U.S. Geological Survey
Streamflow- and Precipitation-based Flood Warning and Mapping
With Integrated USGS tools

USGS Central Midwest Water Science Center

Illinois Association for Floodplain and Stormwater Management
Annual 2020 Conference
USGS WaterWatch  https://waterwatch.usgs.gov/

Streamgage-based maps, graphs, and tables describing real-time, recent, and past streamflow conditions for the United States
Midlothian Creek at Oak Forest, IL

WaterWatch : Flood Tracker

USGS 05536340 MIDLOTHIAN CREEK AT OAK FOREST, IL

Conferece Center

USGS WaterWatch
Tinley Creek near Palos Park, IL

Waterwatch: Streamgage Stats

Daily Flow Equal or Exceeded Percentages

51 cfs equaled or exceeded 5% of the time
Waternow
http://water.usgs.gov/waternow

Text or email station number to WaterNow@usgs.gov to receive current conditions

USGS Current Water Conditions

USGS WaterNow
to me

Blue River at Blue Ridge Blvd Ext in KC, MO 04/01/2019 15:00 CDT
Gage height, feet = 25.83
Discharge, cubic feet per second = 136
See: https://waterdata.usgs.gov/nwis/uv/?site_no=06893150

06893150

Blue River at Blue Ridge Blvd Ext in KC, MO 4/1/19
15:00 CDT
Gage height = 25.83 ft
Discharge = 136 ft3/s
Wateralert
http://water.usgs.gov/wateralert

Sign up to receive alert messages by text or email

Subscription Form

The U.S. Geological Survey WaterAlert service sends e-mail or text (SMS) messages when certain parameters, as measured by a USGS real-time data-collection station, exceed user-definable thresholds. The development and maintenance of the WaterAlert system is supported by the USGS and its partners, including numerous federal, state, and local agencies.

Real-time data from USGS gauges are transmitted via satellite or other telemetry to USGS offices at various intervals; in most cases, 1 to 4 times per hour. Emergency transmissions, such as during floods, may be more frequent. Notifications will be based on the data received at these site-dependent intervals.

**Site Info:**
- Number: 350726106314230
- Name: MITCHELL ELEMENTARY
- Agency: USGS
- Transaction ID: fG3gy

**Send Notification To:**
- My mobile phone
- My email address

**Notification Frequency:**
- Hourly
- Daily

**Precipitation Parameter(s):**
- 1 hour
- 2 hours
- 4 hours
- 6 hours
- 12 hours
- 24 hours

**Alert Threshold Condition:**
- Greater than (>)
- Less than (<)
- Outside a range (< or >)
- Inside a range (> and <)

Real-time value is greater than: 

I have read and acknowledge the Provisional Data Statement and Disclaimer.
Preempted Decision Support
Consequence-based flood scenarios

Step 1
- Precipitation
- Calibration & Prediction

Step 2
- HEC-HMS / PRMS
  - Rainfall-Runoff

Gaging
- Stage
- Streamflow
- Precipitation
Preempted Decision Support
Consequence-based flood scenarios

Step 3
HEC-RAS / SRH2D Mapper
- Hydraulics and Inundation

Step 4
Consequence-based product dissemination
- Scenarios defined
- Gage / Radar observed conditions correlated to flood inundation mapping
City of Harrisonville, Missouri

Proposed

Explanation

- Location of property damage from 2017 flooding
- ▲ Potential location of USGS streamgage
- △ Potential location of USGS rain gage
Muddy Creek Data Collection
City of Harrisonville, Missouri

- Drainage Area
  ~ 5 sq. mil
- Partial-record gage
- Precipitation gage

Partial Record Gage Location
Precipitation Gage Location

Muddy Creek Basin
## Flood Warning Support Systems

### Precipitation-based gaging/mapping

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### USGS Water Alert!

#### Subscription Form

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- My mobile phone
- My email address

**Notification Frequency:**
- Hourly
- Daily

**Precipitation Parameter(s):**
- 1 hour
- 2 hours
- 4 hours
- 5 hours
- 12 hours
- 24 hours

**Alert Threshold Condition:**
- Greater than (>):
- Less than (<):
- Outside a range (<>):
- Inside a range (>= and <=)

Real-time value is greater than: undefined

I have read and acknowledge the [Provisional Data Statement](#) and [Disclaimer](#).
Flood Warning Support Systems

Precipitation-based gaging/mapping

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Recent Installation for Flood Warning at the City of Grandview
Flood Warning Support Systems

Precipitation-based gaging/mapping

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USGS Water Alert!

Precipitation Parameter(s):
- 1 hour
- 2 hours
- 4 hours
- 6 hours
- 12 hours
- 24 hours

Alert Threshold Condition:
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Real-time value is greater than: 6.0
Flash Flooding – First Line of Defense
National Weather Service - Notifications

Notifications – “What do they mean?”

1. **Flood Watch**: Preparation, issued when conditions are favorable for a hazardous weather event to occur. Flooding possible.

