HYSPLIT 2021

For Windows/Mac/Linux

- Bolded entries are individual commands to be placed on the command line; they should be written and entered as a single line in the terminal

- Italicized entries with > are graphical user interface (GUI) clicks and entries

- Main HYSPLIT site: https://www.ready.noaa.gov/HYSPLIT.php

- Full HYSPLIT user's guide: https://www.ready.noaa.gov/hysplitusersguide/

- HYSPLIT tutorial: https://www.ready.noaa.gov/documents/Tutorial/html/index.html

- If you need the Linux installation, or the registered Windows or Mac versions, you need to first register at: https://www.ready.noaa.gov/HYSPLIT_register.php
    - **Note: will need official UBC letterhead, and several days before response**

- Unregistered (trial) Windows and Mac installations do not require registration

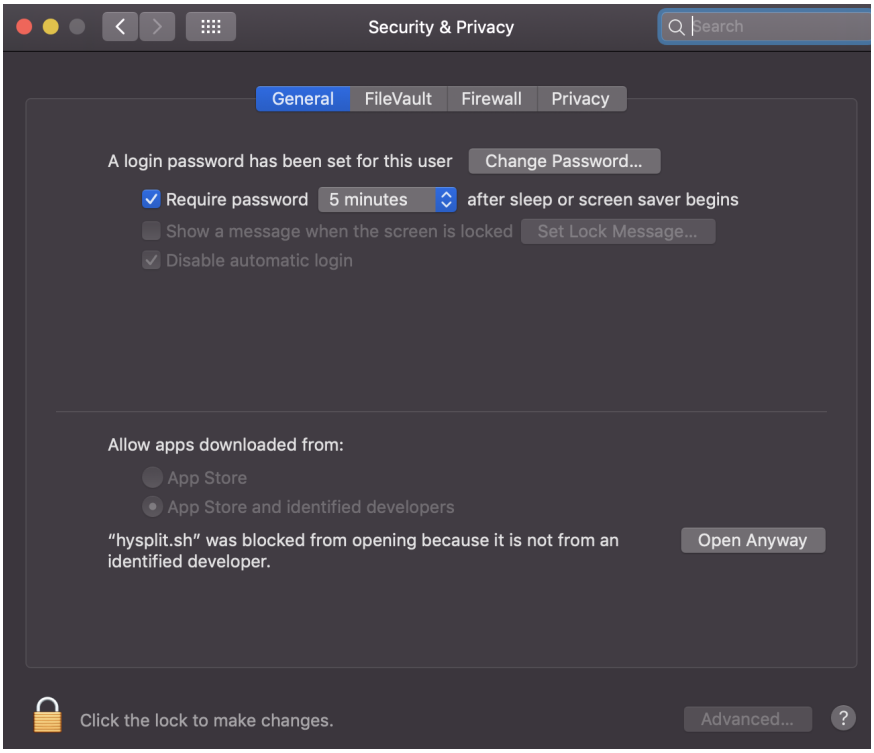
Install + GUI HYSPLIT (Mac Registered, V5.1.0)

- NOTE: GUI workflow is the same across Windows/Mac/Linux...after you've installed HYSPLIT for your OS, you can just follow the instructions here to do the test runs

- Enter your email address at this link, and log in: https://www.ready.noaa.gov/hyreg/HYSPLIT_machysplit.php

- Download and open the .dmg: hysplit_R_v5.1.0.dmg

- A finder window should show up; drag and drop the "hysplit" folder into your home directory (or you can also just run *install_hysplit.app*)
- In your finder, go into *home* > *hysplit* > *working*, and double-click hysplit.sh
    - You may need to allow your system to recognize that it's safe
    - *System Preferences* > *Security & Privacy*, and *Open Anyway*

