Ongespannen rekenen

en de MetaSWAP-UZF koppeling

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Provincie Limburg

Brabant Water

Inhoud

Ongespannen rekenen

- Wat is ongespannen rekenen
- Verschil in berekeningsresultaten ongespannen t.o.v. gespannen rekenen
- Waar is ongespannen rekenen van belang
- Aansturen ongespannen rekenen in iMOD 5 (Modflow 6)

Ongespannen rekenen MetaSWAP-UZF koppeling

- Wat is de MetaSWAP-UZF koppeling
- Aansturing MetaSWAP-UZF koppeling in iMOD 5.5 (Modflow 6)
- Resultaten MetaSWAP-UZF koppeling

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Wat is ongespannen rekenen

- Engelste term UNCONFINED calculations
- Bij ongespannen rekenen is het doorlaatvermogen (transmissiviteit) van een modellaag gelijk aan de doorlatendheid van de modellaag * watervoerende dikte
- Bij gespannen rekenen is het doorlaatvermogen (transmissiviteit) van een modellaag gelijk aan de doorlatendheid van de modellaag * dikte van de modellaag

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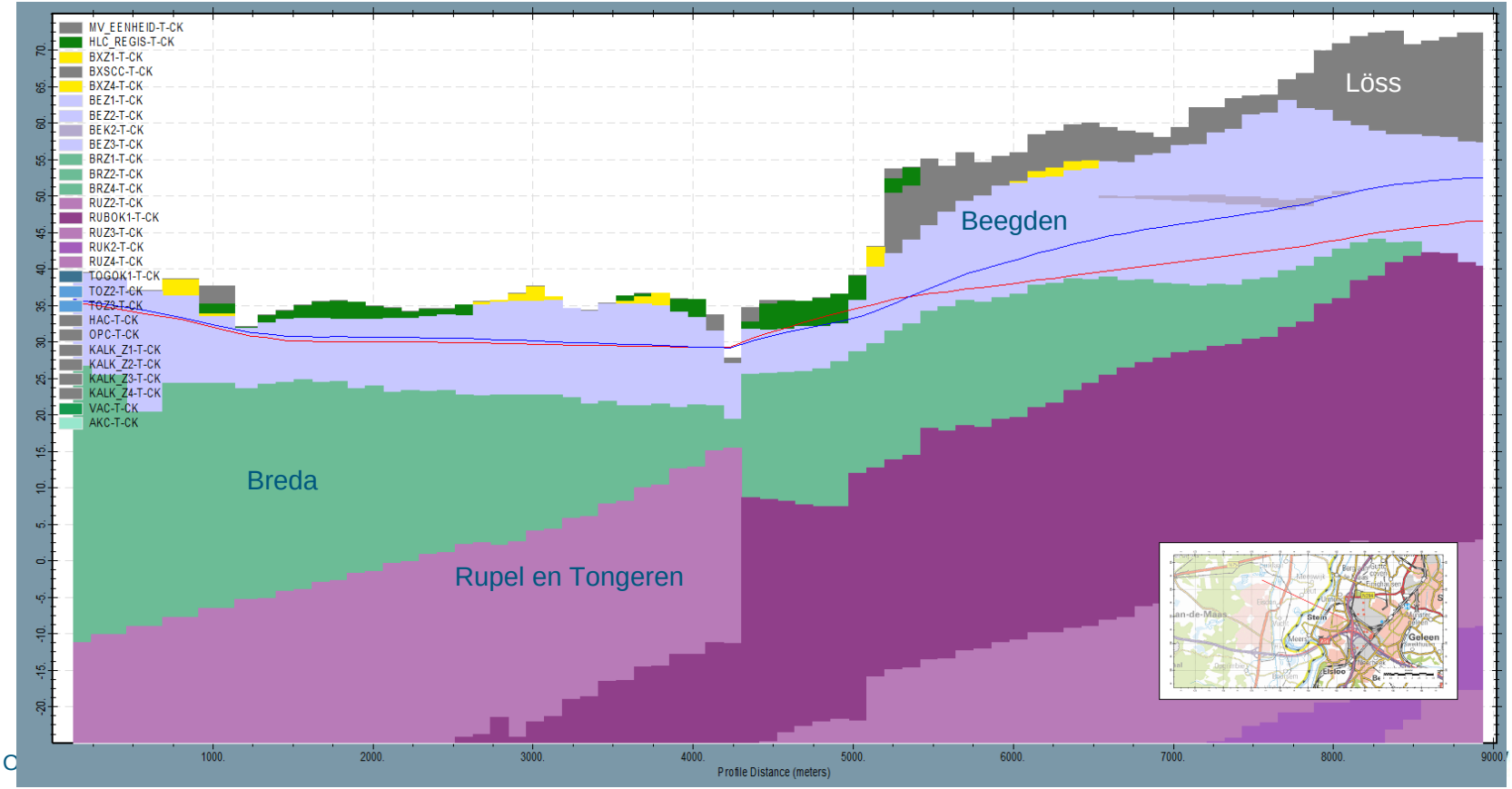
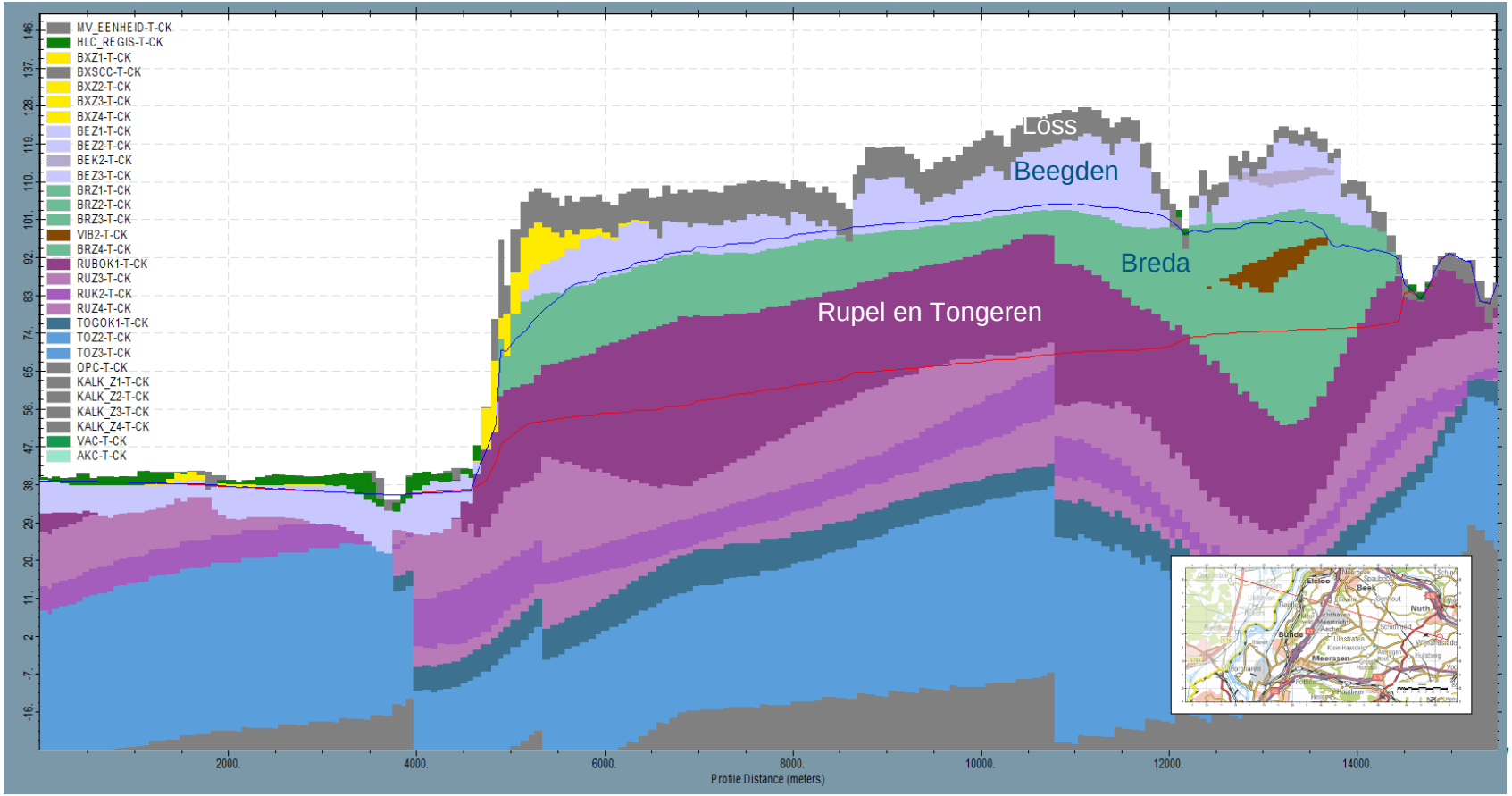
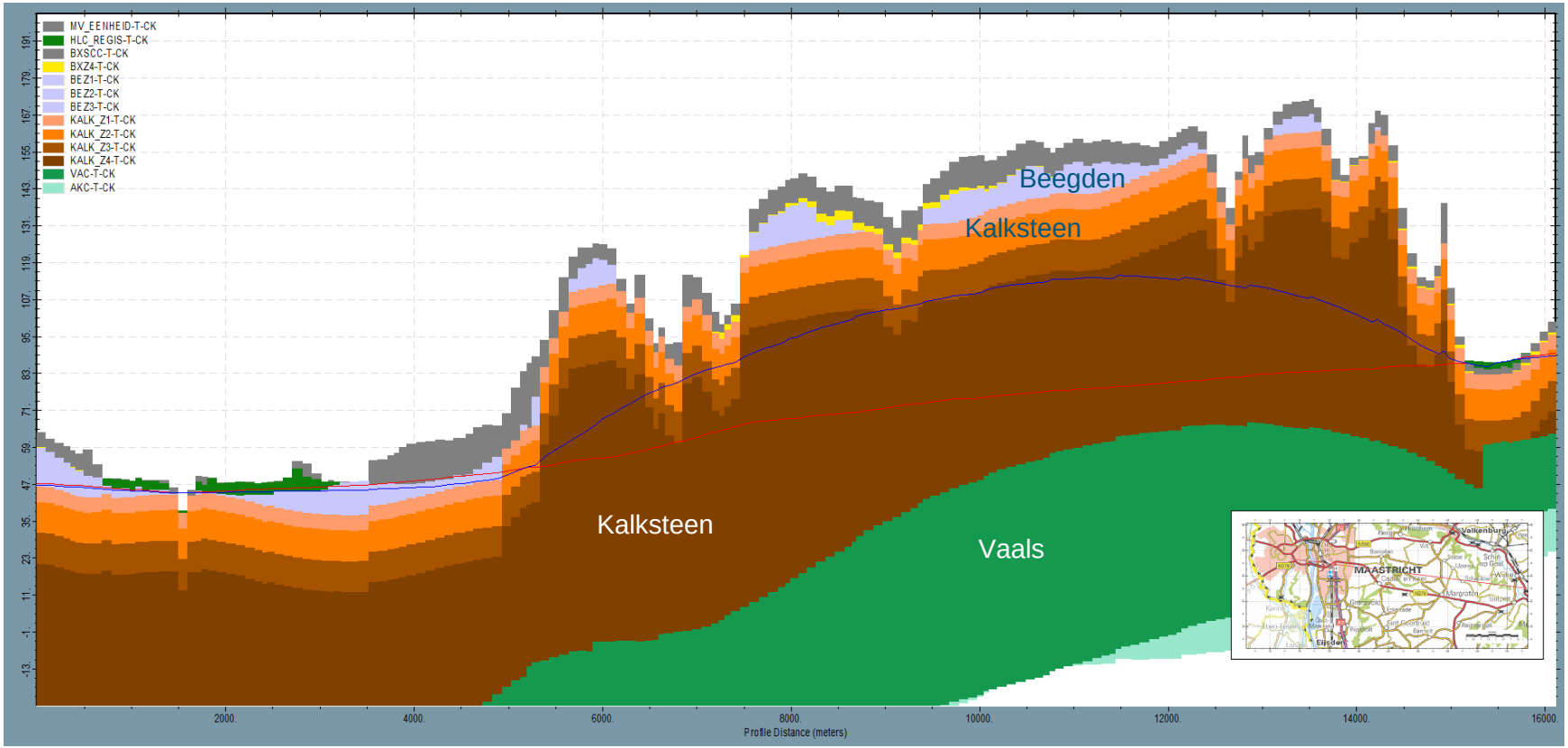
Verschil in berekende gws ongespannen vs gespannen



