Storm Interrogation

AWOC Severe Track
ICSvr 3-IV-A

FFG Modification

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Flash Flood Index

FF=

diFF = ABR - FFG

- ABR and FFG both in inches
- Determining Flash Flood Severity within Flash Flood Monitoring and Prediction (FFMP)

•FFMP determines Flash flood severity in the difference column

•This can also be called a Flash flood index of potential flash flood severity

Flash Flood Index Values

- FF0 ABR = FFG
- FF1 ABR = FFG + 1.00 inches
- FF2 ABR = FFG + 2.00 inches
- FF3 ABR = FFG + 3.00 inches
- FF4 ABR = FFG + 4.00 inches
- FF5 ABR = FFG + 5.00 inches, etc

FF index gives potential severity of the flash flooding, and is a measure of how much assitional rainfall exceeding FFG occurs. FF1 is basically nuisance flooding, low lying areas, basements. FF2 is more severe, perhaps some water rescues, light damage. FF3 is severe flash flooding, significant damage, very high threat to life and property. FF4 and FF5 are catastrophic flash flooding, like Fort Collins, Johnstown, etc.

Flash Flood Guidance

$$FFG = TR + SM$$

- TR is the threshold runoff, a constant for each watershed, and a climatic average runoff needed to bring streams to bank full.
- SM is the amount of ABR needed to initiate runoff based on soil moisture content.

To know DIFF is valid you need:

1. Rainfall estimates good
2. FFG valid

- There are 2 components to FFG, TR and SM. FFG depends on these two factors added togther.

FFG Assumptions

- FFG is ABR over specific intervals (1, 3 hours) needed to initiate flooding on streams.
- Assumes stream at low flow level: TR
- Assumes no rainfall since data cutoff: SM
- Assume soil moisture computation for Mean Areal Precipitation area (MAP) from RFC model run is representative of the small basin's soil moisture state: SM

•If the stream is not at low flow conditions then FFG is too high and TR needs to be adjusted down

•RFC models are run at 12 Z and 0Z, if additional rainfall occurs after these times, SM will not incorporate it and FFG will be too high and SM needs to be adjusted down

•Soil moisture may not be well represented during the RFC model run

Places to Automatically Reduce FFG

- Highly urbanized watersheds
- Basins with steep terrain
- Basins with impervious soil, such as burn scars or bedrock soil.
- Watersheds with a high percentage of strip mined area.

FFMP allows you to change FFG for specific watersheds at any time that overides the RFC guidance for those watersheds. The potential basins you may want to consider lowering FFG are listed on the slide..

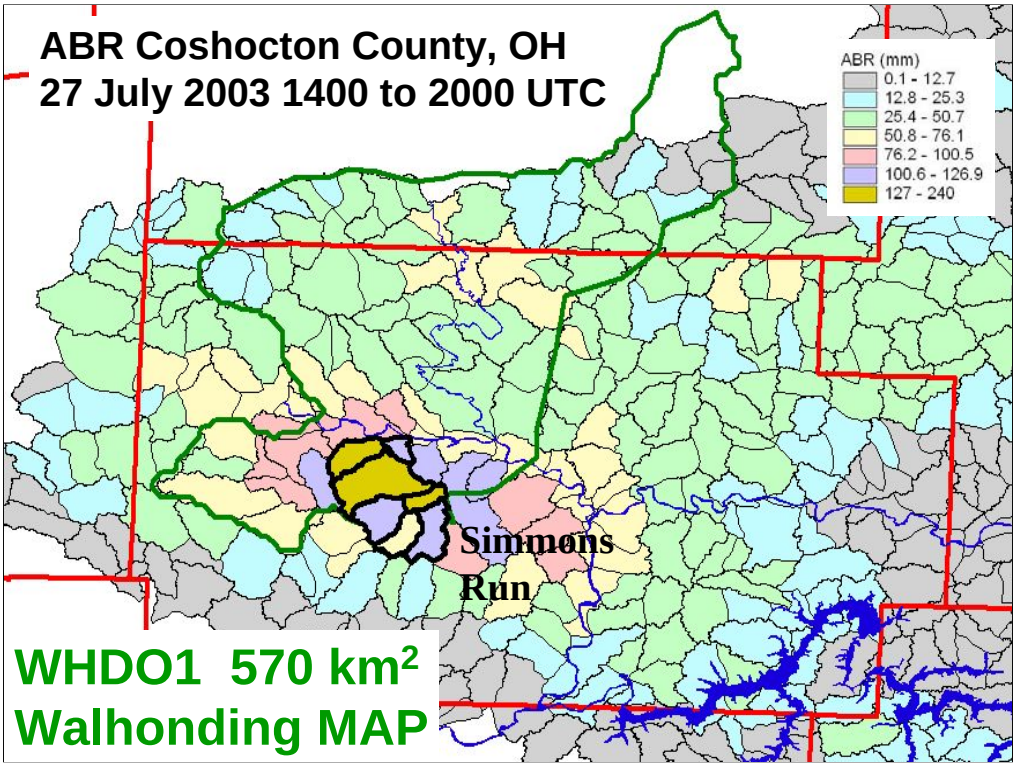
•Many offices already set urban watershed FFG to 1in/hr

