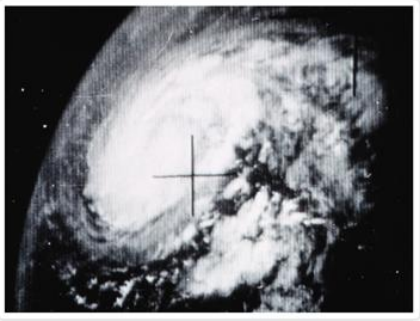
NWC Enterprise GIS and Visualization Services

JANUARY 22, 2020

Presenters: Mark Glaudemans, Fernando Salas, Corey Krewson
Geo-Intelligence Division, NOAA/NWS Office of Water Prediction

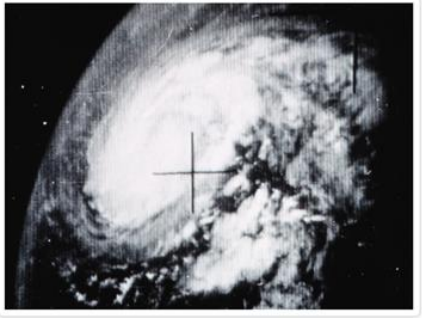


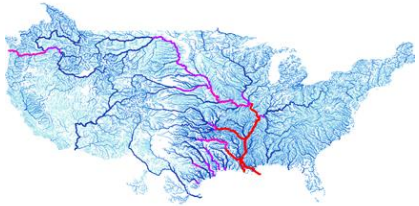
Acknowledgements

Laura Keys, Corey Krewson, Zach Wills, Brad Bates, Brian Cosgrove, Shawn Crawley, Whitney Flynn, Derek Giardino, Dave Gochis, Monica Stone, Mark Glaudemans, Darone Jones, Trey Flowers, Ed Clark, Tom Graziano

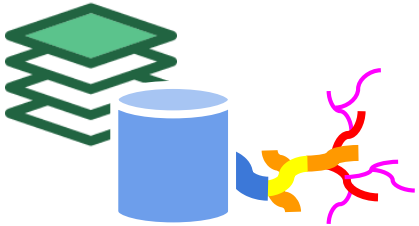
- **Large integrated team across:** Office of Water Prediction (OWP), West Gulf River Forecast Center (WGRFC), Southern Region HQ, NCEP, Lynker, Esri, UCAR/NCAR and others



Evolving NWS Hydrologic Services



Water Prediction Services - Centralized summit to sea water prediction capabaility through the establishment of the National Water Model.



Water Resources Data Services – Spatial and temporal data services providing access to multidimensional hydrologic datasets and value added information.

Impact Based Decision Support Services – Operational support helping partners understand depth of hydrologic forecast across scales of space and time.

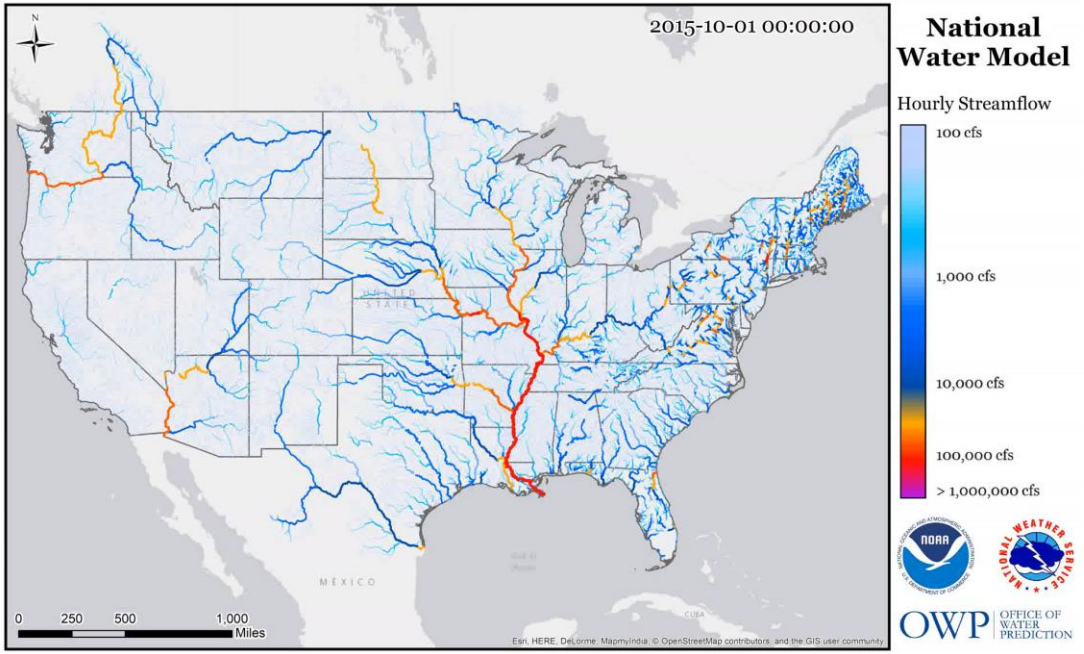
NOAA/NWS National Water Model

Domains

- Contiguous U.S.
- Hawaii

Operational Configurations

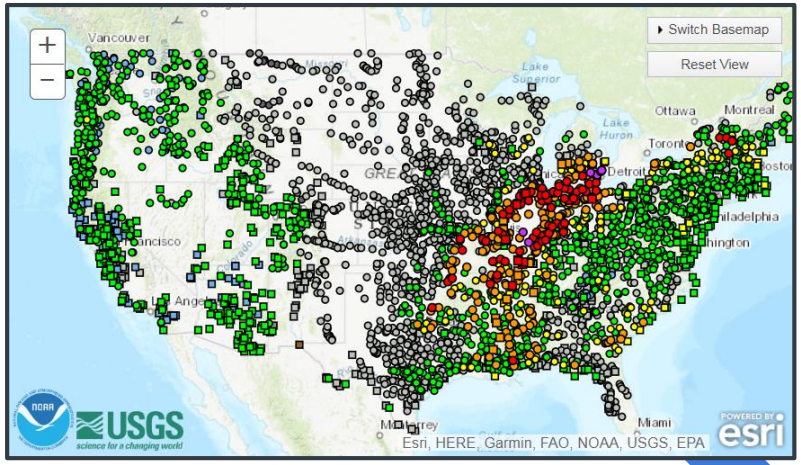
- Analysis (Nowcast)
- Short-Range (18-hr forecast)
- Medium-Range (10-day ensemble forecast)
- Long-Range (30-day ensemble forecast)



Multi-decade Reanalysis Simulation

Driven by downscaled NLDAS forcing. Future versions will driven by Analysis of Record for Calibration (AORC) dataset.

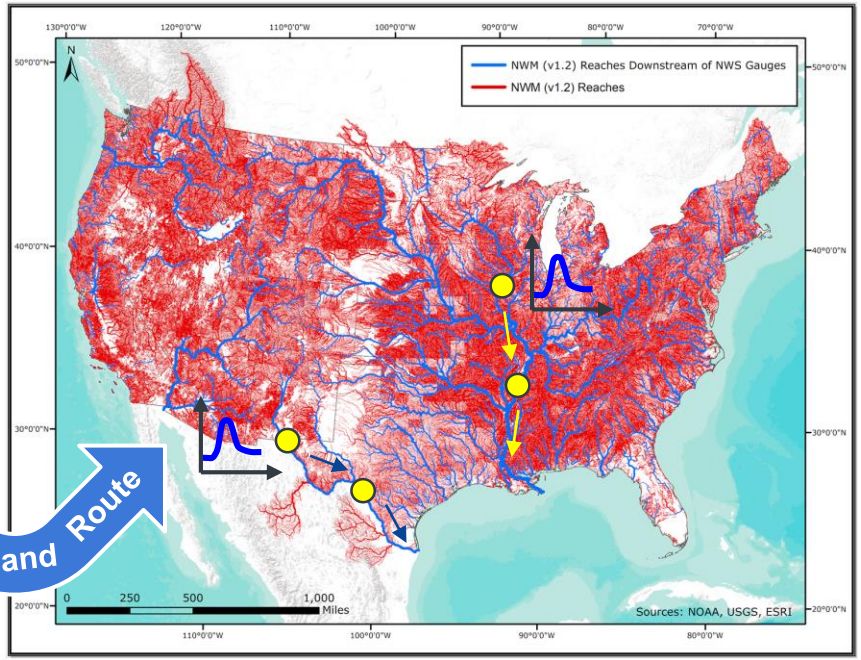
Complimentary Hydrologic Prediction Systems



