Title: **Representing Subsurface Lateral Groundwater Flow in Earth System Models**

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Project Abstract:
Subsurface lateral groundwater flow plays an important role in controlling water table dynamics. Due to the relatively coarse spatial resolutions of land surface and Earth system models, this process is often omitted even though it can be significant due to subgrid heterogeneity. In this study, we developed a physically based model, Hydrological Hillslope Soil Column (H2SC), to simulate subsurface lateral groundwater flow using hillslopes to represent subgrid spatial variability in topography. This model explicitly considers the transitions between different water table scenarios (e.g., with or without a seepage phase) and the interactions between land and river. We coupled this model to the land component (ELM) and river component (MOSART) of the Energy Exascale Earth System Model (E3SM) and applied it globally. H2SC is being calibrated using observed water table depth. Model evaluation will be performed using observational data of the surface water balance. Preliminary simulations show that lateral groundwater flow is affected by topography through its impacts on water table slopes. Analysis will be performed to understand how lateral flow contributes to the river discharge and influences the spatial distributions of water table along the hillslope.