Agency Priority Goal Action Plan

Mitigate Flood Impacts by Demonstrating Improved Decision Support Services to Emergency Managers

Goal Leader:

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Overview

Goal Statement: By September 30, 2019, NOAA National Weather Service will improve decision support services by demonstrating a new flood inundation mapping capability serving 25 million people (approximately 8%* of the continental U.S. population) residing in flood-vulnerable freshwater basins, and delivering an enhanced excessive rainfall outlook product that extends the lead time of high risk predictions from two days to three days.

Emergency Managers will use this information to more effectively mitigate flood impacts by prepositioning resources, ensuring critical infrastructure (e.g., hospitals, evacuation routes, etc.) are viable, and ordering evacuations[1].

*Future out-year goal is to incrementally expand flood inundation mapping to near 100% of the continental U.S. population residing in flood-vulnerable freshwater basins.

Challenge:

- Flood and other water emergencies increasingly are associated with property damage and threats to safety. For example, in 2016, just four flooding events led to $16.6 billion in damages and 49 deaths.** Losses associated with flooding events in 2017, which are still being tabulated, are expected to exceed 2016.
- Emergency managers lack detailed information during flood emergencies to efficiently allocate resources to save lives and property.

Opportunity:

- NOAA can use advances from the state-of-the-art National Water Model (NWM) to demonstrate improved decision-support products to emergency managers.
- Provide emergency managers and the public a longer lead time out to Day 3 for “High Risk” of Excessive Rainfall. Excessive rainfall expresses the probability of rainfall exceeding flash flood guidance.

** https://www.ncdc.noaa.gov/billions/events/US/1980-2017

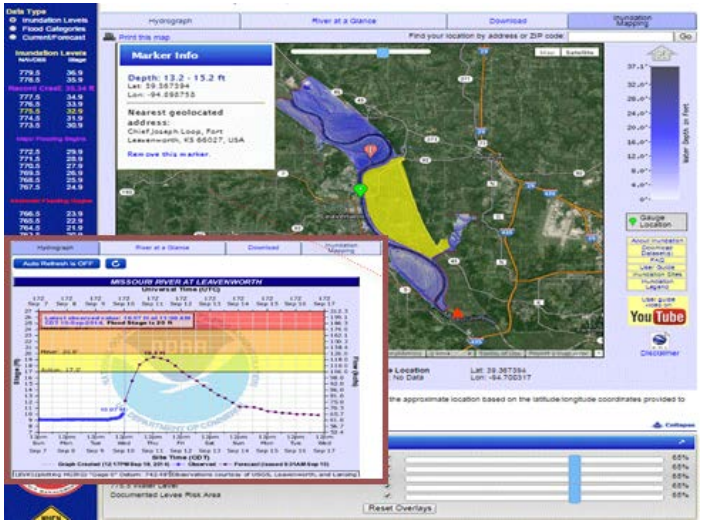
1 Execution of the APG is subject to availability of staff resources, especially at the Weather Prediction Center, River Forecast Centers, and the National Water Center which could be affected by implementation of the Analyze, Forecast, and Support reduction.

Long-Range Vision for Flood Inundation Mapping

Flood Inundation Maps: Maps depicting the spatial extent and depth of flood waters so Emergency Managers can better mitigate impacts of flooding and build more resilient communities.

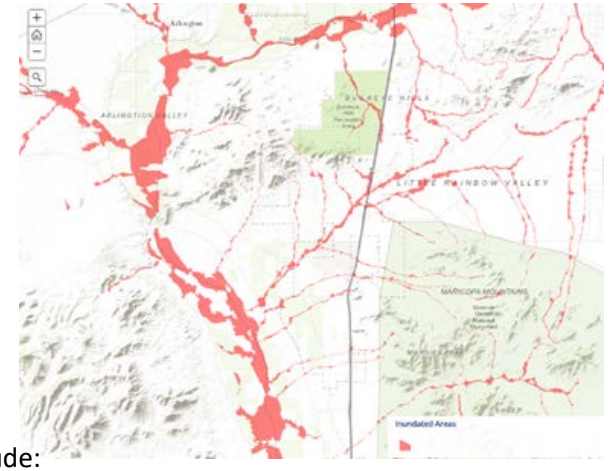
Current Capability: Static Inundation Map libraries at ~150 river locations across the United States.

