



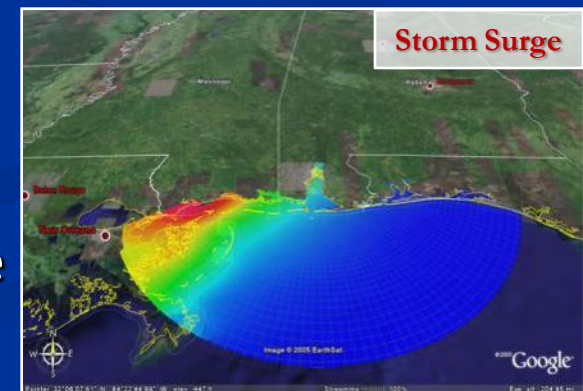
# Using Virtual Globes to Improve Situational Awareness in the National Weather Service

By Keith Stellman and Andy Foster

25<sup>th</sup> IIPS Conference  
January 15, 2009

## ❖ Virtual Globe Benefits to the NWS

- Easy-to-use GIS platform **empowering** NWS personnel to view and create GIS data.
- Enhances **situational awareness** especially during hazardous weather events.
- Provides tool to conduct **impact and risk analysis**.  
What if...? Map.
- Enhances **decision support** products and services.
- Common operating **infrastructure** that can be utilized between multiple agencies.



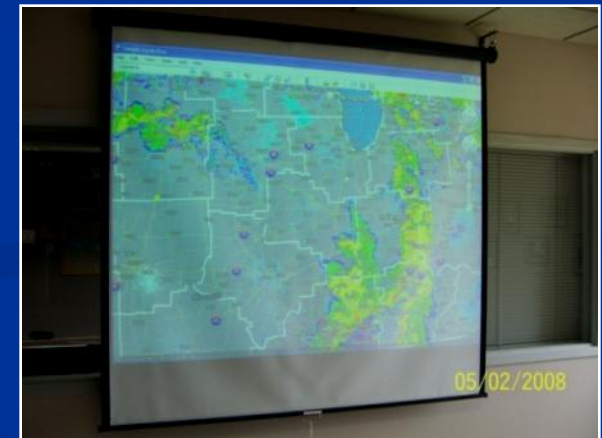


# Virtual Globes in the NWS



## ❖ Virtual Globes as a Situational Awareness Tool

- Radar & Satellite
- Watch & Warning Polygons
- Storm Reports
- Spotter calls / Verification
- Risk & Impact Analysis / Decision Tool
- Flood & Flash Flood (AHPS, QPF, FFG, etc.)
- Model Guidance
- Fire Weather
- Observations
- Equipment Status (radar, METAR)

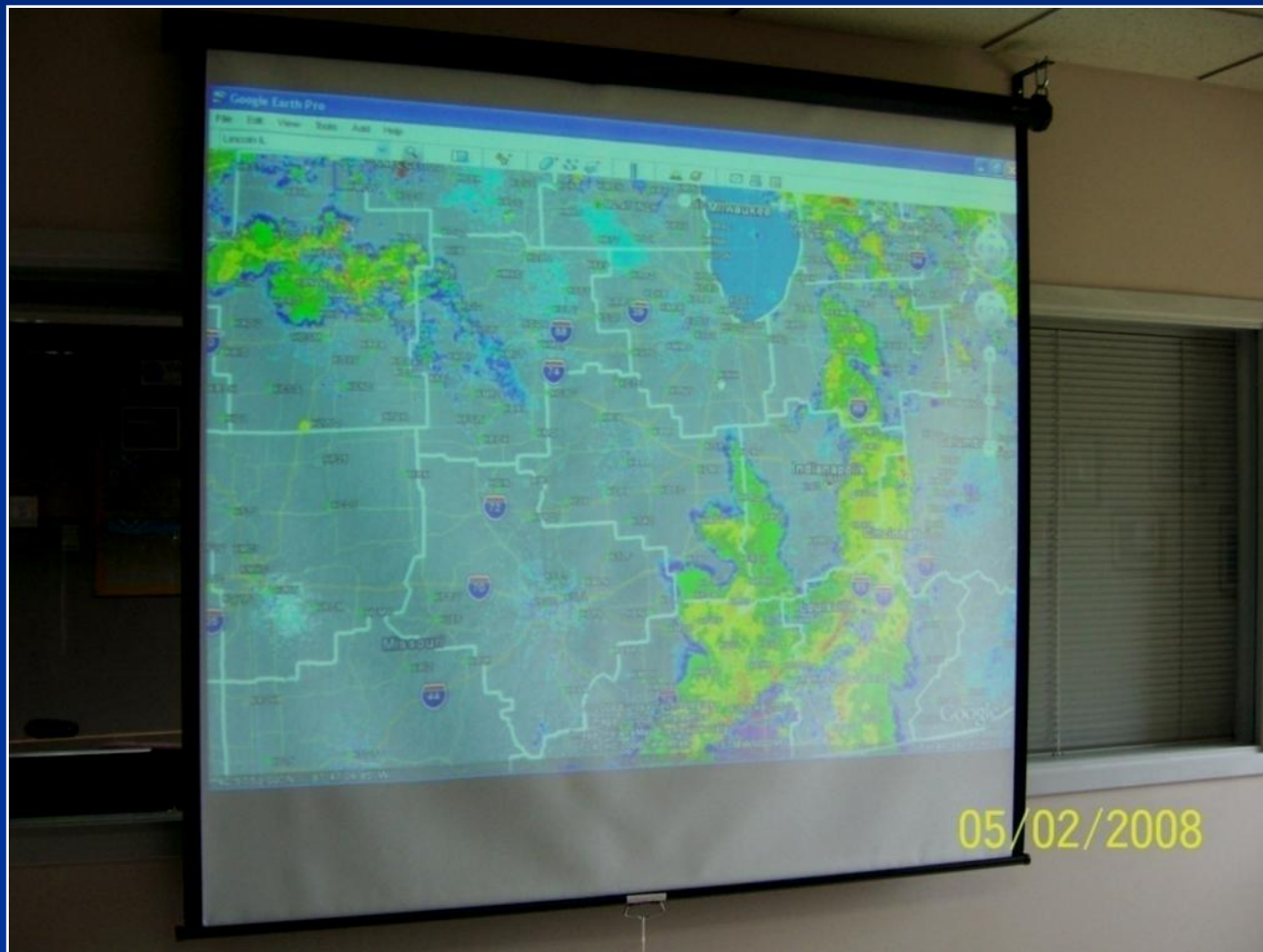




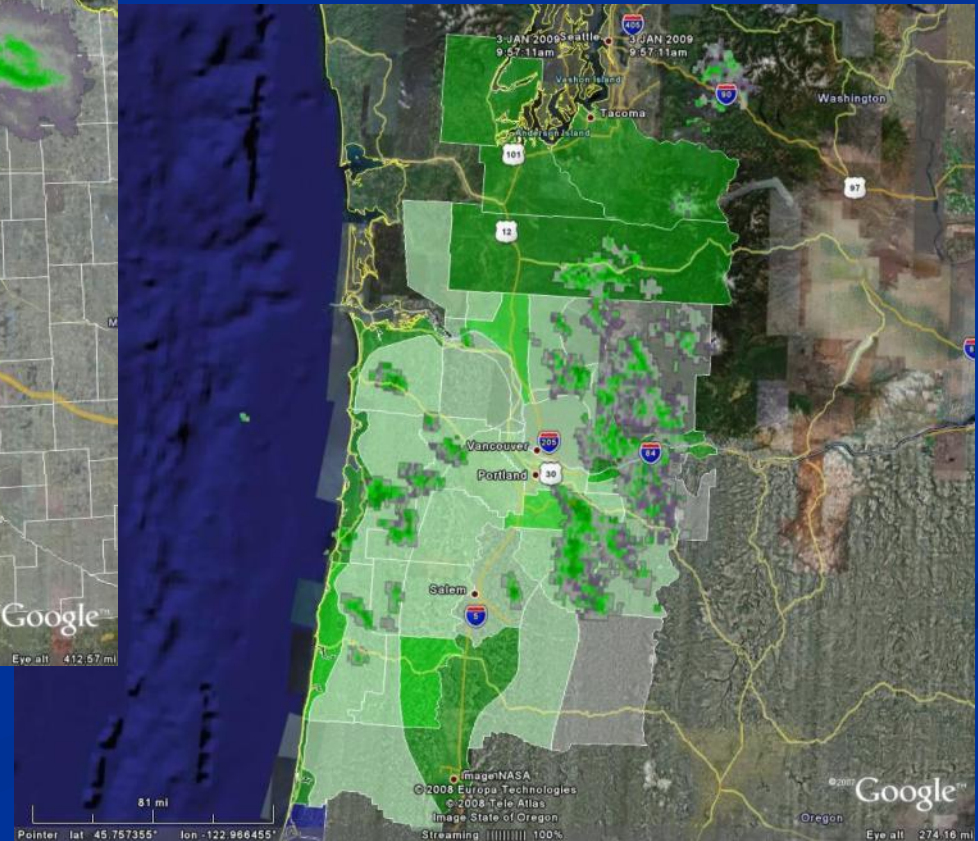
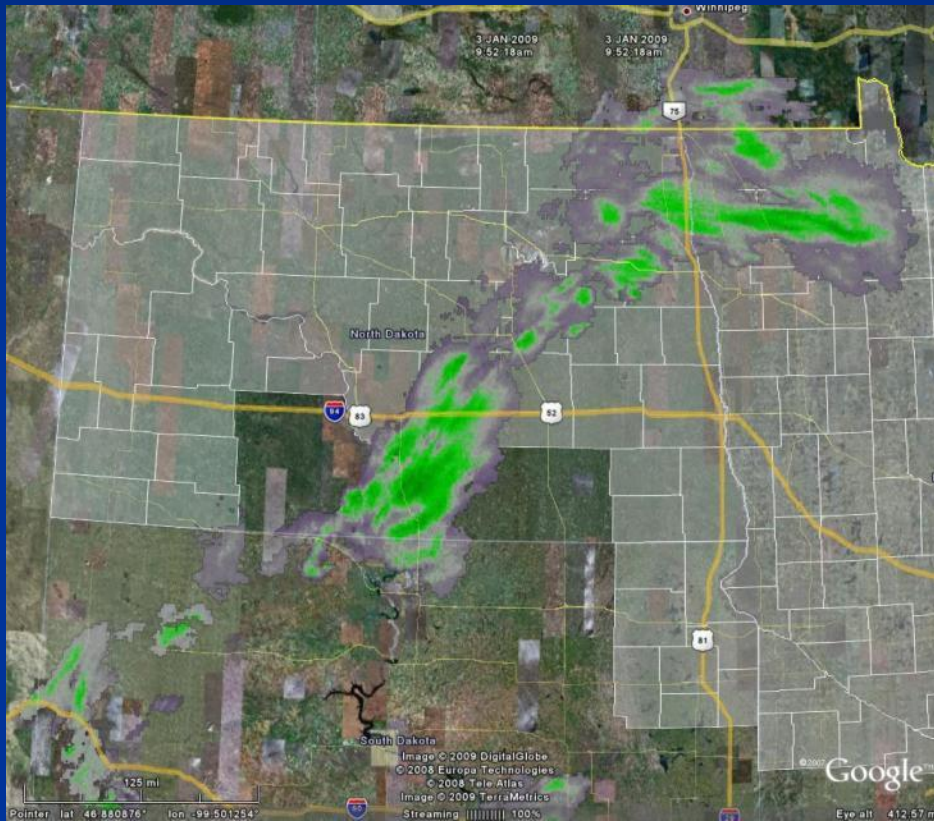
# Virtual Globes in the NWS



