**Supplementary material**

**Modelling of infiltration using artificial intelligence techniques in semi-arid Iran**

Parveen Sihag et al.

**Table S1.** Detail of dataset with statistical features. S: sand; C: clay, Si: silt; D: density; W: moisture content.

(a)

| Site no. | Serial no. | Time, *t* | S | C | Si | D | W | Cum. inf., *F*(*t*) | Inf. rate, *f*(*t*) |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 1 | 1 | 2.5 | 38 | 10 | 52 | 1.61 | 2.9 | 0.8 | 0.32 |
| 2 | 5 | 38 | 10 | 52 | 1.61 | 2.9 | 1.6 | 0.32 |
| 3 | 10 | 38 | 10 | 52 | 1.61 | 2.9 | 3.1 | 0.3 |
| 4 | 15 | 38 | 10 | 52 | 1.61 | 2.9 | 4.2 | 0.22 |
| 5 | 20 | 38 | 10 | 52 | 1.61 | 2.9 | 5.2 | 0.2 |
| 6 | 30 | 38 | 10 | 52 | 1.61 | 2.9 | 7.1 | 0.19 |
| 7 | 40 | 38 | 10 | 52 | 1.61 | 2.9 | 8.8 | 0.17 |
| 8 | 50 | 38 | 10 | 52 | 1.61 | 2.9 | 10.4 | 0.16 |
| 9 | 60 | 38 | 10 | 52 | 1.61 | 2.9 | 11.9 | 0.15 |
| 10 | 70 | 38 | 10 | 52 | 1.61 | 2.9 | 13.4 | 0.15 |
| 2 | 11 | 2.5 | 30 | 12 | 58 | 1.42 | 3.08 | 0.8 | 0.32 |
| 12 | 5 | 30 | 12 | 58 | 1.42 | 3.08 | 1.5 | 0.28 |
| 13 | 10 | 30 | 12 | 58 | 1.42 | 3.08 | 2.5 | 0.2 |
| 14 | 15 | 30 | 12 | 58 | 1.42 | 3.08 | 3.3 | 0.16 |
| 15 | 20 | 30 | 12 | 58 | 1.42 | 3.08 | 4 | 0.14 |
| 16 | 30 | 30 | 12 | 58 | 1.42 | 3.08 | 5.2 | 0.12 |
| 17 | 40 | 30 | 12 | 58 | 1.42 | 3.08 | 6.3 | 0.11 |
| 18 | 50 | 30 | 12 | 58 | 1.42 | 3.08 | 7.4 | 0.11 |
| 19 | 60 | 30 | 12 | 58 | 1.42 | 3.08 | 8.5 | 0.11 |
| 20 | 70 | 30 | 12 | 58 | 1.42 | 3.08 | 9.6 | 0.11 |
| 3 | 21 | 2.5 | 38 | 12 | 50 | 1.79 | 2.58 | 0.9 | 0.36 |
| 22 | 5 | 38 | 12 | 50 | 1.79 | 2.58 | 1.7 | 0.32 |
| 23 | 10 | 38 | 12 | 50 | 1.79 | 2.58 | 3.1 | 0.28 |
| 24 | 15 | 38 | 12 | 50 | 1.79 | 2.58 | 4.3 | 0.24 |
| 25 | 20 | 38 | 12 | 50 | 1.79 | 2.58 | 5.4 | 0.22 |
| 26 | 30 | 38 | 12 | 50 | 1.79 | 2.58 | 7.5 | 0.21 |
| 27 | 40 | 38 | 12 | 50 | 1.79 | 2.58 | 9.2 | 0.17 |
| 28 | 50 | 38 | 12 | 50 | 1.79 | 2.58 | 10.8 | 0.16 |
| 29 | 60 | 38 | 12 | 50 | 1.79 | 2.58 | 12.2 | 0.14 |
| 30 | 70 | 38 | 12 | 50 | 1.79 | 2.58 | 13.6 | 0.14 |
| 4 | 31 | 2.5 | 38 | 12 | 50 | 1.63 | 2.49 | 0.9 | 0.36 |
| 32 | 5 | 36 | 14 | 50 | 1.63 | 2.49 | 1.7 | 0.32 |