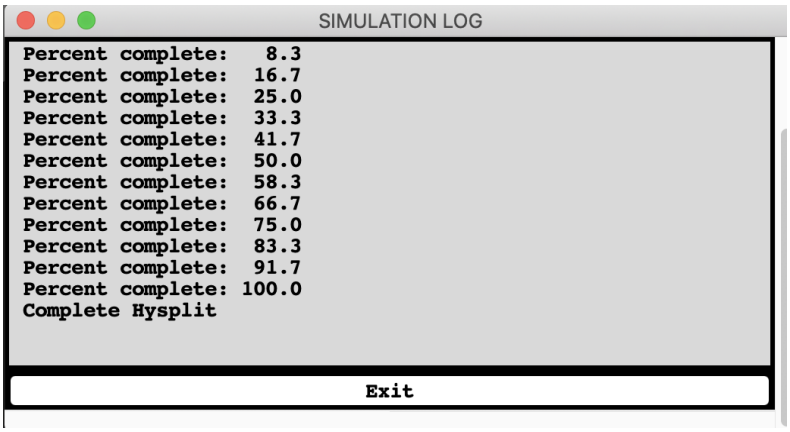


- If all is well, you should see the HYSPLIT Graphical User Interface (GUI) show up

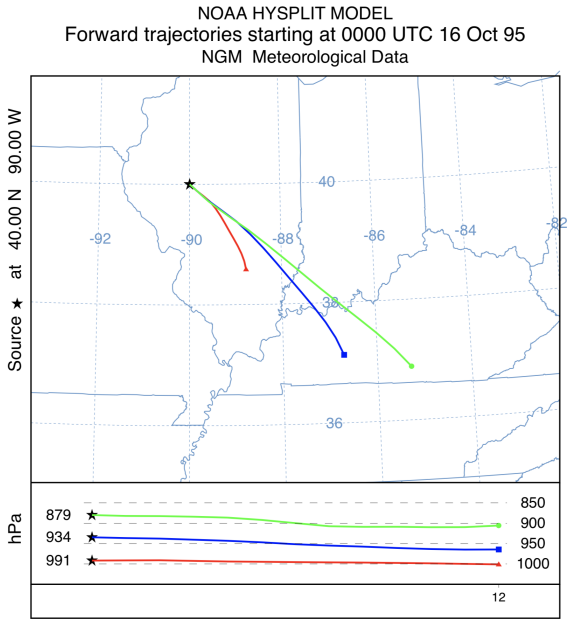
- Click *Menu*
- You should see 4 main tabs
    - Meteorology: set up background meteorology
    - Trajectory: follow a single particle as it moves through the wind field (passive transport = wind field not affected by particle)
    - Concentration: integrate many particles, to create mean (trajectory) and turbulent (dispersive) components to compute concentrations
    - Advanced: Modelling setup; edits namelist file SETUP.CFG

- Model workflow
    - Setup Run: configures simulation; produces file “default_traj” or “default_conc”
    - Model Run: runs the model; copies the “default_” file above to a file named “CONTROL” which is read by the model executable (similar to aermod.inp for AERMOD)
    - Display: read model output and produce a Postscript graphics file

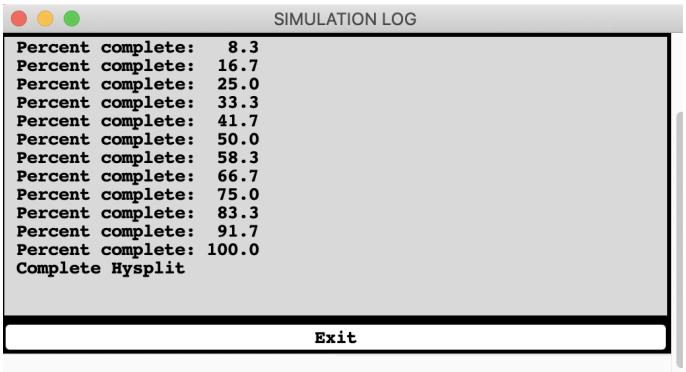
- Trajectory test
    - *Trajectory* > *Setup Run* > *Save*, to accept default configuration and set up the model
    - *Trajectory* > *Run Model*. The model will execute. You should see:



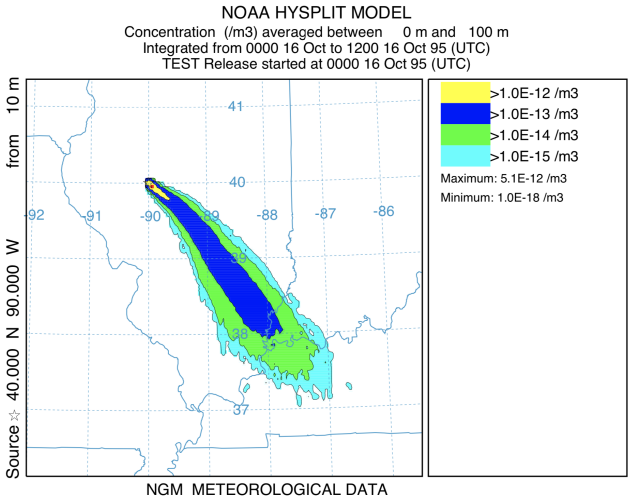
- Click *Exit* on the simulation log. Then from the menu go to *Trajectory* > *Display* > *Trajectory*; hit *Execute Display* at the bottom. A .ps graphic will be produced, and pop up right away.
- You should see:



- Concentration test
  - *Concentration* > *Setup Run* > *Save*, to accept default configuration and set up the model
  - *Concentration* > *Run Model*. The model will execute. You should see:



- Click *Exit* on the simulation log. Then from the menu go to *Concentration* > *Display* > *Concentration* > *Contours*; hit *Execute Display* at the bottom. A .ps graphic will be produced, and pop up right away.
- You should see:

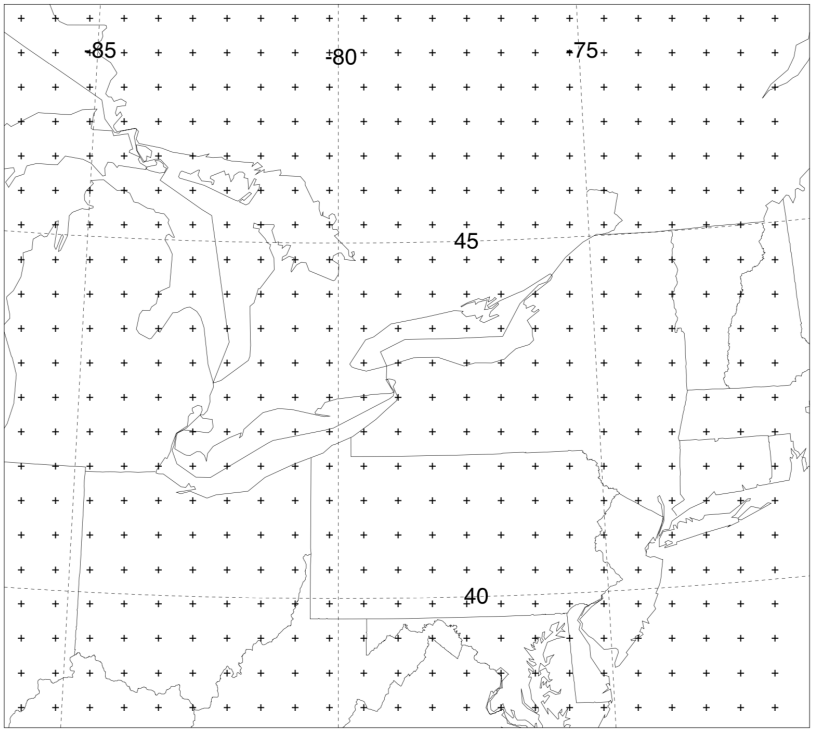


- If you **`ls ~/hysplit/working`** directory, you should see all of the files you just created