## ❖ Situational Awareness Tool in NWS Operations



## ❖ Monitor Watches, Advisories & Warnings

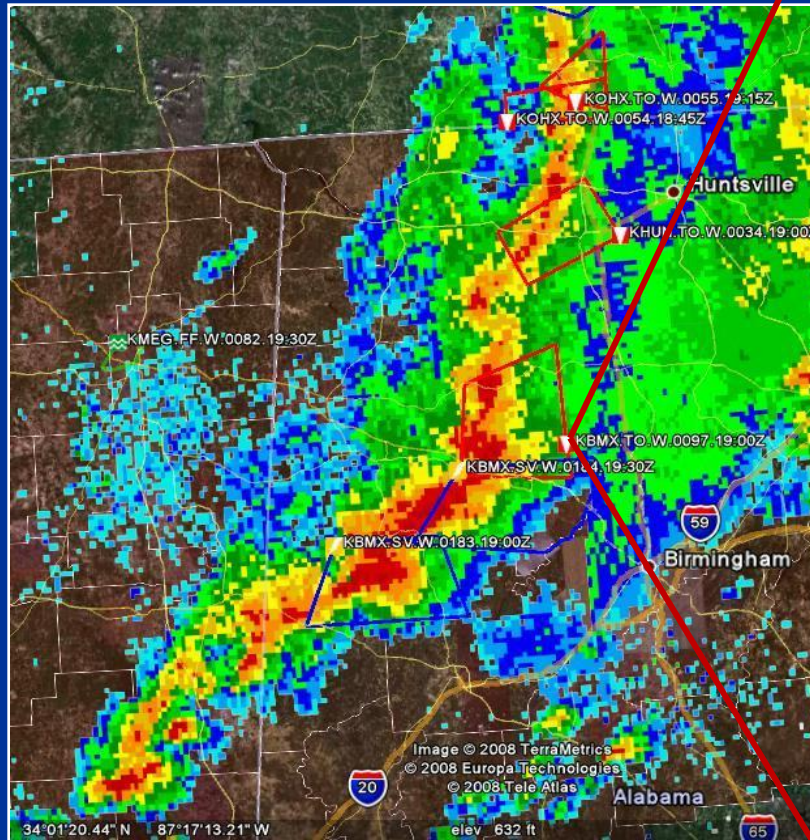




# Virtual Globes in the NWS



## ❖ Monitor Convective Warnings



**KHUN.TO.W.0034.19:00Z**

ALCO79-083-103-081900-  
 /O.NEW.KHUN.TO.W.0034.080508T1823Z-080508T1900Z/

BULLETIN - EAS ACTIVATION REQUESTED  
 TORNADO WARNING  
 NATIONAL WEATHER SERVICE HUNTSVILLE AL  
 123 PM CDT THU MAY 8 2008

THE NATIONAL WEATHER SERVICE IN HUNTSVILLE HAS ISSUED A

- \* TORNADO WARNING FOR...  
 SOUTHERN LIMESTONE COUNTY IN NORTH CENTRAL ALABAMA...  
 NORTHWESTERN MORGAN COUNTY IN NORTH CENTRAL ALABAMA...  
 NORTHEASTERN LAWRENCE COUNTY IN NORTHWEST ALABAMA...
- \* UNTIL 200 PM CDT
- \* AT 118 PM CDT...NATIONAL WEATHER SERVICE DOPPLER RADAR INDICATED A SEVERE THUNDERSTORM CAPABLE OF PRODUCING A TORNADO NEAR MOULTON... MOVING NORTHEAST AT 33 MPH.
- \* LOCATIONS NEAR THE PATH OF THIS TORNADO INCLUDE...  
 MOULTON.  
 HILLSBORO.  
 TRINITY.  
 DECATUR.

A WALL CLOUD HAS BEEN REPORTED WITH THIS STORM...AND IT COULD PRODUCE A TORNADO AT ANY TIME. IF YOU ARE IN ITS PATH...TAKE COVER NOW.

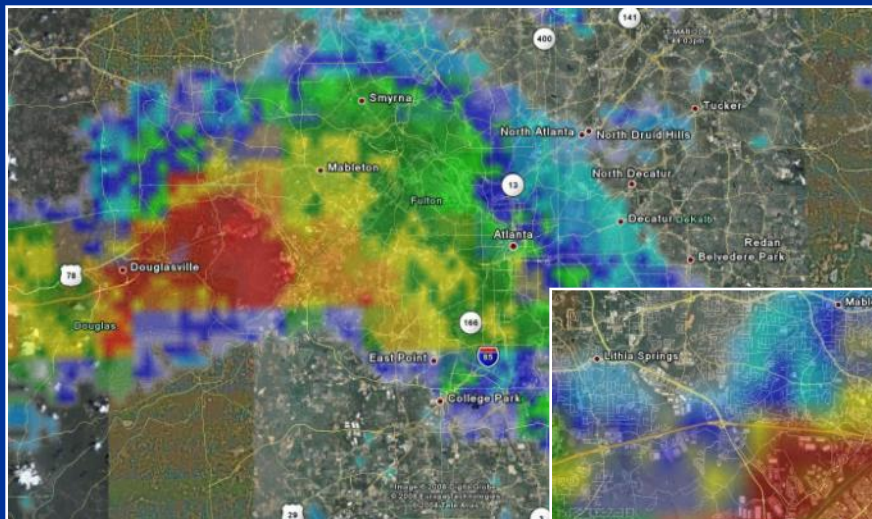
A TORNADO WATCH REMAINS IN EFFECT UNTIL 200 PM CDT THURSDAY AFTERNOON FOR NORTHWESTERN ALABAMA.

LAT...LON 3481 8694 3461 8682 3443 8731 3459 8741  
 TIME...MOT...LOC 1823Z 243DEC 29RT 3455 8726



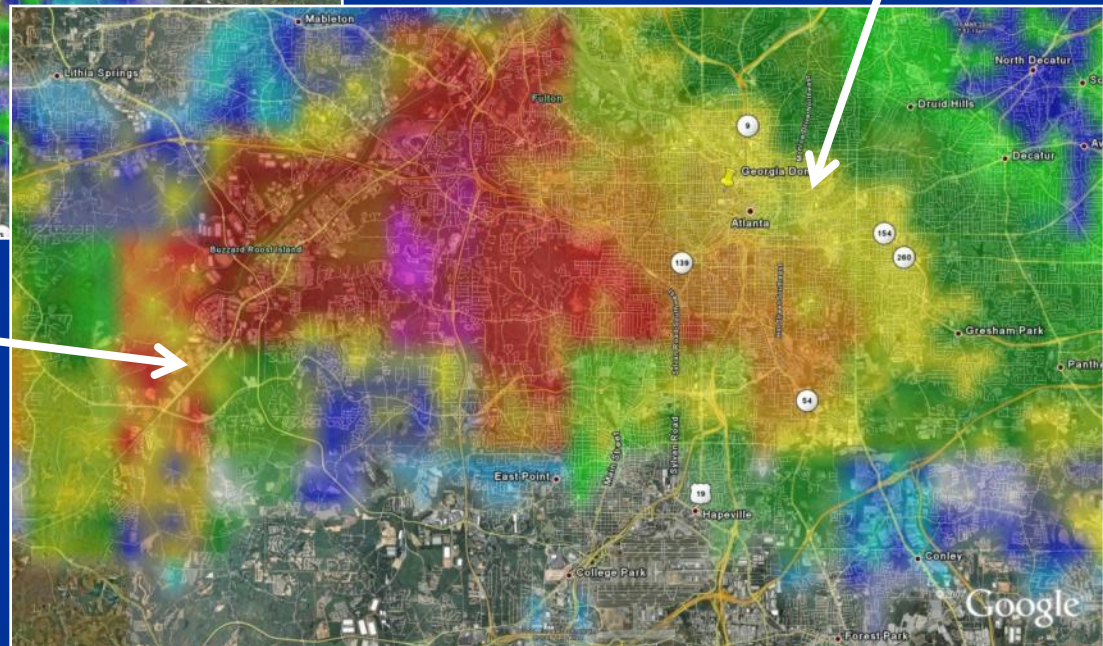
## ❖ Strategic Planning & Impact Assessment

- Integrate key data to promote S.A. and assess potential impact.



