

SEEFFG Operations Workshop

System Validation

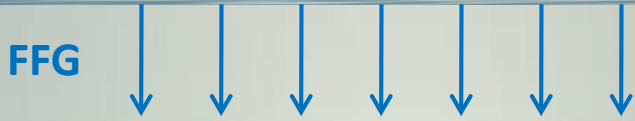


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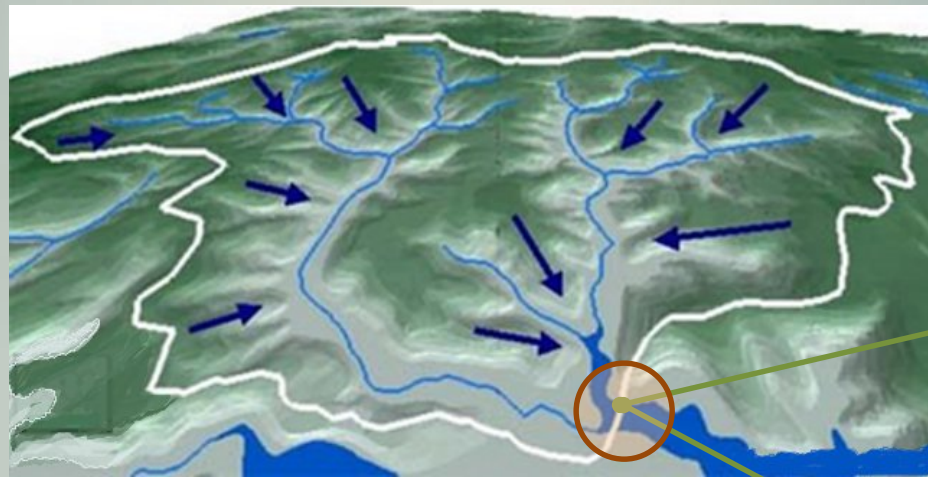
09 May 2016

Fundamental Concepts for Flash Flood Guidance

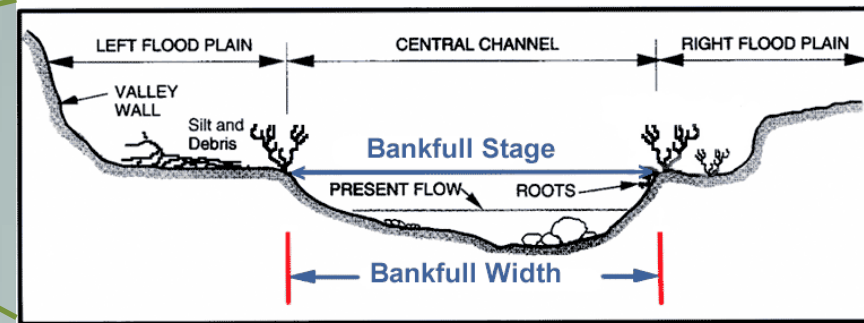
FFG



Flash Flood Guidance (FFG): The amount of **rainfall** of a given duration and over a given catchment that is just enough to cause **flooding conditions** at the outlet of the draining stream



