A Web Based Interface for Distributed Short-Term Pollution Potential Forecast: Coupling SWAT with the Global Forecast System Model

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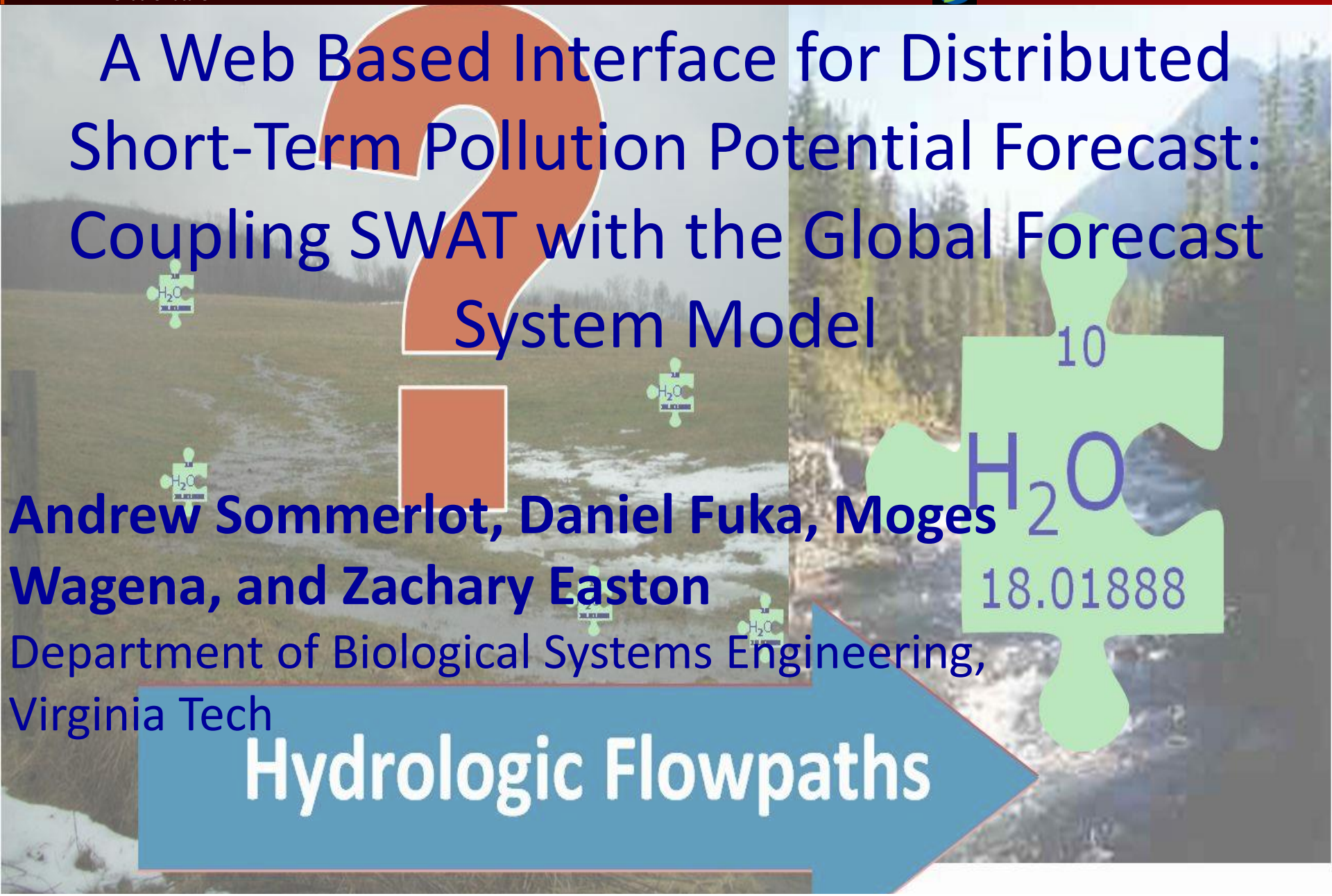


Overview

Introduction – Why short-term?

Methods – forecast framework development

Results - Hindcasting and distributed forecasts

Application – Web Based Decision Support System

Future Work – Further development

Intro

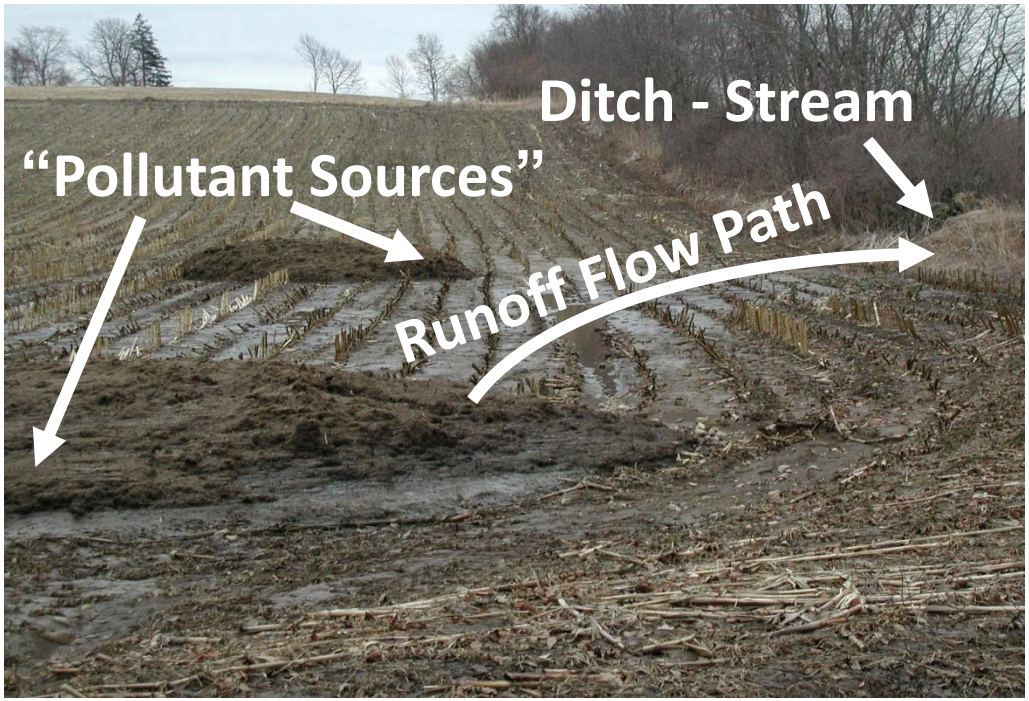
Studies exist incorporating long-term future climate projections into hydrologic models

These studies cannot accurately predict daily hydrology in the short-term

Why short-term?

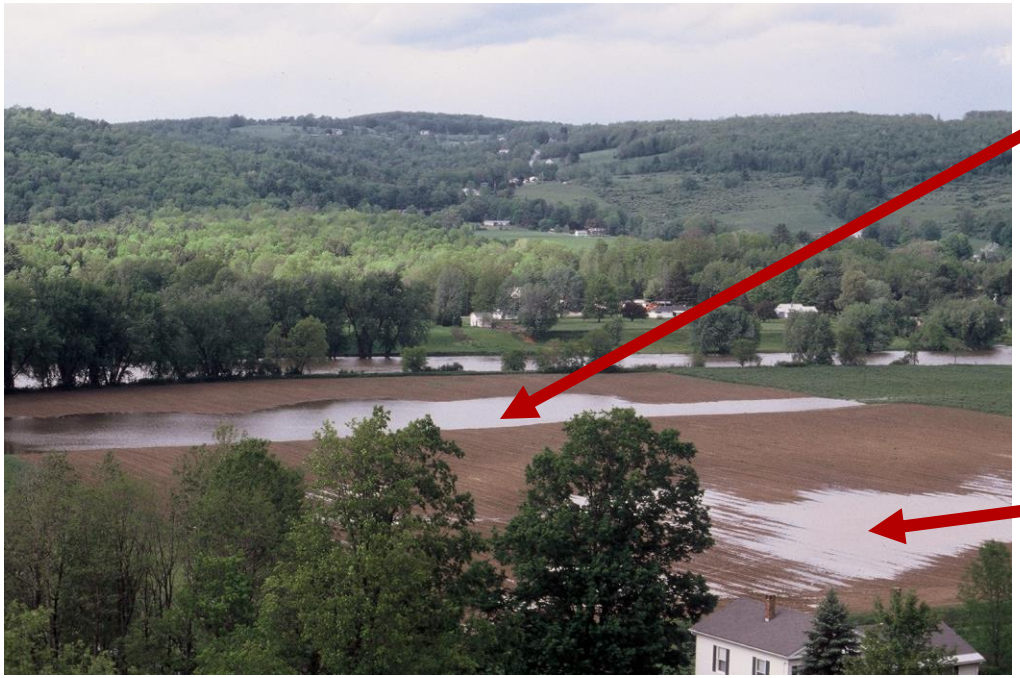
Intro

Variable Source Area (VSA) hydrology plays a major role in runoff and pollutant transport



