Here we outline a plan to assist the UNHCR with research to determine the resilience of different refugee camp’s water supplies to climate change. We seek to understand the effect that changes in regolith properties and the water cycle have on infiltration versus runoff generation during storm events. We will explore how changes in regolith properties affect infiltration to unconfined, near surface aquifers. We also will investigate how an evolving regolith will respond to projected changes in precipitation events. This research could assist in determining where to sit wells in erosional landscapes to support refugee populations. These topics are novel and do not infringe on the research Ellen Milnes’ research group at the University of Neuchatel is doing. These data can be used to answer the following research questions:  1) How do changes in the water cycle events affect infiltration? 2) How do changes in regolith, including desertification via climate change and anthropogenic influence affect infiltration. 3) Which camps/areas are sensitive to climate change? We plan to develop a model in Landlab to determine how changes in regolith/bedrock properties affect the ratio of infiltration to runoff during a storm. We will generate climate projections and reconstruct realistic hydrographs and storm frequencies for different camps. We use this model to determine how the ratio of infiltration to runoff is affected by 1) the shape of the hydrograph, 2) storm frequency, 3) topography, and 4) land use and urbanization. We can involve organizations like UNHCR, IGRAC, and the critical zone observatory.

Water depths are variable at each point throughout the model run, changing as a function of discharge inputs, outputs, and effective rainfall rate at each time step (Eq. 5). Water depth values can be mapped across the domain at discrete time steps. In this example, water depth was plotted at the peak of the outlet hydrograph (Fig. 8c). The scale in Fig. 8c emphasizes flow patterns in the channels, but water depth and discharge are calculated across the entire watershed, including on the hillslopes. These water depths can be used to calculate shear stress (following Eq. 10). Stress values were tracked at all points throughout the model run, and the local maximum value for each node was plotted in Fig. 8d. Shear stress values can be used to interpret the size of particles that can be entrained and transported by surface flow. Greater shear stress values correspond to areas with greater water depths (e.g., channels), where more sediment transport would be expected in high flow conditions.