FFMP

Source Definitions

NOTE: See the Examples section – it helps understand this format quite a bit – and provides an additional tip for HPE/HPN data sources.

As of AWIPS OB8.3, FFMP Advanced allows for custom definition of data sources in FFMP. If the user wants FFMP to recognize and make use of a data source (be it QPE, QPF, or Guidance), that data source needs to be defined **properly** in the source configuration file and FFMP must be re-localized. Of course, that data also needs to be ingested into AWIPS, but that is accomplished outside of FFMP.

This document will provide guidance on how to properly define the domain settings in FFMP Advanced. Of course, editing a very format-specific file manually can very easily result in typing errors or format errors. Once time allows, we'd like to move this function into a full GUI, thus direct file editing would not be necessary. But until then, this is what we have to deal with.

FFMPsourceConfig.dat

The text file used for defining FFMP data sources is called "`FFMPsourceConfig.dat`" and is located in the `$FXA_DATA/ffmp` directory. This file will be automatically created the first time FFMP Advanced localizes (from the old configuration file), assuming you still have the old configuration files on your system.

Define only one data source per line in this file. Use the format defined below, in the "Entry Format" section.

After you have made changes to this file, execute the following steps:
1) As **fxa** on **dx1**, localize for FFMP. (Note that this will delete all FFMP output data files, including any Forced FFG.
   ```
   cd /awips/fxa/data/localization/scripts
   ./mainScript.csh -ffmp
   ```
2) Make sure the FFMPprocessor is running (as **fxa** on **px1**). If it was running before the localization, the localization wil restart it, but if it was not running, then it will not be started.
   ```
   startFFMPprocessor
   ```
3) Re-start the notificationServer as **fxa** on **dx1**:
   ```
   stopNotificationServer
   startNotificationServer
   ```

CWA Coverage

The very first line of the FFMPsourceConfig.dat file (flagged by the "+" character) lists the CWAs you want FFMP to 'see'. This list should include your primary CWA and any potential Service Backup CWAs. This list should be pipe (|) delimited only. Here is an example:

```
+|LWX|AKQ|RLX
```

Entry Format: Order!

FFMP Advanced expects the data sources listed in FFMPsourceConfig.dat to be in a certain order: QPE data sources always come before non-QPE sources and 'Relate Key' sources. (See the Relate Key section below for a description of what Relate Keys are.)

Entry Format: Shortcuts!

The descriptions below go into detail regarding what the format needs to be for manually created data source entries. However, for certain sources, there are short-cuts of which to take advantage, for which the FFMP Advanced localization can recognize and convert automatically for you. These sources currently include **radars** (both WSR88D and TDWR, both DHR and DPR) and 'normal' **RFC-issued FFG**.

For radars using the **non Dual-Pol DHR** product, all you have to do is create a new text line immediately after the "+" line in this configuration file with the lower-case radar identifier, like this:
```
klwx
```

For radars using the **Dual Pol DPR** product, all you have to do is create a new text line immediately after the "+" line in this configuration file with the lower-case radar identifier and DPR moniker, like this:
```
klwxDPR
```

For **RFC-issued FFG**, you need to also provide the time duration, separated by a pipe (|), like this:
```
MARFC3|3
```

Entry Format

The following **pipe-delimited** format must be used for each data source listed in FFMPsourceConfig.dat:

```
SourceKey |  IsRelKey | Durations | Types | DepictKey | DataKey | Transform | Expiration | RelKey
```

Entry Format Descriptions	
Format Item	**Format Item Description**

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Format Item	**Format Item Description**
SourceKey	All upper-case text name for the Data Source of interest. If the data source represents only one duration, it can be useful to put that duration in the SourceKey. *Do not use spaces or special characters*.
IsRelKey	If this key is a Relate Key, define as "1", otherwise, leave empty. (See discussion below regarding use of Relate Keys.)
Durations	A **comma** (,) delimited list of durations that are valid for the Data Source. This will depend on the Type (see below), but generally speaking, this is blank for QPE sources, and will have a single entry for nonQPE sources, unless the source is a Relate Key.
Types	This is a list of 4 sub-types used by FFMP, **comma**-delimited (,). The four types and value definitions are:

