**Docker and Docker Toolbox for SUMMA (Mac OS and Windows)**

Docker is the recommended platform for downloading and running SUMMA if you do not plan on changing the source code (i.e. rearranging or replacing equations). Essentially, Docker is going to be the magician behind getting SUMMA to run smoothly and without too much coding on your part (for the test cases). This document is going to (hopefully) be a helpful amalgamation of the steps required to get SUMMA up and running on your computer. Specifically, we will get Docker running, install SUMMA, and download and run the test cases provided on the SUMMA NCAR website.

Information in this doc was gathered from various sources and I will include links throughout if you wish to gain clarification from those sources. I have tried to make this an easy to read and follow document, but this is some complicated stuff and I wouldn’t be surprised if I failed to make some parts easy to understand, so don’t hesitate to ask me or the internet for help.

**A few things to start:**

* The version of your operating system matters. Only the newest versions of Windows or Mac OS will work for Docker. Else you will need to download Docker Toolbox (instructions for both are bellow, use the outline [view > show document outline] on the left to navigate to Docker Toolbox if that applies to you). This means you don’t have to read both sections!
* The SUMMA GitHub is a good resource, especially the [installation folder](https://github.com/NCAR/summa/tree/master/docs/installation).
* For both Windows and Mac: a useful app to have is [Sublime Text](https://www.sublimetext.com/), the files from summa are much easier to read in this format. It’s not required, but it’s what I’ve been using and I think it’s a great interface for this context (TextEdit [Mac] or Xcode [Mac] will also work, but Notepad will not work).
* For Windows: Lucky Mac users can unpack tar files with a simple double-click. If you are using Windows, you will want something to help you access the tar directory for the summa test cases. I use [7 Zip](http://www.7-zip.org/) and it seems to work fine for this tar directory (note that some tar extraction tools available around the web may not treat the files nicely and you may end up with some gibberish).
* I installed Docker on a Mac and Docker Toolbox on a laptop with Windows. The instructions are written specific to those operating systems. So if you’re installing Docker on Windows or Docker Toolbox on Mac OS, you may find helpful hints by searching the doc (crtl+F or command+F) for your operating system. If other issues come up, let me know!
* summa folder = summaTestCases\_2.x

**Docker (for those new and shiny operating systems):**

*I completed the Docker section on a Mac, so some steps may differ for Windows.*

The Macs in FA 125 can easily be updated to the newest OS and by easily I mean it takes 40 minutes to update the OS, but installing Docker is a walk in the park after that.

Docker can be found [here](https://www.docker.com/community-edition) and will be very straightforward to install and run.

* When you double-click the Docker download, you will be prompted to drag your little whale friend over to applications.
* You can check that Docker is running by typing *docker run hello-world* and hitting return.

**Install SUMMA:**

*GitHub page for this* [*here*](https://github.com/NCAR/summa/blob/master/docs/installation/SUMMA_docker.md)**.**

* Open Terminal (Macs. Can be found by searching for Terminal).
* Double check that Docker is working by typing *docker run hello-world* and hitting the return key. You will hopefully get a lengthy response and no errors.
* Type (or copy) *docker pull bartnijssen/summa:latest* into Terminal and hit return.
* Summa should now be recognized by Docker and you can double check by typing *docker run bartnijssen/summa:latest -v* and hitting return
  + If you don’t see the summa version, build time, etc. then something may have gone wrong with the installation.

**Download and unpack tar files:**

* Download the tar.gz file available [here](https://ral.ucar.edu/projects/summa) under the Test Cases tab. We will be using these to get acquainted with Docker and SUMMA

*Leave the names of the folders as is (summaTestCases\_2.x and folders within it) unless you want to edit the shell scripts and I know you don’t want to do that.*

To unpack the files:

* Mac*:* Just double-click the tar.gz file. And put the summaTestCases\_2.x folder in an easy to access place, I recommend the desktop.
* Windows*:* If you’re using 7 Zip you can right-click the tar.gz file >7 -zip> open archive > double- click the tar.gz file > click the summa folder > extract (choose simple directory).

**Install test cases:**

*You can also reference the ‘readme’ file included in the summaTestCases\_2.x folder.*

Open Terminal (Macs): we will be calling scripts from the summa folder and running them in Terminal (Docker is just chilling and working in the background).

For simplicity, open Terminal in the summa folder:

* Go to System Preferences > Keyboard > Shortcuts > Services
* Scroll to ‘New Terminal in Folder’ and click the box and exit this window
* Right-click on the summa folder and click ‘New Terminal in Folder’
  + This keeps all files in this directory and not scattered across your drive and allows you to call the files with ‘/bin/bash’

Run installTestCases\_docker:

* Type (or copy) */bin/bash installTestCases\_docker.sh* into Terminal and hit return.
  + This script adds an ‘output’ folder to the summa folder and copies the ‘settings’ and ‘TestCases\_data’ folders so that the original files remain safe (\_org folders).
* You should get ‘TestCases for docker installed’. Errors running this script may be related to what directory you’re working in versus where the summa folder is located, so double check that you are running the script in a Terminal you opened in the summa folder.

**Edit and run test cases:**

*You can also reference the ‘readme’ file.*

Edit test case script:

Before we can run the test cases we need to edit the ‘runTestCases\_docker.sh’ file in the summa folder.

