

Appendix to

National Water Hazards & Vulnerabilities: Improved Forecasting for Response & Mitigation

Statement of

Antonio J. Busalacchi, Jr., Ph.D.

President, University Corporation for Atmospheric Research (UCAR),

Boulder, Colorado

before the

United States Senate

Committee on Appropriations

Subcommittee on Commerce, Justice, Science and Related Agencies

April 4, 2017

The following appendix illustrates the power and promise of the National Water Model to significantly improve forecasters' abilities to provide valuable hydrologic forecasting products.

Appendix page 1 provides the technical specifications of the NWM.

Appendix page 2 demonstrates the modelling pathway from initialization through product development – by way of soil moisture, terrain flow, catchment, and infrastructure integration.

Appendix page 3 is a sample visualization that the NWM would provide to river and weather forecasters.

Appendix page 4 is a continental view of the rivers and streams that NWM can forecast.

Appendix page 5 is a continental view of a NWM soil moisture forecast.

Appendix page 6 is a view of the NWM's integration with infrastructure to provide forecast products for important transportation corridors impacted by hydrologic events.

Appendix page 7 is an inundation forecast product for North and South Carolina during Hurricane Matthew.

Appendix page 8 is a CONUS map of NEXRAD radar coverage. Filling gaps in NEXRAD radar will enable better weather and hydrologic forecasts.

The National Water Model Version 1: Technical Specs

Development Team: NCAR/RAL, NOAA/OWP/NWC, USGS, CUAHSI, Universities

Sponsor: NOAA Office of Water Prediction

Data Throughput:

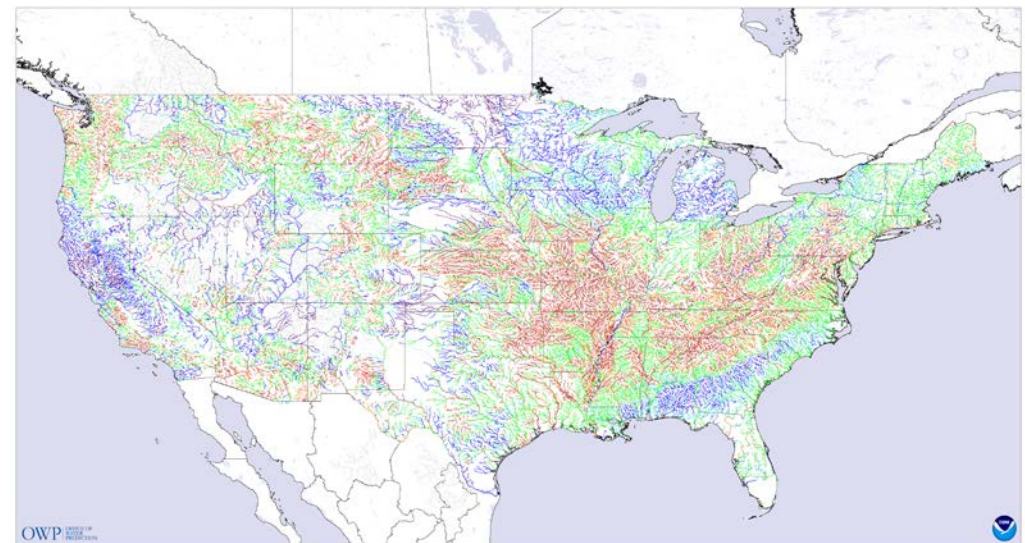
- Input data per day: 4.45 Terabytes
- Output data per day: 3 Terabytes
- # of river channels: 2.7 million
- # of reservoirs: 1,260
- Total # of computational elements: ~360,000,000

Model Details:

- Number of lines of code: 74,740
- Computer usage: > 100,000 cpu-hours per day

National Streamflow Anomaly Map

National Water Model Streamflow Anomaly Guidance
Analysis valid for 2017-01-10 21:00:00 UTC
Model initialized at 2017-01-10 18:00:00 UTC



Current imagery displays data for stream order 3 and greater. Anomaly derived by comparison of NWM modeled streamflow to NHDplus EROM monthly average streamflow.

