



bmi

pymt



Coupling Hydrologic Models with Data Services in an Interoperable Modeling Framework

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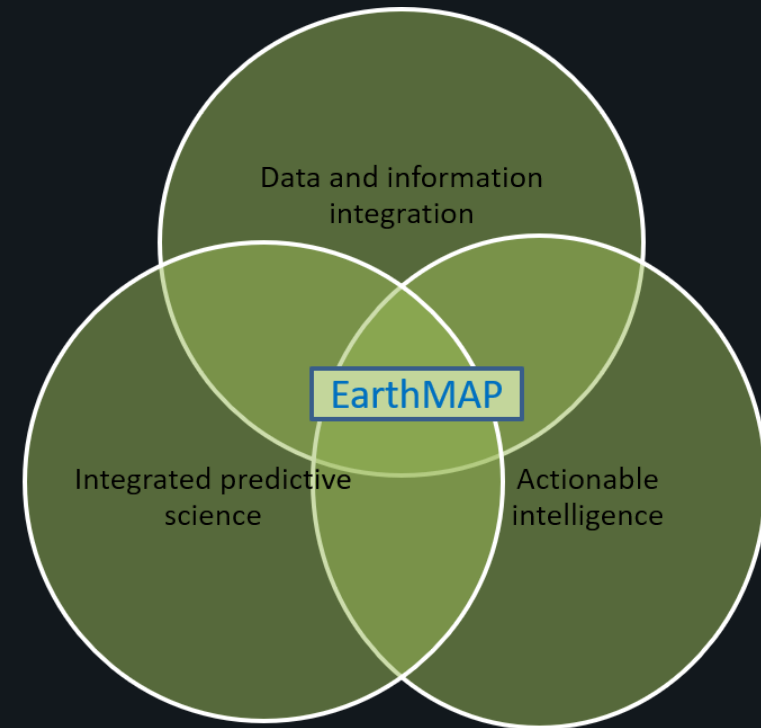
Presentation overview

1. Why are we doing this project?
2. What do we mean by a interoperable modeling framework?
 - Component models
 - CSMDS: Basic Model Interface - BMI
 - CSDMS: Python Modeling Toolkit - pyMT
3. What do we mean by Data services?
4. Demonstration
5. Challenges and takeaways

IMPD 5-year plan

Develop and deliver a Modeling and Prediction Collaborative Environment ("sandbox") that can be used to couple hydrology and other environmental simulation models with data and analyses

EarthMAP



CSDMS COMPONENT MODEL HIERARCHY

Component-models encapsulate a set of related functions into a reusable form.

