

Title: The Exploration of Coastal Hydro-biogeochemistry Across a Network of Gradients and Experiments Consortium (EXCHANGE)

Allison N. Myers-Pigg^{1*}, Allison Lewis³, Peter Regier¹, Kaizad Patel¹, Khadijah Homoka¹, Opal Otenburg¹, Stephanie Pennington¹, Nicholas Ward¹, Ken Kemner⁴, Vanessa Bailey¹, EXCHANGE Consortium

¹Pacific Northwest National Laboratory, Richland, Washington

²University of Toledo, Toledo, Ohio

³Lawrence Berkeley National Laboratory, Berkeley, California

⁴Argonne National Laboratory, Argonne, Illinois

Contact: (allison.myers-pigg@pnnl.gov)

Project Lead Principal Investigator (PI): Vanessa Bailey

BER Program: ESS

Project: COMPASS-FME

Project Website: <https://compass.pnnl.gov/fme>; <https://compass.pnnl.gov/fme/EXCHANGE>

Project Abstract: The EXCHANGE Consortium aims to improve understanding of how the two-way exchange of water between estuaries or large lake lacustraries and the terrestrial landscape influence the state and function of ecosystems across diverse coastal interfaces. Our overarching goal is to develop a community-driven, regionally distributed sampling network to examine how spatial variations lead to ecosystem control points at the coastal terrestrial-aquatic interface (TAI). We are using a combination of bulk measurements, molecular level analyses, and laboratory experiments on soil, sediment, and water samples collected across transverse gradients (from upland to estuarine waters – the coastal terrestrial-aquatic interface) at geographically distributed sites around two major coastal regions—the Mid-Atlantic and the Great Lakes. These geographically distributed measurements and experiments will enable us to elucidate how organic matter (OM) cycling dynamics vary between saline and freshwater coastal TAIs, respectively. We are studying the spatial variability in coastal ecosystem dynamics through a series of targeted campaigns. Campaigns developed via workshops with regional partners follow ICON-FAIR principles from conception to data analysis and publication. The first EXCHANGE campaign (EC1) focuses on baseline understanding of the chemical forms and distribution of carbon and nutrients across research sites in both regions. During the Fall of 2021, participants in EC1 collected samples from 52 coastal TAIs using standardized sampling kits. Experiments were performed on samples from a subset of sites to evaluate the response of soil and sediment greenhouse gas production to inundation. Spatial variation across regions was apparent across multiple data types, with variability in surface water chemistry (e.g. dissolved organic carbon, nitrate/nitrite) greater in the Mid-Atlantic compared to the Great Lakes. Spatial variations in terrestrial and aquatic biogeochemical properties and processes studied as a part of EXCHANGE are the product of a range of different environmental conditions, geomorphic settings, and inundation history. For example, total carbon in transition zone soils was lower in soils with visually observed iron oxidation. The data produced by EXCHANGE increase our understanding of how OM processing and transport is coupled to depth and duration of soil saturation and the abundance of redox-sensitive elements, which is essential to the parameterization of reactive transport modeling across spatial scales.