Saturation-Excess driven runoff on agricultural land

Motivation



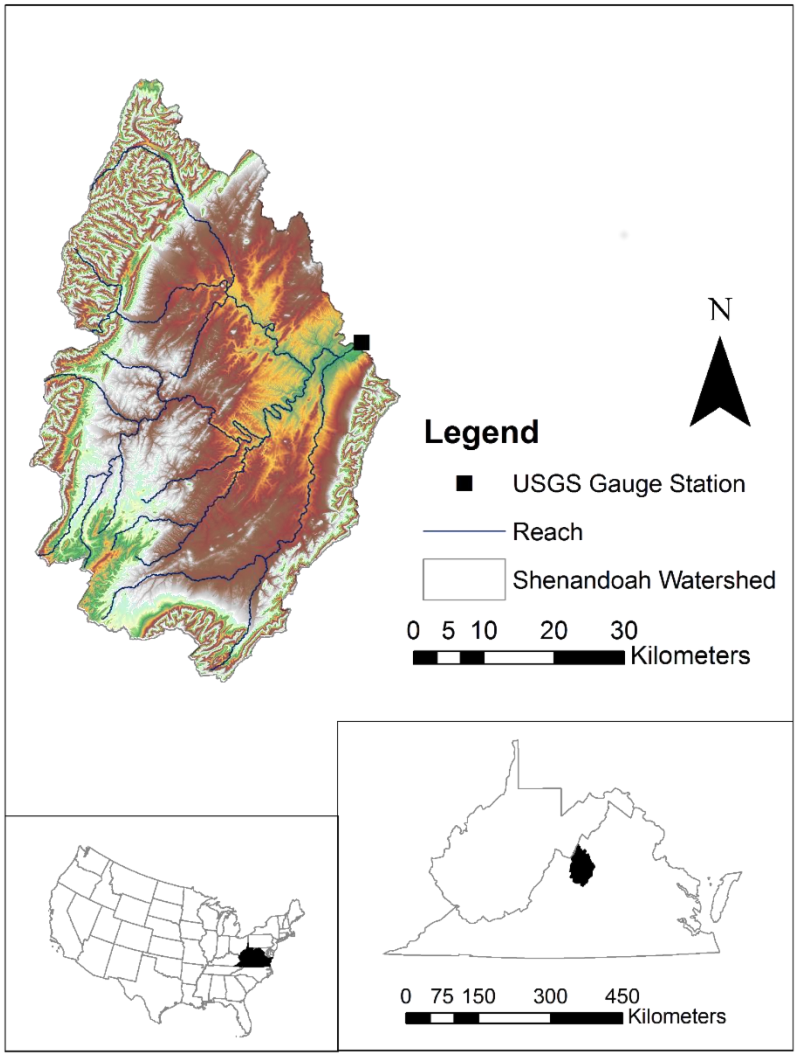
Identify short-term high risk areas to better inform management practices

Intro

When and where should we spread manure, fertilizers, etc?

Objective: Provide sub-field scale short-term distributed hydrology forecast to inform landscape management decisions

Study Area: SF Shenandoah



Identified by the EPA as a Critical Nitrogen and Phosphorus Source to the Chesapeake Bay

