Appendix to

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

Statement of

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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

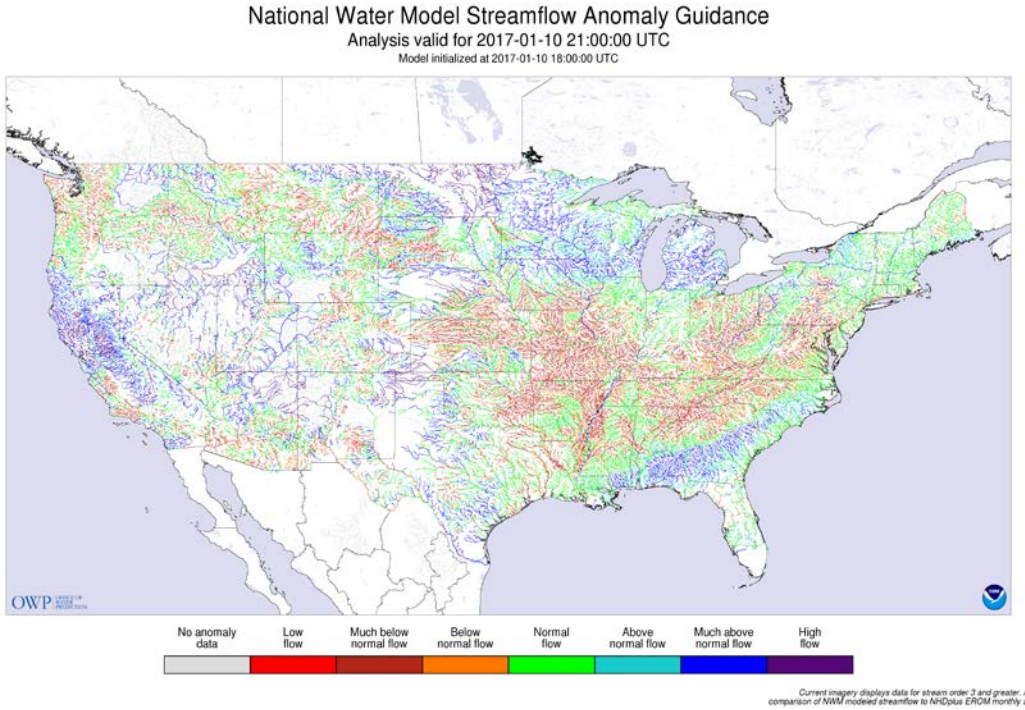
Data Throughput:

- 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



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

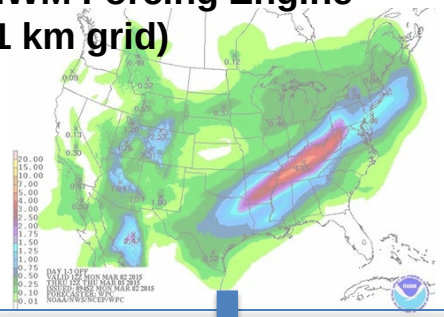
National Water Model
Initial Operating Capability: Model Chain

NWM uses NCAR supported community WRF-Hydro system

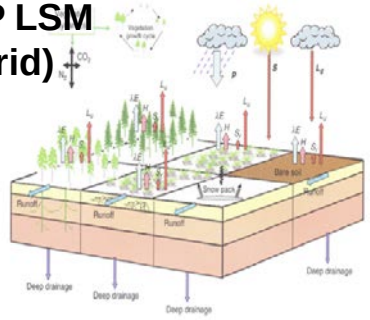
NWM: http://water.noaa.gov/about/nwm

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

1. NWM Forcing Engine (1 km grid)

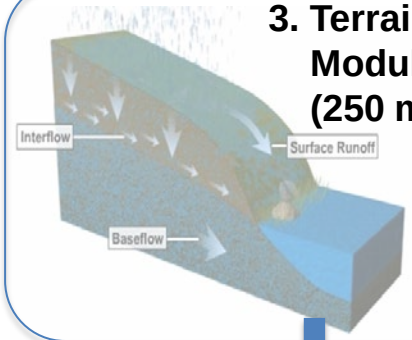


2. NoahMP LSM (1 km grid)

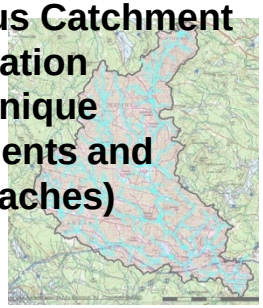


2-way coupling

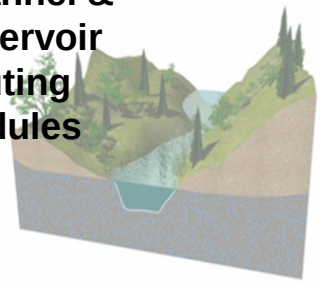
3. Terrain Routing Module (250 m grid)



