
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:

arbennett

andrbenn@uw.edu

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?

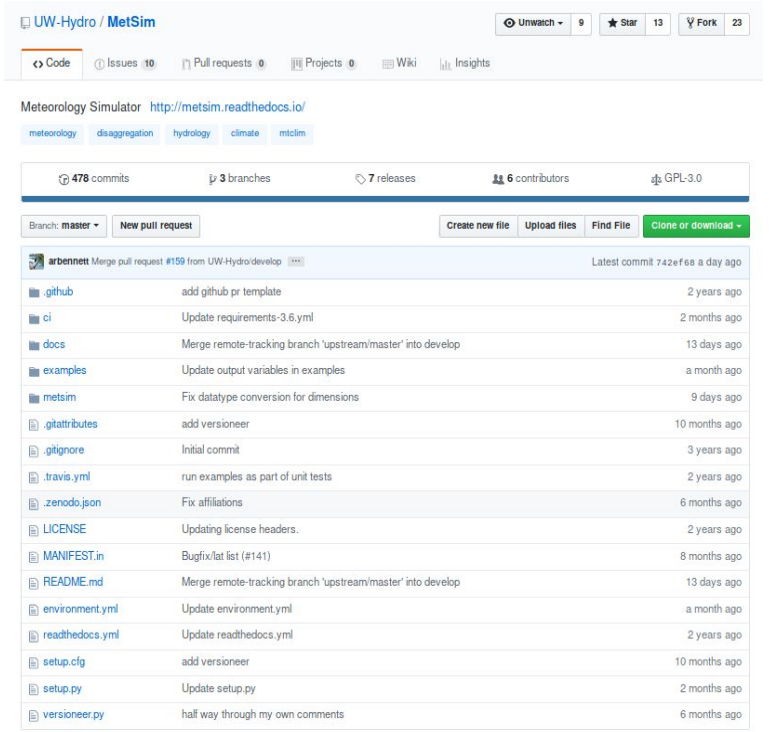
Install it:

```
pip install metsim
```

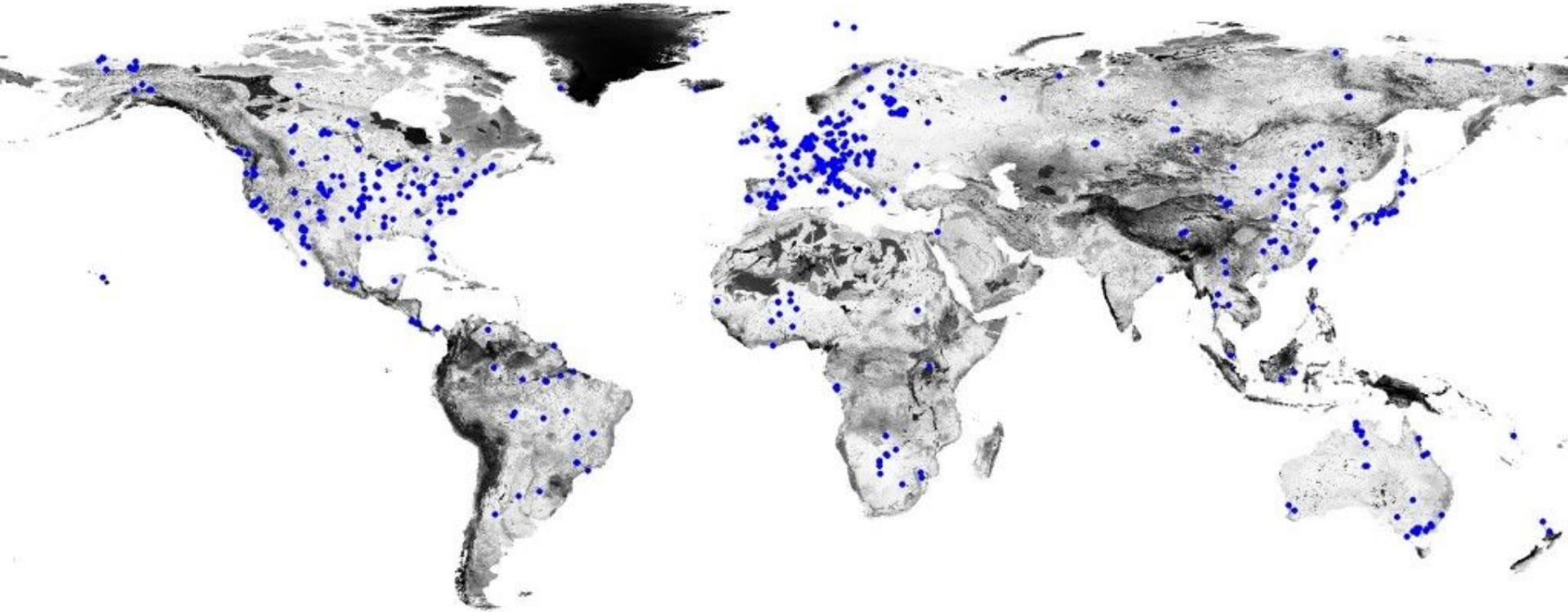
```
conda install -c conda-forge metsim
```

