NOAA Air Resources Laboratory
Monthly Activity Report

August 2007

Contents

1. Highlight - HYSPLIT at NOAA's Web Operations Center (WOC). In response to requirements developed by NOAA's Homeland Security Program Office, a new operational version of HYSPLIT will be available to NOAA's National Weather Service Forecast Offices (WSFOs) and other emergency response personnel through a secure web portal operationally supported by the WOC. The meteorological forecast data are updated directly from the National Centers for Environmental Prediction (NCEP). ARL installed HYSPLIT and a customized version of the READY-HYSPLIT interface on a development LINUX machine at the WOC for testing. The system has been redesigned over the last several months to include better graphics at the local-scale level, a Google Earth output option, the ability for users to enter a hazardous chemical source-term with resulting graphics in a format more meaningful to emergency responders, and the ability to run HYSPLIT with user-entered surface or upper-air observations. The system will be tested by several WSFOs over the next few months and feedback will be used to further enhance the model. roland.draxler@noaa.gov; glenn.rolph@noaa.gov

2. Highlight - Tracer Technology Patent Filed. A patent application for the Stepped Electric Field Detector (SEFD) was filed with the United States Patent and Trademark Office on August 24, 2007. This detector was developed at FRD during 2006 as part of our ongoing tracer technology development efforts. To date, only prototypes of the detector have been built and significant development effort is needed before it is ready for implementation. However, it should be possible to produce the SEFD for a fraction of the cost of existing detectors. The SEFD offers trace level sensitivity to some compounds and is much less sensitive to oxygen than electron capture detectors.

It may find application in a number of different fields in addition to atmospheric tracer detection. roger.carter@noaa.gov, Shane Beard, and Randy Johnson

Air Resources Laboratory Headquarters, Silver Spring

3. HYSPLIT Seminar and Workshop at the University of Alaska. Due to interest by several research groups at the University of Alaska Fairbanks (UAF), a HYSPLIT seminar and 2-day training workshop has been organized for September (http://www.arsc.edu) at the Arctic Region Supercomputing Center (ARSC). The model was installed at ARSC and linked with their routine 6 km resolution Weather Research and Forecasting (WRF) model forecasts for Alaska. roland.draxler@noaa.gov

4. HYSPLIT LAPS and WRF for the National Capital Region (NCR). Our collaborative modeling program with the NOAA Global Systems Division (GSD) is continuing to progress. GSD is running the Local Analysis and Prediction System (LAPS) hourly over the National Capital Region at 1.5 km resolution and also a daily WRF forecast at 1.5 km initialized with the North American Mesoscale model (NAM) and another run initialized with LAPS. LAPS analyses also incorporate all the DCNet tower data. Previous HYSPLIT calculations using LAPS showed some inconsistent results. However, we recently determined that we should have been using the balanced fields rather than the raw fields and now the dispersion results more realistic. An example calculation for a one-hour release at 0800 UTC 15 August is shown below for a HYSPLIT simulation using WRF initialized with NAM and WRF initialized with LAPS. The LAPS initialized forecast was closer to the LAPS analysis (which was not available when WRF was run) than the NAM initialized forecast. The DCNet tower wind direction was between 220 and 230 degrees during the hypothetical event. More objective evaluation criteria will be developed in the next few months. roland.draxler@noaa.gov and gopal@noaa.gov
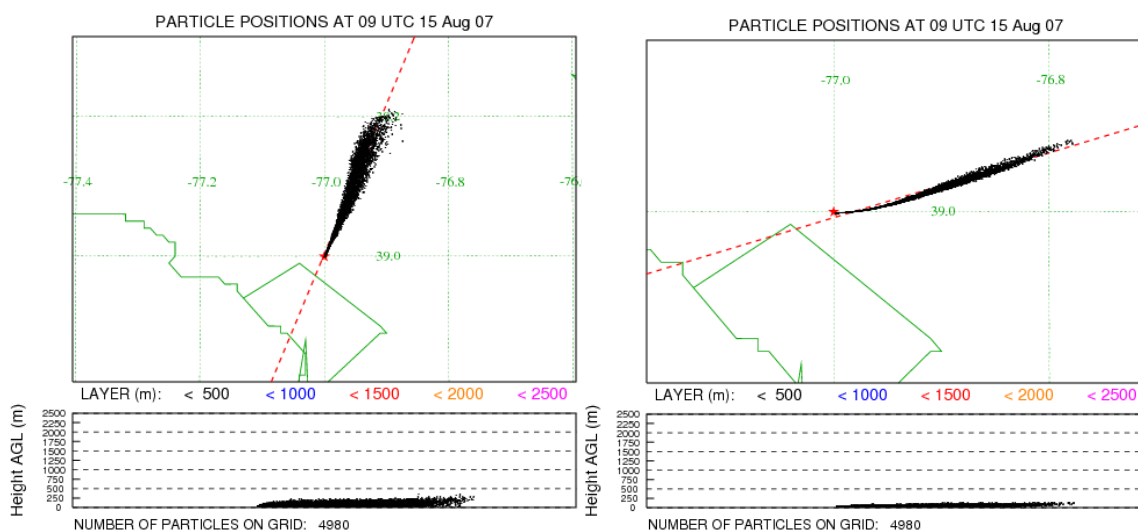
NAM initialized WRF   LAPS initialized WRF

