Geophysical Research Abstracts
Vol. 21, EGU2019-12447-1, 2019
EGU General Assembly 2019

Contribution of Diffuse- and Point-Source Nutrient Loads to Emergent Scaling in Urbanized River Networks.

Soohyun Yang (1), Enrico Bertuzzo (2), Olaf Buettner (3), Dietrich Borchardt (3), and Suresh Rao (1)

(1) Purdue University, Lyles School of Civil Engineering, West Lafayette, United States, (2) Ca' Foscari University of Venice, Department of Environmental Sciences, Informatics and Statistics, Venice, Italy, (3) Helmholtz UFZ Centre for Environmental Research, Department of Aquatic Ecosystem Analysis and Management, Magdeburg, Germany

River network structures are known to be scale-invariant, characterized by Horton scaling ratios, and power-law relations between geomorphological variables (e.g., Hack's law). River networks also manifest scaling character for their functions, such as hydraulic geometry, or in-stream nutrient uptake processes. Human-related variables (e.g., human settlements) also reveal globally consistent scale-invariance over stream orders within a river basin. Based on scaling properties of river networks, recent work demonstrated scaling of dissolved organic carbon removal at the basin-scale (exported from diffuse sources). Our recent study showed that point-source nutrient loads discharged from wastewater treatment plants (WWTPs) exhibited scaling properties in three large river basins in Germany. In the current study, we link these scaling ideas to investigate how spatially heterogeneous nutrient loads discharged from multiple urban point sources (i.e., WWTPs) scale across urbanized basins. Available data from three German river basins for size distribution and locations of WWTPs are used to determine scaling of nutrient loads based on stream order hierarchy and spatial patterns based on Geomorphologic Width Function approach. Nutrient loads from spatially heterogeneous point sources are super-imposed in diffuse nutrient loads to produce spatially heterogeneous patterns of nutrient concentrations. We examine the joint contribution of hydrologic dilution and in-stream processes to the emergent scaling across the entire basin of water-quality impairments (nutrient concentrations exceeding specified thresholds).