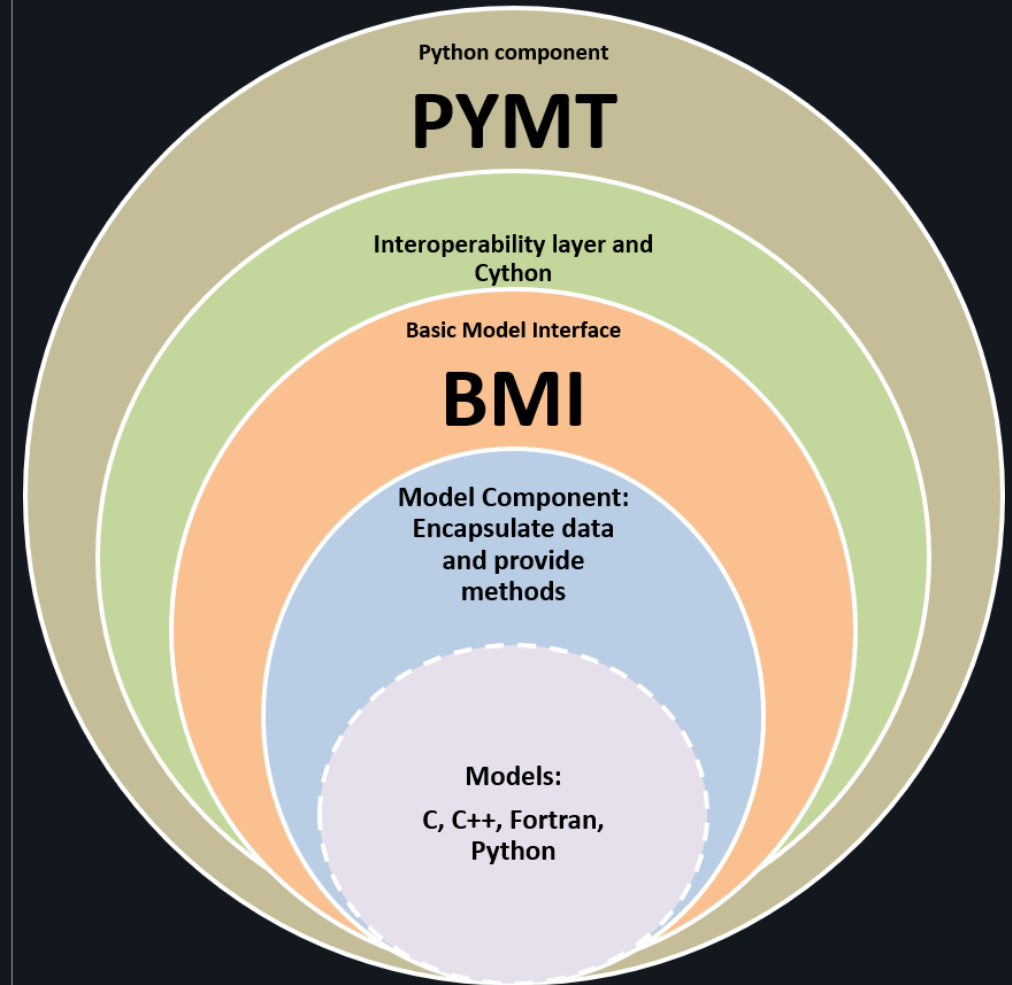
- In OOP, a class bundles data and provide methods that operate on the data within a single unit or component

