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CREATING INTERACTIVE GRAPHICAL OVERLAYS IN THE ADVANCED WEATHER INTERACTIVE PROCESSING SYSTEM (AWIPS) USING SHAPEFILES AND DGM FILES

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OVERVIEW

Two examples of local AWIPS applications that create graphical overlays interactively are presented here:

1) Anvil Threat Corridor Forecast Tool (Anvil Tool) using shapefiles
2) AMU Trajectory Map Maker (Trajectory Tool) using DGM files

SHAPEFILE PROPERTIES

- Shapefiles are used by the National Weather Service (NWS) to view background maps in AWIPS. They are also a source of data for creating geographic entity lookup tables (GUTL), used by Paramon to describe areas under a warning, watch, or advisory.
- NWS offices usually obtain Shapefiles from the AWIPS maps database ([http://www.nws.noaa.gov/prodata](http://www.nws.noaa.gov/prodata)) and rarely modify or create their own maps.
- Shapefiles can be created or modified with GIS software (e.g., ArcGIS), third-party software libraries (e.g., Shapefile C Library) or a custom program.
- A shapefile stores the geometry and attribute information of the spatial features in a data set. The data stored in a shapefile is stored as a set of vector coordinates. The feature can be a point, polygon, or polyline.
- A shapefile contains a main file, index file, and a DBASE table.
  - The main file contains a record for each spatial feature (e.g., counties state).
  - The index file contains the offset of each record from the beginning of the main file (e.g., counties state).
  - The DBASE table contains records for each attribute (e.g., counties state). Attributes are commonly used to describe or label spatial features.
- Each point in a shapefile is represented by two double-precision coordinate values, in the order X, Y, where X represents longitude and Y represents latitude.
- A polygon consists of one or more rings; a ring is a sequence of four or more connected points that form a closed loop. The first and last vertex of a ring must be the same.
- A polyline is an ordered set of vertices and consists of one or more parts.

An AWIPS display showing three shapefiles: Citrus, Interstate highways, and state/county boundaries. Each data layer uses a different color and is represented by a unique “opaque” in hexadecimal format.

- The Denver AWIPS Risk Reduction and Requirements Evaluation (DARE) Graphics Metatile (DGM) was created specifically for AWIPS and is not as well-known as KML for use in many applications.
- The command to set the drawing color is ignored by AWIPS.
- With the exception of color tables, AWIPS graphics colors can only be changed manually in the D2D application. Color tables are used for the "deep" graphics display, such as profiler time-height displays. Deep graphics cannot be overlaid on images or have graphics loaded on top of them.
- Each DGM command is represented by a unique “opaque” in hexadecimal format.
- Most useful DGM commands:
  - Draw Linked Vectors: opcode = 0x1010; Draw Unlinked Vectors: opcode = 0x2000.
  - Draw Text: opcode = 0x3000.
  - Select Absolute Address: opcode = 0xDDCT (TT = FF for frame addressing, TT = 00 for normal addressing; format is the default).
  - Select Relative Address: opcode = 0xDDCT (TT = FF for frame addressing, TT = 00 for normal addressing).
  - Set Frame Size: opcode = 0xOFn (2^n size of frame) g = 1 for absolute coordinates in minutes of longitude/latitude; when g = 2, a central point is given in minutes and absolute coordinates refer to an offset from the central point in seconds of longitude/latitude.

REFERENCES


AMU TRAJECTORY MAP MAKER

- Purpose: Overlay the ground trajectories of space vehicles during launch and landing on top of radar products.
- Potential Users: the 45th Weather Squadron and Spaceflight Meteorology Group.
- The tool plots trajectories using a tool file of latitude/longitude points as input. The tool file can be either a direct export (DOP) Map file format or Launch file format.
- DOP file format: Each line contains either a latitude/longitude pair or a blank line (east and north are positive). Sequential lines of latitude/longitude pairs are treated as a simple linked vector. A blank line causes a new linked vector to start.
- Launch file format: Three separate text files for each launch -- one for the right and left edges of the expected trajectory and the center of trajectory. Each line contains three decimal numbers — the first is the altitude or time into the flight, the second is the latitude and the third is the longitude.
- How it works: When the user selects a file in the files listbox, the tool opens the input file for reading. If the file is in the correct format, the DGMfile is created. The frame size is written to the DGM file with the Set Fm Size command. Either the Draw Linked Vectors or Draw Unlinked Vectors command is then written to the DGM file. The number of points or pairs is written to the DGM file, followed by the latitude/longitude points or pairs. Finally, the frame label, if selected, is written to the DGM file.

Installing Instructions:

- Copy the AMUjmap_tool and gmgfmtcsh files to the /awips/ha/win/bin directory.
- Create the input directories to hold the input files:
  - /awips/ha/win/awipss/AMUjMapMaker/DOP
  - /awips/ha/win/awipss/AMUjMapMaker/Launch
- Create the output directories to hold the DGM files:
  - /awips/ha/win/mp/MapLeft
  - /awips/ha/win/mp/MapRight
  - /awips/ha/win/mp/MapLand
- Add the tool to the /FM_HOME/data/maininfo.txt localization file.
- Add application product button to the /FM_HOME/data/maininfo.txt localization file.
- In the backgroundMenus.txt localization file, add a submenus called "Trajectory Maps". Inside the submenu add three product buttons: "Left Track", "Nominal Track", "Right Track", and "Shuttle Landing".
- Add data keys for the three DGM products to the maininfo manual localization file.
- Add data keys for the three DGM products to the prodmaininfo.txt localization file.
- Run the localization script with the default options. Restart the D2D application.

ADVANTAGES OF DGM FILES

- DGM files are easier to create than shapefiles.
- Not all DGMs are interactive. DGM files are static and can be imported into D2D just like any other data product.
- Unlike shapefiles, DGM files can be created directly in AWIPS.

ADVANTAGES OF SHAPEFILES

- There is pre-existing software that can be used to create or modify shapefiles.
- There is a large repository of shapefiles for use as maps, such as the AWIPS map database.
- The lines and points in a shapefile can be very precise since latitude/longitude points are stored with double-precision.
Creating Interactive Graphical Overlays in the Advanced Weather Interactive Processing System Using Shapefiles and DGM Files

Graphical overlays can be created in real-time in the Advanced Weather Interactive Processing System (AWIPS) using shapefiles or DGM files. This presentation describes how to create graphical overlays on-the-fly for AWIPS, by using two examples of AWIPS applications that were created by the Applied Meteorology Unit (AMU). The first example is the Anvil Threat Corridor Forecast Tool, which produces a shapefile that depicts a graphical threat corridor of the forecast movement of thunderstorm anvil clouds, based on the observed or forecast upper-level winds. This tool is used by the Spaceflight Meteorology Group (SMG) and 45th Weather Squadron (45 WS) to analyze the threat of natural or space vehicle-triggered lightning over a location. The second example is a launch and landing trajectory tool that produces a DGM file that plots the ground track of space vehicles during launch or landing. The trajectory tool can be used by SMG and the 45 WS forecasters to analyze weather radar imagery along a launch or landing trajectory. Advantages of both file types will be listed.