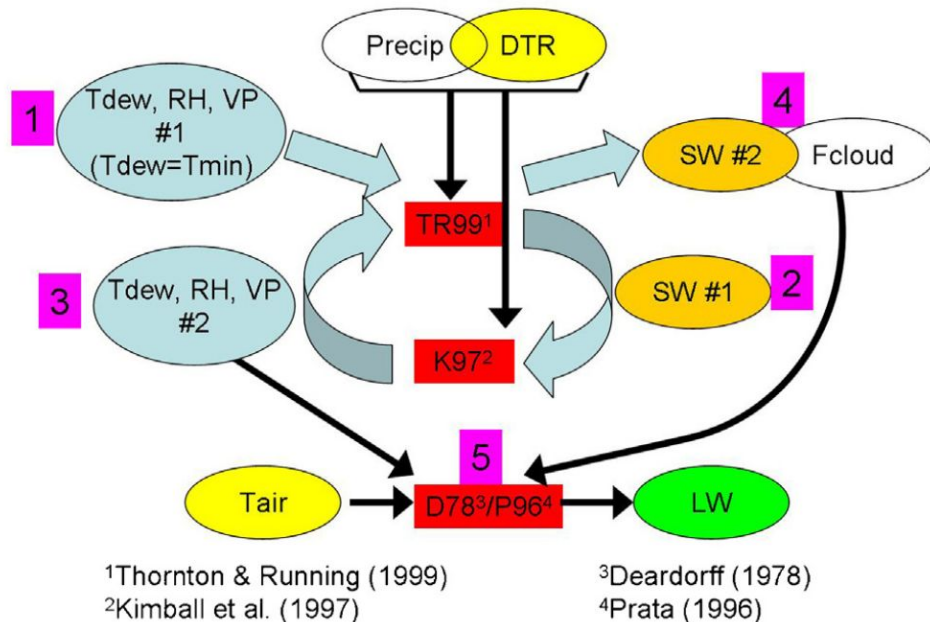
- Top of atmosphere shortwave radiation
- Day length
- Maximum transmittance



Meteorology simulation

Origins: MTCLIM

- Mountain climate simulator
- Developed 1989 (First release)
- Daily time step
- Used input at "base" station to generate output at a "site" location
- Outputs shortwave radiation, daylight average temperature, humidity, and cloud fraction



Temporal disaggregation

- **Temperature:** Interpolation via Hermite polynomials
- **Shortwave:** Fraction of total shortwave multiplied by fraction received
- **Vapor pressure:** Linear interpolation from daily maximum temperature
- **Longwave:** Computed from temperature and vapor pressure
- **Precipitation:** Assumed constant, or using PITRI method

PITRI Citation: Bohn, T. J., K. M. Whitney, G. Mascaro, and E. R. Vivoni, 2019. A deterministic approach for approximating the diurnal cycle of precipitation for large-scale hydrological simulations. *Journal of Hydrometeorology*, 20(2):297-317. doi: 10.1175/JHM-D-18-0203.1.

**Let's go
try it out**