Integrated Fire, Smoke and Air Quality Data & Tools Network

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Background

The management of fire, smoke, and air quality is tasked to multiple agencies at federal, state, and local levels.

The diversity in data collection methods, data reporting requirements, data formatting schemes, data analysis methods, and data presentation create a daunting challenge for the integration of these data.

However, integration of these heterogeneous datasets is precisely what is called for by federal and regional organizations in order to derive a more comprehensive understanding of emissions from wildland and prescribed fires.

The primary objective of the project presented here is to demonstrate innovative technologies for integrating data and tools available to fire and air quality management organizations.

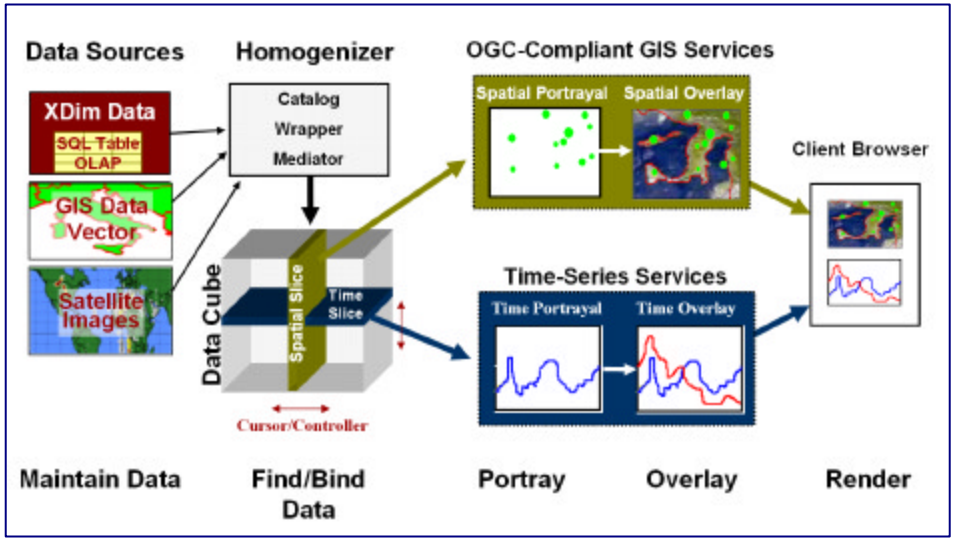
Distributed Data Networks

Numerous state, regional, and national fire related databases and online access applications exist. The challenge is to integrate them on-the-fly without requiring substantial changes to the underlying systems.