- Provides the spatial extent and depth of flood waters
- Displays inundation maps for levels from minor flooding through flood of record
- Limited spatial coverage, resource intensive, only at small number of USGS streamgage locations



Next Steps -- NWM enabled capability: The high spatial and temporal resolution capabilities of the National Water Model coupled with high resolution hydrography datasets will allow us to provide real-time flood inundation mapping capabilities at neighborhood-level in a more consistent and timely way.

- Provides spatial extent of flood waters
- Technique can be driven by official streamflow forecasts or NWM guidance (to be demonstrated in this APG for the WGRFC domain)
- Incrementally expand flood inundation mapping to 2.7 million stream reaches nationwide



Future Planned Enhancements: Build on and enhance the NWM enabled capability to include:

- Flood Inundation maps informed by the (to be developed) NWM hyper-resolution capabilities to provide improved resolution of maps and better depict the urban built environment
- Flood Inundation maps informed by the (to be developed) NWM coupled with estuarine and coastal processes, and groundwater models

Summary of Progress – FY 18 Q3

- Milestones Completed:
  - Q3FY18: Initiate flood inundation mapping (FIM) techniques using the River Forecast Center (RFC) official forecast for West Gulf River Forecast Center (WGRFC) domain.
  - Q4FY18: Initiate flood inundation mapping techniques using the National Water Model (NWM) guidance for WGRFC domain.

- These important milestones established processes for the National Water Center to convert location-specific official river forecasts from the West Gulf RFC to Flood Inundation Maps. The work completed in the Q4 milestone also extends the Flood Inundation Map domain beyond the river locations with complementary National Water Model guidance. All maps will be evaluated to gauge the ability to support Emergency Managers' decision making, such as using these maps to reduce flood impacts by prepositioning resources, ensuring critical infrastructure (e.g., hospitals, evacuation routes) are viable, and ordering evacuations.

- APG **On Track** for completion Q4 FY19.

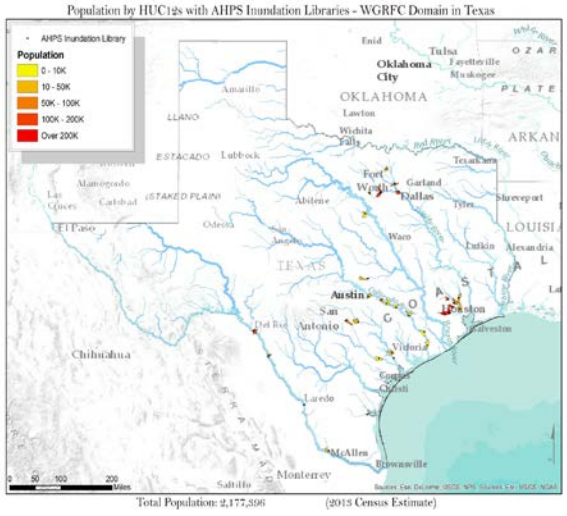
Key Milestones (Flood Inundation Mapping)

Milestone Summary					
Key Milestone	**Milestone Due Date**	**Milestone Status**	**Change from last quarter**	**Owner**	**Anticipated Barriers or other Issues Related to Milestone Completion**
Initiate flood inundation mapping (FIM) techniques using the River Forecast Center (RFC) official forecast for West Gulf River Forecast Center (WGRFC) domain	FY18 Q3	Complete	Completed		
Internal validation of FIM (using official forecast) with OWP and WGRFC	FY18 Q4				
Initiate flood inundation mapping techniques using the National Water Model (NWM) guidance for WGRFC domain	FY18 Q4	Complete	Completed		
Internal validation of FIM (using NWM guidance) with OWP and WGRFC	FY19 Q1				
NWM version 2.0 released	FY19 Q2				
Complete tabletop exercise planning	FY19 Q2				
Execute tabletop exercises with demonstration area Emergency Managers	FY19 Q3				
Incorporate feedback from tabletop exercises. Complete FIM demonstration.	FY19 Q4				