FFG Reduction Example

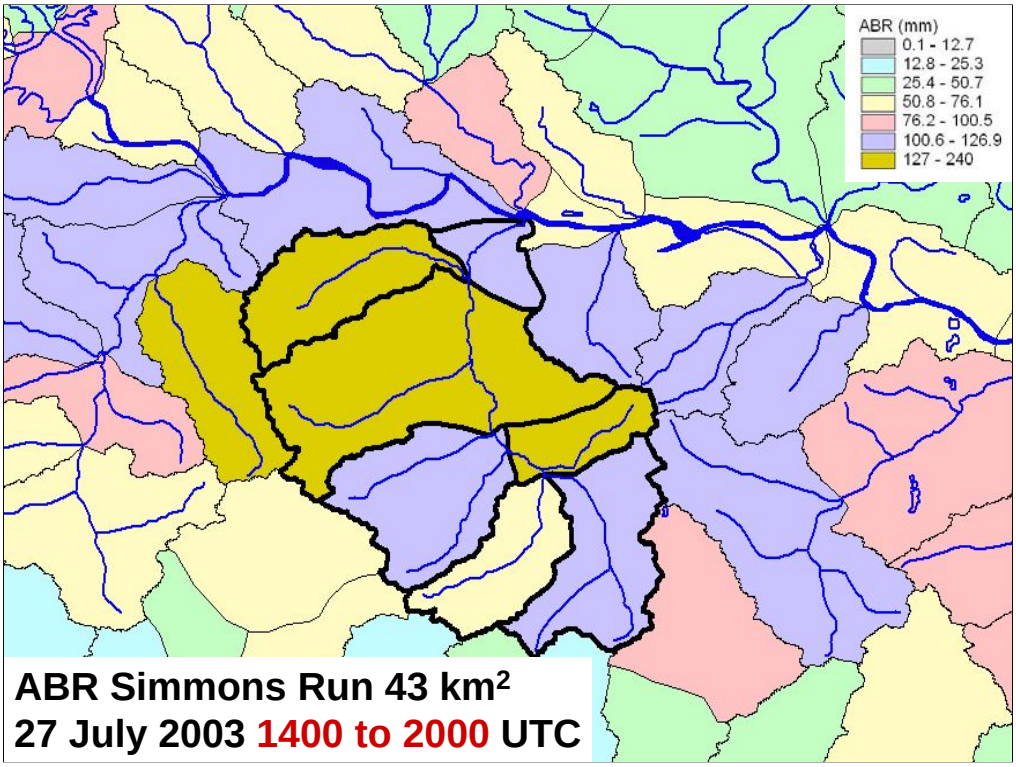
Simmons Run Flash Flood near Warsaw, OH

- **27 August 2003**
- **Coshocton County, OH**

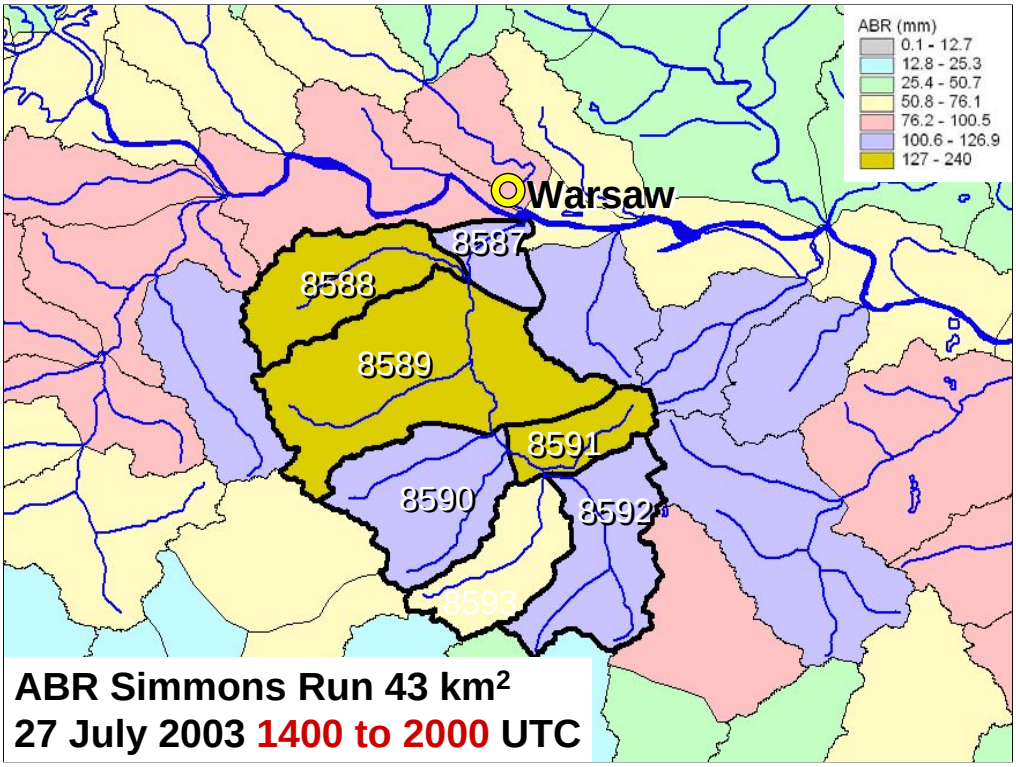
Case study to show how FFG modification factor may be applied.