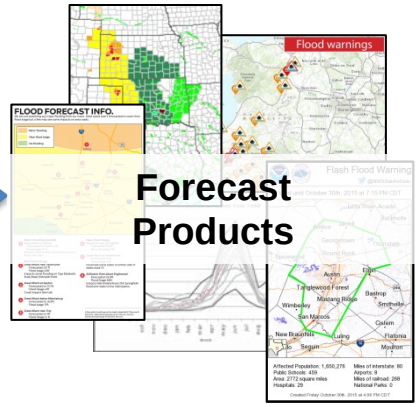
4. NHDPlus Catchment Aggregation (2.6M unique catchments and river reaches)



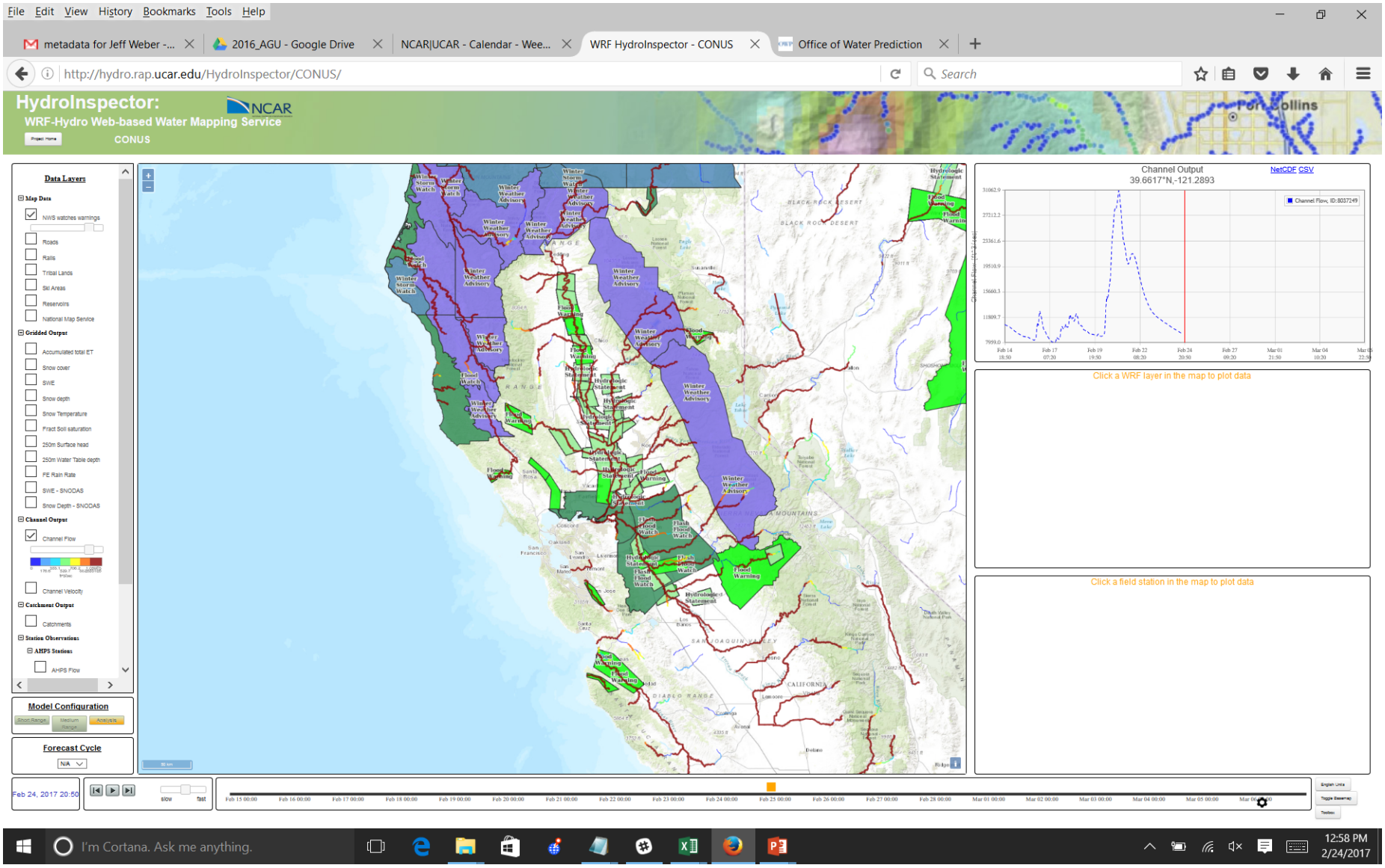
5. Channel & Reservoir Routing Modules



Forecast Products



