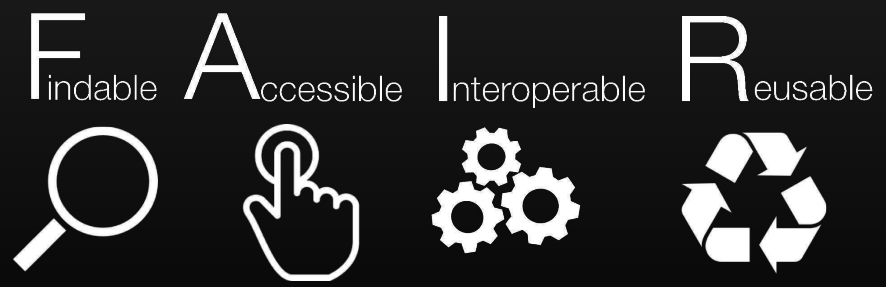
APEX R tool: An Open-source R scripted workflow to prepare model inputs and execute APEX simulations in parallel.

Dr. Lima, Edberto Moura[1], Böning Kristin[1], Carlos Alberto Arnillas[2], Bano Mehdi-Schulz[1]

[1]University of Natural Resources & Life Sciences, Vienna (BOKU)
Department of Water-Atmosphere-Environment
[2]University of Toronto - Scarborough

Context

- SoilX –
- 5 Work Packages
- EU Project
- 6 Countries
- > 20 Researchers
- Publish your result data sets: in a fair way!



https://www.go-fair.org/fair-principles/
https://doi.org/10.1038/sdata.2016.18

SWAT Community

SWAT Community Tools

MapSWAT

MapSWAT is an open-source QGIS plugin integrated with Google Earth Engine (GEE) that obtains and prepares SWAT+ input maps. It aims to help new or advanced users streamline the setup of their SWAT+ models. MapSWAT makes the preparation of SWAT+ input maps less error-prone, time-consuming and resource-intensive and facilitates model application in any study area worldwide. Additional information and the MapSWAT user manual and executable are available online. View reference paper.

SWAT-C

SWAT-Carbon is a watershed scale model that converges terrestrial and aquatic carbon cycles at the watershed scale. It is based on the SWAT2012 and has unique functions to assess impacts that agricultural management and climate change have on a wide range of processes and indicators, such as soil organic carbon storage, nitrous oxides emissions, freeze-thaw cycles/water temperature, and riverine carbon fluxes.

R-SWAT

Free, open source, graphical user interface for SWAT/SWAT+ calibration, parameter sensitivity/uncertainty analysis. For help see the user group and tutorial videos.