Clone it:

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



Why do we need MetSim?



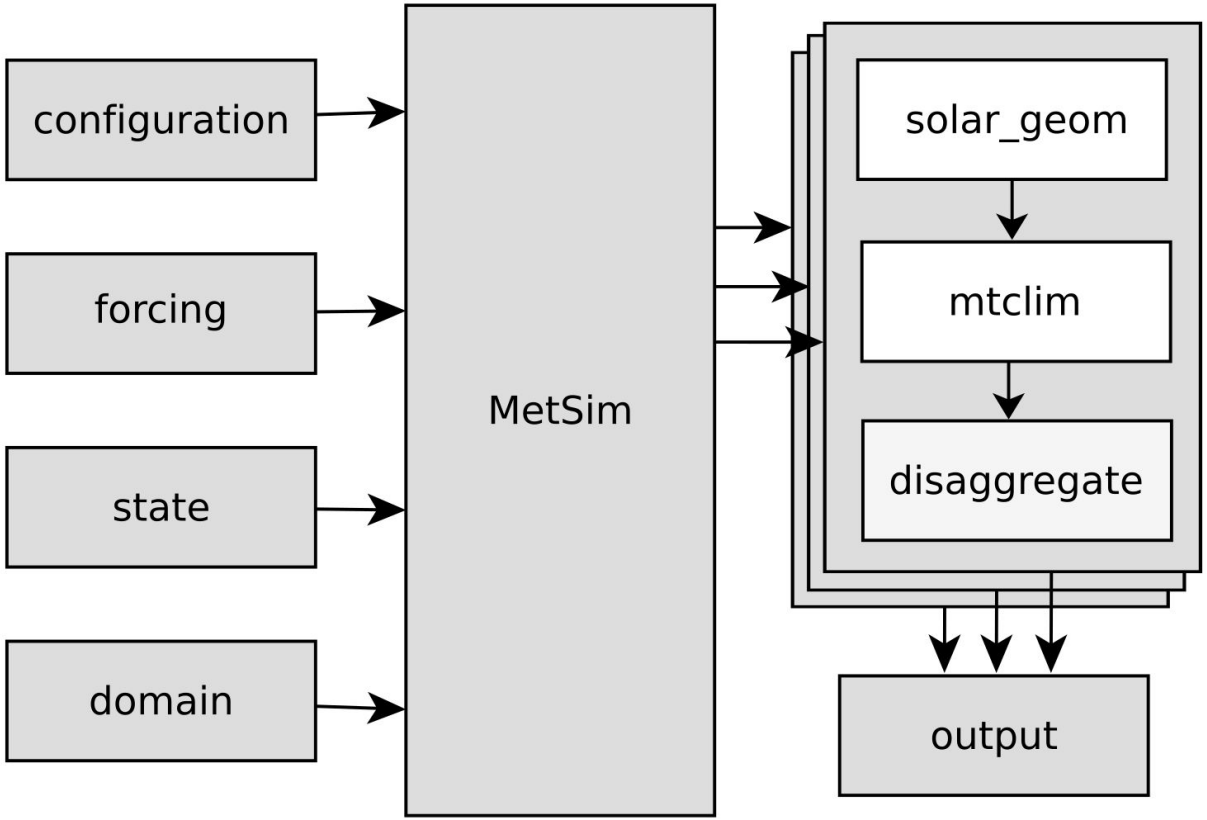
https://fluxnet.fluxdata.org/about

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**

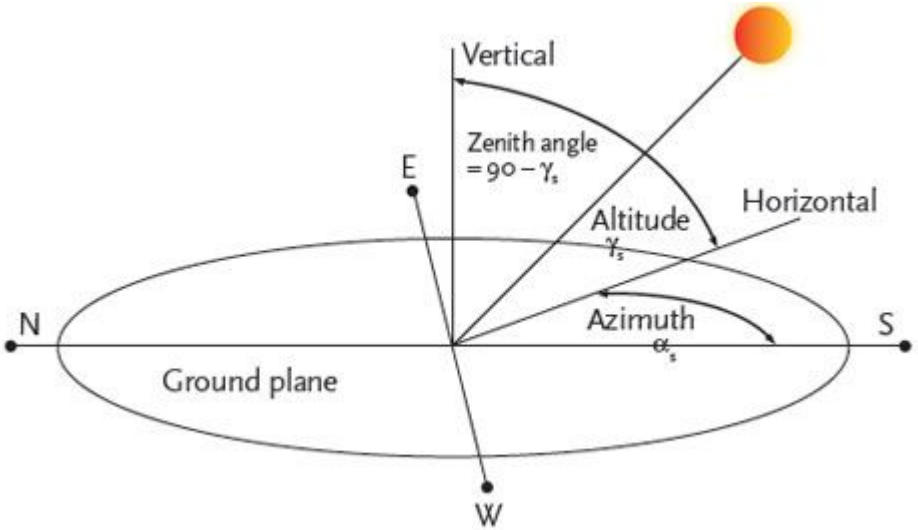
What does MetSim actually do?

Architecture



Solar geometry

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

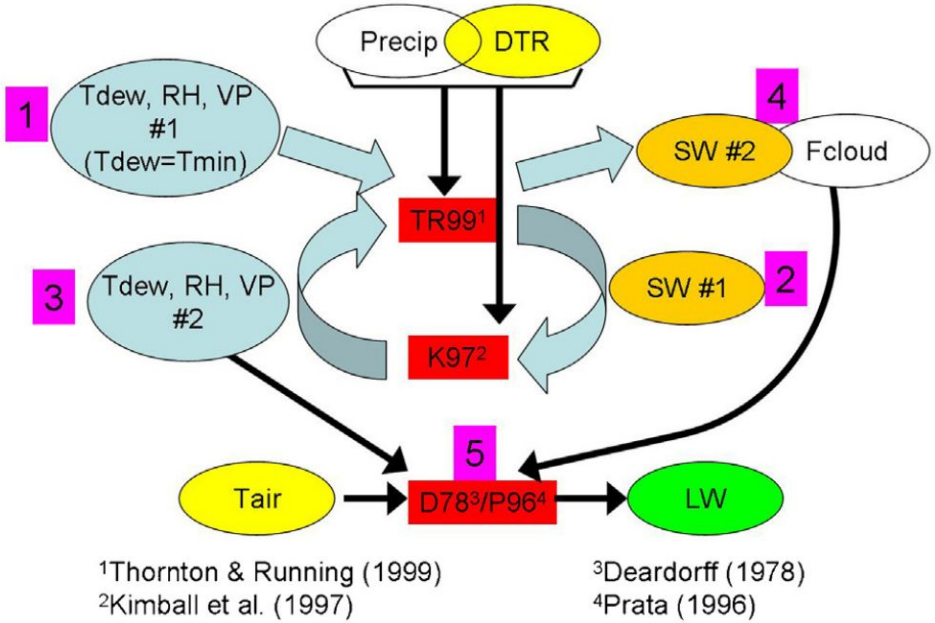


https://www.cibsejournal.com/cpd/modules/2013-07/

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



Bohn, T. J., B. Livneh, J. W. Oyler, S. W. Running, B. Nijssen, and D. P. Lettenmaier, 2013a: Global evaluation of MTCLIM and related algorithms for forcing of ecological and hydrological models, Agr. Forest. Meteorol., 176, 38-49, doi:10.1016/j.agrformet.2013.03.003

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