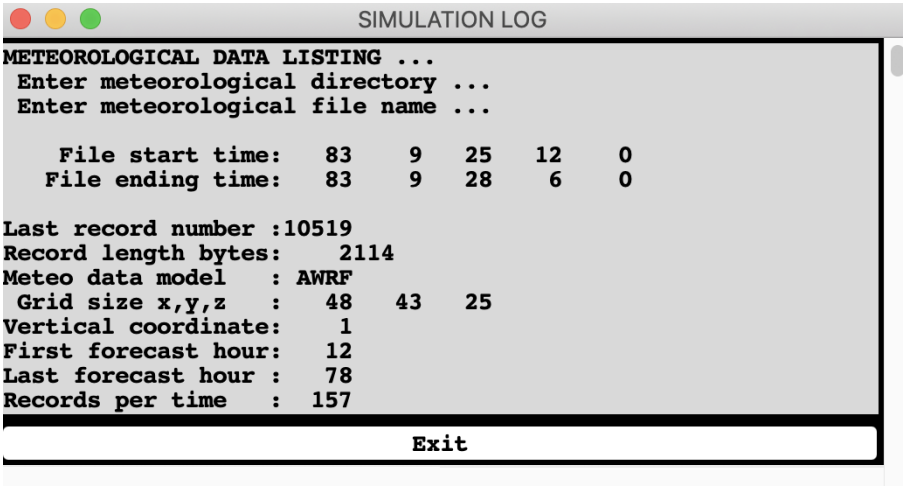
```
ASCDATA.CFG          TRAJ.CFG          concplot.ps       default_ftp       icon63.png        plants.txt        trajplot.ps
CONC.CFG             VMSDIST           concplot.sh       default_tplot     oct1618.BIN       redball.png
CONTROL              WARNING           default_conc      default_traj      oct1718.BIN       sample_conc
MESSAGE              blueball.png      default_cplot     greenball.png     particle.png      sample_traj
Readme_working.txt   cdump             default_exec      hysplit.sh*       particlelegend.png tdump
```

- Meteorology test

- Download sample CAPTEX (27-km WRF binary) file and place into your working directory:
  - **`cd ~/hysplit/working`**
  - **`wget`** **`http://www.ready.noaa.gov/documents/Tutorial/captex/captex2_wrf27uw.bin`**
  - ^One line, of course
  - If wget doesn't work, then download by hand and place into ~/hysplit/working by drag and drop
- Visualize the domain by going back to the hysplit menu and *Meteorology > Display Data > Grid Domain.* Click *Set File Name of ARL format Data* and select captex2_wrf27uw
- Click *Create Map,* and you should see:



- To see the details of the domain, *Meteorology > Display Data > Check File*, set the file name as captex2_wrf27uw, then *Run File Program*
- You should see the details of the file as:



Install + GUI HYSPLIT (Win Registered, V5.1.0)

- (Thanks Reagan!)

Step 1: Download Graphical Utilities

More information on the graphical utilities can be found on the hysplit download page, but a summary of their install is provided here.
https://www.ready.noaa.gov/HYSPLIT.php

1. **Tcl/Tk GUI interface**

   This software allows hysplit to run as a GUI on windows.

   Click the link below to download the interface.

   https://www.ready.noaa.gov/data/web/models/hysplit4/trial/tcl.zip

   Unzip the folder and move to your C drive so the path is **C:\tcl**

2. **GhostScript Editor**

   In order to view the graphics you create in hysplit. This program must be downloaded.

   You can download it via this link (32 bit):

   https://github.com/ArtifexSoftware/ghostpdl-downloads/releases/download/gs9550/gs9550w32.exe

   or you can look for other options here.

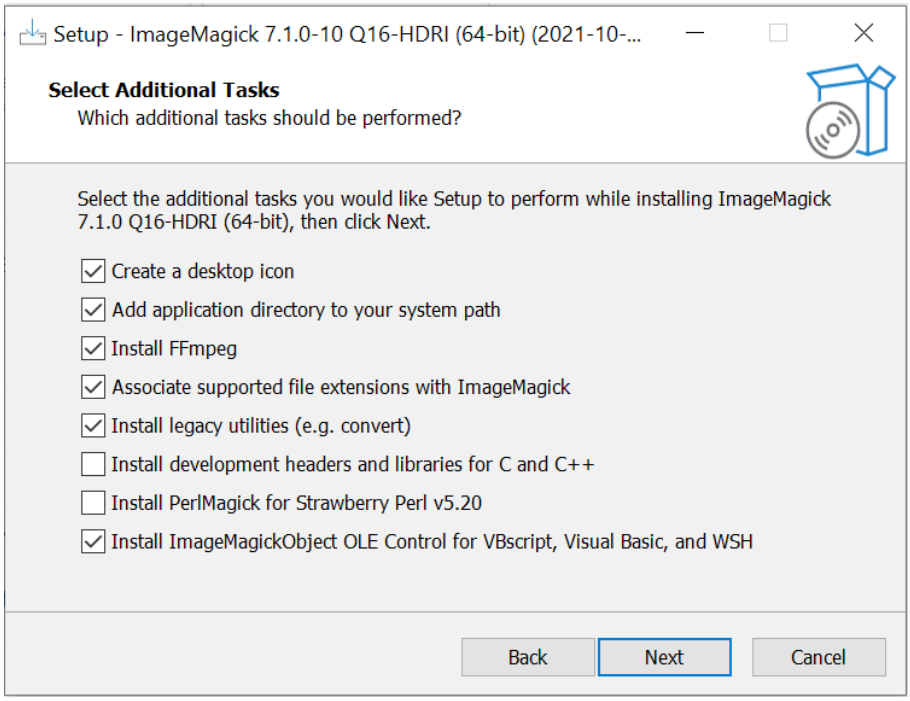
   https://ghostscript.com/releases/index.html

