# 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: <u>https://www.ready.noaa.gov/HYSPLIT.php</u>
- Full HYSPLIT user's guide: <u>https://www.ready.noaa.gov/hysplitusersguide/</u>
- HYSPLIT tutorial: <u>https://www.ready.noaa.gov/documents/Tutorial/html/index.html</u>
- If you need the Linux installation, or the registered Windows or Mac versions, you need to first register at: <u>https://www.ready.noaa.gov/HYSPLIT\_register.php</u>
  - Note: will need official UBC letterhead, and several days before response
- Unregistered (trial) Windows and Mac installations do not require registration

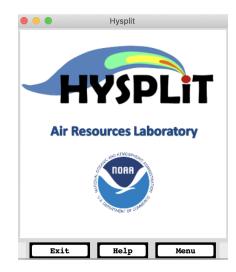
### Install + GUI HYSPLIT (Mac Registered, V5.1.0)

 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: <u>https://www.ready.noaa.gov/hyreg/HYSPLIT\_machysplit.php</u>
- 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
  - $\circ$  You may need to allow your system to recognize that it's safe
  - System Preferences > Security & Privacy, and Open Anyway

•••		Security & Privacy	Q Search
	Orment	FileVault Firewall Privacy	
	General	FileVault Firewall Privacy	
	A login password has been set	t for this user Change Password	)
		minutes 🛛 🛟 after sleep or screen sa	
			age
	Allow apps downloaded from:		
	"hysplit.sh" was blocked from identified developer.	opening because it is not from an	Open Anyway
CI	ick the lock to make changes.		Advanced

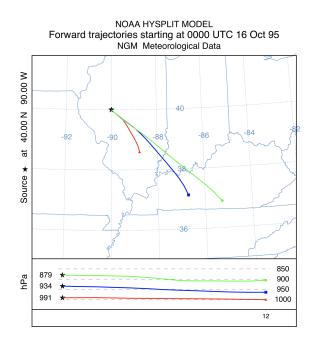
• If all is well, you should see the HYSPLIT Graphical User Interface (GUI) show up



- 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:

Percent complete:	8.3	
Percent complete:	16.7	
Percent complete:	25.0	
Percent complete:	33.3	
Percent complete:	41.7	
Percent complete:	50.0	
Percent complete:	58.3	
Percent complete:	66.7	
Percent complete:	75.0	
Percent complete:	83.3	
Percent complete:		
Percent complete:	100.0	
Complete Hysplit		
		Exit

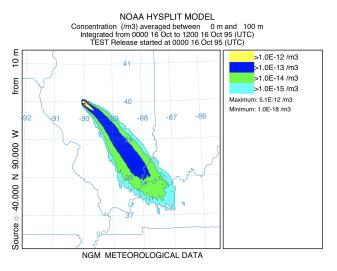
- Click *Exit* on the simulation log. Then from the menu go to *Trajectory* > *Display* > *Trajectory*; hit *Execute Display* at the bottom. A .ps
   graphic will be produced, and pop up right away.
- $\circ$  You should see:



- 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:

Percent complete:	8.3	
Percent complete:	16.7	
Percent complete:	25.0	
Percent complete:	33.3	
Percent complete:	41.7	
Percent complete:	50.0	
Percent complete:	58.3	
Percent complete:	66.7	
Percent complete:		
Percent complete:	83.3	
Percent complete:	91.7	
Percent complete:	100.0	
Complete Hysplit		
		Exit

- 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:

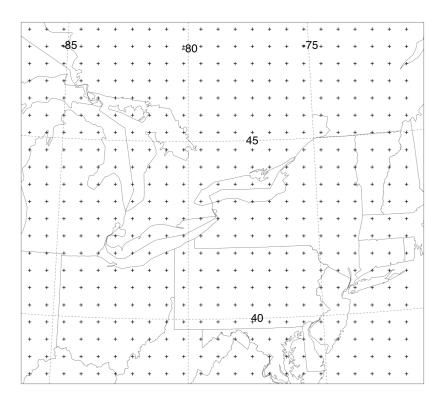


• If you **ls** ~/hysplit/working directory, you should see all of the files you just created

