|  |  |  |  |
| --- | --- | --- | --- |
| ***Type*** | **Model** | **approach** | **example** |
| **1D** | Drainmod | Tipping bucket+ combination of Kirkham equation and Hooghhoudt | [Skaggs et al. 2011](https://elibrary.asabe.org/abstract.asp?aid=42259#:~:text=DRAINMOD%20is%20a%20process%2Dbased,cases%2C%20in%20the%20drainage%20system.)  [Liang et al. 2018](file:///\\srvdfs6\home_p39\amehmandoostkotlar\Downloads\1-s2.0-S037837741730330X-main.pdf) |
| Swap | Richards equation+ various approaches (Hooghhoudt, resistances…) | [Jooni et al. 2018](https://www.sciencedirect.com/science/article/pii/S037837741830917X?via%3Dihub) |
| Hydrus-1D | Richards equation+ various approaches (Hooghhoudt, Ernst) |  |
| RZWQM | Richards equation+ Hooghhoudt | [Jiang et al. 2018](https://reader.elsevier.com/reader/sd/pii/S0168169917303678?token=FD75C455EFCDF4BEF3EB632A9DEBA3EAF8EA55C43FAED03E31BCBFB5BF2A97408C27021E8675A380A376B829CA8E24BD&originRegion=eu-west-1&originCreation=20230501174101) |
| **2D** | Hydrus 2D | Richards equation+ seepage face | [Gärdenäs et al 2006](https://www.sciencedirect.com/science/article/pii/S0022169406001521)  [Dou et al. 2022](https://reader.elsevier.com/reader/sd/pii/S0378377422004462?token=C972BEF4FB4FD0D1C8FBA0489240A19E5D5D3E6C91837537B3D4FBA0CFDE499A48197A27B806378E86B192AD11894E6E&originRegion=eu-west-1&originCreation=20230501181239) |
| **3D** | Sutra | Richards equation+ define sink term | [Van de Craats et al. 2021](https://agupubs.onlinelibrary.wiley.com/doi/full/10.1029/2021WR029623) |
| Comsol | Richards equation+define sink term |  |
| Hydrus 3D | Richards equation+ seepage face |  |

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| --- | --- | --- | --- |
| Type | Model | approach | example |
| 1D | Drainmod | Tipping bucket+ combination of Kirkham equation and Hooghhoudt | [Skaggs et al. 2011](https://elibrary.asabe.org/abstract.asp?aid=42259#:~:text=DRAINMOD%20is%20a%20process%2Dbased,cases%2C%20in%20the%20drainage%20system.)  [Liang et al. 2018](file:///\\srvdfs6\home_p39\amehmandoostkotlar\Downloads\1-s2.0-S037837741730330X-main.pdf) |
|  | Swap | Richards equation+ various approaches (Hooghhoudt, resistances…) | [Jooni et al. 2018](https://www.sciencedirect.com/science/article/pii/S037837741830917X?via%3Dihub) |
|  | Hydrus-1D | Richards equation+ various approaches (Hooghhoudt, Ernst) |  |
|  | RZWQM | Richards equation+ Hooghhoudt | [Jiang et al. 2018](https://reader.elsevier.com/reader/sd/pii/S0168169917303678?token=FD75C455EFCDF4BEF3EB632A9DEBA3EAF8EA55C43FAED03E31BCBFB5BF2A97408C27021E8675A380A376B829CA8E24BD&originRegion=eu-west-1&originCreation=20230501174101) |
| 2D | Hydrus 2D  SWMS-2D | Same as Hydrus 1D | [Gärdenäs et al 2006](https://www.sciencedirect.com/science/article/pii/S0022169406001521)  [Dou et al. 2022](https://reader.elsevier.com/reader/sd/pii/S0378377422004462?token=C972BEF4FB4FD0D1C8FBA0489240A19E5D5D3E6C91837537B3D4FBA0CFDE499A48197A27B806378E86B192AD11894E6E&originRegion=eu-west-1&originCreation=20230501181239) |
| 3D | Sutra |  | [Van de Craats et al. 2021](https://agupubs.onlinelibrary.wiley.com/doi/full/10.1029/2021WR029623) |
|  | Comsol- Multiphysics | Richards equation, define sink term |  |
|  | Hydrus 3D | Same as Hydrus 1D |  |

Drainage in Richards equation based problems are stated in sink term

In drainmode

Graphical user interface, text, application

Description automatically generated

Text, letter

Description automatically generated

 the variables from Cum\_Q.out are:

CumQ1 gives cumulative flux through the constant head boundary. Thus it is horizontal flow.