Downtown Atlanta

Tornadic Supercell

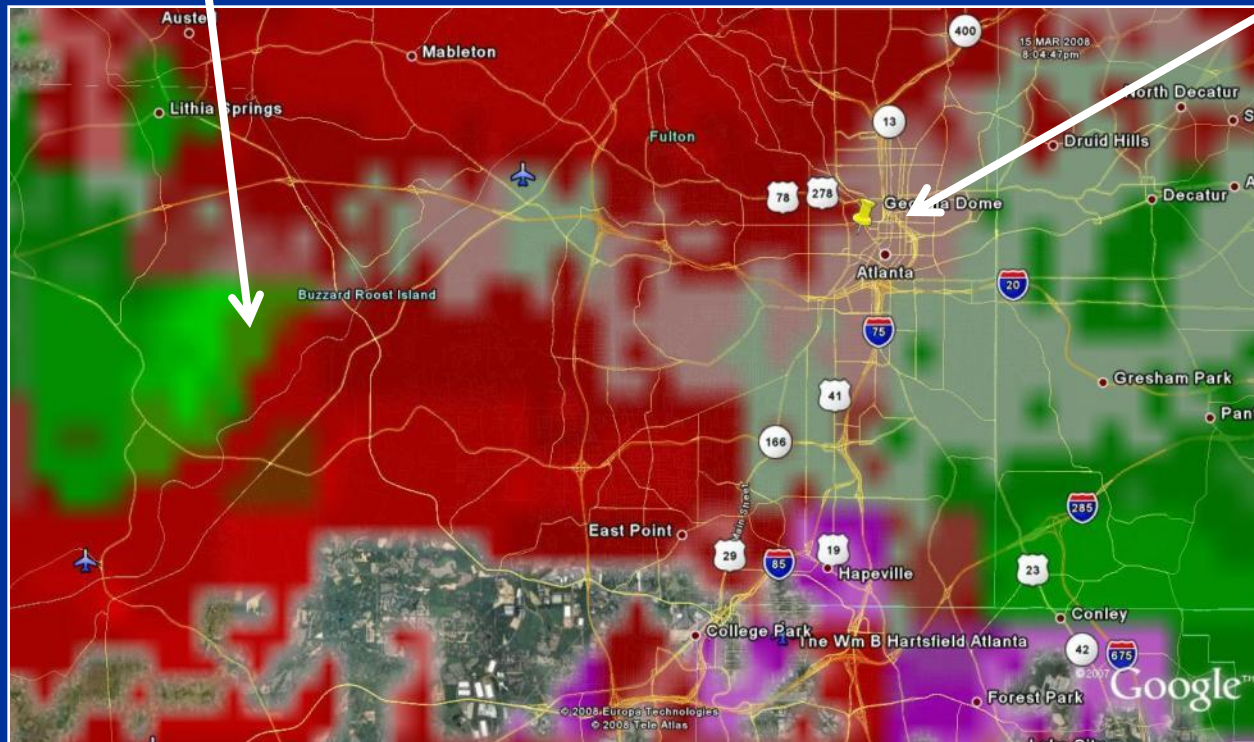


## ❖ Strategic Planning & Impact Assessment

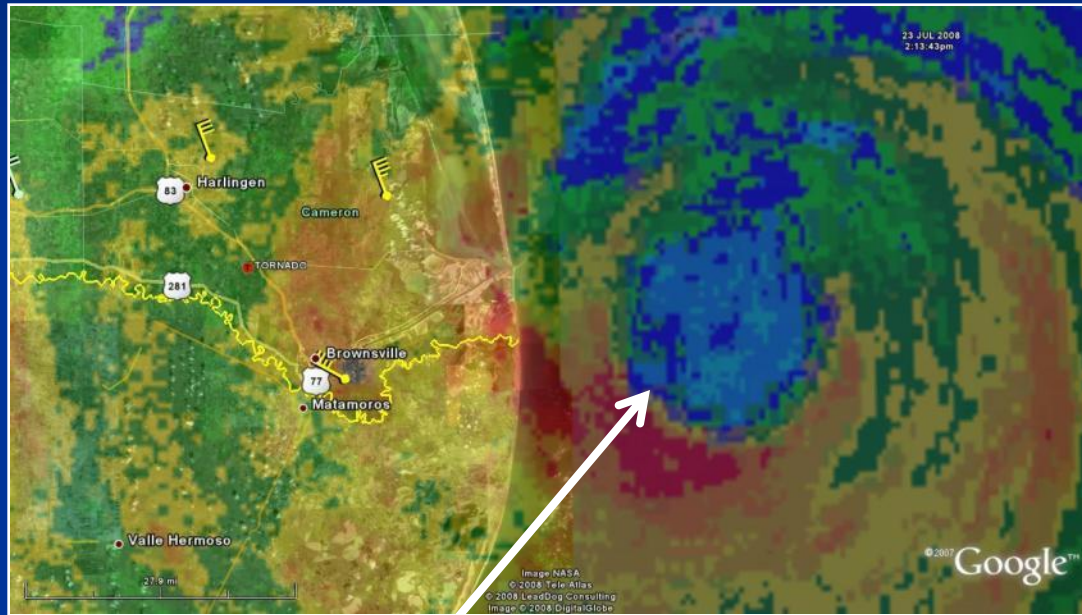
- Support strategic & tactical response of critical decision makers

Tornadic Circulation

Georgia Dome



## ❖ Strategic Planning & Impact Assessment



Hurricane Dolly



South Padre Island





# Virtual Globes in the NWS



## ❖ Storm Reports & Verification

- Search businesses, agencies, etc.



Google Earth Pro interface showing search results for 'gas station'.

File Edit View Tools Add Help

Search

Fly To Find Businesses Directions

What e.g., Museums  
gas station

Where e.g., Houston, Texas  
Current view

gas station (1 - 10)

- A Exxon Filling Station #17  
711 E Reed Rd, Greenville, MT 38701
- B Exxon Filling Station #16  
1625 Highway 1 S, Greenville MS 38701
- C Shell West Services Station  
1902 Jackson Ave W, Oxford MS 38655
- D Shell Go  
Highway 7 & Carrollton Ave, Greenwood, MS 38930
- E Kum & Go

Map view showing a zoomed-in area of Perry, OK. A red line indicates a storm path. A pop-up window displays information for the City of Perry: To Report a Fire Dial.

25 MAY 2008 12:03:41am

City of Perry: To Report a Fire Dial

732 Delaware St  
Perry, OK 73077  
(580) 336-2211  
[perryok.org](http://perryok.org)

Directions: [To here](#) - [From here](#)

Perry Fire Department  
Orlando Volunteer Fire Department

Highway 77-West

2.61 mi

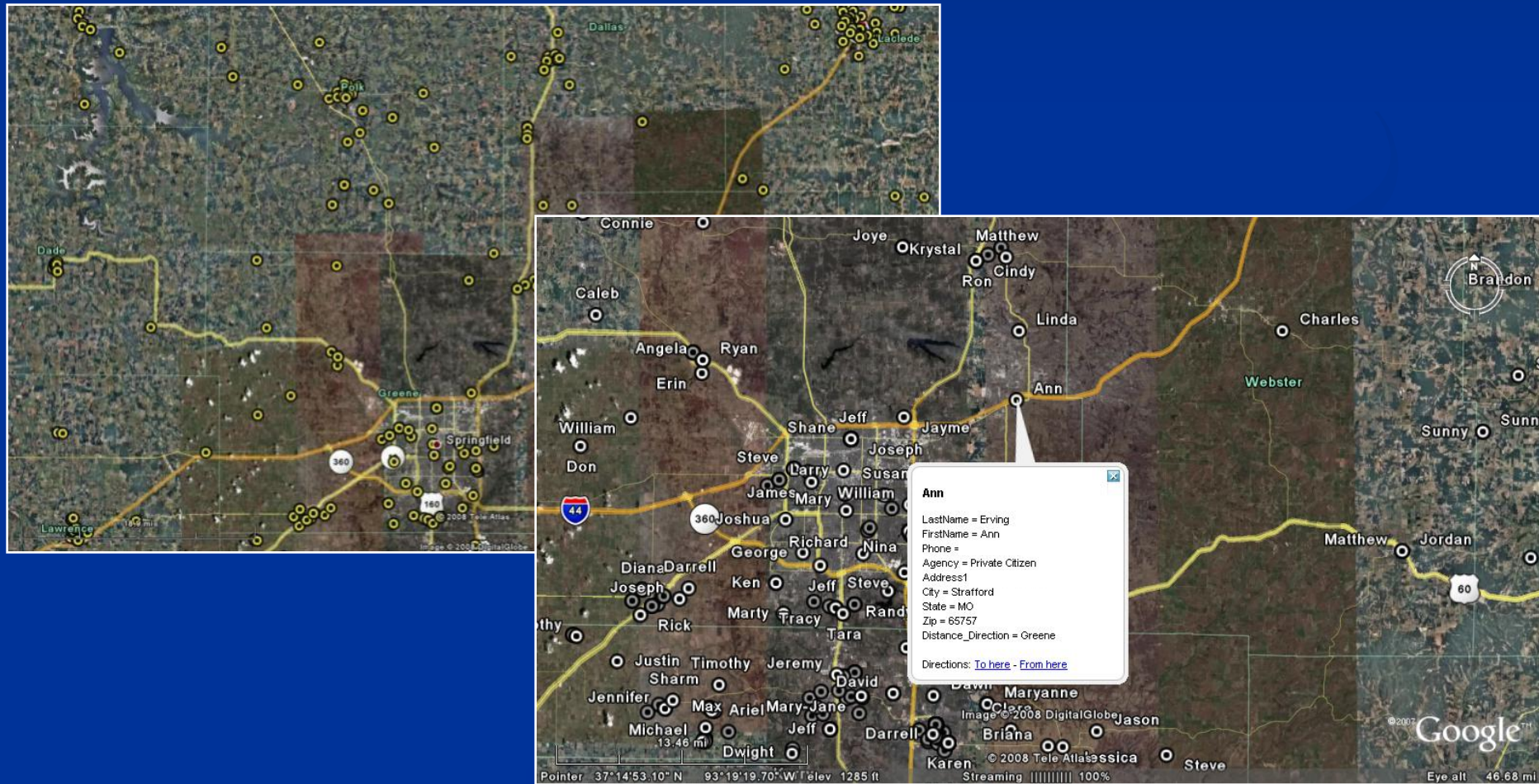
Pointer 36°18'30.80" N 97°19'40.61" W elev 1129 ft

Streaming 100%

© 2008 TerraMetrics  
© 2007 Google

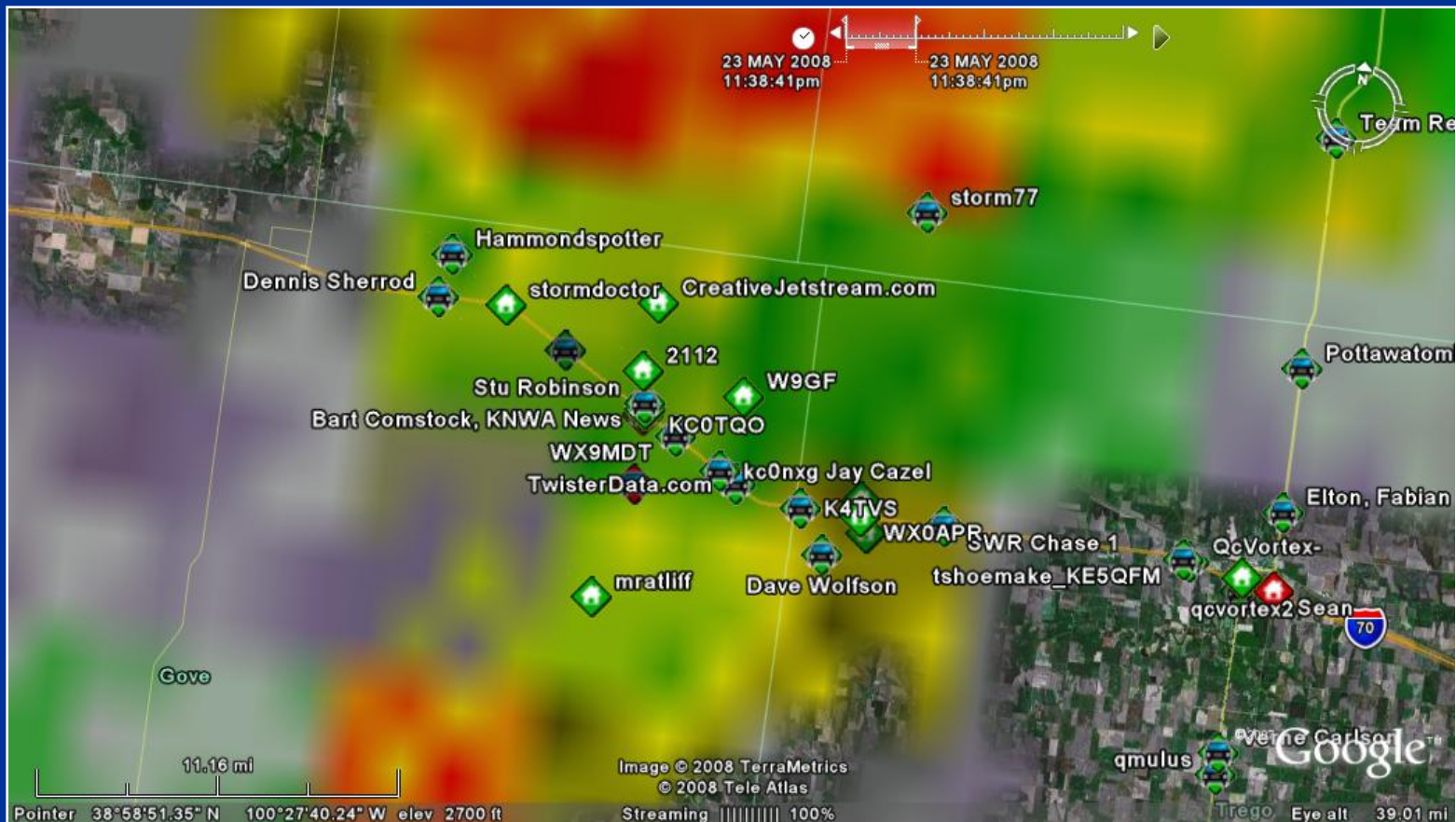
## ❖ Spotters

- Integrate warnings polygons and spotters to aid verification.