Advanced Hydrologic Predictions Service

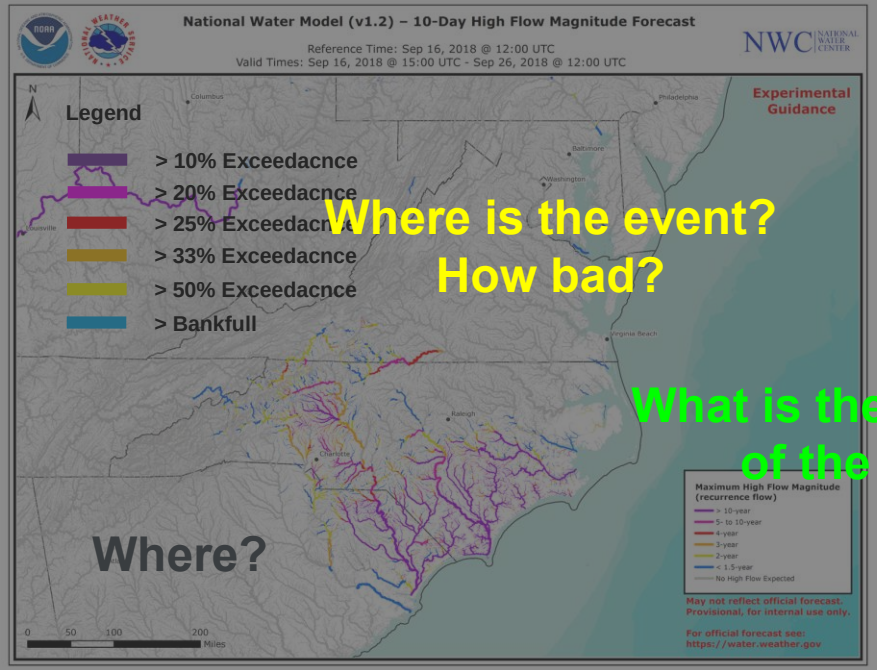
1 forecast point for every 1,000 river miles

Replace and Route

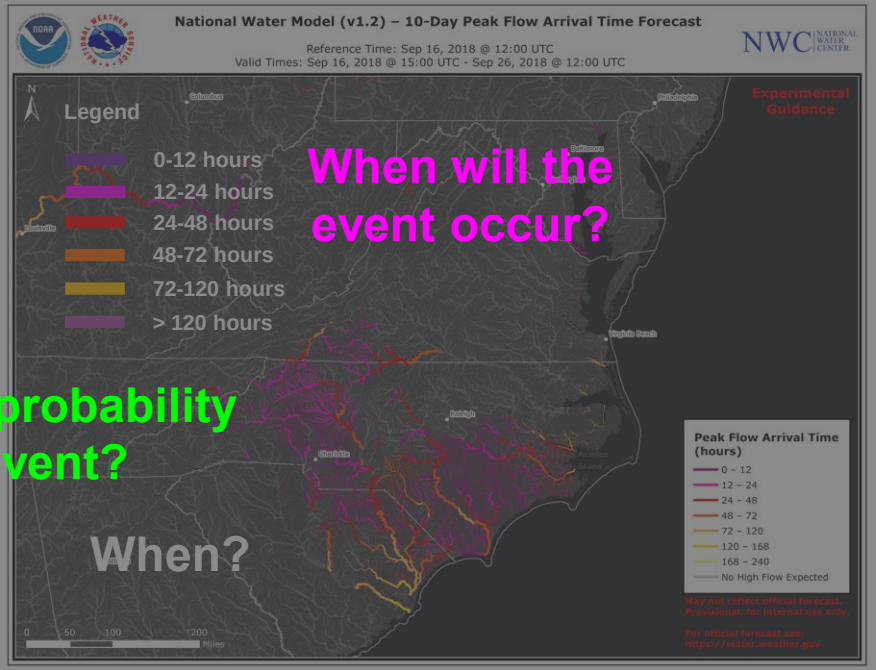


National Water Model

Synthesizing Hydrologic Forecasts

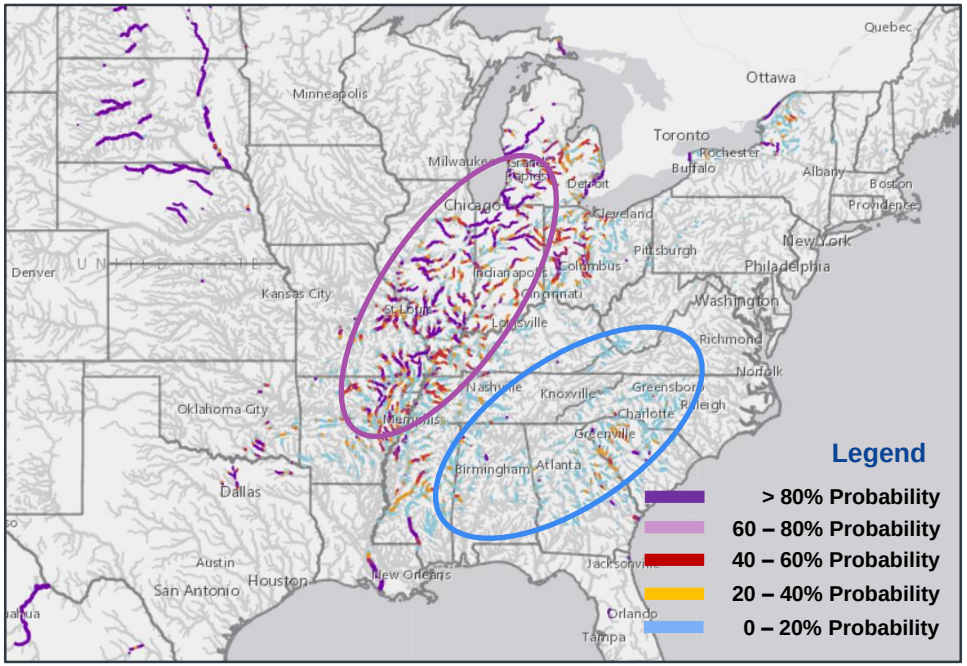


10-Day High Flow Magnitude



10-Day High Flow Arrival Time

Synthesizing Hydrologic Forecasts



10-Day High Flow Probability

National Water Center Enterprise GIS (EGIS)

ArcGIS REST Services Directory

Home > services

JSON | SOAP

Folder: /

Current Version: 10.61

View Footprints In: ArcGIS Online Map Viewer

Folders:

- nwm
- owp
- reference
- rfc
- System
- Utilities

Map Server

ArcGIS REST Services Directory

Home > services

JSON | SOAP

Folder: /

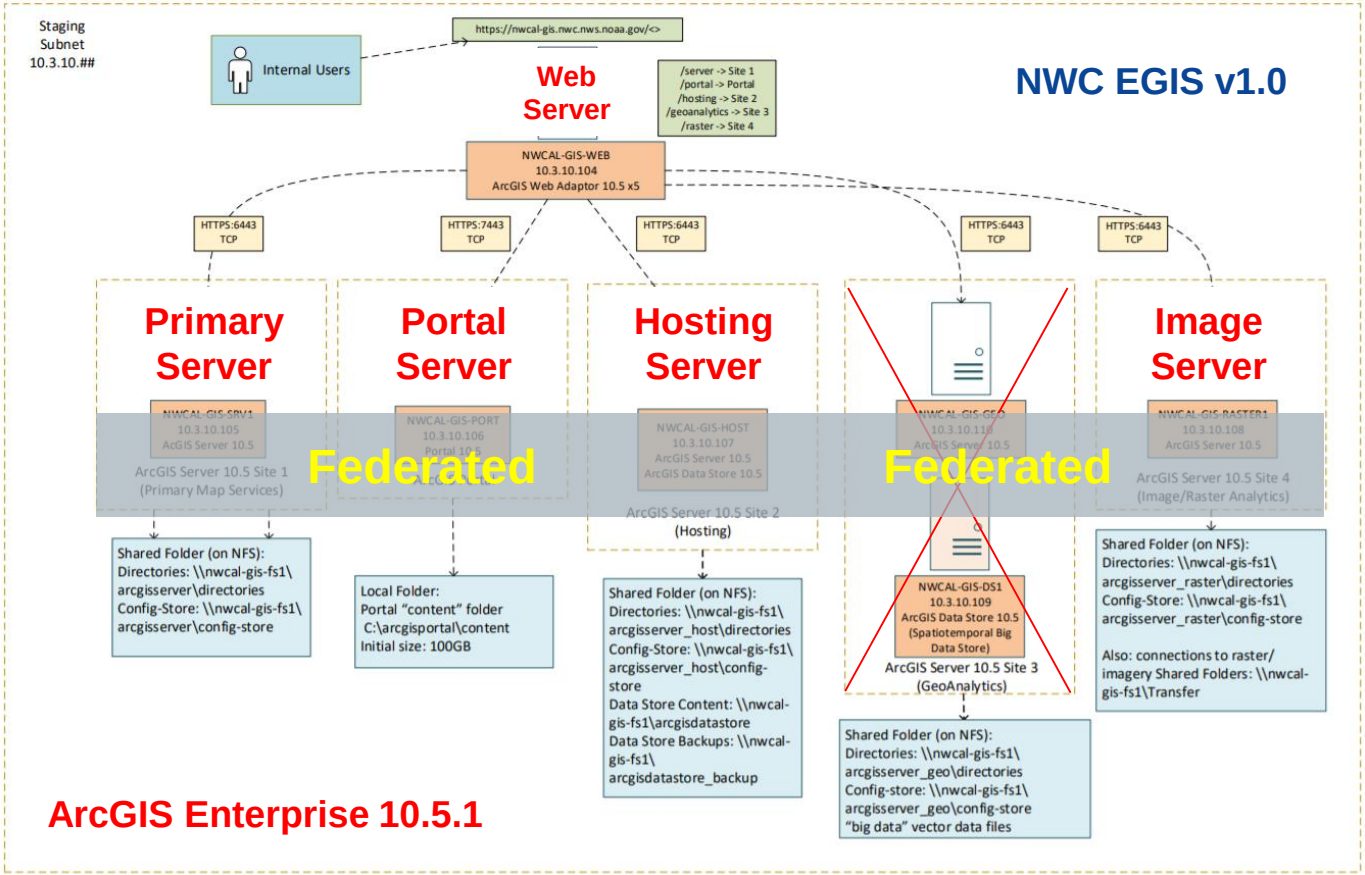
Current Version: 10.61

View Footprints In: ArcGIS Online Map Viewer

Folders:

- nwm
- Utilities

Image Server


Staging Subnet 10.3.10.##
Internal Users
https://nwcal-gis.nwc.nws.noaa.gov/<>
Web Server
/server -> Site 1
/portal -> Portal
/hosting -> Site 2
/geoanalytics -> Site 3
/raster -> Site 4
NWC EGIS v1.0
NWCAL-GIS-WEB
10.3.10.104
ArcGIS Web Adaptor 10.5 x5
HTTPS:6443 TCP
HTTPS:7443 TCP
HTTPS:6443 TCP
HTTPS:6443 TCP
HTTPS:6443 TCP
Primary Server
Portal Server
Hosting Server
Image Server
NWCAL-GIS-SRV1
10.3.10.105
ArcGIS Server 10.5
ArcGIS Server 10.5 Site 1
(Primary Map Services)
NWCAL-GIS-PORT
10.3.10.106
Portal 10.5
NWCAL-GIS-HOST
10.3.10.107
ArcGIS Server 10.5
ArcGIS Data Store 10.5
ArcGIS Server 10.5 Site 2
(Hosting)
NWCAL-GIS-GEO
10.3.10.110
ArcGIS Server 10.5
NWCAL-GIS-DS1
10.3.10.109
ArcGIS Data Store 10.5
(Spatiotemporal Big Data Store)
ArcGIS Server 10.5 Site 3
(GeoAnalytics)
NWCAL-GIS-RASTER1
10.3.10.108
ArcGIS Server 10.5
ArcGIS Server 10.5 Site 4
(Image/Raster Analytics)
Federated
Federated
Shared Folder (on NFS):
Directories: \\nwcal-gis-fs1\arcgisserver\directories
Config-Store: \\nwcal-gis-fs1\arcgisserver\config-store
Local Folder:
Portal "content" folder
C:\arcgisportal\content
Initial size: 100GB
Shared Folder (on NFS):
Directories: \\nwcal-gis-fs1\arcgisserver_host\directories
Config-Store: \\nwcal-gis-fs1\arcgisserver_host\config-store
Data Store Content: \\nwcal-gis-fs1\arcgisdatastore
Data Store Backups: \\nwcal-gis-fs1\arcgisdatastore_backup
Shared Folder (on NFS):
Directories: \\nwcal-gis-fs1\arcgisserver_geo\directories
Config-store: \\nwcal-gis-fs1\arcgisserver_geo\config-store
"big data" vector data files
Shared Folder (on NFS):
Directories: \\nwcal-gis-fs1\arcgisserver_raster\directories
Config-Store: \\nwcal-gis-fs1\arcgisserver_raster\config-store
Also: connections to raster/imagery Shared Folders: \\nwcal-gis-fs1\Transfer
ArcGIS Enterprise 10.5.1

Data and Processing

Visualization Processing Servers

nwcal-gis-proc1
nwcal-gis-proc4

Launch Processes

Esri File GDBs

Watch and pull data

NWC dstore

Viz Processing Pipeline

Data and Web Services

EGIS Data

*\\nwcal-gis-fs1\Transfer\primary\data**
*\\nwcal-gis-fs1\Transfer\image\data**

Create Service Definitions

ArcGIS Enterprise Servers

nwcal-gis-srv1 (Primary Map Services)
nwcal-gis-raster1 (Raster Analytics)
nwcal-gis-geo (GeoAnalytics)
nwcal-gis-port (ArcGIS Portal)
nwcal-gis-host (Hosting)

Note: Pink indicates function of NWM-Viz Processing Pipeline

Publish Services/ ***Update Services***

Update Apps

Load Balancer/Reverse Proxy

ArcGIS Web Adapter (nwcal-gis-web)

Web Service Interface Examples (REST)

https://nwcal-gis-web.nwc.nws.noaa.gov/server/rest/services/nwm_v11/ana_v11_anomaly_v20/MapServer
https://nwcal-gis-web.nwc.nws.noaa.gov/raster/rest/services/nwm_v11/ana_v11_soil_moisture_v10/MapServer

Maps, Apps and Platforms

NOAA Geoplatform

http://noaa.maps.arcgis.com/home/index.html

Web Maps/ Web Apps

NWC Portal for ArcGIS

https://nwcal-gis-web.nwc.nws.noaa.gov/portal/home/

Web Maps/ Web Apps

Users, Apps and Platforms

NWC and VPN Users

Data and Processing

Visualization Processing Server (production)

Watch and Pull Data

NWC dstore

Watch and Pull Data

Visualization Processing Server (dev)

Copy

Mount

NWM-Viz Processing Pipeline

NWM-Viz Processing Pipeline

Firewall 1

Data and Web Services

ArcGIS Enterprise Servers
At least two primary servers

EGIS Data

Note: Pink indicates function of NWM-Viz Processing Pipeline

Update Services

DMZ

EGIS Data
*\\nwcal-gis-fs1\Transfer**

Behind NWC Firewalls

ArcGIS Enterprise Servers
nwcal-gis-srv1 (Primary)
nwcal-gis-raster1 (Raster)
nwcal-gis-geo (Geo)
nwcal-gis-port (Portal)
nwcal-gis-host (Hosting)

Update Services

Load Balancer/Reverse Proxy

HAProxy/NGINX

ArcGIS Web Adapter (nwcal-gis-web)

Web Service Interface Examples (REST)

https://xxx.nwc.nws.noaa.gov/server/rest/services/
("Public NWS" Map Service URL)

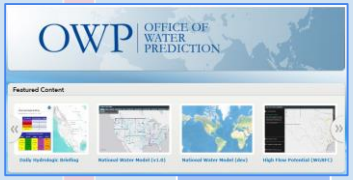
https://nwcal-gis-web.nwc.nws.noaa.gov/server/rest/services/
(NWC Map Service URL)