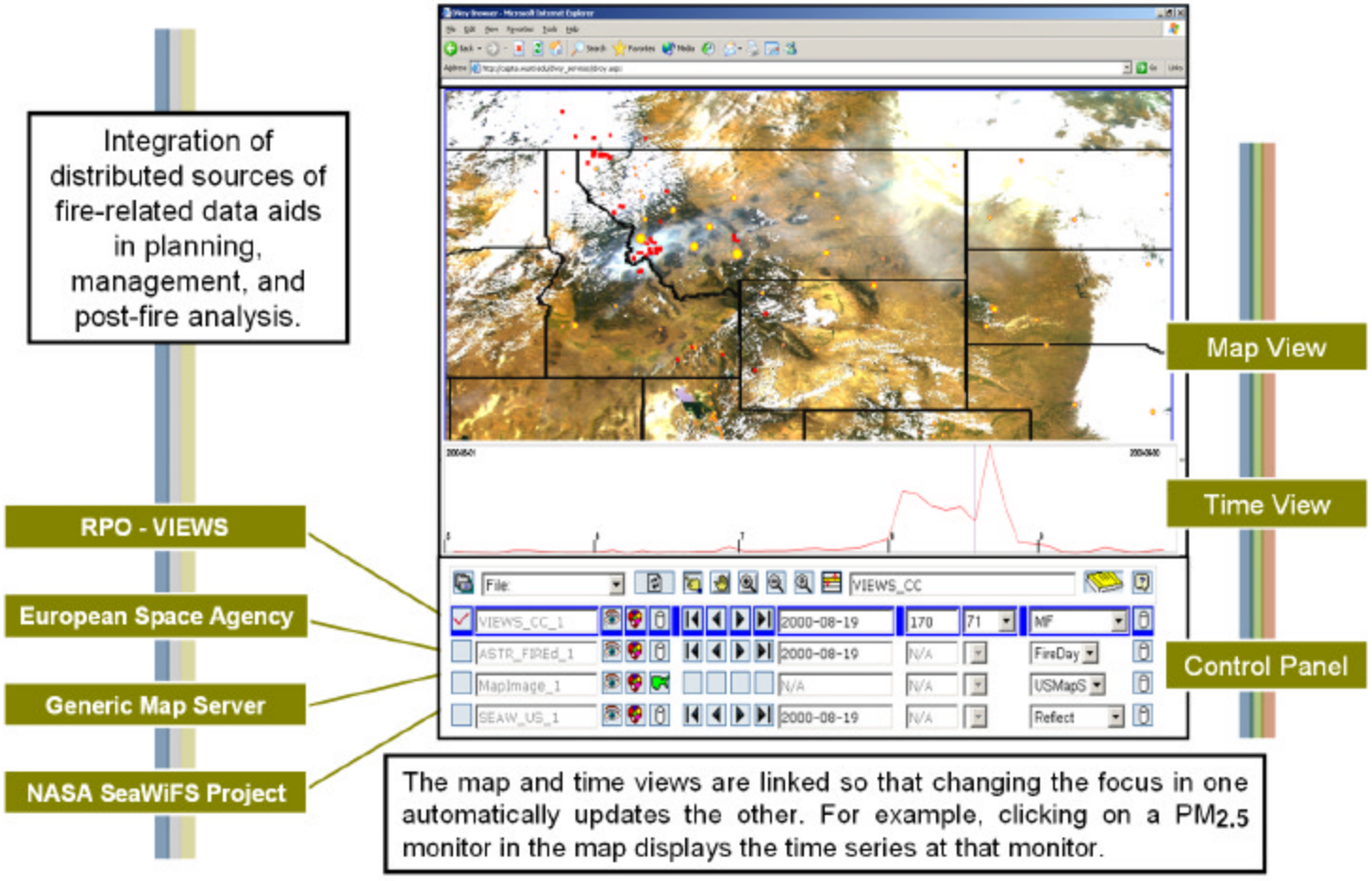
Recent research has focused on achieving data interoperability (XML-based metadata standards, FGDC, OpenGIS, Geospatial One Stop).

A number of fire management and air quality organizations have made data available through web applications, including BlueSkyRAINS (www.blueskyrains.org), GeoMAC (geomac.usgs.gov), WFAS (www.fs.fed.us/land/wfas/), BLM (www.firehistory.blm.gov/firehistory), UMD (maps.geog.umd.edu), NOAA (www.firedetect.noaa.gov/viewer.htm) and USGS (gisdata.usgs.net/website/IVM/viewer.asp).

Distributed Voyager is one available framework that supports distributed data access as well as a variety of tools for browsing and analyzing the data (Husar et al.: capita.wustl.edu/Voyager) and is particularly well suited for fire related applications.



Distributed Voyager Fire Data Application



The fire location data (indicated by red dots) and $PM_{2.5}$ concentrations (indicated by yellow circles) are accessed using data 'wrappers' that are linked to their respective data sources (European Space Agency and RPO-VIEWS). The distributed Voyager interface is fully described in Husar et al.: capita.wustl.edu/Voyager.