SWAT+ Toolbox

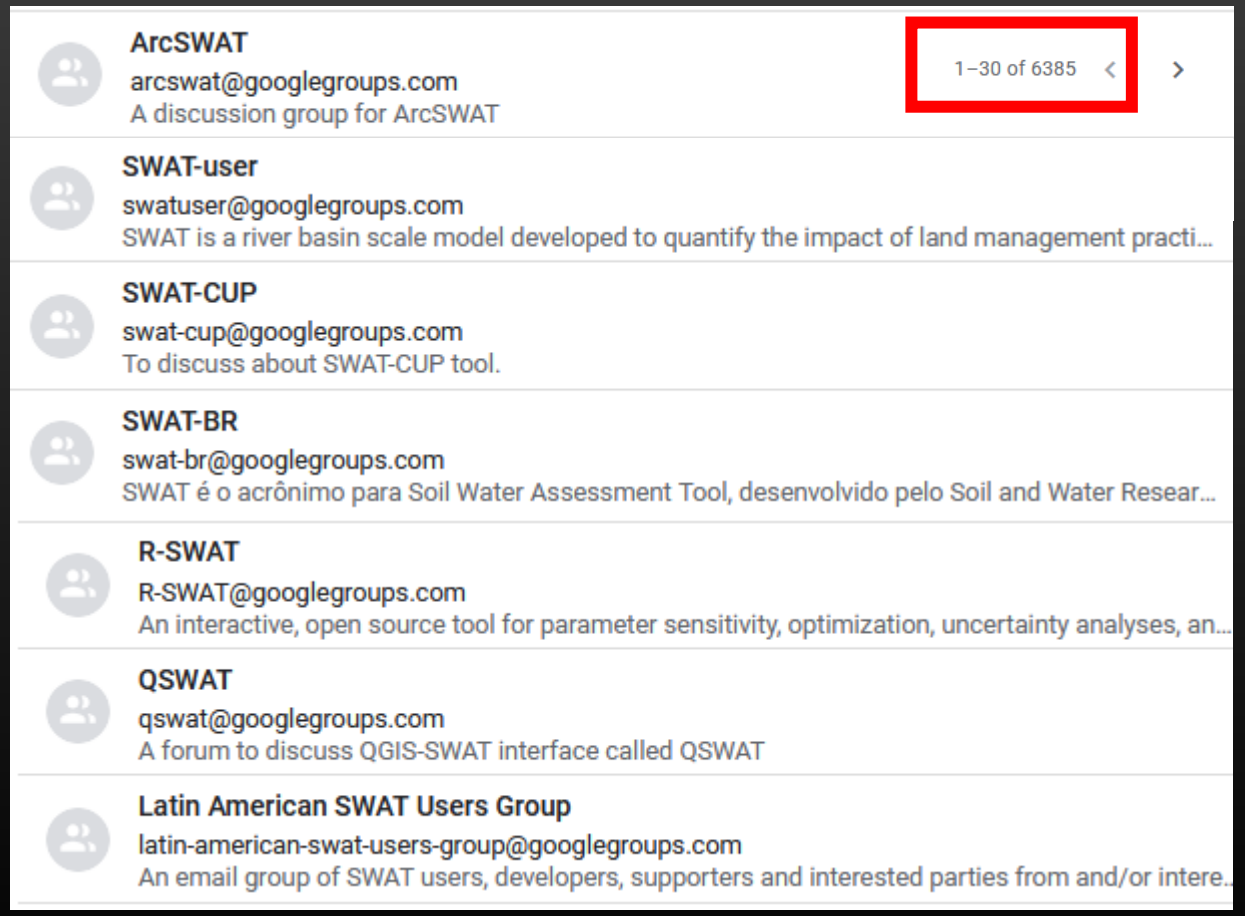
SWAT+ Toolbox is a user-friendly tool for SWAT+ model adaptations. Get the most recent version from the Additional Tools section of the SWAT+ page.

SWATrunR

Integrate SWAT+ and SWAT2012 models in modeling workflows in R

SWATdoctR

SWATdoctR is a collection of functions and routines for SWAT+ model diagnostics and calibration in R. The R package includes routines for a guided model calibration, functions for the evaluation of the model performance, as well as functions for the visualization and diagnosis of simulation outputs. For reference see the original publication.



EPIC/APEX Community

☆ EPIC / APEX Modeling Forum 285 members 1–30 of 568 ›

Welcome to the EPIC / APEX Modeling Question and Discussion forum! We welcome users of all levels and invite you to ask any questions you might have about our modeling programs.

If you already have a google account associated with this email address, you will have to log in using that account!

Thank you for visiting!
Modeling Team, Texas A&M AgriLife Research at Blackland (Temple, TX)

