

## CAM-CLUBB Tutorial Instructions

Homework (BEFORE arriving at NCAR:

1. **Get your computer set up:** Please do at least #1 (Install Docker), #2 (Download the tutorial) and #3-4 (Load it) BEFORE arriving at NCAR. If you have trouble, please let Andrew know ([andrew@ucar.edu](mailto:andrew@ucar.edu)). Feel free to do the other steps beyond this if you are interested.
2. **Read about SCAM (read this):** Gettelman, A., J. E. Truesdale, J. T. Bacmeister, P. M. Caldwell, R. B. Neale, P. A. Bogenschutz, and I. R. Simpson. "The Single Column Atmosphere Model Version 6 (SCAM6): Not a Scam but a Tool for Model Evaluation and Development." *Journal of Advances in Modeling Earth Systems* (2019).  
<https://doi.org/10.1029/2018MS001578>.

1.0 Version. (June 3, 2019)

We have tried to be clear about commands by using a `fixed width font` and a prompt (`>`). These commands are to be typed at a prompt in a terminal on your local computer, not within a docker container.

1. Install docker on your system

Mac: <https://docs.docker.com/docker-for-mac/install/>

(specifically: <https://hub.docker.com/editions/community/docker-ce-desktop-mac>)

Note: you need to sign up for a free account.

Windows: <https://docs.docker.com/docker-for-windows/install/>

(specifically: <https://hub.docker.com/editions/community/docker-ce-desktop-windows>)

Note: need to sign up for a free account

Linux: See different tabs for CentOS, Fedora, Debian, etc:

<https://docs.docker.com/install/>

Once docker is running:

2. Download The Image to a space on your local machine (let's call it scam)

```
> mkdir scam1.0
> cd scam1.0
```

Download using (A) an FTP client from the command line, (B) wget or (C) paste into a browser:

(B) wget: > wget URL

```
ftp://ftp.cgd.ucar.edu/pub/andrew/scam_tutorial_v1.0.tar.gz
```

(C) Paste as a URL into a browser:

```
ftp://ftp.cgd.ucar.edu/pub/andrew/scam_tutorial_v1.0.tar.gz
```

(2GB download)

3. Unzip. Do not untar (Docker uses the tar file)

```
> gunzip scam_tutorial_v1.0.tar.gz
```

(6GB unpacked)

4. Load tar file into docker (one time) (On Linux, make sure that you have permission to run docker by creating a docker group and adding your username to that group.)

```
> docker load < ./scam_tutorial_v1.0.tar
```

This will take some time (3-10 minutes) so be patient.

5. Set up work directory. [optional, not need on a mac]

```
> mkdir work
```

6. Run the container with binding to work directory

Make sure the {scam\_path} is set to an absolute local machine path...

```
> docker run -p 8888:8888 -v  
{local_path}/scam1.0/work:/home/scam/work -d scam_tutorial_v1.0
```

(On Windows, your local path will have backslashes rather than foreslashes, so that the argument to -v will become something like C:\Desktop\scam06\work:/home/scam/work.)

Note: do NOT use the .tar suffix (not sure why docker does this, but it works)

This (A) runs the container, (B) opens up a port for html, and 'binds' the /home/scam/work directory IN THE CONTAINER to /Users/andrew/cesm/scam06/work

This is necessary to allow your files to live on after exiting the container. (If the command hangs, you might need to grant access to your hard drive. Type in your computer's password in any docker windows that pop up, and disable any firewall that you think might be interfering.)

Alternative: Run the container with a bash shell to control it from the command line: (In the command below, do NOT change “/Users/andrew/cesm” to the path on your local machine.)

```
> docker run -it -v {Local Path}/scam1.0/work:/home/scam/work
--entrypoint=/bin/bash scam_tutorial_v1.0
```

(then skip to step 9)

7. Start up jupyter lab in a browser (the container is running the Jupyter lab session)

<http://127.0.0.1:8888>

8. Launch a terminal in jupyter lab (see Tabs on Jupyter’s menu bar).

You are now running a terminal window *inside* the virtual machine. You can only see the virtual machine file system. But the `work` directory is linked to the `work` directory you created in step 5.

9. Copy scripts to work directory:

```
> cp -r tutorial/* work
> cp create_scam6_iop work
> cd work
```

10. Run the model In the jupyter file browser

Run the script in the terminal window with

```
> ./create_scam6_iop
```

You are now running SCAM in the container locally!

It will take ~5-7 minutes to compile, build and run. Hit return in the terminal to update it.

When done, you should have a prompt again, and a ‘cases’ directory:

```
> ls cases, and there should be a case.
```

The output file is in the `<casename>/run` directory...

This cases directory will also appear on your local machine.

11. To edit the script: go to the file browser in `work/create_scam6_iop` and open it.

Or open a terminal session and use emacs or vi

This has full access to configure and namelist: you can save and re-run in the terminal

12. Plot Stuff with Python

- If using Jupyter: There is a jupyter notebook file in the container that will work on test data, or on your output files. Go to Jupyter’s file browser (folder icon in left panel) in the Jupyter browser: It’s in `work/notebooks/rscam.ipynb`:
  - launch `rscam.ipynb` with the file browser,
  - then on the menu bar, click ‘run-->run all cells’. You can change the variable names to generate different plots. (Shift-Return to execute the cell)
  - To see all the variable names, you just type the data set name (`ds1` or `ds0`) in a cell (uncomment this in Cell 9 and execute with shift-Return)

- A stand alone python script can be run also on the data (configured for test data) and generates a pdf: do this with the terminal.
  - `> cd work/python/`
  - `> python rscam_contour3.py`
  - Visualize this in the browser by pointing the file browser to work/python and clicking on the PDF. Or you can find the pdf on your local system work/python directory
- You can also use the netCDF file on your local machine to do whatever analysis you want (IDL, interactive viewer like panoply, etc).

13. To shut down the container:

If using Jupyter Lab, save anything you want, and close the browser tabs (shutdown if desired).

Then:

```
> docker ps
```

This will give you something that looks like this:

```
CONTAINER ID   IMAGE                COMMAND
ed5d24acaacb   scam_tutorial_v1.0  "/opt/conda/bin/jupy..."
```

You want the 'CONTAINER ID' (First string, above, `<CONTAINER ID>=ed5d24acaacb`)

Then:

```
> docker stop <CONTAINER ID>
```

Your work directory will still be on the local machine.

If in a shell, just `> exit`

(This closes the container, at least on a mac or on windows)

14. To reload container, repeat step 6 (rerun): remember to change the local path....

Jupyter version:

```
> docker run -p 8888:8888 -v
{local_path}/scam1.0/work:/home/scam/work -d scam_tutorial_v1.0
```

Bash/Shell Version:

```
> docker run -it -v {Local Path}/scam1.0/work:/home/scam/work
--entrypoint=/bin/bash scam_tutorial_v1.0
```