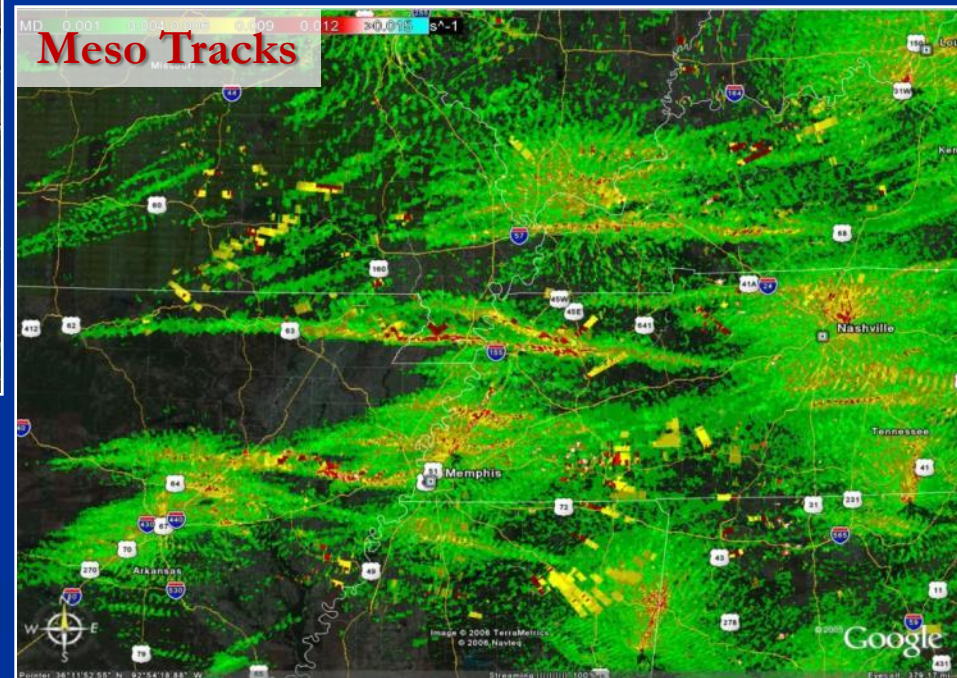
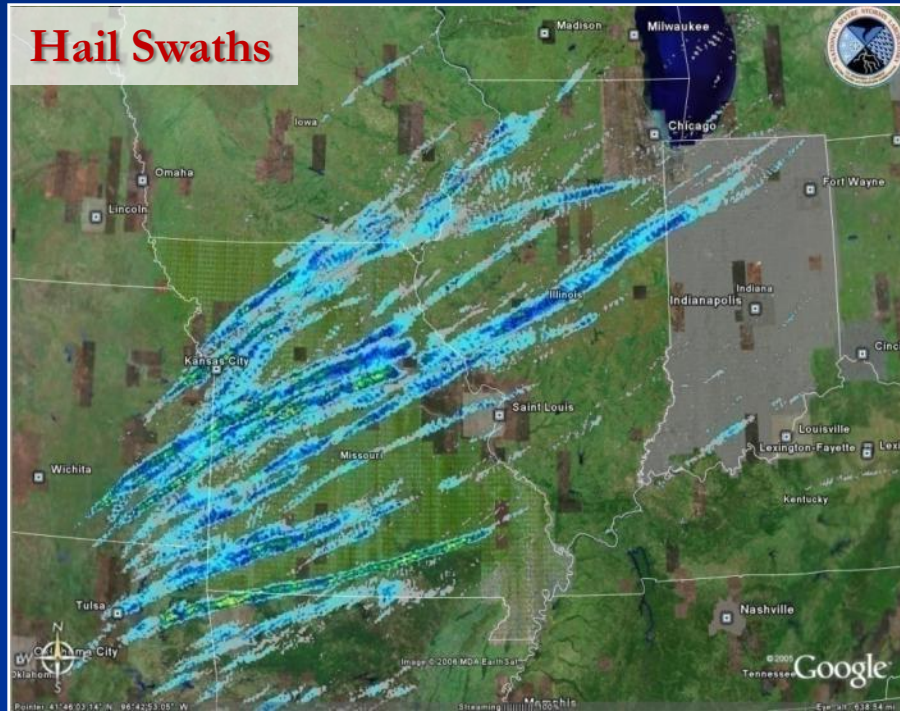


## ❖ Spotters

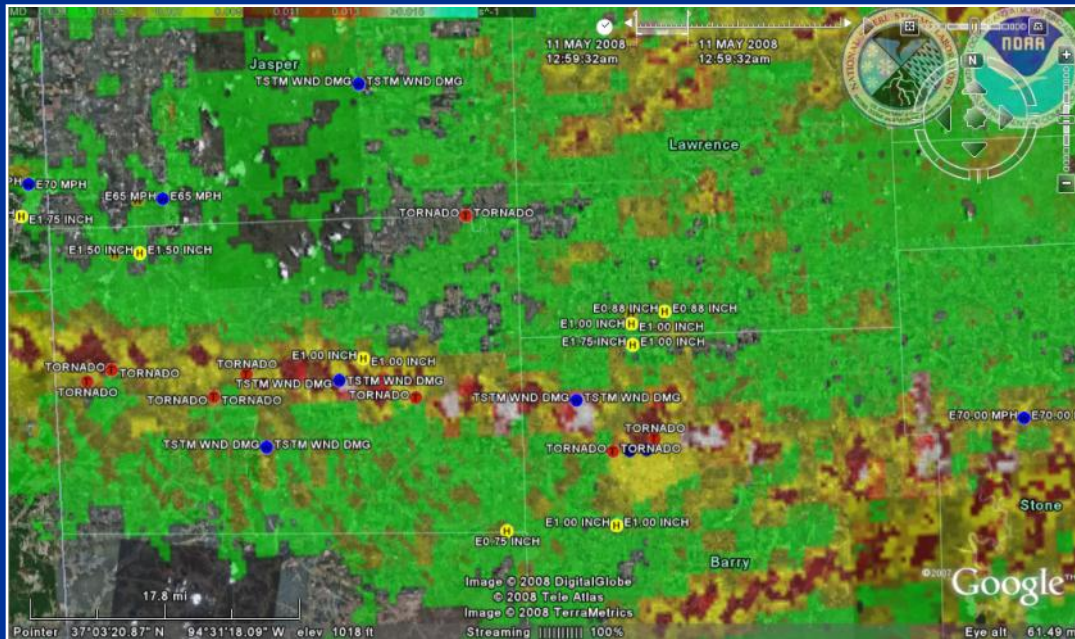
- Integrate warnings polygons and spotters to aid verification.



## ❖ Post Storm Assessment & Surveys



- ❖ Post Storm Assessment & Surveys
  - Draw Tracks For Survey Teams and Public Display

