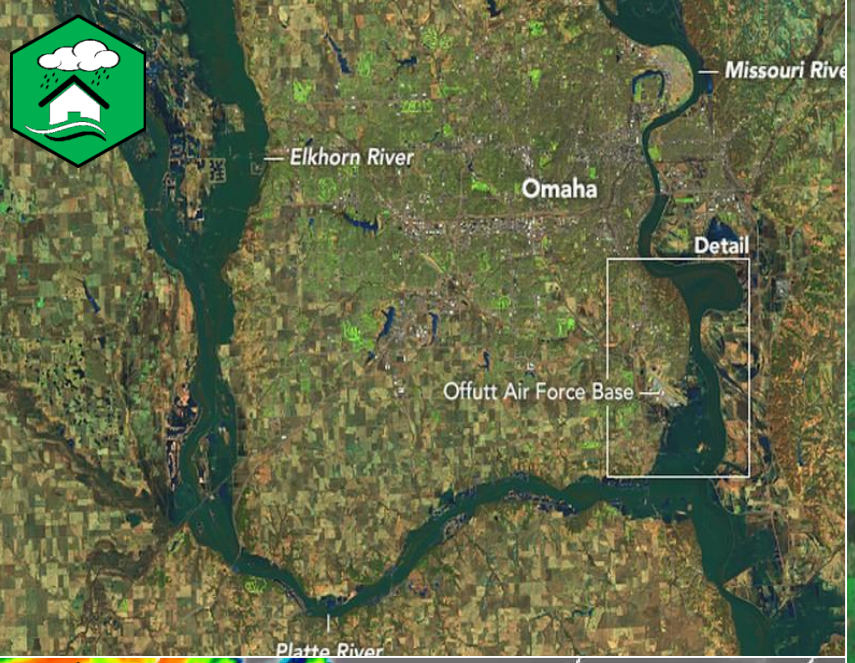
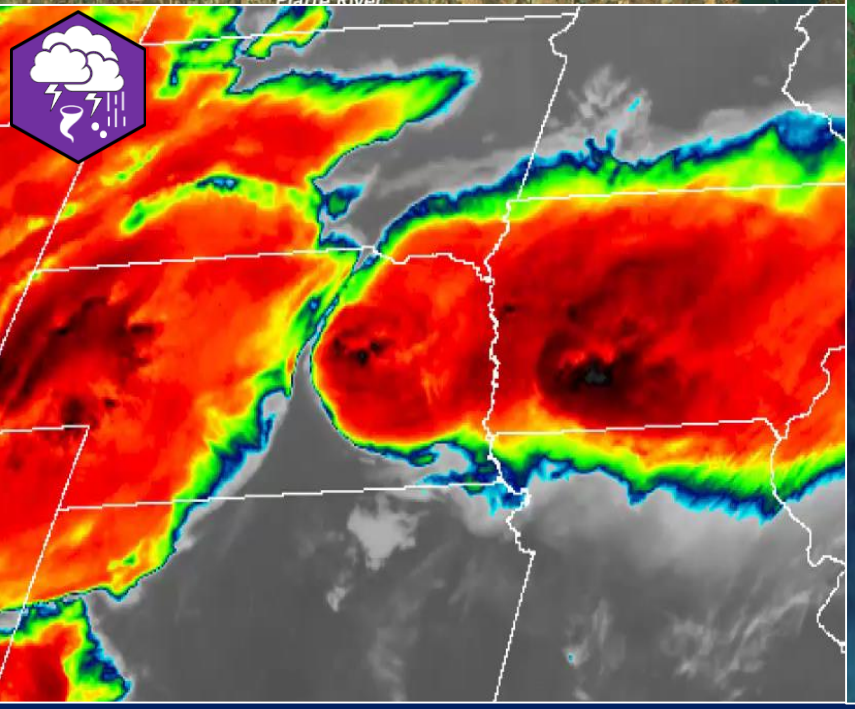
GIS Situational Awareness For Emergency Response





Flood
Storm
Wildfire

SAFER

Special Thanks To:

Stephan Smith – NOAA VLab Director
John Schattel – NOAA VLab Support Team

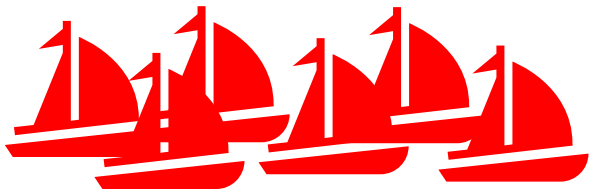
JJ Brost, Jason Johnson, Paul Mckee, &
Jack Settelmaier – NWS Southern Region HQ

Jeff Garmon (CYS), Joe Arellano (EWX), Alan Gerard (NSSL), Steve Wilkinson (GSP), & Kris Lander (WGRFC)

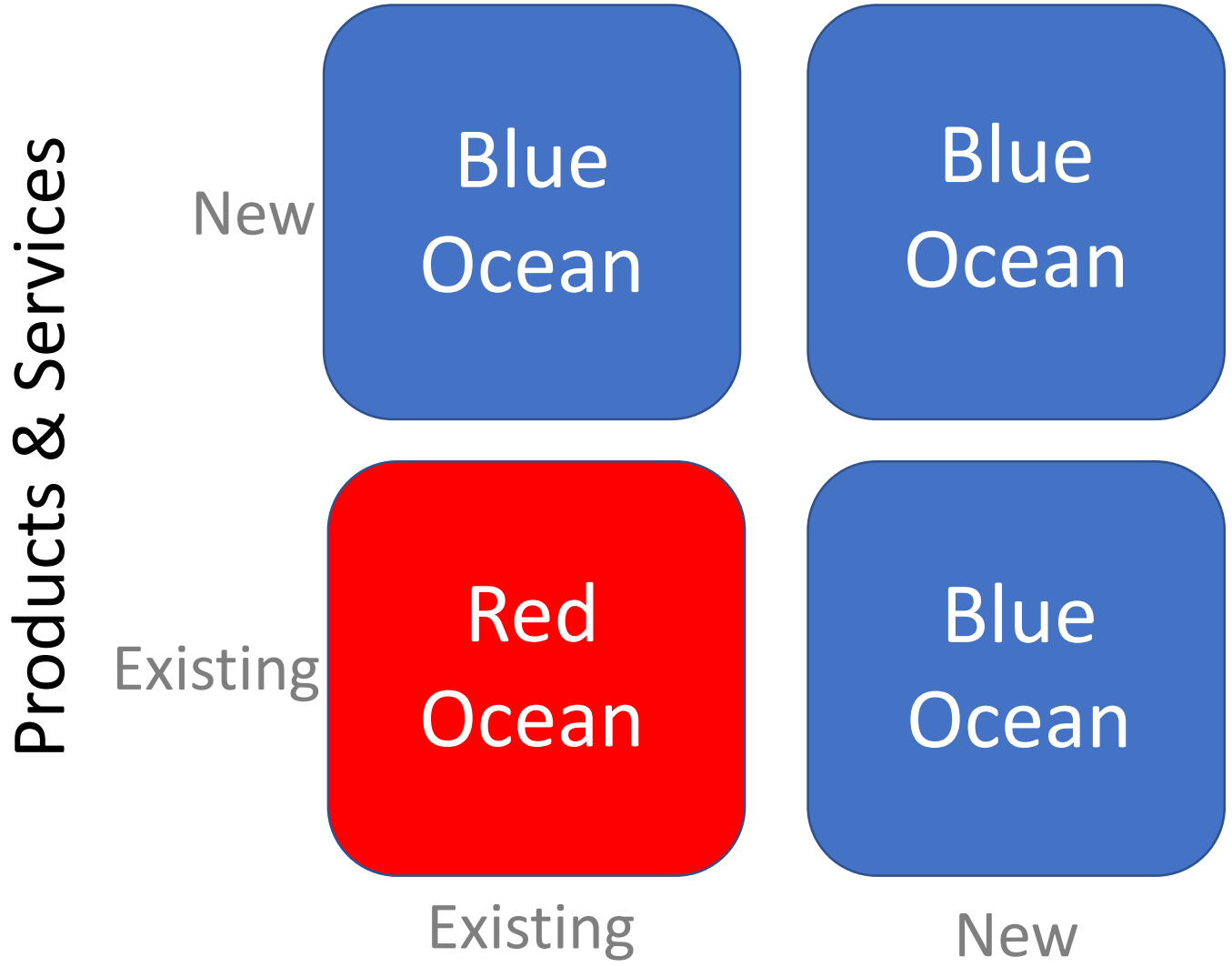
NWS WFO Jackson (MS), San Antonio,
& Cheyenne GIS/IDSS Teams

Blue & Red Ocean Strategy

Innovate & Pursue
New Opportunities
Perspective



Defend Current
Position Perspective



Reference: Kim & Mauborgne, "Blue Ocean Strategy", *Harvard Business Review*, October 2004

