# Evaluating green infrastructure fluxes using Parflow.CLM

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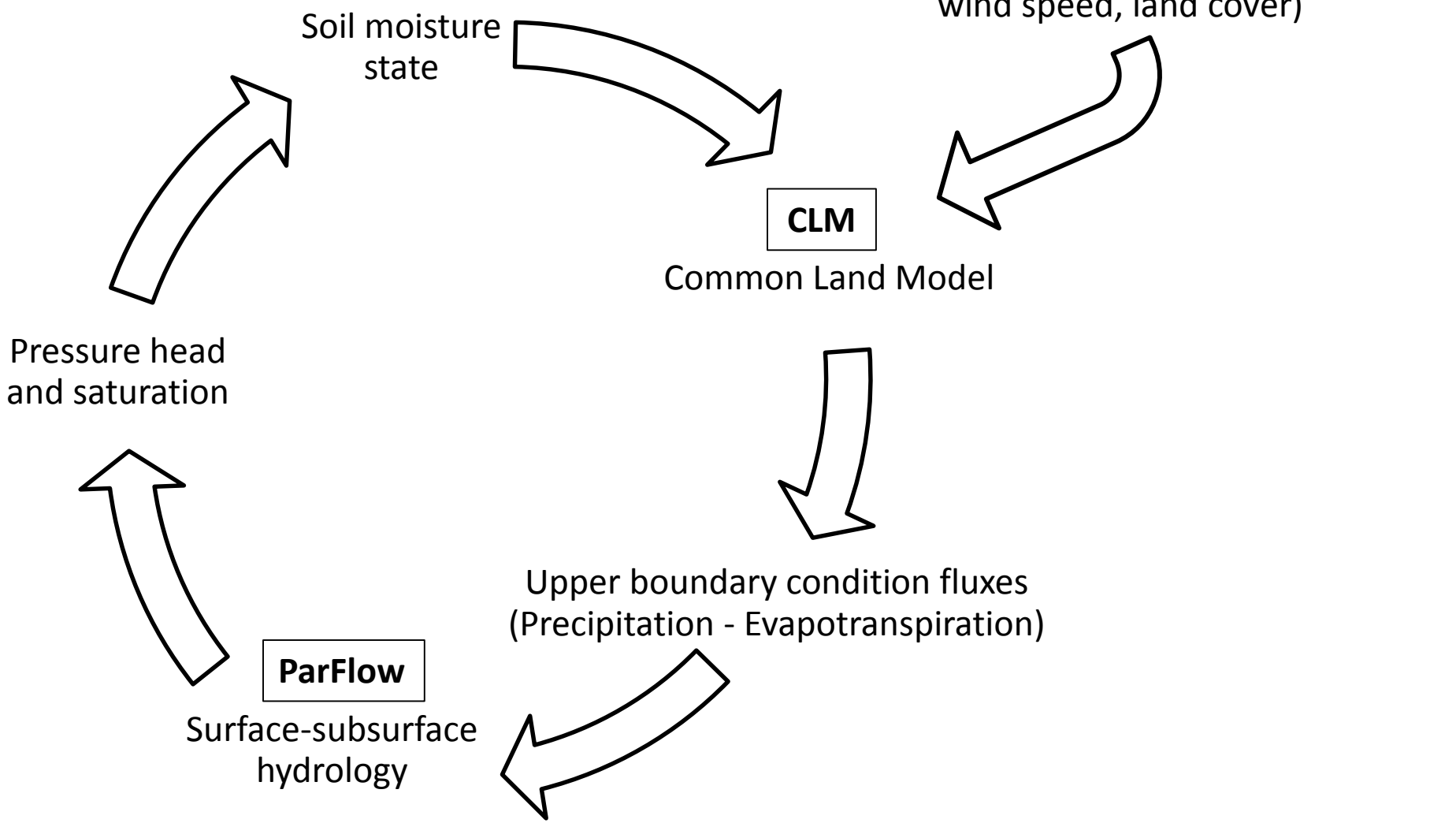
October 14, 2015

# Objectives

- Evaluate performance of Philadelphia GI projects at subwatershed and site scales
- Use the integrated hydrologic model ParFlow.CLM as an analysis tool
- Demonstrate the capabilities of this modeling approach