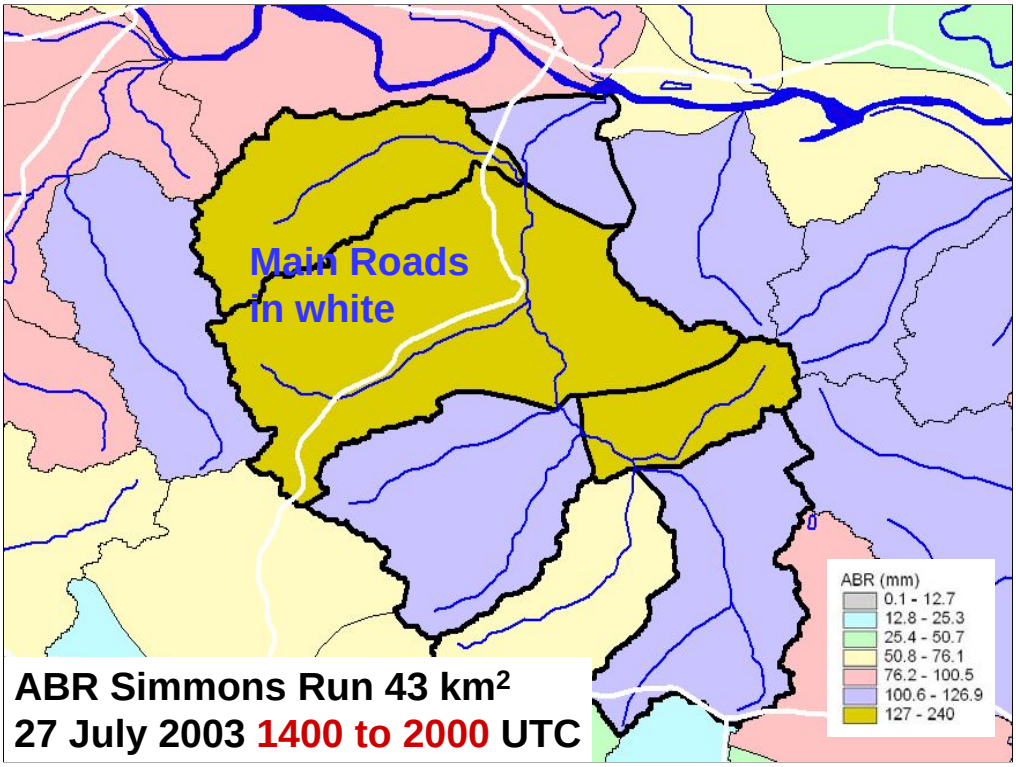
ABR 6 hour rainfall as it would appear in FFMP



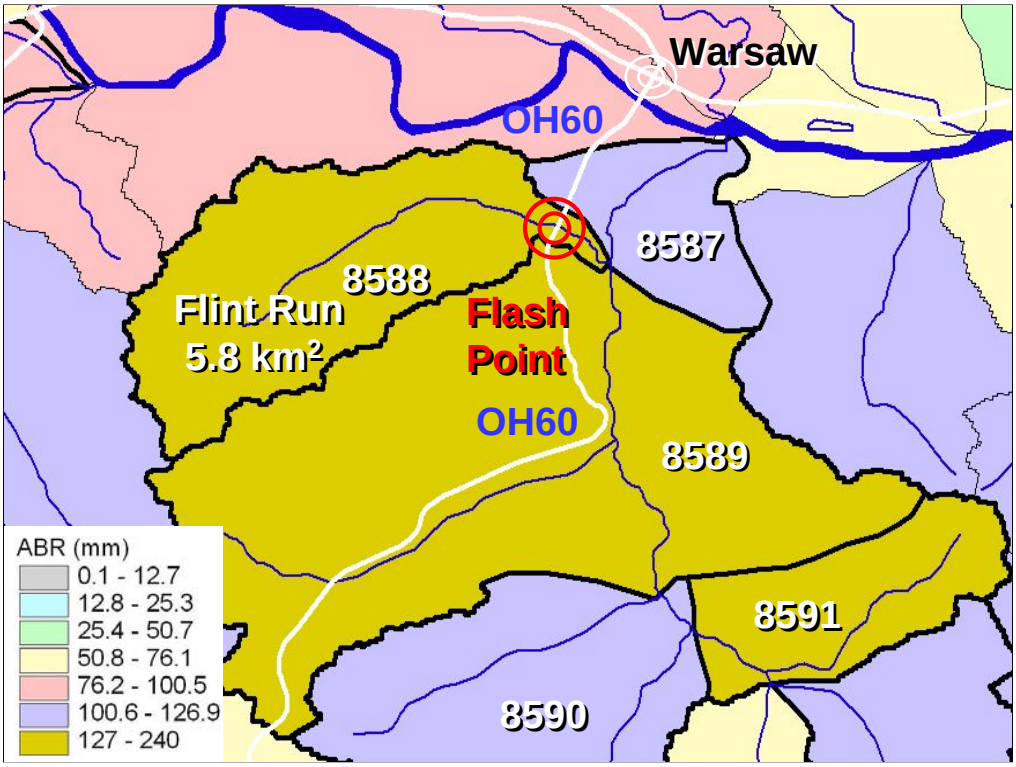
Zoomed into Simmons Run Water shed, 7 different segments flowing into the Walhonding river



