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Real-time Environmental Applications and Display sYstem: READY

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ABSTRACT

Air quality forecasters, emergency responders, aviation interests, government agencies, and the atmospheric research community are among those who require access to tools to analyze and predict the transport and dispersion of pollutants in the atmosphere. Because of this need, the unique web-based Real-time Environmental Applications and Display sYstem (READY) has been under continuous development since 1997 to provide access to a suite of tools for producing air parcel trajectory and dispersion model results and displaying meteorological data.

READY provides a "quasi-operational" portal to run the HYSPLIT atmospheric transport and dispersion model and interpret its results. Typical user applications include modeling the release of hazardous pollutants and volcanic ash, forest fire and prescribed burn smoke forecasting, poor air quality events, and various climatological studies. In addition, READY provides the user with quick access to meteorological data interpolated to the location of interest, helping in the interpretation of the HYSPLIT model results.

1. Introduction

Air quality forecasters, emergency responders, aviation interests, government and international agencies, and the atmospheric research community are among those who require quick and easy access to tools that allow them to analyze and predict the transport and dispersion of pollutants in the atmosphere.

In order to provide these services in a timely manner and convenient format, a web-based system was initially developed in 1997 by the National Oceanic and Atmospheric Administration's (NOAA) Air Resources Laboratory (ARL) and named the Real-time Environmental Applications and Display sYstem (READY, http://www.ready.noaa.gov, Fig. 1). READY has been continuously maintained and expanded since then to provide access to a suite of new tools for displaying meteorological forecast and archived data and producing air parcel trajectory and dispersion model results through a series of user-interactive web pages.

In this paper we provide an overview of the current READY system and some of the unique applications that are available to the scientific community and those needing access to dispersion model products in real-time. In section 2 we give a short technical description of the system design and in section 3 we provide a background on the HYSPLIT transport and dispersion model. Section 4 provides information on the meteorological data available in READY and section 5 provides details on all the meteorological products available to READY users. In section 6 we give details on the HYSPLIT products and training materials available in READY and in section 7 we provide details on the DATEM Tracer Verification Archive. Finally, in section 8, we highlight some of the future products planned for READY including the use of the Weather Research and Forecasting (WRF) meteorological model and the Short Range Ensemble Forecast (SREF) data by HYSPLIT.

2. System design

The impetus for creating the READY web site in 1997, when very few interactive web sites were available, was the need from other U.S. federal agencies to run the HYSPLIT atmospheric transport and dispersion model (Stein et al., 2015) remotely and display the graphical results. A common operational problem was retrieving the graphical products from ARL's computer through the client's firewall, which only allowed text data to be transmitted. As a workaround, ARL configured the HYSPLIT model to be able to run using a series of Common Gateway Interface (CGI) scripts, primarily written in Perl, which requested the needed inputs from the user via a web browser to produce a dispersion simulation and resulting output graphics.

In addition to HYSPLIT, ARL had several programs written over

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Fig. 1. Screenshot of READY, http://www.ready.noaa.gov, accessed 1 February 2017.

the preceding years to request and display meteorological data that HYSPLIT used in its transport calculations. Dispersion modelers use these tools to dissect the meteorological data used by the dispersion model to better understand the underlying atmospheric stability and wind patterns driving the transport and dispersion of pollutants. These programs, which included displaying weather data on maps, vertical soundings, and time-series plots, were also rewritten to be able to function through the web server.

3. HYSPLIT model

HYSPLIT is one of the most widely used models for atmospheric trajectory and dispersion calculations (Stein et al., 2015) and was most likely the first dispersion model available to the scientific community through the web in 1997. HYSPLIT, initially developed in the 1980's (Draxler, 1982; Draxler and Hess, 1998), is a Lagrangian particle/puff model used for a wide range of applications from computing simple air parcel trajectories to complex transport, dispersion, chemical transformation, and deposition simulations with scales ranging between 1 and 1000's of kilometers.

The model calculation method is a combination between a moving frame of reference that follows air parcels as they move from their initial location for the simulation of advection, diffusion, and deposition (Lagrangian) and a fixed three-dimensional grid as a frame of reference to compute the pollutant air concentrations