System Fluxes: Task 1

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Task 1 of the FY15-17 PNNL SBR SFA Plan will assess the effects of daily, seasonal, and yearly variations in the hydrologic cycle and climate on groundwater-surface water interactions, contaminant mobilization and transport, and C and N concentrations/emissions from the SIZ at the reach scale and their feedbacks to climate. The task aims to improve reach-scale understanding of the spatial and temporal dynamics of biogeochemical cycling in the SIZ, their interactions with the water cycle, and feedbacks to climate through observational studies, data synthesis, and integration of Task 2 and 3 results into reach-scale models, and to develop a facies-based classification of SIZ environments along a river reach through synthesis of existing data and new measurements, and to establish a methodology with Tasks 2 and 4 to use these for reach-scale predictions of SIZ controls on contaminant, C, and N fluxes.

To achieve these goals, reach-scale data and results from other tasks will be assembled and integrated into a community-modeling framework to advance understanding of SIZ processes and their contributions to reach-scale hydrochemistry. The new model framework to be established include three modeling components extending from upstream (i.e., Priest Rapids Dam) to downstream (Richland, WA) boundaries of the Hanford Reach. These components will be developed in a parallel but integrated fashion as follows: i) a facies model of the SIZ; ii) a terrestrial component from canopy top to the SIZ bottom that incorporates SIZ processes; and iii) a riverine component to simulate in-stream processes and their linkages to the SIZ. Centered on the facies concept, the terrestrial and riverine components will be coupled to represent interactions between the river and groundwater through advection, dispersion, and diffusion. By applying the modeling framework at the reach scale and beyond, we seek fundamental insights on the impacts of dynamic water exchange between the SIZ and the river on critical reach-scale microbial and ecological functions that regulate riverine C and N budgets, and on the potential influences of climate change (e.g., increased stream temperature and oscillation of river stages) on the highly coupled riverine-SIZ environment, and in turn, biogeochemical fate and transport processes and their feedbacks to regional climate.