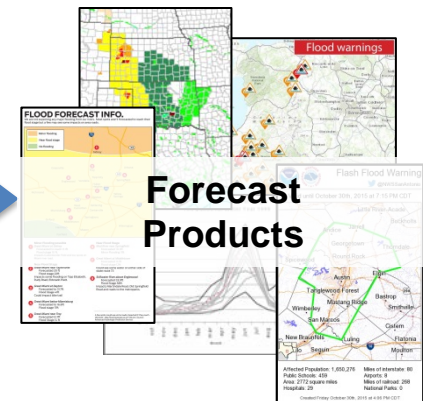
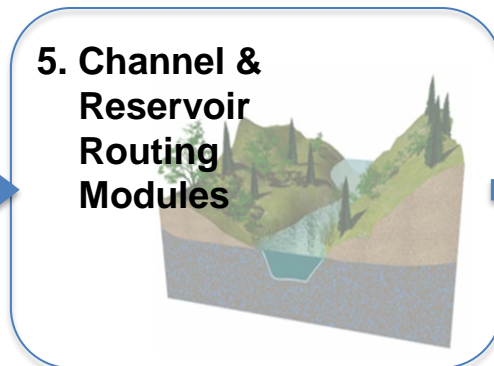
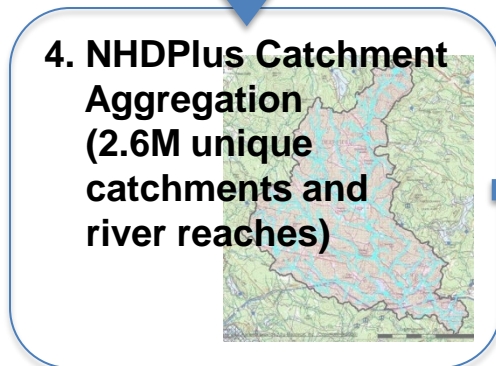
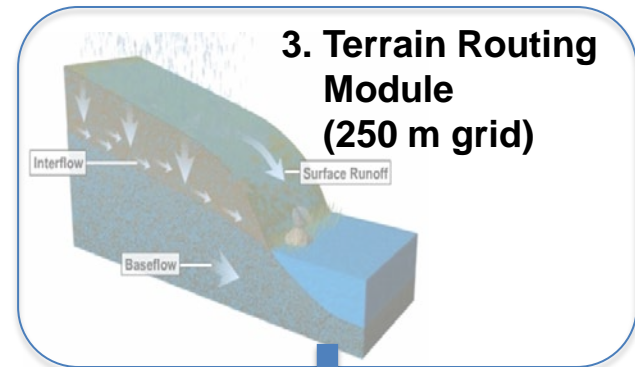
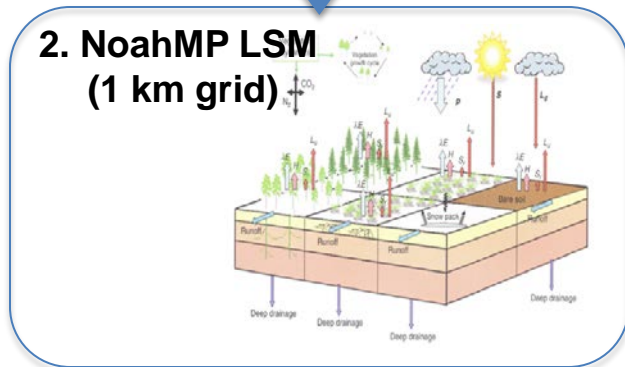
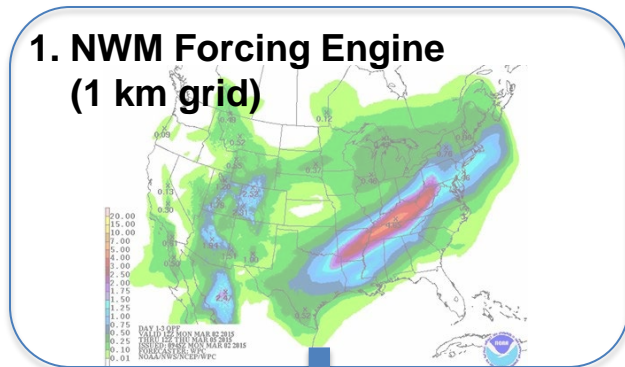
Available online at: <http://water.noaa.gov/tools/nwm-image-viewer>

