

Exceptional Event Decision Support System

Background

The objective of this sub-project is to improve National air quality management by developing a decision-support system (DSS) for the implementation of the new EPA Exceptional Event (EE) Rule, which permits States to flag air quality (AQ) data caused by exceptional air pollution, such as forest fires and dust storms. The Rule requires States to provide evidence and quantify exceptional source contributions. Based on the reported evidence, EPA decides if the EE flag is justified. Preparing and evaluating the EE evidence is a tedious, costly and technically challenging task for the State and EPA offices.

Technical Approach

The EE DSS sub-project will achieve its goals primarily by linking, harmonizing and integrating and otherwise 'connecting the pieces' contributed by its autonomous core constituent partners represented by the projects GIOVANNI, VIEWS, AIRPACT and DataFed. A specially strong link, will be developed between the Naval Research Laboratory, which provides the global air quality forecasts and DataFed. The NAAPS model outputs will be routinely accessed and cached at DataFed for incorporation in the EE DSS and the associated tools for visualization, processing and data fusion. The proposed sub-project will consist of three major tasks:

Task 1: Network for Event Decision Support

The data required for Exceptional Event Analysis will be linked and federated using NEDS. The key roles of the federation infrastructure are to (1) facilitate registration of the distributed data in a user-accessible catalog; (2) ensure data interoperability using international, standard protocols; (3) provide a set of basic tools for data registration and access. Data federation is to be accomplished by turning data stored and exposed through various servers into a data services accessible through standard protocols. This loosely-coupled networked architecture is to be consistent with the "publish-find-bind" triad of Service Oriented Architecture and also to support the GEOSS motto: "Any Single Problem Requires Many Data Sets. Any Single Data Set Serves Many Applications."

Task 2: Tools and Methods for EE Report Preparation

Following standards-based data access the EE DSS will provide tools for data exploration, processing and visualization. The same tools will be applicable to all datasets. The tools will leverage the benefits of OGC standards-based service oriented architecture. Service orchestration will be used for easy creation of new tools. The shared web-based tools will promote collaboration among developers and analysts.

The **DataFed Browser/Editor** will be the primary tool for the exploration of spatial-temporal pattern of pollutants. The multi-dimensional data are to be displayed in spatial views (maps) and in temporal views (timeseries). The DataFed browser will also serve as an editor for data processing workflows. **Google Earth Data Browser**, will be used as a software mashup between DataFed, and Google Earth. The two applications are to be dynamically linked so that the user can select and browse any federated dataset in Google Earth. **Analyst Consoles** (or dashboard) will be available to display the state of the current pollution situation through a collection of synchronized views. The consoles will be customizable by users.

Concentration Anomaly Tool is to be developed and used operationally by the States and EPA to provide an automatic calculation of the normal pattern of air quality or as the deviation from the normal. This tool will permit the calculation of concentration anomalies. The **Combined Air Quality Trajectory Tool (CATT)** will be further developed to establish whether the air masses associated with the exceedance pass through the source region of the exceptional source. The Anomaly tool and the CATT tool will not be developed by this project but be pursued through other support. e.g. Federal and Regional EPA.

Task 3: Collaboration Facilities

Collaboration will be facilitated using an open wiki workspace. Each event will be assigned an EventSpace, which will combine information on data, interpretation, discussion and community-produced event summary. These EventSpaces will be searchable through an Event Catalog in order to facilitate the finding and reuse of past event analyzes. The organization, statistics and spatial-temporal display of past aerosol events by type will aide in developing a long-term climatology of events. The EventSpaces will be primarily for the Federal, Regional and State analysts, however the sub-project will be open for participation by the broader AQ Analysts community. This project will link to the activites of FASTNet, a networked community of analysts, for detecting, analyzing and describing exceptional events, supported independently from this project.

Transition approach

The end-state of the EE DSS will be an operational system managed and maintained by the key stakeholders: Federal and Regional EPA and the States. The transition to the post-project operational phase will be a smooth and natural completion of our research group's participation in the evolution of the EE Rule.

Performance measures

The most direct measure of the EE DSS performance is the number of flagged samples and the time required for the preparation and evaluation of the flag requests. Additional measures include the amount of data accessed, explored and used in the reports. A more subtle performance measure is the ratio of the requested and approved EE flags. Data usage in the EE DSS is the next important measure of system performance. The usagedetermined both by the 'user pull' forces (e.g. data relevance, data quality), as well as by the provider push (e.g. ease of access, tools for processing). The federated data access system using a common service orchestration engine will allow the counting of data accesses in fine detail.

Anticipated results

Decision support facilities to be developed in this sub-project will allow users to (1) explore and analyze data for specific EEs (2) prepare EE flagging reports (3) evaluate and approve the EE reports. For the States, the EE tools will make the event documentation easy and efficient, while for EPA, the standardized DSS tools should make the decisions more consistent and robust. This sub-project will provide broader benefits through innovative application of remote sensing and information technologies to AQ regulatory processes. The EE DSS should also contribute to the creation of a persistent core network for supporting other AQ applications. The network should also

exemplify multi-organization/agency collaboration using the principles and architecture of the Global Earth Observing System of Systems.

Project management

The specifications and the design of the EE DSS will be overseen by an advisory group which will be lead by user representatives from EPA, and the States and also include data providers and mediators. The loosely coupled 'system-of-systems approach will be fortified with concrete goals. The sub-project will have clear deliverables in the form of the functioning EE DSS. The responsibility for overall coordination and for the delivery of the functioning EE DSS will be that of the PI, R. Husar, director of CAPITA, in close collaboration with the project PI, D. Westphal.

Schedule:

In Year I, the detailed specification of the EE DSS will be completed driven primarily by the needs of the end users. Also, the core standards-based data connectivity network will be expanded from DataFed to include the other Data Systems. The main EE Tools, the DataFed and Google Earth Browsers and well as the Analysts Colsoles will be developed. Year II will focus primarily on exposing the EE DSS to the State, Regional and Federal EPA, including a complete user-friendly interface, help instructions, tutorials and facilities for proactively gathering and incorporating user feedback. Year III will be devoted largely to the establishment of the operational EE DSS that will become the supporting decision system for the long-term implementation of the EE Rule.