3. **ImageMagick**

   You can download the program using this link:

   https://download.imagemagick.org/ImageMagick/download/binaries/ImageMagick-7.1.0-10-Q16-HDRI-x64-dll.exe

   Install the software to the suggested default directory, but when prompted for additional tasks check the box to **Install Legacy Utilities**.

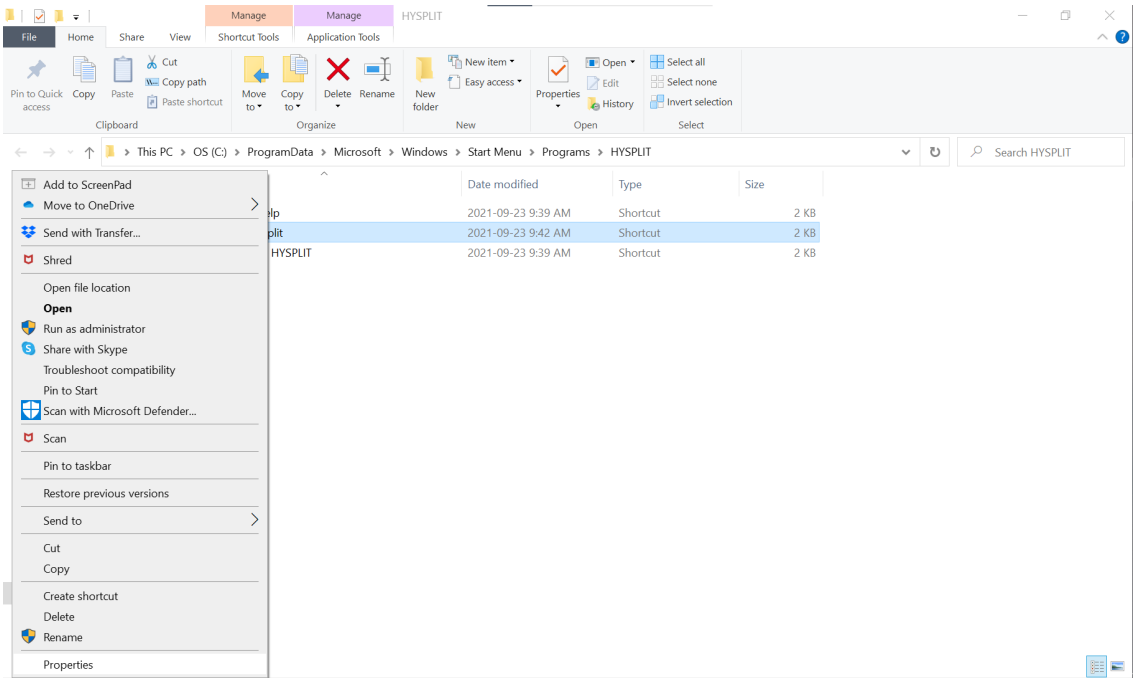


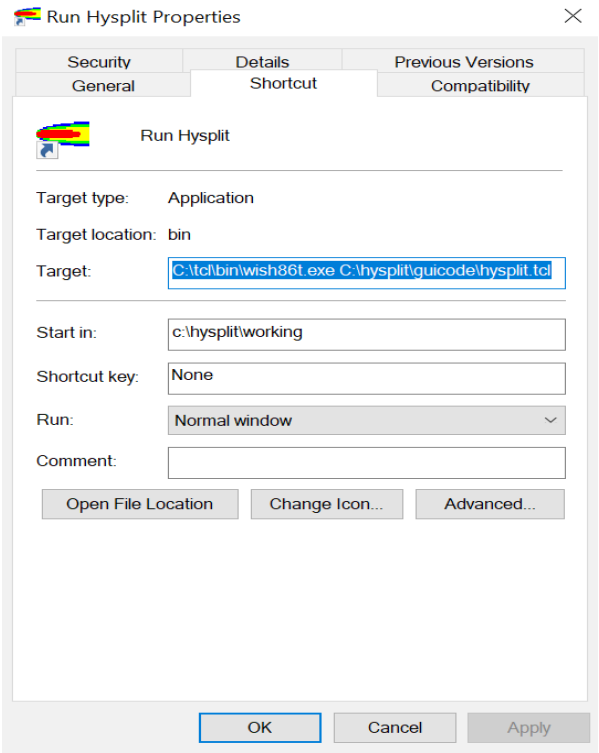
Step 2: Download Hysplit

Enter your email address at this link, and log in:
https://www.ready.noaa.gov/hyreg/HYSPLIT_pchysplit.php

You will then be sent to a page with the Windows downloads for hysplit. Use the first link if you can. Otherwise follow the instructions for the second option.

Once hysplit has been downloaded, right click on the *RUN HYSPLIT* shortcut and click *Properties.* In the target field, add **C:\tcl\bin\wish86t.exe** *before* the other paths.





Step 3: Test HYSPLIT GUI

Follow the instructions in the Mac section above to do the test run.

Install + GUI HYSPLIT (Linux Registered, V5.1.0)

- Enter your email address at this link, and log in: https://www.ready.noaa.gov/hyreg/HYSPLIT_linux.php

- Download and open the .tar.gz that MATCHES the OS of your system, and place into your home directory
    - If you're working on a personal laptop, it's probably the Ubuntu version: hysplit.v5.1.0_UbuntuOS20.04.2LTS.tar.gz
    - If you're working on a server, it's probably one of the RedHat/CentOS versions
    - Move it to your home directory, and unzip
        - **`mv <path_to_downloaded_tar.gz> ~`**
        - **`tar -xvzf <name_of_tar.gz>`**

