Introduction and Motivation

A current focus of science today is the issues of anthropogenic warming and the alterations it is having on precipitation intensity and distribution. However, there is less research done on the effects that precipitation have on the land surface as a result of these changes. To better understand impacts of extreme precipitation on water in the subsurface, we model three different locations at Gordon Gulch using Hydrus 1-D. This allows us to quantify the results by calculating the change in soil water storage volume at each of the different locations.

Methodology

Double-ring Infiltrometer Test

Purpose: Measure downward component of flow through soil

- Create a level surface at sample site
- Maintained constant water level in outer-ring used to minimize lateral flow
- Measured infiltration rate of water into the soil over 1hr period

Permeameter Testing: Calculating Hydraulic Conductivity (K) Value

Purpose: Determine hydraulic conductivity values of soil samples at each of the test location

- Methods per sample:
  - Calculate pore space
  - Record Pressure head (psi)
  - Record length of sample
  - Solve for K with Darcy’s Law

Hydrus 1-D: Modeling Infiltration to Subsurface

Purpose: Identify changes in soil water storage for three cases over a 150 day period of precipitation.

- Three soil cases: homogeneous soil, four-layered profiles (hilltop, slope) with varying soil hydraulic properties.
- Input data: 150-days of precipitation.

Results

Soil Water Storage Volume

Figure 10. Soil water storage of homogeneous (one soil), hilltop, and slope cases (09/01/13 – 01/28/14), soil water storage increases for all cases analogous to the increase in measured soil moisture data for the same period.

Conclusions

- Modeled soil water storage agrees with the observed general patterns of soil moisture.
- Homogeneous soil stores more than double the amount of water of the hilltop and slope cases. The heterogeneity of the hilltop and slope cases affects their ability to store more water.
- In each case, the soil profile becomes wetter with infiltration until the soil reaches full saturation, after which water storage continues to decrease over time but soil remains partially saturated.
- After six weeks, the soil moisture of each profile remains higher than the initial condition.

References

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