Components communicate with each other via interfaces

An interface in this case is a set of common methods for example

- Initialize, run (time-step), finalize
- setter and getter
- time

Data or data-streams can also be components

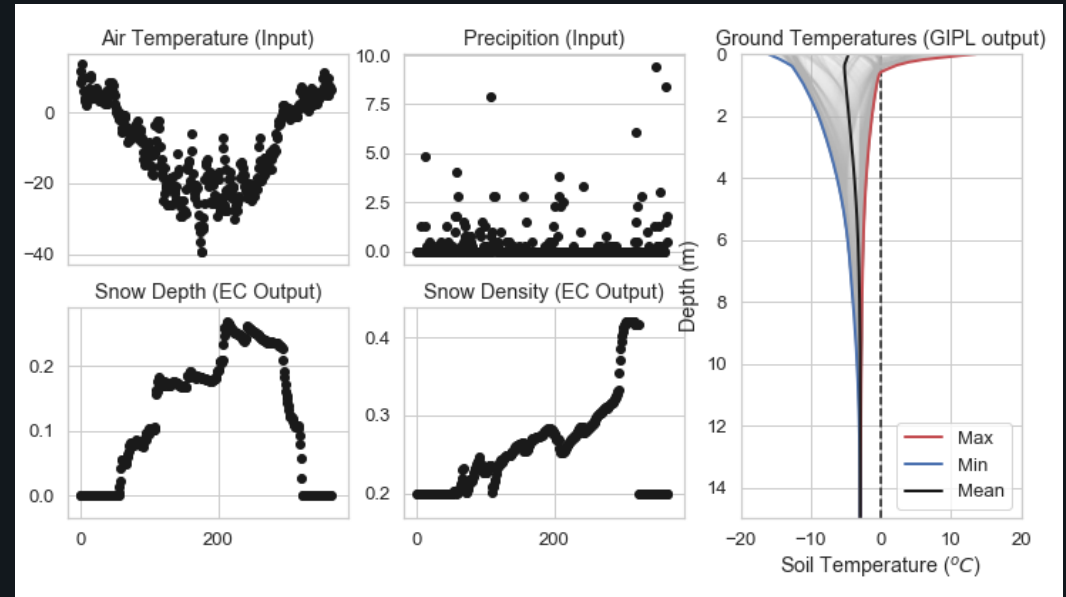


Example coupled snow and pemafrst temperature model

```
for i in np.arange(365):  
  
    ec.update() # Update Snow Model Once  
  
    # Get output from snow model  
    tair = ec.get_value('land_surface_air__temperature')  
    prec = ec.get_value('precipitation_mass_flux')  
    snd = ec.get_value('snowpack__depth', units='m')  
    rsn = ec.get_value('snowpack__mass-per-volume_density', units = 'g cm-3')  
  
    # Pass value to GIPL model  
    gipl.set_value('land_surface_air__temperature', tair)  
    gipl.set_value('snowpack__depth', snd)  
    gipl.set_value('snow__thermal_conductivity', rsn * rsn * 2.846)  
  
    gipl.update() # Update GIPL model Once
```

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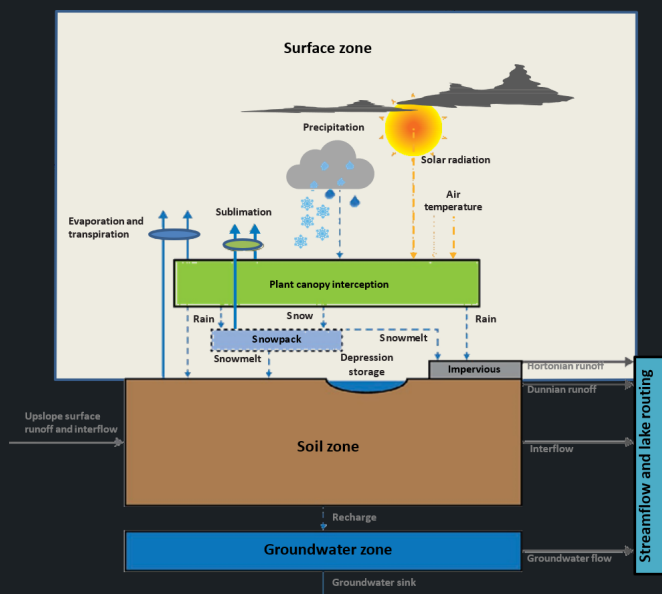
Visualization



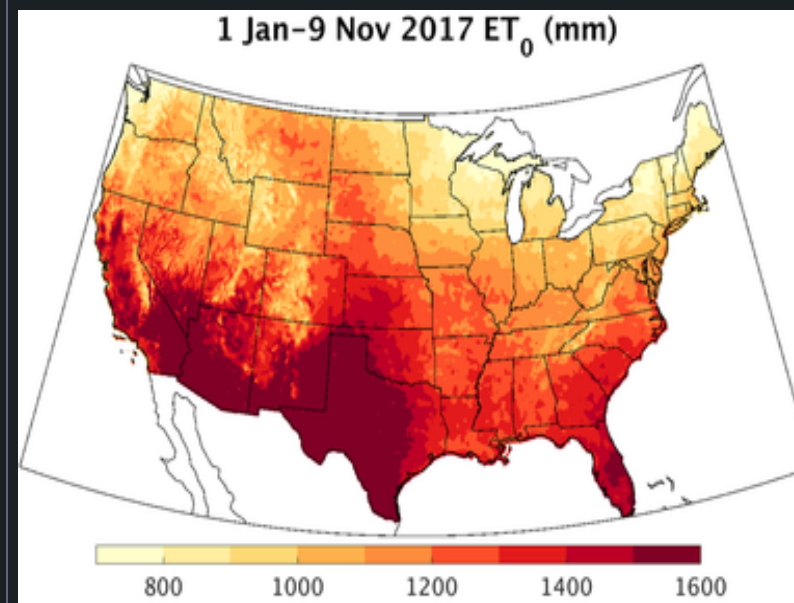
CDI Project Components and Data Services

PRMS Model Components

- Surface
- Soil
- Groundwater
- Streamflow



Gridmet Climate Data Services



Quick Demonstration:

Note:

- model run-time interaction
- Data-services example
- If your a modeler how much fun this is!

Challenges and Takeaways

- Older Fortran code would benefit from Fortran 2003 OOP and derived type enhancements
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