Firewall 2

Maps, Apps and Platforms

NOAA Geoplatform
http://noaa.maps.arcgis.com/home/index.html

Web Maps/ Web Apps

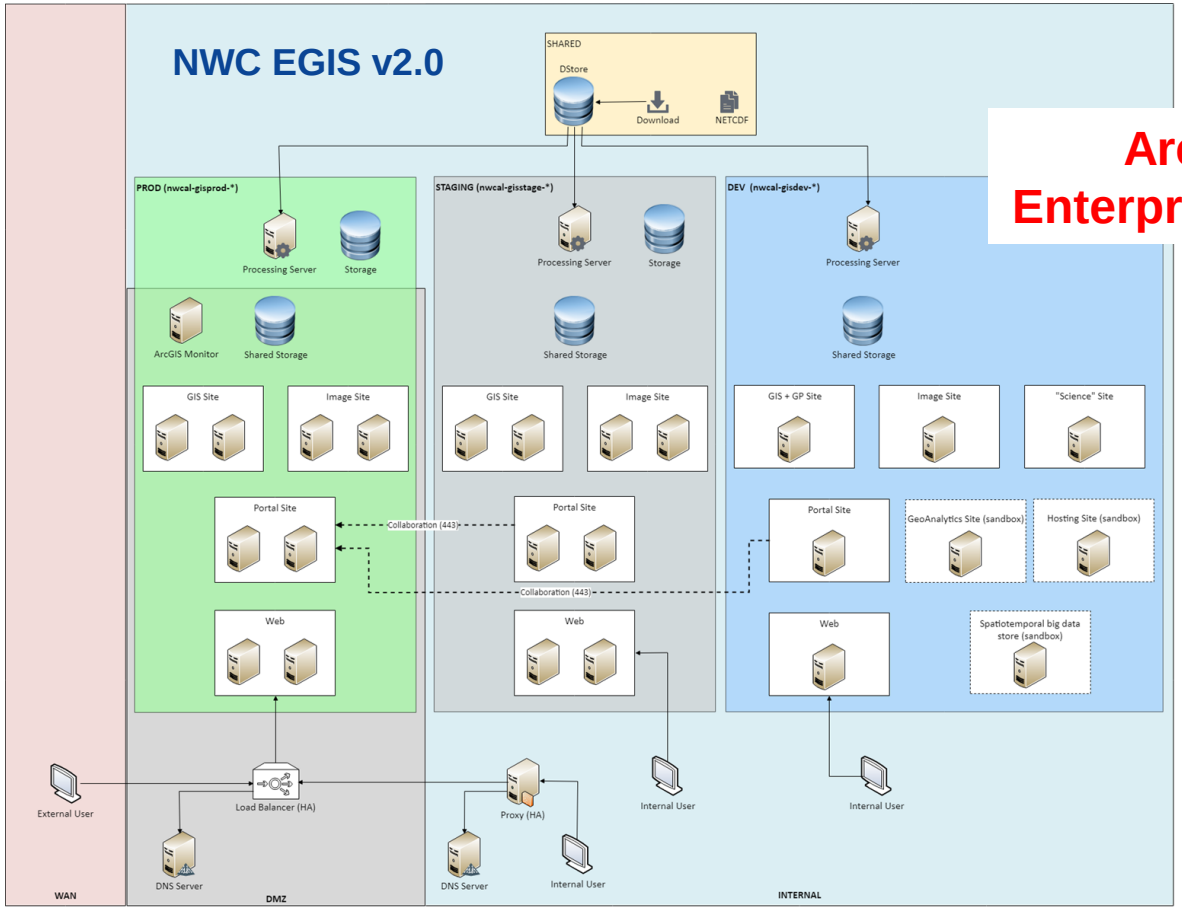


NWC Portal for ArcGIS
https://nwcal-gis-web.nwc.nws.noaa.gov/portal/home/

Web Maps/ Web Apps

Users, Apps and Platforms
NWC/VPN and WGRFC/MBRFC/VPN

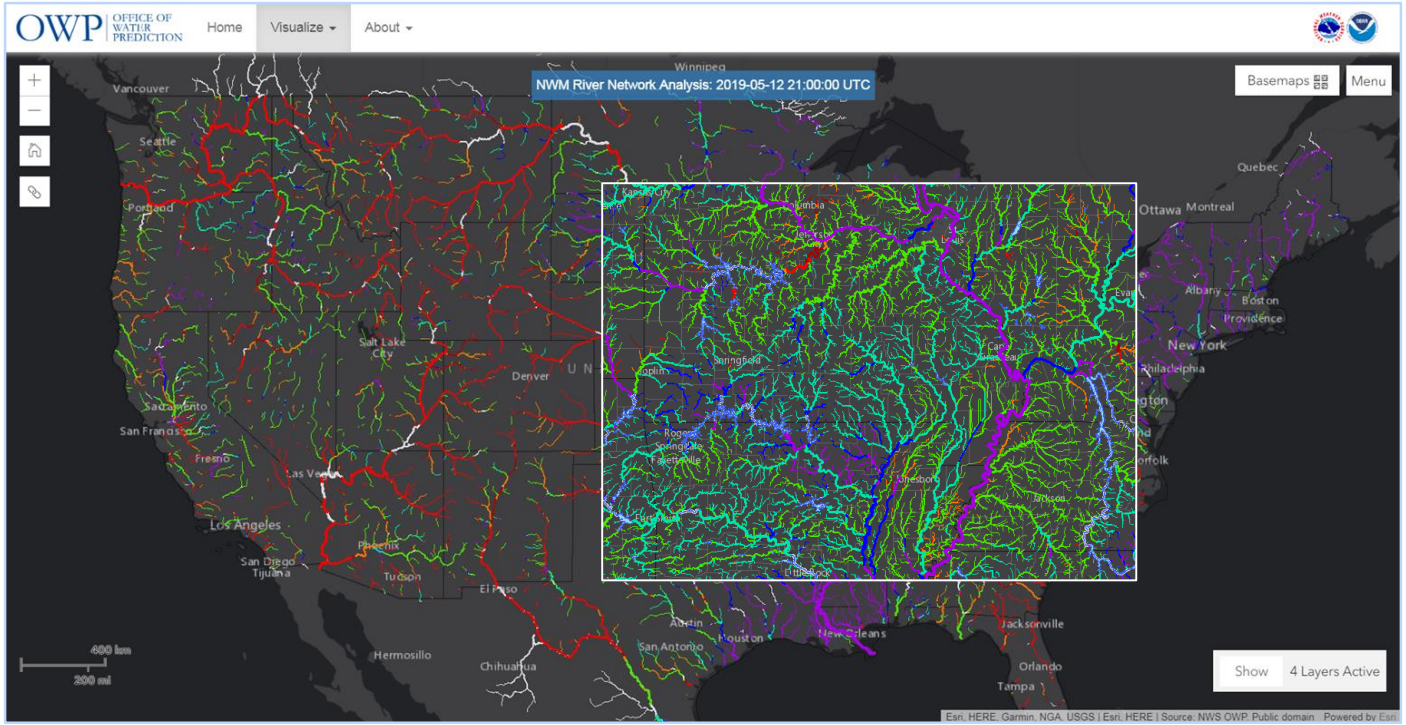
Local Users
NWC/VPN



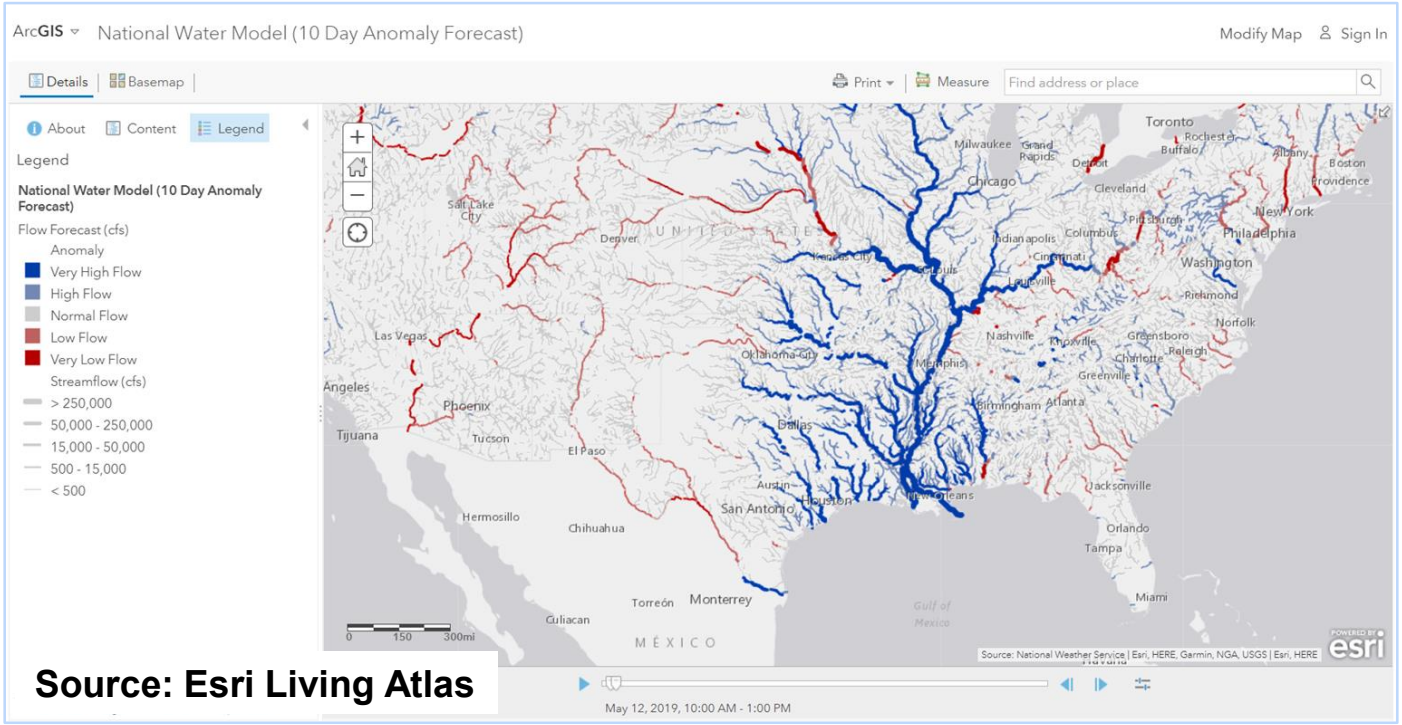
ArcGIS Enterprise 10.6.1

Quick Demo…

NWM Guidance on water.noaa.gov



NWM Guidance in Esri Living Atlas



Source: Esri Living Atlas

Performance.gov

Management Priorities | Agencies | About | News

Department of Commerce

- **Agency Priority Goals**
  - Accelerate Patent Processing
  - **Mitigate Flood Impacts**
  - Prepare to Conduct a Complete and Accurate Decennial Census
  - Remove Foreign Trade Barriers