| 33 | 10 | 36 | 14 | 50 | 1.63 | 2.49 | 3 | 0.26 |
| 34 | 15 | 36 | 14 | 50 | 1.63 | 2.49 | 4.3 | 0.26 |
| 35 | 20 | 36 | 14 | 50 | 1.63 | 2.49 | 5.4 | 0.22 |
| 36 | 30 | 36 | 14 | 50 | 1.63 | 2.49 | 7 | 0.16 |
| 37 | 40 | 36 | 14 | 50 | 1.63 | 2.49 | 8.4 | 0.14 |
| 38 | 50 | 36 | 14 | 50 | 1.63 | 2.49 | 9.7 | 0.13 |
| 39 | 60 | 36 | 14 | 50 | 1.63 | 2.49 | 11 | 0.13 |
| 40 | 70 | 36 | 14 | 50 | 1.63 | 2.49 | 12.3 | 0.13 |
| 5 | 41 | 2.5 | 30 | 26 | 44 | 1.36 | 2.43 | 1.6 | 0.64 |
| 42 | 5 | 30 | 26 | 44 | 1.36 | 2.43 | 2.7 | 0.44 |
| 43 | 10 | 30 | 26 | 44 | 1.36 | 2.43 | 4.8 | 0.42 |
| 44 | 15 | 30 | 26 | 44 | 1.36 | 2.43 | 6.5 | 0.34 |
| 45 | 20 | 30 | 26 | 44 | 1.36 | 2.43 | 8.3 | 0.36 |
| 46 | 25 | 30 | 26 | 44 | 1.36 | 2.43 | 9.8 | 0.3 |
| 47 | 30 | 30 | 26 | 44 | 1.36 | 2.43 | 11.3 | 0.3 |
| 48 | 35 | 30 | 26 | 44 | 1.36 | 2.43 | 12.7 | 0.28 |
| 49 | 40 | 30 | 26 | 44 | 1.36 | 2.43 | 14.1 | 0.28 |
| 6 | 50 | 2.5 | 26 | 25 | 49 | 1.448 | 2.37 | 1.4 | 0.56 |
| 51 | 5 | 26 | 25 | 49 | 1.448 | 2.37 | 2.3 | 0.36 |
| 52 | 10 | 26 | 25 | 49 | 1.448 | 2.37 | 3.5 | 0.24 |
| 53 | 15 | 26 | 25 | 49 | 1.448 | 2.37 | 4.8 | 0.26 |
| 54 | 20 | 26 | 25 | 49 | 1.448 | 2.37 | 5.9 | 0.22 |
| 55 | 25 | 26 | 25 | 49 | 1.448 | 2.37 | 6.9 | 0.2 |
| 56 | 30 | 26 | 25 | 49 | 1.448 | 2.37 | 7.9 | 0.2 |
| 57 | 35 | 26 | 25 | 49 | 1.448 | 2.37 | 8.9 | 0.2 |
| 58 | 40 | 26 | 25 | 49 | 1.448 | 2.37 | 9.9 | 0.2 |
| 7 | 59 | 2.5 | 33 | 16 | 51 | 1.4 | 2.48 | 1.5 | 0.6 |
| 60 | 5 | 33 | 16 | 51 | 1.4 | 2.48 | 2.5 | 0.4 |
| 61 | 10 | 33 | 16 | 51 | 1.4 | 2.48 | 4 | 0.3 |
| 62 | 15 | 33 | 16 | 51 | 1.4 | 2.48 | 5.4 | 0.28 |
| 63 | 20 | 33 | 16 | 51 | 1.4 | 2.48 | 6.7 | 0.26 |
| 64 | 25 | 33 | 16 | 51 | 1.4 | 2.48 | 8 | 0.26 |
| 65 | 30 | 33 | 16 | 51 | 1.4 | 2.48 | 9 | 0.2 |
| 66 | 35 | 33 | 16 | 51 | 1.4 | 2.48 | 10 | 0.2 |
| 67 | 40 | 33 | 16 | 51 | 1.4 | 2.48 | 11 | 0.2 |
| 8 | 68 | 2.5 | 20 | 18 | 62 | 1.08 | 3.84 | 0.3 | 0.12 |
| 69 | 5 | 20 | 18 | 62 | 1.08 | 3.84 | 0.6 | 0.12 |
| 70 | 10 | 20 | 18 | 62 | 1.08 | 3.84 | 1 | 0.08 |
| 71 | 15 | 20 | 18 | 62 | 1.08 | 3.84 | 1.5 | 0.1 |
| 72 | 20 | 20 | 18 | 62 | 1.08 | 3.84 | 1.9 | 0.08 |
| 73 | 25 | 20 | 18 | 62 | 1.08 | 3.84 | 2.3 | 0.08 |