National Water Model Initial Operating Capability: Model Chain

NWM uses NCAR supported community WRF-Hydro system

NWM: <http://water.noaa.gov/about/nwm>

WRF-Hydro: https://www.ral.ucar.edu/projects/wrf_hydro



Hydrologic Forecasts: Providing guidance to NWS forecasters

File Edit View History Bookmarks Tools Help

metadata for Jeff Weber - ... | 2016_AGU - Google Drive | NCAR|UCAR - Calendar - Wee... | WRF HydrolInspector - CONUS | Office of Water Prediction

http://hydro.rap.ucar.edu/HydrolInspector/CONUS/

HydrolInspector:
WRF-Hydro Web-based Water Mapping Service
CONUS

Data Layers

Map Data

- NWS watches/warnings
- Roads
- Rails
- Tribal Lands
- Stl Areas
- Reservoirs
- National Map Service

Gridded Output

- Accumulated total ET
- Snow cover
- SWE
- Snow depth
- Snow Temperature
- Fract Soil saturation
- 250m Surface head
- 250m Water Table depth
- PE Rain Rate
- SWE - SNOGAS
- Snow Depth - SNOGAS

Channel Output

- Channel Flow
- Channel Velocity

Channel Velocity

- Comments

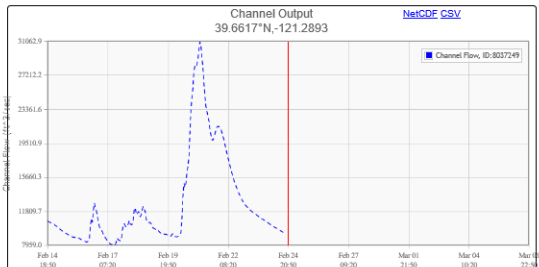
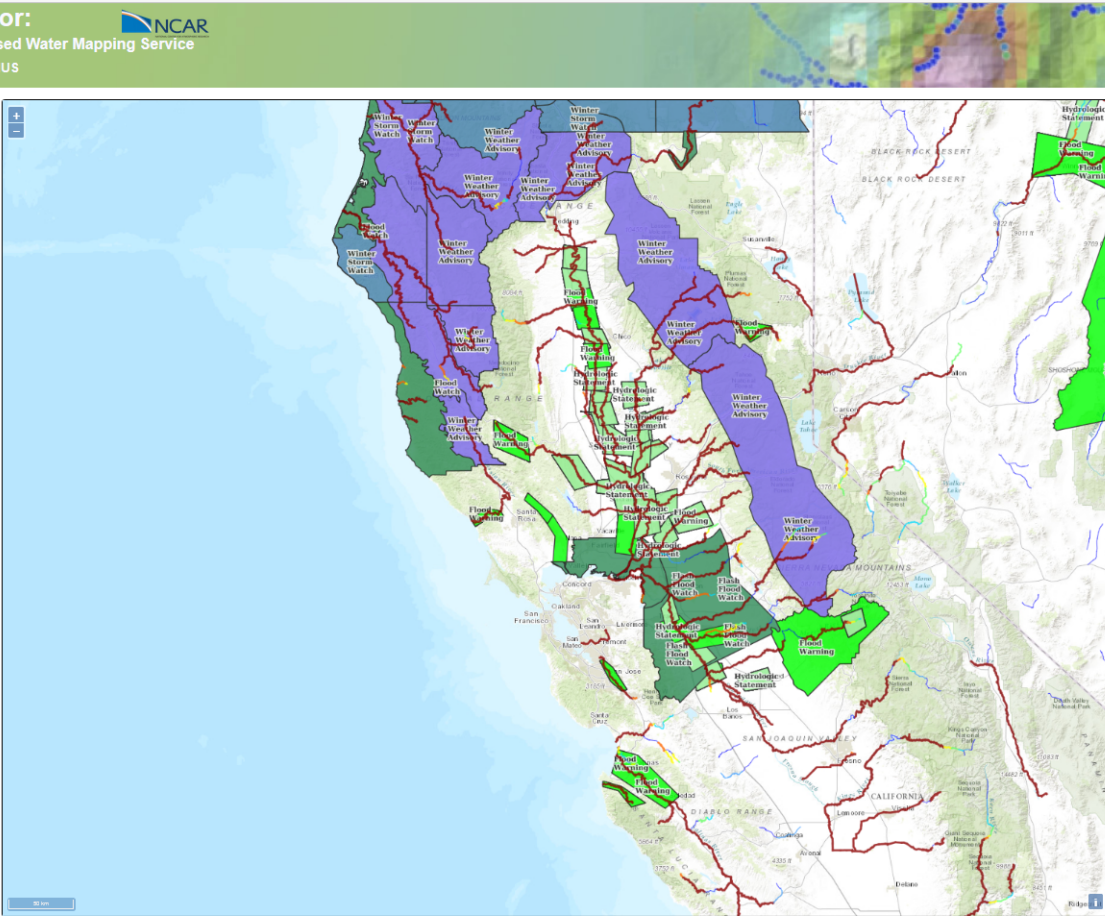
Station Observations