Sub-Type name	Description	Values
Data	QPE, QPF, or Guidance	`0 = QPE`
		`1 = Guidance`
		`2 = QPF`
Source	Domain: ie Radar Polar, Cartesian Lat/Lon (color in doc. coordinated with Transform below)	`0 = Radar Polar grid`
		`1 = Radar azeq (VIL) grid`
		`2 = HRAP grid`
		`3 = LatLon Cartesian`
		`4 = GIS shape files`
Unit	Accumulation vs. 'Instantaneous' rate	`0 = rate`
		`1 = accumulation`
File	Type of file data is stored in.	`0 = ORPG` **DHR** `radar product`
		`1 = netCDF`
		`2 = GIS .dbf file`
		`3 = Volume Browser netCDF`
		`4 = ORPG` **DPR** `radar product`

DepictKey	The Depict Key for the data source. It is likely you will need to look this up in the various depict key files that get created upon localization of AWIPS. If you add a radar, remember to use the post-localization key. If you are unfamiliar with how AWIPS and the D2D use depict and data keys, ask around on awipsinfo, or look on the FFMP webpage for more info, or (lastly) contact FFMP support. NOTE: For Volume Browser data sources, be sure to use the gridDepictKey found in **$FXA_LOCALIZATION_ROOT/$FXA_LOCAL_SITE/gridDepictKeys.txt**
DataKey	Same as for Depict Keys (above) except for Data Keys. NOTE: For Volume Browser data sources, be sure to use the gridDataKey found in **$FXA_LOCALIZATION_ROOT/$FXA_LOCAL_SITE/gridDepictKeys.txt** or **gridDataKeys.txt**.

Transform	This is a list of a number of **colon**-delimited (:) items that get used to transform the incoming data so that it can be assigned to small basins. The following are the elements of the Transform Format Item and what each means. (Note that some elements have meanings that depend on other configuration elements.):		
	Sub-Transform Name	**Description**	**Values (when applicable)**
	Source Type	Same as Source Type above for 'Types'	
	Units	Units of the data in the data source. This can also have a multiplier if the data stored in the Data Source is not of full units. Use an upper case X to separate units from multiplier. If this is 'byte', then a separate conversion file needs to be made available. Examine the byteConv.dat file for one of your RFC FFG sources to see an example. Basically, the following rules need to be followed: 1. The file is to be named byteConv.dat and placed in $FXA_DATA/ffmp/*srcA*/(*srcB*)/lookupFiles (*srcB* may or may not exist, depending on the Data Type.) 2. All items in the file are delimited by a space 3. The first item in the file is the number of subsequent items in the file. 4. The subsequent items are byte value conversions. For example: the 5th item after the first item is the precipitation value to be used for a byte value of 5.	ie: byte, in, mm/hr, inX0.1
	Domain Pairs (Western Longitudes are negative)	There are 3 Domain Pairs that have different impacts depending on the Source Type. They are used to help FFMP manage data ingest and transformations from raw data domains to the small basin domain used by FFMP internally. It is expected these transforms will evolve and improve over time. . (**The color coding relates to the colored Types above**.)	
		Source Type	**Description**	**Examples**
	Origin Pair	0 (Radar Polar Grid)	Radar lat/lon	

