

Identifying the Dust Sources Using the Backward Trajectory Model

Ishaq Dimeji Sulaymon, *PhD*

WMO Sand and Dust Storm Warning Regional Center
SDS-WAS Node GCC
Jeddah, KSA

idsulaymon@ncm.gov.sa; sulaymondimeji@ymail.com

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INTRODUCTION

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HYSPLIT Model: Theory and Practice

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Definition

HYSPLIT: The HYbrid Single-Particle Lagrangian Integrated Trajectory model.

Backward trajectory analysis is used to determine the origin/source of air masses and establish source receptor relationships.

Why using the HYSPLIT model for Backward Trajectory?

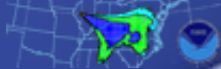
1. It is used to simulate air mass trajectories.
2. To classify trajectories with similar geographic origins.
3. To investigate the influence of long-range regional/trans-border transport of air pollutants from neighboring cities/regions into the study areas.



- ❑ **How to use the HYSPLIT Model for Trajectory analysis**

- ❑ **Can be used in several ways:**
 - Via the web (online version)
 - On the computer:
 - From a GUI on the computer
 - From the command line on the computer
 - Using batch files and scripts on the computer

- ❑ **Special Research Versions** – two examples are:
 - HYSPLIT-SV (semivolatiles), e.g., Dioxin, PCB's
 - HYSPLIT-HG (mercury)



Model Installation

The following optional, but highly suggested, programs should be installed prior to installing the registered version of HYSPLIT. The trial version already includes Tcl/Tk, Ghostscript, and Info-Zip and, therefore, do not need to be reinstalled prior to installing the registered version over top of the trial version. Install all programs in the default directories to make HYSPLIT installation easier.

- ✔ Tcl/Tk - Although the model can also be run from a DOS window using a command line interface, it is easier for novice users to use the GUI menus provided with the installation. These GUI menus use the Tcl/Tk interpreter.
 - ✔ [Get Tcl/Tk 8.4.14](#)
 - ✔ [Tcl/Tk Website](#)

- ✔ Ghostscript/Ghostview - By default, HYSPLIT creates high-resolution, publication quality graphics in PostScript format. These can be printed directly on any PostScript printer or viewed on the standard PC display and printed on any printer (even non-Postscript) if Ghostscript has been installed.
 - ✔ [Get Ghostscript 8.13](#)
 - ✔ [Get Ghostview 4.6](#)
 - ✔ [Ghostscript Website](#)

- ✔ ImageMagick - One feature of the GUI is the ability to convert the Postscript graphics output file to other graphical formats. This capability is enabled through the installation of ImageMagick, which requires the prior installation of Ghostscript.
 - ✔ [Get ImageMagick 6.3](#)
 - ✔ [ImageMagick Website](#)

HYSPPLIT self-installing executables

Two versions of PC HYSPPLIT are available and can be downloaded from the HYSPPLIT website (www.ready.noaa.gov/HYSPPLIT.php). (An Apple version is also available on the website, however this workshop will use the PC version). It is recommended that HYSPPLIT be installed in the C:\hysplit4 directory, however it can be installed in other locations. This document will assume HYSPPLIT is installed in the C:\hysplit4 directory.

- ☑ [setup48U.exe](#) - (61 Mb) – trial version, does not support forecast data, no registration required
- ☑ [setup48R.exe](#) - (21 Mb) – registered version, requires web site registration to download

The following sub-directories will be installed with a proper installation of HYSPPLIT:

arcview	– information on ESRI shapefiles
bdyfiles	– surface height, land-use, and roughness length files
browser	– custom tcl scripts to support the GUI help browser interface
cluster	– scripts and files to create trajectory cluster analysis
concmdl	– scripts and files to automate and customize concentration simulations
csource	– dll files required for the particle viewer & editor
data2arl	– programs to convert meteorological data to the HYSPPLIT format
document	– most recent version of the technical documents and User's Guide
exec	– all executables can be found in this directory
gisprog	– programs to convert text files to shapefiles
grads	– source code to convert HYSPPLIT output and meteorological data to grads
graphics	– map backgrounds and map customization files
guicode	– tcl scripts required to run the GUI
html	– help files
metdata	– sample meteorological data file and program to read the data
source	– subroutines to compile the meteorological data conversion programs
trajmdl	– sample scripts and files to customize trajectory simulations
cluster	– scripts and files to create trajectory cluster analysis
uninstall	– programs to uninstall HYSPPLIT
utilities	– graphical display utilities
vis5d	– scripts and files to create VIS5D output
working	– output written here; sample CONTROL files

The meteorological data (e.g. GDAS 2.5 degree global reanalysis) can be downloaded from:

☑ <ftp://arlftp.arlhq.noaa.gov>

These files can be downloaded to any directory, however it will be easier to find them if they reside in the hysplit4/working directory.

Requirements

A trajectory or concentration simulation only requires one file called **CONTROL**, which defines various model parameters and other input and output files. An optional file called **SETUP.CFG** may be present to define more advanced simulation features. The Graphical User Interface (GUI) provides a user-friendly way to create these files, set any other command line options that some of the post-processing graphics programs may require, and run HYSPLIT and associated programs. Alternatively, the **CONTROL** and **SETUP.CFG** files can be created with any text editor, such as Notepad, and then HYSPLIT and its associated programs can be run from the DOS command line.