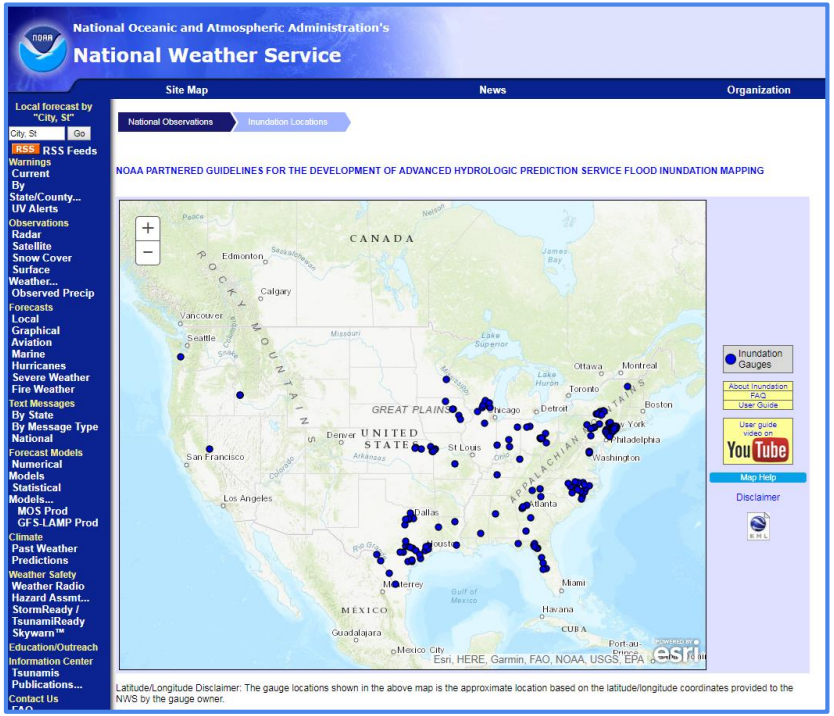
Department of Commerce

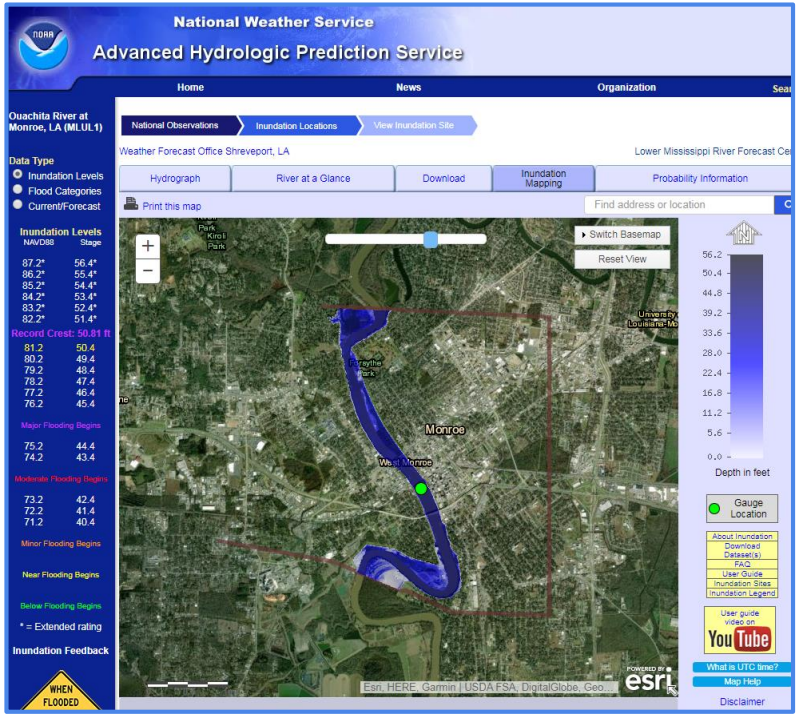
Mitigate Flood Impacts by Demonstrating Improved Decision Support Services to Emergency Managers

Goal Leader: Dr. Neil Jacobs, Assistance Secretary of Commerce for Environmnetal Observation and Prediction, performing the duties of Undersecretary of Commerce for Oceans and Atmosphere

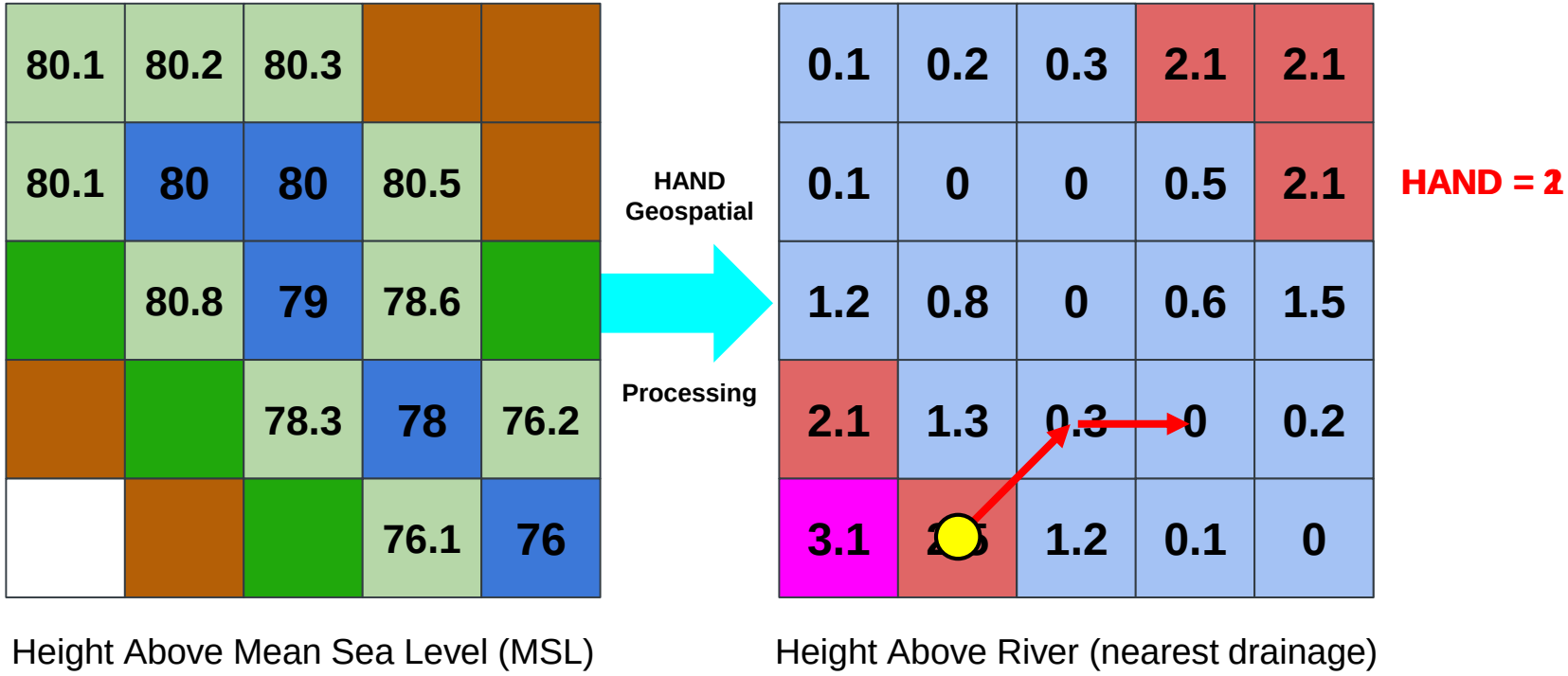
Goal Statement: By September 30, 2019, NOAA National Weather Service will improve decision support services by demonstrating a new flood inundation mapping capability serving 25 million people (i.e., 8 percent of the U.S. continental population) residing in flood-vulnerable freshwater basins and delivering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