		1 (Radar VIL grid)	Radar lat/lon	
		2 (HRAP Grid)	Lat/lon of lower left corner (southwest) **Except RFC FFG: upper left (northeast)**	
		3 (Lat/lon Cartesian)	Lat/lon of lower left corner (southwest)	
		4 (GIS shape files)	Lat/lon of lower left corner (southwest)	
	Limit Pair	0 (Radar Polar Grid)	Max degrees, max radius (km)	360,240
		1 (Radar VIL grid)	Cartesian dimensions (_nx, _ny)	
		2 (HRAP Grid)	Cartesian dimensions (_nx, _ny)	
		3 (Lat/lon Cartesian)	Lat/lon of upper right corner (northeast)	
		4 (GIS shape files)	Lat/lon of upper right corner (northeast)	
	Resolution Pair	0 (Radar Polar Grid)	Degree azimuth gate, range gate(km)	1,1
		1 (Radar VIL grid)	Grid cell width (km) in x/y directions	
		2 (HRAP Grid)	Grid cell width relative to standard HRAP (~4x4km)	1,1 0.25,0.25
		3 (Lat/lon Cartesian)	Grid cell width in degrees	0.01,0.01
		4 (GIS shape files)	Not used: define as "0:0".	
	Extra	Comma delimited list, that can be blank and can be optional, depending on the factors mentioned below. ***Note the comma element position noted with the examples***.		*(blank)*
		File Type = 1 or 3 (netCDF or	This is the name of the attribute that holds the pertinent data in the netCDF files.	**1** image pr

		VB netCDF)	This can also be a comma-delimited list containing time and layer info, *when the netCDF file of interest has multiple arrays* for the same attribute. These are optional. If they are not included, the following defaults will be used: • Time = 0 • Layer = "SFC"	**1,,3,4** pr,,3600,SFC
		File Type = 2 (GIS dbf file)	This must be two names separated by a comma. The first is the name of the basin identifier attribute and the second is the name of the data value attribute.	**1,2** PFAF_ID,myQPF
		Any **grid**	This can also have a row- or column- (or azm- or rng-) major indication, preceded by a comma. If no –major indication is made, row/rng-major is assumed.	**1,2** **,2** pr,col image,row ,row
			NOTE: "row-major" means the data is stored row-by-row and "column-major" means the data is stored column-by-column.	
Expiration	Number of minutes, after which the data is to be considered 'too old' to be used. This may mean the **data is ignored** (in the case of Unit Type of 1 (accumulation)), or the applicable **time duration** of the data is **trimmed** to this value if data time interval is bigger than this value (in the case of Unit Type of 0 (rate)). This value should of course be something greater than the data interval expected, but not too much greater so as to render the values misleading.			
RelKey	Relate Key - when defined, the Source Key is to be considered one part of the Relate Key data. See the section on Relate Keys below.			

Here are some **example entries** and what they dictate to FFMP Advanced:

`klwx|||0,0,0,0|1080411808|1080411808|0:byte:36.9839:-77.0072:360:230:1:1|11|`

Source Key	`klwx`	The KLWX WSR-88D
IsRelKey		Blank = this source is not a Relate Key source
Durations		None – this source is of Unit Type 0 (see below)
Types	`0,0,0,0`	
Data	`0`	QPE
Source	`0`	Radar Polar Grid
Unit	`0`	Rate
File	`0`	ORPG Radar Product: **DHR**
Depict Key	`1080411808`	Unique depict key for **DHR** from klwx
Data Key	`1080411808`	Unique data key for **DHR** from klwx
Transform	`0:byte:36.9839:-77.0072:360:230:1:1:`	
SourceType	`0`	Radar Polar Grid
Units	`byte`	Data is stored as bytes and must be converted from byte values to usable data via a conversion file*.
Origin Pair	`36.9839:-77.0072`	Latitude and longitude of the radar's location
Limit Pair	`360:230`	Polar grid is 360 degrees by 230 km.
Resolution Pair	`1:1`	Azimuthal increment is 1 degree and radial increment is 1 km.
Extra		blank
Expiration	`11`	When determining the duration for which this rate data applies, if the time between the current data and the previous data is greater than this, this value will be used.
RelKey		Blank, no Relate Key in use for this source