EPIC / APEX Website

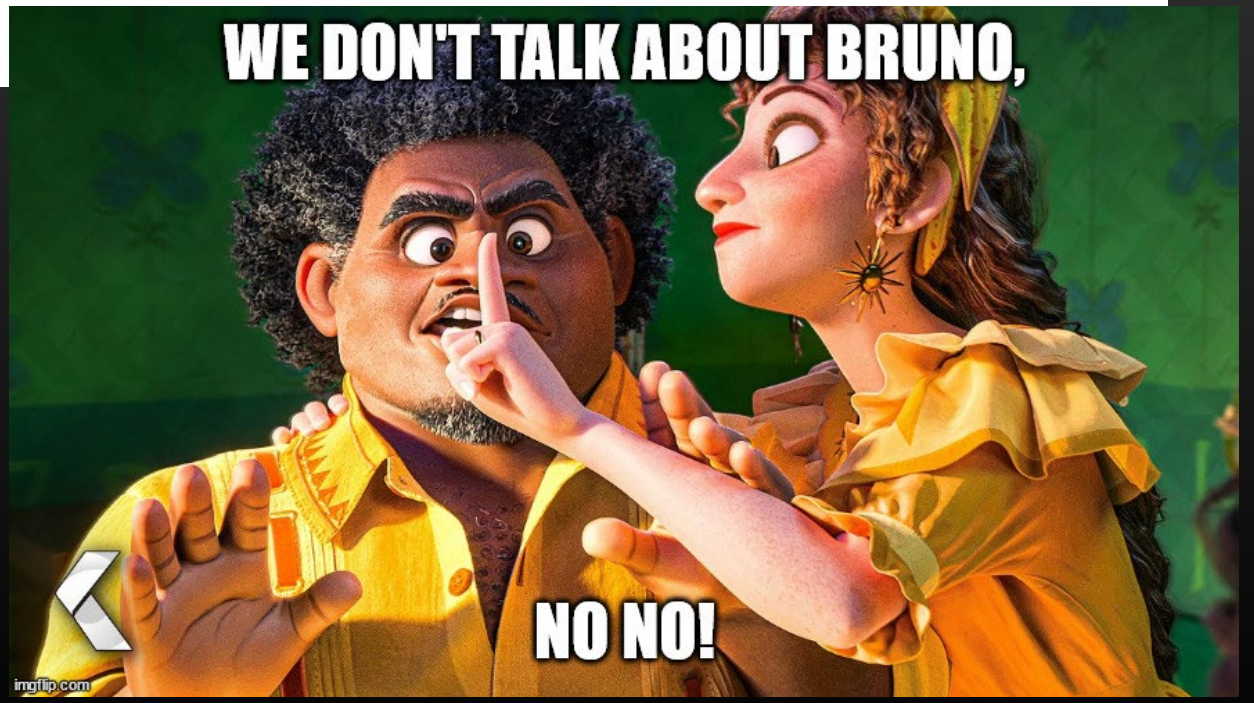