# ParFlow.CLM

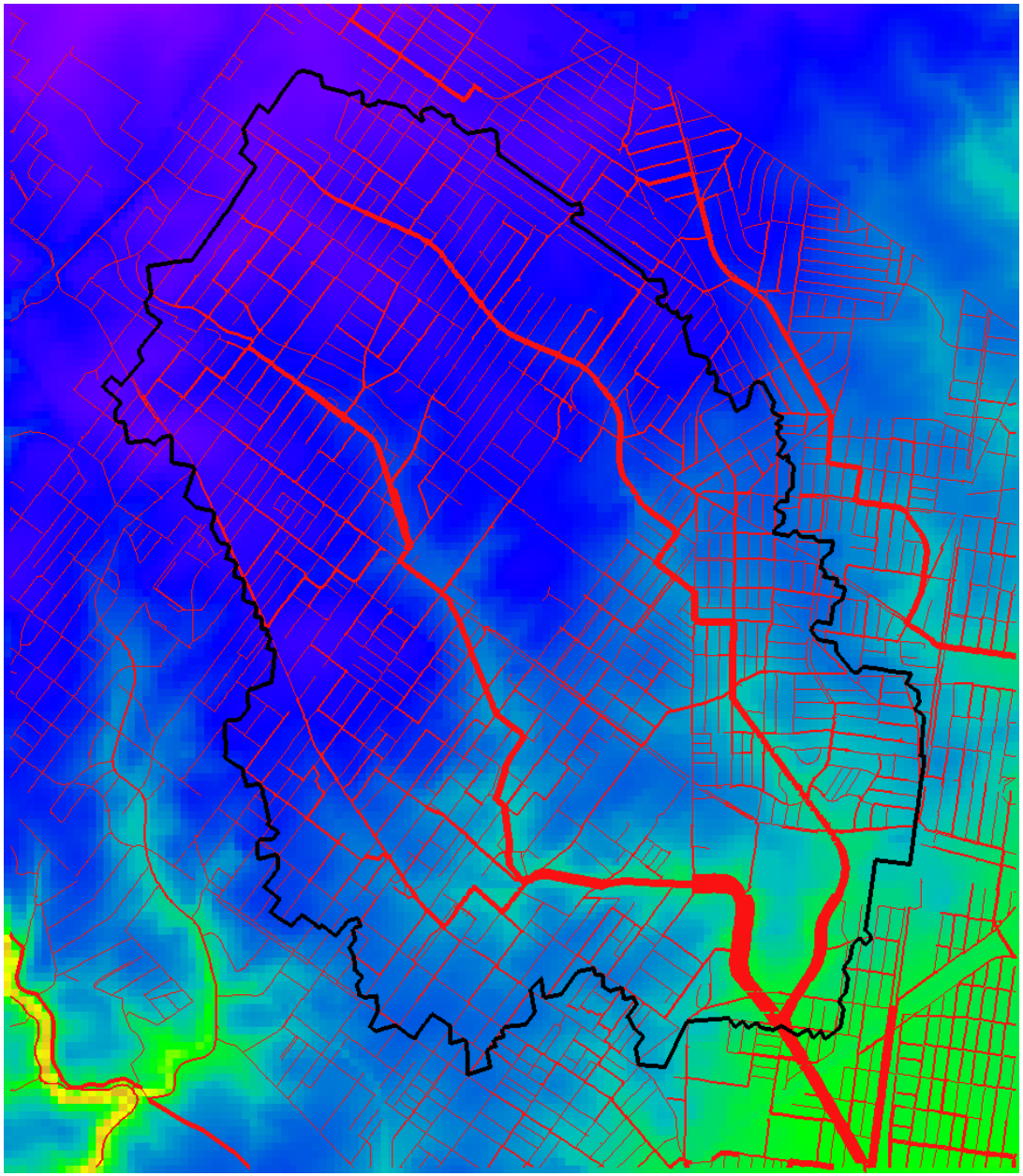



Courtesy of A. Bhaskar

# Wingohocking Model Domain

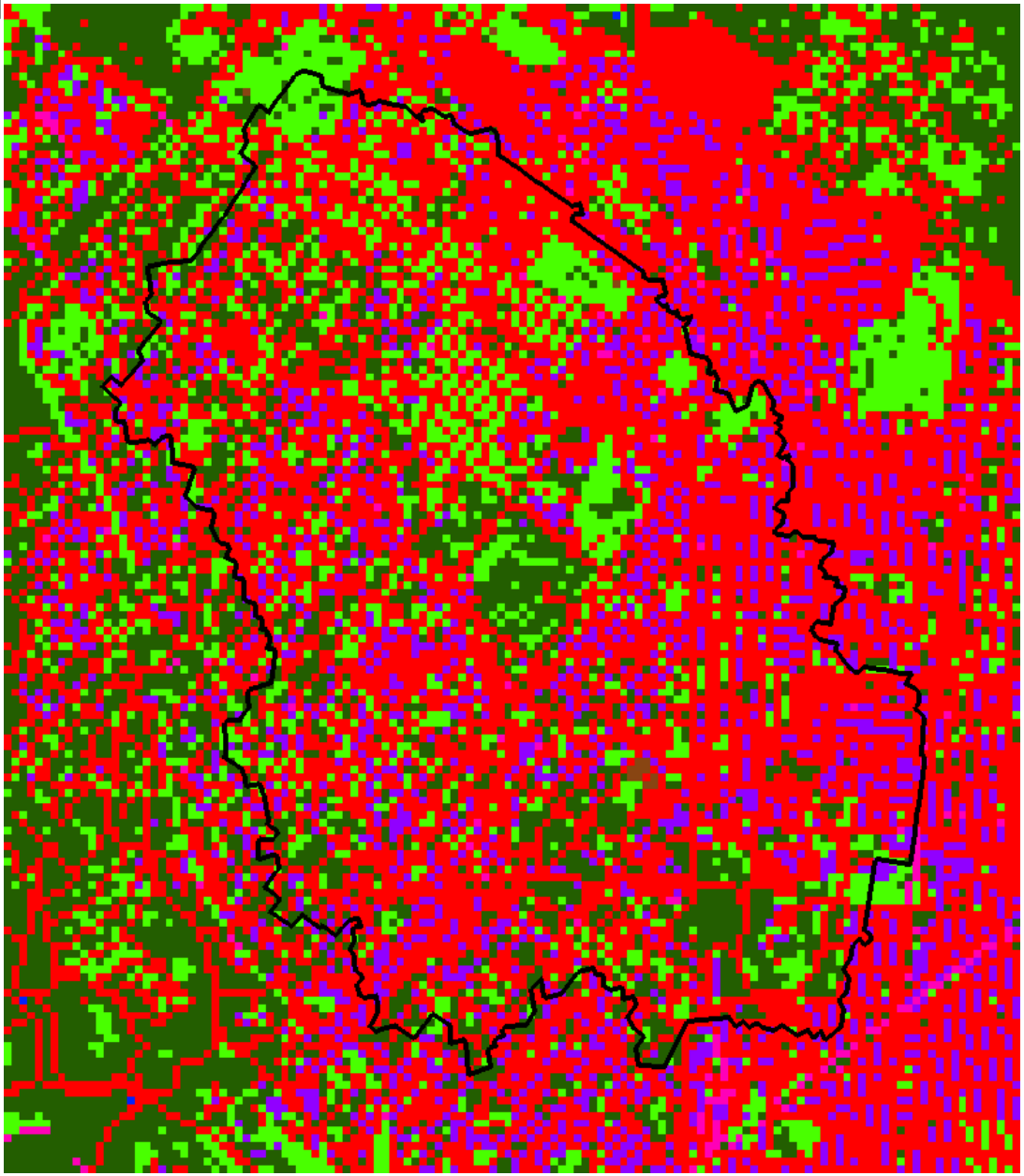
# Model inputs

- DEM resampled to 40 m x 40 m resolution
- Vertical discretization 1 m
- Domain area of 32 $km^2$
- 70 m depth
- Burning of pipes based on invert elevation