Verschil in berekende gws ongespannen vs gespannen

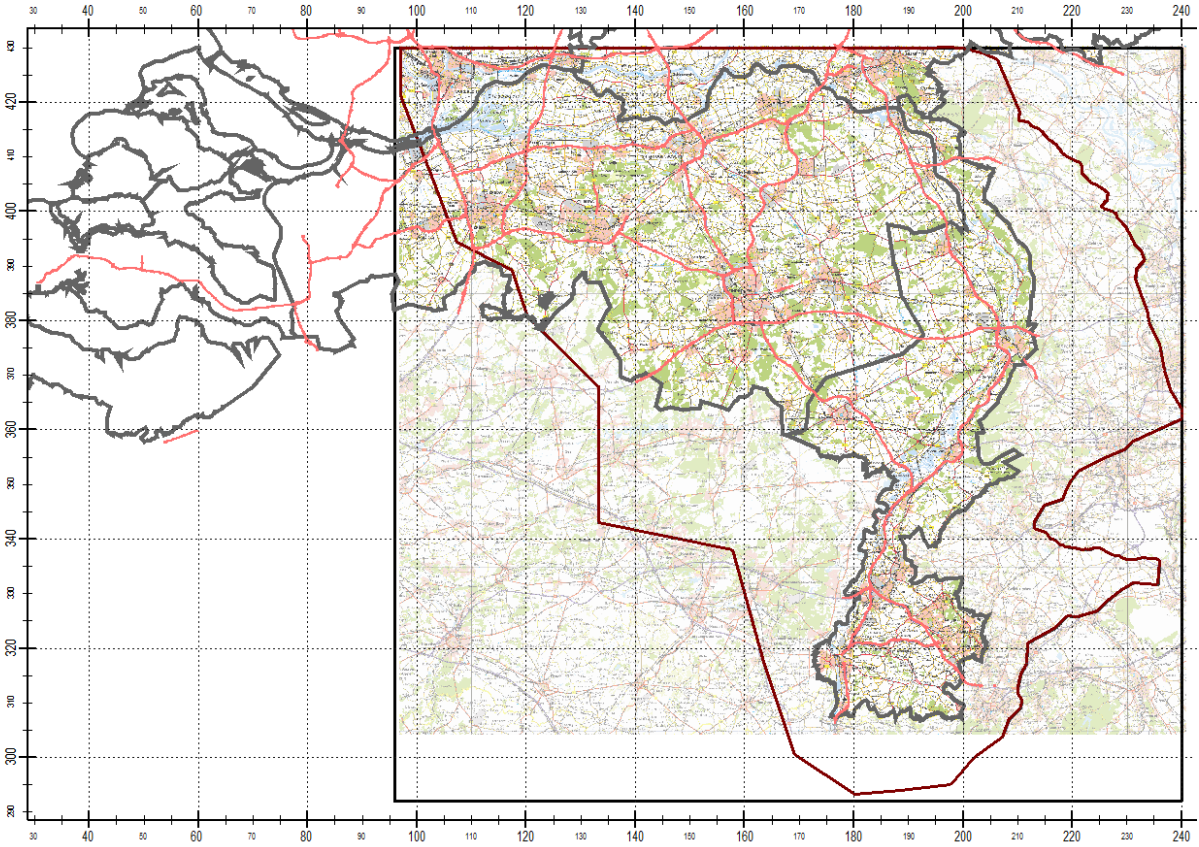


Verschil in berekende gws ongespannen vs gespannen

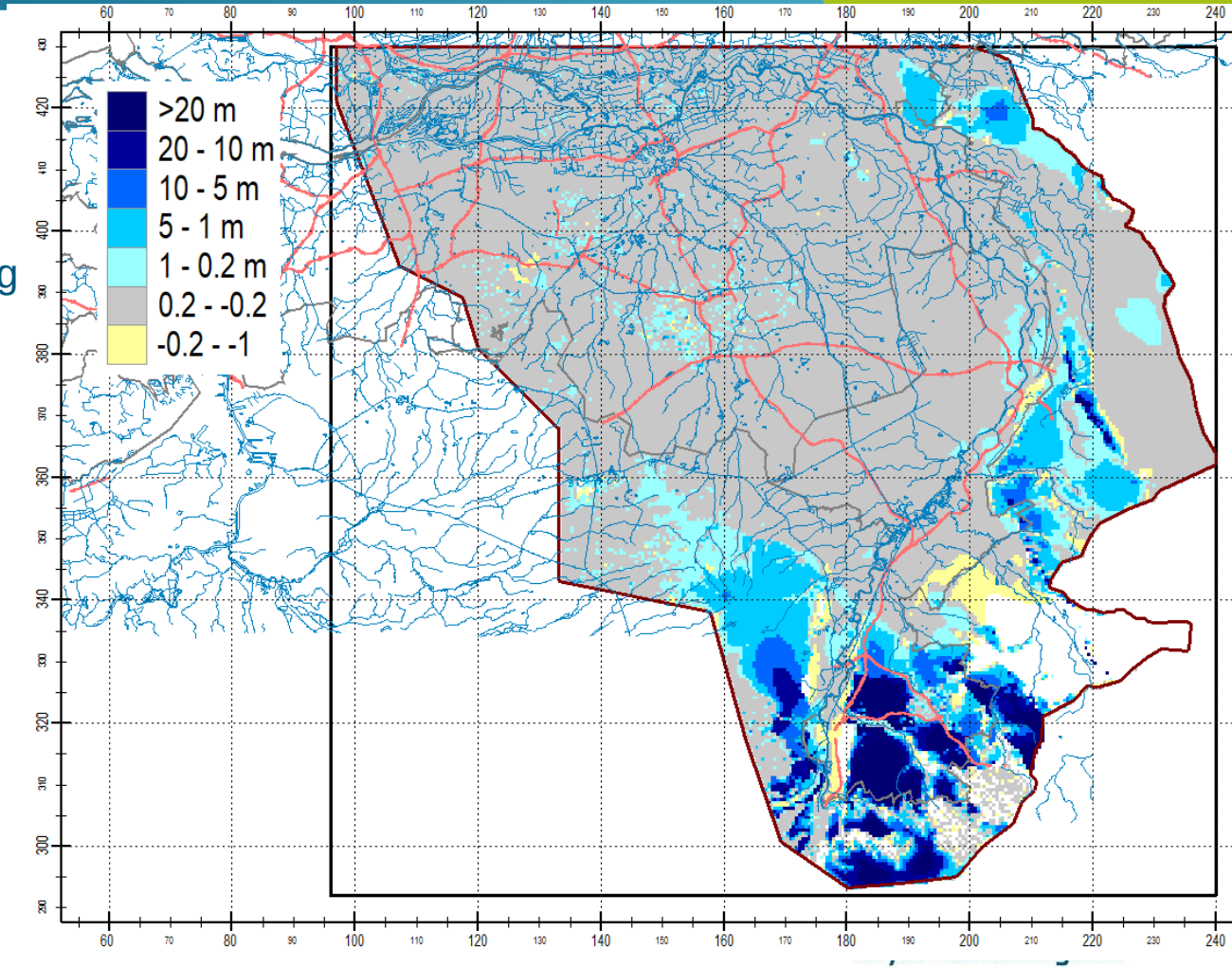


Waar is het van belang

- Vergelijking gespannen berekening met ongespannen berekening voor hele Ibrahym modelgebied.



- Vergelijking gespannen berekening met ongespannen berekening voor hele Ibrahym modelgebied.
- Stationair berekeningen



Aansturing Ongespannen Rekenen

iMOD Handleiding:

UNCONFINED= (optional)	Use this keyword to include unconfined conditions for model layers, e.g. UNCONFINED=1,1,1,0,0,0 by default UNCONFINED=0 and model layers are confined. So, if NLAY=10 and UNCONFINED=1,1,1 this means that the first three model layers are unconfined, the remaining layers are confined. The values for UNCONFINED are: ◇ **UNCONFINED 0** The model layer is confined, the saturated thickness is defined by the top- and bottom elevation per model layer; ◇ **UNCONFINED 1** The model layer is unconfined, the saturated thickness is defined by the compute hydraulic head and the bottom elevation per model layer. It is obligatory to include the modules STO and SPY whenever unconfined conditioned are simulated for a transient model. For SIM_TYPE=3 (MODFLOW6) the bottom heights of the river package are set to the bottom level of the layer in case they extend this. In case INEWTON=0 (and/or SIM_TYPE=2), iMOD adds and configures the WETDRY option automatically. It assigns at least a 0.1 m threshold for each cell to activate rewetting. For all layers rewetting is achieved by underlying cells only, except the last layer for which rewetting can occur by neighbouring cells. The yield the average head (HeadMean). The head is estimated to be the bottom of the model layer (BottomLayer) + WETFCT * (HeadMean - BottomLayer) Each iteration the rewetting and drying is evaluated (MODFLOW Keywords IHDWET=0, IWETIT=1, WETFCT=0.1). ◇ **UNCONFINED 2** The model layer is confined by the saturated thickness is defined by the starting heads and the bottom elevation per model layer. Notice that in combination with MODFLOW6 usage of **NEWTON** solver is highly recommended for unconfined simulations.
NEWTON= (optional)	Use this keyword to enforce the Newton-Raphson formulation for groundwater flow between connected, convertible groundwater cells and stress packages that support calculation of Newton-Raphson terms for groundwater exchanges. Cells will not dry when this option is used. By default, NEWTON=0 and the Newton-Raphson formulation is not applied.