- Rename the output directory to hysplit, e.g.
    - **`mv hysplit.v5.1.0_CentOS7.9.2009 hysplit`** (cmd line)
    - Or can just rename in your finder window

- The Linux build of HYSPLIT uses shared libraries, not static...meaning that you need to have all the libraries (i.e. C, Fortran) already installed and in your paths
    - **`export PATH=/path/to/gcc_and_gfortran/bin:$PATH`**
    - **`export LD_LIBRARY_PATH=/path/to/gcc_and_gfortran/lib`** OR **`lib64`**)

- Go into the guicode directory
  - **`cd hysplit/guicode`**

- Run hysplit.tcl
  - **`./hysplit.tcl`**

- You should now see the GUI menu as shown in the Mac section above; follow the guide to continue with the tutorial

- Should you have trouble with running HYSPLIT, or come across errors in relation to missing libraries...well, make sure they're all there!
  - https://www.ready.noaa.gov/data/web/models/hysplit4/linux//README_external_libraries.txt
  - Also: https://www.ready.noaa.gov/documents/Tutorial/html/install_unix.html
  - In particular: "The graphical user interface requires Tcl/Tk. The native graphical format for HYSPLIT is Postscript, which can be viewed using Ghostscript. Postscript graphics are converted to other formats using ImageMagick. If not already available on your system, they may be easily installed using **`yum`**, **`apt`**, or **`brew`**. For some systems, just entering one of the commands, for instance **`wish`** for Tcl, **`gs`** for Ghostscript, or **`convert`** for ImageMagick will prompt the system to download and install the required libraries and software."