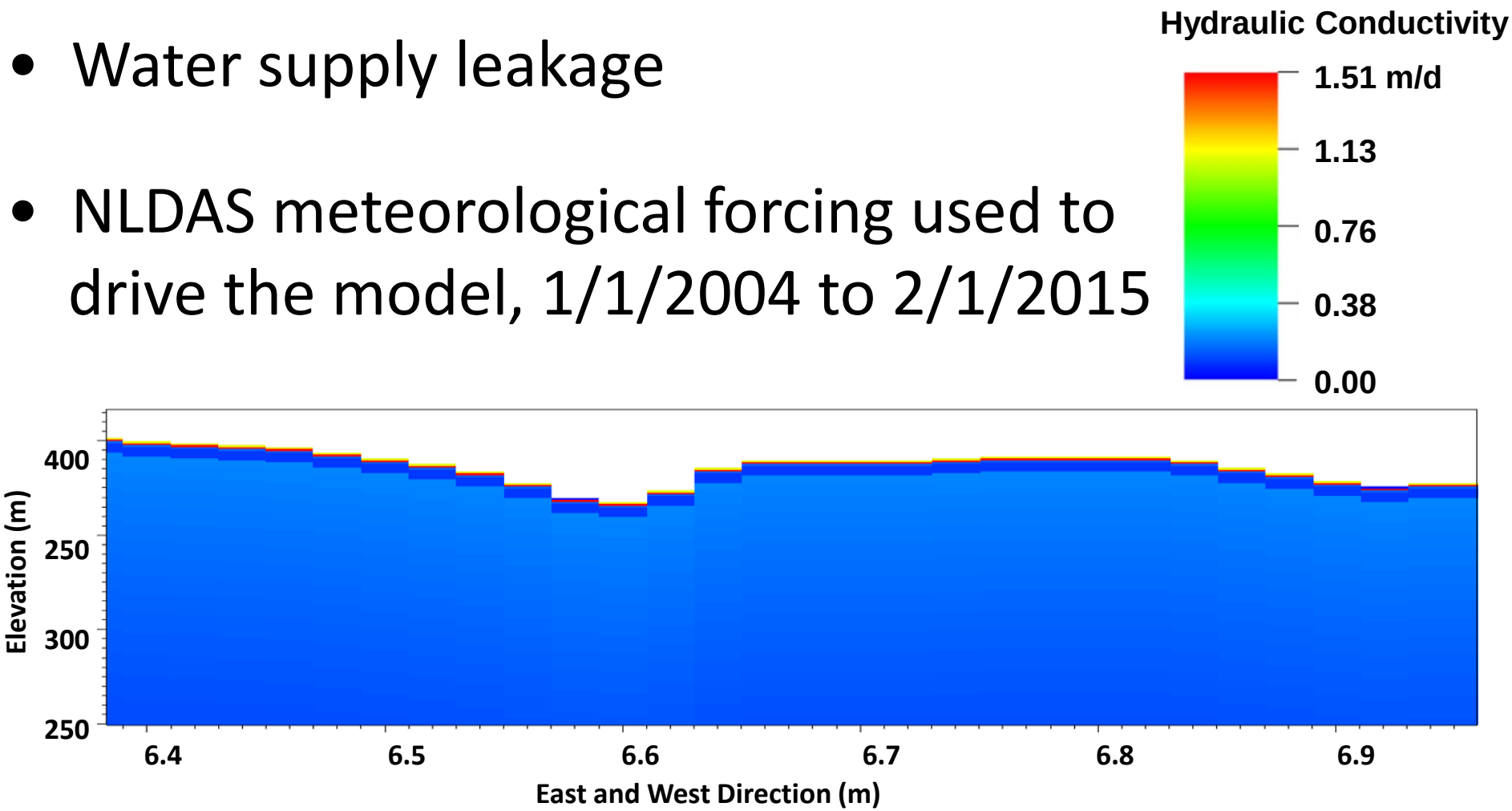
# Model inputs, cont'd

- Landcover data
  - CLM vegetation input
  - Impervious locations
- SSURGO soil data
  - Surface layer hydraulic properties

