PySeawATES

Python Seawat ATES model developed by KWR and TU Delft

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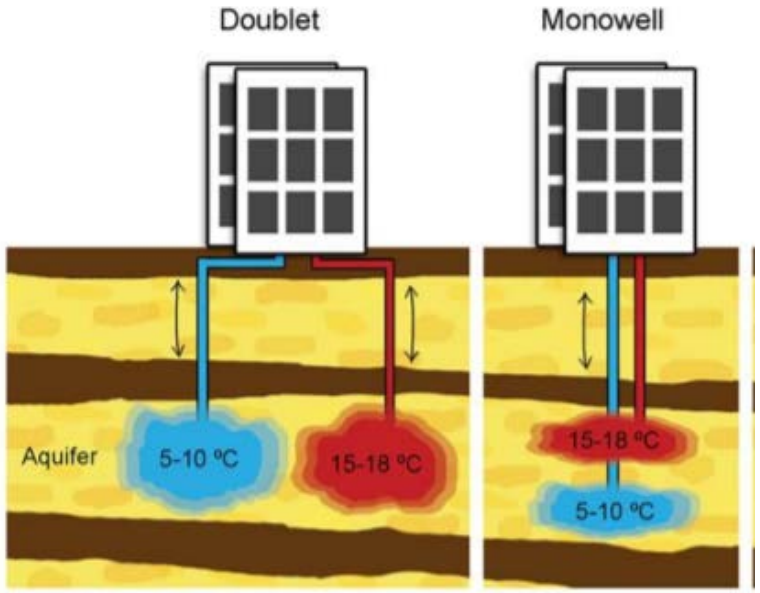
PySeawATES

- Model to calculate thermal impact and performance of ATES systems
  - Monowells
  - Doublets
  - HT-ATES
- Grid functionality
  - Axisymmetrical (1 [mono] or 3 layers [doublet])
  - 3D
- Easy input file and understandable settings



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Requirements

- Python 3.6
- Swtv4 executable
- Developed in/for spyder
- Pip install flopy → add flopy folder in working directory of your model
- https://modflowpy.github.io/flopydoc/
- https://www.usgs.gov/mission-areas/water-resources/science/modflow-and-related-programs?qt-science_center_objects=0#qt-science_center_objects

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Main structure

Wells are handled as object and for the basis of the model for grid building and control

- wellData.xlsx→Wells and subsurface composition are specified
- pyseawATES.py → main code controls simulation
- Agent_functions.py → definition of well objects
- Grid_functions.py → definition of the grid objects

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Structure of PySeawATES.py

- [A] Load data/packages etc
  main model inputs an charateristics
- [B] detailed inputs, parameter values, grid charateristics
- [C] iterate the model
  NB. model is run for each time step separately. This allows for control of flows at run-time.
- [D] post processing of data, calculate efficiencies, prepare data for plotting
- [E] plot figures

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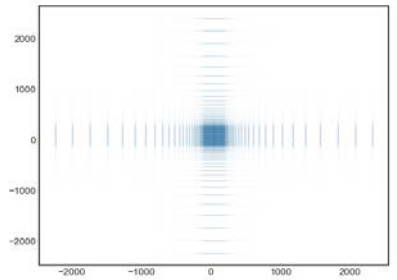
Grid functions

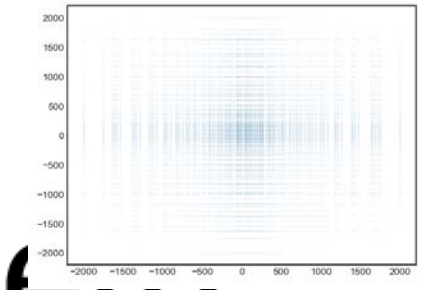
```
166 '''Make grid'''
167 ###################### Make the grid + ass
168 #Simplified layer parameters  #All dimens
169 dmin = 10#?idea 1 #  2.5  # ?  smallest c
170 dmin_bound = 100 #total boundary length w
171 dmax = 100#?idea 250 # 100 #  ? largest c
172 dz = 5 # gridlayer thickness [m]  !! sync
173 aroundAll = 500 #normal=1500 [m] size of
174 nstep = 15 #minimum number of steps, grid
175 grid_extents = None #[-300,300,-300,300]
```

2 Options

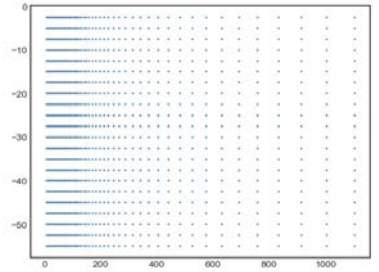
- Linear/uniform (close to well) + logarithmic at boundaries
- All logarithmic

