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ParFlow Performance Tracking & ParFlowIO

William Lawrence
Boise State University

Nicholas Prussen
Boise State University

Jared White
Boise State University

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BOISE STATE UNIVERSITY
COLLEGE OF ENGINEERING
Department of Computer Science

William Lawrence, Nicholas Prussen, Jared White
Advisor: Dr. Catherine Olschanowsky

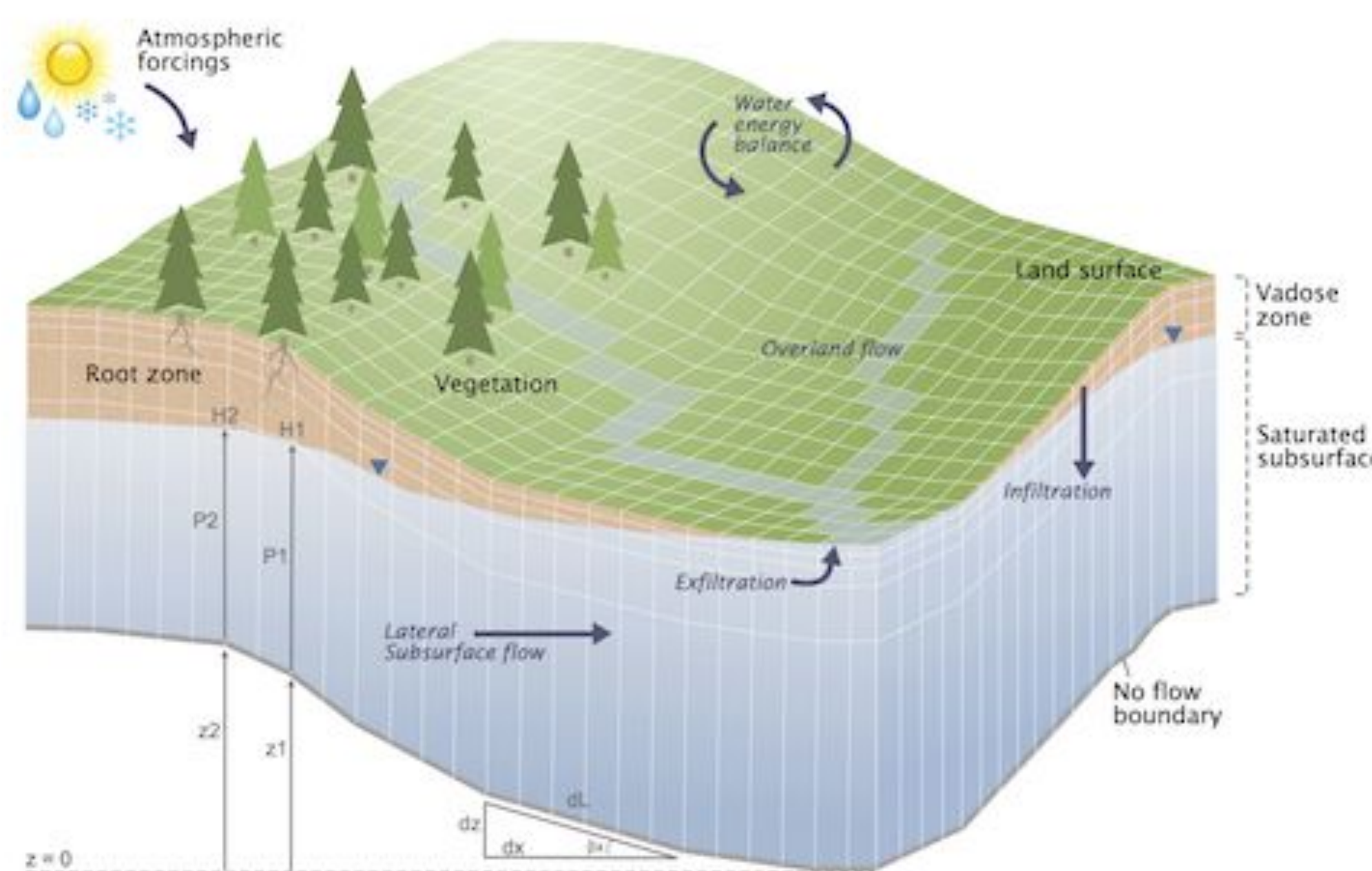


1. ParFlow

ParFlow is a hydrology model that simulates groundwater flow.

It runs on many of the fastest supercomputers in the world and has produced hundreds of papers.

Our two research projects (ParFlowIO & ParFlow Performance Tracking) support the development and use of ParFlow.



ParFlow visualization (from ParFlow.org)

2. HydroFrame

- HydroFrame is a diverse team of hydrologists, computer scientists and software engineers. Their goal is to make national hydrologic simulations more accessible.
- ParFlow is a piece of software under the HydroFrame project.

3. ParFlow Performance Testing

Parflow Performance Testing is an initiative to easily display performance data to those running ParFlow. This project uses a combination of a ReactJS frontend with a Flask API to issue queries to the MongoDB database. This interface will serve as an easily accessible way to monitor ParFlow runs on Verde at Princeton.