Red Ocean

Warning & Watch Services

Social Media Channels

NWS Webpages

NWS Routine Text Products

NWP Output

IDSS GIS/AGOL Services

River Flooding GIS Output

Post-Wildfire Flash Flood & Debris Flow Vulnerability

Integrated Emergency Management Services

Blue Ocean

Wyoming SAFER Hazard Dashboard - Situational Awareness For Emergency Response

NOAA/NWS Cheyenne Link

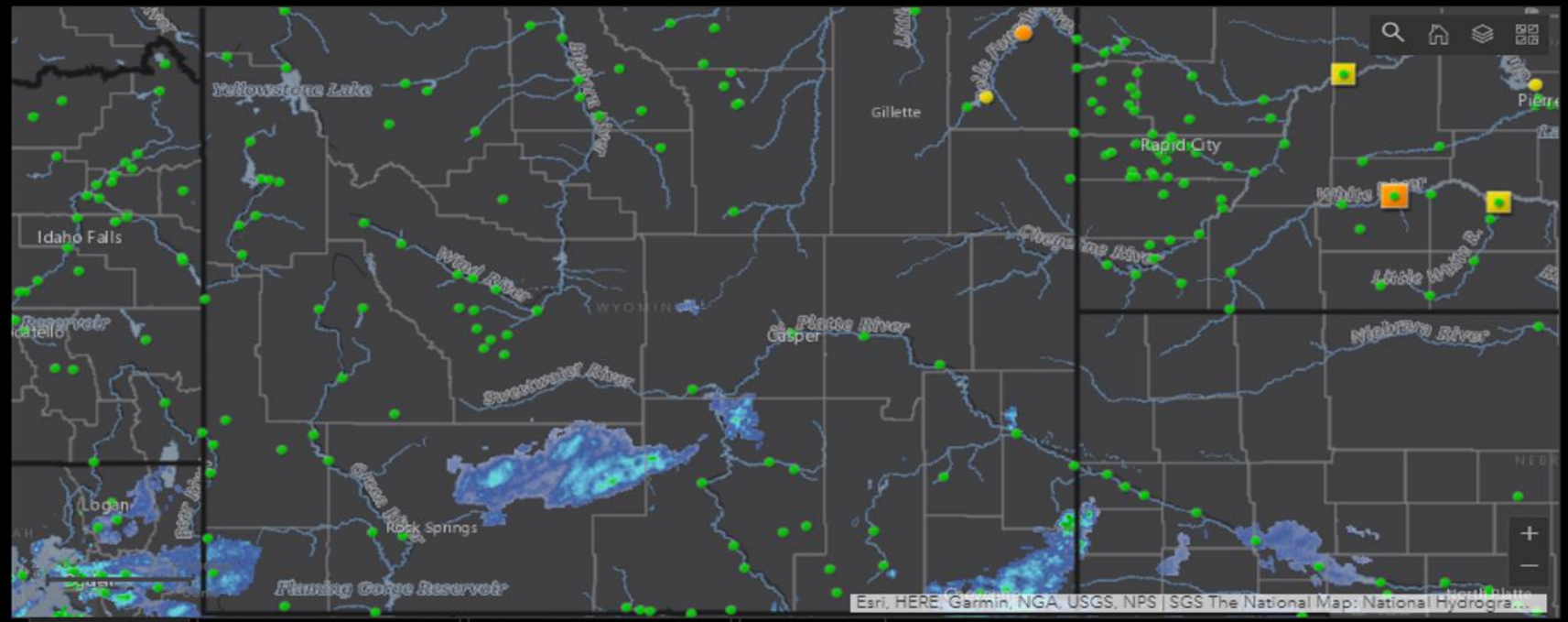
Flood-SAFER | Storm-SAFER | Wildfire-SAFER | Looping Radar + River Status | River Levels + Flood Extents | USGS Stream Traces | Latest Weather Graphics | NWSChat Live Access

Observed Flooding Sites

- Major Flooding
- Moderate Flooding
- Minor Flooding
- Near Flood
- No Flooding
- Flood Category Not Defined
- At or Below Low Water Threshold
- Observations Are Not Current
- Out of Service

72 Hour Forecast River Stages (ft)

- Major Flooding
- Moderate Flooding
- Minor Flooding
- Near Flood
- No Flooding
- Flood Category Not Defined
- At or Below Low Water Threshold
- Forecasts Are Not



Main Dashboard | 1-Hour Precipitation Rate Map | 3-Hour Precipitation Rate Map | Looping Radar

River Level Status:

Belle Fourche River at Alva:
Flood Stage: **minor**
Latest Observation: 5.08 ft

Last update: a few seconds ago

Rivers Observed above Flood Stage

1

Last update: a few seconds ago

Observed River Flood Category (in map exent):

Last update: a few seconds ago

Rivers Forecast Above Flood Stage

1

Last update: a few seconds ago

Recent Events (last 30 only; click to view details)

10:05 Position Update	10:05 Position Update	10:05 Incident Update	10:07 Position Update	10:30 Position Update	11:18 Location Update	07:53 Objective Update
Albany County Elected Officials and Departmen Head is Activated	01 Transportation is Activated	Woff- Training A is Active. The following message is a Exercise/Drill at Albany	The Incident Commander position is assigned to Aimee Binning.	The Liaison Officer position is assigned to Don Wofford.	Laramie wy is a Weather - Snow at 6 Wyoming Ben, laramie, WY, 82070, Lat:	Identify Critical Infrastructure Impacts status is In Progress: Normal

New Messages 3


How can the NWS launch
into the GIS IDSS blue ocean?

Bridge innovative tools across the **NWS** & **Emergency Manager** span.

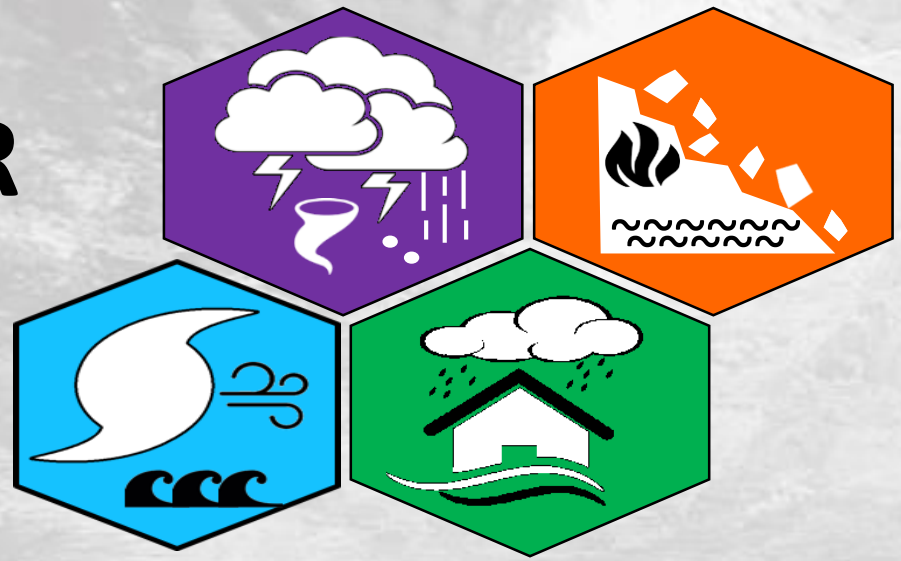
Science Messaging Response

Connections Relationships

SAFER GIS DSS Application Suite

Storm-SAFER

Wildfire-SAFER



Tropics-SAFER

Flood-SAFER

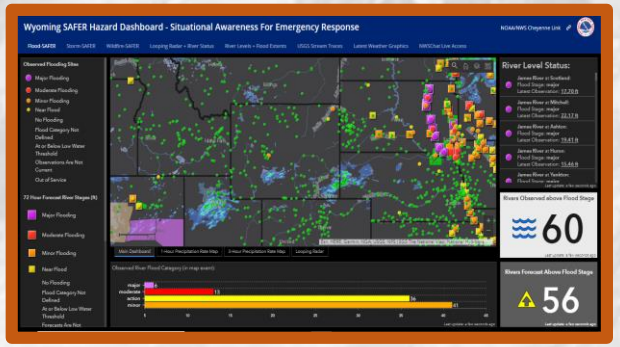
Provides NWS & Partners with:

1) When
2) Where
3) How Bad

Heat-SAFER

WRN-SAFER

WY-SAFER Hazard Dashboard

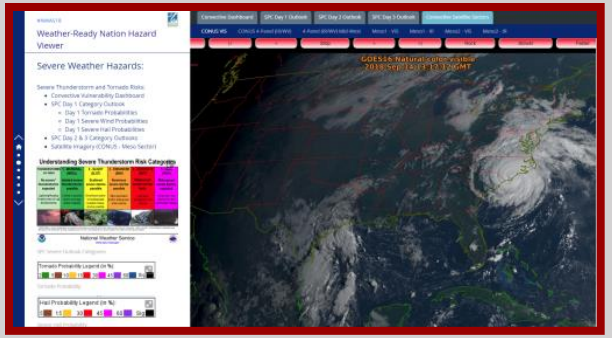


Storm-SAFER

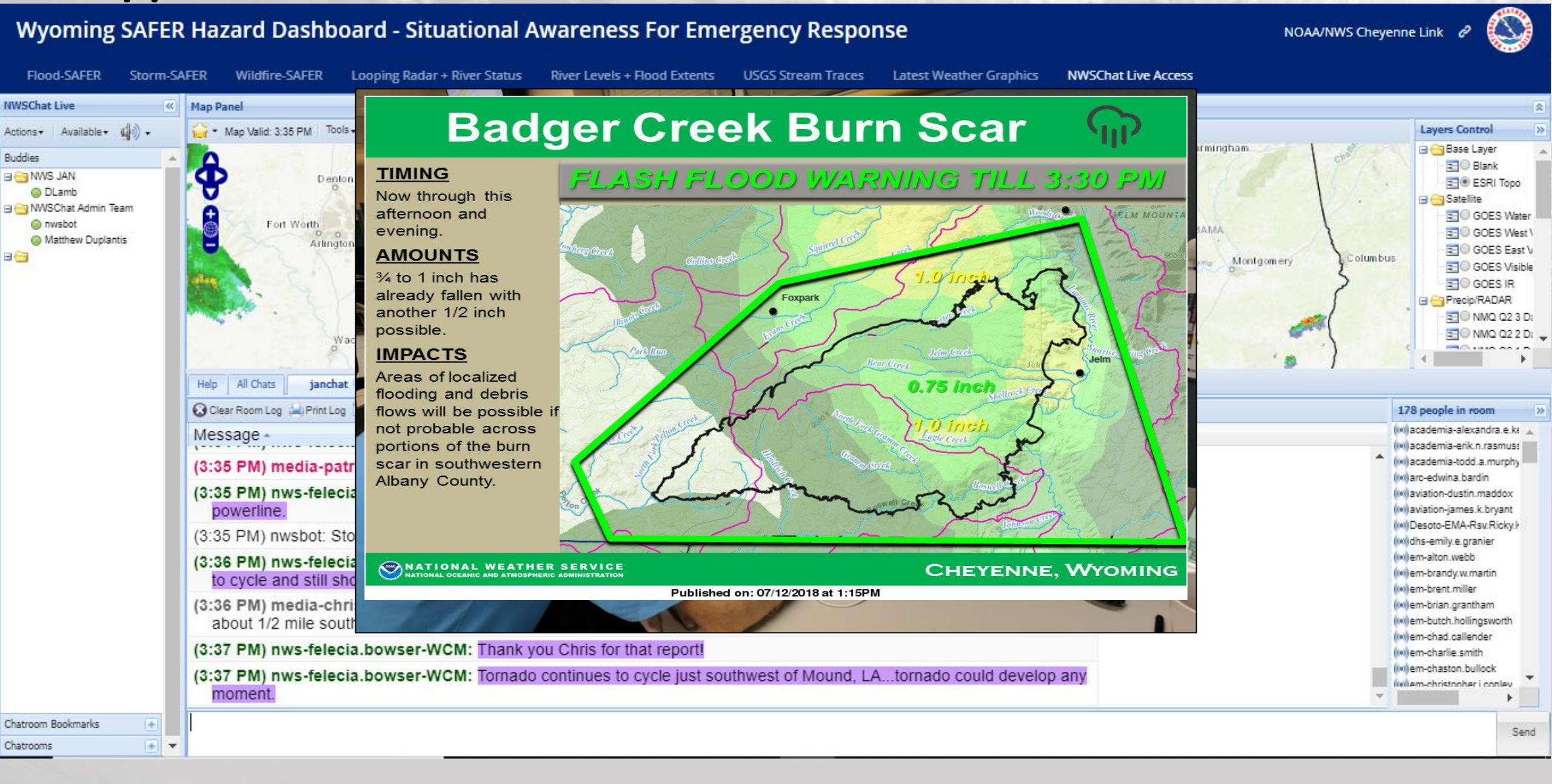
Wildfire-SAFER

Flood-SAFER

WRN-SAFER



Hyper-Local Awareness → Clearer Communication



SAFER AGOL Application Architecture

6 Tabs total

Legend: Web Application | Web Map | Supporting File | Web Link

SAFER Web Tabbed Story Map Application – arcg.is/CKOfv

Tab 1 – NOAA/NWS/EWX – SAFER Situational Awareness Overview Dashboard Application

NOAA/NWS/EWX – SAFER Situational Awareness Overview Map

Tab 2 – Radar & River Flood Stage Time Aware Map

Radar_Warnings Web Map

Tab 3 – SAFER – Flood Extents and Hydrographs

EWX Hydrograph .csv file

Tab 4 – MRMS 1-Hour Rainfall Accumulation Estimates

Tab 5 – MRMS 3-Hour Rainfall Accumulation Estimates

Tab 6 – USGS Streamer Application – Web Link

USGS Streamer Link

WY-SAFER Hazard Dashboard: arcg.is/aanH5

Storm-SAFER: arcg.is/0nTaHL

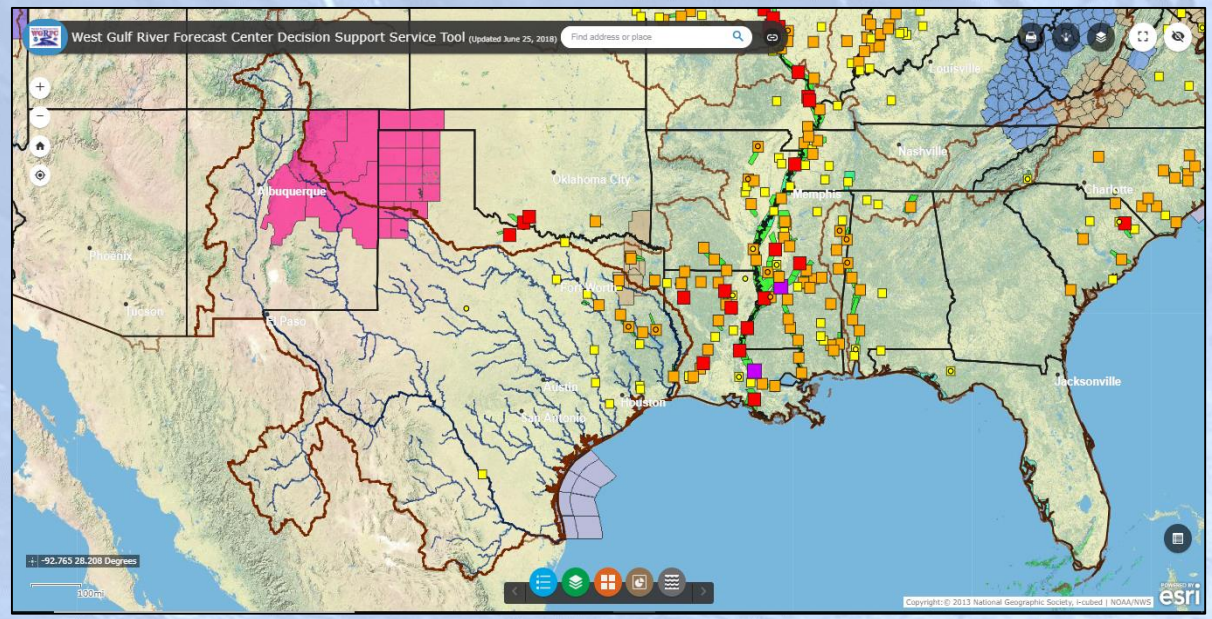
Wildfire-SAFER: arcg.is/1Dj8XC

WRH HRRR & Debris Flow: dev.wrh.noaa.gov/wrh/debrisflow/#

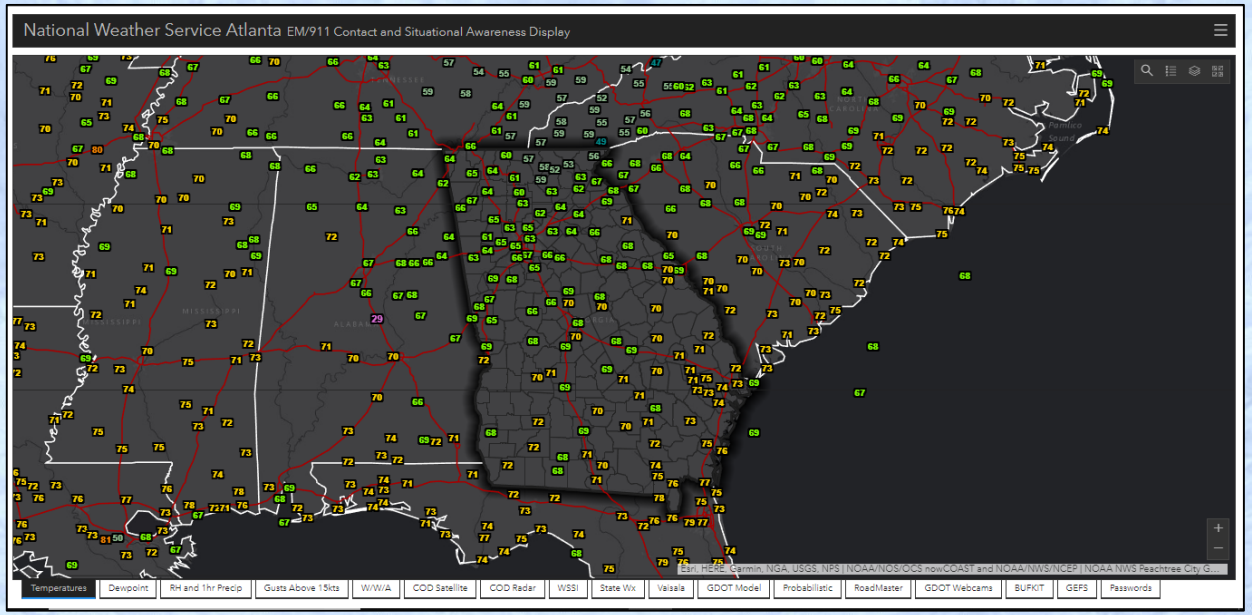
Flood-SAFER: arcg.is/CKOfv (Texas Centric Version)