Landuse Profile

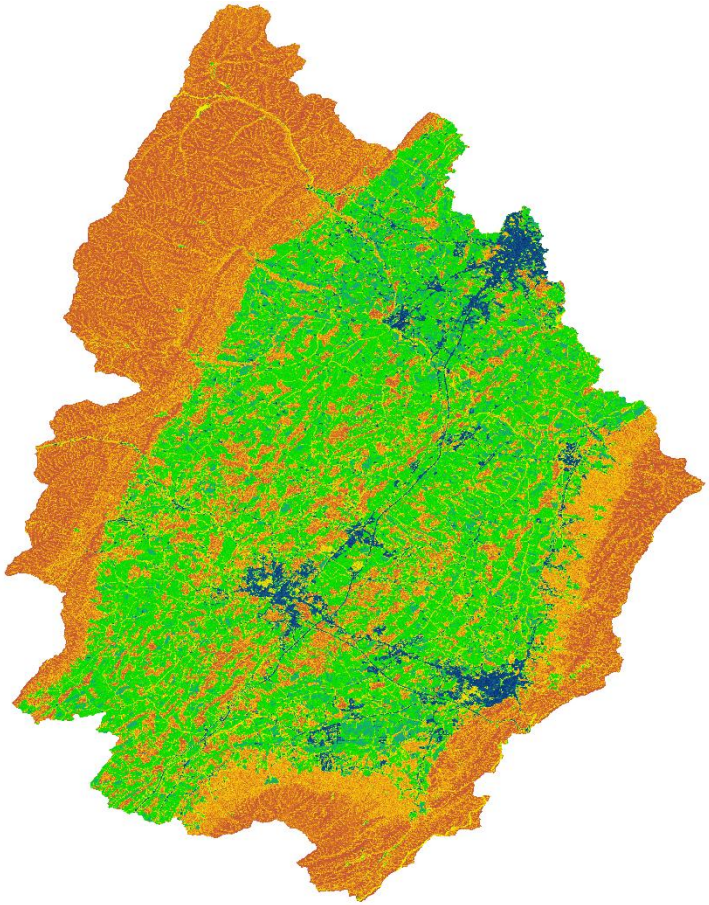
Area - 2600 km^2

Forest - 50%

Agriculture - 38%

Urban - 11%

SWAT-VSA Model Initialization



We want detailed distributed hydrology

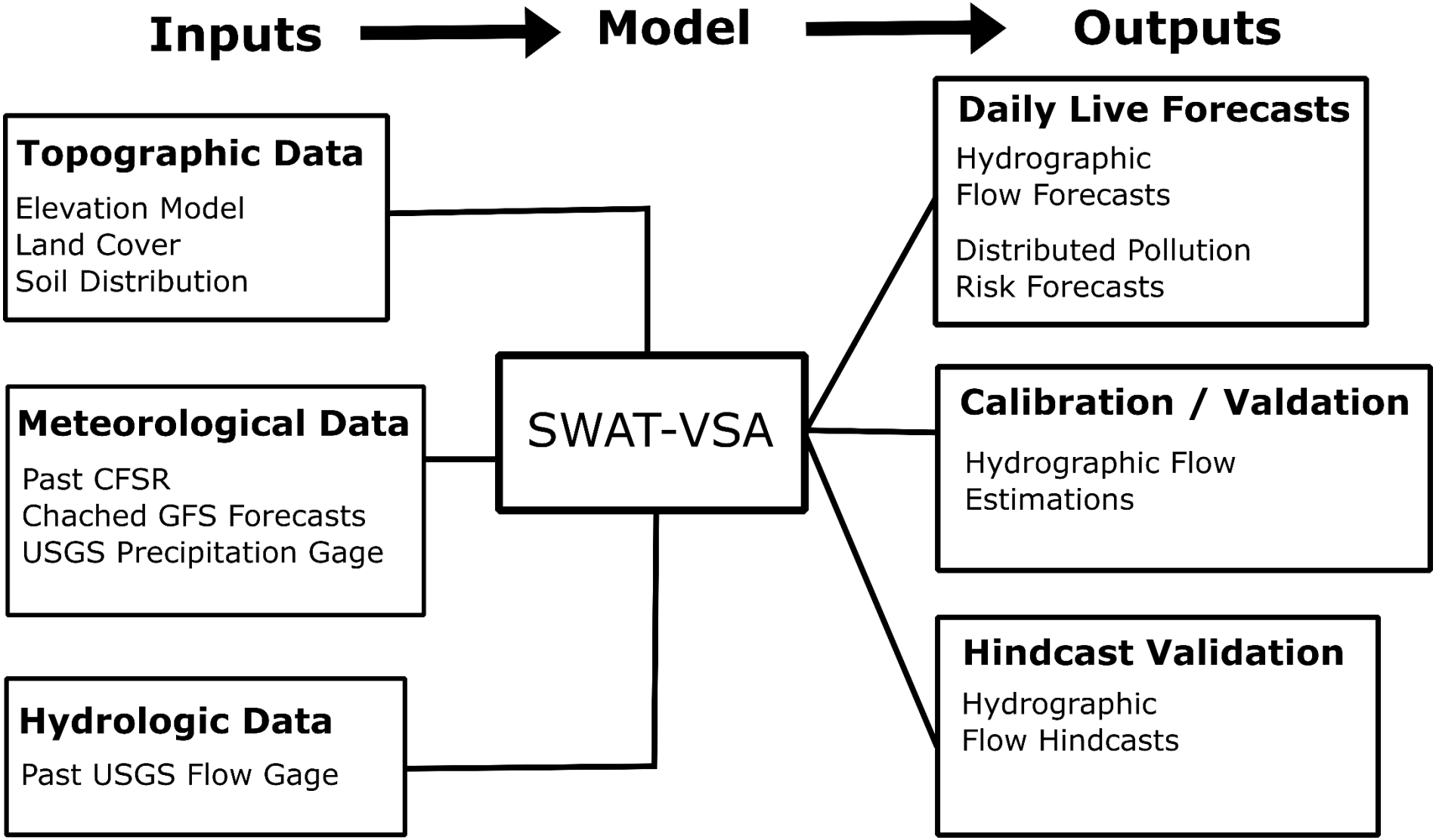
TopoSWAT used for SWAT-VSA initialization

No HRU thresholds for full hru definition

Spatial Inputs:

- 3 m DEM
- FAO Soils
- NLCD 2011

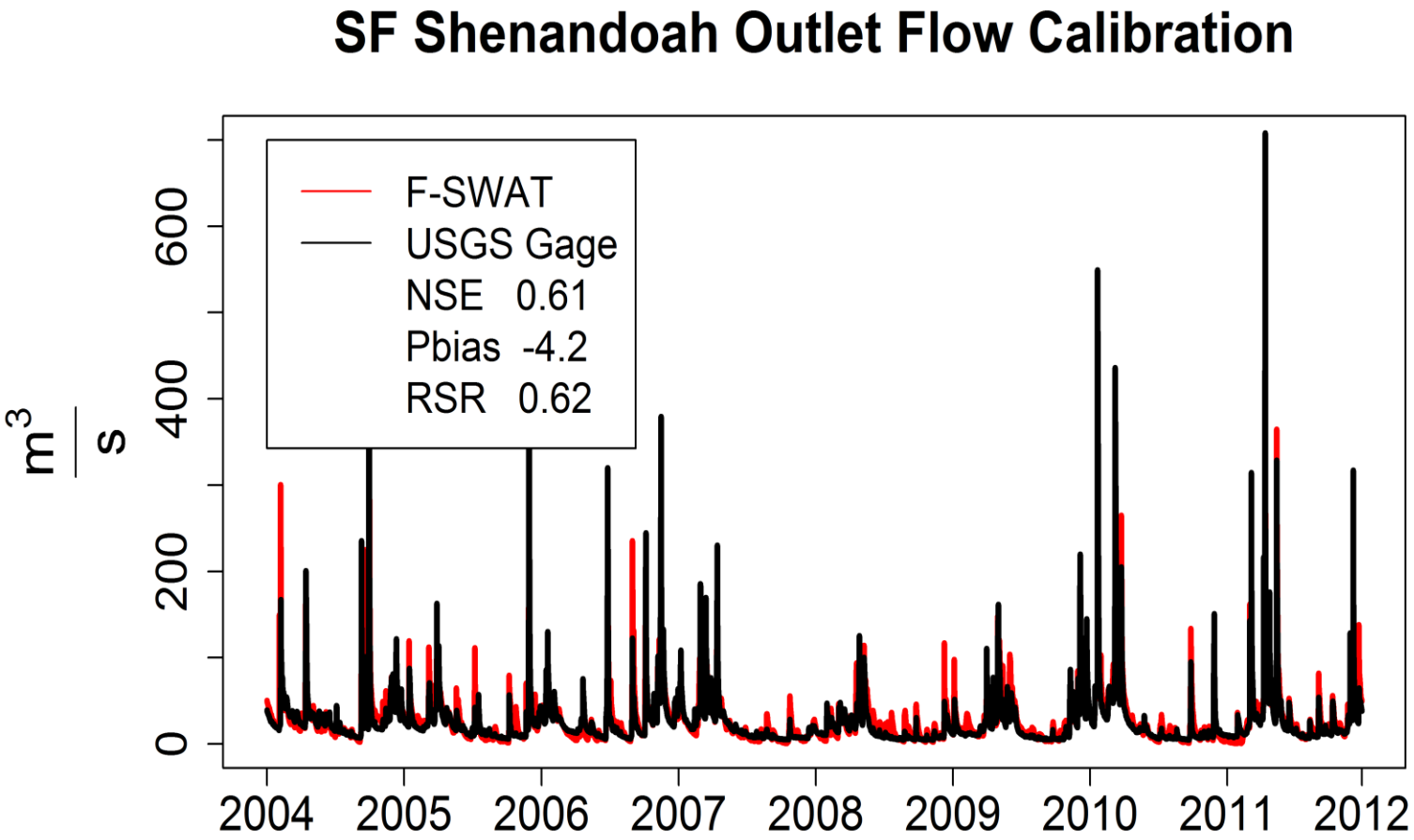
SWAT-STF : Short Term Forecast



Sommerlot et al., 2015

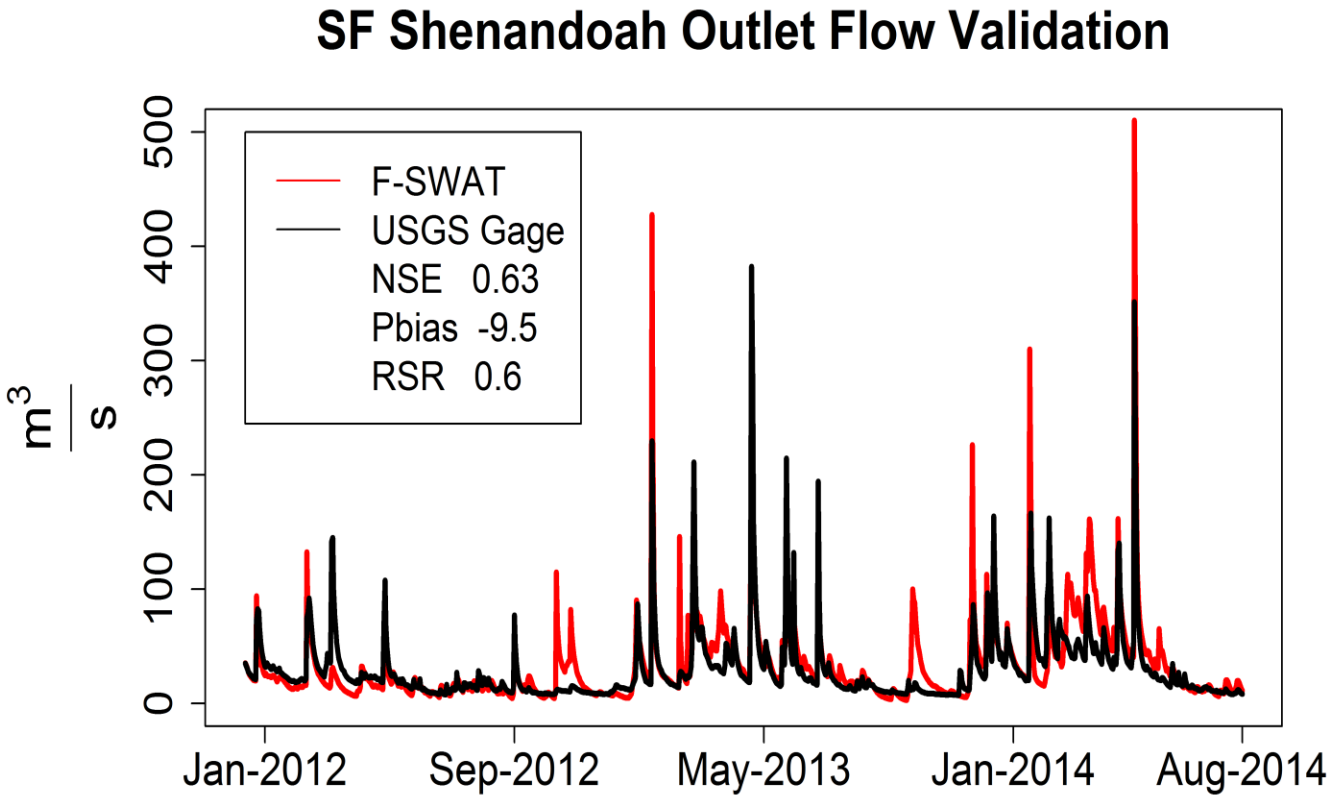
Calibration

2004 – 2011
NSE = 0.61



Validation

2012 – 2014
NSE = 0.85



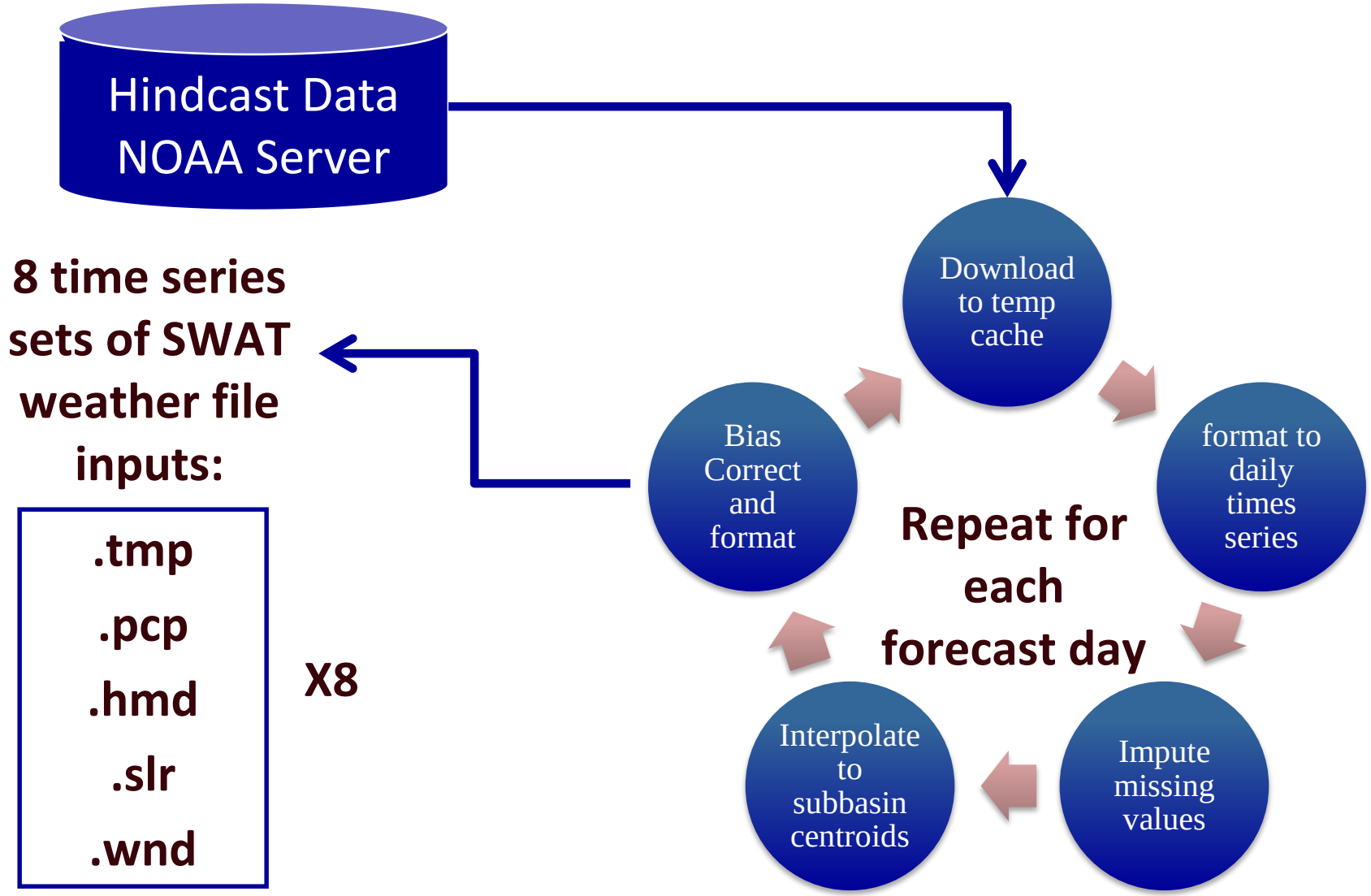
Hindcast Data Set

~ 6 TB of Raw Forecast outputs in GRIB format

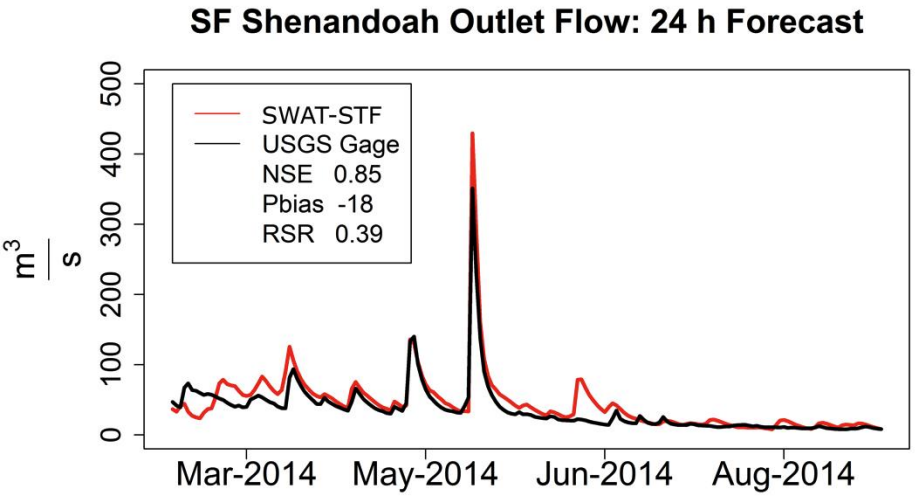
Thousands of Files – each a sub-daily worldwide grid