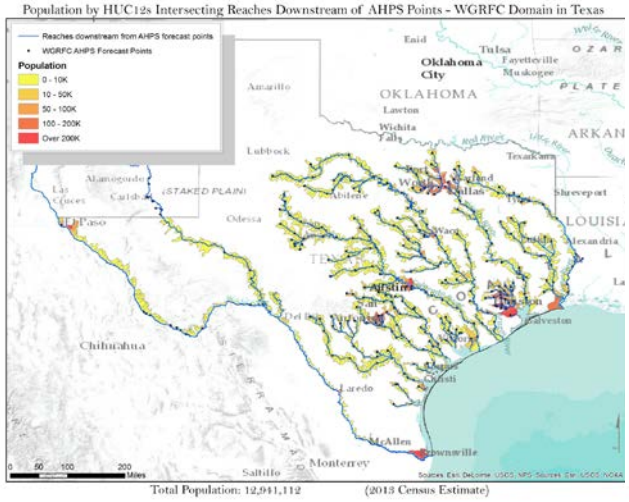
Key Indicators (Flood Inundation Mapping)

Population served by inundation information, considering areas within NWS West Gulf Forecast Center service area in Texas.*

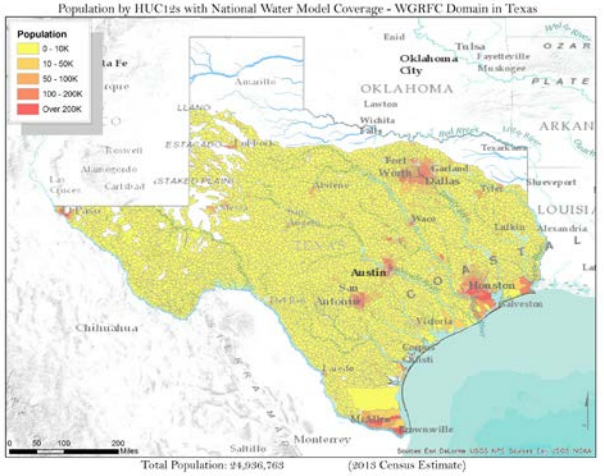
- Baseline: < 1% of population (2.2M) served by current Advanced Hydrologic Prediction Service (AHPS) static inundation maps near specific river locations
- FY18 Q3: Initiate demonstration on 4% of population (12.9M) served with NWM hydrography and Height Above Nearest Drainage (HAND) technique near NWS official forecast locations.
- FY18 Q4: Initiate demonstration on 8% of population (24.9M) served with NWM guidance and HAND technique along full river/stream network.
- FY19 Q4: Complete demonstration on 8% of population and incorporate emergency manager feedback.
- Out-year: ~100% of CONUS population (317M) served by NWM model and HAND technique



Baseline



FY18 Q3



FY18 Q4

*Population totals based on 2013 population in adjacent hydrologic areas, defined by Hydrologic Unit Code (HUC) 12 delineations.

