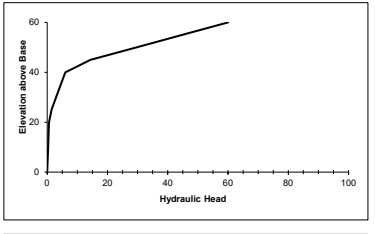
Direct solution for flux

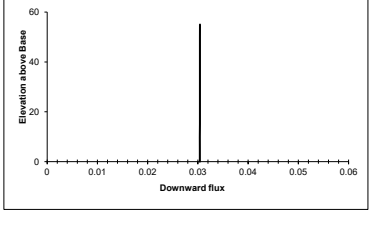
| | K | num cells |
|---|---|---|
| zone 1 | 0.01 | 4 |
| zone 2 | 0.1 | 4 |
| zone 3 | 1 | 5 |
| | | |
| Keq | 0.02921 | |
| q | 0.02921 | |

| z | K zone cell | K cell | H | q | zone 1 | zone 2 | zone 3 |
|---|---|---|---|---|---|---|---|
| 60 | 1 | 0.01 | 60 | | 1 | 0 | 0 |
| 55 | 1 | 0.01 | 44.7903 | 0.03042 | 1 | 0 | 0 |
| 50 | 1 | 0.01 | 29.5807 | 0.03042 | 1 | 0 | 0 |
| 45 | 1 | 0.01 | 14.3712 | 0.03042 | 1 | 0 | 0 |
| 40 | 2 | 0.1 | 6.00616 | 0.03042 | 0 | 1 | 0 |
| 35 | 2 | 0.1 | 4.4854 | 0.03042 | 0 | 1 | 0 |
| 30 | 2 | 0.1 | 2.96474 | 0.03041 | 0 | 1 | 0 |
| 25 | 2 | 0.1 | 1.44417 | 0.03041 | 0 | 1 | 0 |
| 20 | 3 | 1 | 0.60791 | 0.03041 | 0 | 0 | 1 |
| 15 | 3 | 1 | 0.4559 | 0.0304 | 0 | 0 | 1 |
| 10 | 3 | 1 | 0.30392 | 0.0304 | 0 | 0 | 1 |
| 5 | 3 | 1 | 0.15196 | 0.03039 | 0 | 0 | 1 |
| 0 | 3 | 1 | 0 | 0.03039 | 0 | 0 | 1 |

Map of node and cell numbers

| | node | cell | |
|---|---|---|---|
| 1 | - | | 1 |
| 2 | - | | 2 |
| 3 | - | | 3 |
| 4 | - | | 4 |
| 5 | - | | 5 |
| 6 | - | | 6 |
| 7 | - | | 7 |
| 8 | - | | 8 |
| 9 | - | | 9 |
| 10 | - | | 10 |
| 11 | - | | 11 |
| 12 | - | | 12 |
| 13 | - | | 13 |




The Challenge:

**Create a 1D, vertical steady state model with constant head top and bottom boundaries.**

Show, based on the flux with depth, that the model is steady state.
Repeat this for a homogeneous and for a **heterogeneous** column.

**Show that the steady state flux agrees with the direct calculation based on the harmonic mean average K.**

**Show the steady state head profile for a column with approximately equal-thickness layers with different K values.**
Use this profile to explain why the equivalent hydraulic conductivity, **Keq, is closer to the lower of the K values.**

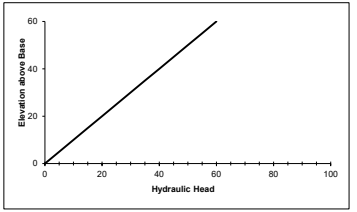
Direct solution for flux

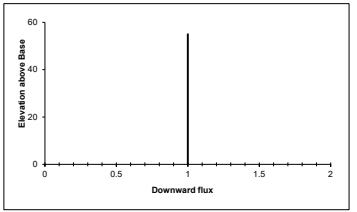
| | K | num cells |
|---|---|---|
| zone 1 | 1 | 12 |
| zone 2 | 1 | 0 |
| zone 3 | 1 | 0 |
| | | |
| Keq | 1 | |
| q | 1 | |

| z | K zone cell | K cell | H | q | zone 1 | zone 2 | zone 3 |
|---|---|---|---|---|---|---|---|
| 60 | 1 | 1 | 60 | | 1 | 0 | 0 |
| 55 | 1 | 1 | 55 | 1 | 1 | 0 | 0 |
| 50 | 1 | 1 | 50 | 1 | 1 | 0 | 0 |
| 45 | 1 | 1 | 45 | 1 | 1 | 0 | 0 |
| 40 | 1 | 1 | 40 | 1 | 1 | 0 | 0 |
| 35 | 1 | 1 | 35 | 1 | 1 | 0 | 0 |
| 30 | 1 | 1 | 30 | 1 | 1 | 0 | 0 |
| 25 | 1 | 1 | 25 | 1 | 1 | 0 | 0 |
| 20 | 1 | 1 | 20 | 1 | 1 | 0 | 0 |
| 15 | 1 | 1 | 15 | 1 | 1 | 0 | 0 |
| 10 | 1 | 1 | 10 | 1 | 1 | 0 | 0 |
| 5 | 1 | 1 | 5 | 1 | 1 | 0 | 0 |
| 0 | 1 | 1 | 0 | 1 | 1 | 0 | 0 |

Map of node and cell numbers

| | node | cell | |
|---|---|---|---|
| 1 | - | | 1 |
| 2 | - | | 2 |
| 3 | - | | 3 |
| 4 | - | | 4 |
| 5 | - | | 5 |
| 6 | - | | 6 |
| 7 | - | | 7 |
| 8 | - | | 8 |
| 9 | - | | 9 |
| 10 | - | | 10 |
| 11 | - | | 11 |
| 12 | - | | 12 |
| 13 | - | | 13 |

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