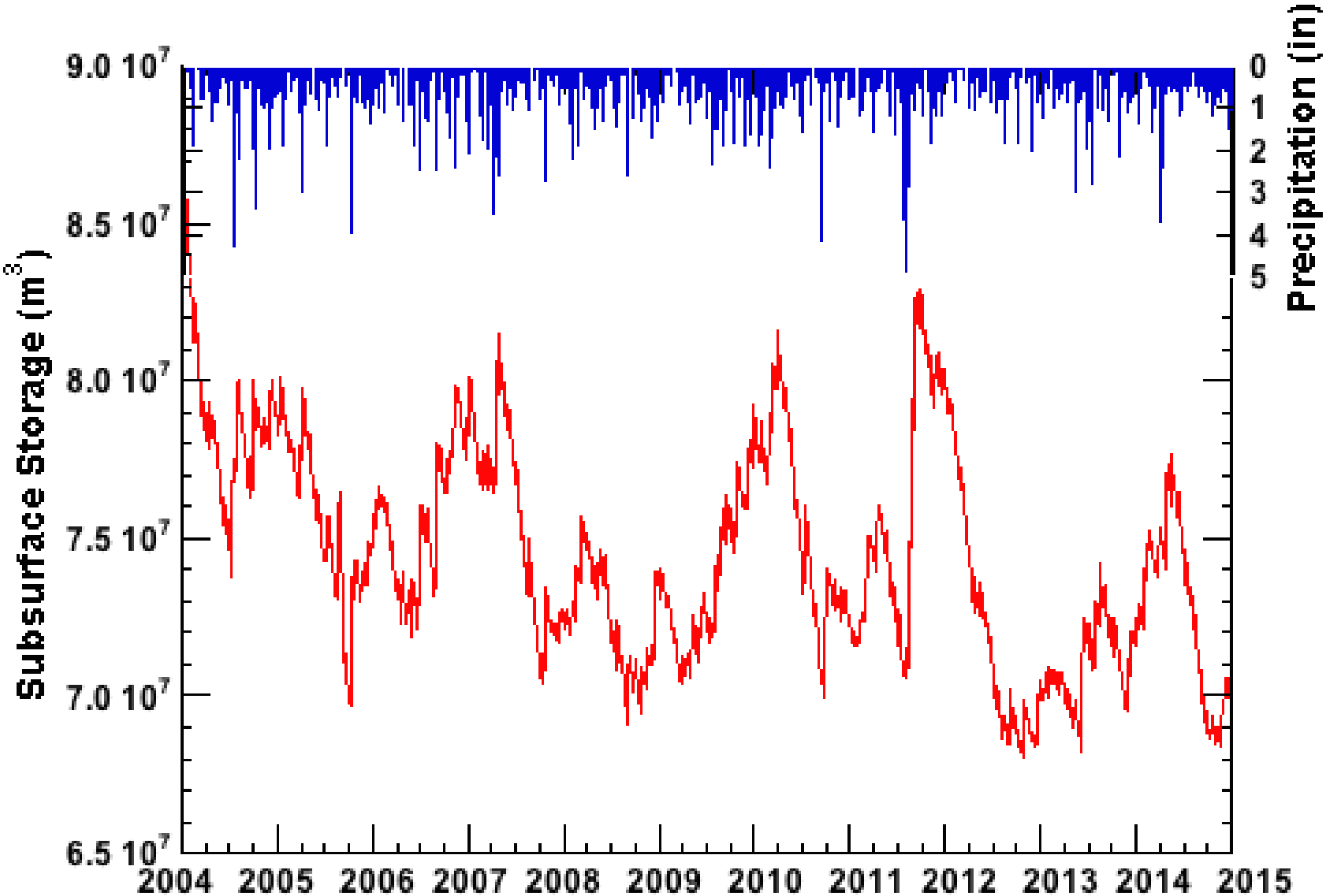


# Model inputs, cont'd

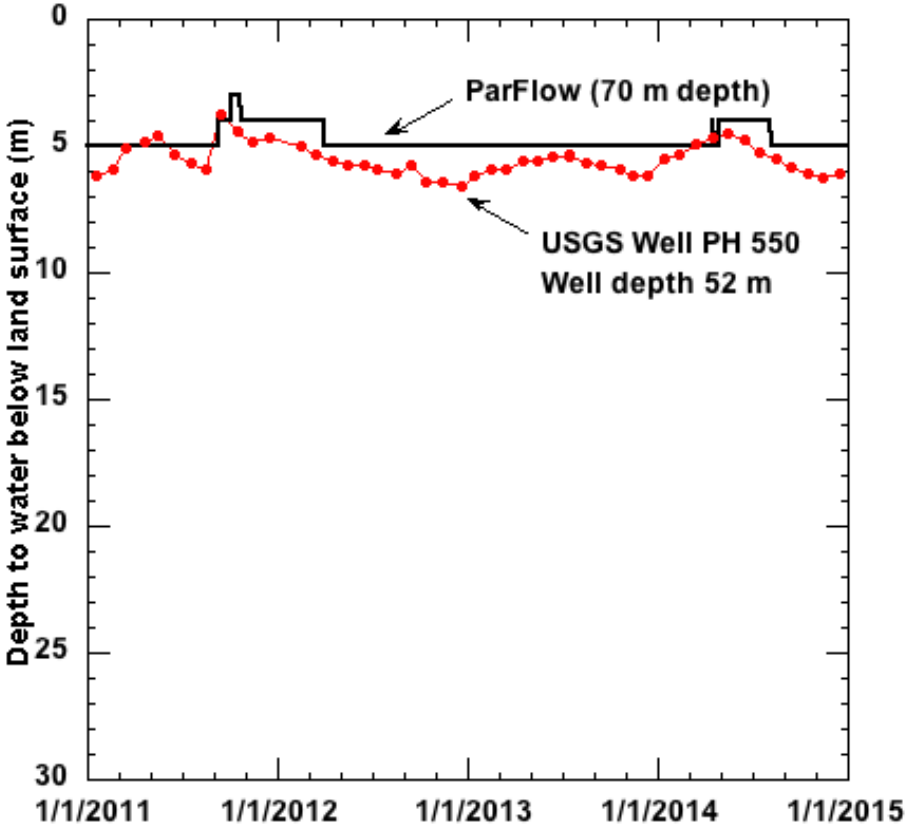
- Geology – soil, saprolite, fractured rock
- Water supply leakage
- NLDAS meteorological forcing used to drive the model, 1/1/2004 to 2/1/2015