WRN-SAFER: arcg.is/Xm40r

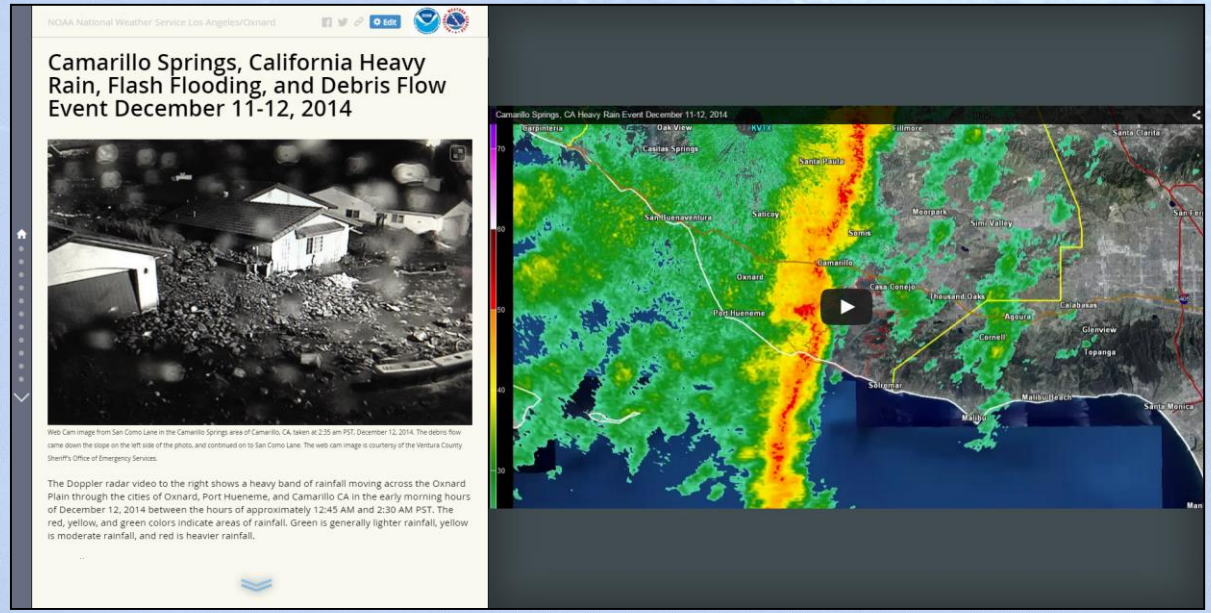
Links



NWS – West Gulf River Forecast Center – [Map Link]



NWS – Atlanta/Peachtree City, GA – [Map Link]



NWS – Los Angeles/Oxnard, CA – [Map Link]

NWS – Morristown, TN – [Map Link]

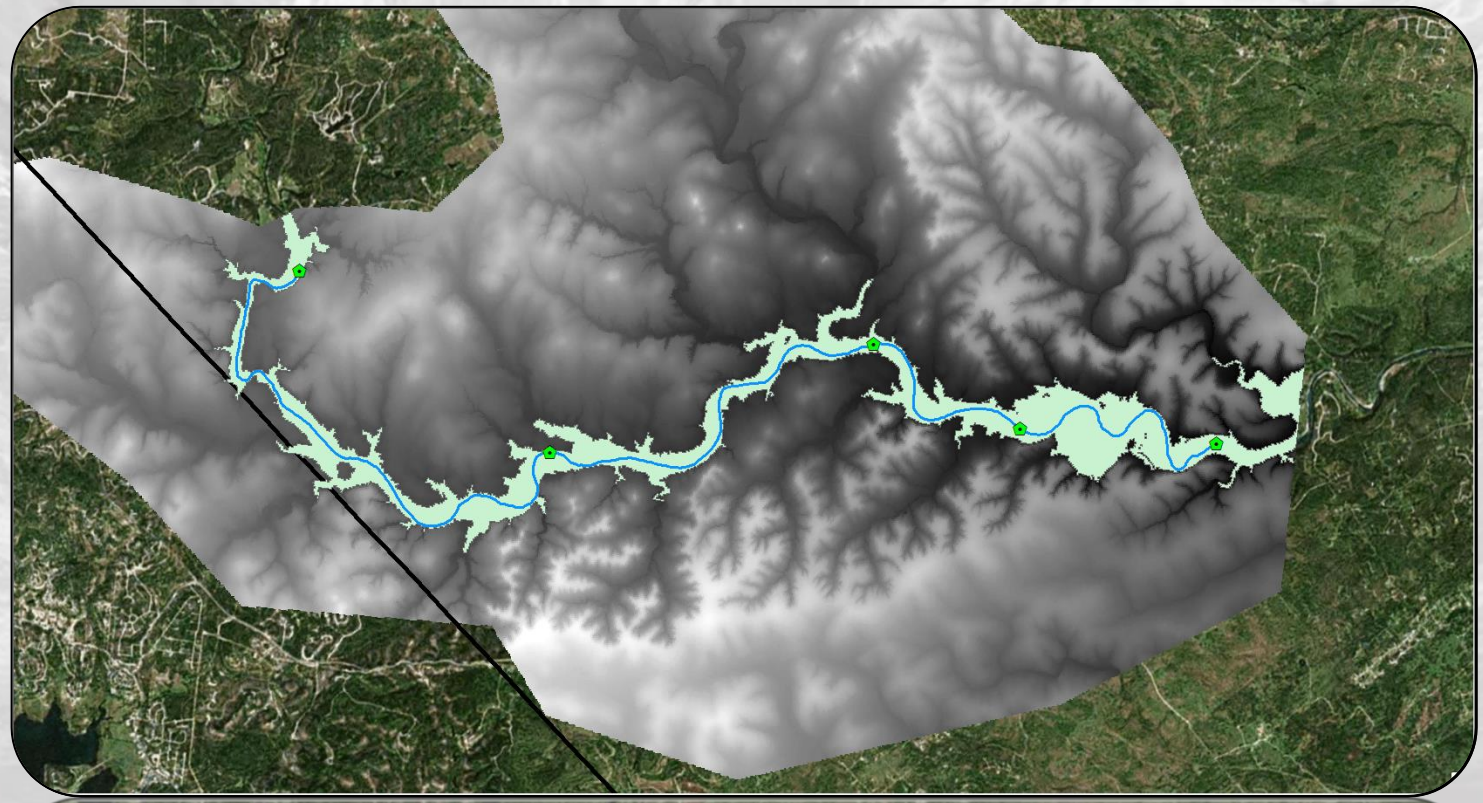
Another Blue Ocean – River Flooding Extent Maps

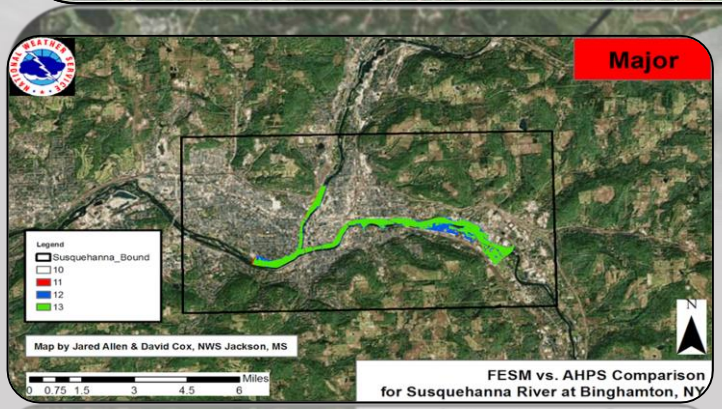
U.S. Army Corps of Engineers
Flood Event Simulation Model