- AHPS Stations
- AHPS Flow

Model Configuration

Forecast Cycle

NA



Click a WRF layer in the map to plot data

Click a field station in the map to plot data

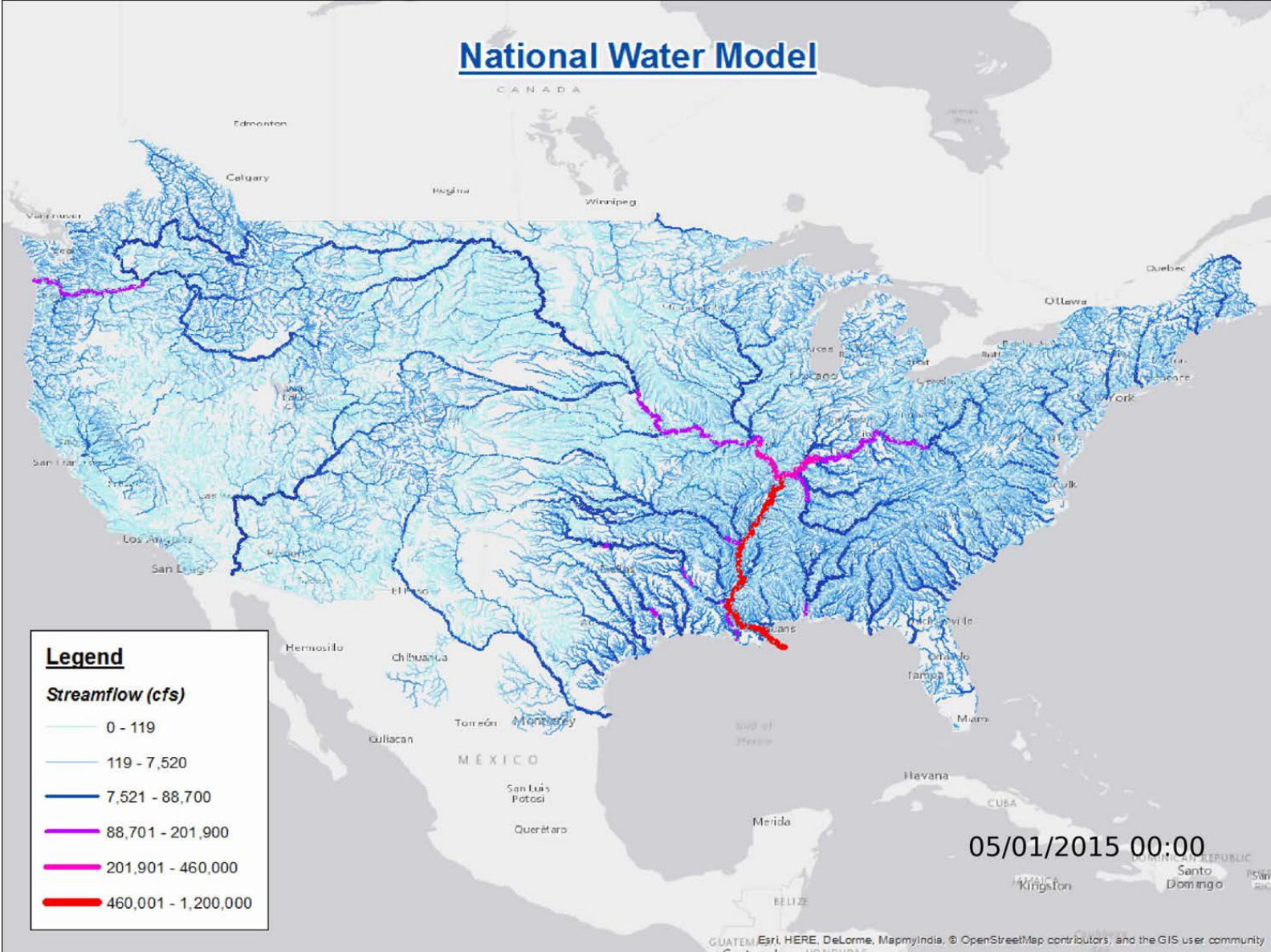
Feb 24, 2017 20:50

slow fast

Feb 15 00:00 Feb 16 00:00 Feb 17 00:00 Feb 18 00:00 Feb 19 00:00 Feb 20 00:00 Feb 21 00:00 Feb 22 00:00 Feb 23 00:00 Feb 24 00:00 Feb 25 00:00 Feb 26 00:00 Feb 27 00:00 Feb 28 00:00 Mar 01 00:00 Mar 02 00:00 Mar 03 00:00 Mar 04 00:00 Mar 05 00:00