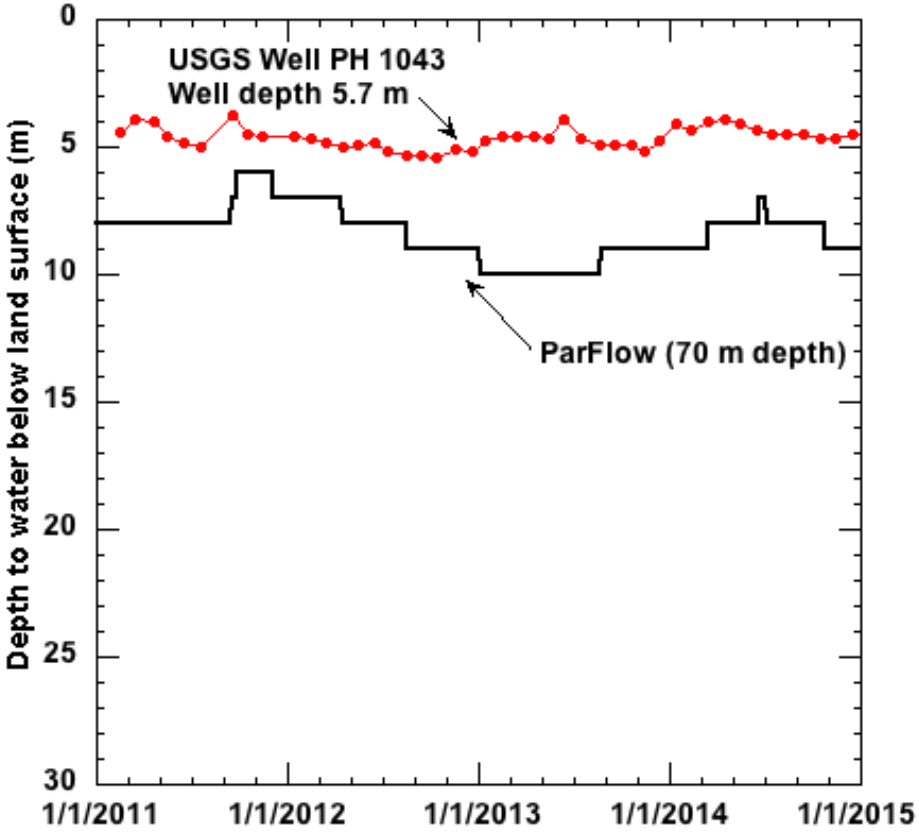


# Model output: subsurface storage



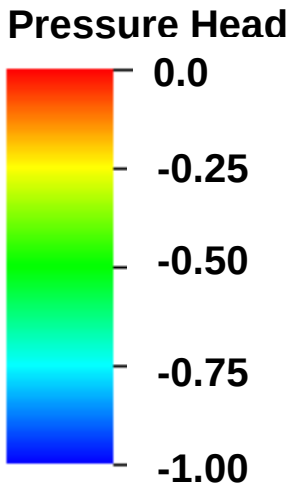
# Model output: depth to water table

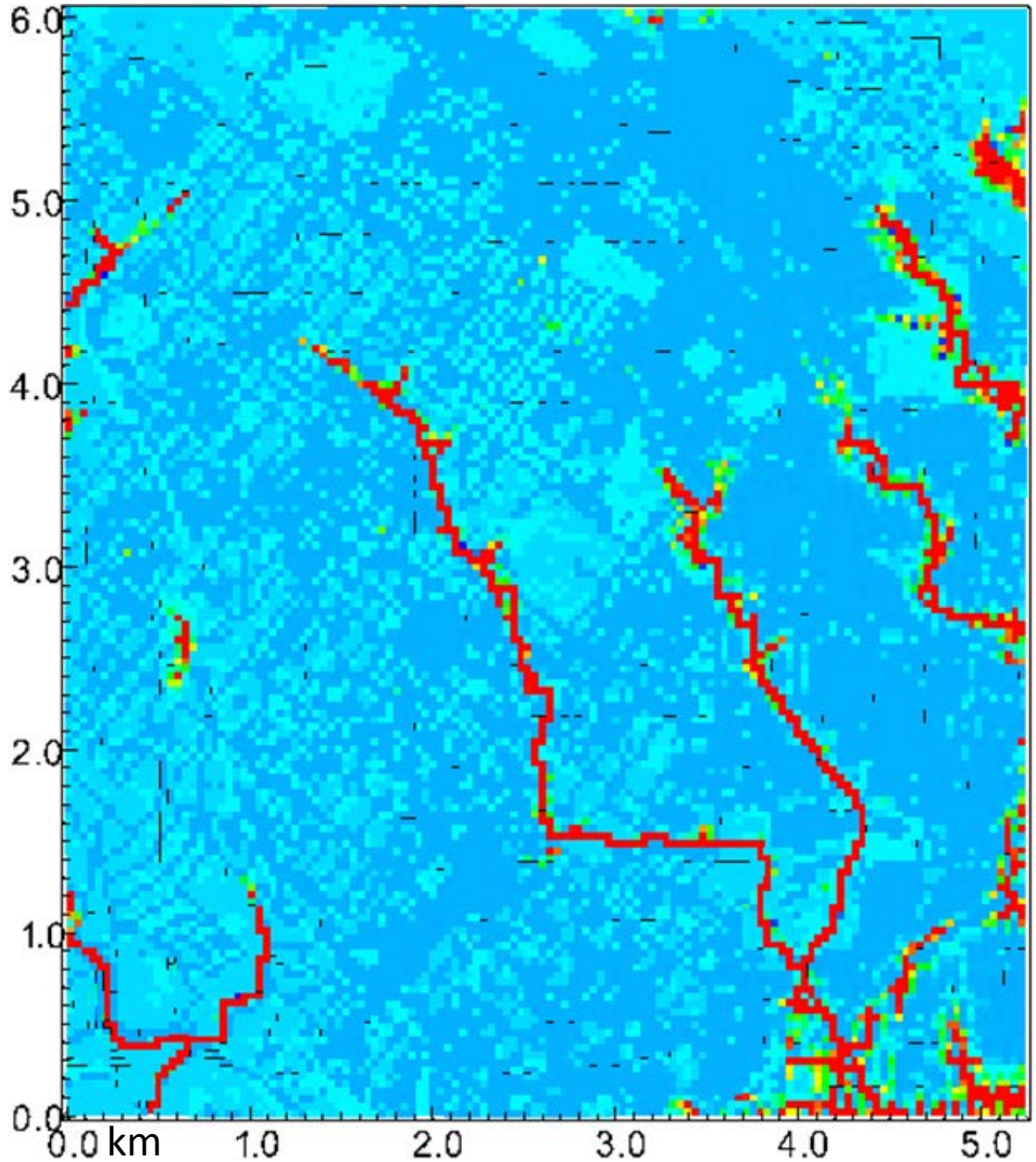


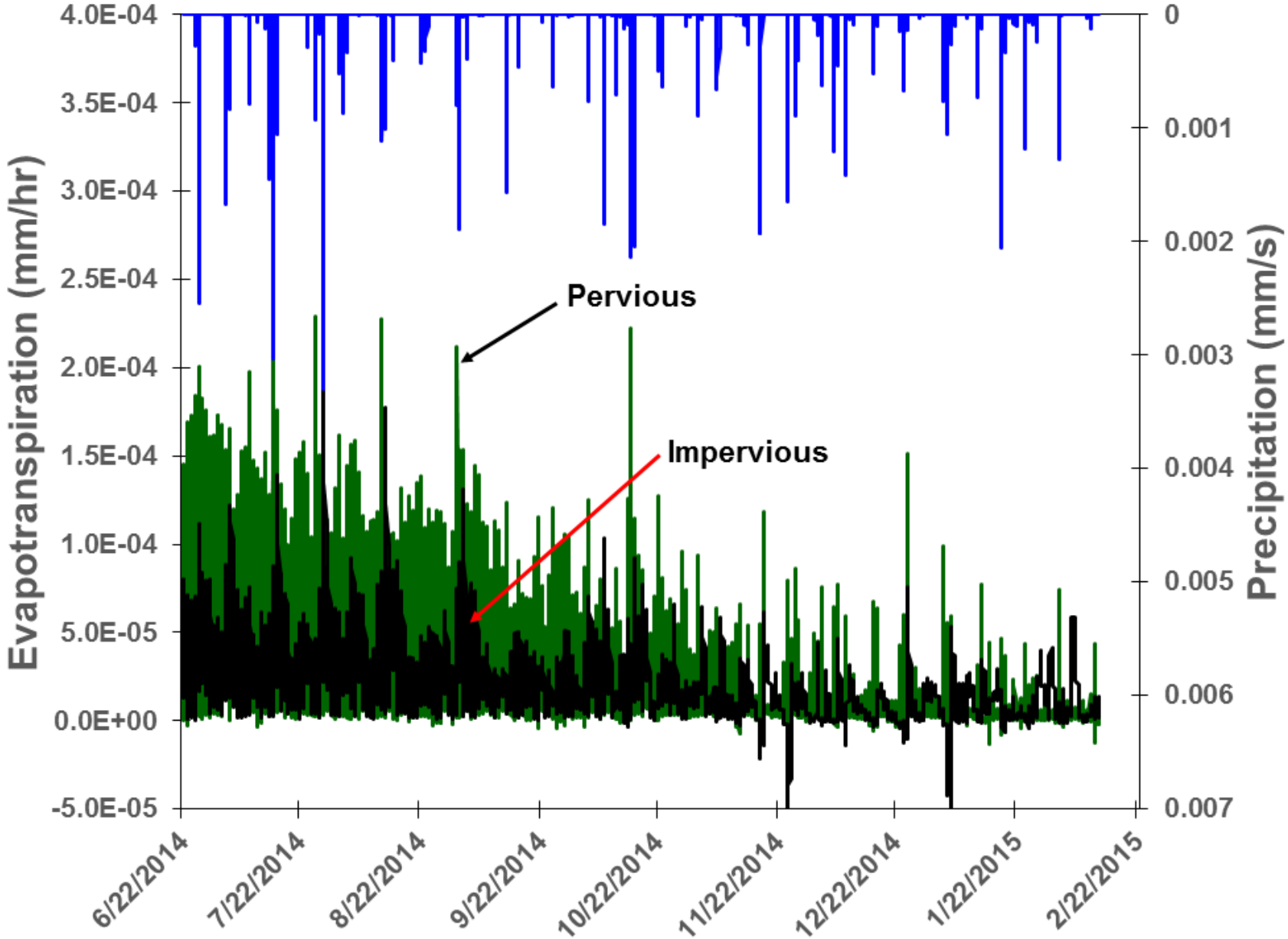
# Model output

- Pressure head
  - Base flow during dry periods at pipe locations
- CLM variables

