# VI.1 INTRODUCTION TO USER INFORMATION FOR THE FORECAST SYSTEMS

Bookmarks



Contents



[Next] [Previous] [Bookmarks] [Top]

## Introduction

This Chapter describes user information for the following forecast systems:

- o Operational Forecast System (OFS)
- o Extended Streamflow Prediction (ESP) System
- o Flash Flood Guidance (FFG) System

[Next] [Previous] [Bookmarks] [Top]

## Operational Forecast System

The Operational Forecast System (OFS) is a continuous forecasting system which provides the forecaster with real-time predictions of river flow and other variables to use in producing river and flood forecasts and other hydrologic products.

The OFS is designed for use by the River Forecast Centers (RFCs) to generate forecasts for points where the time to peak varies from about 12 hours to several days or longer. The OFS is not designed for general direct use at flash flood locations or for extended (weeks or months into the future) predictions. However the OFS is designed to keep snow, soil-moisture and river conditions current for use when needed in flash flood and dam break procedures, as well as the starting point for extended streamflow predictions.

Figure 1 [Bookmark] shows the relationships of the OFS to the other

NWSRFS systems.

The 3 primary components of the OFS are:

- Data Entry - the automatic or manual entry into a data base of all observed and forecast data needed by the OFS

- Preprocessor - the conversion of the entered data into the form needed by the OFS models including the conversion of point values to areal estimates

- Forecast - the use of the data to estimate snow and soil moisture conditions and to compute runoff, streamflow and reservoir levels

Figure 2 [Bookmark] contains an overview of the OFS.

The OFS includes several data bases and programs that use the data base.

**Data Bases**

The 4 primary data bases in the OFS are:

- Preprocessor Data Base (PPDB) - The PPDB contains observed data and some forecast and projected values. All of the data in the PPDB are point values. There are two storage methods used in the PPDB based on how the data are to be used by the Preprocessors. Precipitation, temperature and evaporation data are stored by day. River, reservoir and snow (RRS) data are stored by station. A set of read/write routines is used to access the PPDB.

- Preprocessor Parametric Data Base (PPPDB) - The PPPDB contains parametric data needed by the Preprocessors. The PPPDB contains general user, station, area and computational order parameters. A set of read/write routines is used to access the PPPDB.

- Processed Data Base (PDB) - The PDB contains times series data. The PDB stores all time series output by the Preprocessors and the Forecast Component. A set of read/write routines is used to access the PDB.

- Forecast Component Data Base (FCDB) - The FCDB contains Forecast Component parametric, carryover and Rating Curve files data. The Forecast Component is organized by Segments, where a Segment is a group of Operations performed as a unit. A Segment usually contains all the Operations needed to compute flow at a single forecast point. The parametric files contain the Operations Table and all the related parametric data for each Segment as well as information controlling the computational order of the Segments. The carryover files contain the state variables for each Segment for various dates. A forecast run can only be initiated on these dates. The Rating Curve file contains Rating Curves and other forecast point information used by the Segments.

**File Maintenance Programs**

The OFS includes the following programs that can define, change, delete and output information stored in the OFS data bases:

- Preprocessor Parameter Initialization Program (PPINIT) - Program PPINIT is the file maintenance program for the Preprocessors and the Data Entry programs. PPINIT is used to define the station network which involves assigning space in the PPDB for the station's data, storing information about the station in the PPPDB, making entries in Data Entry files that control automatic transfers of station data and creating space in the PDB for any RRS time series generated for the station. PPINIT is also used to define areal information and create space in the PDB for areal time series. In addition PPINIT is used to redefine, delete and output this information.

- Forecast Component Initialization Program (FCINIT) - Program FCINIT is the file maintenance program for the Forecast Component. FCINIT is used to define all of the Segment information including the Operations Table and parameters for each Operation. FCINIT is also used to define Rating Curves and the computational order information for the Segments and to redefine, delete and output this information.

- Utility Programs - There are several utility programs in the OFS. Data Entry utility programs are used to control the frequency and types of reports and transfers that the user receives. The PPDB and PDB utility programs are used primarily to display and edit data.

- Reorder Program - This program is used to reorder all OFS files assigned to a given user to minimize disk accesses and to compress the files to remove unusable space. As part of the reorder and compress process, the size of the users files can be made larger or smaller.

**Data Entry Programs**

The OFS includes 2 programs that can be used to write data to the PDB:

- SHEF decode and post - this program is used to decode Standard Hydrologic Exchange Format (SHEF) data reports and post the data to the PPDB

- Relational data base data transfer - this program is used to read a file output from a relational data base and write it to the PDB

**Operational Forecast Program**

The Operational Forecast Program (FCST) contains several preprocessor Functions, the forecast generation Function and some utility Functions. The user interface with program FCST is the Hydrologic Command Language (HCL). HCL enables the user to control the various Functions within FCST through a common set of instructions. HCL can be used to:

- set options (e.g., period to be run, areas or forecast points to be included, display options, etc.)