`klwxDPR|||0,0,0,4|1080411808|1080411808|0:in/hrX.001:36.9839:-77.0072:360:230:1:0.25:,rng|11|`

Source Key	`klwx`	The KLWX WSR-88D
IsRelKey		Blank = this source is not a Relate Key source
Durations		None – this source is of Unit Type 0 (see below)
Types	`0,0,0,4`	
Data	`0`	QPE
Source	`0`	Radar Polar Grid
Unit	`0`	Rate
File	`4`	ORPG Radar Product: **DPR**
Depict Key	`1080411808`	Unique depict key for **DPR** from klwx. (This is not the actual key value for DPR for klwx).
Data Key	`1080411808`	Unique data key for **DPR** from klwx. (This is not the actual key value for DPR for klwx).
Transform	`0:in/hrX.001:36.9839:-77.0072:360:920:1:0.25:,rng`	
SourceType	`0`	Radar Polar Grid
Units	`In/hrX.001`	Data is stored as values of in/hr multiplied by a thousand. The ".001" is used to convert the data read back into in/hr.
Origin Pair	`36.9839:-77.0072`	Latitude and longitude of the radar's location
Limit Pair	`360:230`	Polar grid is 360 degrees by 230 km.
Resolution Pair	`1:0.25`	Azimuthal increment is 1 degree and radial increment is 0.25 km.
Extra	`,rng`	Can be blank for Source type 0 (Radar Poplar Grid), but ",rng" represents that the data is read rng (range) first. Range has priority over azimuth.
Expiration	`11`	When determining the duration for which this rate data applies, if the time between the current data and the previous data is greater than this, this value will be used.
RelKey		Blank, no Relate Key in use for this source

`HPE|||0,2,0,3|12345|12345|2:mm/hr:37.89994:-80.91356:396:360:0.25:0.25:pr|7|`

Source Key	`HPE`	High-resolution Precipitation Estimator
IsRelKey		Blank = this source is not a Relate Key source
Durations		None – this source is of Unit Type 0 (see below)
Types	`0,2,0,3`	
Data	`0`	QPE
Source	`2`	HRAP Grid
Unit	`0`	Rate
File	`3`	netCDF, Volume Browser
Depict Key	`12345`	(bogus) grid depict key for the raw HPE data
Data Key	`12345`	(bogus) grid data key for the raw HPE data
Transform	`2:mm/hr:37.89994:-80.91356:396:360:0.25:0.25:pr`	
SourceType	`2`	HRAP Grid
Units	`mm/hr`	Raw data is in mm/hr (and will be converted by FFMP, if needed, into internal units)
Origin Pair	`37.89994:-80.91356`	Latitude and longitude of the southwest corner of the data grid.
Limit Pair	`396:360`	Cartesian dimensions of the grid: x = 396, y = 360
Resolution Pair	`0.25:0.25`	This grid is at ¼ HRAP. For each single HRAP grid cell, this data grid has 16 grid cells.
Extra	`pr`	The name of the netCDF attribute that contains the pertinent data in the data file is "pr".
Expiration	`7`	When determining the duration for which this rate data applies, if the time between the current data and the previous data is greater than this, this value will be used.
RelKey		Blank, no Relate Key in use for this source

NOTE: **For HPE, you can use the file /awips/fxa/data/localizationDataSets/XXX/localHPE.txt as a quick reference to get the proper values for the Transform Origin and Limit pairs.**

`HPNQPF1||1|2,2,1,3|12345|12345|2:mm:37.89994:-80.91356:396:360:0.25:0.25:stpa,,3600|10|`