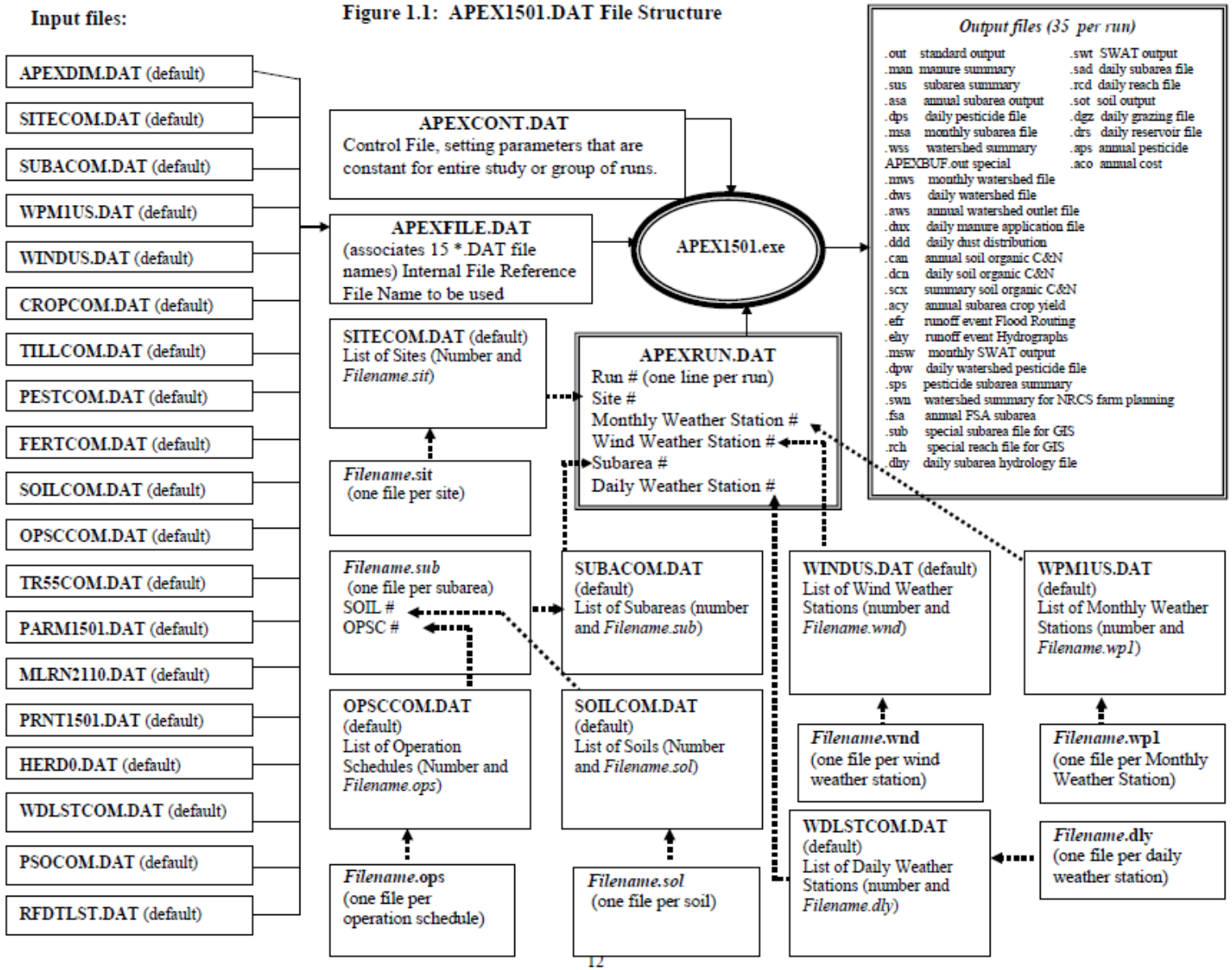
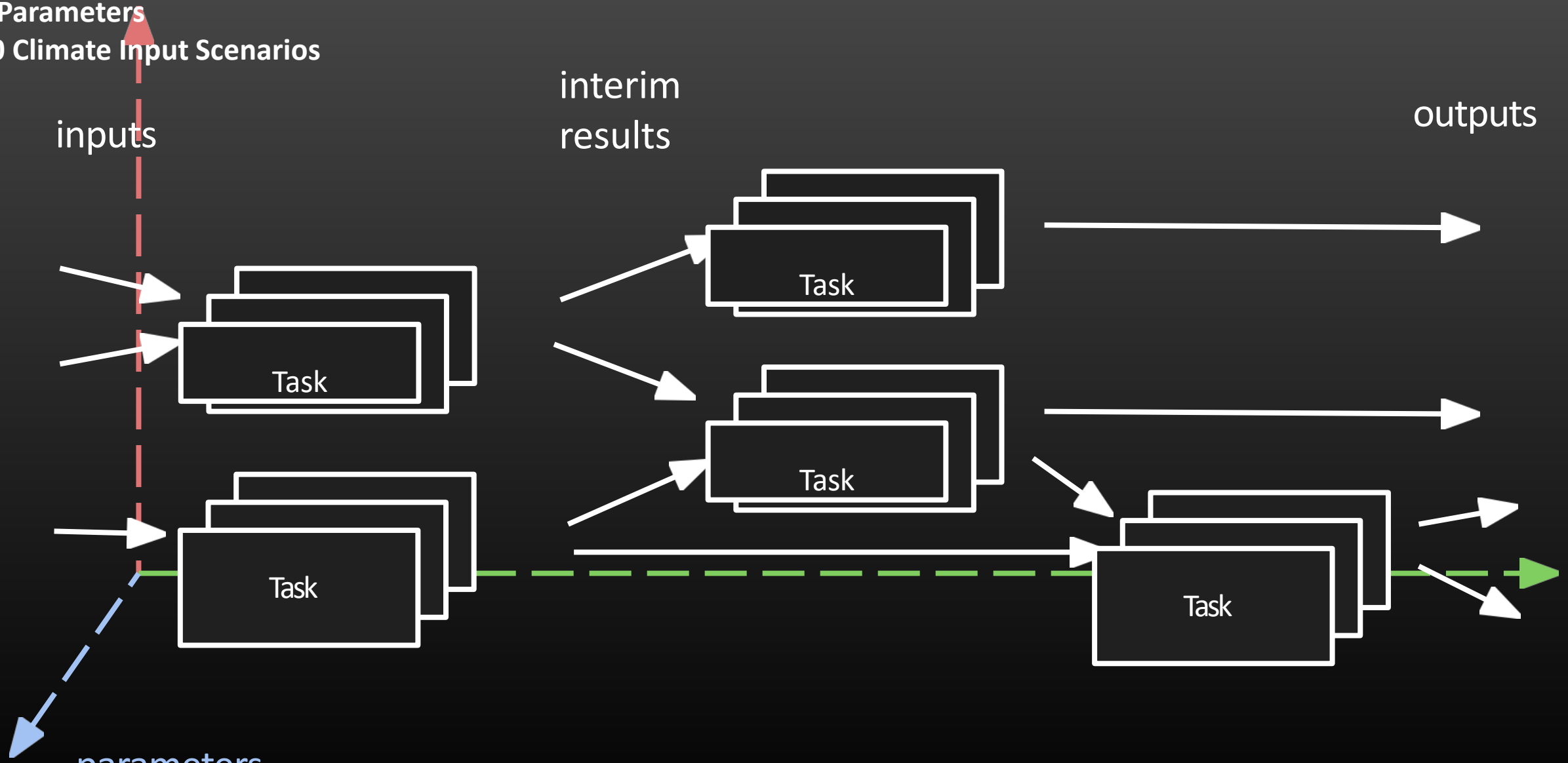
