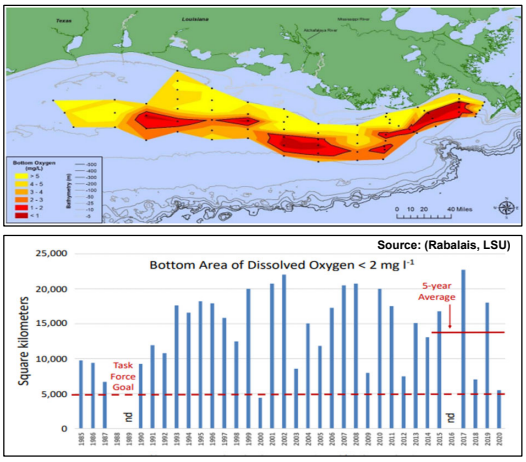
NCCOS NATIONAL CENTERS FOR COASTAL OCEAN SCIENCE

Outline

- 2020 Hypoxia monitoring cruise and retrospective analysis
- Newly funded project on emerging technologies for hypoxia monitoring
- Runoff Risk update and new collaborative effort with USDA Agricultural Research Service (ARS)

NCCOS NATIONAL CENTERS FOR COASTAL OCEAN SCIENCE

Hypoxic Zone Monitoring Results and Outreach



Mid-summer extent of hypoxic zone – metric to assess progress toward HTF Coastal Goal

Predicted Size = 17,353 km²
Measured Size = 5,480 km²
5-Year Average = 14,004 km²

3rd Smallest Measured
(impacts from Hurricane Hanna)

Outreach Efforts

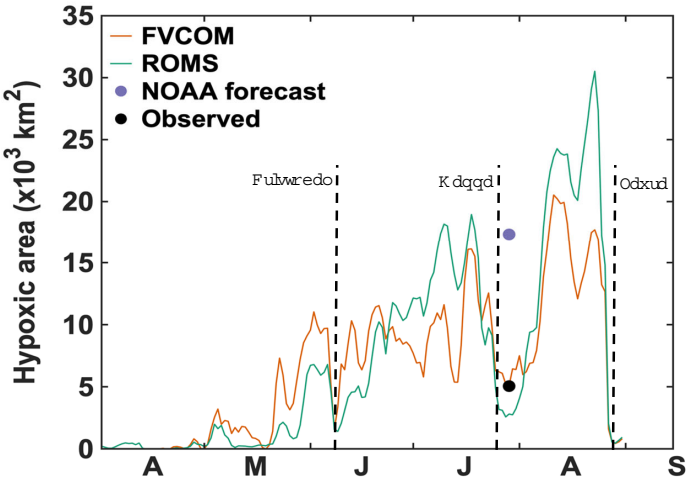
Two Press Releases

Media teleconference held with the Hypoxia Task Force Co-Chairs

Over 185 news articles written as a result

NCCOS NATIONAL CENTERS FOR COASTAL OCEAN SCIENCE

Retrospective Analysis



Source: (Fennel, Dalhousie; Justic, LSU)

Rapid intensification of hypoxic zone after Hurricane Hanna

Model agreement with cruise data

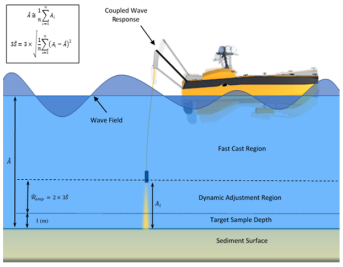
Large August peak

Storms continue to pose challenges with monitoring

NCCOS | NATIONAL CENTERS FOR COASTAL OCEAN SCIENCE

New project to support hypoxia monitoring

- **Purpose:**
  - Develop cost-efficient technology to sample hypoxic zone using autonomous surface vehicles
- **Capabilities:**
  - Utilize a winch driven system to sample within 1m of bottom
  - Can measure in waters from 5m to 50m
  - Data transmitted in real time and made publically available
- **Funding:**
  - Support provided by the NOAA IOOS OTT Program with 3-yr award to the University of Southern Mississippi ($1,161,017)
  - Intended partners include L3Harris, Integral Consulting Inc, Texas A&M Univ, GCOOS, EPA and NOAA



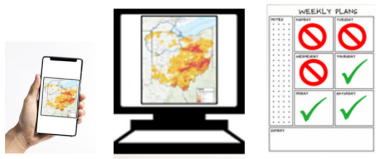
Autonomous Winch Controller Concept


Picture Credits: L3Harris | ASV

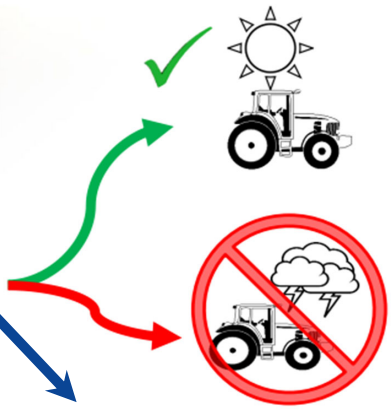
https://ioos.noaa.gov/project/ott-asv-hypoxia/