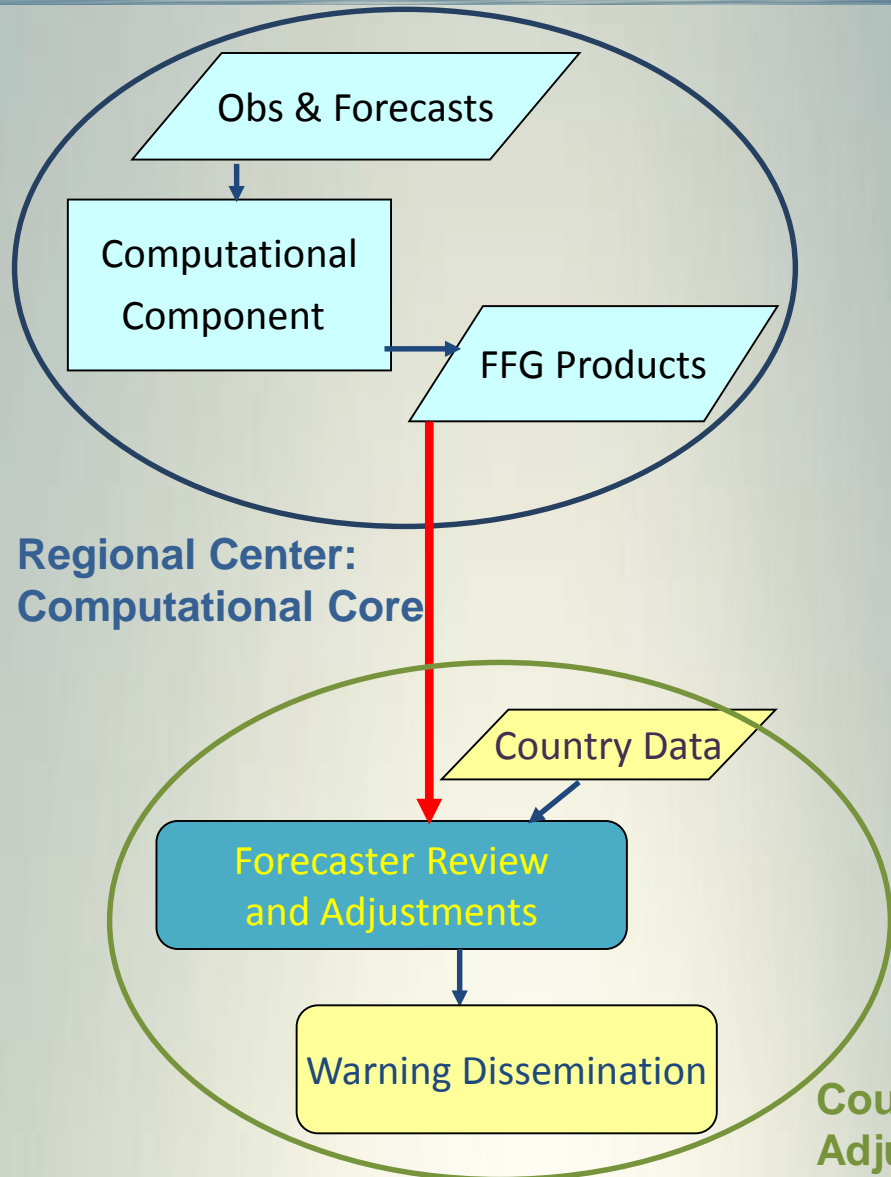
Location of Occurrence



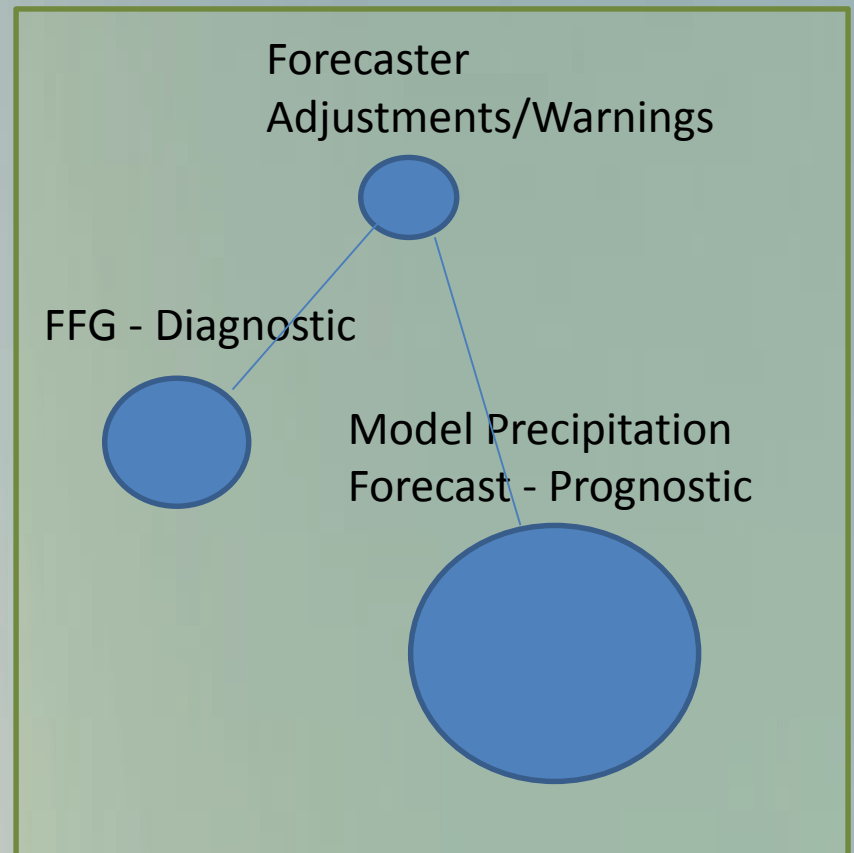
Key concepts for Validation:

- Spatial scale
- Location (where)
- Observations / records of flash flood occurrence

Validation of FFG System and Warnings



Validation Components



Validation of FFG Diagnostic Components

- Mean Areal Precipitation
Comparison of MAP for small basins against raingauge-based estimates for watersheds with dense raingauge networks
- Soil Moisture
Model estimate of average soil water in upper (0-20 cm) and lower (20 – 150 cm) soil layer against neutron probes, well calibrated sensors in various depths)
- If persistent biases are found in certain regions, may correct by post-processing the system results before deciding whether to issue a warning.

Validation of FFG Forecast Components

- Mesoscale Model
Comparison of forecast precipitation, averaged over small basins (FMAP) for against merged MAP product
 - frequency of occurrence of precipitation > precipitation thresholds (based on historical record)
 - varying rainfall durations (1, 3, 6, 24 hours)
- If persistent biases are found in certain regions, apply post-processing bias adjustment before estimating FFFT.

FF Warning Validation

- Occurrence of Flash Flooding
Determine occurrence of flash floods from local observed data
- near outlet of watersheds, events which cover most of basin area
- Requires (detailed) information on flash flood events
- Statistical summaries
Compare summaries to warnings issued (POD, FAR, etc.) for basins within the region
- Case Studies
Closely examine individual case studies of specific events to assess causes of success or failure in the warning process. Apply 'lessons learned' to future.

Definition of Statistics for FFG

Probability of Detection (POD)

$$P_D = \text{Prob} \left[Z \geq p^* \mid P \geq p^* \right]:$$

*Estimated precip exceeded FFG
given observed exceeded FFG*

False Alarm Rate (FAR)

$$P_F = \text{Prob} \left[P < p^* \mid Z \geq p^* \right]:$$

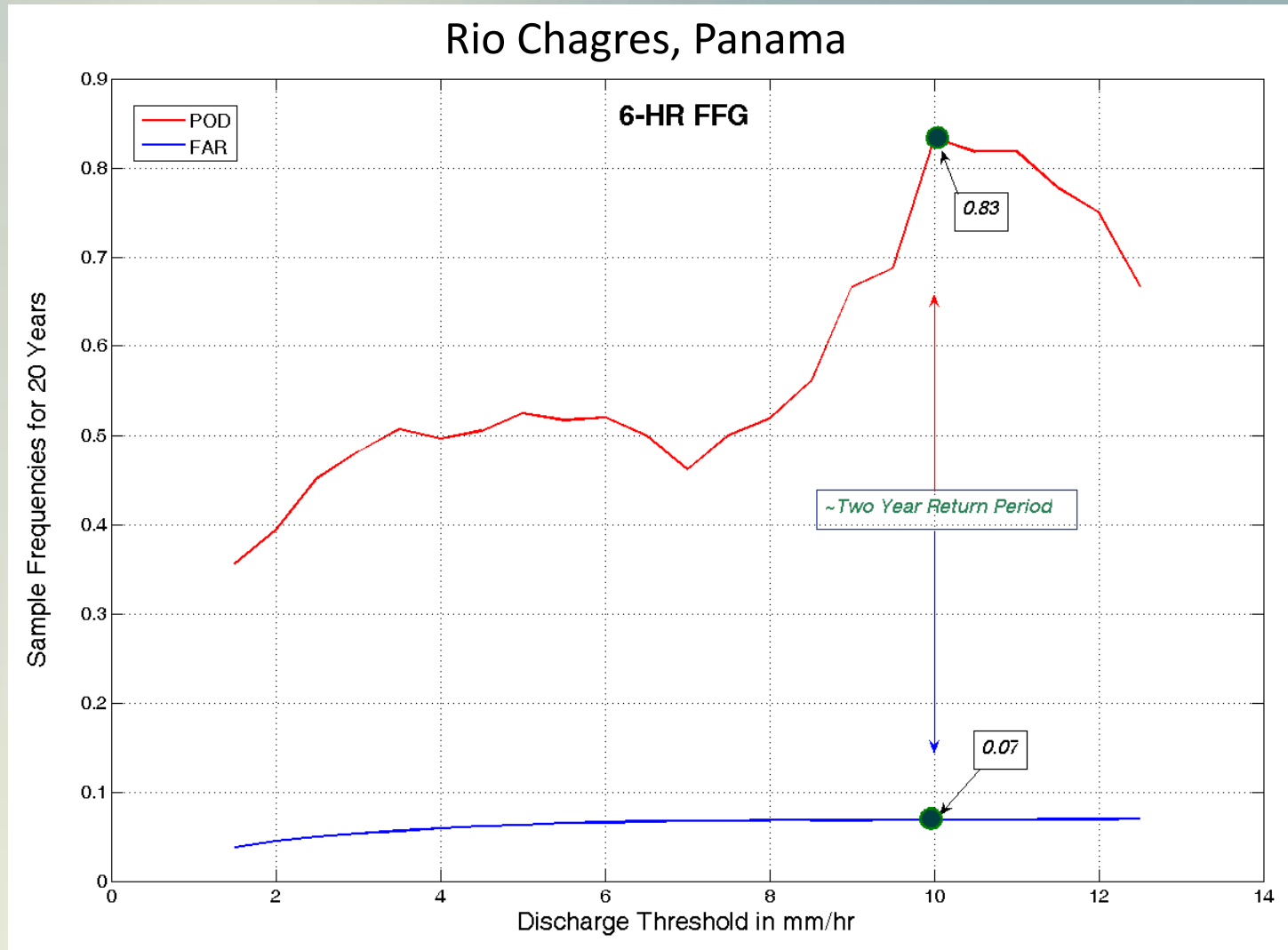
*Observed precip less than FFG
given estimated precip
exceeded FFG*