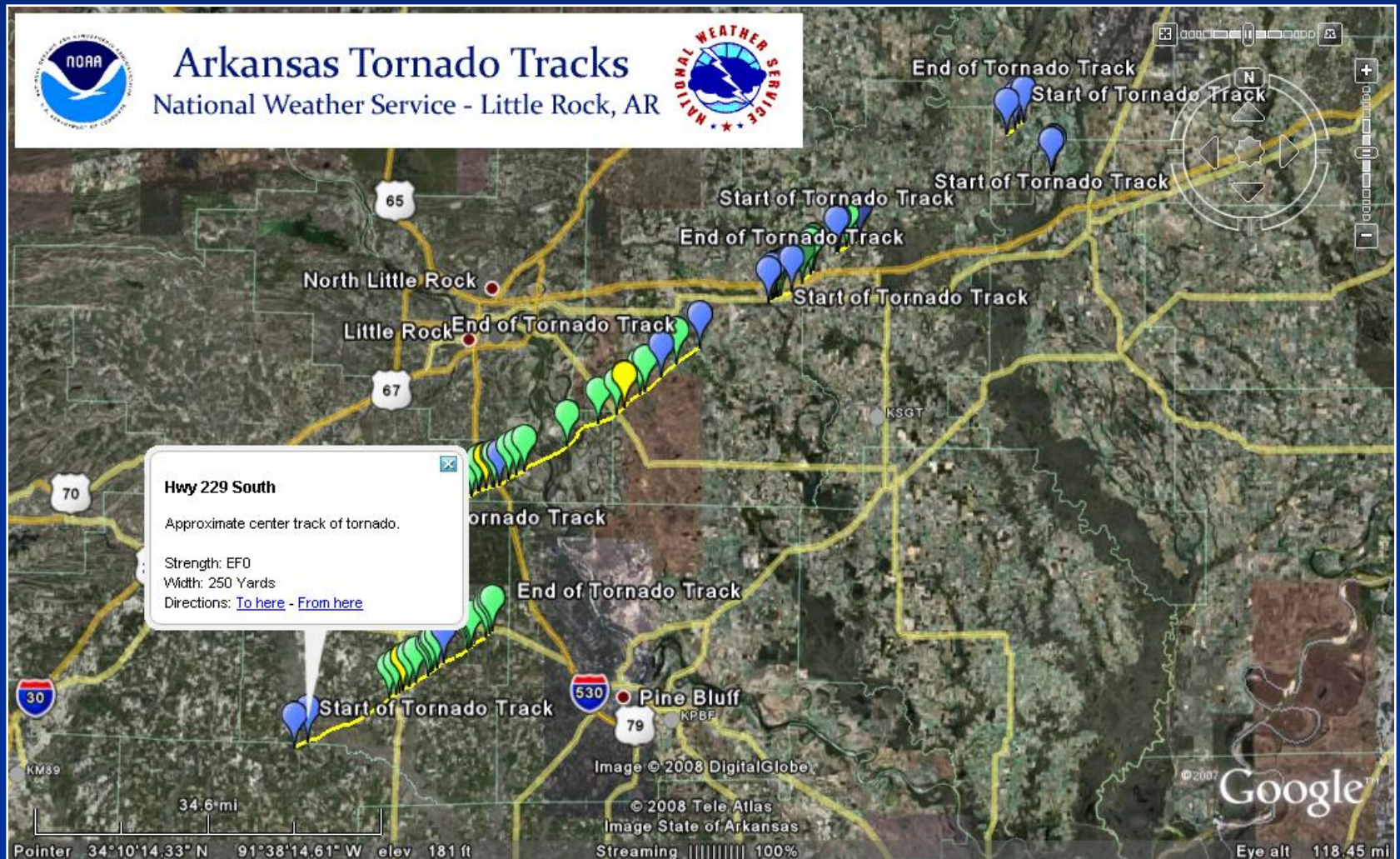




# Virtual Globes in the NWS



## ❖ Post Storm Assessment & Surveys

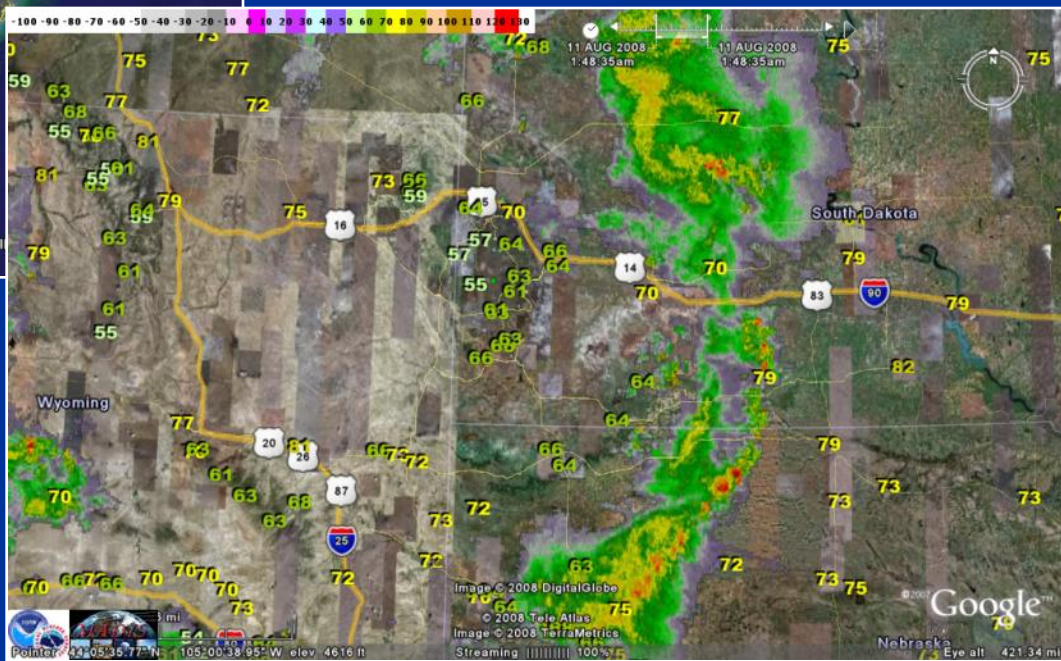
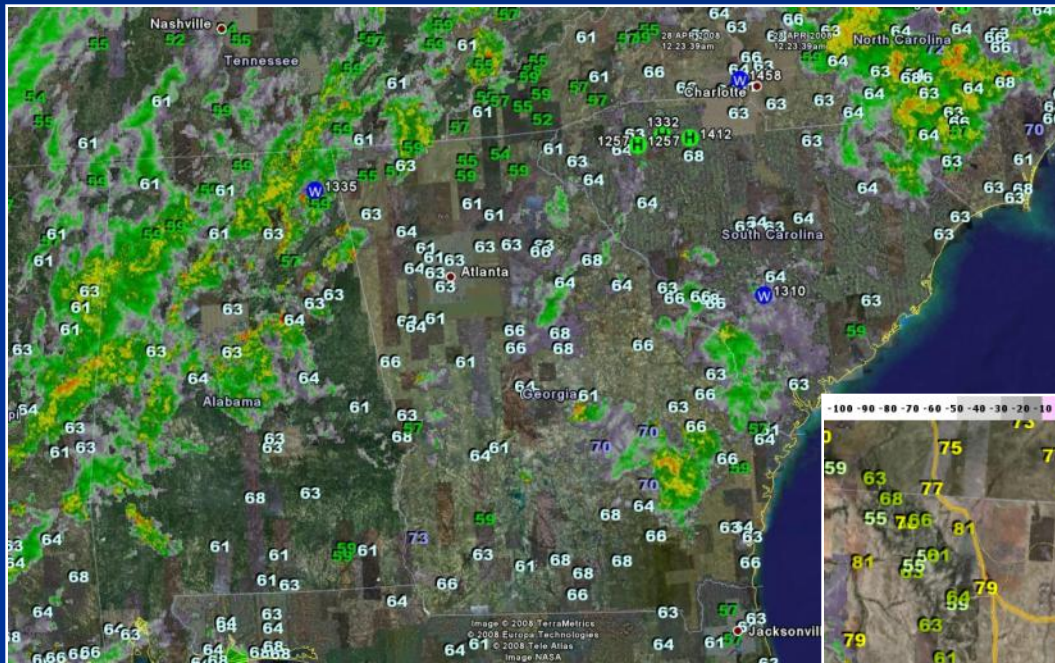




# Virtual Globes in the NWS



## ❖ Observations

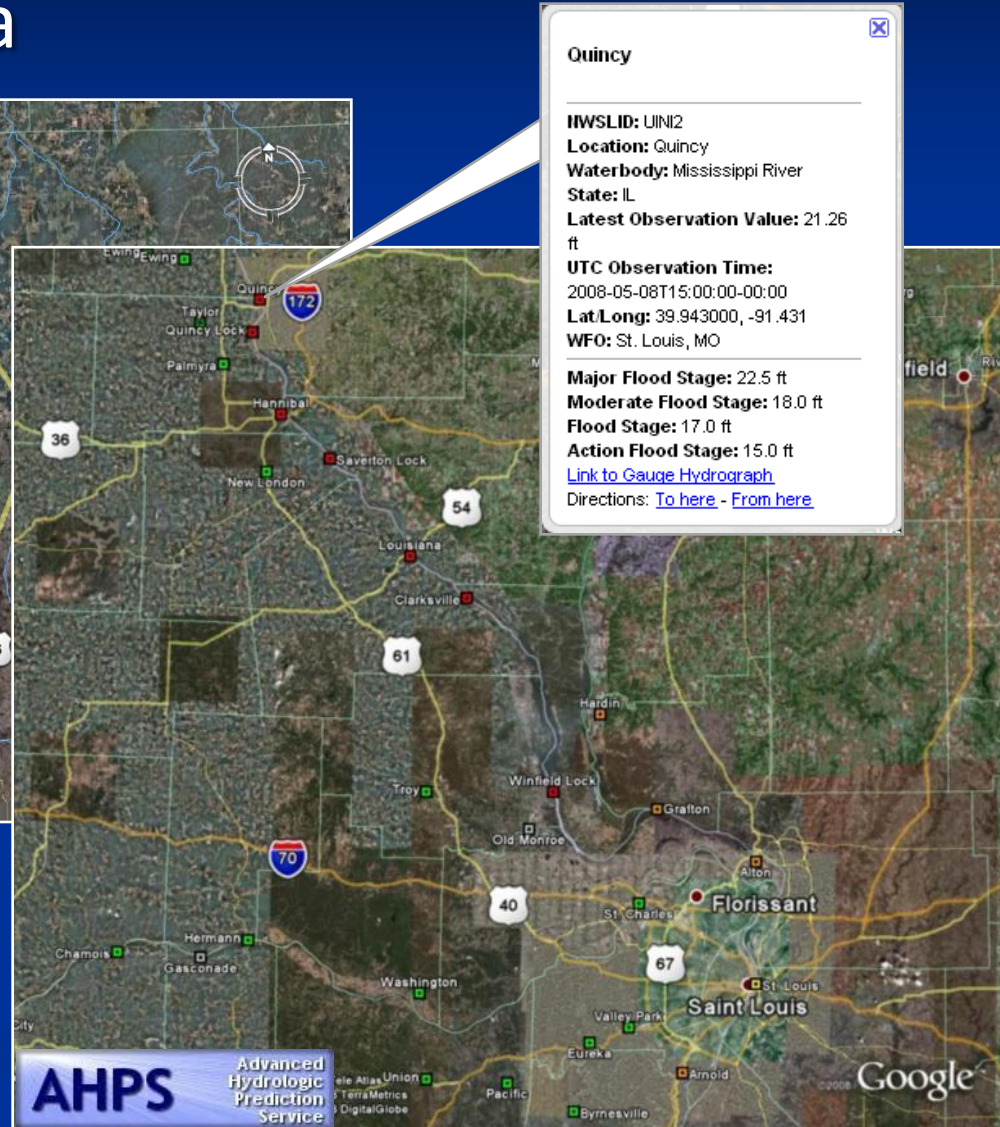
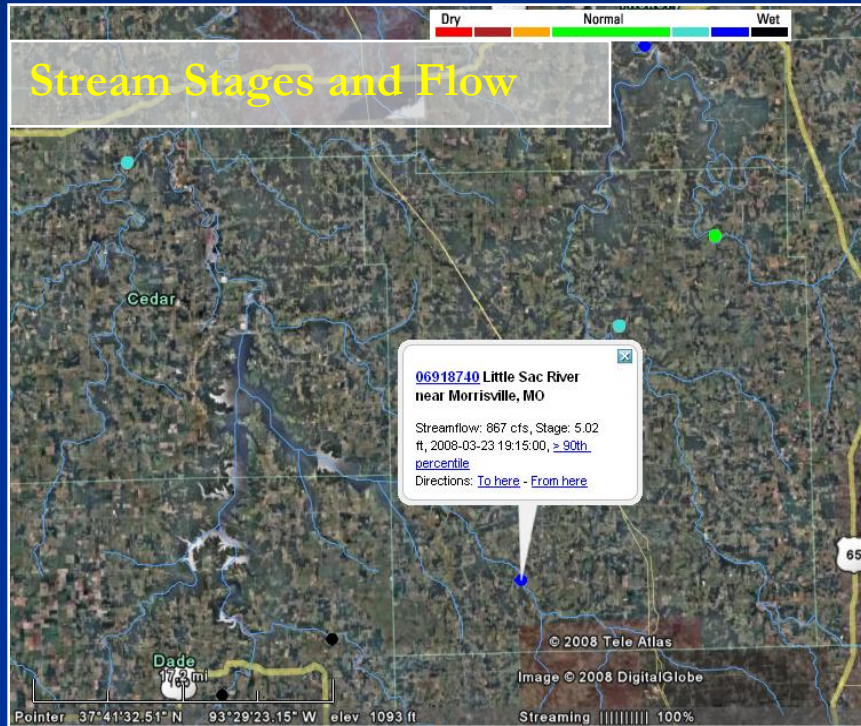