Beyond Distributed Data: Web Services

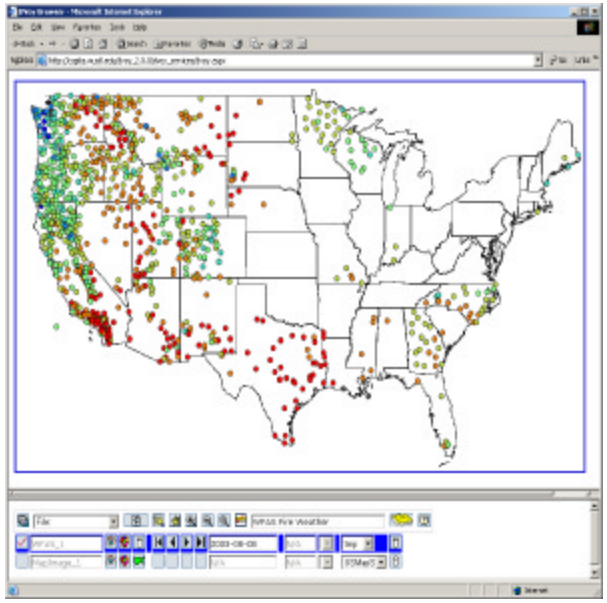
Substantial progress has been achieved in data interoperability.
One the next advances required is interoperable data analysis/processing tools.

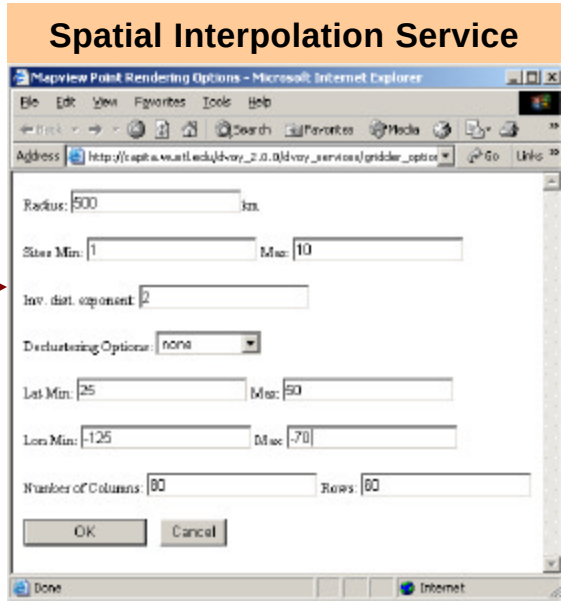
Web services are applications that are used over the Web. Because they are self-contained and use XML-based standards (SOAP, WSDL, UDDI) for describing themselves and communicating with other web resources, they can be reused in a variety of independent applications.

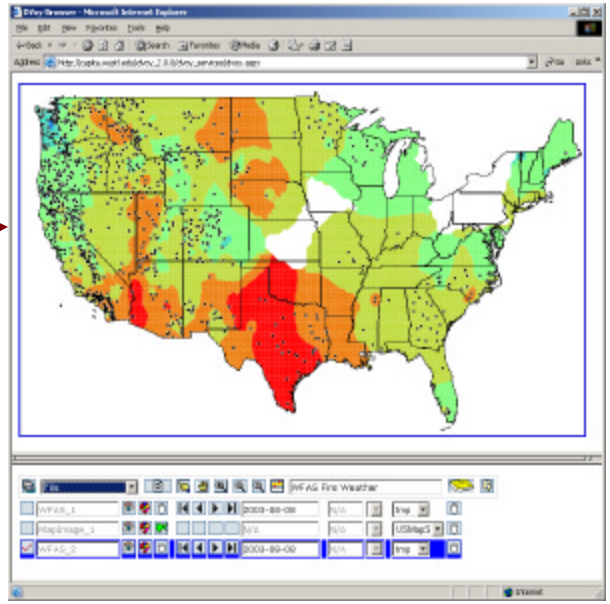
Many of the analysis and processing tools used by the fire, smoke, and air quality management community could benefit from web service technology. Not only can their data be shared but their heterogeneous, distributed tools that operate on that data can be shared as well.

A longer term vision for web services is to be able to “orchestrate” or “chain” multiple services from multiple providers so that new “third party” applications can be constructed.

