

## Update of the Norwegian MACROinFOCUS scenarios Heia and Rustad

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### 1 Background

The Norwegian groundwater scenarios Heia and Rustad were developed for use with the simulation tool MACROinFOCUS 4.4.2, which uses the MACRO model version 4.3. MACROinFOCUS has been updated and the current version is 5.5.3. The latest version of the tool uses the MACRO model version 5.2. The change of the underlying model version required some minor updates of the Norwegian scenarios in order to work with MACROinFOCUS 5.5.3.

### 2 Updates

#### 2.1 General updates

- 1) MACRO 5.2 uses the van Genuchten water retention function instead of Brooks-Corey that was used in version 4.3. This requires the definition of two new model parameters:
  - a. The van Genuchten water retention parameter  $N$  is defined as Brooks-Corey's  $\lambda+1$
  - b. The van Genuchten water retention parameter  $\alpha$  is defined as  $1/CTEN$  where  $CTEN$  (cm) is the water potential defining the boundary between macro and micro pores
- 2) The new MACRO 5 crop parameters  $Ri50^1$  and  $VPD50^2$  are set to default values of  $50 \text{ W/m}^2$  and  $50 \text{ Pa}$ , respectively. This is done in the same way for all scenarios currently included in MACROinFOCUS.
- 3) The clay, silt and sand contents were entered into FOCUS.mdb. Clay content is a model parameter in MACROinFOCUS 5.5.3
- 4) Due to numerical problems in MACROinFOCUS 5.5.3 the values of WILT (wilting point) were recalculated using the values of  $N$  and  $\alpha$ , at a tension of  $-15\,000 \text{ cm}$ .

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<sup>1</sup> Solar radiation that reduces stomatal conductance by 50 % ( $\text{W/m}^2$ )

<sup>2</sup> Vapour pressure deficit that reduces stomatal conductance by 50 % (Pa)

**2.2 Specific updates to database files**

The specific updates to the database files are summarized in Table 1.

**Table 1. Specific database updates**

<b>Database</b>	<b>Table</b>	<b>Field</b>	<b>Comment</b>
FOCUS.mdb	Soil2	Subdeg	Field added. This is the multiplication factor used to derive degradation rate with depth. This information was previously in table Soil3.
FOCUS.mdb	Soil2	Alpha	Field added. This is the van Genuchten water retention parameter $\alpha$
FOCUS.mdb	Soil2	All fields	For both Heia and Rustad artificial horizons have been added in order for the horizon depths to match the previous parameterisation

The artificial horizons in the database table “Soil2” were entered on the basis on what had been used for the parameterization in the previous version of MACROinFOCUS. They were set to match both the depths used for the correction factor for the degradation rate and the profile depth used for the simulation. In version 4.4.3 the correction factor for the degradation rate was entered per numerical layer, whereas in 5.5.3 it is entered per horizon (which consists of several numerical layers). The horizons are summarized in Table 2-Table 5 below.

**Table 2. Horizons defined in MACROinFOCUS 4.4.2 to describe Rustad**

<b>Horizon depths (cm)</b>	<b>ID</b>	<b>Numerical layers</b>	<b>Correction factor for degradation rate</b>
0-18	1	4	1
18-30	2	2	1
30-40	3	2	0.5
40-60	4	2	0.5/0.3
60-220	5	5	0.3/0

**Table 3. Horizons defined for the parameterisation of Rustad in MACROinFOCUS 5.5.3**

<b>Horizon depths (cm)</b>	<b>ID</b>	<b>Correction factor for degradation rate</b>
0-18	1	1
18-30	2	1
30-40	3	0.5
40-50	4	0.5
50-60	4	0.3
60-80	5	0.3
80-220	5	0

**Table 4. Horizons defined in MACROinFOCUS 4.4.2 to describe Heia**

<b>Horizon (cm)</b>	<b>depths</b>	<b>ID</b>	<b>Numerical layers</b>	<b>Correction factor for degradation rate</b>
0-30		1	6	1
30-40		2	1	0.5
40-60		3	2	0.5/0.3
60-220		4	6	0

**Table 5. Horizons defined for the parameterisation of Heia in MACROinFOCUS 5.5.3**

<b>Horizon depths (cm)</b>	<b>ID</b>	<b>Correction factor for degradation rate</b>
0-30	1	1
30-40	2	0.5
40-50	3	0.5
50-60	3	0.3
60-80	4	0.3
80-220	4	0

### **3 Installation instructions**

After installing MACROinFOCUS 5.5.3, replace the databases FOCUS.mdb and CROPS.mdb with the ones containing the Norwegian scenarios. The driving data files should be placed in the directory “\bin” located in the program directory.