

## II.9.1-FFG-OPER FLASH FLOOD GUIDANCE OPERATION DESCRIPTION

This Section describes the Flash Flood Guidance (FFG) Operation.

### General Information

1. Calibration System programs MCP3, OPT3 and the Operational Forecast System program FCST Function ESP cannot call Operation FFG.
2. The OFS program FCST Hydrologic Command Language Technique FFG is used to set whether flash flood guidance values are to be computed (see VI.5.3D-FFG [[Hyperlink](#)]).

ENDRUN must be at least 24 hours beyond LSTCMPDY for a FFG run if temperature data are needed (i.e. if API-CIN Operation included; if API-CONT Operation using ATI included; if Technique SNOW is on and SNOW-17 Operation included; or if Technique FROST is on and a SAC-SMA or API-CONT Operation using the frozen ground option is included). Otherwise ENDRUN can be as soon after LSTCMPDY as possible. The value of IFFG should be set to 0 for program IFP.

3. For rainfall-runoff models API-CIN, API-HAR, API-HFD and API-MKC the runoff calculation algorithms are in separate subroutines so they can be used by both the rainfall-runoff model and Operation FFG.
4. For snow and rainfall-runoff Operations API-CIN, API-HAR, API-HFD, API-MKC, API-CONT, SNOW-17 and SAC-SMA the C array contains carryover for the date closest to LSTCMPDY when the FFG Technique is equal to 1 or 2 when subroutine EX32 is exited. The closest date is defined as the computational time interval equal to or just before LSTCMPDY. This will insure no QPF is included in carryover to be used by Operation FFG.

### Parametric Data

The parametric data needed by Operation FFG is maintained by program FCINIT [[Hyperlink](#)].

The input for the rainfall-runoff relationships definition is described in Section V.3.3-FFG [[Hyperlink](#)].

The parametric data stored is described in Section VIII.3.3-FFG [[Hyperlink](#)].

### Output Data

The parametric data created by the subroutine PIN32 is stored in the Preprocessor Parametric Data Base (PPPDB) [[Hyperlink](#)] as parameter

type FFG which is described in Section IX.4.3C-FFG [[Hyperlink](#)].

The output data created by subroutine EX32 includes rainfall-runoff relationships used to compute flash flood guidance and state variables used to update forecast models.

No time series data is written by Operation FFG.

#### Subroutine PIN32

The execution sequence for subroutine PIN32 is shown in Figure 1 and as follows:

1. Check that the snow Operation type and name have been defined in the Segment.
2. Check that the rainfall-runoff Operation type and name have been defined in the Segment.
3. Check that the basin boundary exists and get the latitude and longitude of the basin centroid from the basin boundary definition.
4. Check that MAP or MAPX associated with the basin identifier is the same as used by the snow Operation or the rainfall-runoff Operation if snow not used.
5. Call subroutine WPPREC to write parametric information to the PPPDB. Space reserved to for the output data created by subroutine EX32.

#### Subroutine EX32

The execution sequence for subroutine EX32 is shown in Figure 2 and as follows:

1. Get Operation name and type of the snow model.
2. Get Operation name and type of the rainfall-runoff model.
3. Get carryover and parameters for snow model.
4. Get carryover and parameters for rainfall-runoff model.
5. Compute runoff using the snow and rainfall-runoff models for 4 values of rainfall for each duration. The first rainfall should be the current storm total rain because all FFG calculations will be greater and never less than this value. The other 3 rainfalls should provide a workable range for the threshold runoffs defined in the FFG System.

In the FFG program FFGUID, threshold runoff is added to the storm total runoff to give a new storm total runoff. Then the

new storm total rain required to produce the new storm total runoff using the rainfall-runoff model is computed. Then the new storm total rain minus the old storm total rain is the FFG. The equations are:

$$SRO_n = SRO_o + TRO$$

$$SRA_n = f(AI, SRO_o)$$

$$FFG = SRA_n - SRA_o$$

where SRO<sub>o</sub> is the storm total runoff from state variables  
SRA<sub>o</sub> is the storm total rain from state variables  
SRO<sub>n</sub> is the new storm total runoff  
SRA<sub>n</sub> is the new storm total rain  
TRO is the threshold runoff  
AI is the Antecedent Index from API models

A typical rainfall-runoff curve is shown in Figure 1.