2. **Flood Advisory**: Weather event that is forecast to occur may become a nuisance. Issued when flooding is not expected to be bad enough to issue a warning. However, it may cause significant inconvenience, and if caution is not exercised, it could lead to situations that may threaten life and/or property.
3. **Flood Warning**: USGS Precipitation-Based Mapping/Warning System. Rain to Peak Estimate ~ 2+ hours
Flash Flooding – Second Line of Defense

USGS / National Weather Service - Notifications

Notifications – Implementation and Definition

4. Flood Warning: Flash flooding is imminent or occurring.
   *Less than 1 hour

5. CodeRed Weather Alert: Advanced warning of severe weather as a bulletin is issued by the National Weather Service.
   - Two-Way Messaging
   - Social Media Capabilities
   - Real-Time Reporting

https://www.weather.gov/safety/flood-watch-warning
Flood Warning Support Systems

Streamflow-based validation

Also serves to monitor best management practices in terms of development.
Flood Warning Support Systems

Streamflow-based validation

Are there more economical alternatives in streamflow gaging for warning systems?

Consideration → Hybrid Crest Stage Gage

Submersible sensors

*Would not* be broadcast / telemetered

*Only high flow measurements made*

Graphical output example
USGS Flood Inundation Mapping

Available Layers – Example: Joachim Creek at Desoto, Missouri

- NWS Radar Data
- Flood Watches/Warnings
- AHPS Forecast Sites
- Flood Category / Gage
- Observed River Stage Information
USGS Flood Inundation Mapping
Forecasting – Example: Joachim Creek at Desoto, Missouri
USGS Flood Inundation Mapping

Inundation Mapping Tied to Flood Categories – Action Stage

Joachim Creek

Action Stage – 8 Feet

Joachim Creek at Desoto, Missouri
USGS Flood Inundation Mapping

Minor or Flood Stage – 10 Feet – Base Layer Option Display

Joachim Creek at Desoto, Missouri
USGS Flood Inundation Mapping

Moderate Stage – 12 Feet

DeWitt Street Impact – 0 – 1 ft

Joachim Creek at Desoto, Missouri
USGS Flood Inundation Mapping

Major Stage – 13 Feet

Walther Park Access Impact – 0.5 – 1.5 ft

Joachim Creek at Desoto, Missouri
USGS Flood Inundation Mapping

Stage of 16 feet in the **Major** flood category

Joachim Meadows Subdivision Impact – 4.5 – 5.5 ft

Joachim Creek at Desoto, Missouri
Meramec River Flooding
Flood Inundation Mapping Effort – Valley Park / Keyes Summit
2017 Flood In Practice

16 foot rise in 2 days
44 feet
28 feet
Meramec River Flooding
Flood Inundation Mapping Effort – Keyes Summit
2017 Flood In Practice

Tree Court Industrial

Meramec River Reach at Valley Park

28 feet
Meramec River Flooding
Flood Inundation Mapping Effort – Keyes Summit
2017 Flood In Practice

Tree Court Industrial

Meramec River
Reach at Valley Park

Water depth: 5.5 - 6.5 ft

44 feet
Flood Inundation Mapper

Value Added – Historic Flooding and Documentation

Meramec River Example

Sign up for WaterAlert for this site
Water information texted directly to you... simply subscribe to WaterAlert!

Project Contacts for more information
Maps created by
Missouri Water Science Center

Maps reviewed by
Missouri Water Science Center
Nebraska Water Science Center

Data Downloads and Metadata
Download Data

References
Download Report
Flood Inundation Mapper

Value Added – Web Camera

Meramec River Example

Meramec River Reach at Fenton
Value Added Web Camera
Examples
Flood Inundation Mapper
Value Added – Location Specific

552 Maple Meadows Drive
Arnold, MO

Water depth: 1.5 - 2.5 ft

Water Depth
1.5 - 2.5 Feet
USGS Water Alert

The “where and why” for subscription

City of Desoto, MO

https://maps.waterdata.usgs.gov/mapper/wateralert/
USGS Water Alert
Joachim Creek at Desoto – Linked to Gage and Mapper

Alert Thresholds

Gage height, in ft
Alert Threshold Condition:

- Greater than (>)
- Less than (<)
- Outside a range (< or >)
- Inside a range (> and <)

Real-time value is greater than: 7.0 ft

I have read and acknowledge the Provisional Data Statement and Disclaimer.

Submit  Reset  Cancel
Application for Lower Meramec River and Mississippi River interaction
Flood Inundation Mapper
Value Added – HAZUS (Building/Vehicle Loss)

Potential Integration

FEMA’s Flood Assessment Structure Tool (FAST)
An open source tool to rapidly analyze structure-level flood risk

HEC-LifeSim
Version 1.0
Hydrologic Engineering Center
Institute for Water Resources
U.S. Army Corps of Engineers
609 Second Street
Davis, CA 95616

Loss Estimation Application

FEMA
Earthquake • Wind • Flood
Local Agencies

• EMA director can focus warnings using automated technologies to get people/property out of harm’s way
• Evacuation routes can be assessed quickly for flood access
• Police would know where to place barricades in advance of flood crest to block flooded roads and prevent accidents
• Officials would have answers quickly
• Public can be better educated to threat of floods
National Flood Insurance Program

What is the value in USGS Flood Warning Gages and Mapping?

Community Rating System

“Credit for measures that protect life and property during a flood, through flood warning and response programs.”

600 Series

610 – Flood Warning and Response