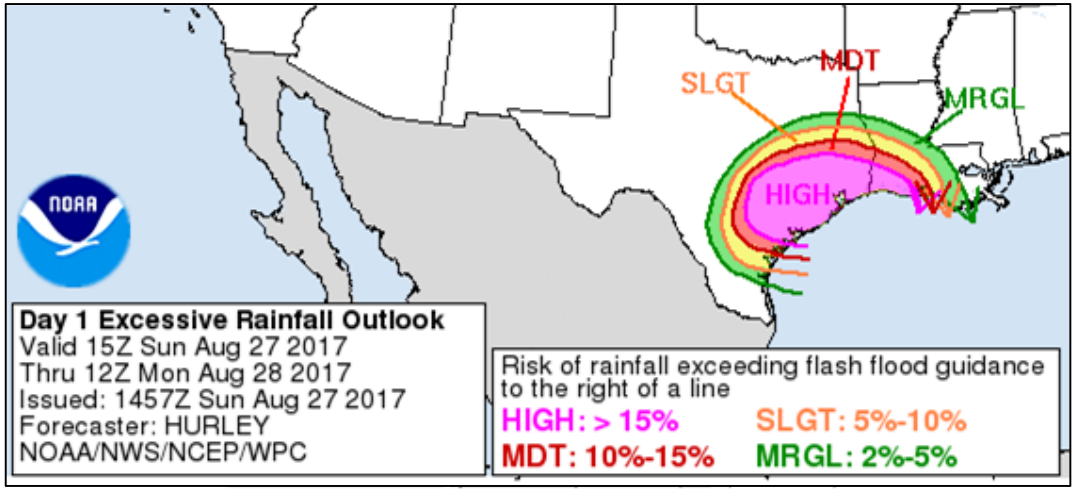
Excessive Rainfall Outlook

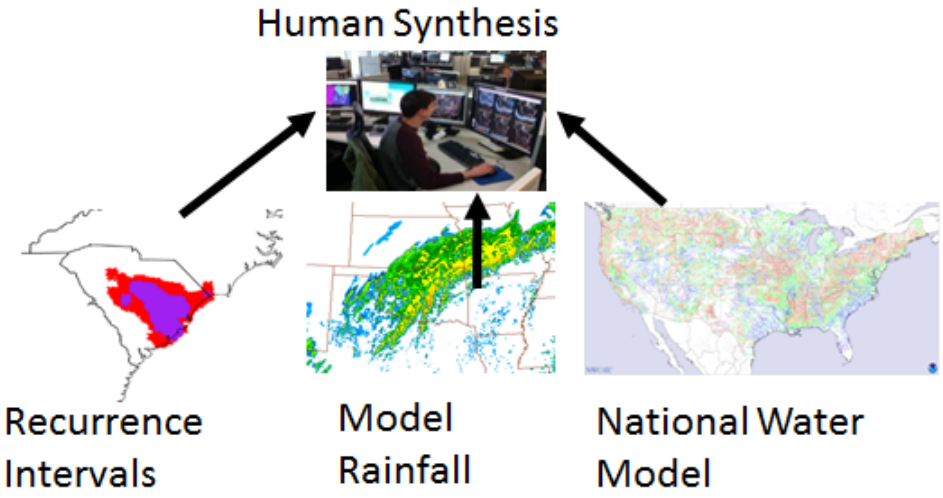
The Excessive Rainfall Outlook (ERO) provides a national summary of rainfall threat by expressing the probability of rainfall exceeding flash flood guidance.

The ERO raises situational awareness that conditions are favorable for impactful rainfall.

The risk of excessive rainfall is expressed both probabilistically and categorically (e.g., Marginal 5-10%, Slight 10-20%, Moderate 20-50%, and High >50%).

"High" risk forecast days have been correlated to events with fatalities and large damages. Currently "High Risk" is only used in Day 1 and Day 2 products.