| 74 | 30 | 20 | 18 | 62 | 1.08 | 3.84 | 2.7 | 0.08 |
| 75 | 35 | 20 | 18 | 62 | 1.08 | 3.84 | 3.1 | 0.08 |
| 76 | 40 | 20 | 18 | 62 | 1.08 | 3.84 | 3.5 | 0.08 |
| 77 | 45 | 20 | 18 | 62 | 1.08 | 3.84 | 3.9 | 0.08 |
| 9 | 78 | 2.5 | 17 | 28 | 55 | 1.3 | 2.24 | 2 | 0.8 |
| 79 | 5 | 17 | 28 | 55 | 1.3 | 2.24 | 3 | 0.4 |
| 80 | 10 | 17 | 28 | 55 | 1.3 | 2.24 | 4.8 | 0.36 |
| 81 | 15 | 17 | 28 | 55 | 1.3 | 2.24 | 6.3 | 0.3 |
| 82 | 20 | 17 | 28 | 55 | 1.3 | 2.24 | 7.5 | 0.24 |
| 83 | 25 | 17 | 28 | 55 | 1.3 | 2.24 | 8.8 | 0.26 |
| 84 | 30 | 17 | 28 | 55 | 1.3 | 2.24 | 10 | 0.24 |
| 85 | 35 | 17 | 28 | 55 | 1.3 | 2.24 | 11.2 | 0.24 |
| 86 | 40 | 17 | 28 | 55 | 1.3 | 2.24 | 12.4 | 0.24 |
| 87 | 45 | 17 | 28 | 55 | 1.3 | 2.24 | 13.6 | 0.24 |
| 10 | 88 | 2.5 | 19 | 16 | 65 | 1.27 | 1.66 | 1.1 | 0.44 |
| 89 | 5 | 19 | 16 | 65 | 1.27 | 1.66 | 1.8 | 0.28 |
| 90 | 10 | 19 | 16 | 65 | 1.27 | 1.66 | 2.9 | 0.22 |
| 91 | 15 | 19 | 16 | 65 | 1.27 | 1.66 | 3.7 | 0.16 |
| 92 | 20 | 19 | 16 | 65 | 1.27 | 1.66 | 4.3 | 0.12 |
| 93 | 25 | 19 | 16 | 65 | 1.27 | 1.66 | 4.8 | 0.1 |
| 94 | 30 | 19 | 16 | 65 | 1.27 | 1.66 | 5.3 | 0.1 |
| 95 | 35 | 19 | 16 | 65 | 1.27 | 1.66 | 5.8 | 0.1 |
| 96 | 40 | 19 | 16 | 65 | 1.27 | 1.66 | 6.3 | 0.1 |
| 97 | 45 | 19 | 16 | 65 | 1.27 | 1.66 | 6.8 | 0.1 |
| 11 | 98 | 5 | 29 | 18 | 53 | 1.4 | 2.18 | 1.8 | 0.28 |
| 99 | 2.5 | 29 | 18 | 53 | 1.4 | 2.18 | 1.1 | 0.44 |
| 100 | 10 | 29 | 18 | 53 | 1.4 | 2.18 | 2.9 | 0.22 |
| 101 | 15 | 29 | 18 | 53 | 1.4 | 2.18 | 3.8 | 0.18 |
| 102 | 20 | 29 | 18 | 53 | 1.4 | 2.18 | 4.7 | 0.18 |
| 103 | 25 | 29 | 18 | 53 | 1.4 | 2.18 | 5.5 | 0.16 |
| 104 | 30 | 29 | 18 | 53 | 1.4 | 2.18 | 6.4 | 0.18 |
| 105 | 35 | 29 | 18 | 53 | 1.4 | 2.18 | 7.1 | 0.14 |
| 106 | 40 | 29 | 18 | 53 | 1.4 | 2.18 | 7.8 | 0.14 |
| 12 | 107 | 2.5 | 29 | 20 | 51 | 1.24 | 1.71 | 1.9 | 0.76 |
| 108 | 5 | 29 | 20 | 51 | 1.24 | 1.71 | 2.6 | 0.28 |
| 109 | 10 | 29 | 20 | 51 | 1.24 | 1.71 | 3.9 | 0.26 |
| 110 | 15 | 29 | 20 | 51 | 1.24 | 1.71 | 4.8 | 0.18 |
| 111 | 20 | 29 | 20 | 51 | 1.24 | 1.71 | 5.7 | 0.18 |
| 112 | 25 | 29 | 20 | 51 | 1.24 | 1.71 | 6.5 | 0.16 |
| 113 | 30 | 29 | 20 | 51 | 1.24 | 1.71 | 7.2 | 0.14 |