Begin Lines
Toggle Datasets
Tools

Hydrologic Forecasts: Providing guidance to NWS forecasters

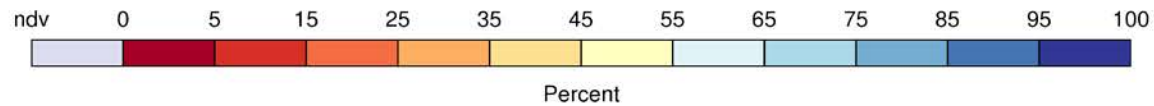
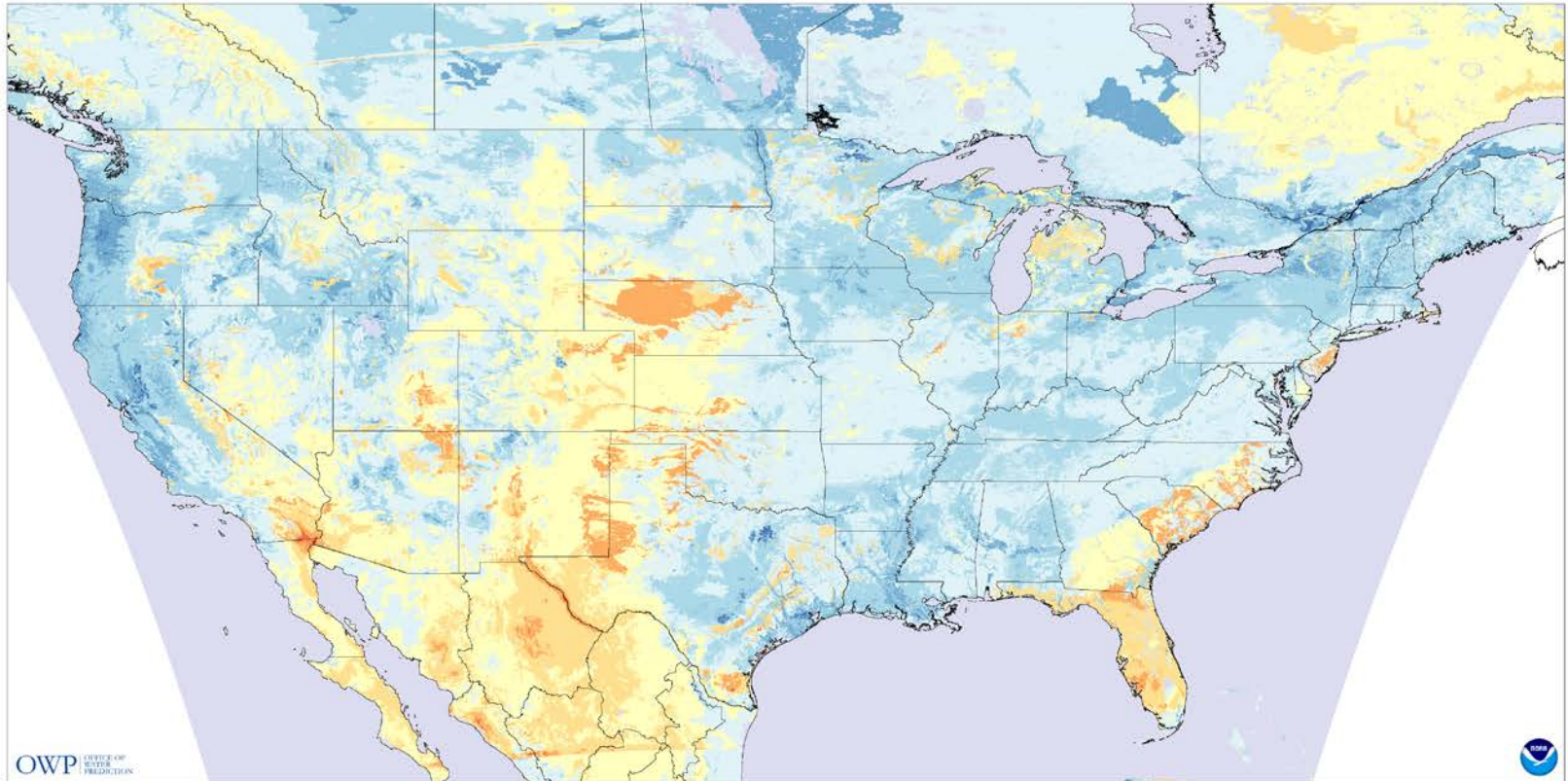