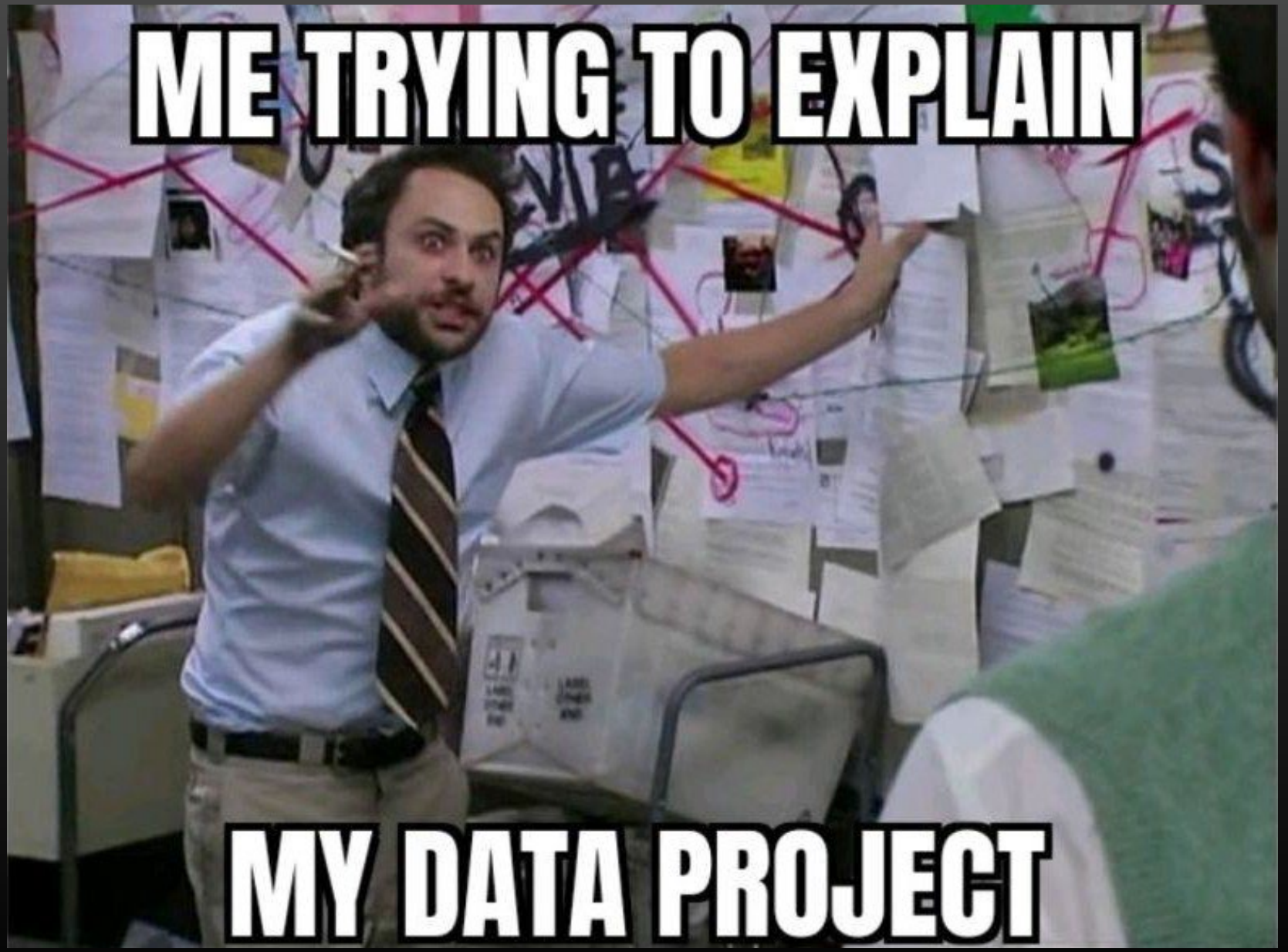