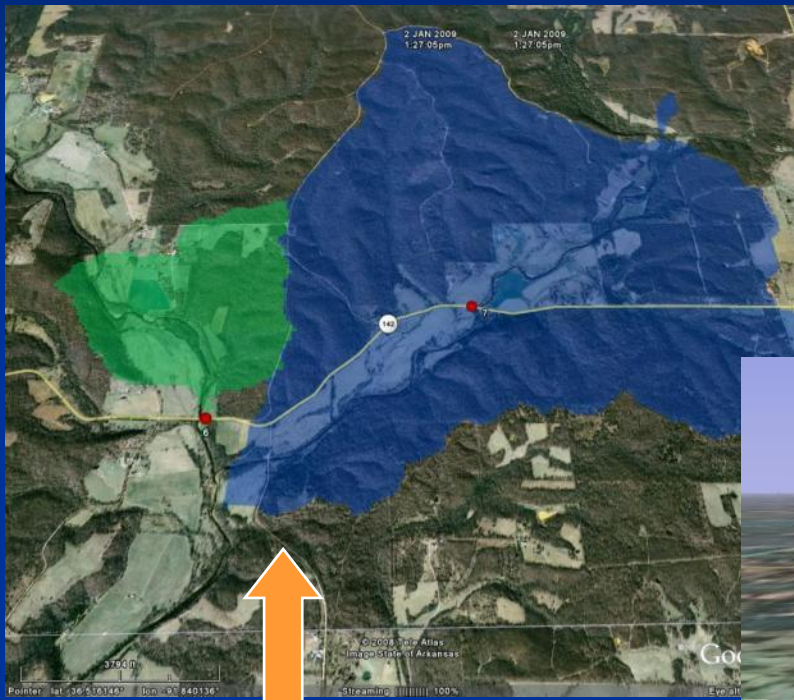
# Virtual Globes in the NWS



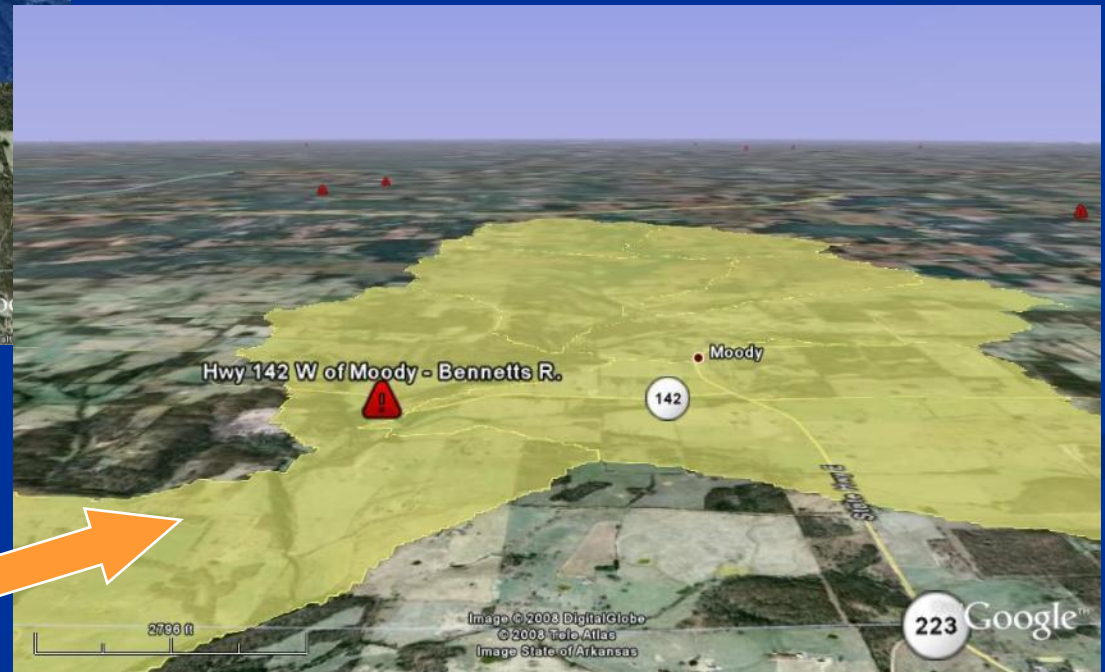
## ❖ River & Stream Data



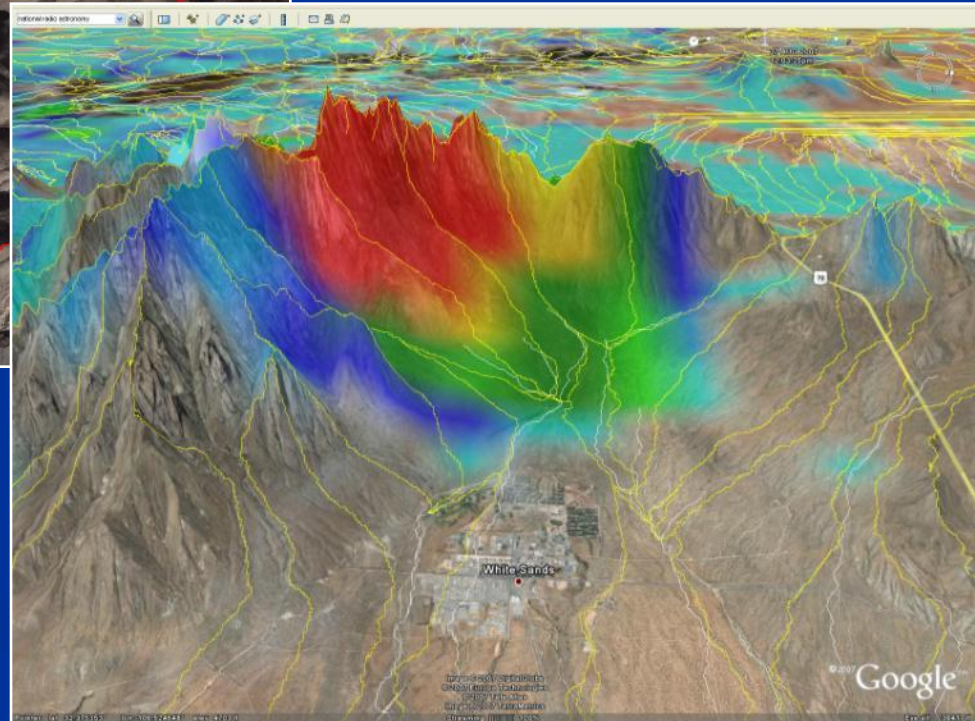
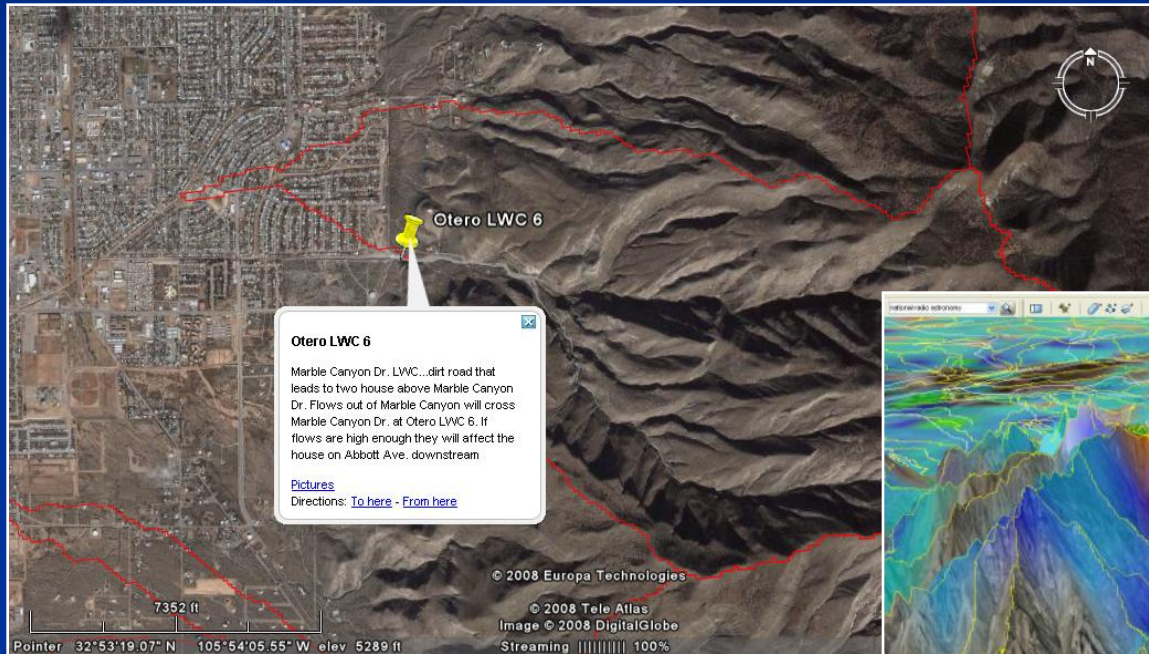
## ❖ Flood Risk Analysis



Flood prone low water crossing and basins



## ❖ Flood Risk Analysis



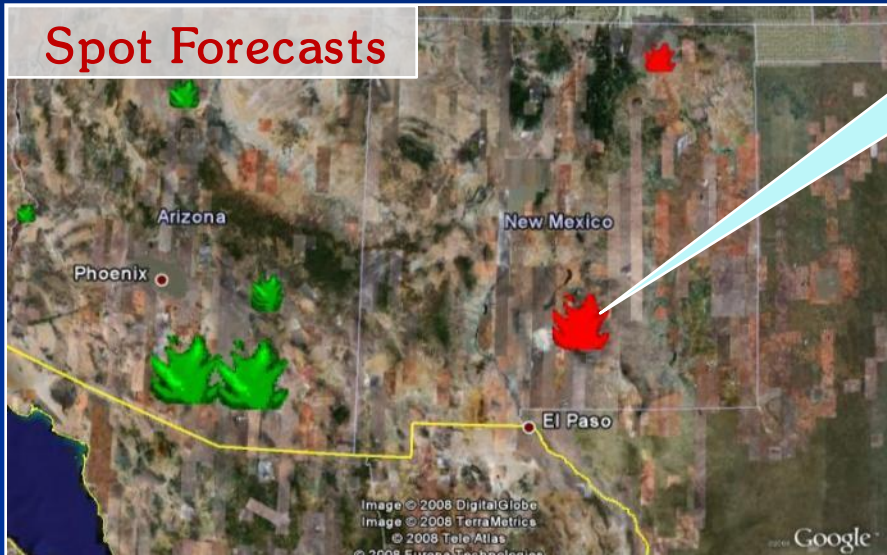


# Virtual Globes in the NWS



## ❖ Fire Weather

### Spot Forecasts



**BURN SITE: South Tularosa**

A SPOT FORECAST REQUEST HAS JUST BEEN RECEIVED FOR A WILDFIRE NAMED "South Tularosa"

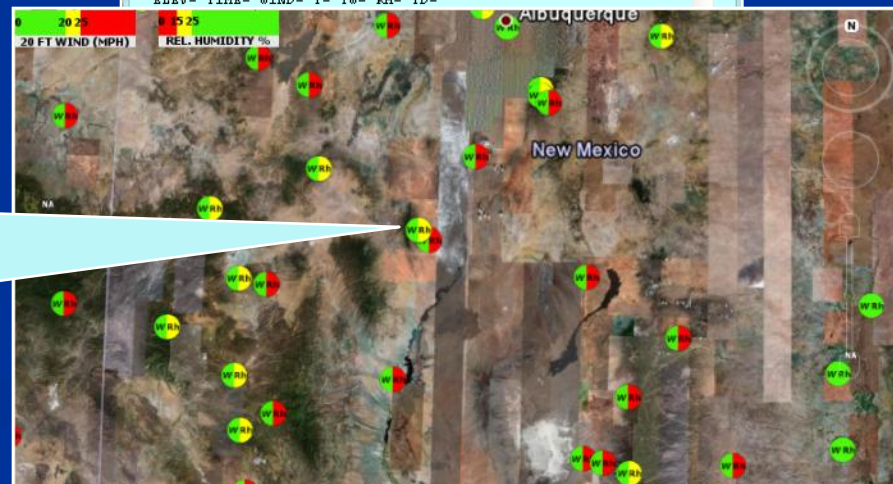
PRIORITY: IMMEDIATE  
 DATE: 5/8/08  
 TIME: 1813  
 PROJECT NAME: South Tularosa  
 PROJECT TYPE: WILDFIRE  
 REQUESTING AGENCY: NM-LNF  
 REQUESTING OFFICIAL: NM-ADC  
 REQUEST REASON: WILDFIRE  
 FAX: (505) 437-7908  
 EMERGENCY PHONE: (505) 437-0778  
 LOCATION:  
 STATE: NM  
 DLAT: 33.13639  
 DLON: 105.75028  
 EXPOSURE: West  
 FUEL TYPE: Mix Conifer  
 SHELTERING: PARTIAL  
 BOTTOM ELEVATION: 7689  
 TOP ELEVATION: 8485  
 SIZE (ACRES): 3860