- make modifications to data, carryover and some parameters

- control which Functions are executed

Sets of HCL instructions which are commonly used can be stored as a named procedure and then run by executing the procedure.

The Functions available in program FCST include:

- MAP - The Mean Areal Precipitation Function computes 6-hour time series of areally averaged precipitation using observed precipitation reports from stations that are part of the defined network and MDR data. MAP values can be computed for all or parts of the user's area.

- MAPX - The Gridded Mean Areal Precipitation Function computes a 1-hour time series of precipitation for the entire user's area using gridded estimates of precipitation based on data from the NEXRAD network.

- FMAP - The Future MAP Function generates 6-hour time series of future precipitation from user supplied areal values.

- MAT - The Mean Areal Temperature Function computes 6-hour time series of mean temperature for the entire user's area using observed point maximum/minimum and instantaneous reports and forecasts of maximum/minimum temperatures.

- MAPE - The Mean Areal Potential Evaporation Function computes areal potential evaporation estimates for the entire user's area using point observed meteorological data and blends the estimates to the long term average when extending the values into the future.

- RRS - The River, Reservoir and Snow Function computes 1 to 24-hour time series for the entire user's area using available point observations of river, reservoir and snow conditions.

- FCEXEC - The Forecast Execution Function generates flow and stage hydrographs and estimates of other hydrologic variables based on input MAP, MAPX, FMAP, MAT, MAPE and RRS time series. FCEXEC contains various types of models (snow, rainfall-runoff, temporal distribution of runoff, routing and reservoir) as well as various display, updating and time series manipulation algorithms. FCEXEC can be run for groups of Segments comprising all or part of the user's area. The sequence of computations in each Segment is controlled by the Operations Table.

There are several utility Functions in program FCST that are used to maintain the carryover dates and display variables that summarize snow cover and soil-moisture conditions.

**Application**

The OFS is a large software system designed for use by forecast centers with responsibility for a large number of forecast points. The system was designed to meet the current requirements of most the users and be flexible enough so that new technology and data systems can be added in the future without requiring major structural changes.

Because OFS is a nationally oriented system it contains features that any given users might not use. However the system provides enough flexibility and user control so that a forecaster can control the models, computational sequence and other options that are used for a particular application. Different models and options can be used in different parts of a forecast area if needed. In addition, the OFS provides the capability to link user specific Functions into the system.

Sections VI.2.1 [Hyperlink], VI.2.2 [Hyperlink], VI.2.3 [Hyperlink] and VI.2.4 [Hyperlink] contain a discussion of items to consider when applying the Operational Forecast System. The discussion contains guidelines both for setting up and using the OFS. The general steps to be followed when defining all of the parametric data and some items to consider when executing the system are also discussed.

[Next] [Previous] [Bookmarks] [Top]

Extended Streamflow Prediction System

The Extended Streamflow Prediction (ESP) System is that part of NWSRFS which generates extended forecasts (weeks or months into the future).

ESP uses conceptual hydrologic and hydraulic models along with the current watershed conditions, historical meteorological data and forecast meteorological data to make extended probabilistic forecasts for a number of streamflow variables.

Parameters, Rating Curve information and carryover are obtained from the OFS Forecast Component files. Information needed for ESP that is not available from the Forecast Component files is defined with the ESP Initialization Program (ESPINIT). ESPINIT is used to define ESP Segment information including the location of time series on the historical data files and the types of analysis to be performed. ESP Segment definition information is stored on the ESP parameter file. The ESPINIT program is also used to redefine, delete and display this information.

The execution portion of ESP is a Function controlled by HCL. The ESP Function accesses the Forecast Component files and the ESP parameter file to obtain necessary run information. Time series data (e.g., MAP, MAT, MAPE and QME) are read from the historical data files. ESP can also read future MAP and MAT time series from the PDB if they are available.

Section VI.2.5 [Hyperlink] contains a discussion of the application of the ESP system. The Section also discusses things to consider when

setting up the Forecast Component files if the ESP system is to be used. The steps necessary for ESP implementation are outlined and guidelines are given for setting up and executing the ESP system.

[Next] [Previous] [Bookmarks] [Top]

Flash Flood Guidance System

The Flash Flood Guidance System (FFGS) is a collection of interrelated software and data capable of computing flash flood guidance and assembling and formatting flash flood guidance into products.

Figure 3 [Bookmark] shows the relationship of the flash flood guidance computation program to NWSRFS and to the product generation program.