Actual Precipitation

FFG

Estimated Precipitation

Example from Data Rich Watershed

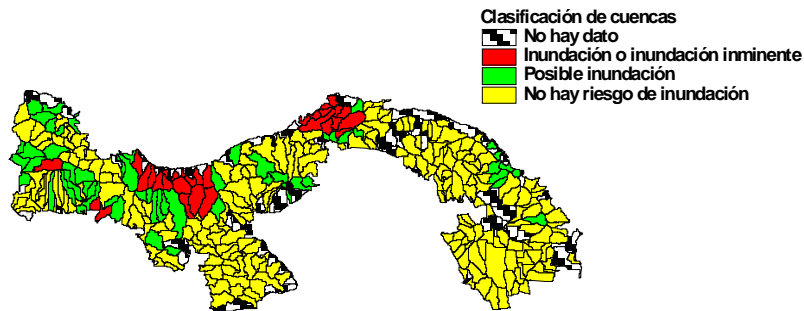


Example of Warning Validation

During 3 month training, system operators from Costa Rica and El Salvador were in daily communication with Country Agencies to receive community information regarding local flooding.



Evaluación del riesgo de inundación correspondiente al 17-09-04 a las 18 Z válido a las 00 Z del 18-09-04



100 0 100 200 Kilometers

Flooding in the Panama Canal verified by local TV news.
Flooding time at the airport was reported at approximately
9 p.m. local time.

3-Hourly FF Threat (*adjst*):

Hits: 57% (63 – 100%)

False: 30% (0 - 21%)

Misses: 13% (0 - 16%)

Contingency Table

Example of Contingency Table for Flash Flood Bulletins developed by Turkish State Meteorological Service (TSMS) for the period 21 May 2012 – 17 June 2013

Warnings	Observations (FF Occurrences)			
		Y	N	Σ
Y	43 <i>(a)</i>	25 <i>(b)</i>	68	
N	18 <i>(c)</i>	306 <i>(d)</i>	324	
Σ	61	331	392	

Hit Rate (POD): $a/(a+c)$	0.70
False Alarm Ratio (FAR): $b/(a+b)$	0.36
False Alarm Rate (POFD): $b/(b+d)$	0.07
Threat Score: $a/(a+b+c)$	0.50

Requires database of observed flash flood events with detail including location (occurrence commensurate with flash flood warning location).

Summary

- ❖ Different aspects of the SEFFG System may be validated
 - Diagnostic products (observed MAP, soil moisture)
 - Forecast product (mesoscale model, FMAP)
 - Flash flood warnings issued by forecasters
- ❖ Post-processed adjustments may be if consistent bias is found in diagnostic or prognostic products
- ❖ Database of observed flash flood occurrences needs to be developed or archived
- ❖ Statistical measures may be produced on regular (annual) basis to assess performance of warning generation process.