Irrigation model

Modelling the irrigation is supported in several ways. There are four methods implemented:

- Irrigation Schedule 1 (code 1)
  - month/day and amount are given for a number of irrigation events during the year
    Example:

```
count MM1  DD1   amnt1   MM2   DD2   amnt2   MM3   DD3   amnt3
3     5    15    80      6     1     80      6     15    80
```

- Irrigation Schedule 2 (code 2)
  - Version 1: start date, end date, interval, and the amount are given
    Example:

```
starting from 05 01 with 20 mm to 07 31 with 20 mm every 15 days
```

  - Version 2: start date, count of events, interval, and the amount are given
    Example:

```
starting from 05 01 with 20 mm 7 times every 14 days
```

- Demand driven - by suction (code 3)
  - irrigation starts as soon as the suction (pore pressure) falls below a threshold (ψ_{start}).
  - The irrigation amount is calculated as the amount of water required to reach the suction at a second threshold (ψ_{stop})
- Demand driven - by ETR/ETP ratio (code 4)

Method 4 is also a demand driven method. However, the thresholds are more oriented at observable entities. The basic assumption is, that agricultural crops usually show significant drought impacts only when the real evapotranspiration rates are falling below e.g. 0.8 times the potential evapotranspiration. Irrigation thus starts at or below a given ratio of real to potential evapotranspiration. The amount of irrigation water is calculated as the difference between the actual water content and the minimal water content when no reduction applies (thus filling up the soil to a soil moisture content causing no evaporation reduction at all).

The ration of real to potential evapotranspiration is required as parameter in the control file. An entry in the irrigation table for the method 4 looks like this:

```
#Code name         method     from  minETR2ETP
19    horticulture 4          2     0.8
```

There is no upper threshold given here. Instead, the parameter HReduDry from the land use table is taken. This parameter is given as suction already.

Internally, the ratio of ETR / ETP (including transpiration and evaporation from snow and interception storage!) is calculated when the unsaturated zone model runs. The ratio is based on the total transpiration and evaporation over the entire root zone, taking into account the root density and root depth. When this ratio falls below the value given in the control file as minETR2ETP, the irrigation model will calculate the required amount of irrigation in the next time step. To do this, the actual soil water content is calculated as average over the root zone. This grid (and the accompanying statistics file, both called e.g. SB1) contains values as relative water volume (0..Θ_{sat}). Also, in the initialization of the unsaturated zone model, a grid called SBHIGH is initialized. It contains the soil moisture for the upper threshold, which is in this case the minimum water content when no reduction of real compared to potential evaporation occurs. It's measure is relative water volume, too. The difference between this upper threshold and the SB1-grid multiplied by the roots depth is the irrigation amount which will be applied during the next time step (Δt <= 1d) or within the next day (Δt < 1d). Reductions due to river water shortage will be applied as in the other irrigation methods.