5. HYSPLIT Trajectory Climatology. In preparation for the UAF Seminar/Workshop and due to interest in Arctic climate issues by researchers at the UAF, an automated trajectory computation and clustering procedure, recently integrated into the HYSPLIT graphical user interface, was tested to determine if the trajectory clustering procedure could be used to detect trends in air mass frequencies. In a sample calculation, twice-a-day 36-h isobaric back trajectories at 500 hPa were computed from Denali, Alaska for the period 1950 through 1999 for the month of February using the NCEP/National Center for Atmospheric Research reanalysis data. The trajectories were then clustered by decade to see if there was a change in the orientation or frequency of the clusters. Unlike for air quality applications, the purpose of the trajectory calculation was not to determine the origin of the air as much as to detect shifts in the patterns in the large-scale steering flow. The results below show the cluster mean trajectories and their frequency (in percent) by decade.
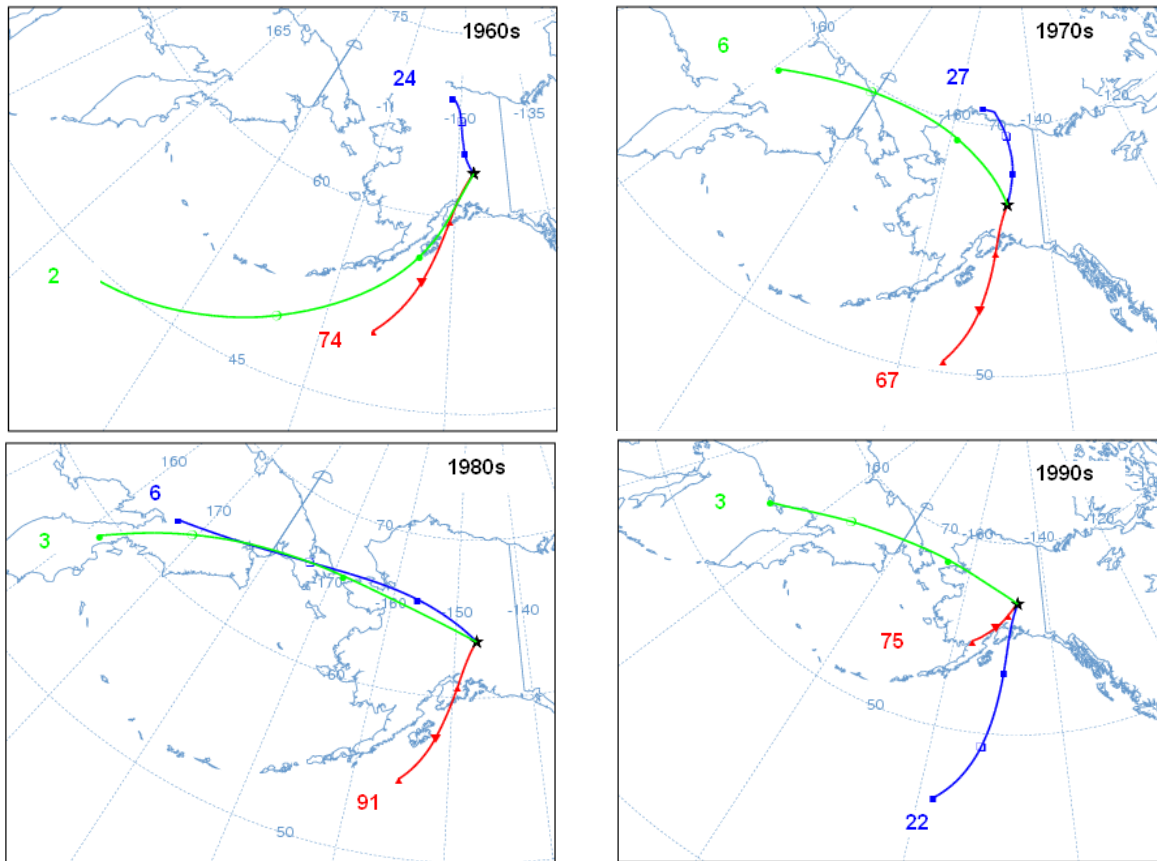
Note that this is only an example calculation representing one location for February using only two trajectories per day. No broad conclusions should be inferred. Further research is required to optimize the clustering methodology for a large number of trajectories before more complete seasonal analyses can be conducted. roland.draxler@noaa.gov; barbara.stunder@noaa.gov