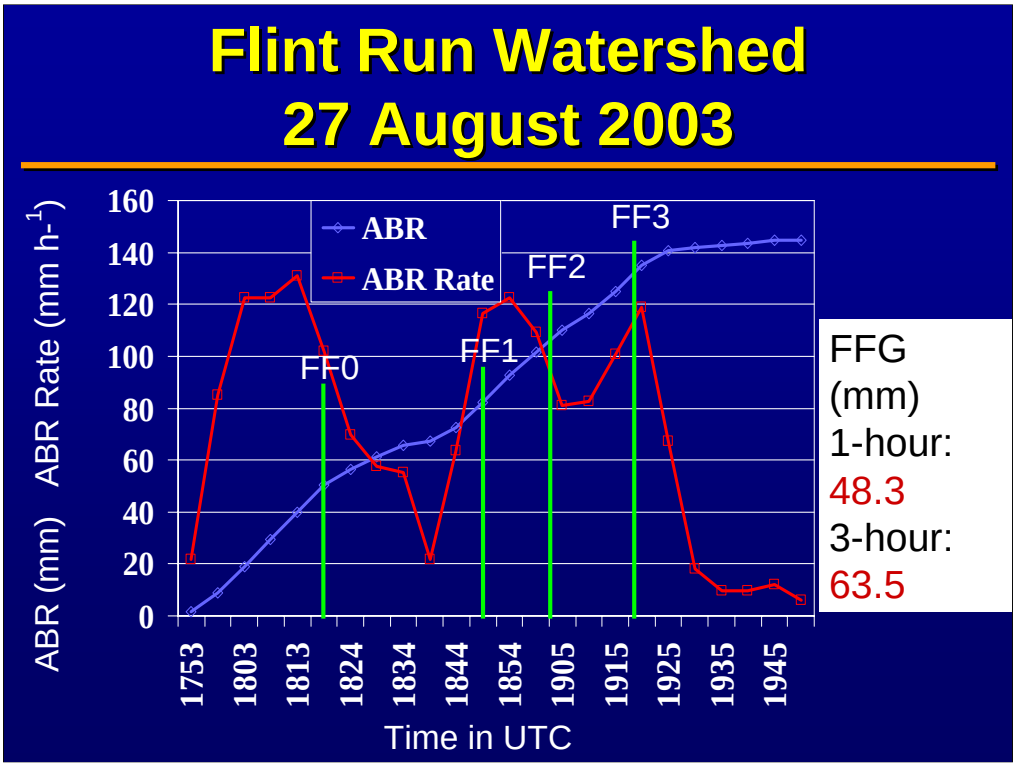
Each watershed segments would show up as a separate entry in FFMP threat table. Heavy rainfall concentrated in 3 small watersheds, with about 5 inches in 2-3 hours.