The FFGS includes techniques and programs for computing flash flood guidance based on soil moisture conditions maintained by the NWSRFS. The flash flood guidance operation computes a rainfall runoff curve for current soil moisture conditions. Threshold runoff needed to initiate flooding is entered in the rainfall runoff curve to determine the corresponding rainfall or guidance value. Because NWSRFS does not contain threshold runoff values, it must compute values of rainfall over a range of runoffs that should include any given threshold runoff value defined in FFGS.

Computed flash flood guidance values are assembled into products depending on the type of guidance being provided in the products. Zone/county and headwater guidance is formatted into SHEF while gridded guidance products are formatted into GRIB by a separate GRIB encoder program.

The FFGS includes the following:

- Method for determining gridded threshold runoff.
- Methods for obtaining current soil moisture conditions and computing flash flood guidance.
- Method for flash flood guidance product generation.
- Method for making hydrologic model state variables available for local flood warning systems (LFWS).
- Computer programs for implementing the methods and support procedures described above, in both the development and guidance systems.

The FFGS includes the following techniques and models:

- Technique for locating sub-basins, computing their threshold runoff values and converting the values to the national HRAP grid system.
- Technique for computing flash flood guidance based on threshold runoff and soil moisture conditions.

- Method for specifying station and area sequence to assemble flash flood guidance products.

- Method for assembling soil moisture state variable products for LFWS.

Section VI.2.6 [Hyperlink] contains a discussion of the application of the ESP system.