Hydrologic Forecasts: Providing guidance to NWS forecasters



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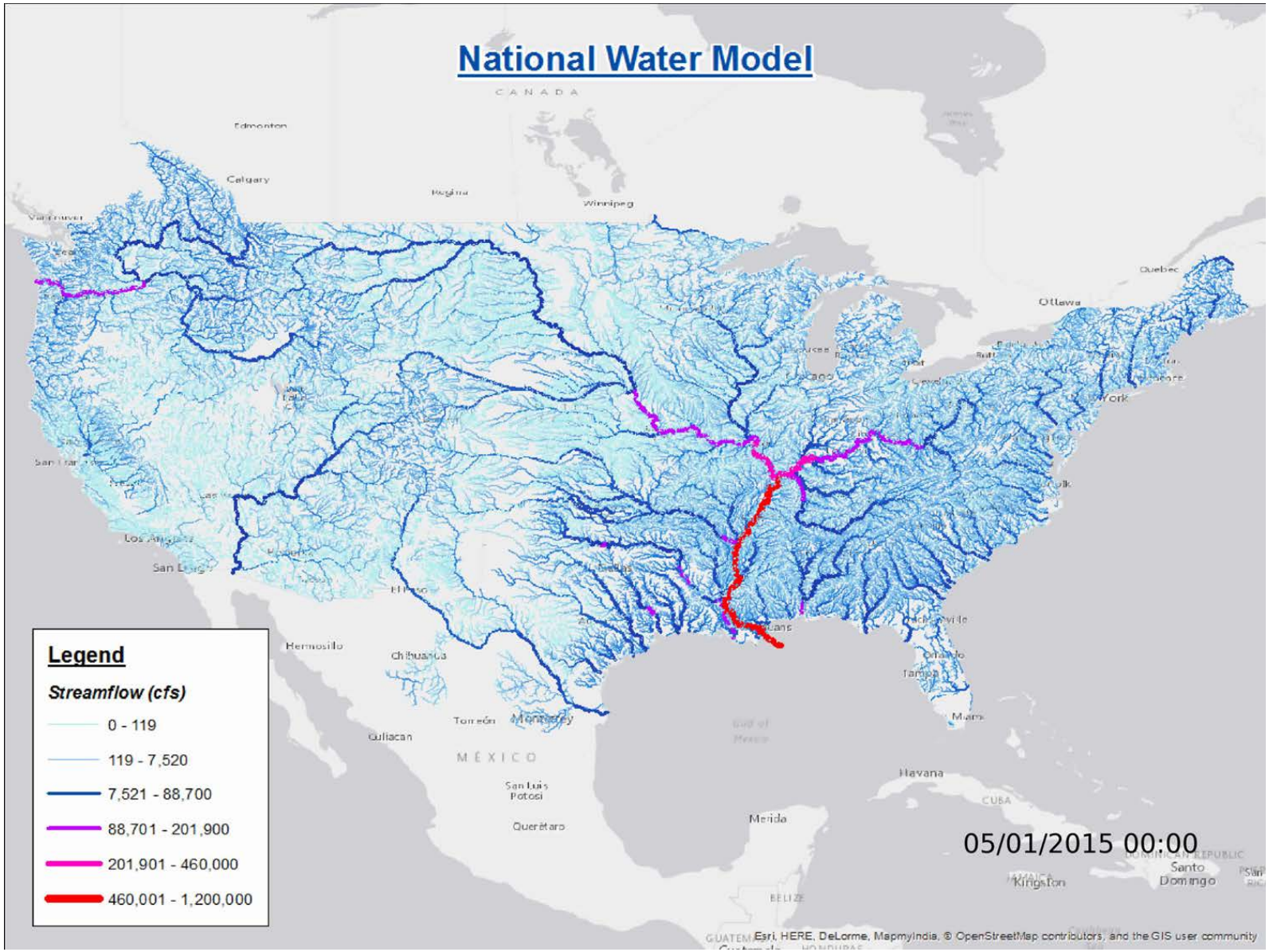
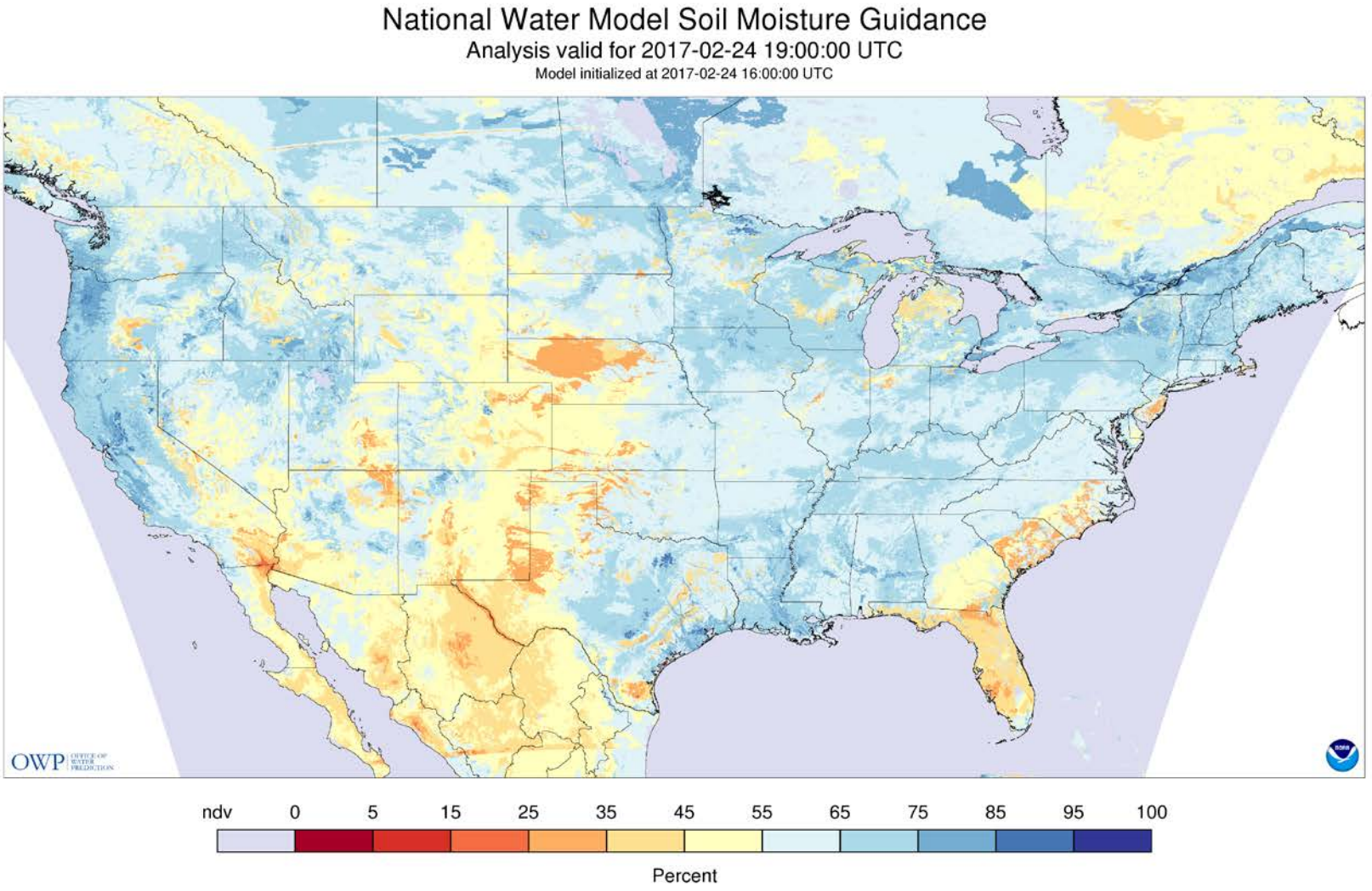
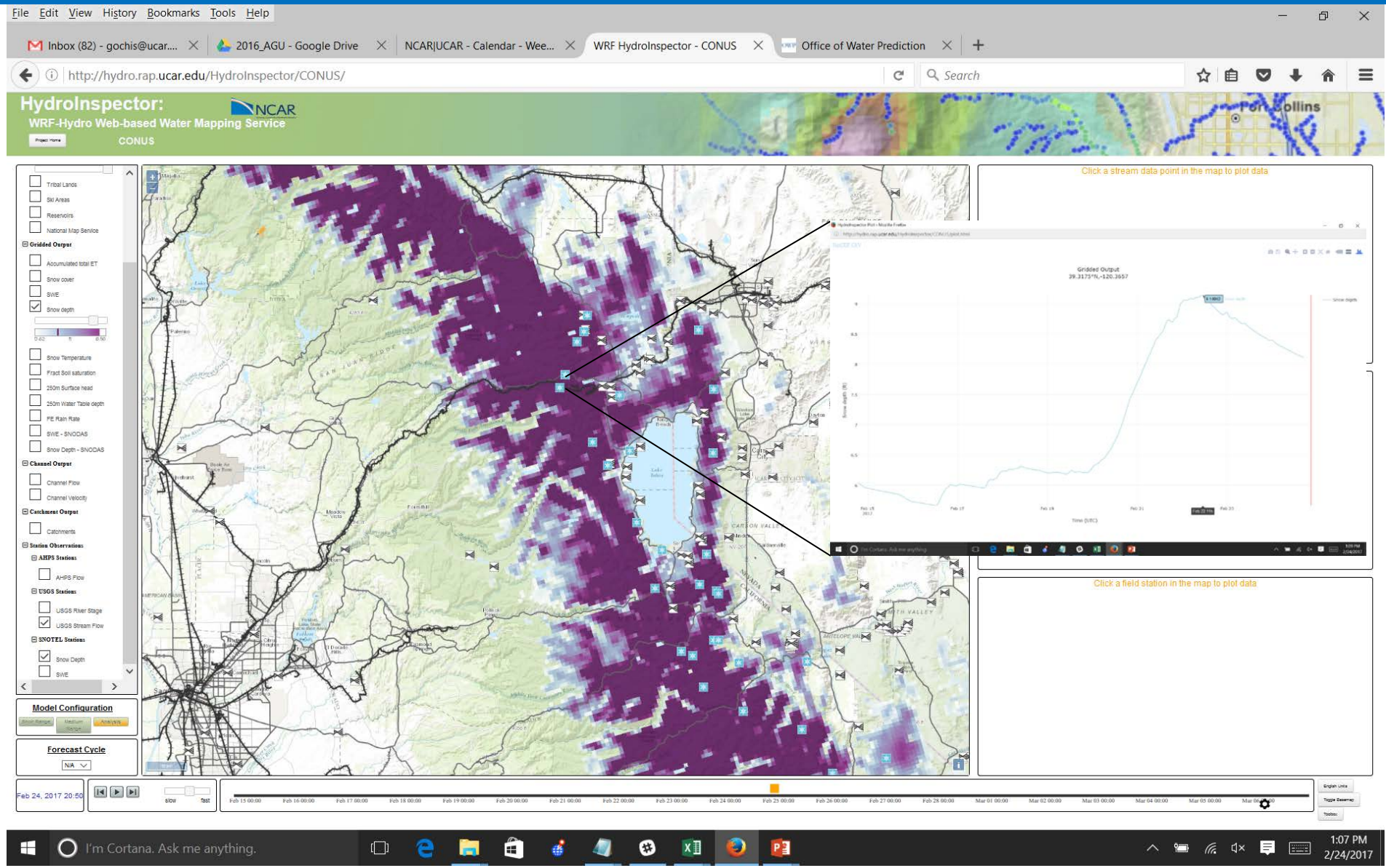


