Releasing Scientific Software in GitHub: A Case Study on SWMM2PEST

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Acknowledgments

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Michelle Simon
Associate Director
US EPA
Storm Water Management Model (SWMM)

Partial statistics on using SWMM for research in 2018 based on Google Scholar

https://www.epa.gov/water-research/storm-water-management-model-swmm
The scientific software we are releasing

SWMM2PEST
An integration of the SWMM and PEST scientific programs

Dynamic rainfall-runoff simulation model
Version 5.1.013 was released in 2018
Computational engine is written in C & the UI in Delphi.XE2
About 45,500 LoC

Model-Independent Parameter Estimation and Uncertainty Analysis
Version 15 was released in 2018
FORTRAN code
About 210,000 LoC
SWMM2PEST: Automatic calibration for SWMM parameters
Best practice of releasing scientific software?

EPA concerns
SWMM2PEST 1.0 to 2.0

Changes around 50%

<table>
<thead>
<tr>
<th>Added &amp; modified lines (source code)</th>
<th>Deleted lines (source code)</th>
<th>Added &amp; modified UI files</th>
<th>Deleted UI files</th>
</tr>
</thead>
<tbody>
<tr>
<td>1029</td>
<td>696</td>
<td>5</td>
<td>2</td>
</tr>
</tbody>
</table>

- Developed by Suraj Kamble
- Python 3.5.4 & PyQt 5
- About 3,300 LoC

- Developed by Xuanyi Lin
- Python 3.5.4 & PyQt 5
- About 3,200 LoC

- Metamorphic testing
- Bugs fixed
- Restructured
- New features added
Release workflow

GitHub-driven release process

- SWMM2PEST
  - discover
  - fix
  - add
  - feedback

- Tests
  - run

- Features
  - continuous release

- Bugs
  - access

- Users

GitHub

- README file
- Source code
- Application
- Release note
Releasing in GitHub

**SWMM2PEST**

SWMM2PEST is a scientific programming library that contains much better parameter estimation methods and significantly lowers the level of back and forth and repetitive work involved in the calibration process of SWMM.

**Purpose & Main Features**

Hydrologists and engineers use Parameter Estimation tools back and forth and repetitive work involved in the calibration process of SWMM.

**Introduction**

SWMM2PEST 2.0 is a lightweight version of SWMM, fixed lots of bugs, and introduces a few new features.

**References**

SWMM: https://www.h stillmahan.com
PEST: http://www.pes.t.org

**Notes:**

- Note that both SWMM2PEST and PEST are not compatible with SWMM 5.1.013.

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**How to run**

1. Run MainFrame.py.
2. Run as Windows application.
3. Download SWMM2PEST.
4. Unzip the file.
5. Run SWMM2PEST.exe

**How to use**

1. Input File Selection
2. Provide SWMM input file
3. Click “Start.”

**Caveats**

1. Do not include the parameter with a value of 0 to do the calibration.
2. The folder path of the input file cannot contain spaces.
3. Some parameters in SWMM input file and observation file must be consistent.
4. Make sure the observation data format is the same format as the time series (mm/dd/yyyy), time (hh:mm:ss) and value, e.g., 01/30,

**Project status**

SWMM2PEST 2.0: June 2018

SWMM2PEST: August 2017

**Contributing**

Everyone is welcome to contribute to this project.

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**README file**

https://github.com/XuanyiLin/SWMM2PEST2.0

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**Categorizing the Content of GitHub README Files**

Gede Artha Azriadi Prana, Christoph Treude, Ferdian Thung, Thushari Atapattu, David Lo
Releasing in GitHub

Source Code

Release software
Strategy 1: Changes between versions

<table>
<thead>
<tr>
<th>SWMM2PEST</th>
<th>SWMM2PEST 1.0</th>
<th>SWMM2PEST 2.0</th>
<th>SWMM2PEST 2.1</th>
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</thead>
<tbody>
<tr>
<td>SWMM PEST</td>
<td>5.1.10</td>
<td>5.1.10</td>
<td>5.1.13</td>
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<tr>
<td></td>
<td>13.3</td>
<td>14.2</td>
<td>14.2</td>
</tr>
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</table>

4 places differed
Strategy 2: Improvements as requirements change

SWMM2PEST 1.0 UI

SWMM2PEST 2.0 UI
Insights

• Release as *required*
• *Connector* versus *connectee* release
• Release to help automated *testing*

Future work

• Investigate other repositories
• Continuous release with more comprehensive user feedback and other developers' opinions
Thank you

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