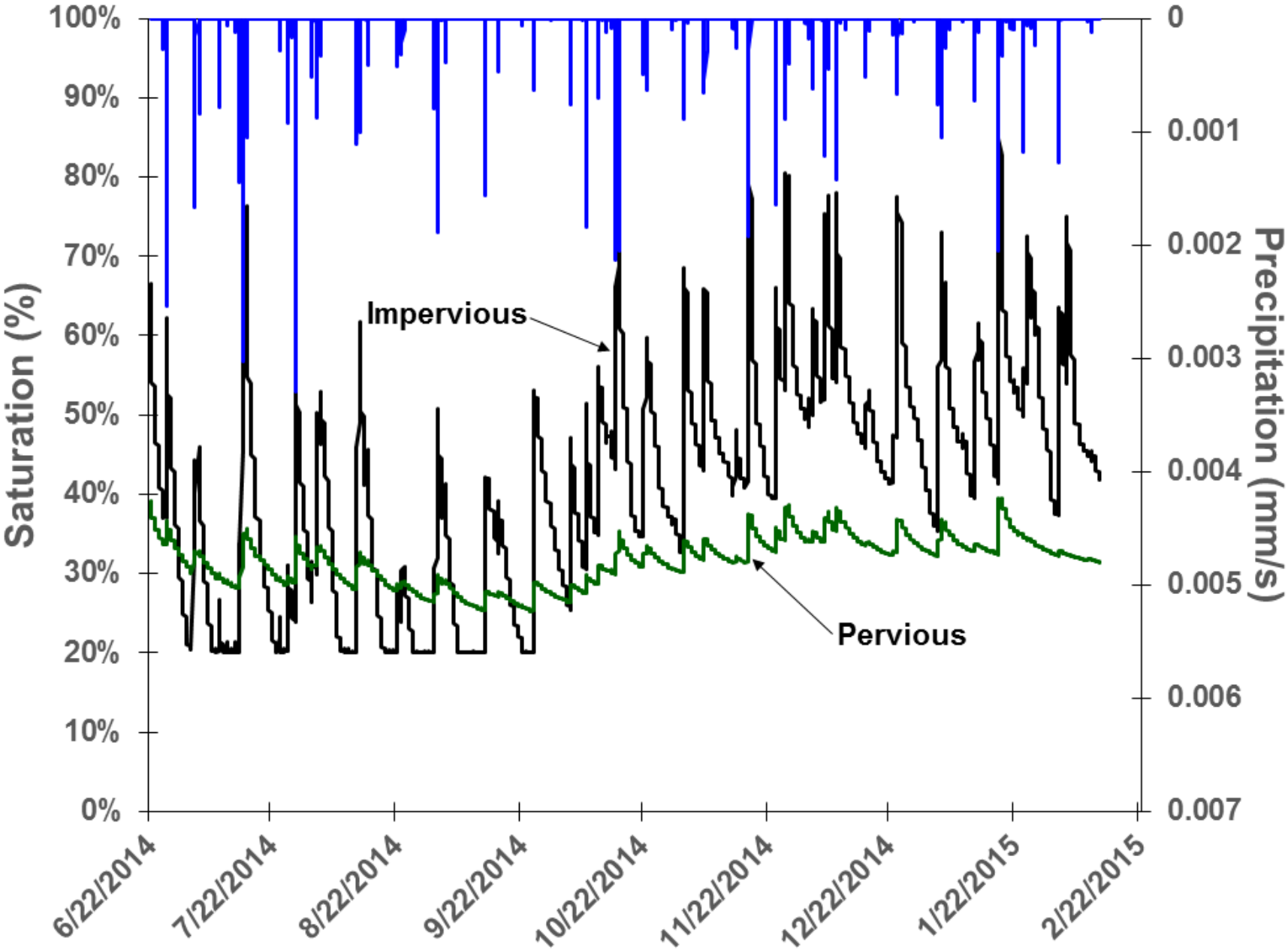


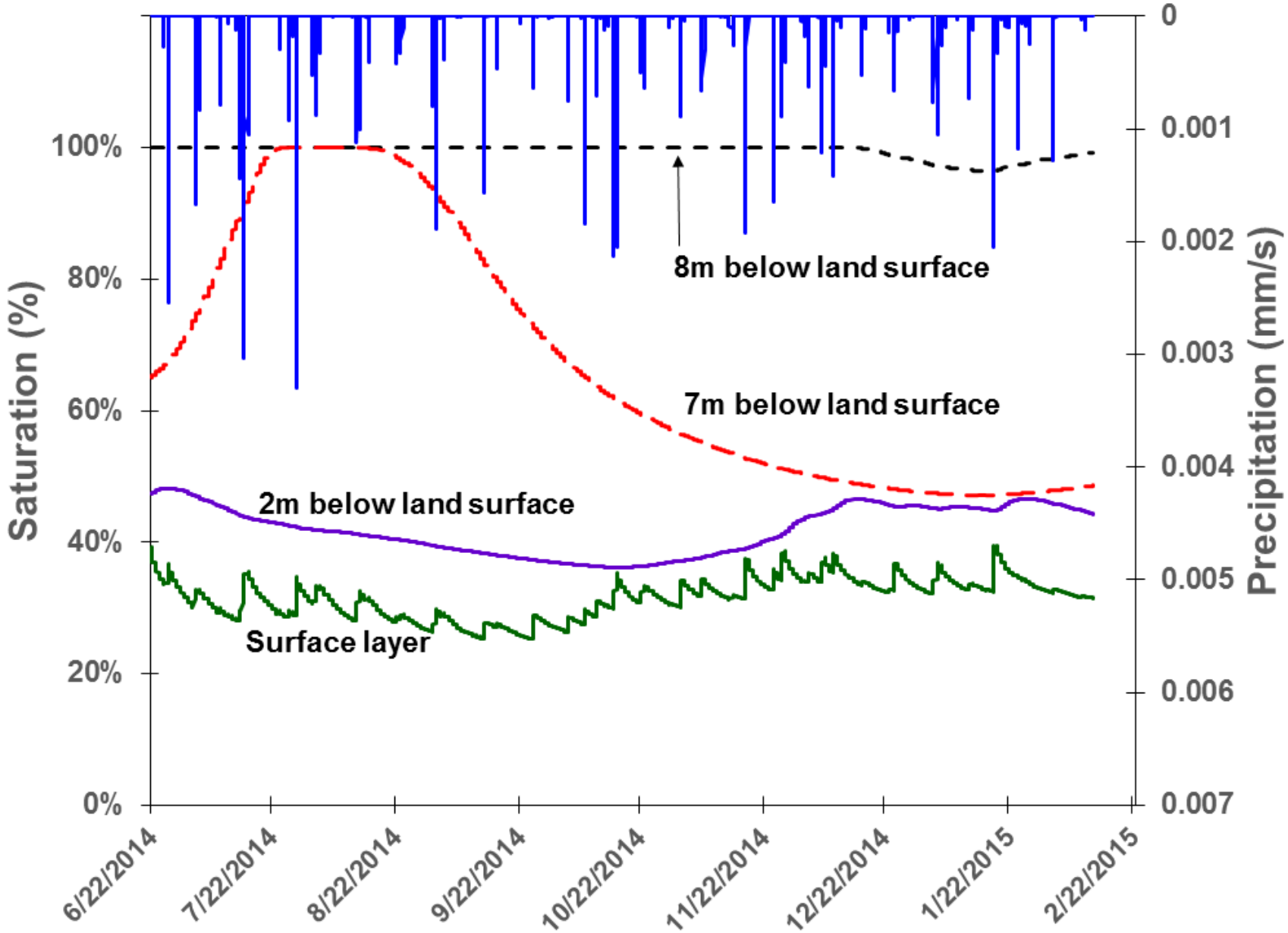
# Evapotranspiration: Pervious vs Impervious



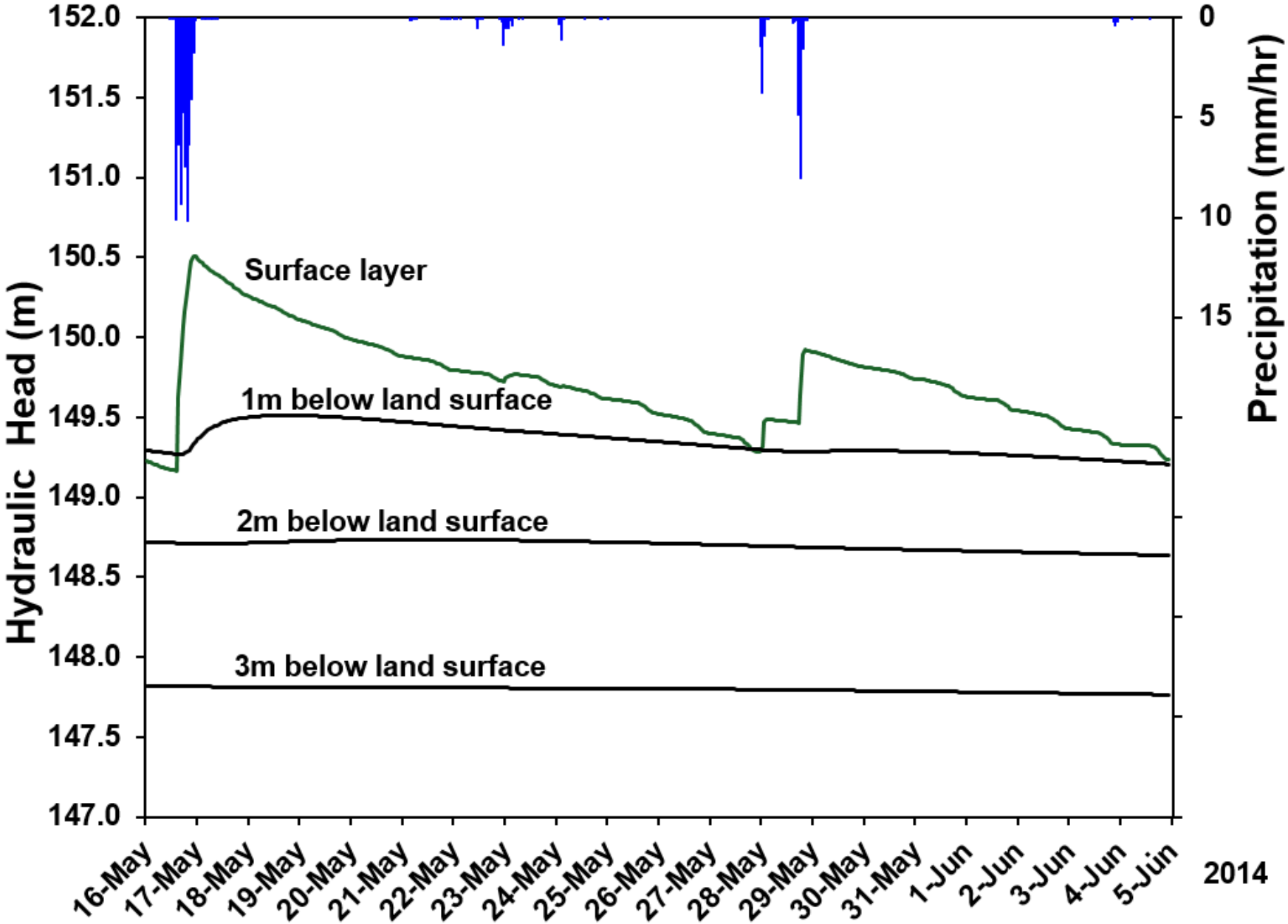
# Surface Saturation: Pervious vs Impervious