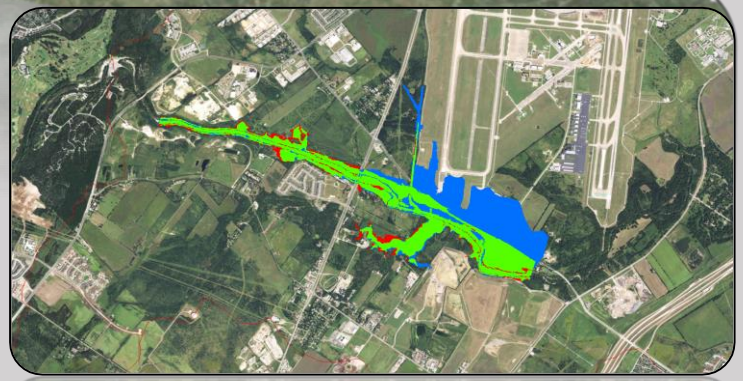
Only 3 files needed to operate model

Extents produced in a matter of hours

70-98% accurate compared to 'accepted' HEC-RAS AHPS standards







Experimental River Flooding Inundation Maps

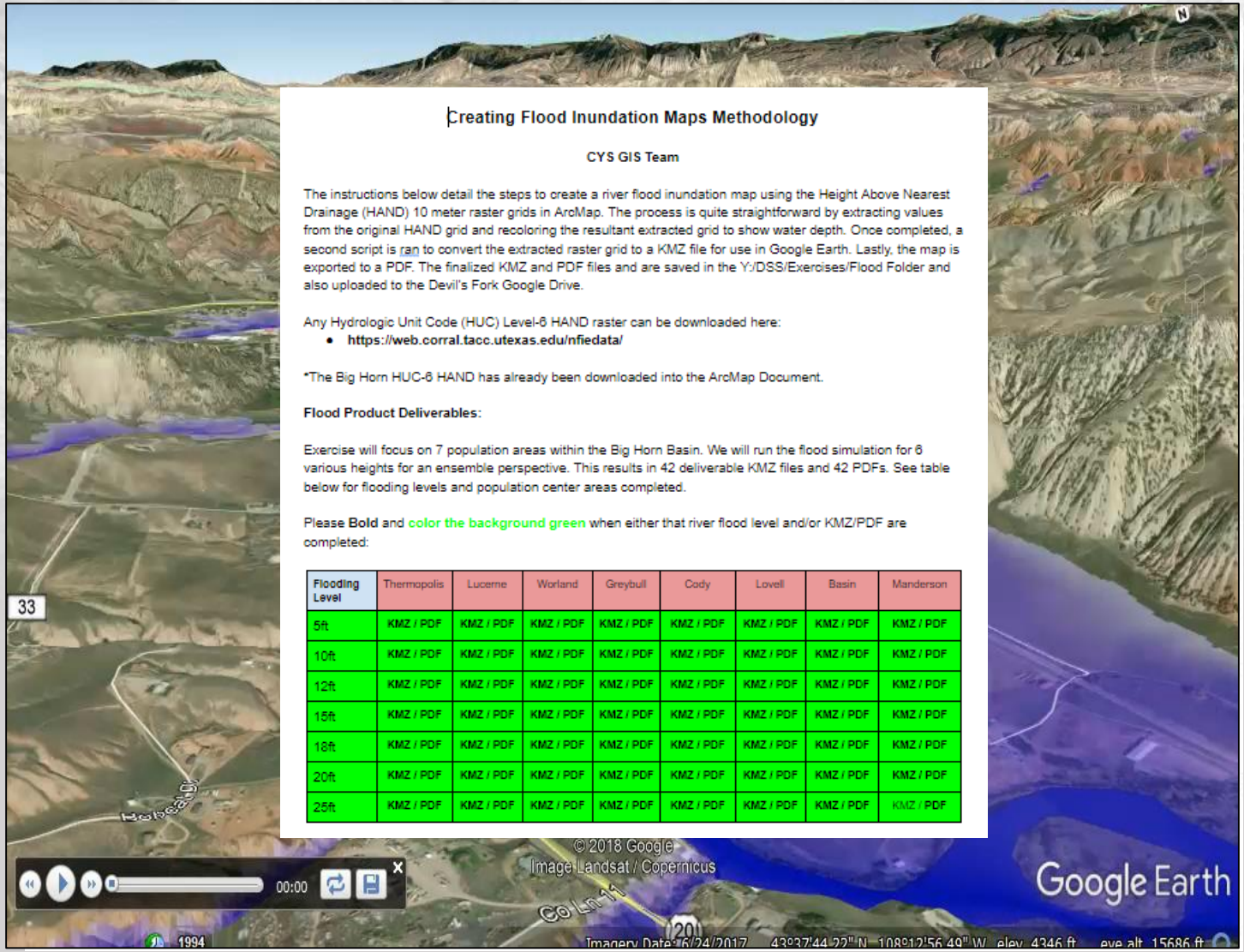
Height **A**bove **N**earest **D**rainage (HAND) Method

Derived HUC6 10-meter DEM Raster files across entire US CONUS

Internal & Core Partner planning exercise use*

Create KMZ files for Google Earth

*more testing needed in central & east CONUS



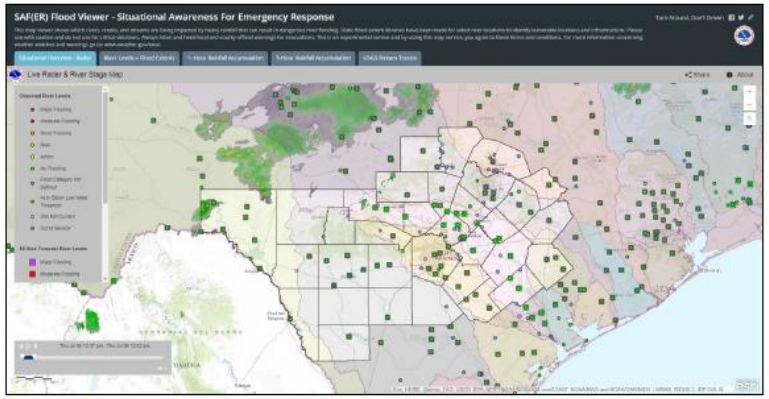
Relationships – R2O + R

How to Build a Flood SAF(ER) ArcGIS Online Web Application

Jared Allen & EWX GIS Team
Senior Forecaster, NOAA/National Weather Service Austin/San Antonio, TX Weather Forecast Office
Jared.Allen@noaa.gov

Greetings,

Below you'll find instructions on how to set-up an ArcGIS online webmap application configured similarly to the current operating version of the Flood Situational Awareness for Emergency Response [SAF(ER)] Application hosted by the NOAA/NWS Austin/San Antonio, TX WFO. It can be accessed by clicking here. In addition, a direct link can be accessed by typing the following URL: arcg.is/1L00Wvm Below is a picture of the latest version. The latest version online may look slightly different than pictured given periodic revisions.



To sum up the application's purpose: It is designed as both an internal NWS and external Emergency Manager one-stop web application to increase river flooding awareness by providing enhanced decision support services to emergency response for river flooding episodes via NWS products and social media channels.

The application is built around the idea of being an easy-to-use, intuitive, fully interactive, zoom-able, engaging application that logically flows from tab to tab to answer essential flood impact questions like:

- What is the flooding situation right now across the region or local area?
- What are the latest radar trends? How much rain has fallen in the last hour? Last 3 hours?
- What specific river, creeks, and streams are being affected? Which small watersheds are being impacted? Where do resources need to be directed to for evacuations or rescues?
- When the river reaches "X" feet, what areas will be impacted? What does the flood extent look like when it reaches major flood stage? Will this road/neighborhood/campground potentially be affected?
- Where does the rain need to fall to impact a specific river location?

Flood Extent Mapping Workflow V2.7

Jared Allen and EWX GIS Team
NWS Austin/San Antonio, TX
Last Updated 4/9/2018

This documentation depicts the workflow for developing flood extent areas for minor, moderate, major, and record flood stages at and along gauge sites located within NWS Austin/San Antonio, TX as well as Jackson's, MS Weather Forecast Offices. The workflow is a multi-platform GIS with additional post processing quality controlling measures across the NWS, USACE, State, county, and city management entities to ensure highest possible accuracy and accord for public dissemination.

Section 1: Goals

Goal 1: To efficiently produce accurate flood extents for minor, moderate, and major flood stages at and along river gauge sites (for a site specific distance) to aid both internal and external coordination and communication of the NWS with Federal, State, County and City emergency response officials.

Goal 2: Develop an intuitive internal and public facing dynamic web map and information viewer displaying the flood stages along specific gauge site segments.
Result: SAF(ER) application - arcg.is/1L00Wvm

Section 2: Overview

Below are brief descriptions and overviews of the programs used to create river flood extent areas. A step-by-step tutorial can be found starting in Section 4.

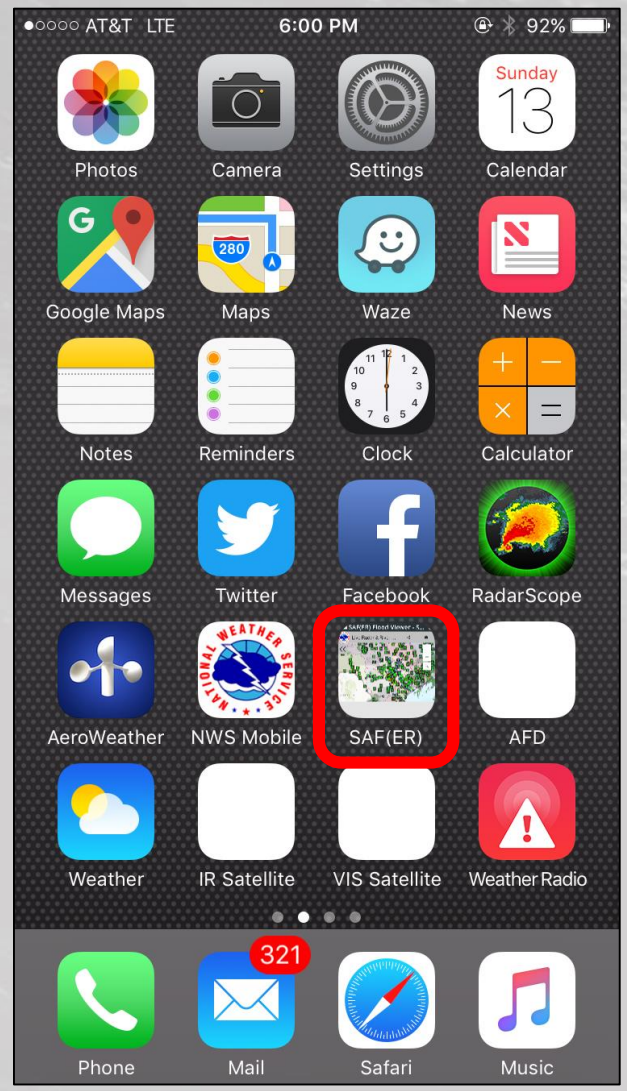
Programs/Applications used in this workflow:

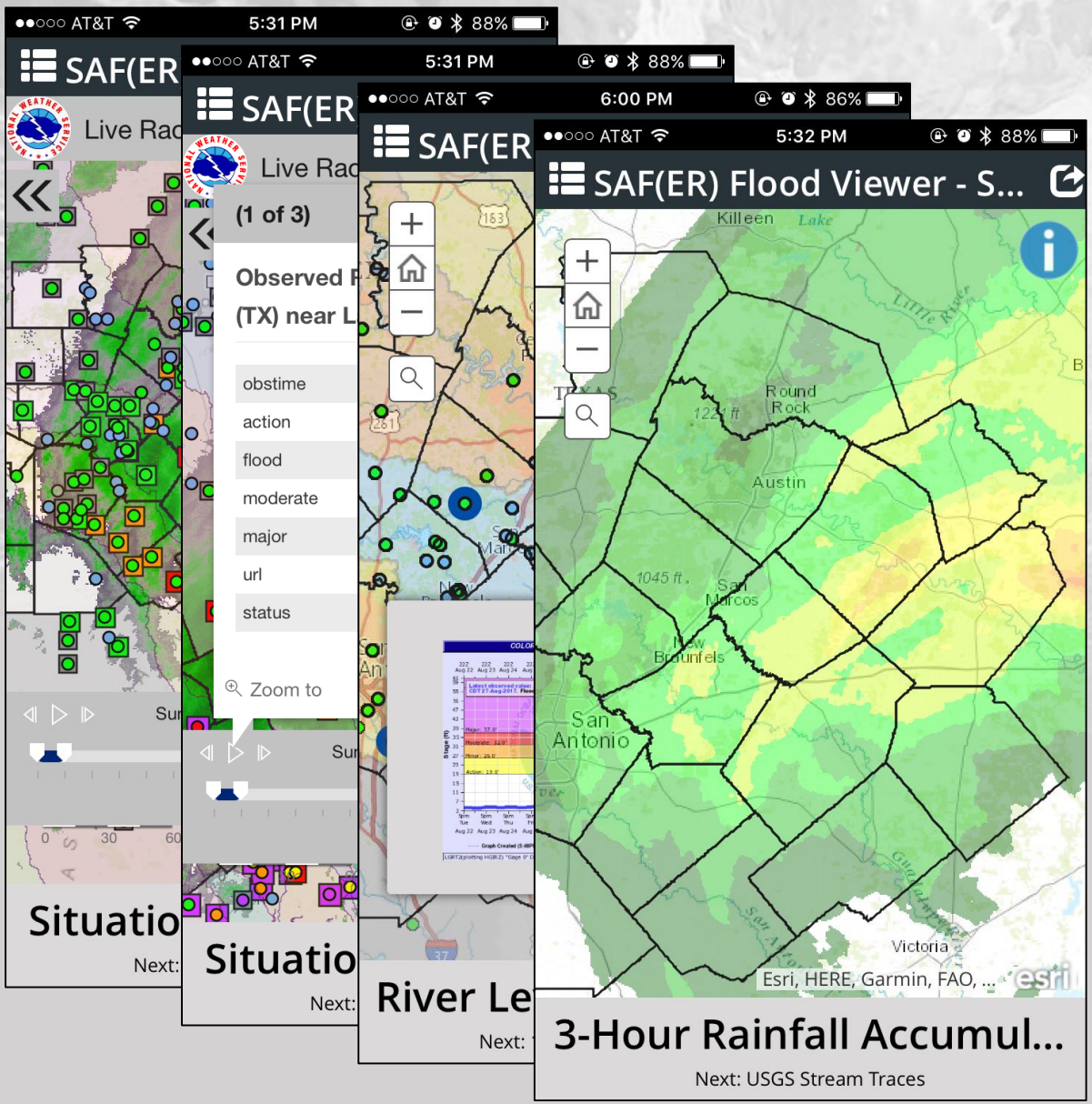
- ArcMap 10.5 or 10.6
- Flood Event Simulation Model (FESM) – US Corps of Engineers Vicksburg, MS
- ESRI ArcGIS Online Mapping Application – Tabbed Story Map

ArcMap 10.5 – Majority of workflow will involve ArcMap 10.5. Work in this environment will consist of building and editing one point river gauge shapefile, one polyline stream shapefile, and a Polygon shapefile to mask the elevation raster dataset (DEM) to a suitable extent. The DEM extent masking will determine how far up/downstream the flood extent will be mapped. Workflow will then transfer to the FESM program once the new shapefiles of gauges (points with respective MSL heights of a water surface) and stream segments (Polyline with From/To Nodes) have been set and saved from ArcMap.

FESM - The required inputs to the model are the one gauge shapefile, one stream polyline shapefile linking the points and a DEM topography raster file. FESM differs from most flood inundation models in that it does not consider either flow or friction, and as a result does not need information about these conditions. Another key difference is that FESM does not directly implement either the Naiver Stocks equations, the de Saint

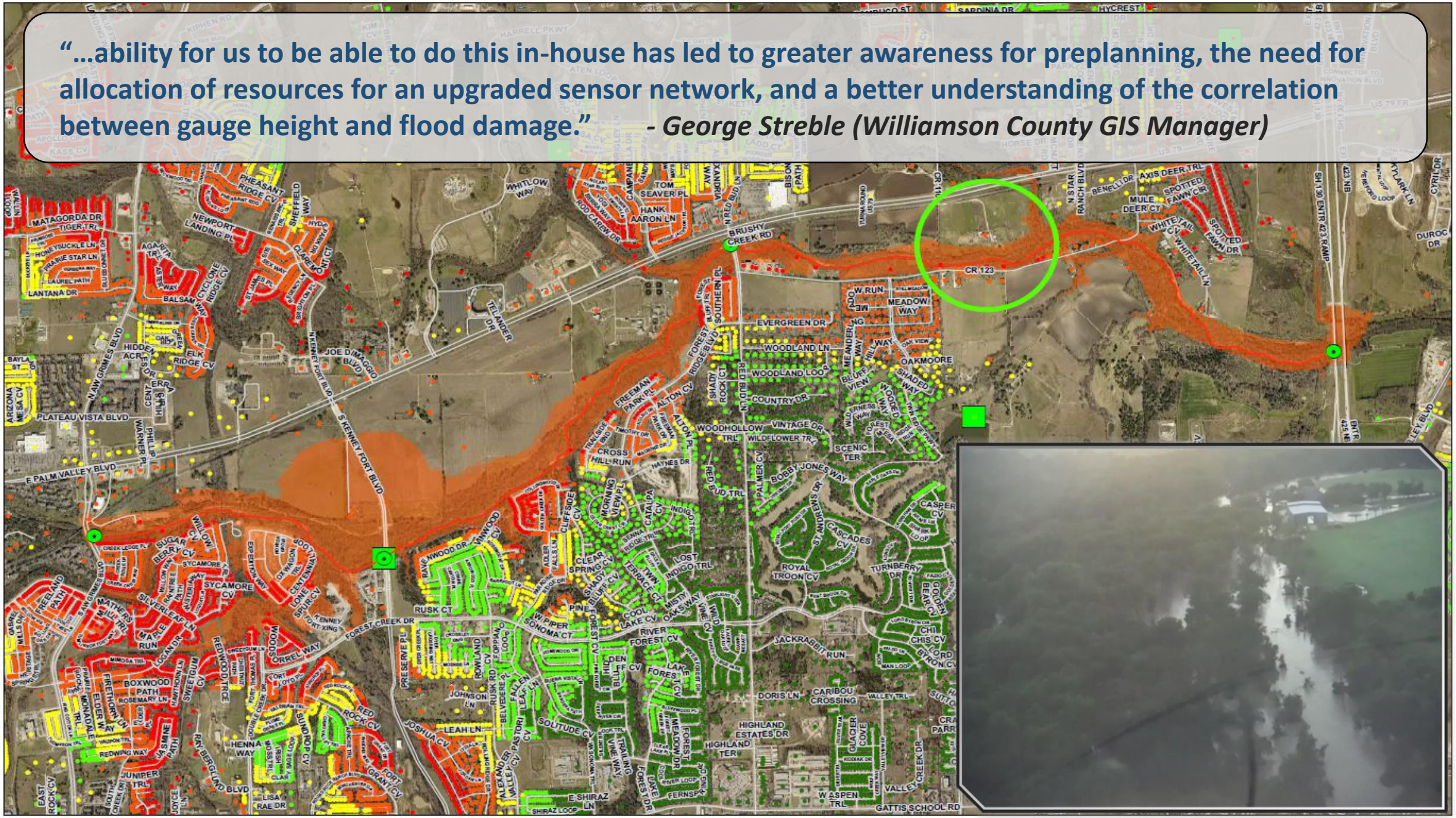
Application – R2O





Williamson County Engagement

"…ability for us to be able to do this in-house has led to greater awareness for preplanning, the need for allocation of resources for an upgraded sensor network, and a better understanding of the correlation between gauge height and flood damage." *- George Streble (Williamson County GIS Manager)*