Spatial Interpolation Service



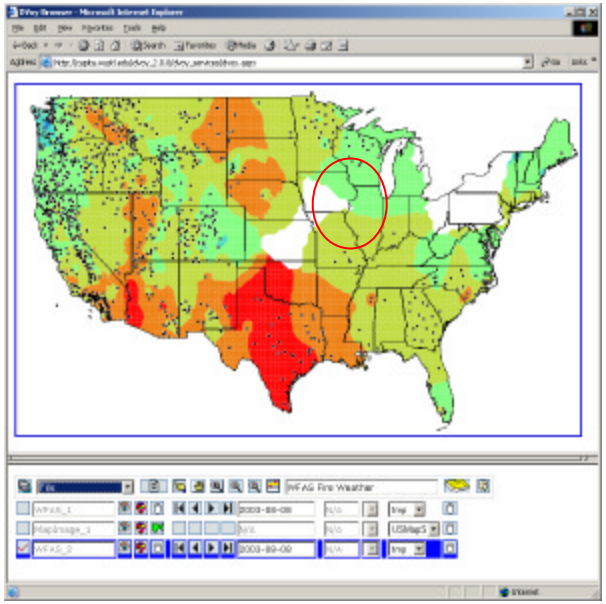


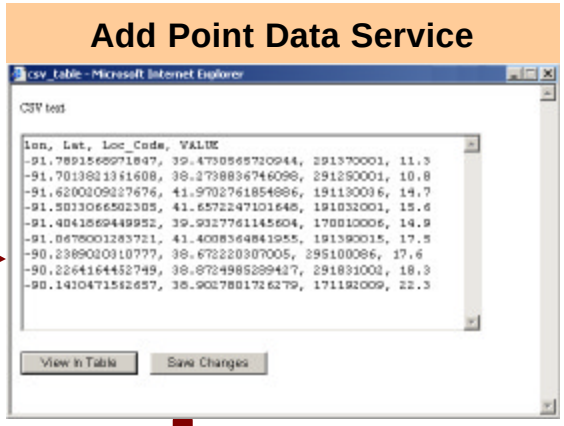


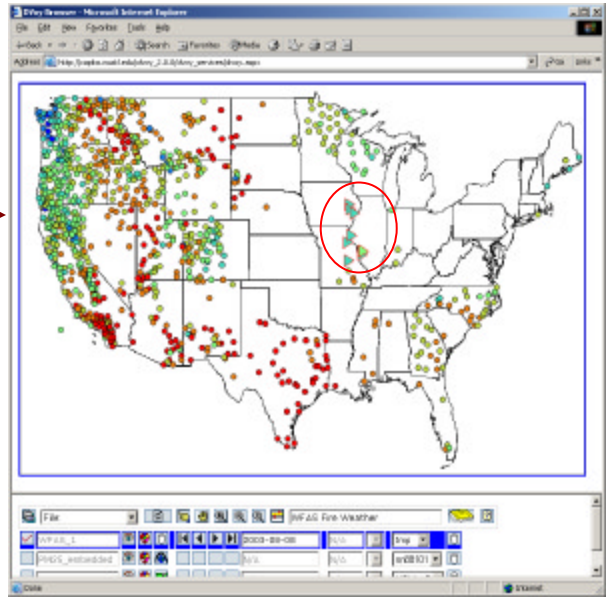
From the dVoy interface (or, in the future, other interfaces), the spatial interpolation service is called.

The interpolation settings are set and the input point data set is interpolated to an estimated continuous surface.

Add Local Data Service







The interpolated surface contains gaps in your area of interest. However, you have some data that is compatible and would like to include it in the interpolation.

From the dVoy interface you launch the Add Point Data Service, copy and paste your data (lat, lon, value), merge the data and re-run the interpolation service.

Other web services might include: difference/ratio calculations, statistics for comparing data/models, resolving spatial and temporal scales differences, customized queries, emissions estimation …

Future Challenges

Organizational/Cultural challenges in shared data and tools

- Identify community sharable resources
- Develop protocols for restricting access to non-public data & tools
- Clearly define benefits gained by sharing (Return on Investment)

Technical challenges in networking distributed tools/services

- Standards for web services
- Simple publish/find/bind methods
- Effective and efficient web services
- Service chaining (service flow languages, application environments)

Additional information can be found at :

http://capita.wustl.edu/FSAN

Please contact Stefan Falke (stefan@me.wustl.edu) with any questions or comments.