Function=RUNFILE

NEWTON=1
COMPLEXITY=COMPLEX
UNCONFINED=1,1,1,1,1,1,1
QWEL=0.10
DDRN=0.1

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Wat is de MetaSWAP UZF koppeling

- Standaard wordt MetaSWAP gekoppeld met Modflow 6 in modellaag 1
  - MetaSWAP geeft grondwateraanvulling door aan modellaag 1
  - MetaSWAP bepaalt freatische bergingscoefficient voor modellaag 1
  - MetaSWAP rekent met 1 bodemtype voor onverzadigde zone

- De grondwateraanvulling berekend door MetaSWAP wordt bij de MetmaSWAP UZF koppeling doorgegeven aan de Modlfow UZF module.
- Freatische berginsgcoefficient komt uit SPY package.
- UZF neemt bodemschematisatie onverzadigde zone over uit het lagenmodel

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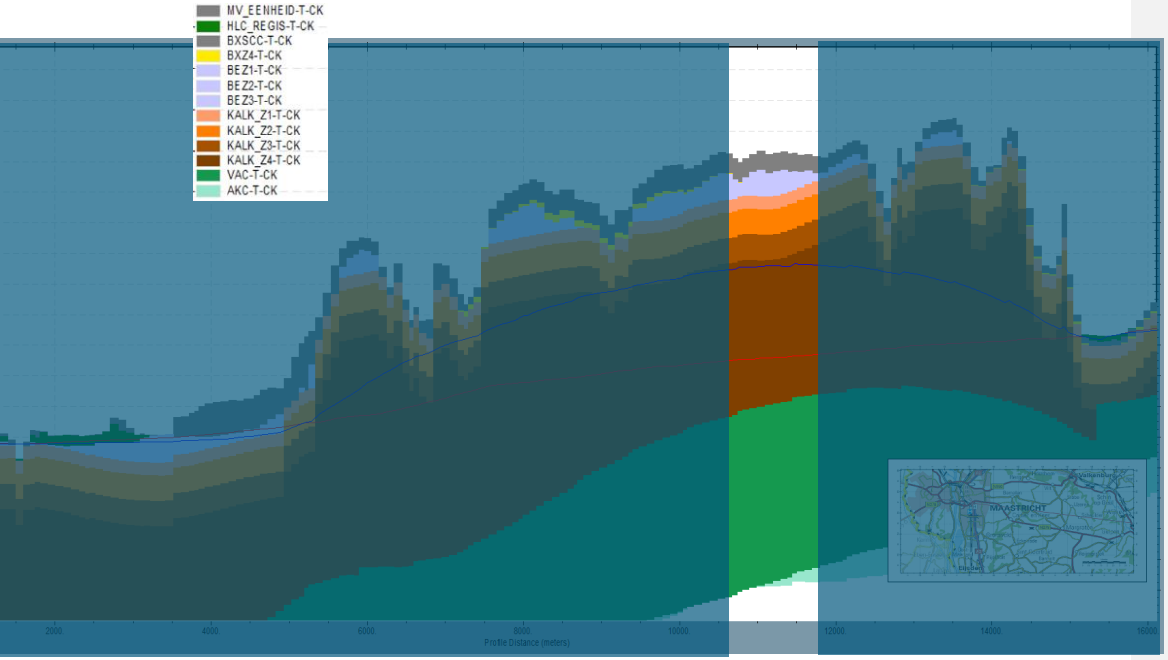
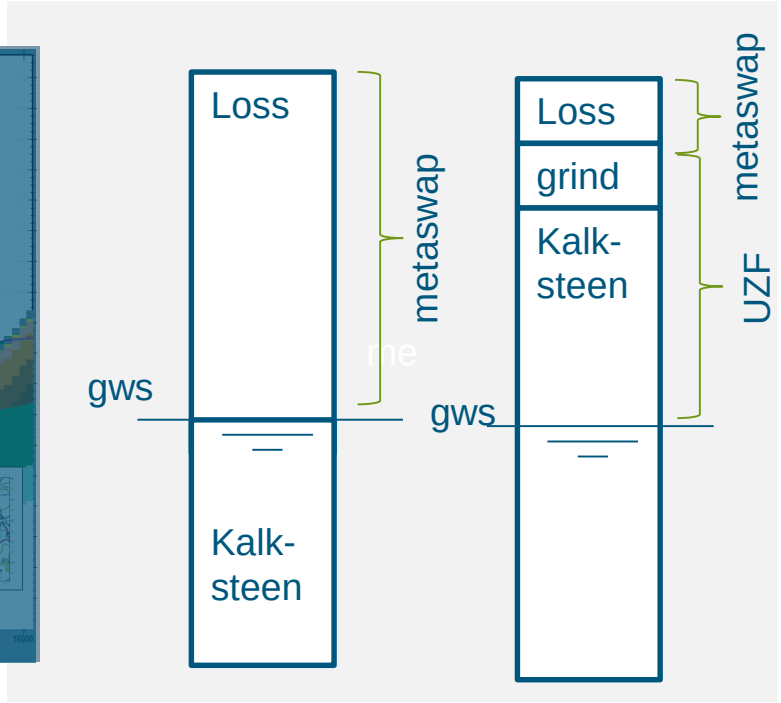
MetaSWAP UZF koppeling methodiek B





