**Table 1.** Specifications of samples

|  |  |  |  |
| --- | --- | --- | --- |
| Code in UNSODA | Texture | Field data | Lab data |
| 1010 | Clay loam |  |  |
| 1121 | Sandy loam |  |  |
| 1330 | Silt |  |  |
| 1331 | Silt loam |  |  |
| 3341 | Sand |  |  |
| 3283 | Silty clay loam |  |  |
| 3281 | Clay |  |  |
| 3270 | Sandy clay loam |  |  |
| 3221 | Loam |  |  |
| 2103 | Loamy sand |  |  |

**Table 2.** Model reference equations

|  |  |  |
| --- | --- | --- |
| Model  | Function | Parameters |
| [Brooks and Corey [6]](file:///C%3A%5CUsers%5CKarina%20Bevins%5CDownloads%5CPreprint.docx#_ENREF_12) (BC) |  | , |
| [van Genuchten [53]](file:///C%3A%5CUsers%5CKarina%20Bevins%5CDownloads%5CPreprint.docx#_ENREF_6) (VG) |   | , , |
| [Fredlund and Xing [19]](file:///C%3A%5CUsers%5CKarina%20Bevins%5CDownloads%5CPreprint.docx#_ENREF_38)(FX) |  | , , |
| [Durner [14]](file:///C%3A%5CUsers%5CKarina%20Bevins%5CDownloads%5CPreprint.docx#_ENREF_39)(DB) |   | , ,, |
| [Kosugi [27]](file:///C%3A%5CUsers%5CKarina%20Bevins%5CDownloads%5CPreprint.docx#_ENREF_40) (LN) |  | , , |
| [Seki [46]](file:///C%3A%5CUsers%5CKarina%20Bevins%5CDownloads%5CPreprint.docx#_ENREF_41)(BL) |  | ,,,, |

h is the suction head; θ is the volumetric water content; Se is the effective water content (Effective saturation) defined by = . Therefore, θ = θr+(θs - θr)Se; In LN model, Q(x) is the complementary cumulative normal distribution function, defined by Q(x)=1-Φ(x), in which Φ(x) is a normalized form of the cumulative normal distribution function; Please note that Q(x) is different from error function; In BC model, λ is the index of pore size distribution. In VG and DB models, is reverse suction air entry to the soil, m is model asymmetric parameter and n is in connection with the soil pore size distribution. In the FX model, is Napier's constant; the FX model is implemented in SWRC Fit version 3.0 and higher. In the web interface, correction function, C (h) =1. In the offline version, the correction function can be changed; other parameters are soil hydraulic parameters to be estimated.

**Table 3.** The statistical benchmarks to estimating the fitting accuracy

|  |  |  |
| --- | --- | --- |
| Parameter | Describe | Calculation method |
| *AIC* | Akaike Information Criterion |  |
|  | Geometric Mean Error Ratio |  |
|  | Median Absolute Deviation |  |
|  | Mean Squared Error |  |
| *NS* | Nash–Sutcliffe model efficiency coefficient |  |
|  | Optimum Index Factor |  |
|  | Correlation Coefficient |  |
|  | Coefficient of Determination |  |
|  | Root Mean Square Error |  |
|  | Symmetric Mean Absolute Percent Error |  |

= Actual, =Correlation,, Standard deviation, n= number of samples, k= number of estimated parameters, = Mean of Actual