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
    <u>http://www.ready.noaa.gov/documents/Tutori</u>
    <u>al/captex/captex2\_wrf27uw.bin</u>
  - ^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:

	S	SIMULA	TION L	.OG		
METEOROLOGICAL DATA L						
Enter meteorological						
Enter meteorological	file	name	•••			
File start time:	83	9	25	12	0	
File ending time:	83	9	28	6	0	
Last record number :1	0519					
Record length bytes:	21	14				
Meteo data model : 2						
Grid size x,y,z :	48	43	25			
Vertical coordinate:						
First forecast hour:	12					
Last forecast hour :	78					
Records per time :	157					
		Ex	it			

### 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/dow nload/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/I mageMagick-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** <u>Utilities</u>.

占 Setup - ImageMagick 7.1.0-10 Q16-HDRI (64-b	oit) (2021-1	0 —		×
Select Additional Tasks Which additional tasks should be performed?				(LION)
Select the additional tasks you would like Setup to 7.1.0 Q16-HDRI (64-bit), then click Next.	perform w	hile installing	ImageMag	ick
✓ Create a desktop icon				
✓ Add application directory to your system path				
✓ Install FFmpeg				
Associate supported file extensions with Imag	eMagick			
✓ Install legacy utilities (e.g. convert)				
Install development headers and libraries for 0	Cand C++			
Install PerlMagick for Strawberry Perl v5.20				
✓ Install ImageMagickObject OLE Control for VB	script, Visu	al Basic, and V	WSH	
	Back	Next	Ca	ancel

#### Step 2: Download Hysplit

Enter your email address at this link, and log in: <a href="https://www.ready.noaa.gov/hyreg/HYSPLIT">https://www.ready.noaa.gov/hyreg/HYSPLIT</a> 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.

← → C 🔒 https://www.ready.noaa.gov/hyreg-bin/gethysplit.pl	☆		*	R	Update	: :)
Click on the following link to download the installation file:						
HYSPLIT_win64R_v5.1.0.exe (64-bit registered version 5.1.0 - May 2021)						
HYSPLIT win64R v5.1.0.zip (64-bit registered version 5.1.0 - May 2021). Unzip the file and move the HYSPLIT folder and everything therein to the have directories C:HYSPLITexec, C:HYSPLITworking, and others. Then create the "Run Hysplit" shortcut on your desktop. To create the shortcut, or navigate to the C:HYSPLITguicode directory. Right-click the hysplit.tcl file and then choose "Send To > Desktop (Create shortcut)." Rename the create	pen W	Vindov	vs Ex	xplore	er and	
The 32-bit is <b>no longer supported</b> , however the last supported version can be found at the following link: <u>HYSPLIT_win32R.exe</u> (32-bit version 854 - April 2017)						

Return to the HYSPLIT web page

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.

to •	to •	Rename New folder		Properties •	📝 Edit 🔁	Select none						
	Organize		New	Ор		Select				-	0	
(C:) > Prog	ramData > Micr	osoft > Windows				11			~	U		
>												
	HYSPLIT		2021-09-23	9:39 AM	Shor	tcut	2 K	В				
>>												
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C. ICH	birtwishoot.	exe C.myspi	nguicode	a iyspiit.t								
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#### 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: <u>https://www.ready.noaa.gov/hyreg/HYSPLIT\_linux.php</u>
- 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.
  - o 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
  - o export PATH=/path/to/gcc\_and\_gfortran/bin:\$PATH
  - o export LD\_LIBRARY\_PATH=/path/to/gcc\_and\_gfortran/lib OR lib64)

