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Configuring a Graphical User Interface for Managing Local HYSPLIT Model Runs through AWIPS

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PRIMARY OBJECTIVES:

Develop a Graphical User Interface (GUI) that allows forecasters to manage the local HYSPLIT for both routine and emergency use. The interface allows forecasters to quickly determine the current HYSPLIT configuration for a list of predefined sites (e.g., fixed sites and floating sites), and to make any necessary adjustments to key parameters such as Input Model, Number of Forecast Hours, etc. This will help NWS MLB forecasters improve efficiency and reduce human error when running HYSPLIT in support of an incident involving toxic substances dispersed into the atmosphere. During emergencies, forecasters also have the ability to invoke playback options (e.g., low-altitude rocket mishap, nuclear power plant mishap, etc.) to assist them in optimizing certain parameter settings such as Emission Duration, Emission Rate, Emission Elevation, etc. The interface is written in Tool Command Language (Tcl) / Toolkit (Tk) making it AWIPS compatible and able to run within most LINUX and Windows operating systems.



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BACKGROUND

- Responding to incidents involving the release of harmful airborne pollutants is a continual challenge for Weather Forecast Offices in the National Weather Service. HYSPLIT guidance is generated for the purpose of obtaining useful trajectory and concentration forecasts associated with the significant release of harmful chemical gases, radiation, wildfire smoke, etc., into local the atmosphere.
- In previous work (Dreher, 2009), the AMU obtained and installed the latest version of HYSPLIT on a Linux system that ingests routine NCEP model products. The AMU also configured a utility program to convert WRF EMS output into HYSPLIT binary format for use in generating dispersion forecasts from a locally run mesoscale model. Several scripts were created to run a sequence of commands to generate HYSPLIT trajectory and concentration output on a routine schedule. The scripts reference parameter files for each product that contain the necessary trajectory and concentration HYSPLIT variables.
- Previously, forecasters had to manually change text configuration files before running a HYSPLIT trajectory forecast. Example of the NAM Parameter text file that a forecaster would manually edit.

```
# NAM Parameter file for NWS MLB HYSPLIT simulations
# General working/data directories
#####
working_dir=/home/jdreher/hysplit4_g95
nam_data_dir=/home/jdreher/hysplit4_g95/NAME/
nam_image_dir=/home/jdreher/hysplit4_g95/IMAGES/
hysplit_exe=/home/jdreher/hysplit4_g95/EXEC
map_files=/home/jdreher/hysplit4_g95/geoplots/floodmap

#####
# NWS MLB Trajectory parameters - BASIC CONTROL FILE
#####
traj_zoom=100 # zoom level of output postscript graphics
traj_year=00; traj_month=0; traj_day=00; traj_hour=00 # Keep these set to zero for current
num_traj_hour=1 # number of forecast hours to process
fhour_traj=03 ; fhour_traj2=06; fhour_traj3=09; fhour_traj4=12 # Forecast hours to launch

#####
# Number of active source locations
traj_source_number=5 # each source location is plotted on same output image
# Source locations - lat, lon, elevations (AGL)
traj_lat1=28.22; traj_lon1=-80.55; traj_elev1=10.
traj_lat2=28.48; traj_lon2=-80.22; traj_elev2=10.
traj_lat3=28.48; traj_lon3=-80.63; traj_elev3=10.
traj_lat4=28.18; traj_lon4=-80.32; traj_elev4=10.
traj_lat5=28.18; traj_lon5=-80.25; traj_elev5=10.
traj_lat6=27.65; traj_lon6=-80.42; traj_elev6=10.
traj_lat7=27.91; traj_lon7=-80.63; traj_elev7=10.
traj_lat8=27.45; traj_lon8=-80.42; traj_elev8=10.
traj_lat9=27.65; traj_lon9=-81.36; traj_elev9=10.
traj_lat10=28.47; traj_lon10=-82.13; traj_elev10=10.

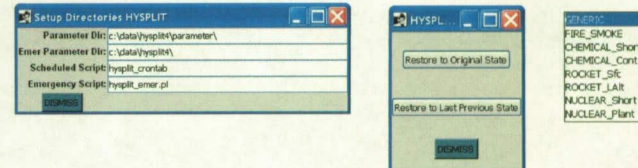
#####
#Tcl Model Options
#####
traj_length=12 # hours
traj_vert_motion=1 # vertical motion option -- zero is based on net input guidance
traj_model_top=10000 # HYSPLIT model top (meters AGL)
traj_num_glide=0 # number of input net glide (usually one)
traj_out=tbl.tcx # output traj file
```