WEATHER CONDITIONS AT PROJECT OR FROM NEARBY STATIONS  
 site ELEV=7500 TIME=1812 WIND=W 10-17 T=58 TW= RH=8 TD= 0/10  
 ELEV= TIME= WIND= T= TW= RH= TD=  
 ELEV= TIME= WIND= T= TW= RH= TD=  
 ELEV= TIME= WIND= T= TW= RH= TD=

**MRRN5 MELROSE RANGE NM US**

OBS DATE/TIME	05/22/2008 15:14	
ELEV	1326 M	4350 FT
TEMP	75 F	24 C
DWPT	28 F	-2 C
RH	18 %	
20 FT WIND DIR	213	
20 FT WIND SPD*	26 MPH	
20 FT WIND GUST*	M	
OBS TYPE	RAWS	

\* For non-RAWS sites, 20-ft winds are estimated as 80% of the reported 10-meter wind.  
[MADIS webpage](#)



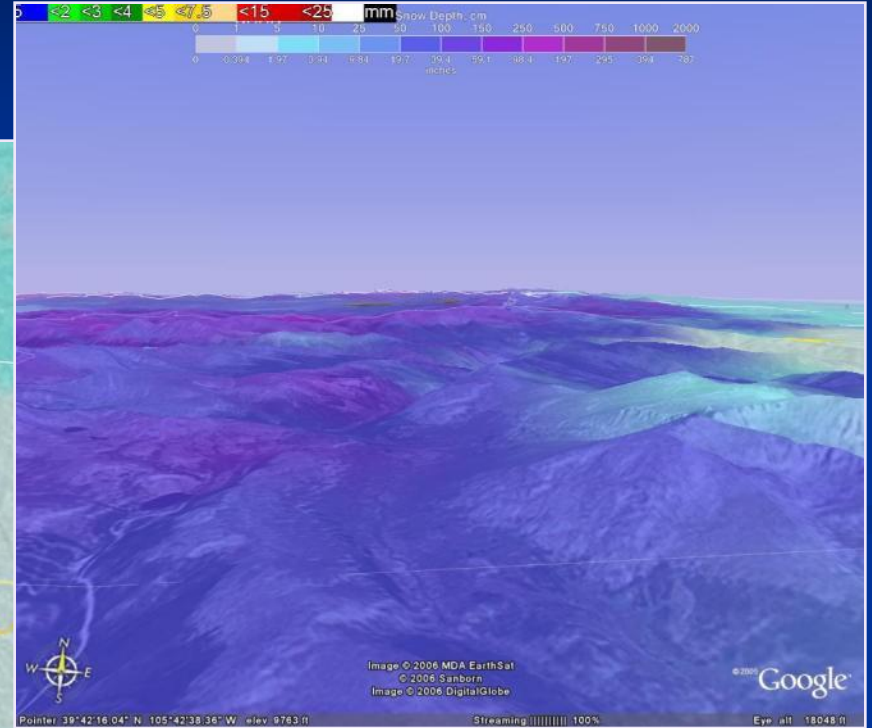
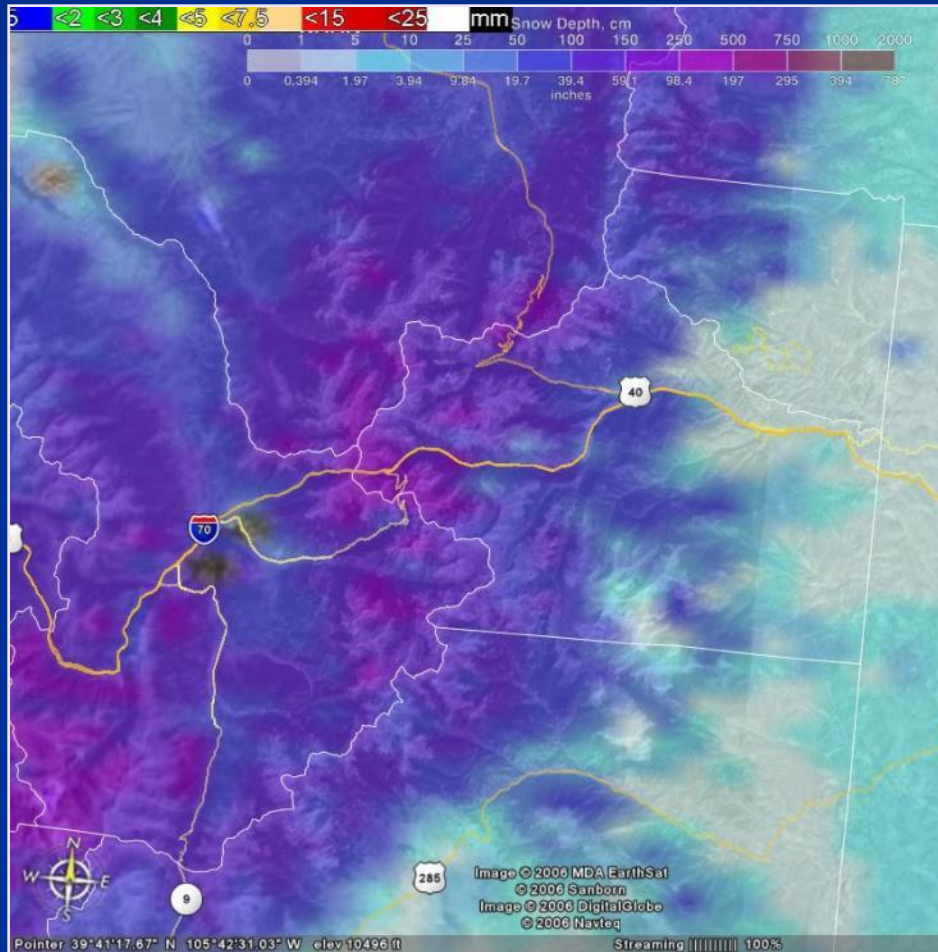
### Fire Weather Observation Ratings



# Virtual Globes in the NWS



## ❖ Snow Data



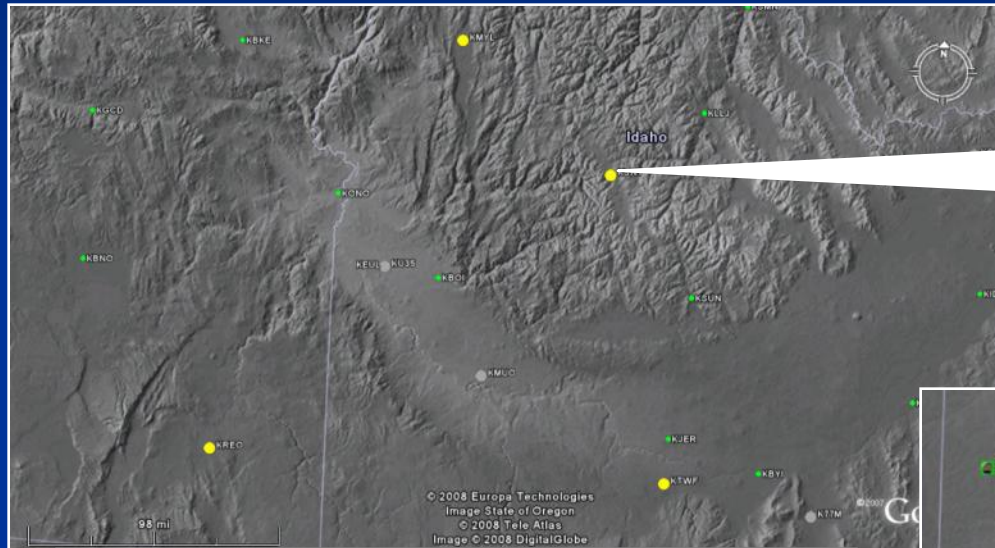
National Operational Hydrologic Remote Sensing Center



# Virtual Globes in the NWS



## ❖ Equipment Status



**KSNT**

000  
221552  
MTRSN  
METAR KSNT 221551Z AUTO 01005KT 02/M01 A2956 RMK A02 SLP974  
T00221006 PWINO FZFRAN TSN0 \$

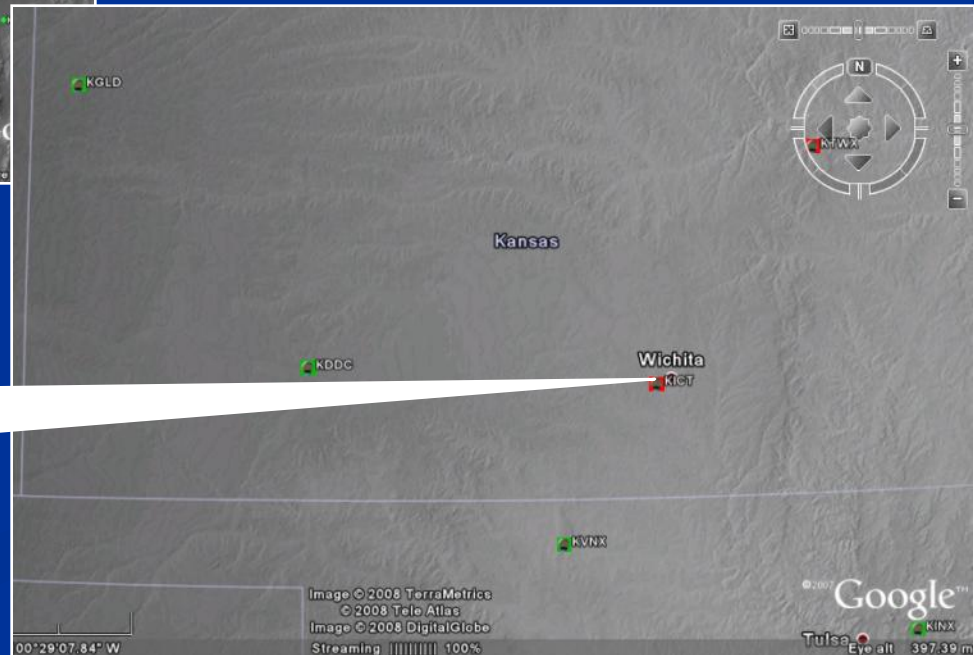
Altimeter: A2956  
Visibility: Missing  
Wind: 01005KT  
Temperature: 02  
Dewpoint: M01  
Sky: Missing  
Sensor Flags: PWINO FZFRAN TSN0

Directions: [To here](#) - [From here](#)