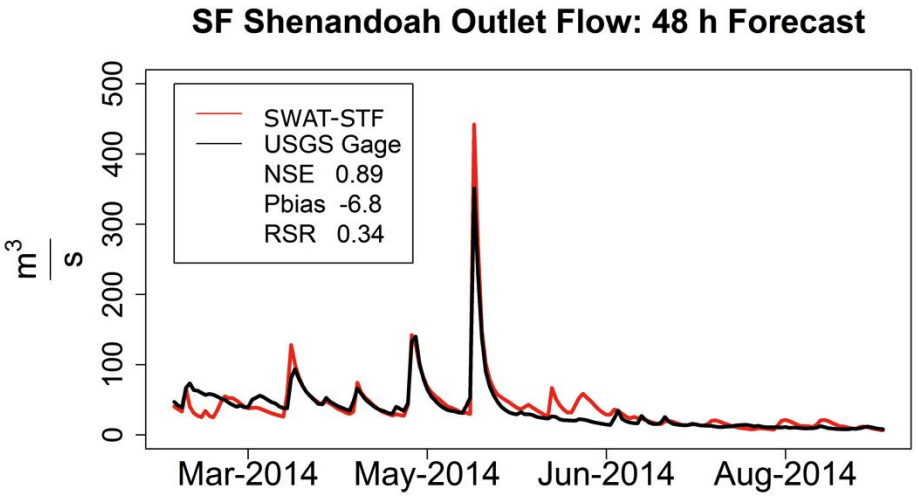
We Need to: Download and Parse the data into SWAT input files

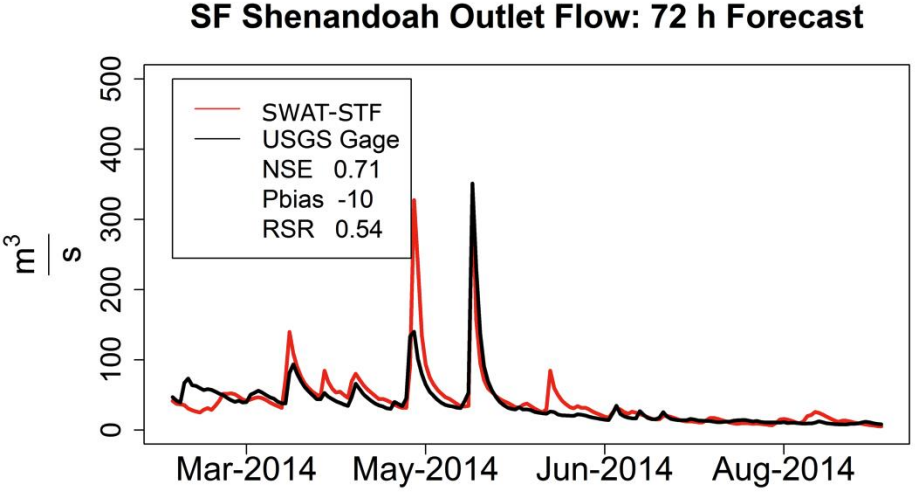
Hindcast Preprocessing

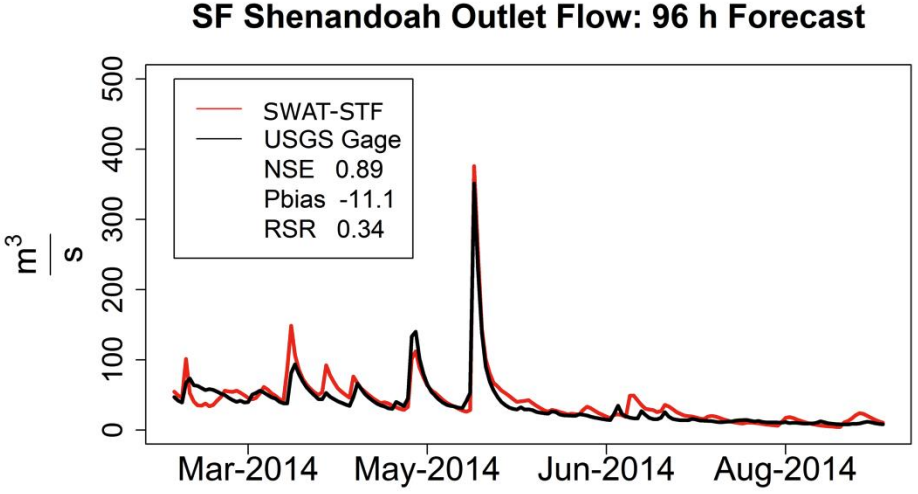


Hindcast Validation







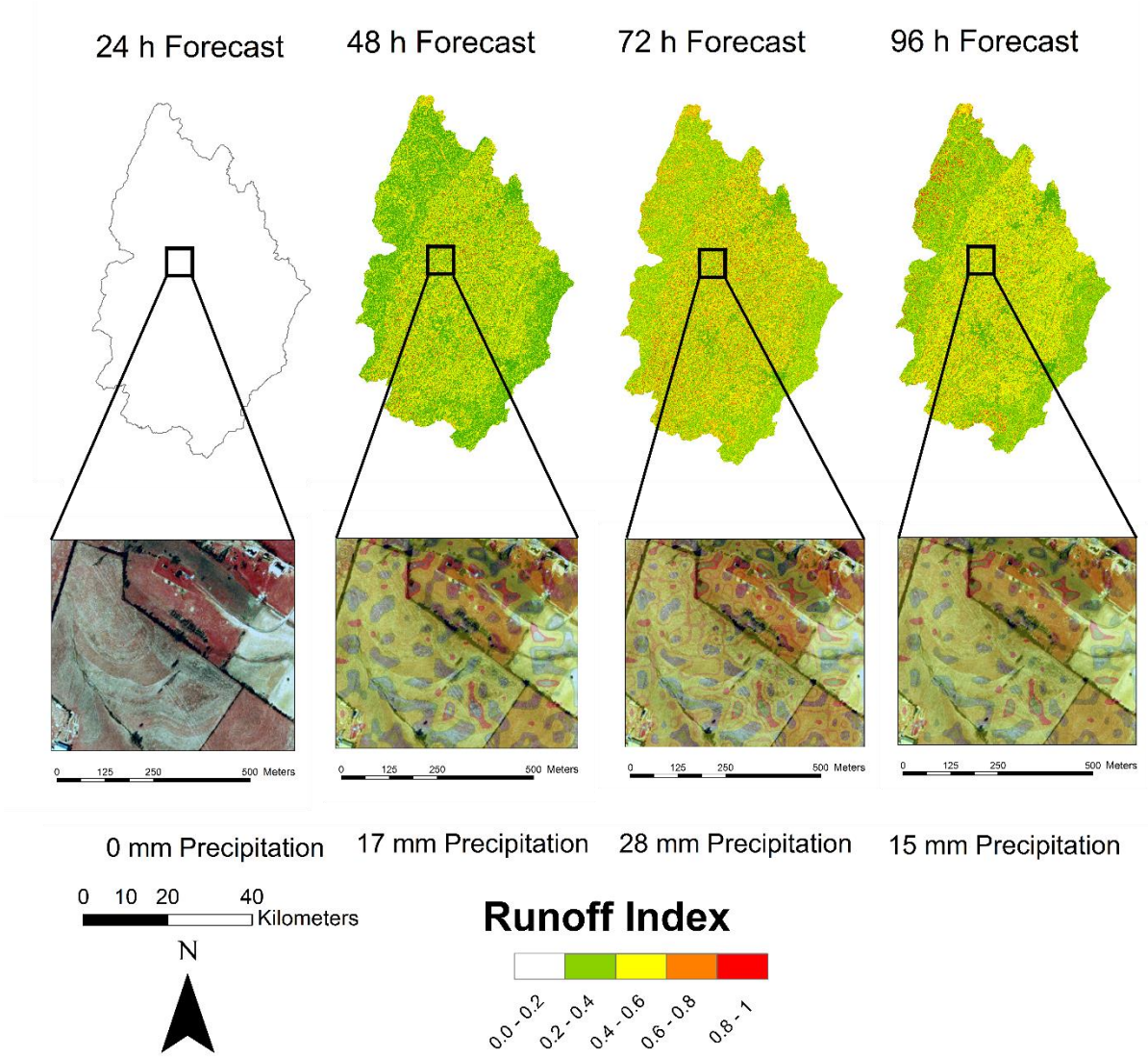


Hindcast Validation

Major Message: Short term forecasting with SWAT-STF is possible up through 4 days