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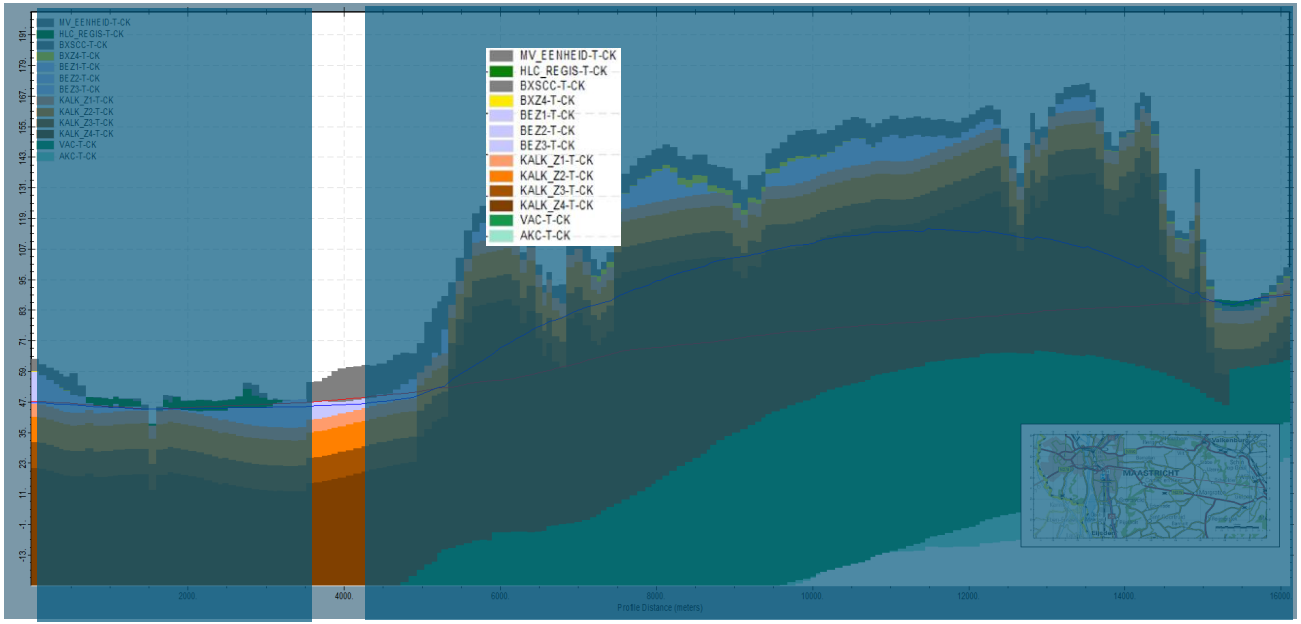
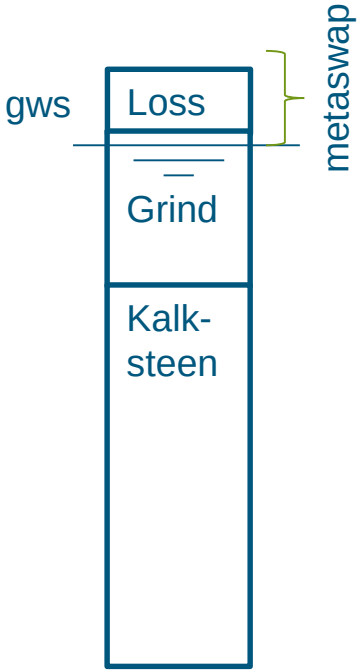
MetaSWAP-ongespannen rekenen koppeling methodiek A





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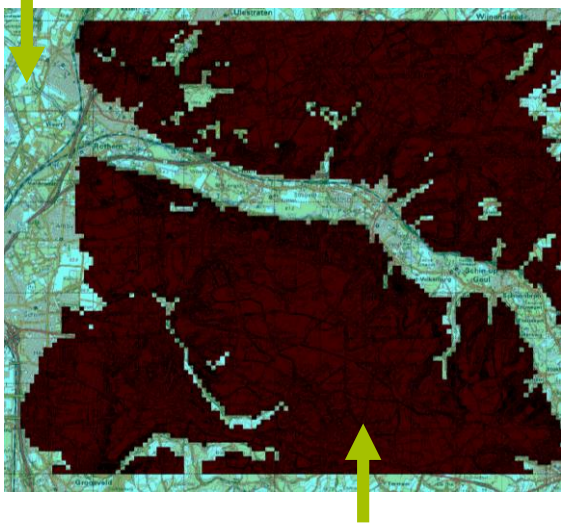
Koppelingsmethodieken MetaSWAP - UZF

Methode A (gelijke resulaten als conventionele koppeling)
Ondiepe grondwaterstanden



Methode B (extra vertraging door complex geologisch profiel)
Diepe grondwaterstanden