AHPS Flood Inundation Map Libraries

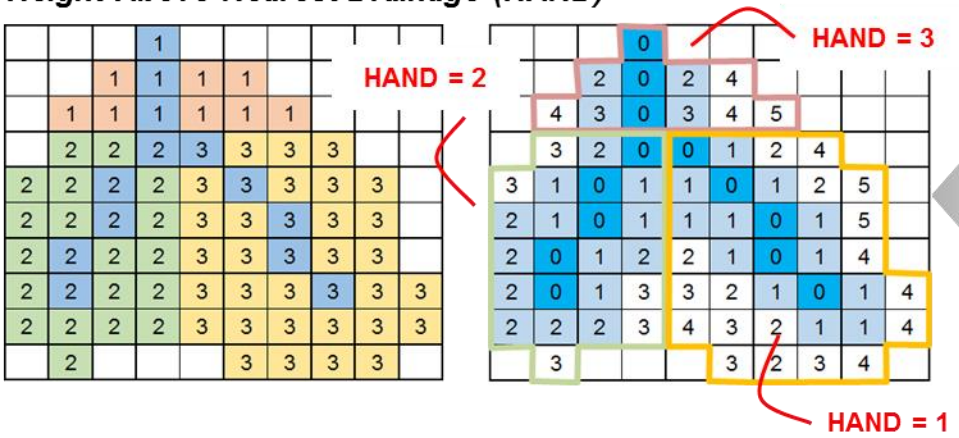


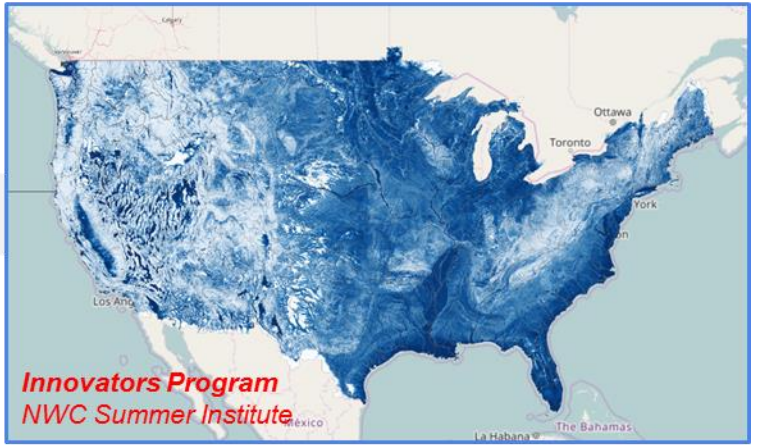


Height Above Nearest Drainage (HAND)



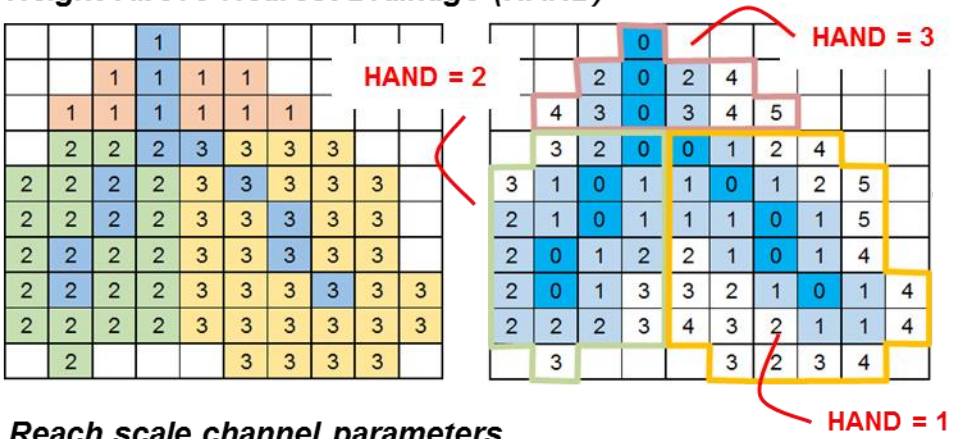
Height Above Nearest Drainage (HAND)

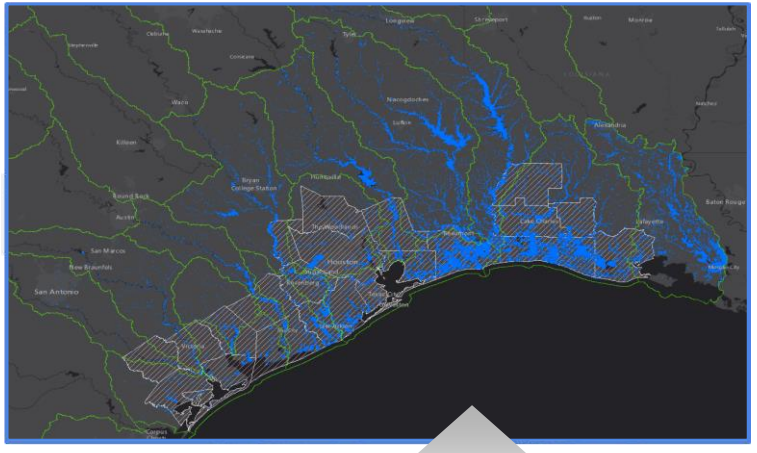




Liu et al., 2019
Zheng et al., 2019

Height Above Nearest Drainage (HAND)

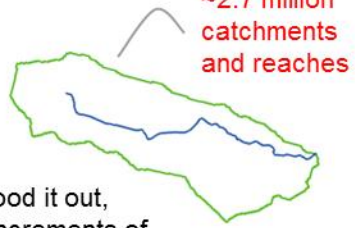




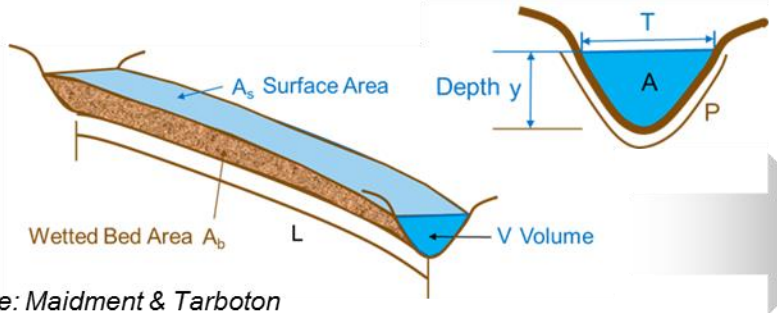
Liu et al., 2019
Zheng et al., 2019

Reach scale channel parameters

A = V/L Cross Section Area
P = A_b/L Wetted Perimeter
T = A_S/L Top Width
R = A/P Hydraulic Radius

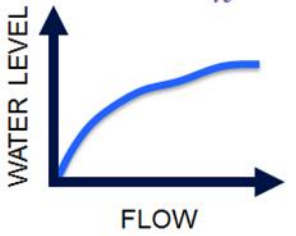


Take blue line network, raise it and flood it out, continue for increments of elevation