Sommerlot et al., 2015

Distributed Hydrology Forecast



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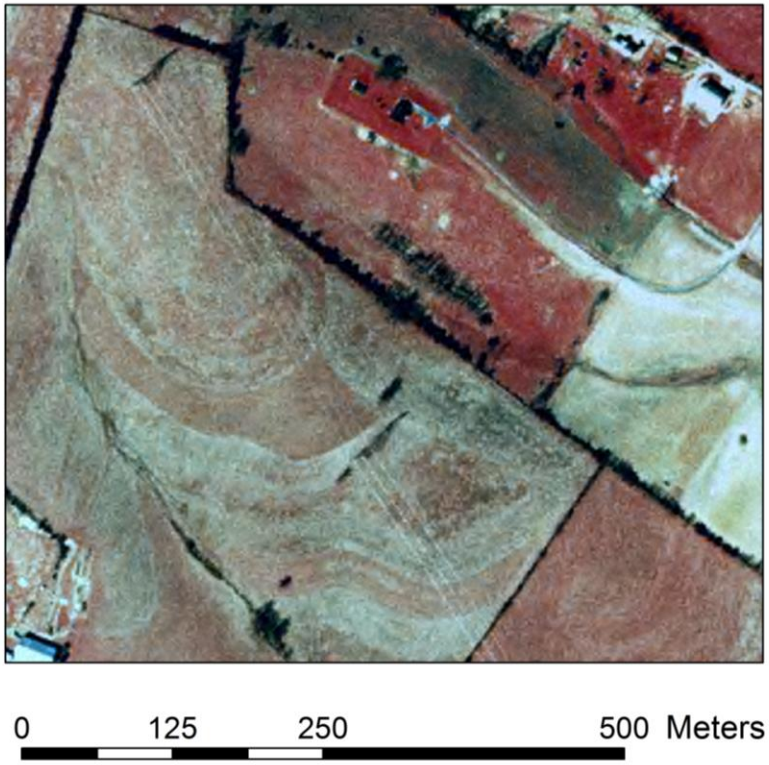
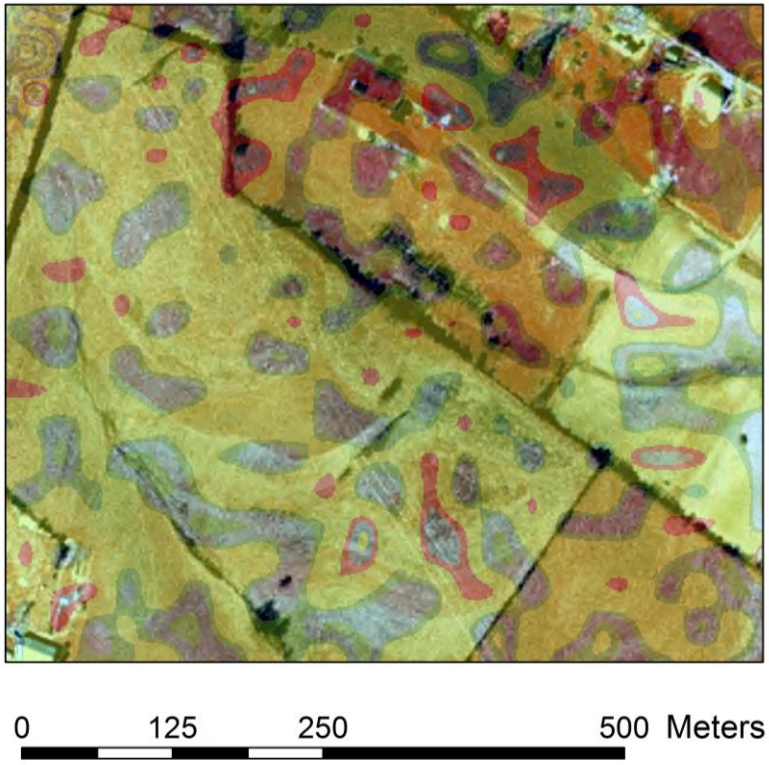


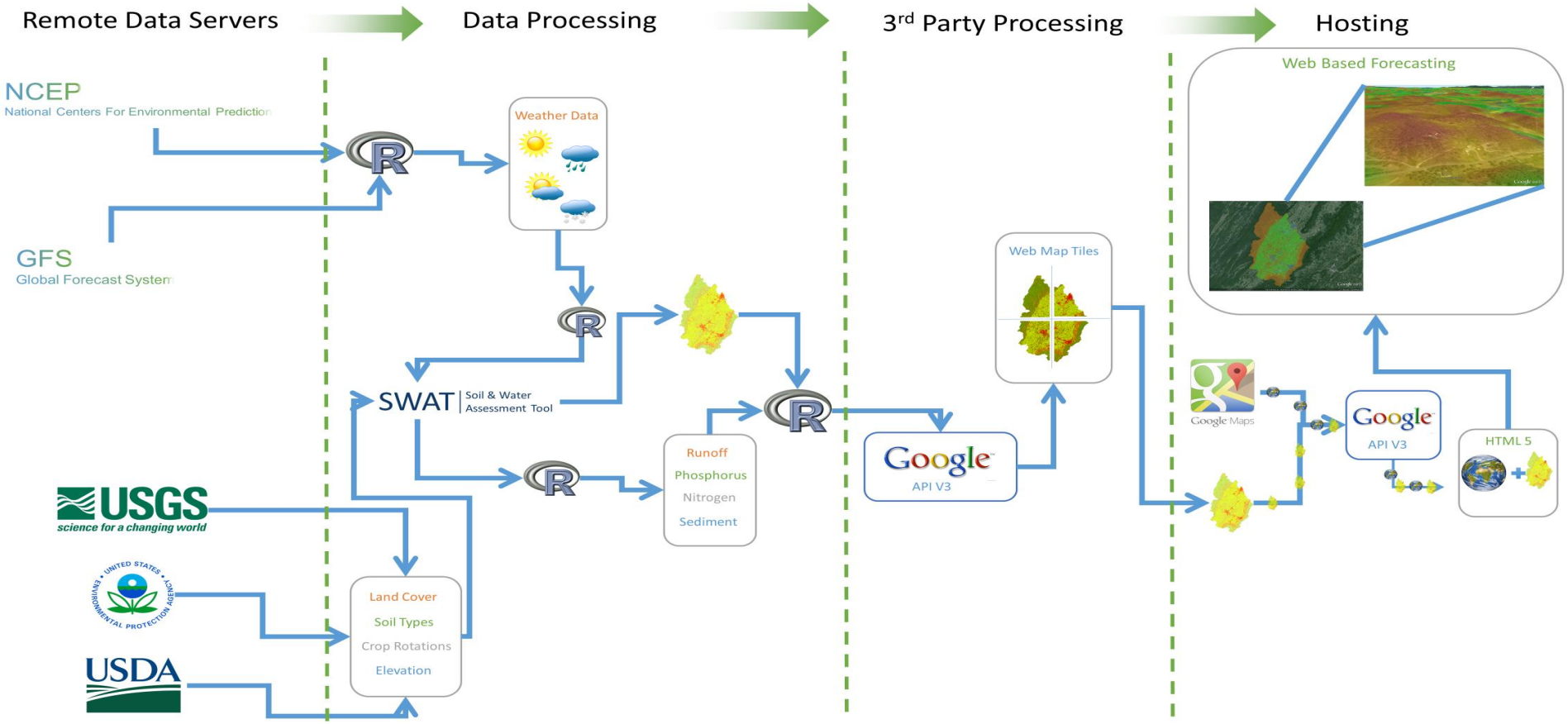


Web-Based Decision Support System

What It Takes:

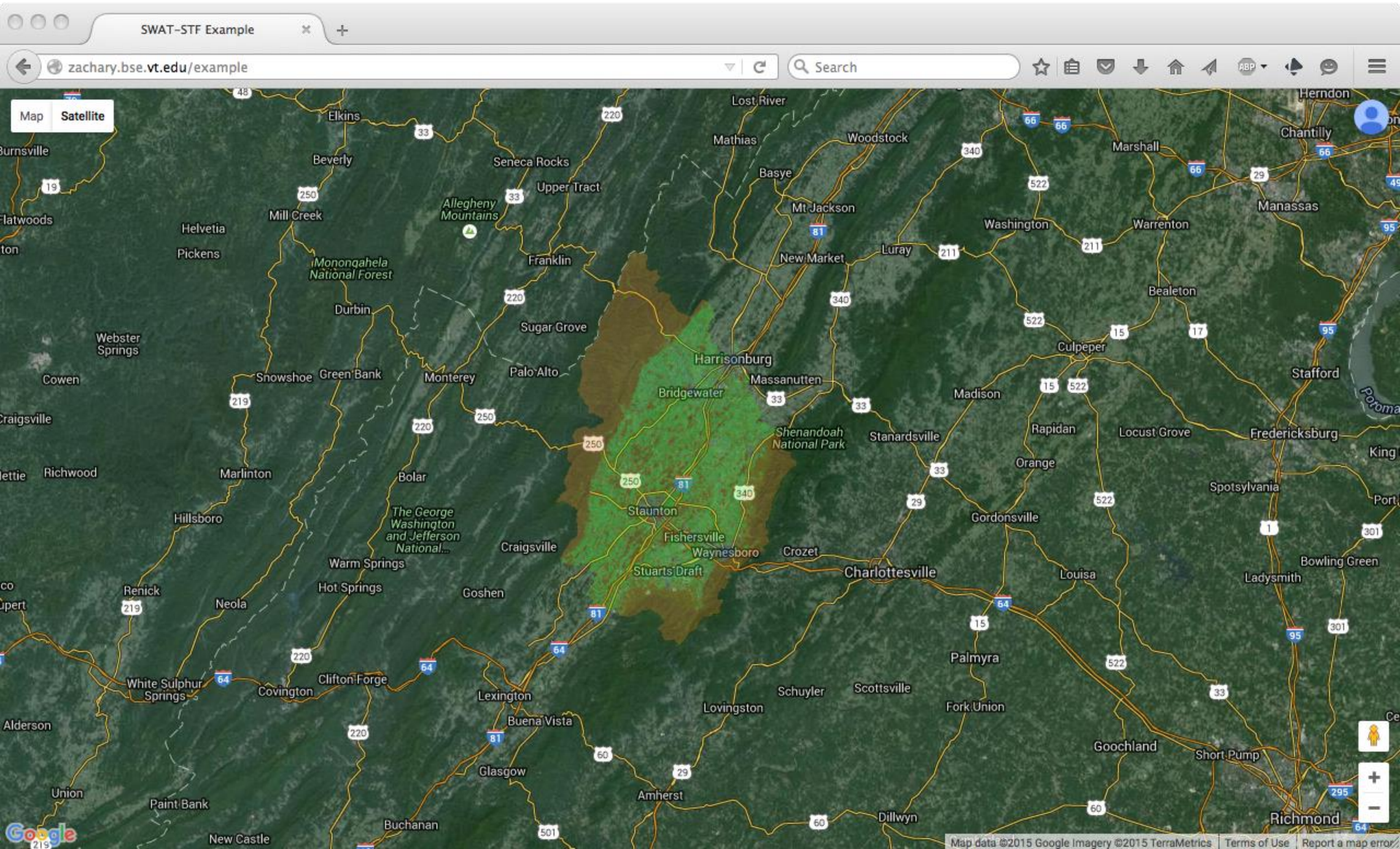
1. Automation Update multiple times daily
2. Parallel Processing
3. Modular Code (R, python, shell script)
4. 1,000s of Georeferenced Map Tiles
5. Hosting
6. User Interface (python flask app, javascript, html, css)

Forecast Framework



Sommerlot et al., 2015

Screen Shots



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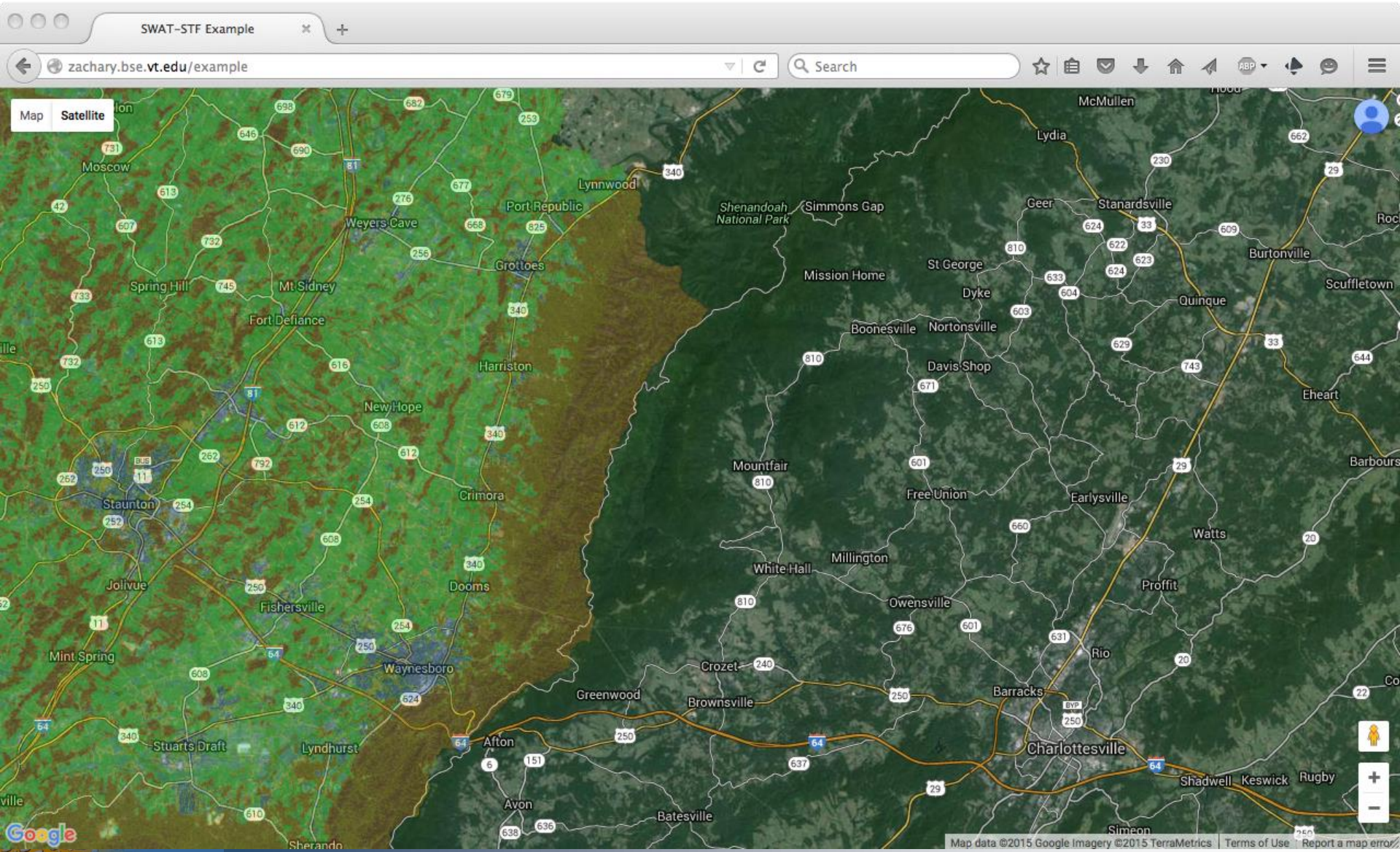