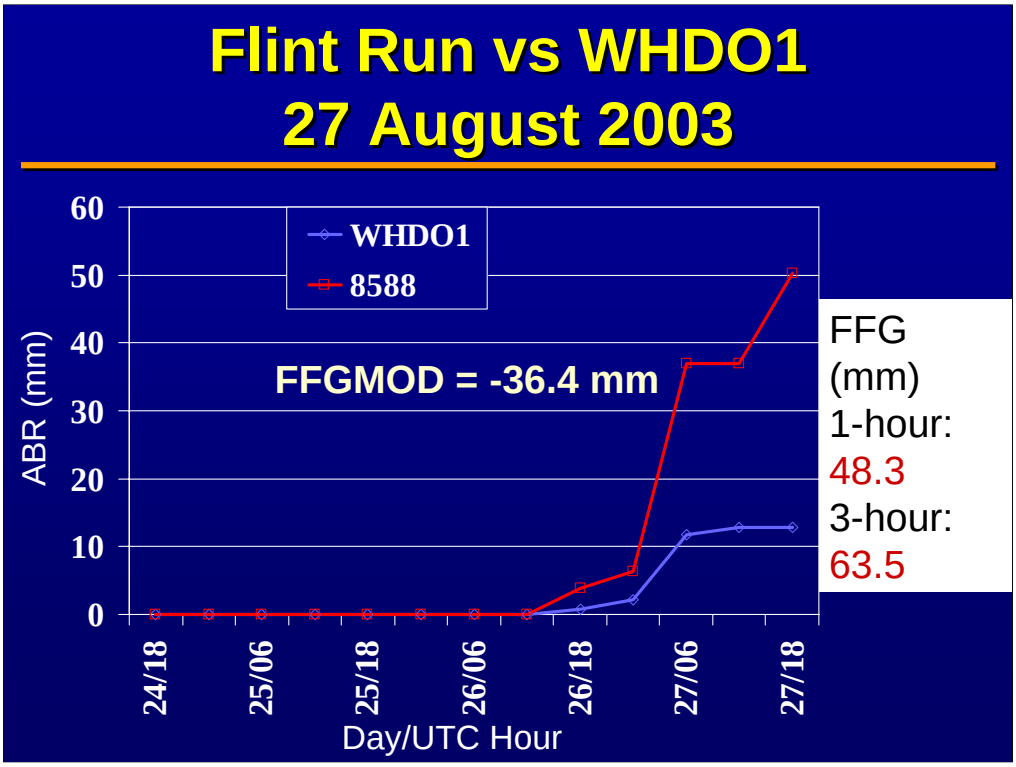
Main roads added showing where the highways would intersect the creeks, indicating areas of flash points were bridges could be washed out



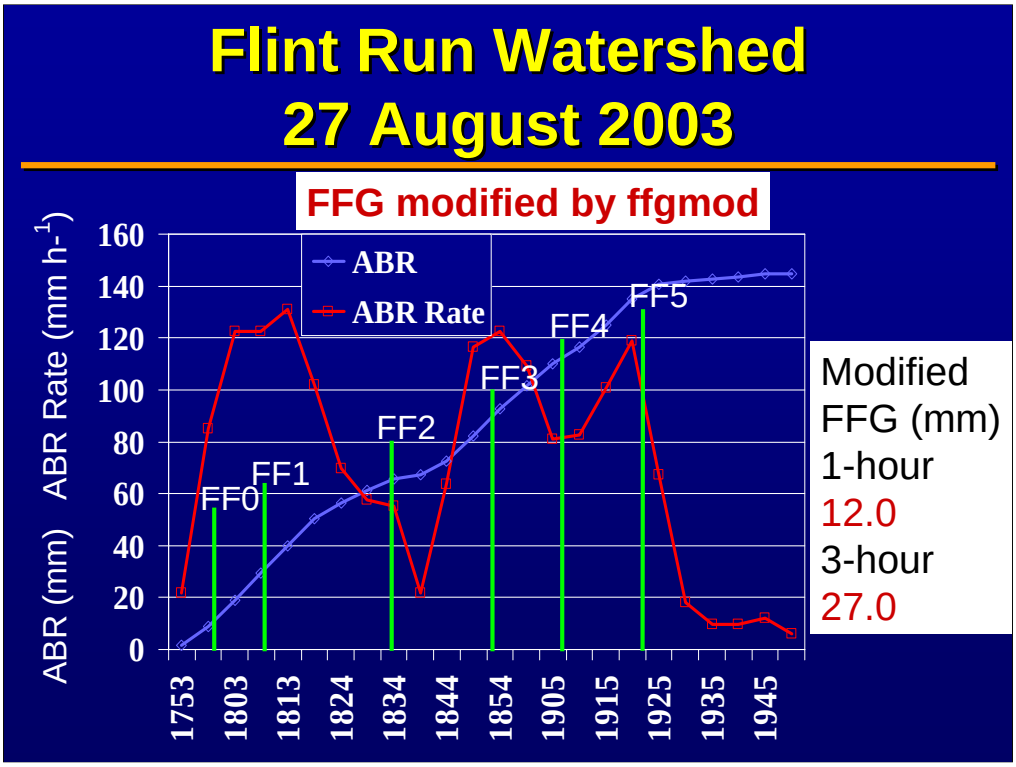
Zooming in on the 3 smaller tributaries with the heaviest rain: Flint Run contains one of the flash points where OH60 crosses the creek. The bridge was washed out at this point.



Graph showing accumulated rainfall for Flint run, 18-20 Z. Most of the rain did fall in about 2 hours. Green lines show when the flash flood index was exceeded.



FFG modification can be computed from the 6 hour rainfall amounts as observed in the watershed by FFMP (red line), and blue line is the computation of the Mean Areal Precipitation area from the RFC model run. Notice the difference in the two. This difference, since negative, is how much FFG should be reduced to get a better representation of FFG, and this difference is the FFGMOD factor.