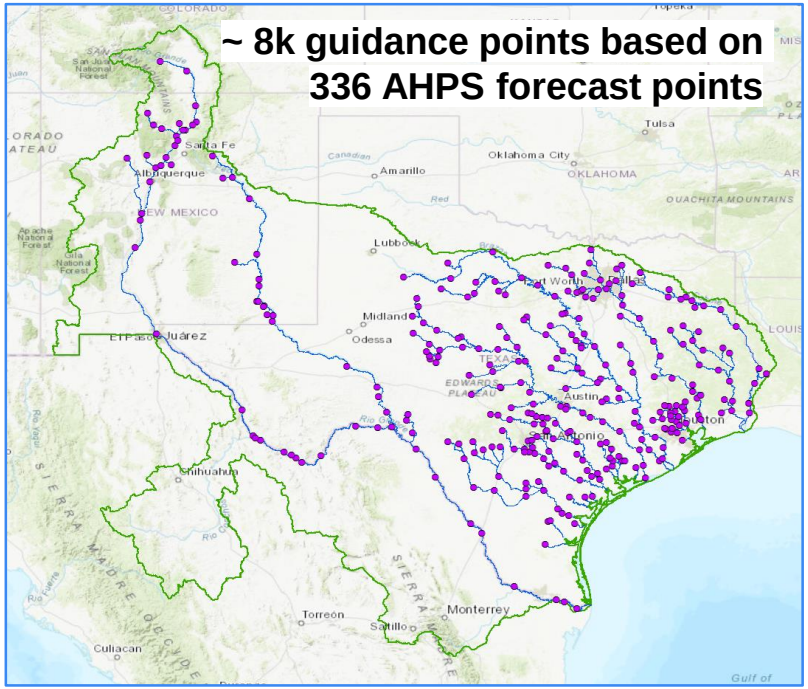


Source: Maidment & Tarboton

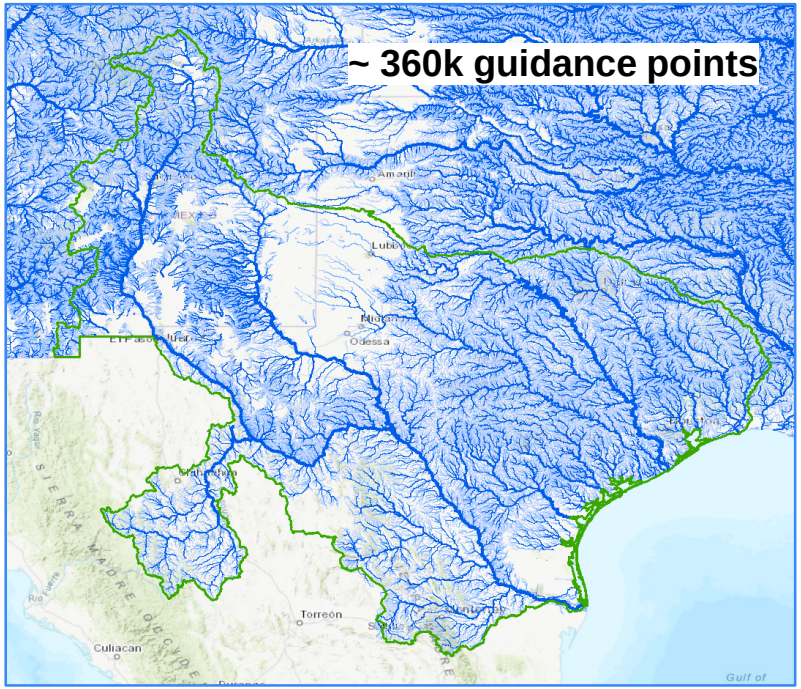
$$Q = \frac{1.49}{n} A R^{2/3} S_o^{1/2}$$



Modeling Domains for Texas/WGRFC

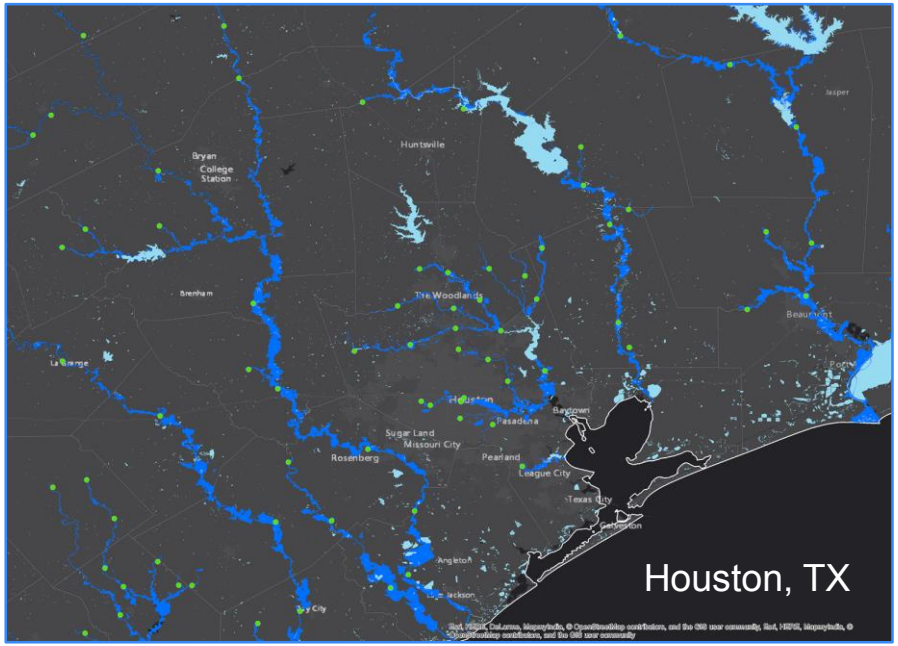


Replace and Route (RnR)

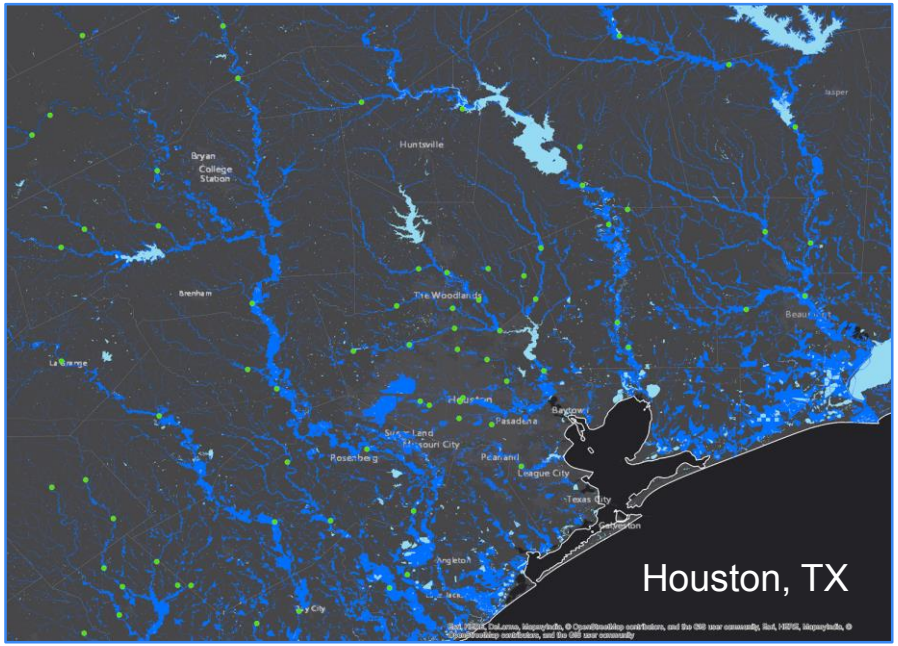


National Water Model (NWM)

Complimentary Inundation Mapping Systems

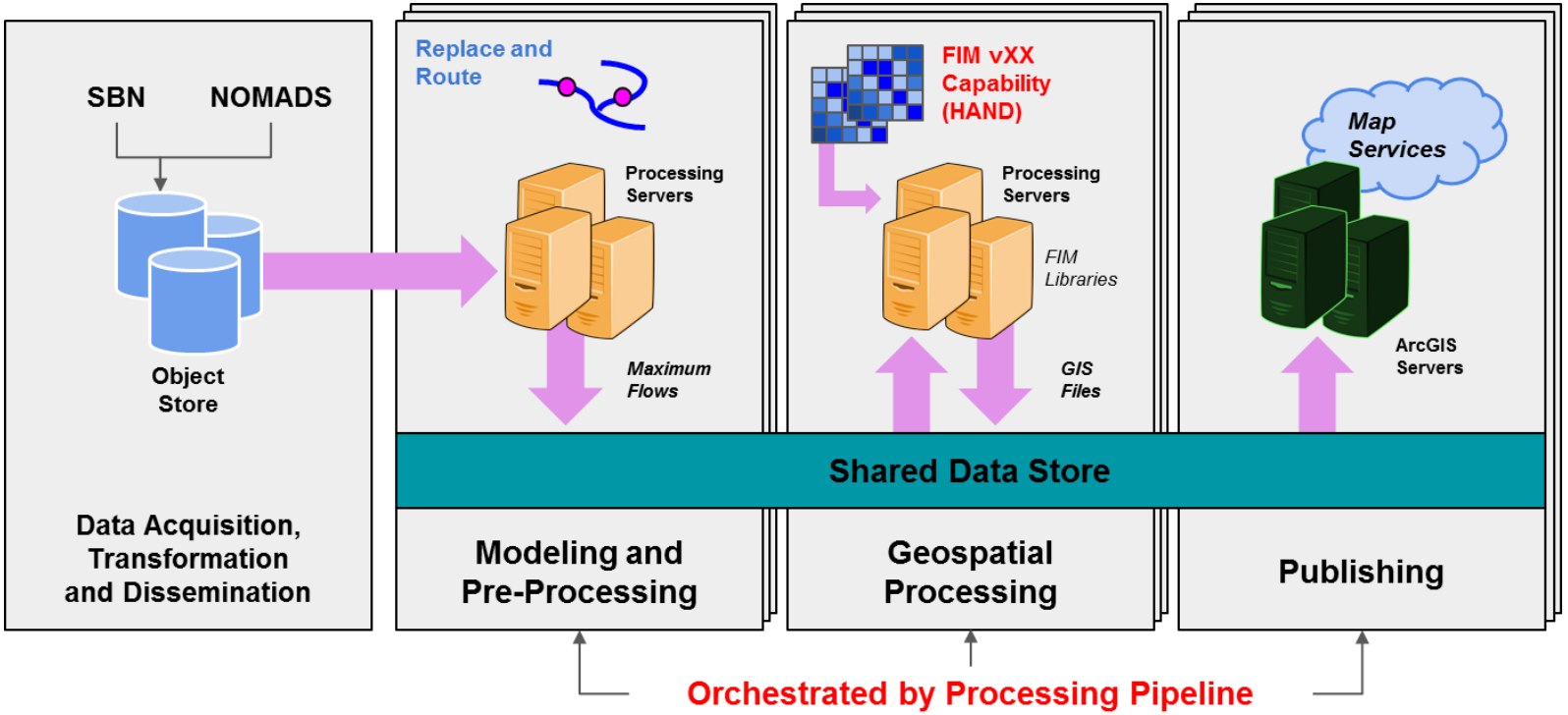


Replace and Route (RnR)