Source Key	`HPNQPF1`	High-resolution Precipitation Nowcaster (HPN)
IsRelKey		Blank = this source is not a Relate Key source
Durations	`1`	1 hour duration
Types	`2,2,1,3`	
Data	`2`	QPF
Source	`2`	HRAP Grid
Unit	`1`	Accumulation
File	`3`	netCDF, Volume Browser
Depict Key	`12345`	(bogus) grid depict key for the raw HPE/HPN QPF data
Data Key	`12345`	(bogus) grid data key for the raw HPE/HPN QPF data
Transform	`2:mm:37.89994:-80.91356:396:360:0.25:0.25:stpa,,3600`	
SourceType	`2`	HRAP Grid
Units	`mm`	Raw data is in mm (and will be converted by FFMP, if needed, into internal units)
Origin Pair	`37.89994:-80.91356`	Latitude and longitude of the southwest corner of the data grid.
Limit Pair	`396:360`	Cartesian dimensions of the grid: x = 396, y = 360
Resolution Pair	`0.25:0.25`	This grid is at ¼ HRAP. For each single HRAP grid cell, this data grid has 16 grid cells.
Extra	`stpa,,3600`	The name of the netCDF attribute that contains the pertinent data in the data file is "stpa" and it has a forecast time of 3600 seconds (1 hour).
Expiration	`10`	If the Data from this source is older than the defined time (in minutes), it will not be used.
RelKey		Blank, no Relate Key in use for this source

NOTE: For HPE/HPN, you can use the file /awips/fxa/data/localizationDataSets/XXX/localHPE.txt as a quick reference to get the proper values for the Transform Origin and Limit pairs.

`MARFC1||1|1,2,1,1|25050|25050|2:byte:45.0159:-79.2525:200:200:1:1:image|1080|RFCFFG`

Source Key	`MARFC1`	RFC-issued FFG from the Mid-Atlantic RFC (MARFC)
IsRelKey		Blank = this source is not a Relate Key source
Durations	`1`	This data is in 1-hour durations already.
Types	`1,2,1,1`	
Data	`1`	Guidance data
Source	`2`	HRAP Grid
Unit	`1`	Accumulation (the data already represents a duration)
File	`1`	netCDF
Depict Key	`25050`	Unique depict key for RFC FFG from MARFC
Data Key	`25050`	Unique data key for RFC FFG from MARFC
Transform	`2:byte:45.0159:-79.2525:200:200:1:1:image`	
SourceType	`2`	HRAP Grid
Units	`byte`	Data is stored as bytes and must be converted from byte values to usable data via a conversion file*.
Origin Pair	`45.0159:-79.2525`	Latitude and longitude of the **northwest** corner of the data grid. (This is usually southwest, but not for RFC FFG.)
Limit Pair	`200:200`	Cartesian dimensions of the grid: x = 200, y = 200
Resolution Pair	`1:1`	This grid is at full HRAP.
Extra	`image`	The name of the netCDF attribute that contains the pertinent data in the data file is "image".
Expiration	`1080`	If the Data from this source is older than the defined time (in minutes), it will not be used.
RelKey	`RFCFFG`	This source is to be considered a part of the Relate Key "RFCFFG". It is expected that other sources are also of the Relate Key RFCFFG and that these will be combined in some fashion. See the Relate Key section below.

`RFCFFG|1|1,3,6|1,2,1,1|0|0|999::0:0:0:0:0:0:|0|`

Source Key	`RFCFFG`	This is the RFCFFG Source Key.
IsRelKey	`1`	This is a **Relate Key** entry!
Durations	`1,3,6`	These are the durations available for this Source Key (1, 3, and 6 hours durations)
Types	`1,2,1,1`	
Data	`1`	Guidance data
Source	`2`	HRAP Grid
Unit	`1`	Accumulation (the data already represents a duration)
File	`1`	netCDF
Depict Key	`0`	No Depict Key is necessary for Relate Keys.
Data Key	`0`	No Data Key is necessary for Relate Keys.
Transform	`999::0:0:0:0:0:0:`	
SourceType	`999`	Void Type value – **Relate Keys** do not make use of this.
Units		Blank – no units for **Relate Keys**.
Origin Pair	`0:0`	**Relate Keys** do not use Transform pairs.
Limit Pair	`0:0`	**Relate Keys** do not use Transform pairs.
Resolution Pair	`0:0`	**Relate Keys** do not use Transform pairs.
Extra		Blank – **Relate Keys** do not make use of this.
Expiration	`0`	Data expiration does not apply to **Relate Keys**.
RelKey		Blank – **Relate Keys** cannot use other Relate Keys.