Hydrologic Forecasts: NOAA/NWM Soil Moisture Analysis

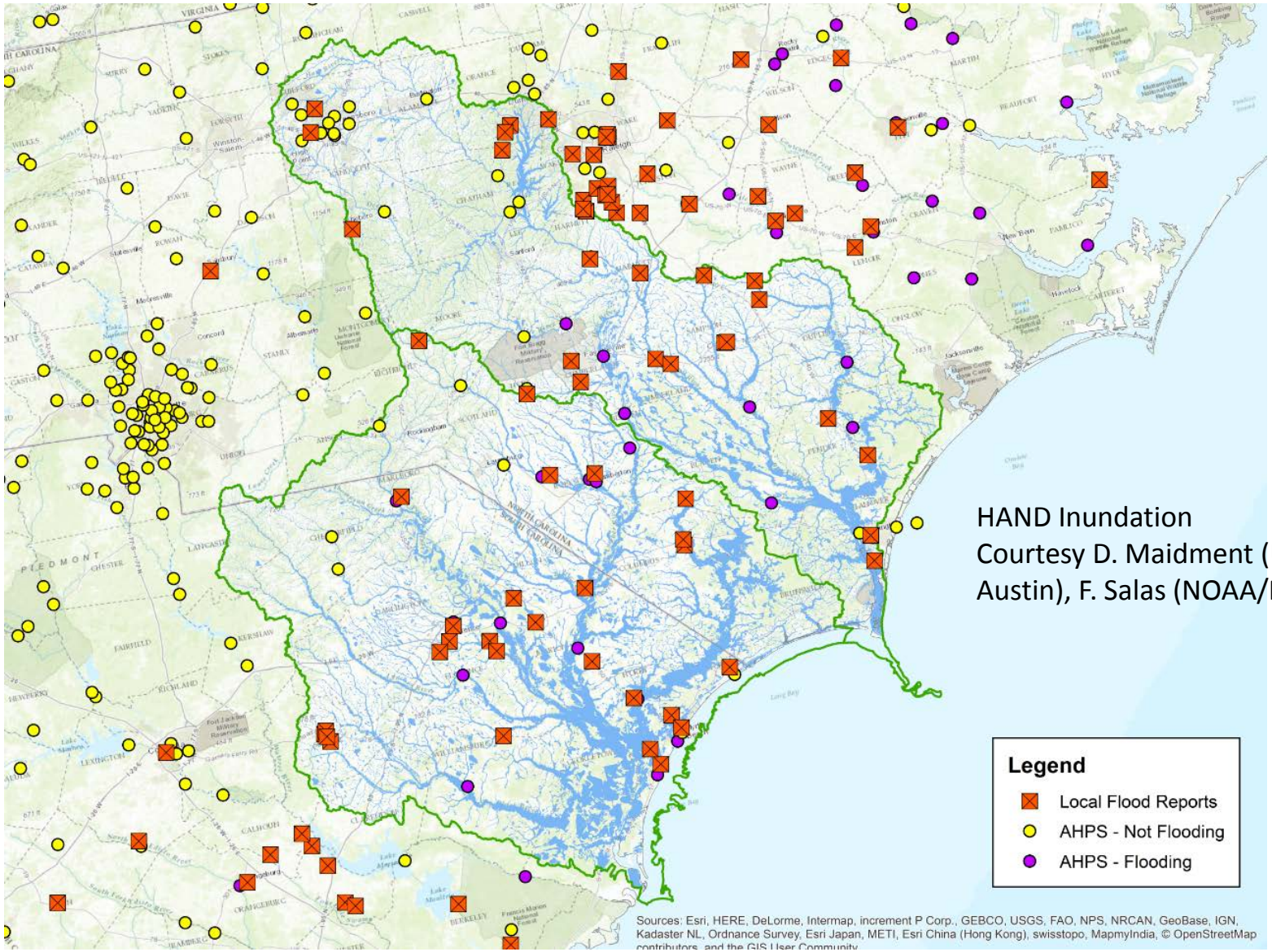


Transportation impacts forecast from the National Water Model



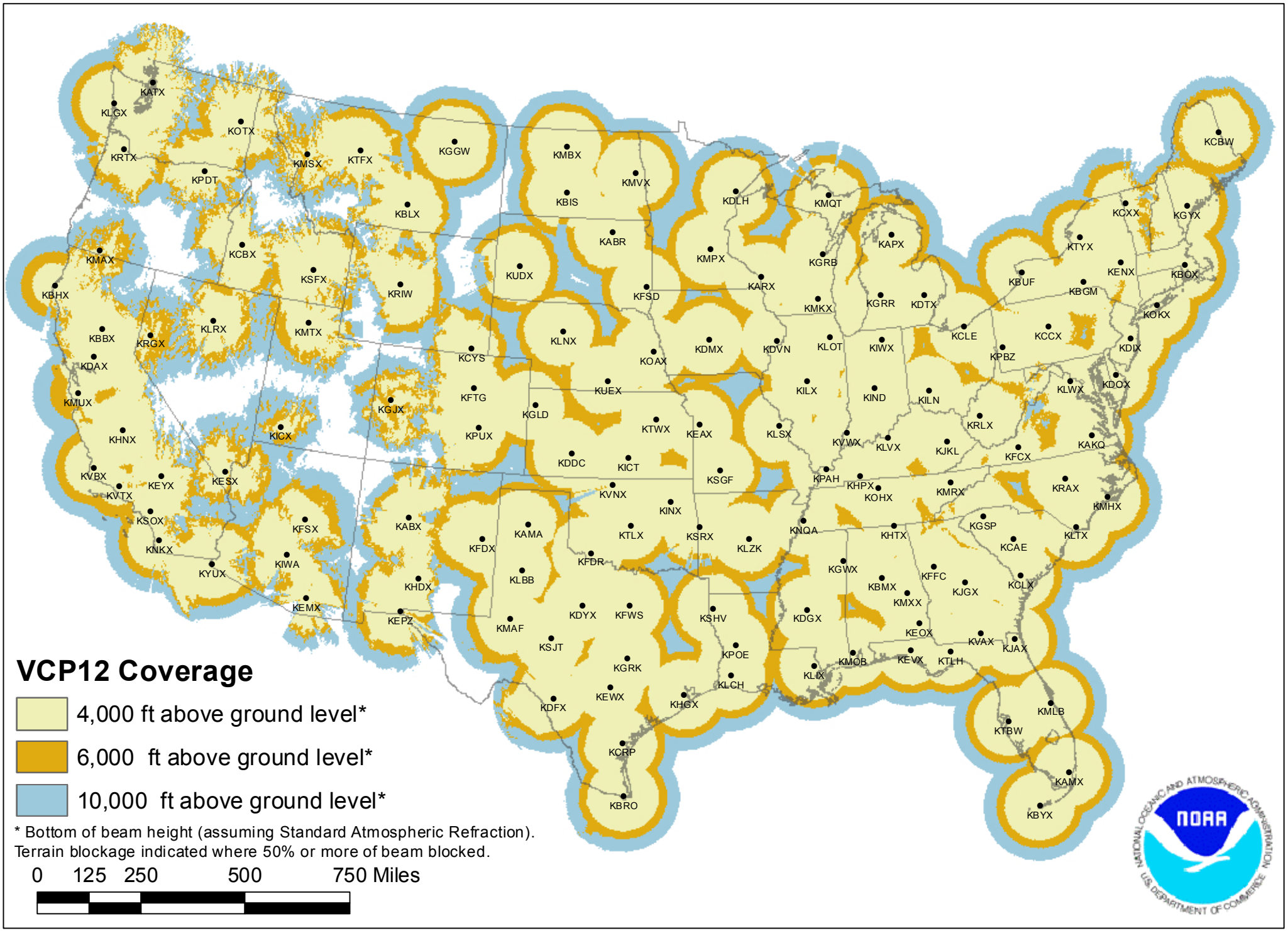
- Transportation impacts along road and rail corridors near Lake Tahoe, CA

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



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

NEXRAD Coverage Below 10,000 Feet AGL



VCP12 Coverage

- 4,000 ft above ground level*
- 6,000 ft above ground level*
- 10,000 ft above ground level*

* Bottom of beam height (assuming Standard Atmospheric Refraction).
Terrain blockage indicated where 50% or more of beam blocked.

0 125 250 500 750 Miles