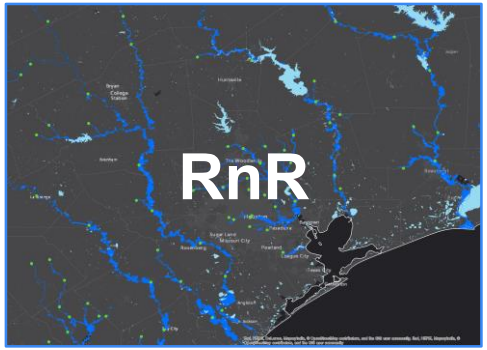


National Water Model (NWM)

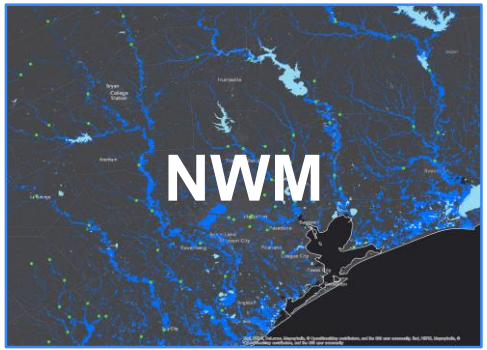
Automated Forecast Inundation Mapping System



Forecast Flood Inundation Map Services



- 5-Day Forecast Maximum Inundation Extent



- Analysis Inundation Extent (i.e. Nowcast)
- 18-Hour Forecast Maximum Inundation Extent
- 3, 5 and 10-Day Forecast Maximum Inundation Extent

Feedback from Table Top Exercises

Led by NWS Field Offices

Source: *Derek G, WGRFC*

Depth — *What kind of rescue to anticipate.*

Complete Implementation — *"If you don't see the whole picture, bad decisions can be made"*

Confidence — *What's the best way to communicate this? Move towards probabilistic maps?*

Timing — *Assessment of past, current and future conditions.*

Velocity — *High Water vs. Swift Water*

Impact Based Decision Support Services

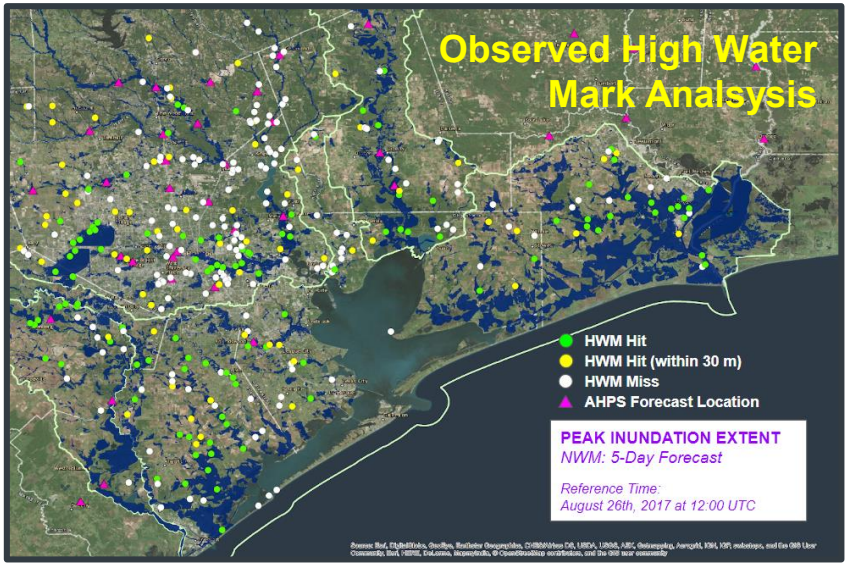
~ 1 Foot **~ 3 Foot** **~ 6 Foot** **~ 9 Foot**

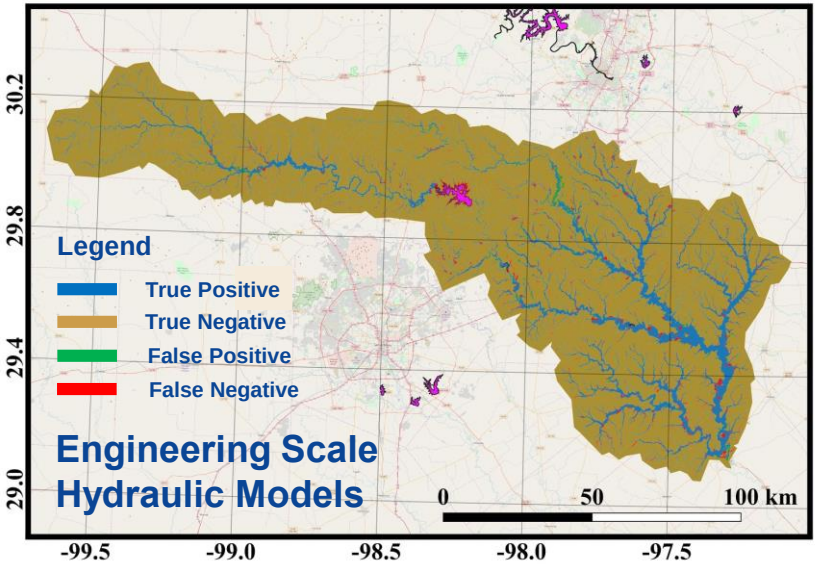
"How many helicopters, boats, and high profile vehicles and where to send them"

– Texas State Operations Center

Source: D. Giardino, WGRFC

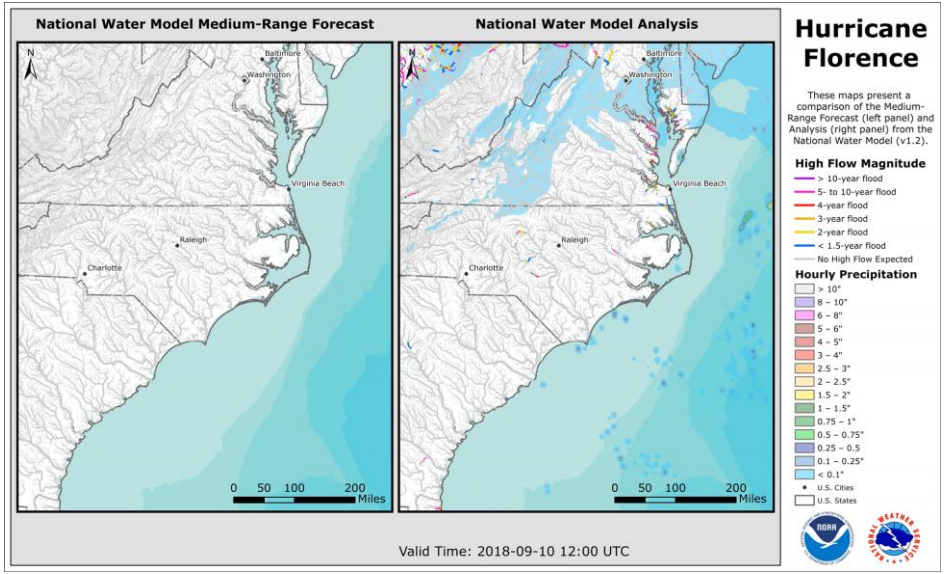
Evaluation of Inundation Map Capabilities





Model Uncertainty: *Weather, Hydrology, Hydraulics, Mapping, Forecast*

Observation Uncertainty: *Terrain, Image Resolution, Visible Coverage (e.g. cloud and tree cover)*



Questions…

Contact:

Fernando Salas – fernando.salas@noaa.gov
Geo-Intelligence Division | NOAA/NWS Office of Water Prediction