6. ARL Summer Intern. Kun Li, a senior in the Science, Mathematics, and Computer Science Magnet Program at Montgomery Blair High School in Silver Spring, MD, completed his summer Internship with Dian Seidel. He presented his work on "Boundary Layer Influences on Tropospheric Temperature Trends" in a seminar on August 22. His investigation of multidecadal changes in

planetary boundary layer structure using radiosonde data showed some of the challenges and potentials of this approach. Kun will be continuing this line of inquiry as his senior research project during the fall semester and present the results at a school research conference and at science fairs next spring. dian.seidel@noaa.gov

*7. **Conference Presentations**.* Dian Seidel has been invited to deliver talks at two upcoming international meetings. At the AGU Chapman Conference on The Role of the Stratosphere in Climate and Climate Change, in Santorini, Greece, (Sept 24-28) she will discuss "Observed Recent Changes in the Tropopause." In a special session on Tropopause Dynamics at the European Meteorological Society 7th Annual Meeting, San Lorenzo de El Escurial (Oct 1-5) she will present a talk on "Recent widening of the tropical belt: Evidence from tropopause observations." These meetings present unique opportunities to interact with European scientists engaged in related work. dian.seidel@noaa.gov

Atmospheric Sciences Modeling Division (ASMD), Research Triangle Park

*8. **Secondary Organic Aerosol Modeling.*** To prepare for the upcoming new release of CMAQ version 4.7, the aerosol module has been made ready for proposed changes in the handling of secondary organic aerosol (SOA). Phase I of the new implementation has been completed, which involved simplifying the aerosol module, removing several species with very low SOA formation potential in order to improve computational efficiency, and separating the vapor species into gas and particle components and tracking each one individually. Phase II, which involves adding new SOA precursors, is currently under way. sergey.napelenok@noaa.gov , prakash.bhave@noaa.gov

Field Research Division (FRD), Idaho Falls

*9. **Perfluorocarbon Tracer Analysis Development.*** PFT method development work focused on trying to resolve some of the technical problems being encountered. In addition to the PDCB chromatogram interference issue mentioned last month, we have experienced problems with excessively rapid drift in the baseline and in the response of the electron capture detector (ECD). Some of the symptoms were consistent with detector age and deterioration. Therefore, the existing ECD detector was replaced by a different (but still used) detector. Testing is ongoing but preliminary results suggest that this step has helped to stabilize the baseline and extend the available voltage range. We are still dealing with some response issues with the "new" detector but hope to resolve them by determining the optimum combination of flow, pressure, voltage, and attenuation adjustments. Due to these troubleshooting efforts, the monthly sample aging and stability tests were not conducted. dennis.finn@noaa.gov and Roger Carter

*10. **Tracer System Development.*** New data systems for the continuous tracer analyzers have been ordered. The current data systems are old enough that parts are no longer available, thereby making maintenance a problem. The new systems will be built around a microcontroller that features solid state data storage, no moving parts, lower power consumption, and a touch screen interface for the users. roger.carter@noaa.gov, Shane Beard, Randy Johnson

*11. **Transport and Dispersion Modeling.*** FRD is continuing to investigate methods that can create 3D wind fields for use with HYSPLIT while taking maximum advantage of the local observations

available in Southeast Idaho. In addition to the INL Mesonet, the NOAA MADIS system provides access to satellite-derived winds, rawinsonde soundings, aircraft observations, and other surface observations. Also, the Pocatello NEXRAD radar provides radial velocities and reflectivities that cover the atmosphere above INL. Ideally, all these data sources should be blended into dynamically consistent 3D wind field that accounts for the topography. The WRF-Var package that is part of the overall WRF modeling system is one program capable of performing this blending. It starts with a background wind field based on a model forecast (e.g., WRF, NAM, etc.) and then assimilates the available data to create an adjusted wind field.

The WRF-Var package has been installed at FRD with the intention of using the local 4 km WRF forecasts as the background. A MADIS account has also been established to provide access to most of the observations. richard.eckman@noaa.gov

Special Operations and Research Division (SORD), Las Vegas

12. Local-scale HYSPLIT Model. A white paper concerning NOAA meteorologists (working at DOE facilities) having a need for a local-scale HYSPLIT model was distributed during the monthly ARL dispersion conference call. Comments will be discussed at the next conference call. walter.w.schalk@noaa.gov

13. WRF Model. The background error (BE) covariances for the 3D variational data assimilation system were compiled and debugged.

The NMC methods were used to compute the BE covariances from 60 WRF forecasts created during the 30 day period from mid-June to mid-July. kip.smith@noaa.gov