Appendix: Spatial Data Format - NWSRFS GeoData

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Overview

The National Weather Service River Forecast System (NWSRFS) includes software with map-based displays. The original map displays were developed on UNIX workstations and have been ported to Linux. The software uses special data formats specific to the NWSRFS, with some files using geographic coordinates and others using HRAP (Hydrologic Rainfall Analysis Project) coordinates. NWSRFS GeoData files that are referenced in GeoView project files can be located in any directory; however, a standard NWSRFS installation typically defines the GeoData location using the `geo_data` `AppsDefaults` variable, followed by an RFC variable, followed by *ascii* and *binary* directories (e.g., resulting in the following directories: */usr/apps/geo_data/abrfc/ascii* and */usr/apps/geo_data/abrfc/binary*). The following table summarizes NWSRFS layers that are supported by the GeoView package. More information about data file formats is provided after the table.

NWSRFS GeoData Types Supported by GeoView

GeoData Type	Shape Type	Supported File Format(s)	Attribute Assignment	Comments
County Boundaries	Polygon	GeoData ASCII (*county.dat*) and binary formats (*county.bin*).	`ID` = identifier `COUNTY` = name	ASCII files are often inconsistent between RFCs
Forecast Group Basins	Polygon	GeoData ASCII (*fg_basin.dat*) and binary (*fg_basin.bin*) formats.	`FG` = identifier	
Forecast Points	Point	ASCII format for forecast points (*forecastpt.dat*).	`Name`, `State`, `FP`	File format is only used with forecast points.
MAP Basins	Polygon	GeoData ASCII (*map_basin.dat*) and binary (*map_basin.bin*) formats.	`MAP Area` = identifier `MAP Name` = name	Can be issues with upper and lower MAP areas.
RFC Boundary	Polygon	GeoData ASCII (*rfc_boundary.dat*) and binary (*rfc_boundary.bin*) formats.	`RFC` = identifier	
Rivers	Polyline	GeoData ASCII (*river.dat*) and binary (*river.bin*) formats.	`REACH` = identifier `NAME` = name `ORDER` = order	

Snow Stations	Point	Snow stations file used with snow updating system (*swe_stations.dat*).	`ID`
			`ELEV*`
			`BASESTA`
			`NAME`
				See NWSRFS Snow Updating System, developed by RTi.

State Boundaries	Polyline	GeoData ASCII (*state.dat*) and binary (*state.bin*) formats.	`Abbreviation` = identifier `Name` = name	

NWSRFS ASCII GeoData Files

The standard format for ASCII polygon/polyline files is as shown in the following example (excerpt from a *map_basins.dat* file). Comments are not allowed in files. Each data feature consists of a header followed by point data. The header has an **identifier** (e.g., a station identifier), **name** (no spaces), **order** (only used for rivers, -1 otherwise), and the **number of points** for the shape. The remaining lines for the feature define each point in the shape as **latitude** (decimal degrees) and **longitude** (decimal degrees).

```
LEDC2 XXX -1 47
39.2430 106.1925
39.2430 106.2425
39.2513 106.2425
39.2513 106.2758
39.2596 106.2758
... etc...
```

Relevant comments about this format:

- Although the file is free format, it does not appear that spaces within header fields are allowed. The name field is often set as XXX in NWSRFS files. The identifier field is also often set to XXX where not needed (e.g., for *rfc_boundary.dat*).

- Most ASCII files seem to use latitude and then longitude, but different RFCs seem to have their own formats. Apparently the binary files are most often used by applications and therefore ASCII files do not always follow a set standard.

- The sign of the latitude and longitude in the files is not always consistent. In some cases, longitudes are always positive. Software that uses the ASCII files can generally assume the files are used in the USA; however, the sign issue can be problematic for international work.

The ASCII forecast point file format is as follows with fixed-format fields for forecast point name, river, identifier, latitude, and longitude. The longitude is by default converted to a negative number for implementations in the United States.

```
BLUE MOUNTAIN DAM         PETIT JEAN RVR     BMTA4   35.1000      93.6500
DARDANELLE 1NE            ARKANSAS RVR       DARA4   35.2333      93.1500
L & D 10 DARDANELLE DAM   ARKANSAS RVR       DRDA4   35.2500      93.1667
```

The ASCII snow stations format is as follows (see the NWSRFS Snow Updating System for information about this file).

```
#Identifier,latitude,longitude,elevF,Base Station,Name
13A08,48.8333,-113.7167,5800F,,PTARMIGAN NO 8
13A03,48.8333,-113.7167,5600F,,ICEBERG LAKE NO 3
13A06,48.7667,-113.7000,5500F,,PIEGAN PASS NO 6
```

NWSRFS Binary GeoData Files

NWSRFS binary GeoData files are only used for the polygon/polyline data. The binary files are used to increase performance when reading the data. The files are typically created by simple C programs that read the ASCII file and writes the binary file. Each shape is written to the binary file as follows:

9 bytes for character identifier (8 characters + trailing null character)
21 bytes for name (20 characters + trailing null character)
4 bytes for "order" integer
4 bytes for number of points
8 bytes for floating point x and y HRAP coordinates
Repeat the previous for the number of points in the shape

Refer to ASCII files and conversion utility programs on the NWSRFS system to understand custom conversions that may vary between implementations.

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