Figure 1. Relationships of NWSRFS Subsystems

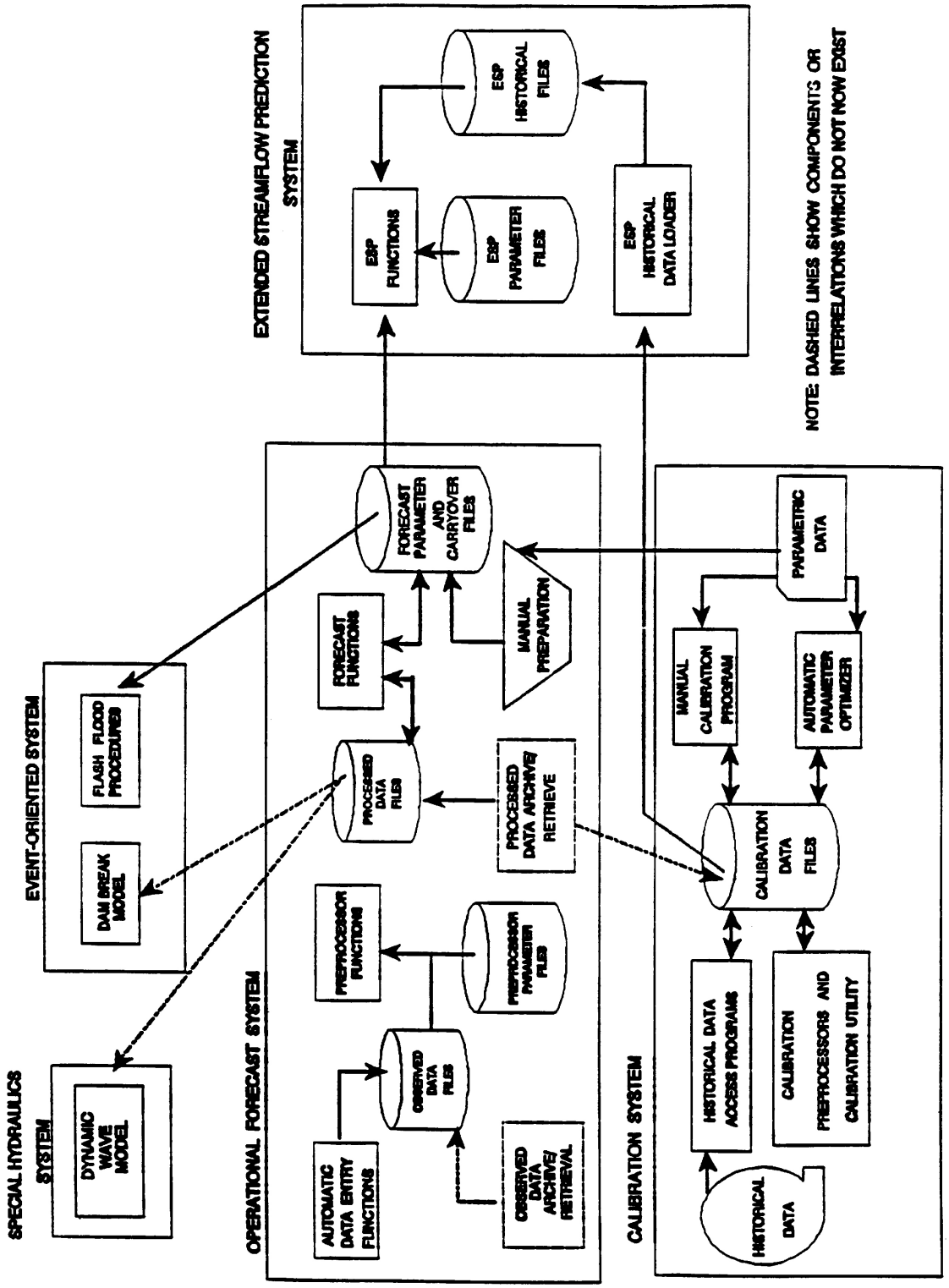

Figure 2. Operational Forecast System

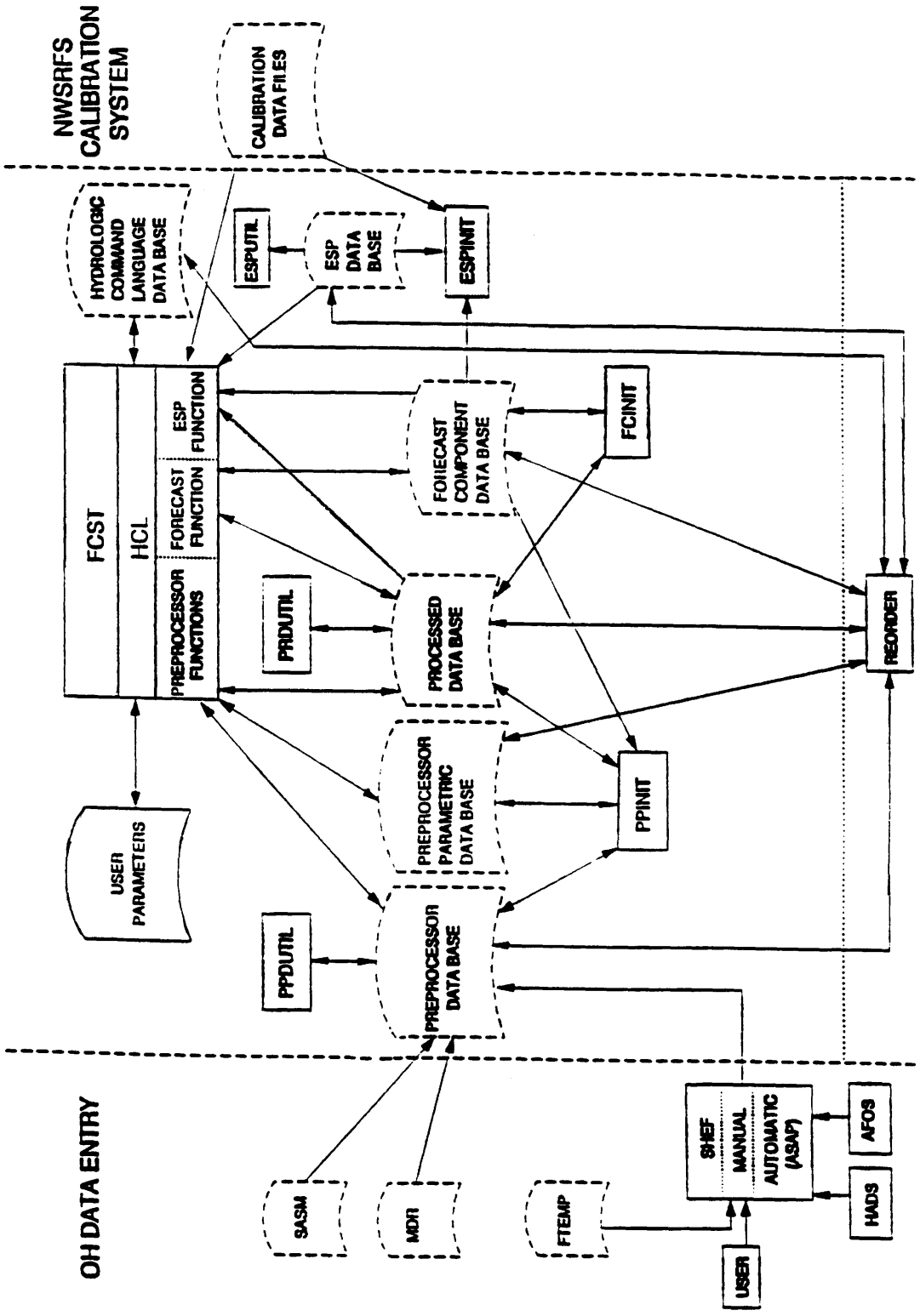

Figure 3. Flash Flood Guidance System