* Open ‘runTestCases\_docker.sh’ with a text editor. This is where I find Sublime Text to be especially useful, because the lines are numbered and the text is color-coded.
* After ‘DOCKER\_TEST\_CASES\_PATH=’ type the path to the directory where your summa folder is located. If you saved the folder to the desktop it will look something like this: */Users/username/Desktop*
  + *Use forward slashes ( / ) for file paths (this is more of a problem with copying paths in Windows). Use /c/ and not C: when referring to the drive.*
  + *Do not include a space after the = or it will not work*
* After ‘SUMMA\_EXE=’ type *bartnijssen/summa:latest*
* Use the pound sign/hashtag to comment out the lines of test cases we do not want to run.

Run test cases:

* Type (or copy) */bin/bash runTestCases\_docker.sh* into Terminal and hit the return key.
  + This could take a while to run, you’ll know when it’s done when the prompt returns (the $). *At this point your output folder should have some ‘.nc’ files. You can now skip to the “Final Thoughts” section.*

**Docker Toolbox (it’s okay, your old OS will still work fine):**

*I completed this section on Windows 10, so some steps may differ for Macs.*

Docker Toolbox is a little more squirrelly in terms of installing and later running summa. Docker Toolbox can be found for [Windows here](https://docs.docker.com/toolbox/toolbox_install_windows/) and [Mac here](https://docs.docker.com/toolbox/toolbox_install_mac/)(Thank you Hamideh for the links).

* You will need to check if your computer has virtualization enabled. To do this, go to task manager > click more details at the bottom if you are not already in that mode > Performance tab
* If virtualization is disabled follow the directions in the [link Hamideh sent](https://answers.microsoft.com/en-us/windows/forum/windows_10-other_settings/cannot-find-the-option-to-enable-intel-vt-x-in/c9203f8a-da57-43be-8c75-cfe43d55cd70?auth=1).
* When installing Docker Toolbox, agree to all install prompts.
* Make sure Virtual Box gets installed. This is easy to find out if you try to open the Docker Quickstart Terminal and you get an error.
  + If you get this error go to Program Files (or where you saved Docker Toolbox) > Docker Toolbox > installers > virtualbox > virtualbox and follow the install wizard.

**Install SUMMA:**

*GitHub page for this* [*here*](https://github.com/NCAR/summa/blob/master/docs/installation/SUMMA_docker.md)**.**

* Open Docker Quickstart Terminal (If you didn’t make a desktop icon for it you can search for it)
* Double check that Docker is working by typing *docker run hello-world* and hitting the return key. You will hopefully get a lengthy response and no errors.
* Type (or copy) *docker pull bartnijssen/summa:latest* and hit return.
* Summa should now be recognized by Docker and you can double check by typing *docker run bartnijssen/summa:latest -v* and hitting return
  + If you don’t see the summa version, build time, etc. then something may have gone wrong with the installation.

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**Install test cases:**

*You can also reference the ‘readme’ file included in the summaTestCases\_2.x folder.*

Open Git Bash (Windows): we will be calling scripts from the summa folder and running them in Git Bash (Docker is just chilling and working in the background).

For simplicity, open Git Bash in the summa folder:

* Right-click on the summa folder and click ‘Git Bash Here’
  + This keeps all files in this directory and not scattered across your drive and allows you to call the files with ‘/bin/bash’
* Note that it is possible to do this through the Docker Quickstart Terminal but you will have to write out the full path for the script files.

Run installTestCases\_docker:

* Type (or copy) */bin/bash installTestCases\_docker.sh* into Git Bash and hit the enter key.
  + This script adds an ‘output’ folder to the summa folder and copies the ‘settings’ and ‘TestCases\_data’ folders so that the original files remain safe (\_org folders).
* You should get ‘TestCases for docker installed’. Errors running this script may be related to what directory you’re working in versus where the summa folder is located, so double check that you are running the script in a Git Bash you opened in the summa folder.

**Edit and run test cases:**

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Edit test case script:

Before we can run the test cases we need to edit the ‘runTestCases\_docker.sh’ file in the summa folder.

* Open ‘runTestCases\_docker.sh’ with a text editor. This is where I find Sublime Text to be especially useful, because the lines are numbered and the text is color-coded.
* After ‘DOCKER\_TEST\_CASES\_PATH=’ type the path to the directory where your summa folder is located. If you saved the folder to the desktop it will look something like this: */c/Users/username/Desktop*
  + *Use forward slashes ( / ) for file paths (this is more of a problem with copying paths in Windows). Use /c/ and not C: when referring to the drive.*
  + *Do not include a space after the = or it will not work*
* After ‘SUMMA\_EXE=’ type *bartnijssen/summa:latest*
* Use the pound sign/hashtag to comment out the lines of test cases we do not want to run.

Run test cases:(this is where it can get squirrelly, as it doesn’t work in Git Bash)

* Open Docker Quickstart Terminal.
* Type *~/summaTestCases\_2.x/runTestCases\_docker.sh* into Docker Terminal where the ‘~’ is the path to the summa folder (e.g. /c/Users/username/Desktop) and hit the enter key.
  + This could take a while to run, you’ll know when it’s done when the prompt returns (the $). *At this point your output folder should have some ‘.nc’ files.*

**Final Thoughts:**

SUMMA output files (hopefully you have a few at this point) are NetCDF files. So, while you can’t open them immediately and find beautiful plots and figures, you can view the data in Python or Matlab and make your fantastic plots there. The Python steps to plotting our results will be in the next google doc.