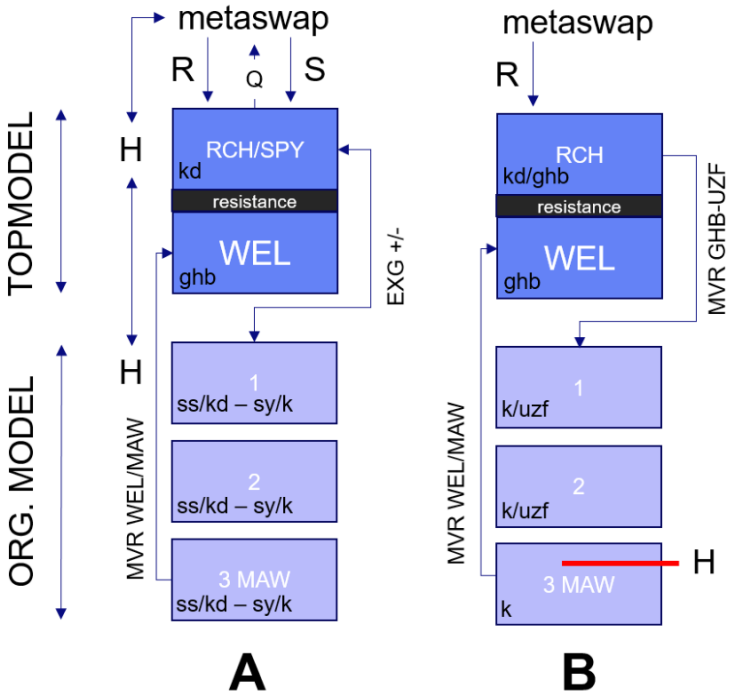


Figure 3.5: *Schematic representation of the layout and connections between the top model and the underlying original model.*

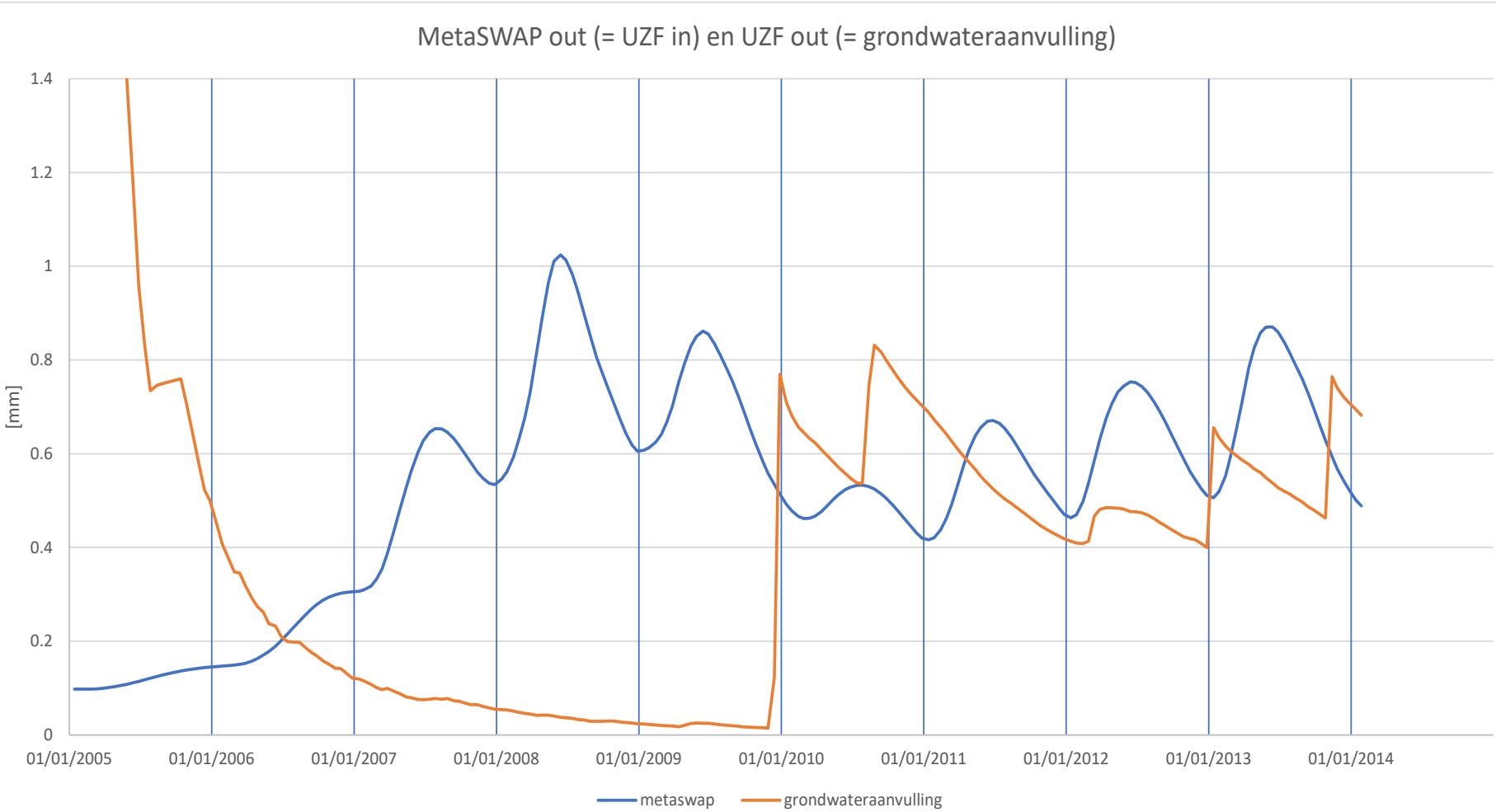
Aansturing Koppeling MetaSWAP - UZF

iMOD Handleiding:

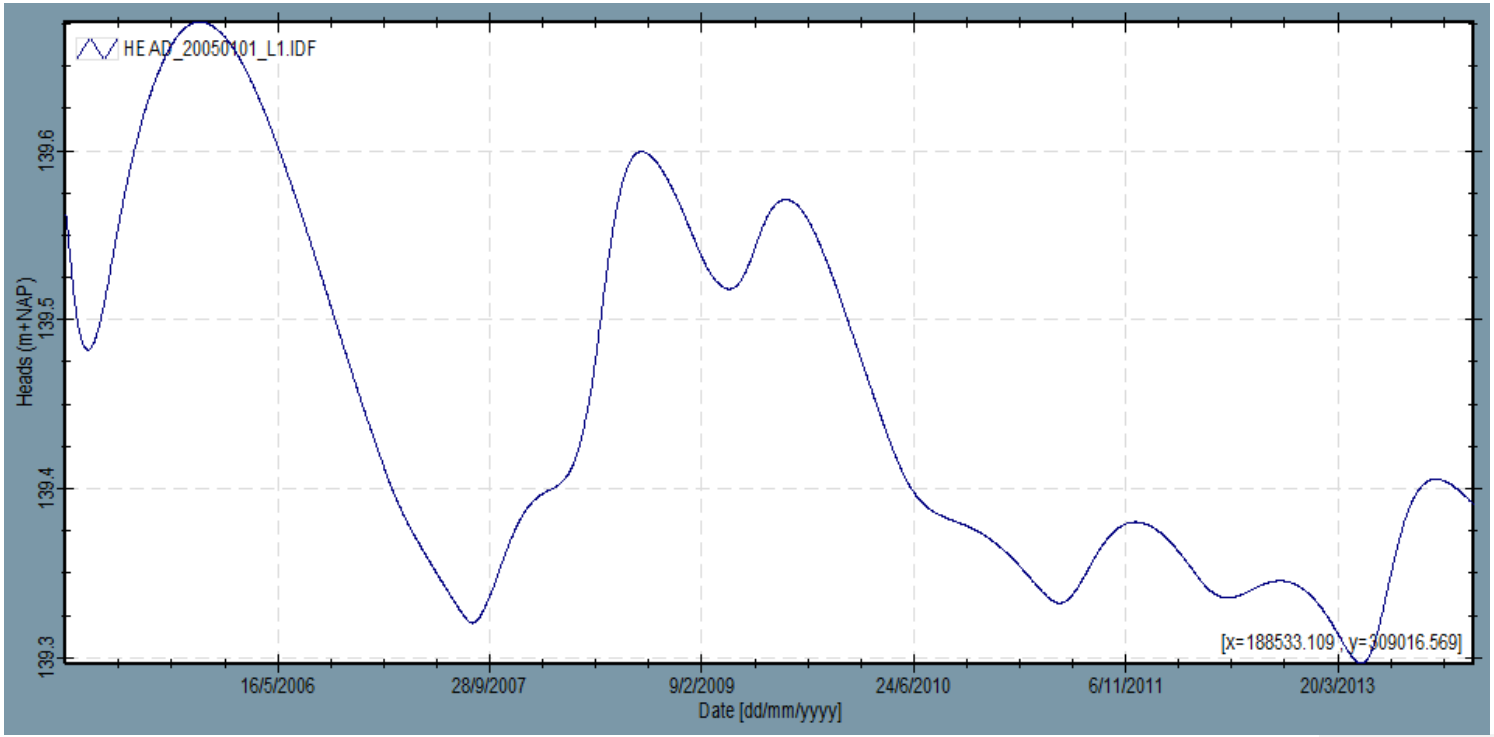
TOPMODEL= (optional)	Use TOPMODEL=1 to insert the coupling of METASWAP in a dummy model on top of the original model. In case TOPMODEL=0, MetaSWAP is coupled to the original model, this is the default setting. TOPMODEL is set to 1 (and cannot be altered) in case the UZF package is activated in combination with the CAP package that activates MetaSwap. Use TOPMODEL=0 for models without MetaSWAP.
DEPTHUZF= (optional)	Use this keyword to specify the absolute depth in meters+MSL level over which the UZF needs to be applied in the model. This can be an IDF file or constant value, e.g. DEPTHUZF=D:\DATA\DEPTH.IDF of DEPTHUZF=10. The latter represents a constant depthlevel of 10 meter throughout the modelling domain. The UZF is applied until the first model layer which is entirely below DEPTHUZF. **Important** that the UZF is connected to an active hydraulic head at all times, if not the water balance of the UZF component might be incorrect.
DBOTDEPTH= (optional)	Use this keyword to specify the absolute depth in meters minus surface-level to connect with MetaSWAP, e.g. DBOTDEPTH=20.0 means that recharge from MetSWAP is extracted from 20 meter below surface level. By default DBOTDEPTH=0.0 and the corresponding DBOT_SVAT.INP is not written and therefore not used by MetaSWAP. In case TOPMODEL=1, the default DBOTDEPTH=20.0 for areas connected to the UZF package and set to the lowest box level in the MetaSWAP database for areas connected conventionally with MetaSWAP. DBOTDEPTH is in this case also used to connect the recharge from MetaSWAP to the correct UZF cell at the appropriate vertical position.

Documentatie – iMOD Manual

- https://oss.deltares.nl/web/imod/user-manuals


MetaSWAP out (= UZF in) en UZF out (= grondwateraanvulling)
[mm]
1.4
1.2
1
0.8
0.6
0.4
0.2
0
01/01/2005
01/01/2006
01/01/2007
01/01/2008
01/01/2009
01/01/2010
01/01/2011
01/01/2012
01/01/2013
01/01/2014
metaswap
grondwateraanvulling

Resultaat MetaSWAP UZF koppeling



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Samenvattend

- Ongespannen rekenen is robuust en eenvoudig te implementeren;
- Methode A en B zijn geimplementeerd in iMOD v5.5 zodat deze gebruikersvriendelijk toegepast kunnen worden;
- Methodiek is gerapporteerd in de officiële iMOD handleiding;
- Van alle waterbewegingen binnen de methode A en B zijn nauwkeurige waterbalansen beschikbaar

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