- Should you continue to have trouble, you could try logging into a shared server, or onto Compute Canada

- Compute Canada Instructions (Cedar)
  - Copy over the .tar.gz to Cedar (note: Cedar is on CentOS 7)
    - **`scp <path_to_hysplit.v5.1.0_CentOS7.9.2009.tar.gz> <username>@cedar.computecanada.ca:~`**
  - Login to Cedar using passwordless X11 forwarding
    - **`ssh -Y <username>@cedar.computecanada.ca`**

- Rename the output directory to hysplit, e.g.
  - **`mv hysplit.v5.1.0_CentOS7.9.2009 hysplit`**

- Go into the guicode directory
  - **`cd hysplit/guicode`**

- Run hysplit.tcl
  - **`./hysplit.tcl`**

- You should now see the GUI menu as shown in the Mac section above; follow the guide in that section to continue with the tutorial

Command Line HYSPLIT (Mac/Linux)

- Download the Tutorial files and unzip
  - **`cd ~/hysplit`**
  - **`wget`** **`https://www.ready.noaa.gov/data/web/workshop/2021/Tutorial.zip`**
    - Note: Tutorial.zip is 1.75 GB; when unzipped it's 3.2 GB
  - **`unzip Tutorial.zip`**

- Go into the Tutorial directory
  - **`cd Tutorial`**

- The test scripts are in Tutorial/batch; the converted meteorological binary files are in Tutorial/captex (for use in more advanced tutorials)

- Go into the batch directory
  - **`cd batch`**
  - **`ls`**

- You'll see a bunch of .bat files, i.e. batch scripts for Windows. For Linux/Mac users...we know the drill now, don't we?

- We want to do the concentration test run, so we'll be editing from test_conc.bat

- First, change permissions
  - **`chmod 755 test_conc.bat`**

- Copy to a shell script, test_conc.sh
  - **`cp test_conc.bat test_conc.sh`**

- Edit the script test_conc.sh with vim (or your favourite editor)
  - **`vi test_conc.sh`**
  - May or may not need to convert to Unix format with **`:set ff=unix`**
  - For your convenience you can just copy in the edited script after the following screenshots

```
#!/bin/bash

# ------------------------------------------------

export DIR=~
export PGM="$DIR/hysplit"
cd "$PGM/working"

# ------------------------------------------------

if [[ -f ASCDATA.CFG ]]; then rm ASCDATA.CFG; fi

echo -90.0   -180.0  lat/lon of lower left corner   >ASCDATA.CFG
echo 1.0     1.0     lat/lon spacing in degrees    >>ASCDATA.CFG
echo 180     360     lat/lon number of data points >>ASCDATA.CFG
echo 2               default land use category     >>ASCDATA.CFG
echo 0.2             default roughness length "(m)"  >>ASCDATA.CFG
echo "$PGM/bdyfiles/"  directory of files         >>ASCDATA.CFG

# ------------------------------------------------

echo 95 10 16 00             >CONTROL
echo 1                      >>CONTROL
echo 40.0 -90.0 10.0        >>CONTROL
echo 12                     >>CONTROL
echo 0                      >>CONTROL
echo 10000.0               >>CONTROL
echo 1                      >>CONTROL
echo "$PGM/working/"         >>CONTROL
echo "oct1618.BIN"      >>CONTROL
echo 1                      >>CONTROL
echo "TEST"                   >>CONTROL
echo 1.0                    >>CONTROL
echo 1.0                    >>CONTROL
echo 00 00 00 00 00         >>CONTROL
echo 1                      >>CONTROL
echo 0.0 0.0                >>CONTROL
echo 0.05 0.05              >>CONTROL
echo 30.0 30.0              >>CONTROL
```

```
40 echo "./"                    >>CONTROL
41 echo "cdump"                 >>CONTROL
42 echo 1                      >>CONTROL
43 echo 100                    >>CONTROL
44 echo 00 00 00 00 00         >>CONTROL
45 echo 00 00 00 00 00         >>CONTROL
46 echo 00 12 00               >>CONTROL
47 echo 1                      >>CONTROL
48 echo 0.0 0.0 0.0            >>CONTROL
49 echo 0.0 0.0 0.0 0.0 0.0    >>CONTROL
50 echo 0.0 0.0 0.0            >>CONTROL
51 echo 0.0                    >>CONTROL
52 echo 0.0                    >>CONTROL
53
54 # ---------------------------------------------
55
56 if [[ -f cdump ]]; then rm cdump; fi
57 if [[ -f SETUP.CFG ]]; then rm SETUP.CFG; fi
58
59 $PGM/exec/hycs_std
60
61 echo ---------------------------------------------
62
63 echo 'TITLE^&','### %0 ### ^&' >LABELS.CFG
64 $PGM/exec/concplot -icdump -c50 -j$PGM/graphics/arlmap
65
66 open concplot.ps
```