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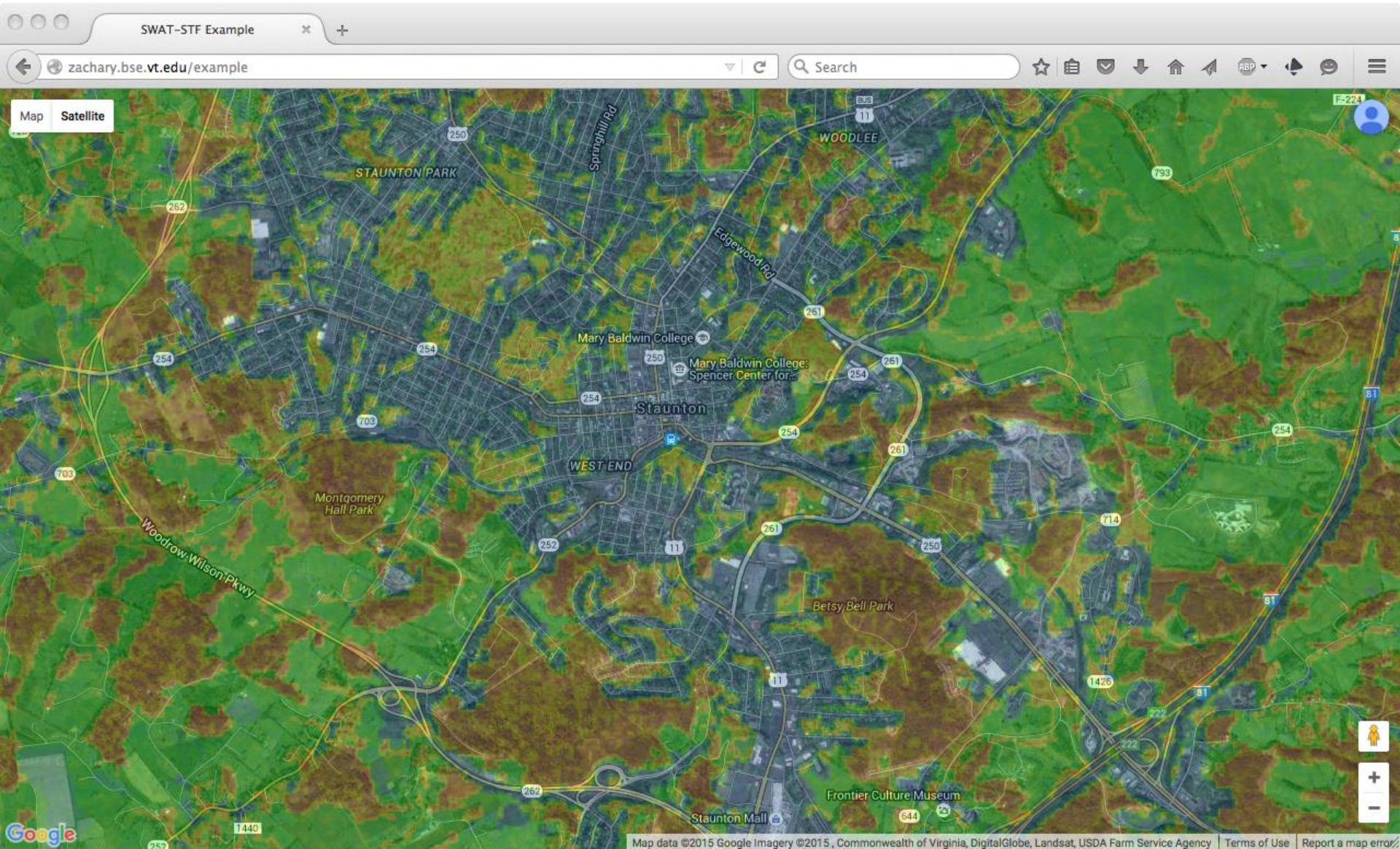

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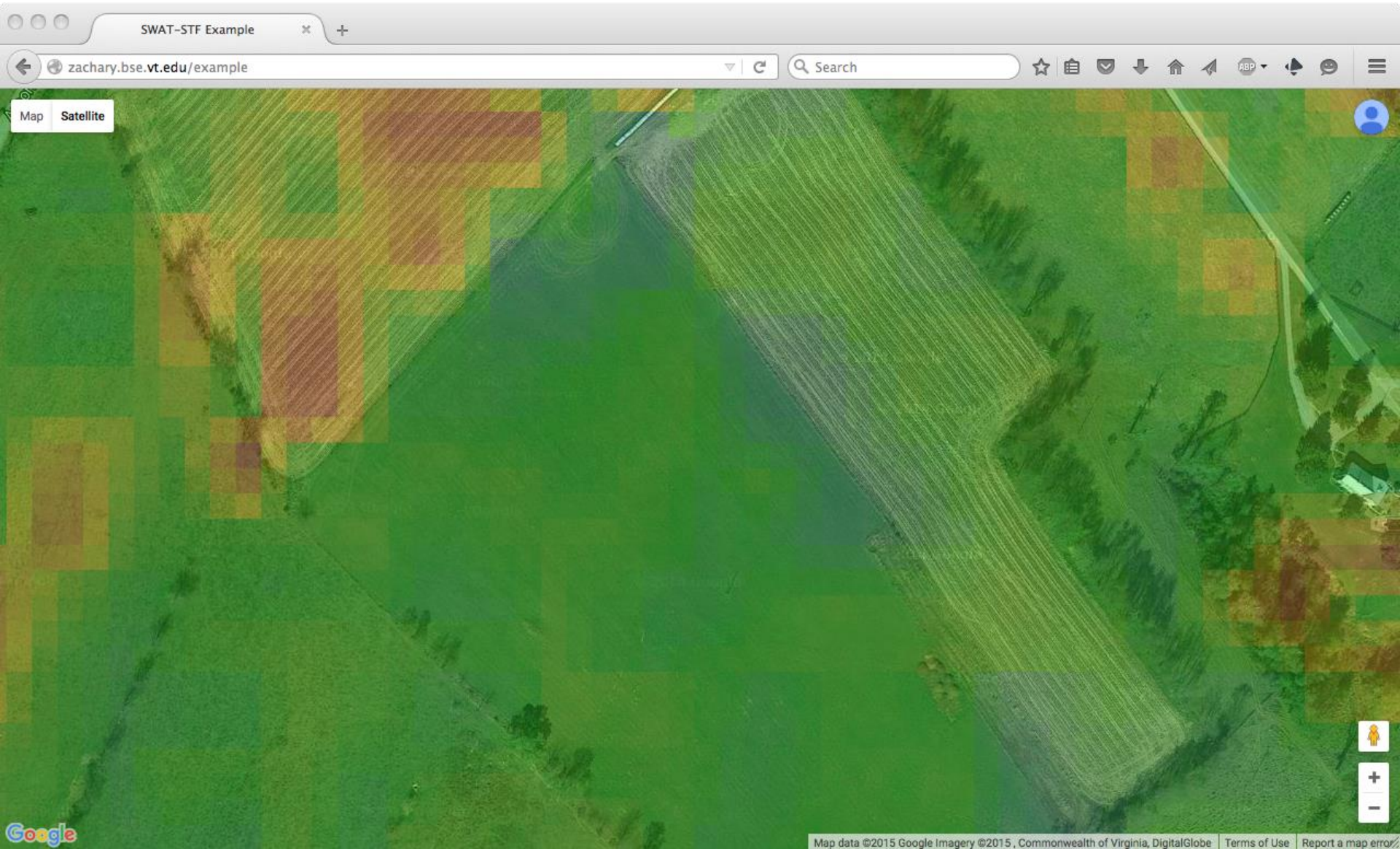

Screen Shots

Conclusion

1. SWAT-STF can provide satisfactory hydrographic forecasts up to 4 days in advance and distributed forecasts
2. SWAT-STF can provide the backend hydrologic modeling in a real-time for a web-based DSS

Future Work

1. Validation of Distributed Forecasts
2. Improvement of Weather Forecast inputs
3. Feed back and improvement of DSS