6. Call subroutine RPPREC to read the FFG parameter record from the PPPDB.
7. Store the following values in the FFG parameter:
  - LSTCMPDY
  - the 4 rainfall-runoff points for each duration
  - the rainfall-runoff model state variables
8. Call subroutine WPPREC to write the FFG parameter record to the PPPDB.

Figure 1. Defining Flash Flood Guidance Operation in Routine PIN32

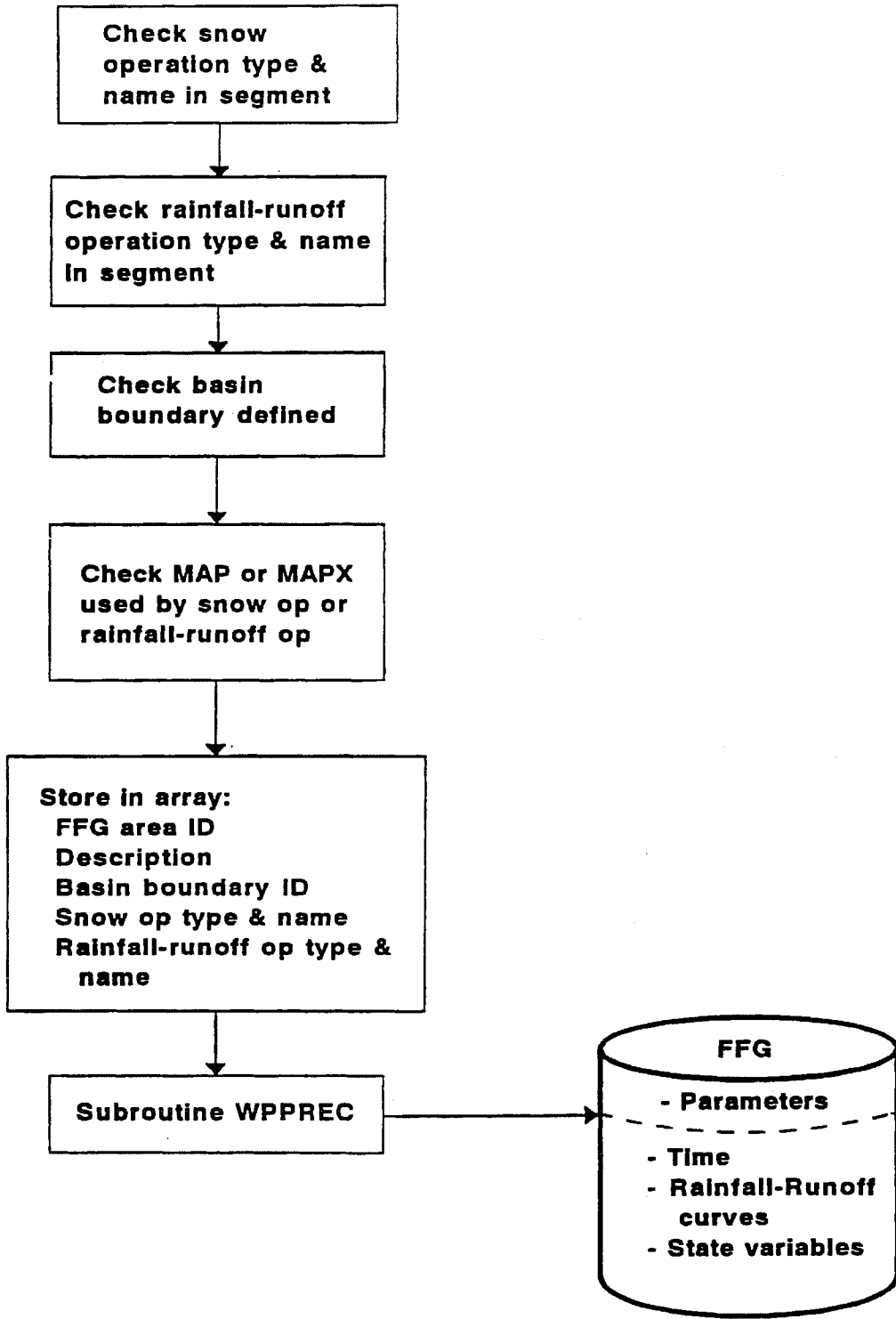


Figure 2. Executing Flash Flood Guidance Operation in Routine EX32