Starting the model from the GUI

After a successful install, the PC desktop should contain a HYSPLIT shortcut with the following properties:



Target: \hysplit4\guicode\hysplit4.tcl

Start in: \hysplit4\working

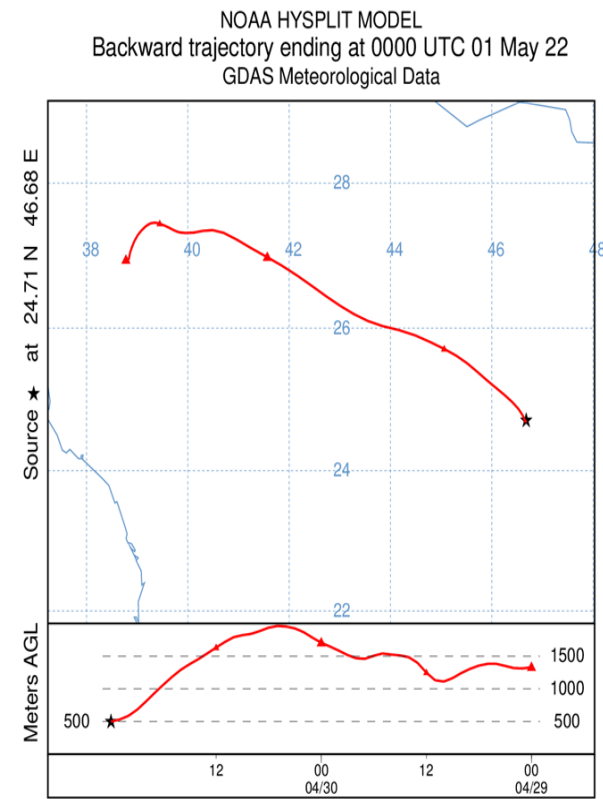
The HYSPLIT “Start in” directory contains sample **CONTROL** files that can be used for initial guidance to set up more complex simulations. These can be loaded into the GUI from the **Retrieve** menu tab under the **Trajectory Setup** or **Concentration Setup** menus. Examples include:

- ☑ sample_conc - concentration simulation example from users guide
- ☑ sample_traj - trajectory simulation example from users guide
- ☑ back_conc - backward dispersion simulation for concentration
- ☑ back_traj - backward trajectory simulation

Trajectory Model Analysis

Steps to run the sample trajectory case provided with the default installation of PC HYSPLIT

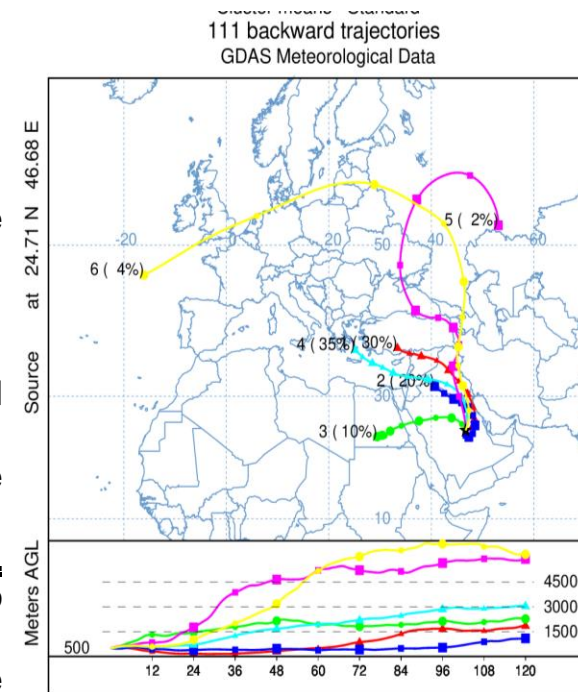
- ☑ Start the model by double-clicking the HYSPLIT icon on the desktop.
- ☑ Click on the green **Menu** button at the bottom of the first screen.
- ☑ Click on the **Trajectory** menu tab and choose **Trajectory Setup**.
- ☑ Click on the **Retrieve** button at the bottom of the menu.
- ☑ Click the **Browse** button and find the file **riyadh_control_traj.txt** in the working directory.
- ☑ Click **OK**.
- ☑ Click **Save** to save the configuration settings.
- ☑ Click on the **Trajectory** menu tab and choose **Run Standard Model**.
(Note: if a menu pops up says that a SETUP.CFG namelist file was found, choose **Delete and Run**)
- ☑ When the model is complete (**Complete Hysplit** is shown), click on the **Exit** button.
- ☑ Click on the **Trajectory** menu tab and choose **Display Options** and then **Trajectory**.
- ☑ Click on the **Execute Display** button to display the trajectory in the GSview viewer.

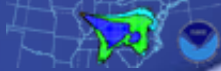


Trajectory Cluster Analysis

Follow these steps to run the sample trajectory case provided with the default installation of PC HYSPLIT

- ✔ Start the model by double-clicking the HYSPLIT icon on the desktop.
- ✔ Click on the green **Menu** button at the bottom of the first screen.
- ✔ Click on the **Trajectory** menu tab and choose **Setup Run**.
- ✔ Click on the **Retrieve** button at the bottom of the menu.
- ✔ Click the **Browse** button and find the file **riyadh_control_traj.txt** in the working directory.
- ✔ Click **OK**.
- ✔ Click **Save** to save the configuration settings.
- ✔ Click on the **Trajectory** menu tab, choose **Special Runs, Daily**, and click on the **Execute Script**.
- ✔ When the model is complete (**Complete Hysplit** is shown), click on the **Exit** button.
- ✔ Click on the **Trajectory** menu tab and choose **Display** and **Frequency**. Then, click on **Create file of trajectory filenames**. Check the INFILE to remove any unwanted text
- ✔ Click on the **Execute Display** button to display the trajectory in the GSview viewer.
- ✔ Click on the **Trajectory** menu tab, choose **Special Runs, Clustering**, and **Standard**.





- At times, the HYSPLIT GUI's may become confused if the user enters information and then cancels those inputs prior to running the model. If this occurs, or if any problems prevent the model from yielding the expected results, exit the model GUI and restart.



THANKS FOR LISTENING