**Table 4.** Ranking of models according to BFM index

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Texture | Model | BFM | RANK | Texture | Model | BFM | RANK |
| clay loam (field data) | BC | 1.209884034 | 6 | clay loam (lab data) | BC | 0.999999993 | 6 |
| VG | 3.528405937 | 4 | VG | 7.248541525 | 5 |
| LN | 2.40755798 | 5 | LN | 6.743698257 | 4 |
| FX | 4.043467757 | 3 | FX | 8.345587424 | 3 |
| DB | 9.823732522 | 2 | DB | 8.955497009 | 1 |
| BL | 9.998084357 | 1 | BL | 8.912426049 | 2 |
| sandy loam (field data) | BC | 1.664957264 | 6 | sandy loam (lab data) | BC | 0.999999951 | 6 |
| VG | 7.932495978 | 2 | VG | 5.463650414 | 5 |
| LN | 7.483067164 | 4 | LN | 8.049575822 | 4 |
| FX | 7.721402481 | 3 | FX | 8.821957539 | 1 |
| DB | 9 | 1 | DB | 8.626950524 | 2 |
| BL | 6.492555284 | 5 | BL | 8.345301325 | 3 |
| silt (field data) | BC | 2.088145891 | 6 | silt (lab data) | BC | 1.076960137 | 6 |
| VG | 7.612377764 | 5 | VG | 2.602946052 | 4 |
| LN | 8.650653769 | 1 | LN | 1.641791359 | 5 |
| FX | 7.918757001 | 4 | FX | 3.414565682 | 3 |
| DB | 8.402570015 | 3 | DB | 9.687449418 | 2 |
| BL | 8.541269282 | 2 | BL | 9.740744942 | 1 |
| silt loam (field data) | BC | 8.849926953 | 1 | silt loam (lab data) | BC | 1.112261437 | 6 |
| VG | 3.539624182 | 4 | VG | 5.912781433 | 5 |
| LN | 2.58276687 | 6 | LN | 6.806167004 | 3 |
| FX | 3.78911914 | 3 | FX | 6.764440496 | 4 |
| DB | 6.869318073 | 2 | DB | 8.184678475 | 1 |
| BL | 3.136174548 | 5 | BL | 7.03548098 | 2 |
| sand (field data) | BC | 9.01457087 | 1 | sand (lab data) | BC | 2.925546452 | 4 |
| VG | 8.425266937 | 2 | VG | 5.660971221 | 3 |
| LN | 8.422838035 | 3 | LN | 2.521575451 | 6 |
| FX | 8.187096845 | 4 | FX | 2.255102858 | 5 |
| DB | 7.702176872 | 5 | DB | 8.553272776 | 1 |
| BL | 1.999996254 | 6 | BL | 7.71409109 | 2 |
| silty clay loam (field data) | BC | 9.927044313 | 3 | silty clay loam (lab data) | BC | 1.514638362 | 6 |
| VG | 9.930593176 | 2 | VG | 4.021008267 | 5 |
| LN | 2.774219706 | 5 | LN | 9.057179516 | 1 |
| FX | 9.955512418 | 1 | FX | 8.891357553 | 2 |
| DB | 8.990076371 | 4 | DB | 7.832332154 | 4 |
| BL | 1.012307762 | 6 | BL | 7.997653202 | 3 |
| clay (field data) | BC | 8.403669524 | 4 | clay (lab data) | BC | 1.962890835 | 5 |
| VG | 9.014229422 | 3 | VG | 1.476082331 | 6 |
| LN | 9.491062811 | 2 | LN | 9.817428497 | 2 |
| FX | 9.937298038 | 1 | FX | 9.829013813 | 1 |
| DB | 6.350243542 | 5 | DB | 9.317311551 | 4 |
| BL | 0.999999999 | 6 | BL | 9.505011003 | 3 |
| sandy clay loam (field data) | BC | 4.843875638 | 4 | sandy clay loam (lab data) | BC | 1.356880516 | 6 |
| VG | 1.02106594 | 6 | VG | 3.765239219 | 5 |
| LN | 1.619733283 | 5 | LN | 5.70822411 | 4 |
| FX | 6.515487653 | 3 | FX | 6.493758886 | 3 |
| DB | 9.973828108 | 1 | DB | 9.242187392 | 2 |
| BL | 9.186563337 | 2 | BL | 9.281002219 | 1 |

**Table 4.** Continued

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Texture | Model | BFM | RANK | Texture | Model | BFM | RANK |
| loam (field data) | BC | 1.812017445 | 6 | loam (lab data) | BC | 9.299071472 | 2 |
| VG | 6.607374601 | 4 | VG | 3.499417131 | 5 |
| LN | 7.465455394 | 3 | LN | 1 | 6 |
| FX | 5.494531219 | 5 | FX | 7.433891449 | 4 |
| DB | 9.648220532 | 1 | DB | 9.567100567 | 1 |
| BL | 8.260298169 | 2 | BL | 8.522889394 | 3 |
| loamy sand (field data) | BC | 1.999997659 | 6 | loamy sand (lab data) | BC | 1.474906371 | 6 |
| VG | 8.248199947 | 5 | VG | 5.633789599 | 4 |
| LN | 8.336462153 | 4 | LN | 5.951611739 | 3 |
| FX | 8.901326298 | 1 | FX | 7.7452524 | 2 |
| DB | 8.471022907 | 3 | DB | 4.912189465 | 5 |
| BL | 8.823015814 | 2 | BL | 9.285511961 | 1 |