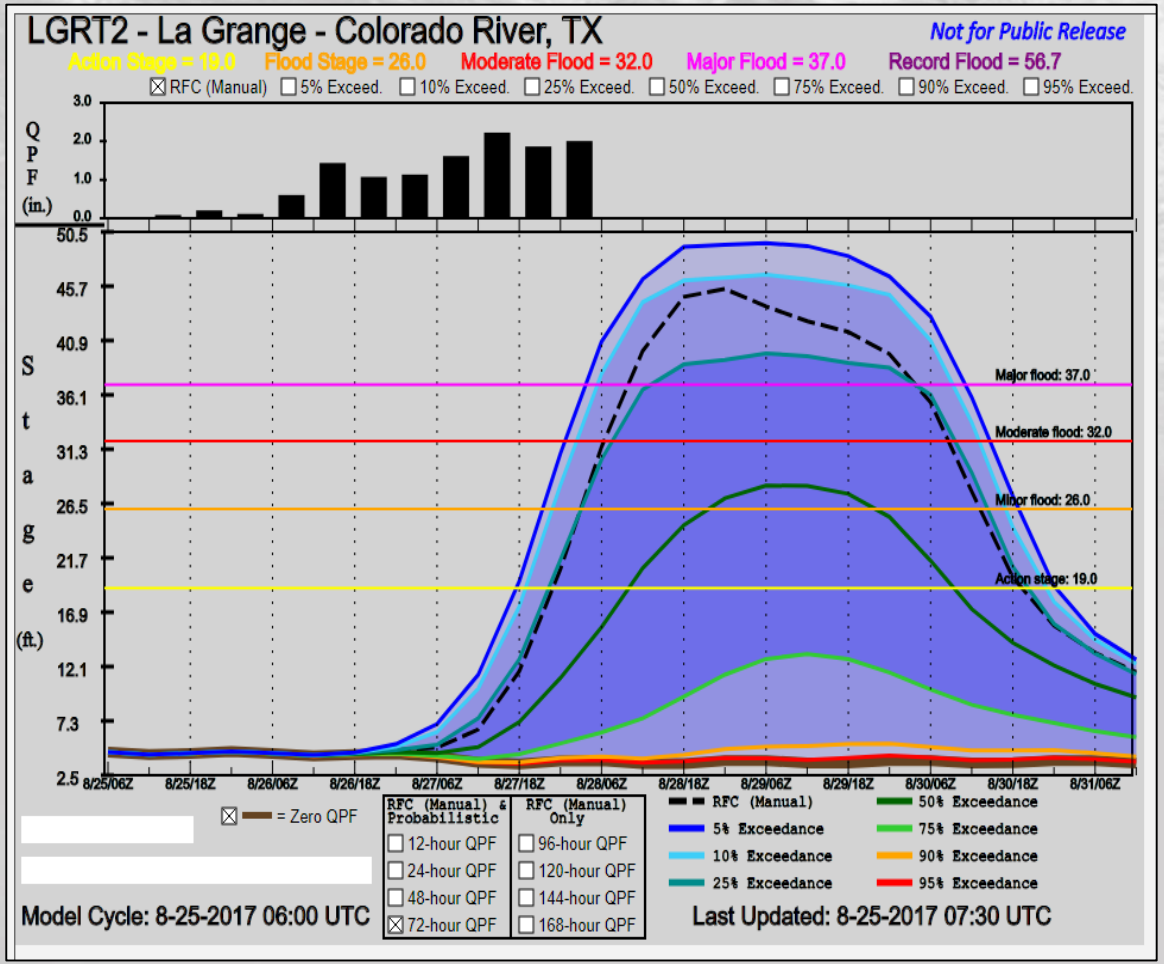


Fayette County Engagement

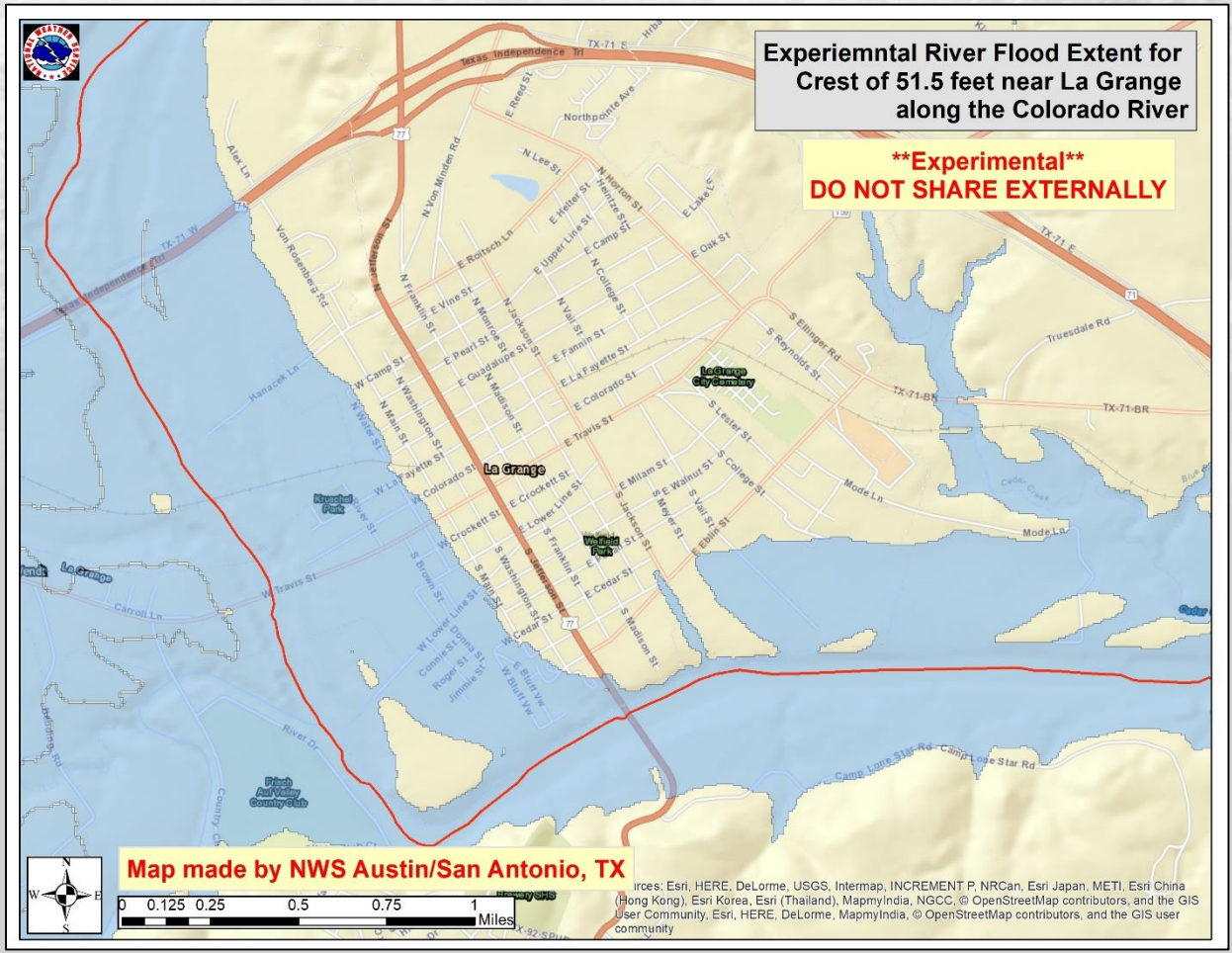
Hurricane Harvey Flooding along the Colorado River at La Grange, TX

"Bottom-line…these graphics saved lives and allowed for me to compel local authorities for greater aid, resources, and response."
– Janet Carrigan (Fayette County, TX EM)