NCCOS | NATIONAL CENTERS FOR COASTAL OCEAN SCIENCE

NOAA Runoff Risk Decision Support Tools



State partners host the tools and provide free-to-use actionable guidance to farmers and producers

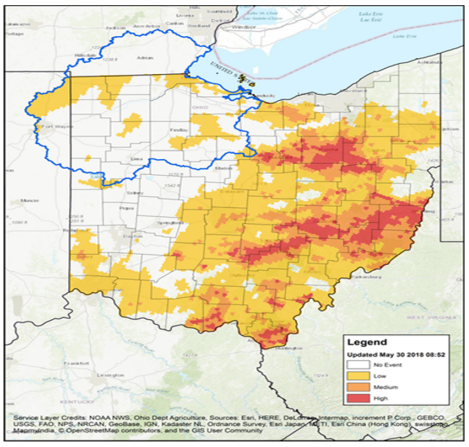


Real-time NWS forecast model output sent to the states

Nutrient applications scheduled to avoid unfavorable conditions

NCCOS NATIONAL CENTERS FOR COASTAL OCEAN SCIENCE

Runoff Risk - Current Status



Graphic showing runoff risk potential for Ohio (May 2018

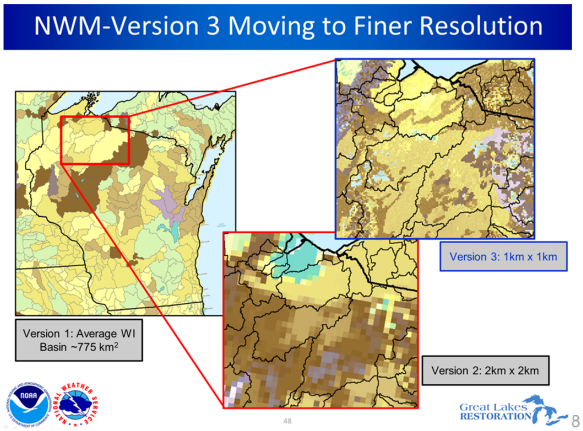
Quick Link to tools (Courtesy of WI): runoffrisk.info

- Runoff Risk (version 2) tools active in MI, MN, OH, and WI
  - Tailored to fit the needs of states
  - States maintain and distribute forecasts
- Very early stages in IN and NY
- Current version will be upgraded in winter 2020-21
- Future implementation nationally on the NWS National Water Model (~2023, based on version 3)

NCCOS NATIONAL CENTERS FOR COASTAL OCEAN SCIENCE

Runoff Risk - Comparison of v2 and v3

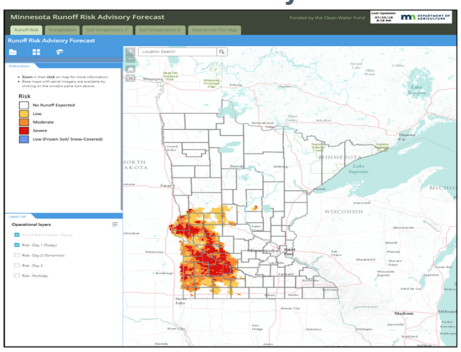
- Runoff Risk v3 will leverage the spatial and temporal scale and processing power of the NWM
- Resolution will be reduced from 2 km down to 1 km
- Use of the NWM platform offers the opportunity to expand outside the Great Lakes footprint



NCCOS NATIONAL CENTERS FOR COASTAL OCEAN SCIENCE

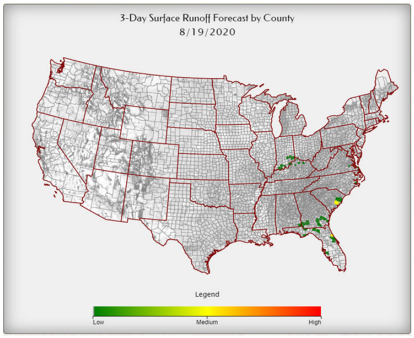
NOAA and USDA Runoff Tools

Runoff Risk Advisory Forecast



State Based
Maintained by NWS & State Partnerships
Gridded land-surface & runoff models
WRF-Hydro Modeling System

Agricultural Operational Planning Tool (AgOPT)



