

Coupled Groundwater/Surface-Water Modeling using GSFLOW Class ID2447

New Mexico Water Science Center

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Laptop Requirement

Each course participant is expected to arrive with a laptop computer that has the required software installed and tested according to the instructions presented here. Laptop computers should be running the Windows operating system. It is important that you try this installation as soon as possible so that there is time to fix any installation problems that occur.

For this class, we expect that everyone will be running a 64-bit version of Windows.

Software Requirements

We ask that you download the following file, and follow the instructions provided here.

ftp://ftpext.usgs.gov/pub/wr/ca/menlo.park/rniswon/gsflowID2447_classrepo.zip

Software to install prior to the class

- ArcGIS 10.5 or newer (will include Python 2.7)
- [USDA Soil Data Viewer](#): This will require administrator privileges, please have IT do this for you prior to the class. Download for non-USDA CCE platforms then follow steps on website to register as add-in to ArcMap.
- Microsoft Access
- 32 bit version Miniconda (see instructions below)
- Jupyter Notebooks (see instructions below)
- Geopandas (see instructions below)
- Flopy (see instructions below)

Please remove any version of Anaconda currently on your computer. Use the following instructions to load Miniconda,

1. Install [Miniconda](#) – from the following site **make sure that download 32 bit – python 2.7 version**. Click on the installed executable and accept the default settings except for “Advanced options” window make sure to uncheck the two options.

2. From the “Windows start menu” open the Anaconda Prompt. In the opened command window, type “activate base” and enter. This will activate the “base environment”
3. Install Notebook for this environment using the following command “conda install -c anaconda jupyter”
4. Install geopandas “conda install -c conda-forge geopandas”
5. Install flopy “conda install -c conda-forge flopy”
6. Create a new file in
C:\Users\User_name\AppData\Local\Continuum\miniconda2\Lib\site-packages and insert the text shown below. Save this file as arcpy.pth. Make sure to replace User_name with your computer user name.

Text added to arcpy.pth file: if you have ArcGIS 10.5 add the following to the txt file
.pth file for arcpy

```
C:\ArcGIS\Desktop10.5\bin  
C:\ArcGIS\Desktop10.5\arcpy  
C:\ArcGIS\Desktop10.5\ArcToolbox\Scripts
```

If you have ArcGIS 10.6, use the following.

```
C:\ArcGIS\Desktop10.6\bin  
C:\ArcGIS\Desktop10.6\arcpy  
C:\ArcGIS\Desktop10.6\ArcToolbox\Scripts
```

Software Installation Test

After following the steps above, please follow these instructions to verify software was installed correctly.

1. Navigate to .\gsflowID2447_classrepo\exercises\saghen_prms\notebook
2. Right click on the file “Jupyter.bat” and open in a text editor
3. Fix the path in “Jupyter.bat” to match your computer configuration, save and close the file.
4. Double click “Jupyter.bat”
5. Within the Jupyter file browser, click on “1_fishnet_params.ipynb.”
6. Click in the first cell of the notebook and hold the shift button while pressing enter on the keyboard. Repeat for the second cell.

7. If output is produced, including the path to “python.exe” and no errors is reported then your installation is correct. However, if an error is reported then please contact Rich Niswonger (rniswon@usgs.gov).

Overview

We have designed the course files to be structured in the following manner. It's important that folders are named according to the list below.

- gsflowID2447 (main directory)
- installation (Scripts for installing the software. Provided in the zip file.)
- Arcpy (Python distribution we will use for this class. Arcpy come standard with ArcGIS 10.5). All other version of Python should be removed from your computer.
- gsflowID2447_classrepo.git (course repository mirroring https://github.com/rniswon/gsflowID2447_classrepo. We will use git to download the repository on the first day of class.)

Data Requirements

The data below only must be attained by students if they are starting a new project that is NOT the Sagehen example. Input data will be developed using Gsflow-Arcpy, a series of Arcpy scripts that use ancillary datasets to develop GSFLOW specific input. Almost all the data required by Gsflow-Arcpy can be downloaded for basins in the United States using the USDA Geospatial Data Gateway <https://gdg.sc.egov.usda.gov/> and elevation data can be downloaded as IMG format from <https://www.usgs.gov/core-science-systems/ngp/tnm-delivery/>.

1. 10m (1/3 arc-second) Elevation data
2. Study area or watershed pour points as shapefiles; for watersheds that contain multiple subbasins, pour points should be provided for each subbasin.
3. Vegetation type and coverage, downloaded as tiles for the study area from <http://www.landfire.gov/vegetation.php>
4. Soils (STATSGO or SSURGO data sets) can be downloaded from <https://gdg.sc.egov.usda.gov/>
5. Impervious cover (Land Cover) for 2011 can be downloaded from NLCD from http://www.mrlc.gov/nlcd11_data.php
6. Climate stations (precipitation, daily minimum and maximum temperatures) for stations located within watershed. Climate station data can be provided by many sources, including local agencies and regionally specific climate data should be located for each particular watershed. Common sources include <https://gis.ncdc.noaa.gov/maps/ncei/summaries/daily> and <https://wrcc.dri.edu/> and http://www.wcc.nrcs.usda.gov/snow/snow_map.html

7. PRISM 30-year monthly average (normals) precipitation and maximum and minimum temperatures at an 800m resolution can be downloaded here
<http://www.prism.oregonstate.edu/normals/>
8. Surficial geology <https://mrdata.usgs.gov/geology/state/>

Tutorial and Documentation links

Although the class does not require Python programming experience, we will be using basic Python within Jupyter Notebooks and familiarity can be helpful. Basic instruction can be provided at:

<https://www.codecademy.com/learn/learn-python>

YouTube videos for 24 lectures describing PRMS are available from:

https://wwwbrr.cr.usgs.gov/projects/SW_MoWS/Recordings.html

It is highly recommended that these be watched prior to the class. For example, an overview of PRMS is available at: https://www.youtube.com/watch?v=qX__lktsYW4. Note, we will be using GSFLOW-ArcPy in the class and not the Weasel software.

Documentation and additional resources are available at:

http://wwwbrr.cr.usgs.gov/projects/SW_MoWS/GSFLOW.html,

<http://water.usgs.gov/ogw/gsflow/index.html>,

https://wwwbrr.cr.usgs.gov/projects/SW_MoWS/Bibliography.html

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<http://dx.doi.org/10.3133/tm6B7>.

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Niswonger, R.G., Prudic, D.E., and Regan, R.S., 2006, Documentation of the Unsaturated-Zone Flow (UZF1) Package for modeling unsaturated flow between the land surface and the water table with MODFLOW-2005: U.S. Geological Survey Techniques and Methods 6-A19, 62 p. <https://pubs.usgs.gov/tm/tm6a37/pdf/tm6a37.pdf>

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Regan, R.S., Niswonger, R.G., Markstrom, S.L., and Barlow, P.M., 2015, Documentation of a restart option for the U.S. Geological Survey coupled groundwater and surface-water flow (GSFLOW) model: U.S. Geological Survey Techniques and Methods, book 6, chap. D3, 19 p., <http://dx.doi.org/10.3133/tm6D3/>.

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