## Hydro FV Assignment 1

**Finite Volumes in space, stationary, 1D (saturated groundwater flow)**

* Know the steps to set up a numerical flow model (stationary, spatial 1D)
* Understand the concepts of internal and external fluxes
* Understand the difference between linear and nonlinear system flow functions
* Evaluate model results by checking convergence, analytical solutions and water balances
* Understand how the 1D groundwater model behaves by checking sensitivities
* Working with spatially varying parameters

Notes: Can be better structured. Implementing 3 different varying kD-fields is maybe a bit too much, you get the idea after one.

## Hydro FV assignment 2

**Finite Volumes in space & time, 1D (saturated groundwater flow)**

* Build a transient flow model (1D groundwater flow)
* Understand why in transient modelling a storage flux and storage coefficient are needed
* Analyse flows in a groundwater model by using a water balance
* Know how to store intermediate results from a transient model
* Understand the difference between the results of linear and nonlinear descriptions of groundwater flow
* Add real recharge data to the model

Notes: You are asked to do all kinds of things and make many plots, but you are asked very little to *understand* these plots. I would add more understanding questions. Also maybe a little less attention to the well (end of 1.2).

## Hydro FVFE assignment 3

**Finite Volumes space & time, 1D (unsaturated flow)**

* Understand unsaturated flow state variables and formulas
* Understand hydraulic relationships for different soil types
* Understand the setup of an unsaturated zone model (dimensions, flow type, boundary conditions)
* Understand equilibrium moisture profiles
* Set up a stationary and transient unsaturated flow model
* Apply initialisation in a model run
* Understand the effect of soil type, groundwater level and numerical method (FV vs FE) on the results of the transient unsaturated zone model
* Understand the value of the simple unsaturated flow models in terms of water management (ponding, capillary rise, recharge to groundwater, plant water use)
* Run the transient unsaturated flow model with real recharge data
* Apply actual evapotranspiration / root extraction using a Feddes function

Notes: the part where you investigate theta-psi-K relationships for different soil types takes quite a lot of time (even just finding out which code belongs to which soil). Assignment 4.2 and 5 are very nice for the applied track because they show the ‘real world’ applications of the model and become quite realistic. However, some parts may again take a lot of time; and they may be a bit too much soil-focused for the meteorology people.

## Hydro FVFE assignment 4

**Finite Volumes & Elements space (stationary), 2D groundwater flow**

* Build a 2D groundwater flow model in X-Y and Y-Z direction
* Understand different node distributions and get an idea of how the package creates these
* Understand the difference in spatial discretisation and results between FV and FE
* Get an understanding of different 2D interpolation methods and how the package performs these
* Implement point and line fluxes in a spatial model
* Understand the meaning of different types of boundary conditions
* Analyse flow in the 2D model using flux vectors
* Understand the behaviour of the model by checking sensitivities

Notes: Needs to be converted to Markdown. Names of the graphs in the answers can be better/ more consistent. In this exercise there are some numerical things that could be nice for the theoretical people to elaborate on.