Shared 3 days prior to Major Crest

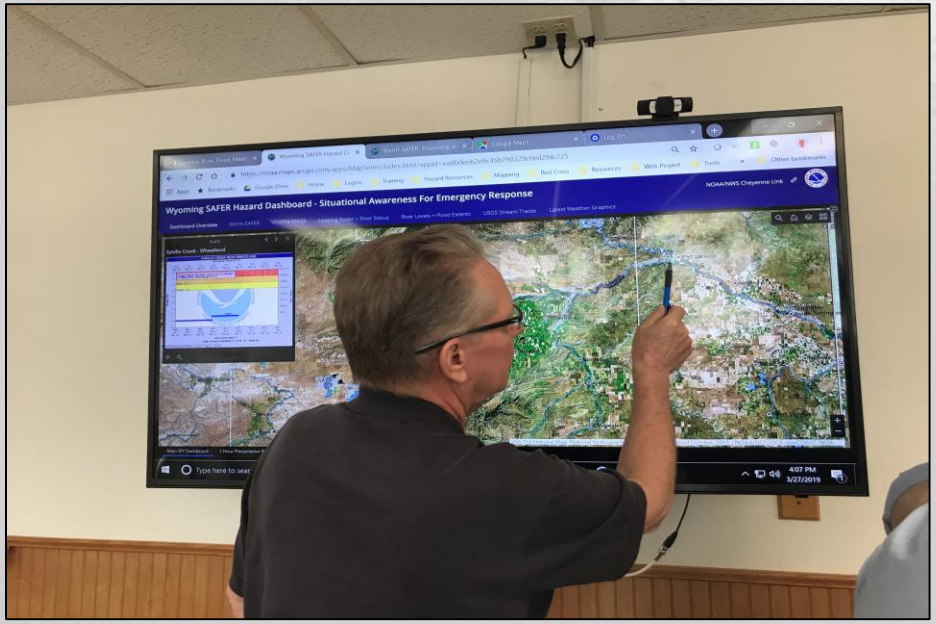


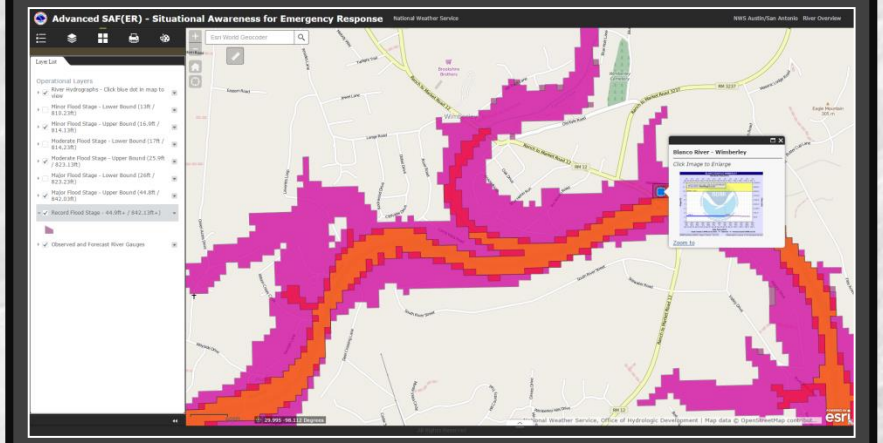
Shared 12-hours prior to Major Crest



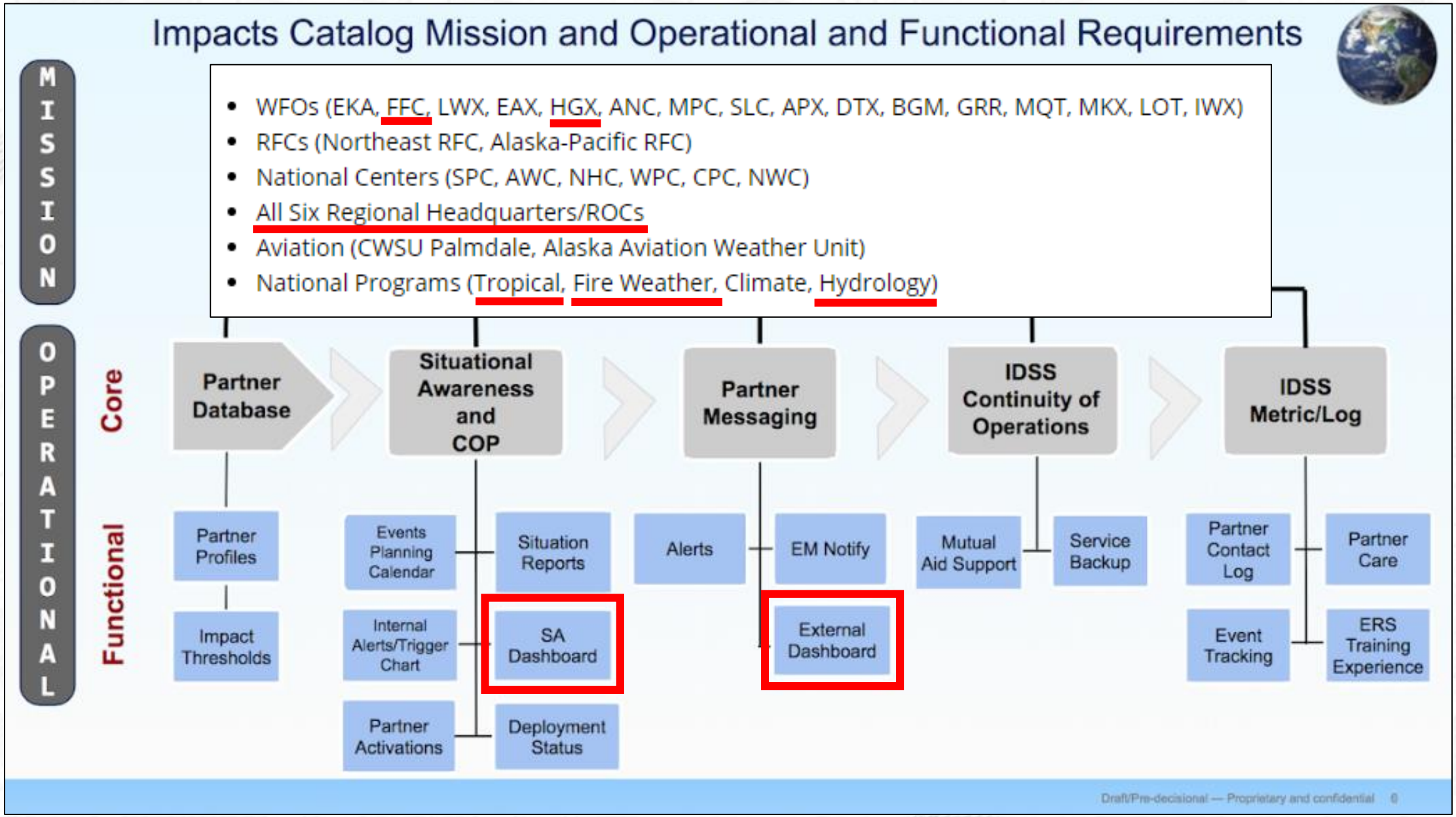
Critical & Timely When Needed

- Preparation:
  - NWS sharing data before the next flood to GIS & EM partners
  - Develop flood extent libraries of different river levels
- Planning:
  - Key decision timelines
  - Communication of hazards
  - People and resource allocation
- Response & Recovery:
  - EOC awareness and service





Impact Catalog – NWS Evolve Mission

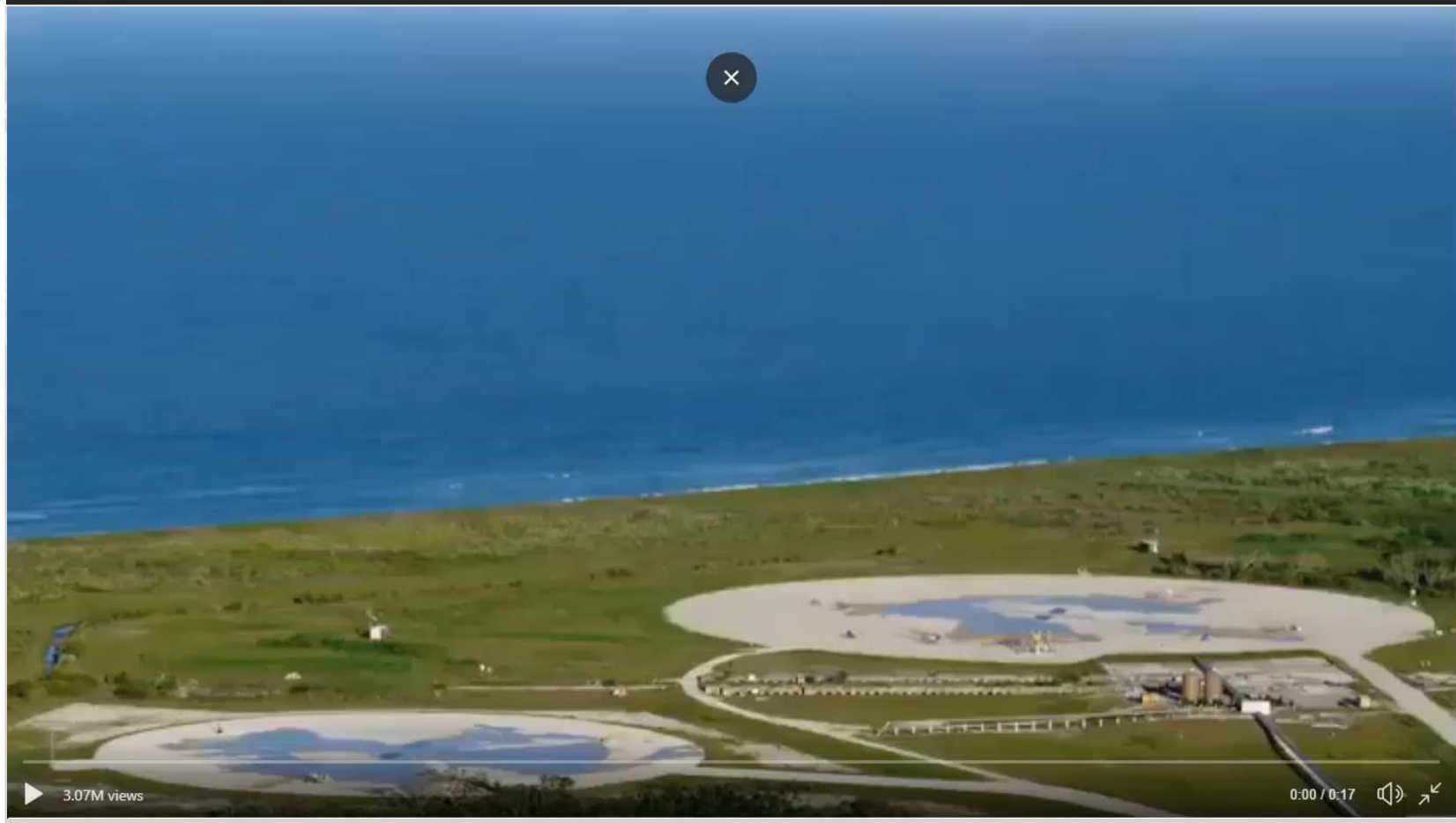


From Launch to Landing

Successful management from local NWS WFO level to National NWS Level is

Regional Development & Organization Beginning:

- Develop base templates
- NWS WFOs request GIS Mutual-Aid from regional team:
  - Similar to Social Media SAVI & MAS Teams
- **Severe Hazard/Impacts**
- **Tropical Hazards/Impacts**
- **River Flooding Impacts**
- **Wildfire Impacts**



Thank you!

NOAA VLab Forum

19 April 2019

Questions & Discussion

Email: Jared.Allen@noaa.gov