Nationally Based
Maintained by USDA/ARS/NRCS
Incorporates watershed models
SWAT/CEAP Modelling System

NCCOS NATIONAL CENTERS FOR COASTAL OCEAN SCIENCE

Emerging NOAA and USDA Collaboration

- Workshop was held in Jan of 2020 to explore avenues and options for collaboration between the two groups with several follow on meetings
- Areas of mutual interest
  - Comparison of the two approaches to learn their strengths and weaknesses
  - Incorporation of key data streams, parameters, and processing to ensure consistency across platforms and efficiency of tool provision
  - Pursue opportunities for leveraging of critical elements toward an interchangeable and integrated platform
- Quarterly meetings and an annual workshop planned for 2021
- **Ultimate Goal**: Enhanced ability to predict nutrient export events across the Mississippi River watershed

NCCOS NATIONAL CENTERS FOR COASTAL OCEAN SCIENCE

Recent Hypoxia Research Efforts and Publications

Several publications have come out with implications for hypoxic zone monitoring, forecasting, economic impacts and management targets.

Ren, L., Rabalais, N.N. & Turner, R.E. (2020) Effects of Mississippi River water on phytoplankton growth and composition in the upper Barataria estuary, Louisiana. Hydrobiologia 847, 1831–1850.

Rahman, Md, K., Richard, Vázquez, O., Khan, I., Thomas, P. (2020) Molecular characterization and expression of arginine vasotocin V1a2 receptor in Atlantic croaker brain: Potential mechanisms of its downregulation by PCB77 Journal of Biochemical and Molecular Toxicology v34

Kim, Jongsun & Chapman, Piers & Rowe, Gilbert & Dimarco, Steven. (2020). Categorizing zonal productivity on the continental shelf with nutrient-salinity ratios. Journal of Marine Systems. 103336.

Kim, Jongsun & Chapman, Piers & Rowe, Gilbert & Dimarco, Steven & Thornton, Daniel. (2020). Implications of different nitrogen input sources for potential production and carbon flux estimates in the coastal Gulf of Mexico (GOM) and Korean Peninsula coastal waters. Ocean Science. 16. 45-63. 0.

NCCOS NATIONAL CENTERS FOR COASTAL OCEAN SCIENCE

Recent Hypoxia Research Efforts and Publications

Several publications have come out with implications for hypoxic zone monitoring, forecasting, economic impacts and management targets.

Grüss, Arnaud & Rose, Kenneth & Justić, Dubravko & Wang, Lixia. (2020). Making the most of available monitoring data: A grid-summarization method to allow for the combined use of monitoring data collected at random and fixed sampling stations. Fisheries Research. 229. 105623. 3.

Tian, Hanqin & Xu, Rongting & Pan, Shufen & Yao, Yuanzhi & Bian, Zihao & Cai, Wei-Jun & Hopkinson, Charles & Justic, Dubravko & Lohrenz, Steven & Lu, Chaoqun & Ren, Wei & Yang, Jia. (2020). Long-Term Trajectory of Nitrogen Loading and Delivery From Mississippi River Basin to the Gulf of Mexico. Global Biogeochemical Cycles. 34. e2019GB006475.

Yao, Yuanzhi & Tian, Hanqin & Shi, Hao & Pan, Shufen & Xu, Rongting & Pan, Naiqing & Canadell, Josep. (2020). Increased global nitrous oxide emissions from streams and rivers in the Anthropocene. Nature Climate Change. 10. 1-5.

NCCOS NATIONAL CENTERS FOR COASTAL OCEAN SCIENCE

Recent Hypoxia Research Efforts and Publications

Several publications have come out with implications for hypoxic zone monitoring, forecasting, economic impacts and management targets.

- Diversions of Mississippi River into adjacent estuarine waters should be considered in relation to expected and, possibly, unexpected changes in phytoplankton communities to the receiving waters and coastal ecosystems (**Ren et al., 2020**)
- Salinity/nutrient relationships in the Gulf of Mexico varied systematically with distance from the two rivers in winter but not in summer. This is because boundaries of the different regions vary with river flow, overall nutrient flux, and grids of stations at the regional spatial scale (**Kim et al., 2020**).
- Model scenario results suggest that overall oxygen demand in the Gulf of Mexico will increase approximately 21% if we fail to reduce riverine N input, likely increasing considerably the area affected by hypoxia **(Kim et al., 2020)**.
- The model results indicate that total nitrogen export during 2000–2014 was twofold larger than that in the first decade of twentieth century: Dissolved inorganic nitrogen export increased by 140% dominated by nitrate; total organic nitrogen export increased by 53% (**Tian et al., 2020**)