3.1 Problem Statement

- Hydrologists want to easily view their run results and compare them to others
- ParFlow developers want to see the progression of runtime improvement with new releases
- This data is immense and not easily comparable

4. ParFlowIO

ParFlowIO is a C++11 library with a Python3 interface for reading and writing ParFlow binary files.

ParFlowIO allows hydrologists to easily work with ParFlow data using standard data processing tools through a Python interface.

4.1 Problem Statement

- Hydrologists want to easily operate on ParFlow results
- ParFlow outputs its results as a ParFlow Binary File (.pfb)
- This file is difficult to read and write
- Existing IO tools are written in C/C++
- These existing tools aren't suitable for quick analysis

4.2 Solution

- ParFlowIO is composed of two parts:
 - A C++11 library containing the majority of the code
 - A Python3 interface to most of the C++ functions
- The Python3 interface allows hydrologists to easily manipulate their ParFlow results.

5. Technologies Used

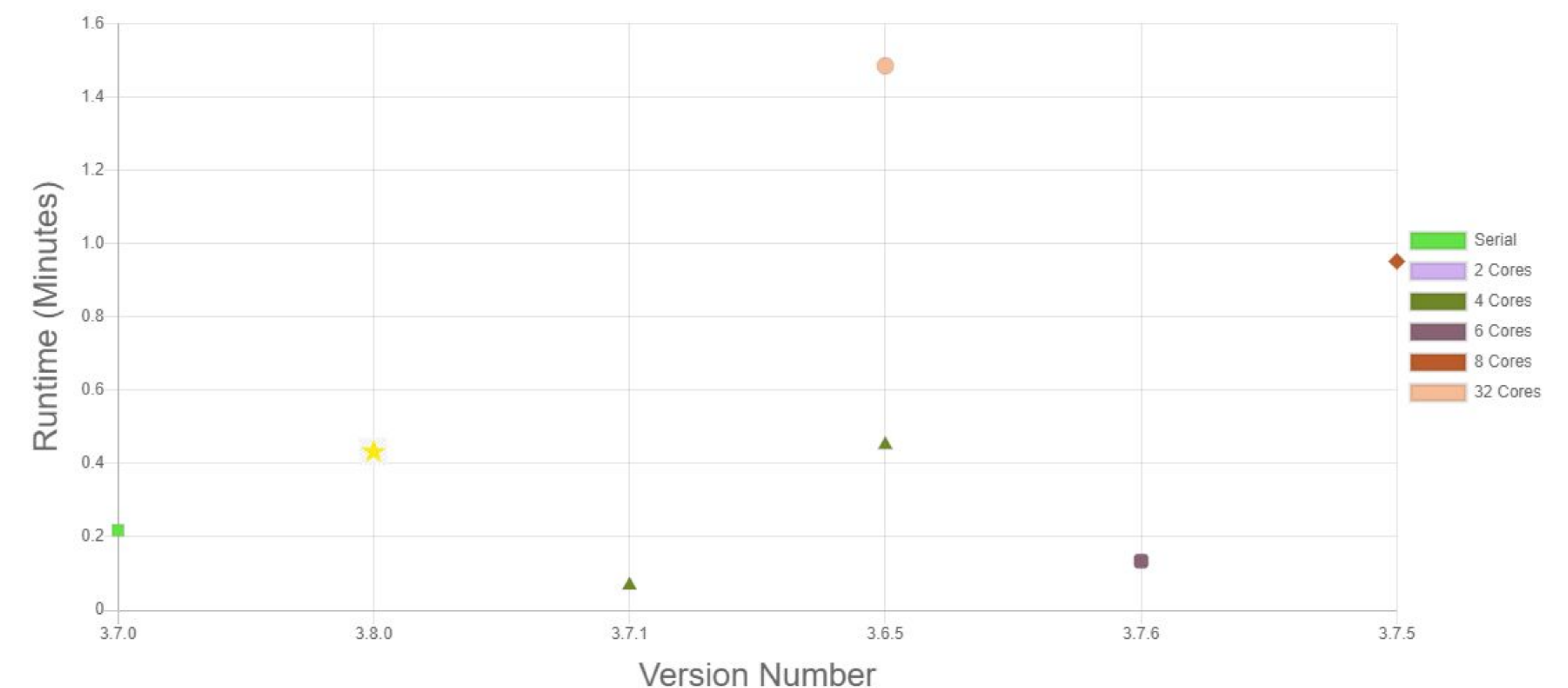
5.1 ParFlow Performance Testing

- ReactJS
- Flask
- MongoDB

5.2 ParFlowIO

- C++11
- Python3
- SWIG

Parflow Runtime vs. Version



6. Future Development

6.1 ParFlow Performance Testing

- Web app to view all runs on Princeton's Verde server and the ability to queue identical runs for re-testing.

6.2 ParFlowIO

- Future development will be handled by Princeton
- Existing tools will be ported to use ParFlowIO

7. Acknowledgements

- Boise State's Research Computing Department. 2017. R2: Dell HPC Intel E5v4 (High Performance Computing Cluster). Boise, ID: Boise State University. DOI: [10.18122/B2S41H](https://doi.org/10.18122/B2S41H).