#!/bin/bash

 # --

export DIR=~
export PGM="$DIR/hysplit"
cd "$PGM/working"

 # --

if [[-f ASCDATA.CFG]]; then rm ASCDATA.CFG; fi

echo -90.0 -180.0 lat/lon of lower left corner >ASCDATA.CFG
echo 1.0 1.0 lat/lon spacing in degrees >>ASCDATA.CFG
echo 180 360 lat/lon number of data points >>ASCDATA.CFG
echo 2 default land use category >>ASCDATA.CFG
echo 0.2 default roughness length "(m)" >>ASCDATA.CFG

```
echo "$PGM/bdyfiles/"  directory of files          >>ASCDATA.CFG

# -------------------------------------------

echo 95 10 16 00          >CONTROL
echo 1                    >>CONTROL
echo 40.0 -90.0 10.0      >>CONTROL
echo 12                   >>CONTROL
echo 0                    >>CONTROL
echo 10000.0              >>CONTROL
echo 1                    >>CONTROL
echo "$PGM/working/"      >>CONTROL
echo "oct1618.BIN"        >>CONTROL
echo 1                    >>CONTROL
echo "TEST"               >>CONTROL
echo 1.0                  >>CONTROL
echo 1.0                  >>CONTROL
echo 00 00 00 00 00       >>CONTROL
echo 1                    >>CONTROL
echo 0.0 0.0              >>CONTROL
echo 0.05 0.05            >>CONTROL
echo 30.0 30.0            >>CONTROL
echo "./"                 >>CONTROL
echo "cdump"              >>CONTROL
echo 1                    >>CONTROL
echo 100                  >>CONTROL
echo 00 00 00 00 00       >>CONTROL
echo 00 00 00 00 00       >>CONTROL
echo 00 12 00             >>CONTROL
echo 1                    >>CONTROL
echo 0.0 0.0 0.0          >>CONTROL
echo 0.0 0.0 0.0 0.0 0.0  >>CONTROL
echo 0.0 0.0 0.0          >>CONTROL
echo 0.0                  >>CONTROL
echo 0.0                  >>CONTROL
```

 # --

if [[-f cdump]]; then rm cdump; fi
if [[-f SETUP.CFG]]; then rm SETUP.CFG; fi

$PGM/exec/hycs_std

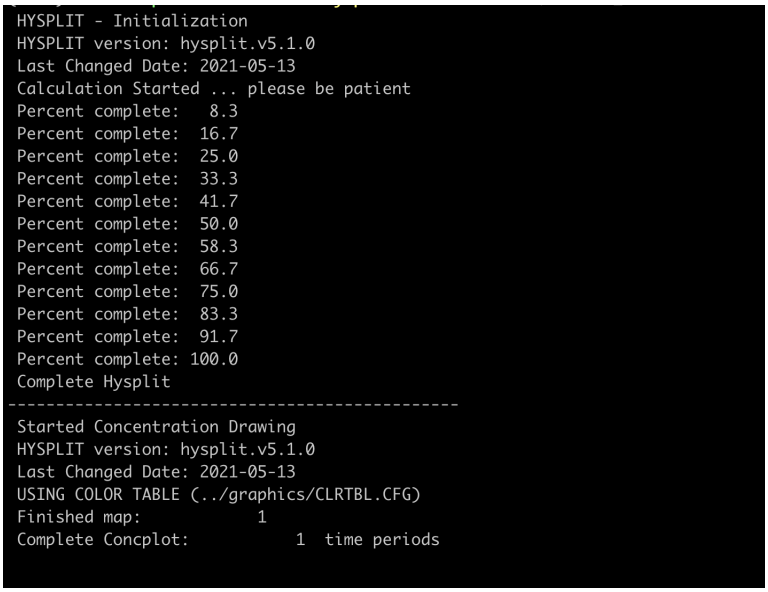
echo --

echo 'TITLE^&','### %0 ### ^&' >LABELS.CFG
$PGM/exec/concplot -icdump -c50 -j$PGM/graphics/arlmap

open concplot.ps

- Run the script
  - `./test_conc.sh`

- If you did this right, you should see:



- ...and the conc plot should also be displayed (should look familiar):