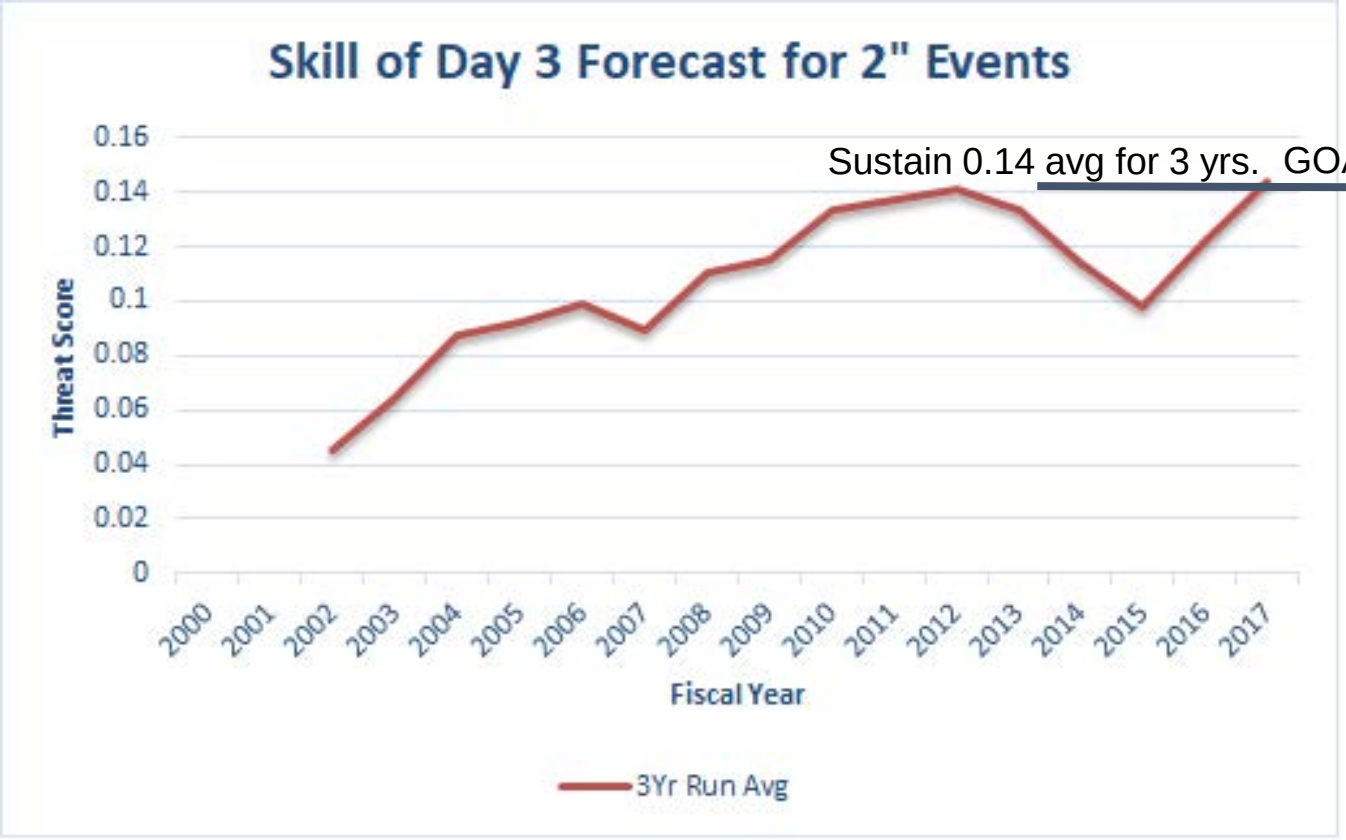
Key Milestones (Excessive Rainfall Outlook)

Milestone Summary					
Key Milestone	**Milestone Due Date**	**Milestone Status**	**Change from last quarter**	**Owner**	**Anticipated Barriers or other Issues Related to Milestone Completion**
Enhance excessive rainfall outlook to include improved definition and calibration	FY18 Q1	Complete			'High Risk' now signifies a >50% chance of rainfall exceeding flash flood guidance.
Execute Flash Flood and Intense Rainfall Experiment and assess Day 3 rainfall tools	FY18 Q4				
Test machine-learning first guess field for Excessive Rainfall Risk areas	FY18Q4				
Internal issuance of test 'high' risk areas on Day 3	FY19 Q1				
Add excessive rainfall outlook to National Hurricane Center webpage for landfalling tropical cyclones.	FY19 Q3				
Execute tabletop exercises with Emergency Managers	FY19 Q3				
Enhance operational excessive rainfall outlook to add High Risk category out to 3 days.	FY19 Q4				

Key Indicators (Excessive Rainfall Outlook)