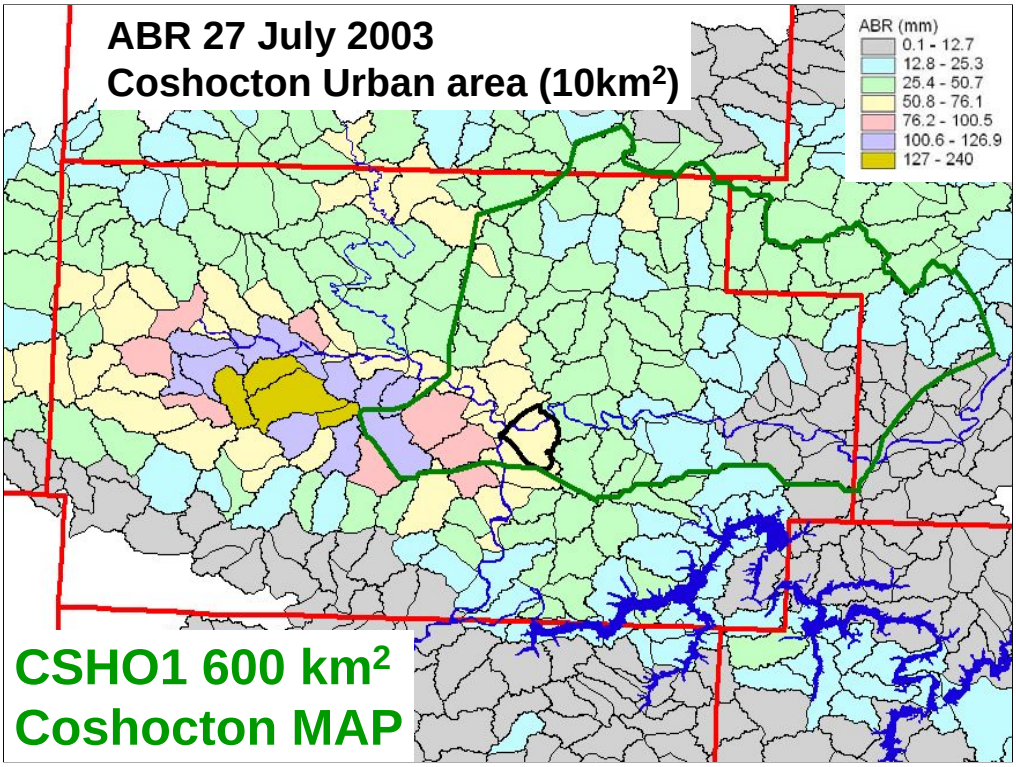
The impace of subtracting off the FFGMOD factore. Now FFG is 12.0 for 1-hour. FF0 state is reached 20 minutes earlier, FF1 is a half hour earlier, adding significant lead time to a Flash Flood warning. In addition to the added lead time, the magnitude of the flooding is better represented with FF5 as opposed to FF3. FF5 flooding was what had happened in reality.

Reduce FFG in Urban Areas Example

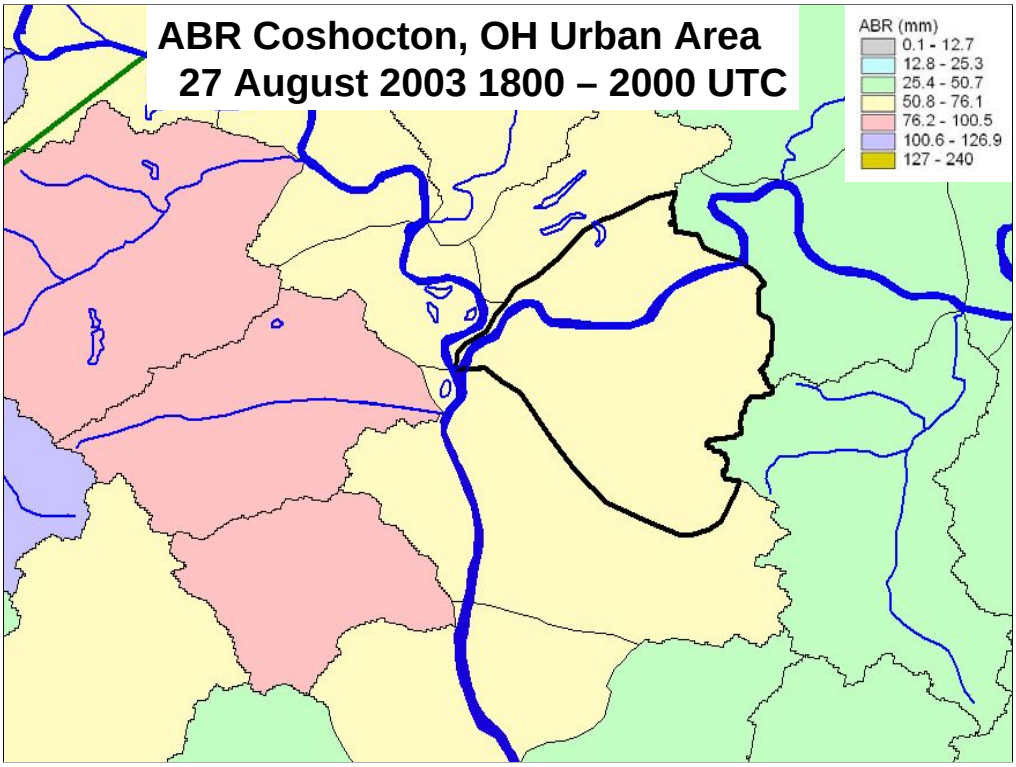
Coshocton, OH Flash Flood
Reduce FFG in urban areas

