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)
Hypoxic Zone Monitoring Results and Outreach

- 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

Retrospective Analysis

- Rapid intensification of hypoxic zone after Hurricane Hanna
- Model agreement with cruise data
- Large August peak
- Storms continue to pose challenges with monitoring

Source: (Fennel, Dalhousie; Justic, LSU)
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

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

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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

Picture Credits: L3Harris | ASV
Runoff Risk - Current Status

- 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)

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

Graphic showing runoff risk potential for Ohio (May 2018)

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
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

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
Recent Hypoxia Research Efforts and Publications

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


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 & 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.
Recent Hypoxia Research Efforts and Publications

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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.


Recent Hypoxia Research Efforts and Publications

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- 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).