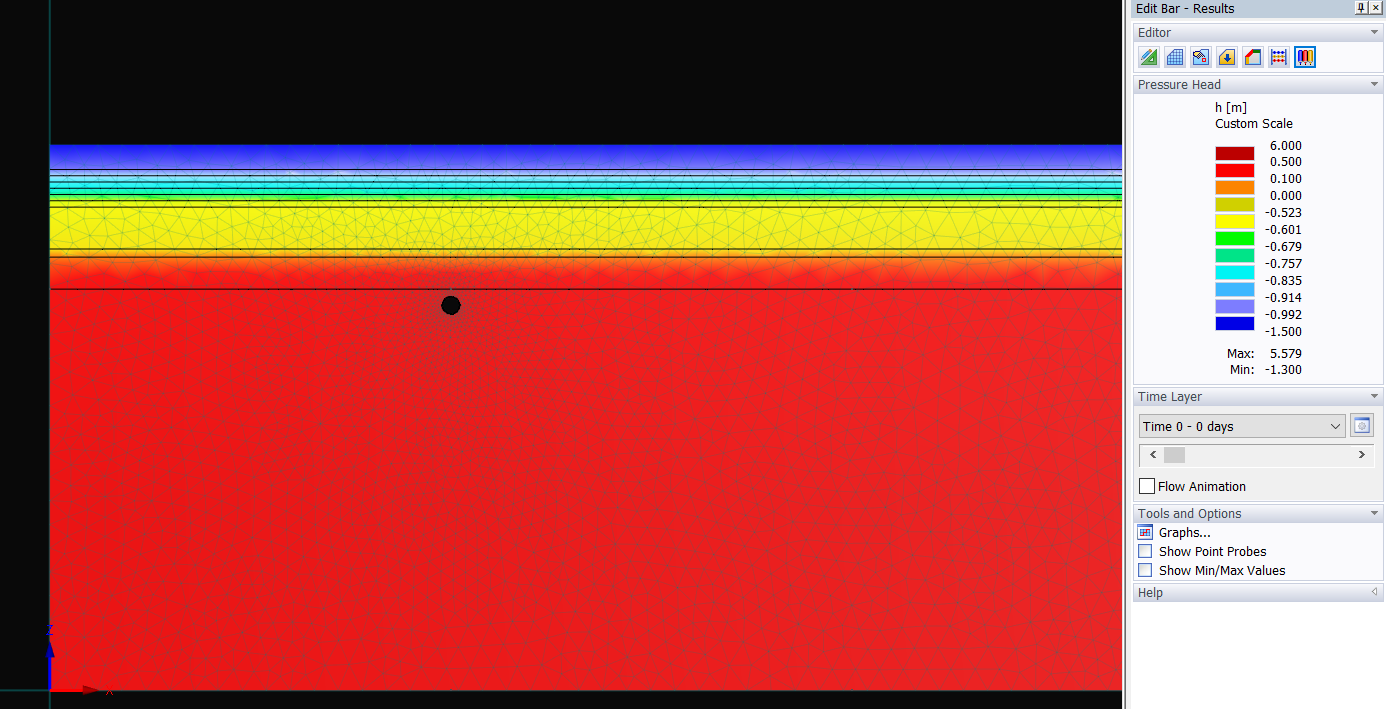
CumQS = Cumulative total value of the flux across a potential seepage faces

Ta = CumQR = Cumulative total actual transpiration rate

I = cInfiltr = Cumulative infiltration flux across the atmospheric boundary  
Ea = cEvapor = Cumulative evaporation flux across the atmospheric boundary

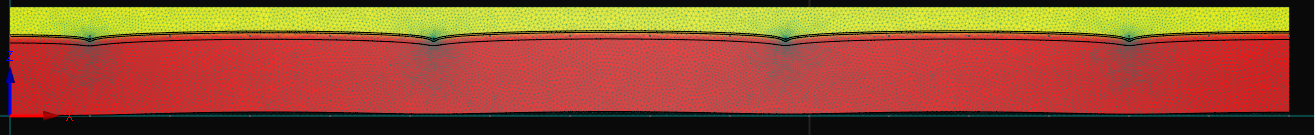
the variables from v\_Mean.out are:  
I = Infiltr = Average infiltration flux per unit atmospheric boundary  
Ea = Evapor = Average evaporation flux per unit atmospheric boundary  
Ta = vRoot = Actual transpiration rate  
Seep = vSeep = Total value of the boundary flux across a potential seepage face

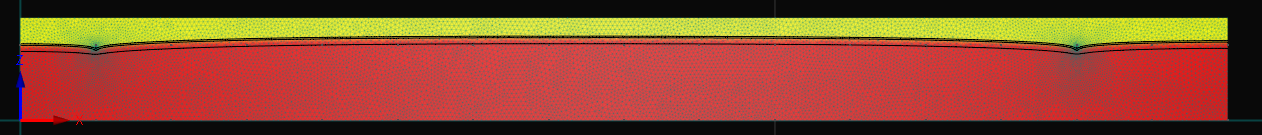
Initial Condition



Top boundary condition: constant flux rate 1 cm/d

Case1: 2 pipes 65m and 4pipes

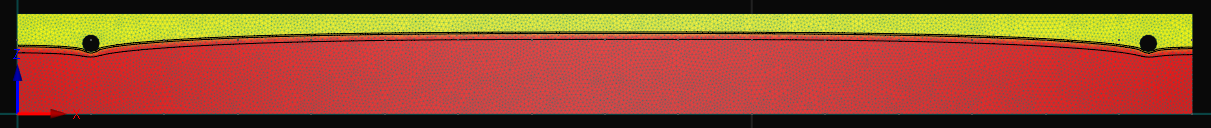




A picture containing shape

Description automatically generated

Case 2 : equivalent ditch



A picture containing chart

Description automatically generated