`gisqpe|||0,4,0,2|18313|18313|4:in/hr:37.89:-80.91:42.23:-72.78:0:0:PFAF_ID,QPE|10|`

Source Key	`gisqpe`	An ESRI GIS shapefile QPE source
IsRelKey		Blank = this source is not a Relate Key source
Durations		None – this source is of Unit Type 0 (see below)
Types	`0,4,0,2`	
Data	`0`	QPE
Source	`4`	GIS shape files
Unit	`0`	Rate
File	`2`	GIS .dbf file
Depict Key	`18313`	(bogus) depict key for the raw gisqpe data
Data Key	`18313`	(bogus) data key for the raw gisqpe data
Transform	`4:in/hr:37.89:-80.91:42.23:-72.78:0:0:PFAF_ID,QPE`	
SourceType	`4`	GIS shape files
Units	`in/hr`	Raw data is in in/hr (and will be converted by FFMP, if needed, into internal units)
Origin Pair	`37.89:-80.91`	Latitude and longitude of the southwest corner of a rectangular bounding domain of the shapes contained in the dbf file.
Limit Pair	`42.23:-72.78`	Latitude and longitude of the northeast corner of a rectangular bounding domain of the shapes contained in the dbf file.
Resolution Pair	`0:0`	Not used for shape file data sources.
Extra	`PFAF_ID,QPE`	The name of the small basin identifier attribute is "PFAF_ID" and the name of the data value attribute is "QPE".
Expiration	`10`	When determining the duration for which this rate data applies, if the time between the current data and the previous data is greater than this, this value will be used.
RelKey		Blank, no Relate Key in use for this source

Relate Keys

Some data sources can be combined inside FFMP Advanced and considered to be a single source. The best example is RFC FFG. RFC-issued Flash Flood Guidance (FFG) comes from multiple River Forecast Centers (RFCs), yet FFMP considers them as a single source of Guidance data. For example: the LWX CWA requires FFG from 3 RFCs (MARFC, SERFC, OHRFC), so, each of the configuration entries for these 3 RFCs will define a Relate Key to use, then that Relate Key will have a separate entry itself.

RFC-issued FFG also comes in various durations (1-, 3-, 6-hour). Because of the ways that AWIPS handles data, each of these durations also needs a separate configuration entry in FFMP Advanced, but can still use the same Relate Key in order to instruct FFMP that all of this data is to be considered one source, with multiple durations available for use. Examine your FFMPsourceConfig.dat file – FFMP Advanced will automatically handle the construction of configuration entries for RFC FFG for you when it first localizes from the pre-Advanced version of FFMP..

Relate Key usage tells FFMP Advanced to 'combine'. Combining multiple durations makes intuitive sense, but combining multiple geographic regions can be complex. For FFMP Advanced's initial release, any geographic combinations will be a simple overlay – the most recent data to be ingested will be overlaid on top of whatever data is already in memory. For RFC FFGs, there is no down side, as, even though their grids overlap, the data they provide in those grids does not overlap. If you wanted to use a Relate Key to combine the data from all of your dedicated radars, the geographic combination will still be a simple overlay, which, as I am sure you can see, can be a bad mosaic method for certain radar combinations. It is expected that FFMP Advanced's mosaicking methods will mature as time goes on.

It is expected that the use of Relate Keys will be very limited. If you'd like to use Relate Keys, and are not sure how to apply them (or if they even apply at all), you can check the FFMP webpage for more info or contact Tom.Filiaggi@noaa.gov (303 497-6578).