- **27 August 2003**
- **Coshocton County, OH**

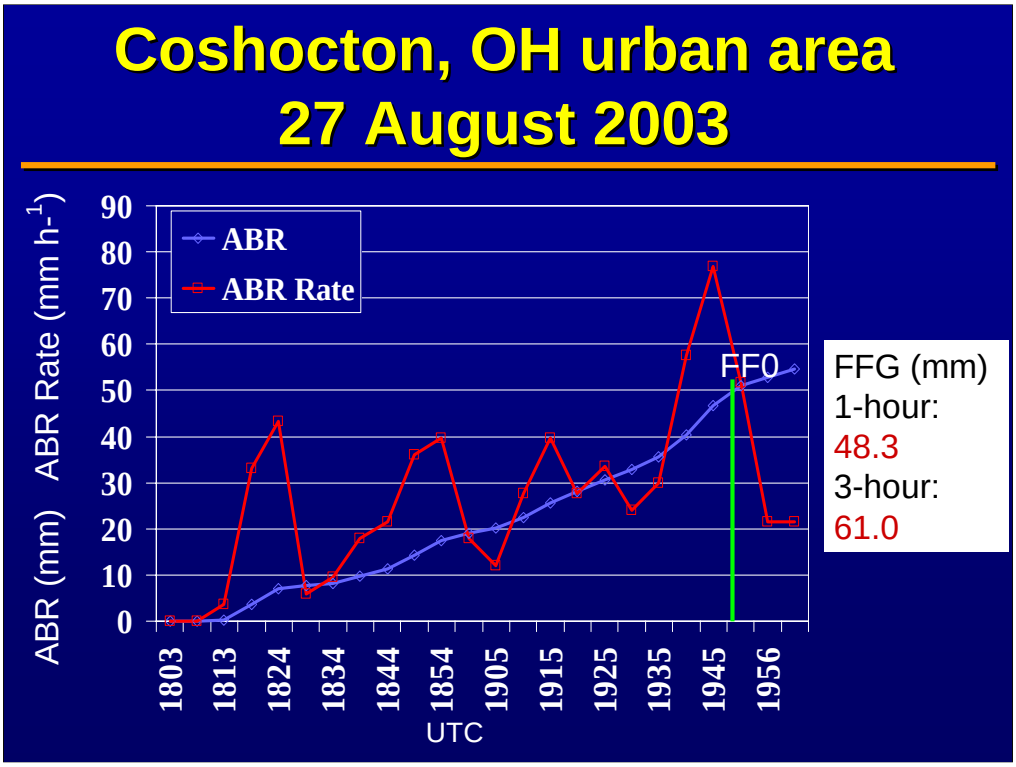
Flint Run was rural, this case study will look at a reduction of FFG within an urban area.



6 hours ABR for Coshocton County area, but this time the black area is the city of Coshocton. The area of the Coshocton MAP area is much larger than the city of Coshocton itself.



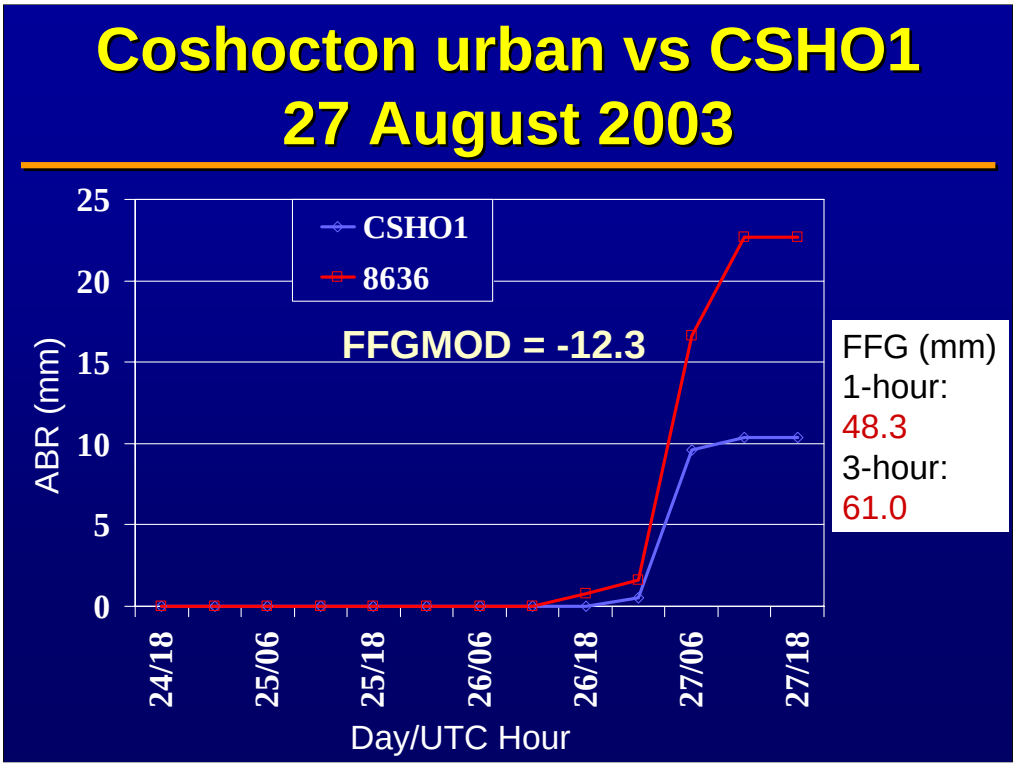
Zoomed in on ABR plot for Coshocton. 2-3 inches have fallen over the city of Coshocton in 2 hours.