• Go into the guicode directory

o cd hysplit/guicode

- Run hysplit.tcl
  - o ./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!
  - <u>https://www.ready.noaa.gov/data/web/models/hysplit4/linux//READM</u> <u>E\_external\_libraries.txt</u>
  - Also: <u>https://www.ready.noaa.gov/documents/Tutorial/html/install\_unix.htm</u> <u>l</u>
  - In particular: "The graphical user interface requires <u>Tcl/Tk</u>. The native graphical format for HYSPLIT is Postscript, which can be viewed using <u>Ghostscript</u>. Postscript graphics are converted to other formats using <u>ImageMagick</u>. 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
  - o cd ~/hysplit
  - o wget

https://www.ready.noaa.gov/data/web/workshop/20 21/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
  - o 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
  - o chmod 755 test\_conc.bat
- Copy to a shell script, test\_conc.sh
  - o 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
 3 # --
 5 export DIR=~
 6 export PGM="$DIR/hysplit"
 7 cd "$PGM/working"
11 if [[ -f ASCDATA.CFG ]]; then rm ASCDATA.CFG; fi
13 echo -90.0
                 -180.0 lat/lon of lower left corner >ASCDATA.CFG
                          lat/lon spacing in degrees >>ASCDATA.CFG
lat/lon number of data points >>ASCDATA.CFG
14 echo 1.0
                 1.0
15 echo 180
                 360
                          default land use category >>ASCDATA.CFG
default roughness length "(m)" >>ASCDATA.CFG
16 echo 2
17 echo 0.2
18 echo "$PGM/bdyfiles/" directory of files
                                                          >>ASCDATA.CFG
20 # -----
22 echo 95 10 16 00
                                   CONTROL
23 echo 1
                                  >>CONTROL
24 echo 40.0 -90.0 10.0
                                  >>CONTROL
25 echo 12
                                  >>CONTROL
26 echo 0
                                  >>CONTROL
27 echo 10000.0
                                 >>CONTROL
28 echo 1
                                  >>CONTROL
29 echo "$PGM/working/"
30 echo "oct1618.BIN"
                                   >>CONTROL
                              >>CONTROL
31 echo 1
                                  >>CONTROL
32 echo "TEST"
                                    >>CONTROL
33 echo 1.0
                                  >>CONTROL
34 echo 1.0
                                  >>CONTROL
35 echo 00 00 00 00 00
                                  >>CONTROL
36 echo 1
                                  >>CONTROL
37 echo 0.0 0.0
                                  >>CONTROL
38 echo 0.05 0.05
                                  >>CONTROL
39 echo 30.0 30.0
                                  >>CONTROL
```

```
>>CONTROL
>>CONTROL
40 echo "./"
41 echo "cdump"
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
54 # -----
56 if [[ -f cdump ]]; then rm cdump; fi
57 if [[ -f SETUP.CFG ]]; then rm SETUP.CFG; fi
59 $PGM/exec/hycs_std
61 echo -----
63 echo 'TITLE^&','### %0 ### ^&' >LABELS.CFG
64 $PGM/exec/concplot -icdump -c50 -j$PGM/graphics/arlmap
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 00 >>CONTROL echo 00 12 00 >>CONTROL >>CONTROL echo 1 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 >>CONTROL echo 0.0 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
  - o ./test\_conc.sh
- If you did this right, you should see:

HYSPLIT - Initialization
HYSPLIT version: hysplit.v5.1.0
Last Changed Date: 2021-05-13
Calculation Started please be patient
Percent complete: 8.3
Percent complete: 16.7
Percent complete: 25.0
Percent complete: 33.3
Percent complete: 41.7
Percent complete: 50.0
Percent complete: 58.3
Percent complete: 66.7
Percent complete: 75.0
Percent complete: 83.3
Percent complete: 91.7
Percent complete: 100.0
Complete Hysplit
Started Concentration Drawing
HYSPLIT version: hysplit.v5.1.0
Last Changed Date: 2021-05-13
USING COLOR TABLE (/graphics/CLRTBL.CFG)
Finished map: 1
Complete Concplot: 1 time periods

