ELECTRICAL RESISTIVITY IMAGING (ERI) OF TRANSPORT PATHWAYS CONTROLLING PHOSPHOROUS LOADS TO DRAINAGE DITCHES IN AGRICULTURAL FIELDS

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The phosphorous (P) index is an applied assessment tool that identifies agricultural fields considered critical sources of P due to hydrologic connectivity between P sources and surface water. There is a need to improve the depiction of subsurface hydrological connectivity in P risk assessment tools in flat, artificially drained landscapes. We are applying time-lapse ERI in conjunction with salt tracers to a site on the Delmarva Peninsula (MD) that is drained by a dense network of open ditches. Our objectives are to examine the relative effects of soil properties, drainage intensity, and management factors on shallow lateral flow generation as a function of storm intensity. We automated an ERI system of 192 electrodes within a 72m2 plot to monitor the movement of salt tracers applied to a 25 cm deep trench during natural rainfall events. This system, operational since September 2015, reveals a consistent preferential pathway within the top argillic horizon into a deeper (> 1m) sandy/sandy loam layer. This preferential pathway is observed regardless of storm intensity. ERI visualizations show the progression of a conductive slug within the sand layer driven by an increase in hydraulic head from precipitation events. Moment analysis revealed an expected progression of center of mass coordinates towards the drainage ditch and an increase in seepage velocity with storm intensity. Changes in ERI in the top 1 m are highly variable. We installed soil moisture, temperature and conductivity probes at 13 cm and 63 cm at four locations in the ERI grid. Soil temperature is shown to be affected by conductive (i.e. diurnal patterns) and convective (i.e. precipitation influx) forces. A simple temperature correction was applied to the top 1 m of the inverted ERI image. ERI monitoring was shown to advance our understanding of shallow subsurface flows contributing to P transport.