PARAMETERIZATION OF TEMPORALLY-RESOLVED BENTHIC NUTRIENT FLUXES IN LAKE OKEECHOBEE

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Benthic fluxes have been recognized as a substantial nutrient source to Lake Okeechobee for several decades. As part of a highly interdisciplinary effort focused on understanding and predicting Harmful Algal Blooms on Lake Okeechobee, we collected for the first time sub-monthly benthic flux measurements from muddy sediments at several locations for one year. Over seasonal timescales, benthic nutrient fluxes from these legacy nutrient-enriched mud sediments can vary by nearly an order of magnitude, with water column nutrient conditions mirroring those of sediment pore waters. Sediment ammonium fluxes were most elevated coincident with the first observations of early-season HABs, whereas phosphate fluxes were greatest towards late summer. This pattern likely implicates seasonal anaerobic respiration processes (i.e. iron). Together, these findings suggests that predictive numerical models must include temporally-resolved benthic nutrient fluxes to ensure accurate forecasting capabilities. However, a purely empirical parameterization would fail to capture the importance of short-term controls and feedback. For example, sediment resuspension obviously serves as a mechanism for the rapid introduction of nutrient rich sediment pore waters to the water column, but net impacts can be critically convoluted by the relative rates of assimilation versus nitrification or mineral surface phosphate saturation. Overall, it is challenging to determine the optimum modeling approach given tradeoffs between accuracy and complexity, especially given our poor fundamental understanding of these more ephemeral processes. Here, several of the abovementioned phenomena will be highlighted along with a hierarchical approach to develop an optimized parameterization for a benthic nutrient cycling module.

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