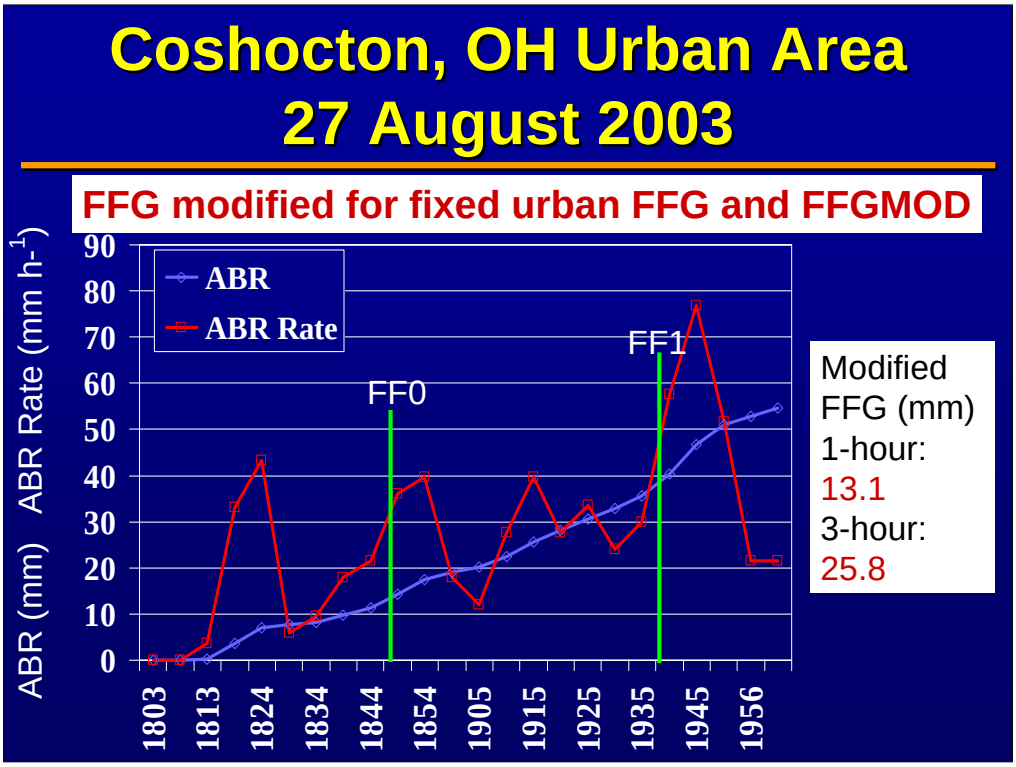
FFG, ABR and ABR Rate for the Coshocton urban area, AMBER basin 8636, in Coshocton

County, OH on 27 August 2003 from 1803 – 2001 UTC.

Barely reach FFG from RFC, and barely exceeded Flash flood guidance



FFGMOD plot, showing the differecne between the RFC Rainfall for the Coshocton MAP area and the actual rainfall in the city of Coshocton over the time period listed above. The difference is –12.3 mm, and thus FFG needed to be reduced by 12.3 mm per hour. For PBZ's urban areas, they use 1 in/hr for all urban areas, so the 12.3 is subtracted off the 1 in/hr FFG, making it even lower.



FFG modified for urban area and from subtracting off FFGMOD factor. The graph is now the modified ABR and ABR Rate for the Coshocton urban area, AMBER basin 8636, in Coshocton

County, OH on 27 August 2003 from 1803 – 2001 UTC.

FF0 reached much earlier, FF1 also achieve. There was significant urban flooding in Coshocton, and PBZ forecasters were able to detect the flooding earlier and get a sense of the magnitude of the flooding because they properly adjusted FFG.

Summary

- Reducing FFG for predefined basin conditions can improve FFMP detection capability and increase warning lead time.
- The use of FFGMOD factor for rainfall since data cutoff may aid in the updating of FFG between RFC issuance times.
- The use of FFGMOD may aid in the update of soil moisture conditions in small basins.

•This is especially true in highly urbanized areas

•FFGMOD may replace the “ratio” column in the FFMP threat table