Geochemical fluxes through intensively managed critical zones

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Extensive land disturbance from agircultural activities in the Midwestern United States could impact weathering and hydrologic fluxes within the critizal zone (CZ) compared to native praire systems. The Intensively Managed Landscapes Critical Zone Observatory (IML-CZO) in eastern Iowa and Glacier Creek Preserve (GCP) in eastern Nebraska were both formed in thick last-glacial Peoria Loess overlying glacial till. Both watersheds include agicultural and praire land uses that can help quantify the impact of such disturbance on both surface and deeper CZ processes. Meteorological stations at the study sites record baseline atmospheric and soil parameters; stream sondes, stream grab samples, soil porewater, and precipitation samplers measure hydrological and geochemical fluxes. Deep soil cores (5-25 m deep) collected from ridgetop topographic positions characterize bulk soil geochemisty and physical properties. At all study sites Ca and Mg enrichment (up to 200%) is observed at depths of 1.5 – 4 m. In Nebraska, this enrichment is at 2 m depth under agricultural land use and 4 m depth under restored prairie; soil moisture and electrical conductivity are also greater in agriculture compared to prairie soils, where dilute precipitation flushes rapidly through upper 1 m of the soil profile. The opposite is observed is Iowa, however, where deeper Ca and Mg enrichment (4 m) is observed under agriculture land use compared to prairie (2.5 m) and soil water flushes rapidly through the upper 1 m of soils under agriculture. The IML-CZO is wetter than GCP (89 cm compared to 78 cm mean annual precipitation) which may drive deeper fluxes and accumulation of weathering products at the Iowa site. Thus, both precipitation and land use may be important in determining the depth and extent of weathering in these deep loess profiles. Comparing geochemical fluxes across these intensively managed landscapes will help quantify land use impacts on both surface and, perhaps most notably, deeper weathering and hydrologic fluxes.