| 114 | 35 | 29 | 20 | 51 | 1.24 | 1.71 | 7.9 | 0.14 |
| 115 | 40 | 29 | 20 | 51 | 1.24 | 1.71 | 8.6 | 0.14 |
| 13 | 116 | 2.5 | 27 | 24 | 49 | 1.32 | 1.95 | 1.2 | 0.48 |
| 117 | 5 | 27 | 24 | 49 | 1.32 | 1.95 | 1.8 | 0.24 |
| 118 | 10 | 27 | 24 | 49 | 1.32 | 1.95 | 2.7 | 0.18 |
| 119 | 15 | 27 | 24 | 49 | 1.32 | 1.95 | 3.6 | 0.18 |
| 120 | 20 | 27 | 24 | 49 | 1.32 | 1.95 | 4.5 | 0.18 |
| 121 | 25 | 27 | 24 | 49 | 1.32 | 1.95 | 5.3 | 0.16 |
| 122 | 30 | 27 | 24 | 49 | 1.32 | 1.95 | 6.1 | 0.16 |
| 123 | 35 | 27 | 24 | 49 | 1.32 | 1.95 | 6.9 | 0.16 |
| 124 | 40 | 27 | 24 | 49 | 1.32 | 1.95 | 7.7 | 0.16 |
| 14 | 125 | 2.5 | 11 | 52 | 37 | 1.56 | 2.42 | 0.9 | 0.36 |
| 126 | 5 | 11 | 52 | 37 | 1.56 | 2.42 | 1.4 | 0.2 |
| 127 | 10 | 11 | 52 | 37 | 1.56 | 2.42 | 2.2 | 0.16 |
| 128 | 15 | 11 | 52 | 37 | 1.56 | 2.42 | 3.1 | 0.18 |
| 129 | 20 | 11 | 52 | 37 | 1.56 | 2.42 | 3.7 | 0.12 |
| 130 | 25 | 11 | 52 | 37 | 1.56 | 2.42 | 4.5 | 0.16 |
| 131 | 30 | 11 | 52 | 37 | 1.56 | 2.42 | 5.1 | 0.12 |
| 132 | 35 | 11 | 52 | 37 | 1.56 | 2.42 | 5.7 | 0.12 |
| 133 | 40 | 11 | 52 | 37 | 1.56 | 2.42 | 6.3 | 0.12 |
| 134 | 45 | 11 | 52 | 37 | 1.56 | 2.42 | 6.9 | 0.12 |
| 15 | 135 | 2.5 | 6 | 50 | 44 | 1.46 | 2.3 | 3.7 | 1.48 |
| 136 | 5 | 6 | 50 | 44 | 1.46 | 2.3 | 6 | 0.92 |
| 137 | 10 | 6 | 50 | 44 | 1.46 | 2.3 | 9.8 | 0.76 |
| 138 | 15 | 6 | 50 | 44 | 1.46 | 2.3 | 13 | 0.64 |
| 139 | 20 | 6 | 50 | 44 | 1.46 | 2.3 | 15.5 | 0.5 |
| 140 | 25 | 6 | 50 | 44 | 1.46 | 2.3 | 17.9 | 0.48 |
| 141 | 30 | 6 | 50 | 44 | 1.46 | 2.3 | 19.8 | 0.38 |
| 142 | 35 | 6 | 50 | 44 | 1.46 | 2.3 | 21.7 | 0.38 |
| 143 | 40 | 6 | 50 | 44 | 1.46 | 2.3 | 23.6 | 0.38 |
| 144 | 45 | 6 | 50 | 44 | 1.46 | 2.3 | 25.5 | 0.38 |
| 16 | 145 | 2.5 | 21 | 42 | 37 | 1.37 | 1.95 | 3.9 | 1.56 |
| 146 | 5 | 21 | 42 | 37 | 1.37 | 1.95 | 7.7 | 1.52 |
| 147 | 10 | 21 | 42 | 37 | 1.37 | 1.95 | 11.4 | 0.74 |
| 148 | 15 | 21 | 42 | 37 | 1.37 | 1.95 | 14.6 | 0.64 |
| 149 | 20 | 21 | 42 | 37 | 1.37 | 1.95 | 17.1 | 0.5 |
| 150 | 25 | 21 | 42 | 37 | 1.37 | 1.95 | 19.5 | 0.48 |
| 151 | 30 | 21 | 42 | 37 | 1.37 | 1.95 | 21.4 | 0.38 |
| 152 | 35 | 21 | 42 | 37 | 1.37 | 1.95 | 23.3 | 0.38 |