Hydrologic Forecasts: NOAA/NWM Soil Moisture Analysis

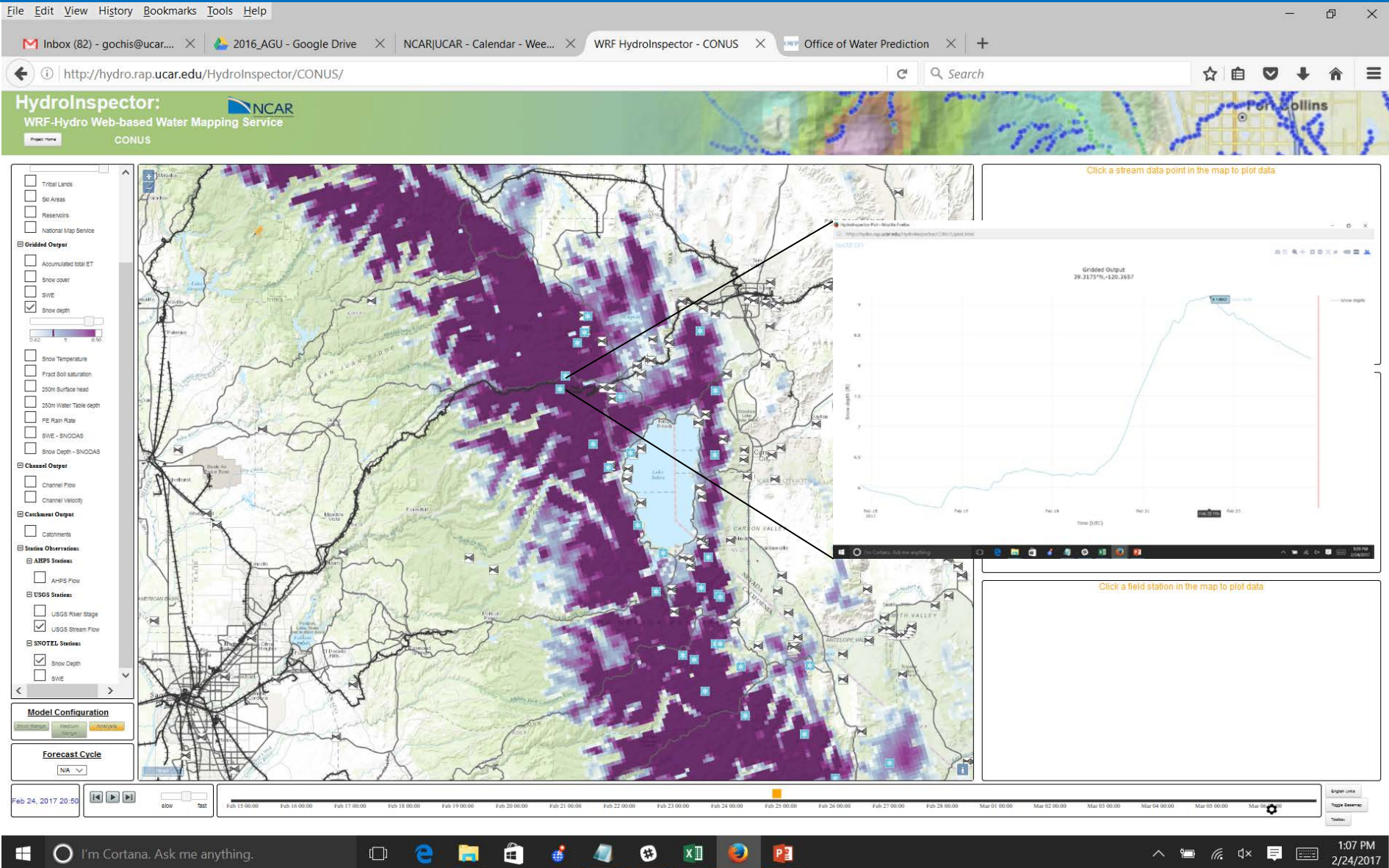
National Water Model Soil Moisture Guidance