Figure 1.1: APEX1501.DAT File Structure



6 LTES
20 Parameters
600 Climate Input Scenarios




ME TRYING TO EXPLAIN
MY DATA PROJECT

EPIC/APEX Community

Technical Paper | Full Access

APEXSENSUN: An Open-Source Package in R for Sensitivity Analysis and Model Performance Evaluation of APEX

Mansour Talebizadeh, Daniel Moriasi, Jean L. Steiner, Prasanna Gowda, Haile K. Tadesse, Amanda M. Nelson, Patrick Starks

First published: 27 September 2018 | https://doi.org/10.1111/1752-1688.12686 | Citations: 4

README

APEX-CUTE

The Agricultural Policy Environmental eXtender - auto-Calibration and UncerTainty Estimator (APEX-CUTE) was developed to facilitate the calibration and uncertainty analysis routines with a user-friendly interface (Wang et al., 2014). APEX-CUTE was developed by the framework of the Integrated Parameter and Uncertainty Analysis Tool (IPEAT, Yen et al. (2014)) with theprimary coding platform in Python. The current revision includes Sensitivity Analysis (SA) and the Dynamically Dimensioned Search (DDS) algorithm (Tolson and Shoemaker, 2007) for APEX auto-calibration. For the DDS optimization procedure, APEX-CUTE interacts with APEX by modifying APEX input files with candidate solution, running APEX, evaluating model output by calculating performance statistics, perturbing current best solution to generate candidate solution, and iteratively repeating the process until maximum number of objective function evaluations completed. APEX-CUTE offers sensitivity analysis using the Morris method (Morris, 1991; Campolongo et al., 2007). These SA and auto-calibration tools can be used to complement users' refinement of an APEX model. Users are responsible for conducting necessary checks for model input and initial runs before conducting SA and/or auto-calibration using APEX-CUTE to make sure that the basic APEX input and setup are correct. More applications of APEX-CUTE can also be found in Wang et al. (2015).

This repository contains source codes and an executable for APEX-CUTE.