| 153 | 40 | 21 | 42 | 37 | 1.37 | 1.95 | 25.2 | 0.38 |
| 154 | 45 | 21 | 42 | 37 | 1.37 | 1.95 | 27.1 | 0.38 |

(b)

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Range | Time, *t* (min) | | | | | | Sand (%) | | | Clay (%) | | |
| Train | Test | | | Total | | Train | Test | Total | Train | Test | Total |
| Lower | 2.5 | 2.5 | | | 2.5 | | 6 | 6 | 6 | 10 | 10 | 10 |
| Higher | 70 | 70 | | | 70 | | 38 | 36 | 38 | 52 | 52 | 52 |
| Mean | 23.3654 | 24.8 | | | 23.8312 | | 24.5769 | 25.06 | 24.7338 | 25.9615 | 25.4 | 25.7792 |
| SD | 16.8329 | 16.7426 | | | 16.7624 | | 10.1806 | 9.9579 | 10.0788 | 13.2342 | 12.7855 | 13.0511 |
| Kurtosis | –0.1992 | 0.5175 | | | –0.0106 | | –0.8007 | –0.5936 | –0.7541 | –0.2291 | 0.216 | –0.1334 |
| Skewness | 0.6376 | 0.801 | | | 0.6794 | | –0.6188 | –0.7082 | –0.6411 | 1.1172 | 1.2455 | 1.1463 |
| Range | Silt (%) | | | | | | Density (gm/cm3) | | | Moisture content (%) | | |
| Train | | | Test | | Total | Train | Test | Total | Train | Test | Total |
| Lower | 37 | | | 37 | | 37 | 1.08 | 1.08 | 1.08 | 1.66 | 1.66 | 1.66 |
| Higher | 65 | | | 65 | | 65 | 1.79 | 1.79 | 1.79 | 3.84 | 3.84 | 3.84 |
| Mean | 49.4615 | | | 49.54 | | 49.487 | 1.4209 | 1.4128 | 1.4183 | 2.3995 | 2.4626 | 2.42 |
| SD | 7.0833 | | | 7.172 | | 7.0888 | 0.1688 | 0.1704 | 0.1688 | 0.5154 | 0.5567 | 0.5282 |
| Kurtosis | –0.2657 | | | –0.3131 | | –0.3109 | 0.0577 | 0.28 | 0.0902 | 1.5208 | 1.0504 | 1.2803 |
| Skewness | 0.5802 | | | 0.6171 | | 0.5864 | 0.3365 | 0.1998 | 0.2888 | 1.0544 | 0.9893 | 1.0281 |
| Range | Cumulative infiltration, *F*(*t*)(cm) | | | | | | Infiltration rate, *f*(*t*)(cm/h) | | |  |  |  |
|  |  |  |
| Train | | Test | | Total | | Train | Test | Total |  |  |  |
| Lower | 0.3 | | 0.8 | | 0.3 | | 0.08 | 0.08 | 0.08 |  |  |  |
| Higher | 27.1 | | 23.3 | | 27.1 | | 1.56 | 1.52 | 1.56 |  |  |  |
| Mean | 6.9827 | | 6.878 | | 6.9487 | | 0.292 | 0.2648 | 0.2832 |  |  |  |
| Std. Dev. | 5.7887 | | 4.979 | | 5.5227 | | 0.2385 | 0.2322 | 0.236 |  |  |  |
| Kurtosis | 2.5744 | | 2.442 | | 2.5669 | | 12.418 | 18.117 | 13.4717 |  |  |  |
| Skewness | 1.5959 | | 1.434 | | 1.5604 | | 3.0417 | 3.7983 | 3.2292 |  |  |  |