Analysis valid for 2017-02-24 19:00:00 UTC

Model initialized at 2017-02-24 16:00:00 UTC

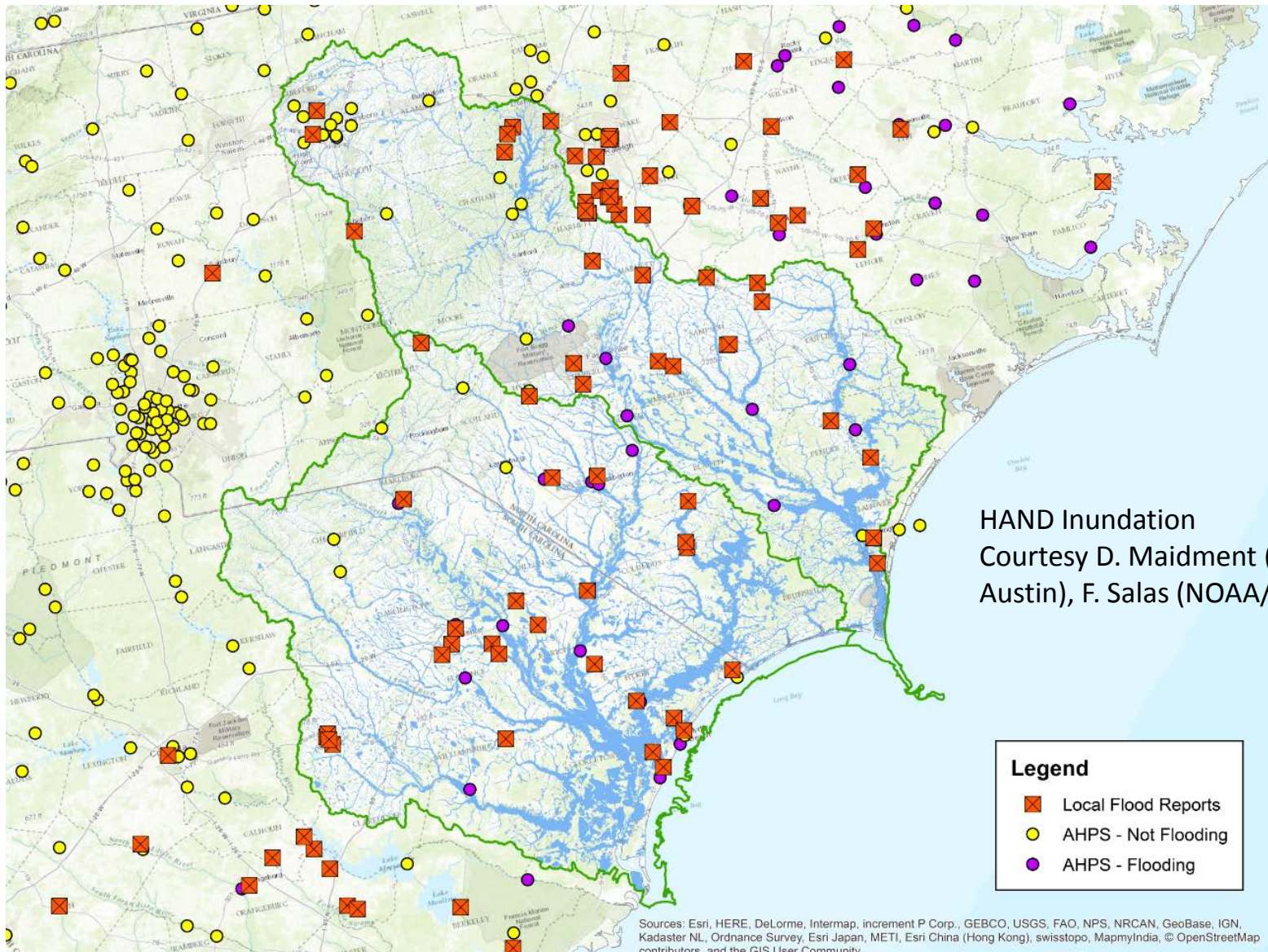


Transportation impacts forecast from the National Water Model



- Transportation impacts along road and rail corridors near Lake Tahoe, CA

Hurricane Matthew: Oct. 6-17, 2016...Inundation forecast product



HAND Inundation
Courtesy D. Maidment (U. Texas-Austin), F. Salas (NOAA/NWC)

Legend

- Red square: Local Flood Reports
- Yellow circle: AHPS - Not Flooding
- Purple circle: AHPS - Flooding

Sources: Esri, HERE, DeLorme, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, MapmyIndia, © OpenStreetMap contributors, and the GIS User Community

