Field and Laboratory Hydraulic Characterization of Landslide-Prone Soils in the Oregon Coast Range and Implications for Hydrologic Simulation

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Received 12 Apr. 2018.

Accepted 2 June 2018.

Supplementary Material

8 Pages; 1 Table, 2 Figures
Grain size distributions between the four laboratory soil samples are similar and well graded. Figure S1 shows the particle-size distributions for the four samples. The 50-80 cm sample from the SP5 soil pit area (Figure 1B) has the coarsest grain-size distribution and is separated laterally from the other three samples at the field site. The other three samples, taken near the SP2 soil pit (Figure 1B), are very similar in grain-size distribution and do not show an obvious trend with depth of sampling.

Table S1. Unsaturated hydraulic parameters for the van Genuchten (1980) model from the laboratory measurements using the TRIM method (Wayllace and Lu, 2012) and the field-based RETC estimates used in the Hydrus-1D modeling.

<table>
<thead>
<tr>
<th>Sample depth</th>
<th>(a_D)</th>
<th>(a_W)</th>
<th>(n_D)</th>
<th>(n_W)</th>
<th>(\theta_r^{-1})</th>
<th>(\theta_s^D)</th>
<th>(\theta_s^W)</th>
<th>(K_s^D)</th>
<th>(K_s^W)</th>
</tr>
</thead>
<tbody>
<tr>
<td>(cm)</td>
<td>cm(^{-1})</td>
<td>cm(^{-1})</td>
<td>(-)</td>
<td>(-)</td>
<td>cm(^3) cm(^{-3})</td>
<td>cm(^3) cm(^{-3})</td>
<td>cm hr(^{-1})</td>
<td>cm hr(^{-1})</td>
<td></td>
</tr>
<tr>
<td>Layer 1</td>
<td>0.012</td>
<td>0.015</td>
<td>1.4</td>
<td>1.35</td>
<td>0.16</td>
<td>0.48</td>
<td>0.38</td>
<td>18.9</td>
<td>14.4</td>
</tr>
<tr>
<td>Layer 2</td>
<td>0.01</td>
<td>0.023</td>
<td>1.9</td>
<td>2.0</td>
<td>0.15</td>
<td>0.42</td>
<td>0.39</td>
<td>13.7</td>
<td>9.2</td>
</tr>
<tr>
<td>Layer 3(^1)</td>
<td>0.008</td>
<td>0.018</td>
<td>2.32</td>
<td>2.32</td>
<td>0.091</td>
<td>0.40</td>
<td>0.26</td>
<td>12.2</td>
<td>10.1</td>
</tr>
<tr>
<td>Layer 3(^2)</td>
<td>0.410</td>
<td>0.328</td>
<td>1.473</td>
<td>1.473</td>
<td>0.313</td>
<td>0.41</td>
<td>0.41</td>
<td>12.2</td>
<td>10.1</td>
</tr>
</tbody>
</table>

\(^1\) \(\theta_r^D\) is assumed to be the same as \(\theta_r^W\) and denoted as \(\theta_r\). \(^2\) TRIM-based model layer 3. \(^3\) RETC-based model layer 3 from field measurements.
Figure S1

- SP2 0 to 23 cm
- SP2, 23 to 75 cm
- SP2, 75 to 155 cm
- SP5, 50 to 80 cm

Grain size (mm)

Percent finer (%)

0.075 mm (No. 200 ASTM sieve)
Wetting $R^2$: 0.745
Drying $R^2$: 0.898

Wetting RETC fit, VG (1980) model
Drying RETC fit, VG (1980) model

Figure S2A

SP1 shallow
○ Drying in-situ data
○ Wetting in-situ data

Wetting $R^2$: 0.745
Drying $R^2$: 0.898

Figure S2B

SP2 deep

Wetting $R^2$: 0.865
Drying $R^2$: 0.878
Figure S2C

Soil-water content (cm$^3$ cm$^{-3}$)

Matric suction (kPa)

Wet matric suction

Drying R$^2$: 0.981
Wet R$^2$: 0.732

SP3 shallow

Figure S2D

Soil-water content (cm$^3$ cm$^{-3}$)

Matric suction (kPa)

Wet matric suction

Drying R$^2$: 0.931
Wet R$^2$: 0.820

SP5 shallow
Figure S2E

SP6 shallow

Drying RETC fit, VG (1980) model

Wetting RETC fit, VG (1980) model

Wetting R²: 0.561
Drying R²: 0.715

Figure S2F

SP7 shallow

Wetting R²: 0.351
Drying R²: 0.894

Soil-water content (cm³ cm⁻³)

Matric suction (kPa)

Logarithmic scale

Soil-water content (cm³ cm⁻³)
Figure S2G

SP8 shallow

Drying in-situ data
Wetting in-situ data

Drying RETC fit, VG (1980) model
Wetting RETC fit, VG (1980) model

Matric suction (kPa)

Soil-water content (cm³ cm⁻³)

Wetting R²: 0.853
Drying R²: 0.964

Figure S2H

SP8 deep

Wetting R²: 0.557
Drying R²: 0.852
Figure Captions

Figure S1. Particle-size distribution from the four repacked soil samples with locations shown in Figure 1A, B.

Figure S2. Best-fit relations of the van Genuchten (1980) model, using the software RETC, to field data for wetting and drying from paired soil-water content sensors and tensiometers. Instrument depths for each soil pit are given in Table 1 and van Genuchten (1980) parameters from RETC are given in Table 3. Wetting and drying data overlap is partially obscured because drying data are plotted atop the wetting. Drying data tend to be at higher suctions because well-defined drying events tended to be in the transition to the dry season when the site is already drying out. Wetting data tended to be at lower suctions because well-defined wetting events tended to be during the winter for prolonged storms. This trend is particularly true for deeper sensors. The earliest storm in each season, when you would expect wetting events at high suctions, tend take place when the tensiometers were at or exceeding the cavitation limit but were not re-established. (A) SP1 shallow. (B) SP2 deep. (C) SP3 shallow. (D) SP5 shallow. (E) SP6 shallow. (F) SP7 shallow. (G) SP8 shallow. (H) SP8 deep.