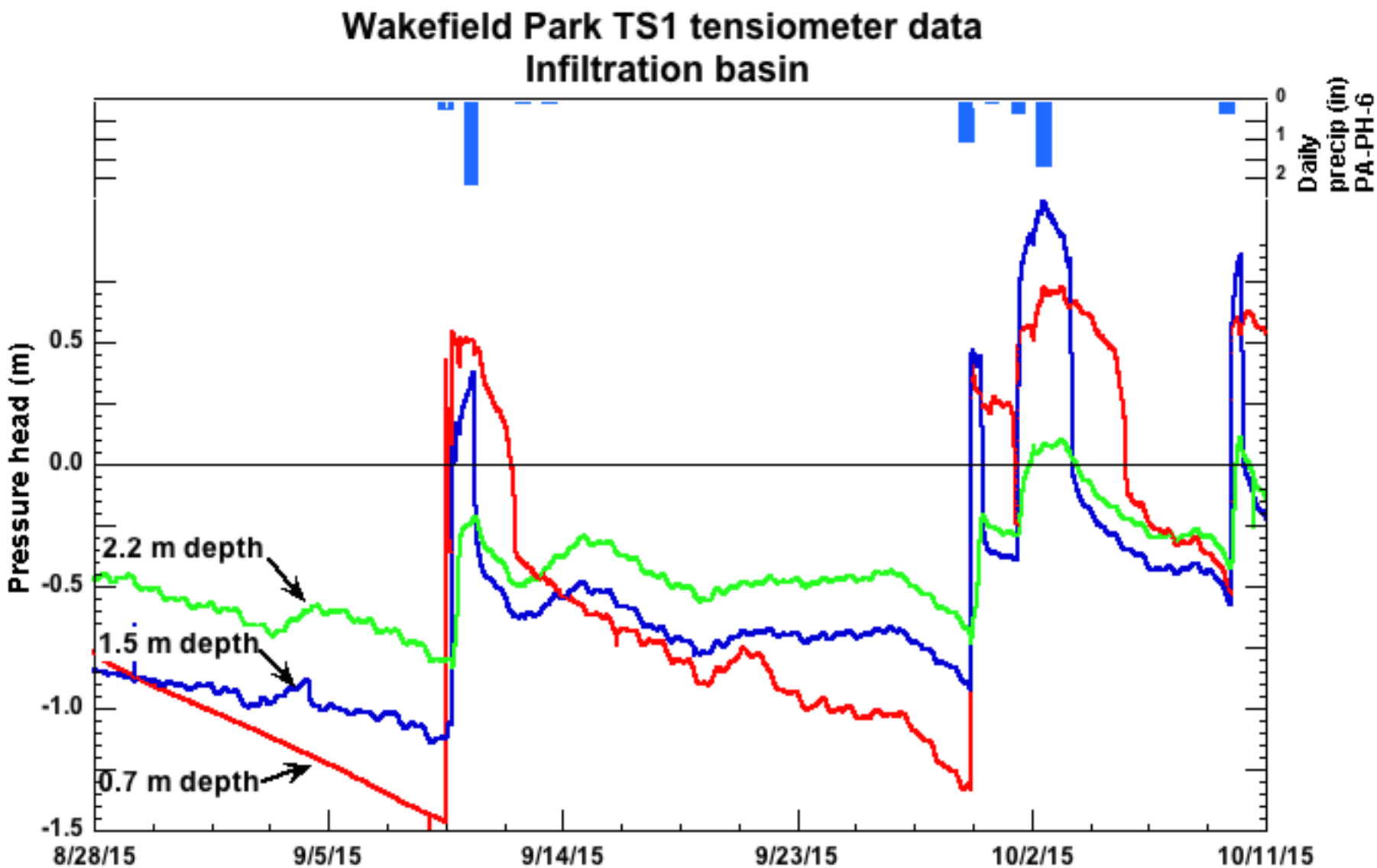
# Pervious saturation through depth



# Pervious layer: Hydraulic head during storms



# Field Data


Wakefield Park TS1 tensiometer data
Infiltration basin
Pressure head (m)
0.5
0.0
-0.5
-1.0
-1.5
2.2 m depth
1.5 m depth
0.7 m depth
8/28/15
9/5/15
9/14/15
9/23/15
10/2/15
10/11/15
0
1
2
Daily precip (in) PA-PH-6

# Advantages and challenges of using Parflow-CLM for modeling green infrastructure

- Advantages
  - Capability of simulating saturated and unsaturated conditions, as well as overland flow
  - Capability of simulating evapotranspiration for various landcover types classified by CLM
  - Spatially and temporally variable output
- Challenges
  - Computational resource requirements

# Future Work

- Model site-scale subdomains using finer gridding
- Determine distribution of subsurface flow paths and travel times using particle tracking
- Evaluate aquifer response to infiltration