Threat score of two inch rainfall events forecast 3 days in advance
(3 FY running average)

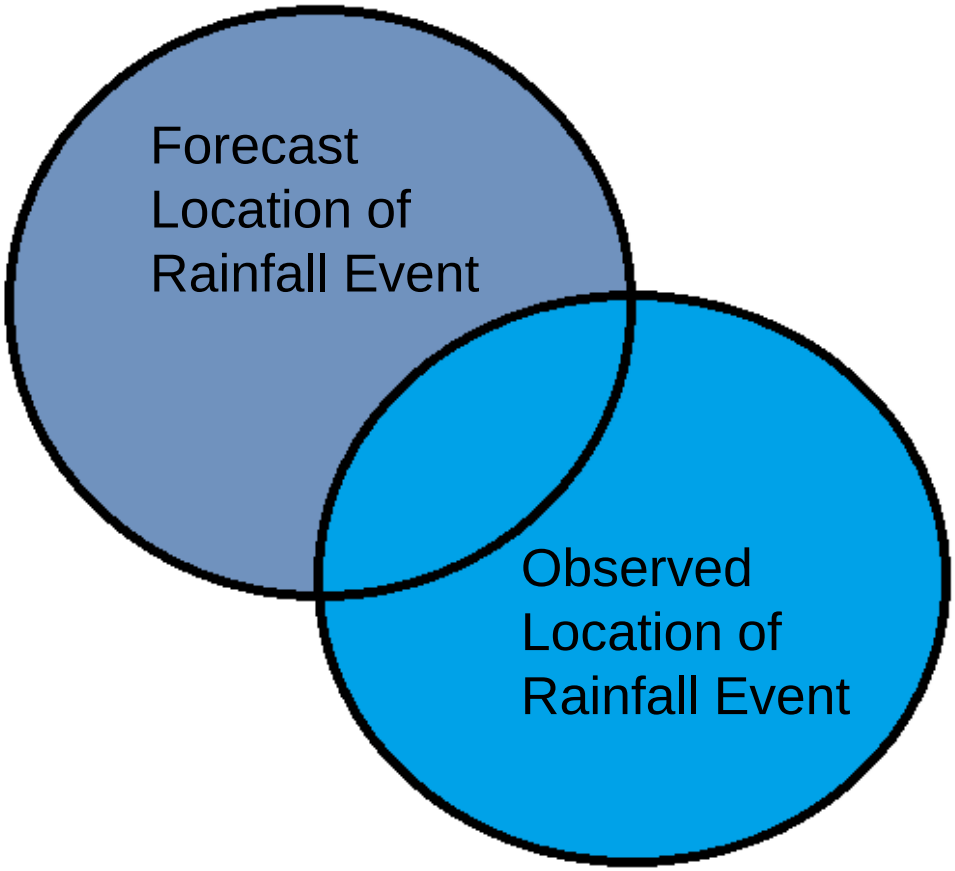
3-year running average goal = 0.14
Sustaining a 0.14 Threat Score gives confidence to provide ‘high risk’ excessive rainfall outlook category on Day 3



What does a 0.14 Threat Score Mean?

Threat Score of 0 = NO overlap between forecast & observed location.
Threat Score of 1 = COMPLETE overlap between forecast & observed location.
Threat Score of 0.14 = Index score which represents 25% overlap between forecast and observed location

Note: Predictions with some variation are still highly useful to planning for and responding to extreme weather.



Additional Information

Contributing Programs

Organizations:

- OMB, DOC, NOAA -- Oversight
- NWS -- Implementing Organization for APG

Program Activities:

- Office of Water Prediction -- Demonstrate Flood Inundation Map
- National Centers for Environmental Prediction -- Deliver Enhanced Excessive Rainfall Outlook

Regulations:

- N/A

Tax Expenditures:

- N/A

Policies:

- None

Other Federal Activities:

- None

Stakeholder Consultations

The APG advances decision support, which is authorized in the Weather Research and Forecasting Innovation Act of 2017.