- Installer: APEX-CUTE 7.8
- Source Code

Journal of Software Engineering and Applications
Vol.12 No.10(2019), Article ID:96106,15 pages
10.4236/jsea.2019.1210027

APEXeditor: A Spreadsheet-Based Tool for Editing APEX Model Input and Output Files

Javier M. Osorio Leyton

Texas A&M AgriLife Research, Blackland Research and Extension Center, Temple, TX, USA
Email: josorio@tamu.edu

Received: September 3, 2019; Accepted: October 28, 2019; Published: October 31, 2019


NOTHING GOOD
Please don't take this too literally!
JUN
2
HAPPENS IN EXCEL...!
imgflip.com

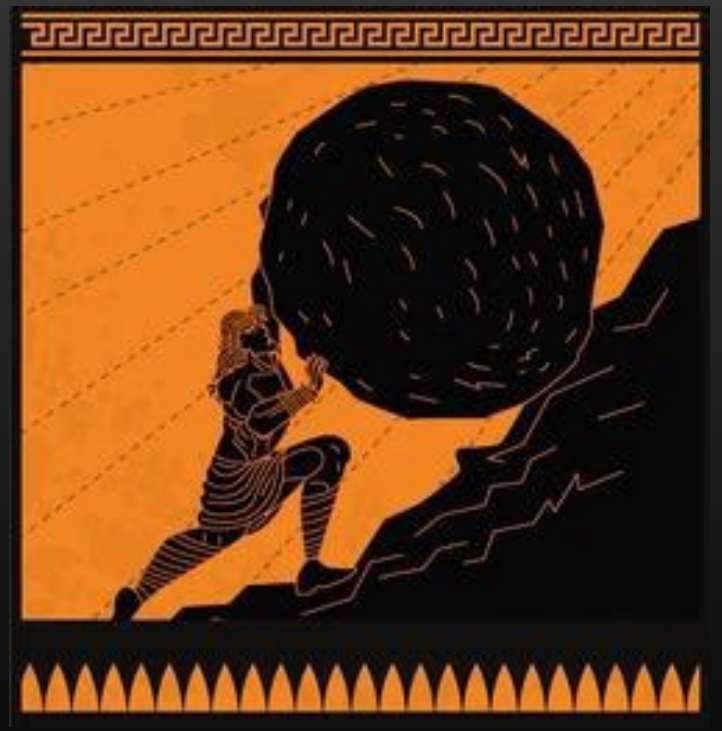
Creating a workflow: Automate everything

Manual steps are…

- error prone
- time consuming
- not documented

Every command or click should be stored in a way, such that it can be executed again!

Be realistic! You will do things over and over again…



But you can automate all steps!

Make things more usable - for yourself and others!

Reproducibility in practice:

- How easily can somebody use the thing later?

Think about your target audience to set priorities! Do they want to …

- re-run all your scripts?
- run the code as piece of software?
- use the code and adapt it?
- use the computation results only?
- understand what and how we did it?

Our goal: reproducibility!

...but in practice:

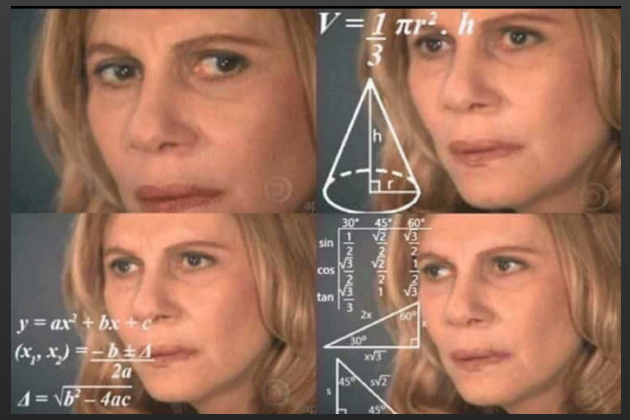
nobody re-runs it or it is broken

irreproducibility by hardware demands

irreproducibility by obscurity

traceability

comprehensibility



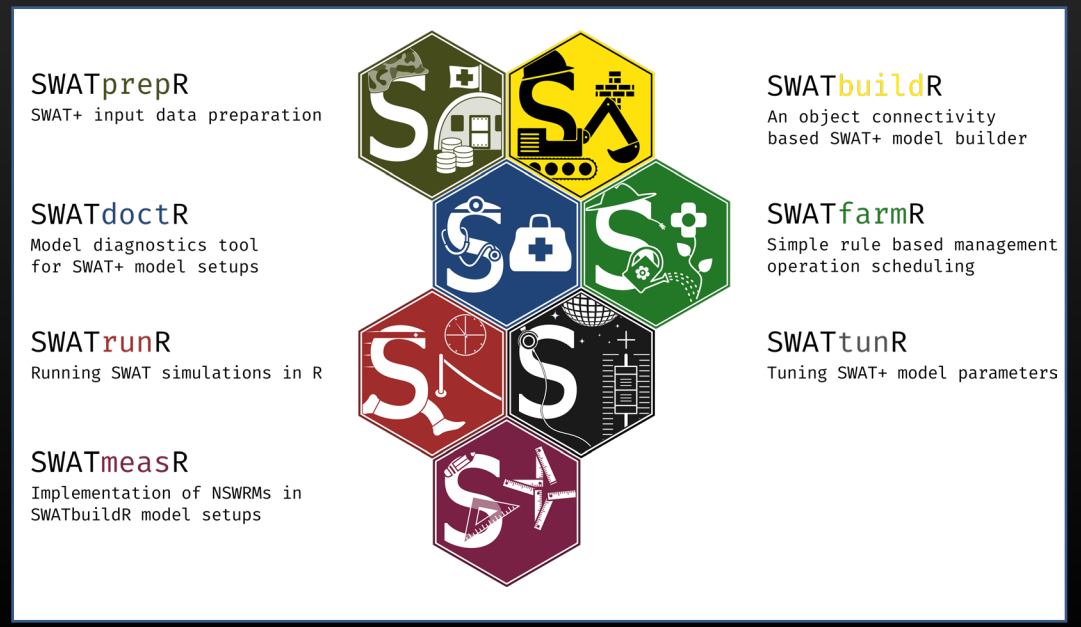
some users might be interested mostly in results

How easily can somebody use the thing later?

R6 object-oriented programming for R: step-by-step APEX model setup.

Inherent or have functions adapt from:

- sensobol
- apexsensun
- SWATdoctR
- SWATrunR
- SWATfarmR



How easily can somebody use the thing later?

Create and Load TxtInOut Files:

load_apex_files: function (project_path)
setup_apex_folder: function (project_path = project_path, run_path = NULL)

How easily can somebody use the thing later?

Updated Functions:

update_APEXRUN: function (ASTN = NULL, ISIT = NULL, IWPN = NULL, ISUB = NULL, …)

update_SUBAREA: function (INPS = NULL, IOPS = NULL, IWTH = NULL, LUNS = NULL, …)

update_APEXCONT: function (NBYR = NULL, IYR = NULL, NGN = NULL, IET = NULL, IPRK = NULL, …)

update_PARM: function (parm.tbl)

update_PRNT: function (output_ext = NULL, over_write_PRNT = TRUE, save_output = FALSE)

How easily can somebody use the thing later?

Sensitive Analysis and CC change data:

create_sample_matrices: function (params, gsa_method = list(method = "SENSOBOL", arguments = list(…))

set_cc_projections: function (ccfile = NULL, update_OPC = FALSE, mgtrulefile = NULL)

gsa_methods supported: MORRIS, LHS, SENSOBOL, FAST99

How easily can somebody use the thing later?

RunAPEX: function (input = list(run_path = file.path(self$run_path, "TxtInOut")

- Standardized input and output management
- Scalability with parallel simulations

Re-running computations might be difficult or take long time… Keep old versions!

- Integration with SQL for long-term storage and analysis

Acknowledgments & Questions

EJP SOIL has received funding from the European Union's Horizon 2020 research and innovation programme: Grant agreement No 862695

https://ejpsoil.eu/soil-research/eom4soil/into-dialogue/soilx

Reach me!

https://github.com/EdbertoLima