**KICT**

General Status Message For: KICT  
Wichita KS 5/22/2008 10L  
Mode of Operation: 2 Precip/Severe Weather  
RDA Operability Status: 32 Inoperable  
Volume Coverage Pattern: 21  
Number of Elevation Cuts: 9  
Elevations: 0.5 1.5 2.4 3.4 4.3 6 9.9 14.6 19.5  
RDA Status: 0 Indeterminate  
RDA Alarms: 64 COMM/Wideband (RDA/RPG)  
Data Transmission Enabled: 2 None  
RPG Operability Status: 10 Maintenance MandatoryOn-line  
RPG Alarms: 8 RPG Control Task Failure  
RPG Status: 2 Operate  
RPG Narrow Band Status: 0 Operate  
RPG Software Build: 100 10  
RDA Software Build: 100 10  
RDA Channel Number: 0 Single Thread  
Delta System Calibration: 0  
The KICT Radar will be down for preventive maint. until 2100z RNF  
THE KICT RADAR WILL BE DOWN FRO MAINT. UNTIL 1800Z. RNF

Directions: [To here](#) - [From here](#)





# Virtual Globes in the NWS



## ❖ NWS KML Resources Enhance SA

**CR KML Resource Page**

ROC Place Files	
<a href="#">Master ROC Places</a>	
SCRAPE Data	
<ul style="list-style-type: none"> <li>• <a href="#">Latest Storm Reports</a> <i>Updated every 2 minutes</i></li> <li>• <a href="#">Storm Reports since 12Z</a> <i>Updated every 5 minutes</i></li> <li>• <a href="#">Storm Reports from Yesterday</a> <i>Updated every 30 minutes</i></li> <li>• <b>Legend for Storm Reports</b> <ul style="list-style-type: none"> <li> - Tornado</li> <li> - Hail</li> <li> - Wind</li> <li> - Flooding</li> <li> - Winter</li> </ul> </li> <li>• <a href="#">Active Warnings (SVR, TOR, FFW)</a> <i>Updated every 2 minutes</i> <ul style="list-style-type: none"> <li> - Tornado Warning</li> <li> - Severe Thunderstorm Warning</li> <li> - Flash Flood Warning</li> </ul> </li> <li>• <a href="#">Central Region CWA Boundaries</a></li> </ul>	<ul style="list-style-type: none"> <li>• <a href="#">Radar Status</a> <i>Updated every 5 minutes</i> <ul style="list-style-type: none"> <li> - Radar Up</li> <li> - Radar Down</li> <li> - Radar Unknown</li> </ul> </li> <li>• <a href="#">Long Fuse Watch/Warning/Advisory</a> <i>Updated Every 10 minutes</i> <ul style="list-style-type: none"> <li> - Winter (WSW)</li> <li> - Non Precip (NPW)</li> <li> - Flooding</li> <li> - Fire WX</li> </ul> </li> <li>• <a href="#">TOR and SVR Watches</a> <i>Updated Every 5 minutes</i> <ul style="list-style-type: none"> <li> - Tornado Watch</li> <li> - Severe Thunderstorm Watch</li> </ul> </li> <li>• <a href="#">METAR Status</a> <i>Updated Every 10 minutes</i> <ul style="list-style-type: none"> <li> - METAR Ok</li> <li> - METAR Maint Error</li> <li> - METAR Missing</li> </ul> </li> </ul>
ArcServer Data	
<ul style="list-style-type: none"> <li>• <a href="#">QPF 00Z Issuance</a></li> <li>• <a href="#">QPF 06Z Issuance</a></li> <li>• <a href="#">QPF 12Z Issuance</a></li> <li>• <a href="#">QPF 18Z Issuance</a></li> <li>• <a href="#">Flood Potential Outlook</a></li> <li>• <a href="#">OPDK1 Flood Inundation Map-Forecast Stages</a></li> <li>• <a href="#">OPDK1 Flood Inundation Map-Observed Stages</a></li> </ul>	<ul style="list-style-type: none"> <li>• <a href="#">AHPS Upstream Basins Fcst &gt; Action Stage</a></li> <li>• <a href="#">AHPS Upstream Basins Obs &gt; Action Stage</a></li> <li>• <a href="#">Snow Water Eqv</a></li> <li>• <a href="#">Snow Depth</a></li> <li>• <a href="#">1 HR FFG</a></li> <li>• <a href="#">3 HR FFG</a></li> <li>• <a href="#">6 HR FFG</a></li> <li>• <a href="#">Radar</a></li> </ul>

*Last Updated: 04/11/08 15:45Z*

- KML files assembled from multiple sources for easy delivery.
- Original files are also being created on a GIS server and are being fed to this page.
- Simple importation into Virtual Globes



# Virtual Globes in the NWS



## ❖ New NWS GIS Internet Page

National Weather Service GIS Data Links - Mozilla Firefox

http://www.oh.noaa.gov/oh/temip/

National Oceanic and Atmospheric Administration  
National Weather Service

Site Map News Organization Search Enter Search Here Go

Local weather forecast by "City, ST"

RSS Feeds **KML**

Watches/Warnings Current By State/County W Alerts more...

Observations Doppler Radar Satellite Snow Cover Surface Weather Observed Precip more...

Forecasts By Local Office Graphical Aviation Weather Marine Weather Hurricanes Severe Weather Fire Weather more...

Text Messages By State By Message Type National

Forecast Models Numerical Models Statistical Models more...

Climates Past Weather Predictions

Weather Safety Weather Radio Hazard Assessment StormReady TsunamiReady more...

Education Outreach Data

### National Weather Service GIS Data Portal

The National Weather Service produces several data sets that are available in formats available to import into Geographic Information Systems (GIS). GIS is a collection of computer hardware, software, and geographic data for capturing, managing, analyzing, and displaying all forms of geographically referenced information. It takes the numbers and words from the rows and columns in databases and spreadsheets and puts them on a map.

Go to the **National Weather Service** GIS pages in the following formats:

### KML

Keyhole Markup Language (KML) is used by a variety of GIS and mapping applications and the specifications are freely available. It is used to describe geographic features and to manage the display of three-dimensional, geospatial data in the programs Google Earth, Google Maps, Google Mobile, ArcGIS Explorer, and WorldWind. (The word Keyhole is an earlier name for the software that became Google Earth; the software was produced in turn by Keyhole, Inc., which was acquired by Google in 2004.)

The term "Keyhole" actually honors the KH reconnaissance satellites, the original eye-in-the-sky military reconnaissance system now some 30 years old. KML files are very often distributed as KMZ files, which are zipped KML files with a kmz extension. [more about KML](#)

### Shapefile

Shapefiles are a geospatial vector data format for geographic information systems software. Shapefiles spatially describe points, polygons, polylines. A "shapefile" commonly refers to a collection of files with ".shp", ".shx", ".dbf", and other extensions on a common prefix name (i.e., "takes.shp"). SHP files can be viewed in GIS viewers as well as more sophisticated GIS applications. [more about shapefiles](#)

**National Weather Service** viewers are available in shapefiles.

The [AWIPS map database](#) catalog contains background map data in shapefile format that are used by the National Weather Service (NWS) for use by the user community. These data consist of a variety of official NWS forecast zones and county designations used by the NWS. In addition other data that might be of interest and that are used by the (NWS) Advanced Weather Information Processing System (AWIPS) are available through the [catalog](#).

[A list of key sites](#) to access NOAA GIS data.

Following resources will help you view these GIS files.

- NASA World Wind viewer (latest version 1.4 released February 14, 2007) - free download from [NASA](#)
- GoogleEarth viewer - KML file format support - free download from [Google.com](#)
- ESRI's ArcGIS Explorer - KML file format support - free download from [ESRI.com](#)
- Keyhole Keyhole 2 LT and Keyhole 2 NV (NVIDIA graphics cards only) - KML file support - (Purchase) -

National Weather Service GIS Data Links

NWS KML/KMZ Links

Site Map News Organization Search Enter Search Here Go

### National Weather Data in GIS formats

The National Weather Service produces several data sets that are available in formats available to import into Geographic Information Systems (GIS). GIS is a collection of computer hardware, software, and geographic data for capturing, managing, analyzing, and displaying all forms of geographically referenced information. It takes the numbers and words from the rows and columns in databases and spreadsheets and puts them on a map.

[National Weather Service GIS survey](#)

Following resources will help you view these GIS files.

- NASA World Wind viewer (latest version 1.4 released February 14, 2007) - free download from [NASA](#)
- GoogleEarth viewer - KML file format support - free download from [Google.com](#)
- ESRI's ArcGIS Explorer - KML file format support - free download from [ESRI.com](#)
- FME (Feature Manipulation Engine) that converts data in one format to another - KML file format support - (Purchase) - download from [Safe.com](#)

The following links will either provide kml/kmz/shape files, will link you to a page with these type of files, or displays info in a GIS viewer.

Current Weather	Forecasts	Past Weather
<b>Watches &amp; Warnings</b> <a href="#">Current Weather Warnings</a> <a href="#">Flash Flooding - Basins and Streams</a>	<a href="#">Your Local Weather Forecast</a> <a href="#">MOS Guidance</a> <a href="#">GFS Meteograms</a> <a href="#">GOES Sounding Skew-T</a> Tulsa area: <a href="#">Max</a>   <a href="#">Min</a>   <a href="#">POP</a> <a href="#">River Gate Forecasts</a>	<b>Doppler Radar</b> <a href="#">NWS Radar archive data</a>  <b>Normals, Means, Extremes</b> <a href="#">NCDC Climate Atlas</a> of the United States <a href="#">NCDC GIS Portal</a>  <b>Severe Weather</b> Storm Reports: <a href="#">Tornado</a> , <a href="#">Wind and Hail</a> 1950-2006 Database of <a href="#">Tornado</a> , <a href="#">Large Hail</a> , and <a href="#">Damaging Wind Reports</a>
<b>Doppler Radar</b> <a href="#">Real Time Radar</a> <a href="#">Radar Locations</a>		<b>Rain/Snowfall</b> <a href="#">CoCoRaHS Observations</a> <a href="#">NOHRSC Snow Data</a>
<b>Surface Observations</b> <a href="#">Metar Obs</a> <a href="#">RAWS Obs</a> <a href="#">APRSWNET Obs</a> <a href="#">MesoWest Obs</a> <a href="#">Other Surface Obs</a>		<b>Hurricanes</b> <a href="#">Past Atlantic Storm Tracks</a> <a href="#">Past East Pacific Storm Tracks</a>
<b>Satellite</b> <a href="#">Infrared   Loop</a> <a href="#">Visible   Loop</a> <a href="#">Water Vapor   Loop</a>		
<b>Remote Gages</b> River Gages: <a href="#">Observed</a> Snow Gages: <a href="#">w/ labels</a>   <a href="#">w/o labels</a>	<b>Fire Weather</b> <a href="#">Current Spot Forecast Sites</a> <a href="#">Fire Weather Categorized Observations</a> <a href="#">MODIS fires</a> <a href="#">IMET Locations</a>	<b>Additional Info</b> <a href="#">Coastal Estuarine Bathymetry</a> <a href="#">nowCOAST</a> web mapping portal
<b>Great Lakes</b> <a href="#">Wave Height</a> <a href="#">Ice</a> <a href="#">Water Temperature</a>		
<b>Surface Fronts</b> Past and Present <a href="#">Synoptic Features</a>		

<http://www.weather.gov/gis/>



# Virtual Globes in the NWS



- Virtual Globes are a valuable operational tool
  - Enhances situational awareness
  - Supports warning decisions
  - Impact and risk analysis
  - Enhances coordination
  - Improve quality of products & services



# Virtual Globes in the NWS



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