GRAPHICAL USER INTERFACE

The HYSPLIT GUI allows the user to select site locations, model(s) of preference, map output selection, emission control data and an additional feature playback option which automatically changes particle , vertical and horizontal parameters based on the source release. When a Submit button is pressed in the background the code process, apply functions to data or parameters and then outputs the proper formatted HYSPLIT configuration files.

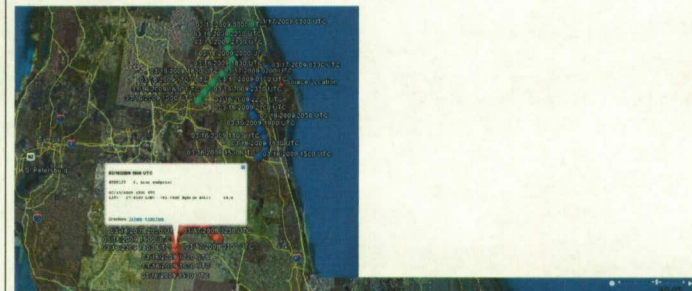
- Programmed** using Tool Command Language (Tcl) / Toolkit (Tk) programming language
- Fixed Sites:** The forecaster can enter or update information such as, Name, Latitude, Longitude, Forecast Time, Model choice, Emission Duration and Rate on the 10 daily updated sites. The HYSPLIT model runs daily for these 10 sites.
- Floating Sites:** The forecaster can enter or update the same information as for Fixed Sites along with a playback option on five additional daily sites. Once changed, these sites will be added to the 10 daily HYSPLIT model run.
- Emergency Site:** The forecaster can enter or update the same information as for Fixed Sites along with a playback option on a single site and then have the HYSPLIT model run with those parameters once the submit button is clicked.
- Playback Option:** The forecaster can select the category of the source release particulate.

GRAPHICAL USER INTERFACE POP-UP MENUS



The HYSPLIT GUI has several menu buttons that when clicked additional menu pop-up. Three of them are displayed above. The Directories menu on the left allows the user to set or change file directories along with important background script names. The Restore Menu button (middle) allows the user to change the HYSPLIT parameters back to their default settings or those from a previous GUI startup. The menu on the right displays the playback options that are available for the forecaster to select from.

EXAMPLE HYSPLIT OUTPUT DISPERSION MAPS



HYSPLIT Trajectories - 12hr Forecast

HYSPLIT Concentration Plot - potential pollutant release

CONCLUSIONS

- The forecaster has control over all the input and selectable fields.
- Up to 15 source sites can easily be configured.
- Playback option allows the forecaster to quickly select the particulate of the source release which then changes the parameter variables.
- All titles, fields, buttons and labels have mouse over "Help" describing their functionality.
- Once done the forecaster just has to click on the "Submit" button, which will then update all configuration files.
- An Emergency single site selection menu has been configured which allows the forecaster to quickly configure and run a HYSPLIT Trajectory forecast and view its graphics output.

REFERENCES

Dreher, Joseph, 2009: Configuring the HYSPLIT Model for National Weather Service Forecast Office and Spaceflight Meteorology Group Applications. NASA Contractor Report CR-2009-214764, Kennedy Space Center, FL, 36 pp. [Available from ENSCO, Inc., 1980 N. Atlantic Ave., Suite 830, Cocoa Beach, FL, 32931, and <http://science.ksc.nasa.gov/amu/final.html>]

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