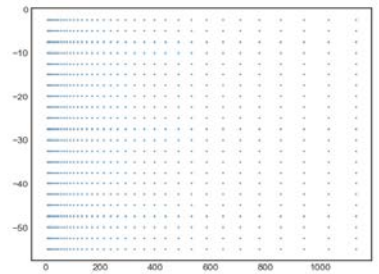
3D





AXI

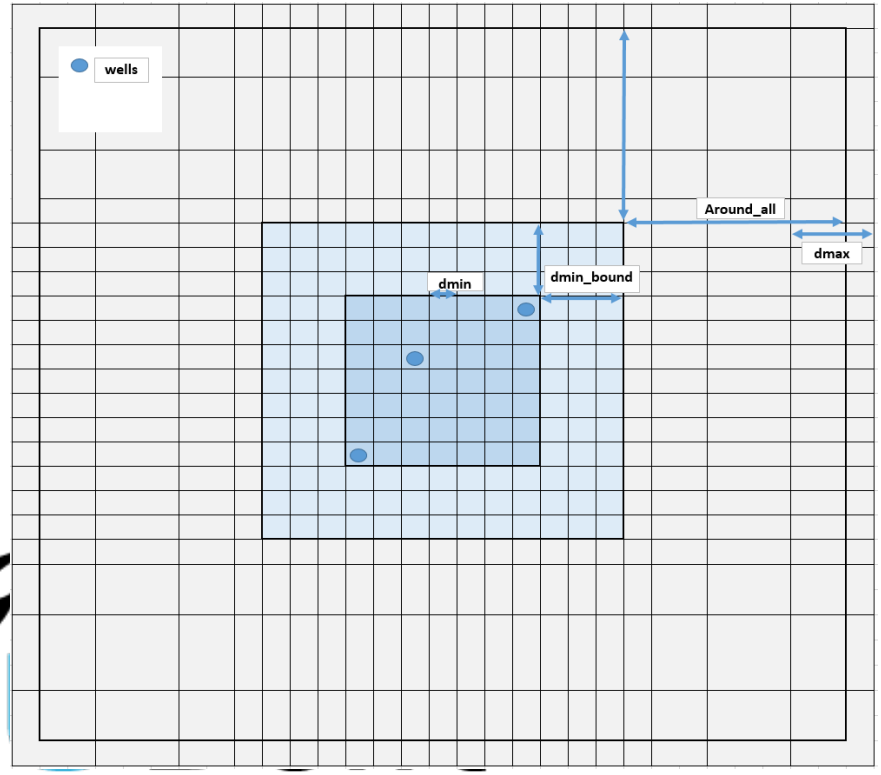




IMCL. ‘grid cleaner’

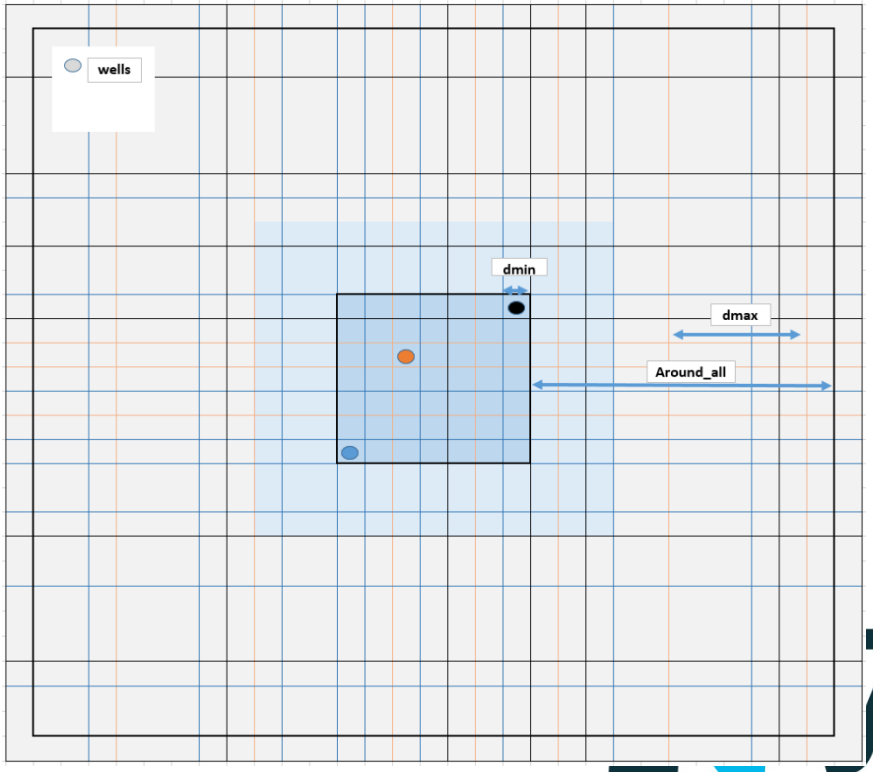
Grid settings 3D

3D, topview, linear



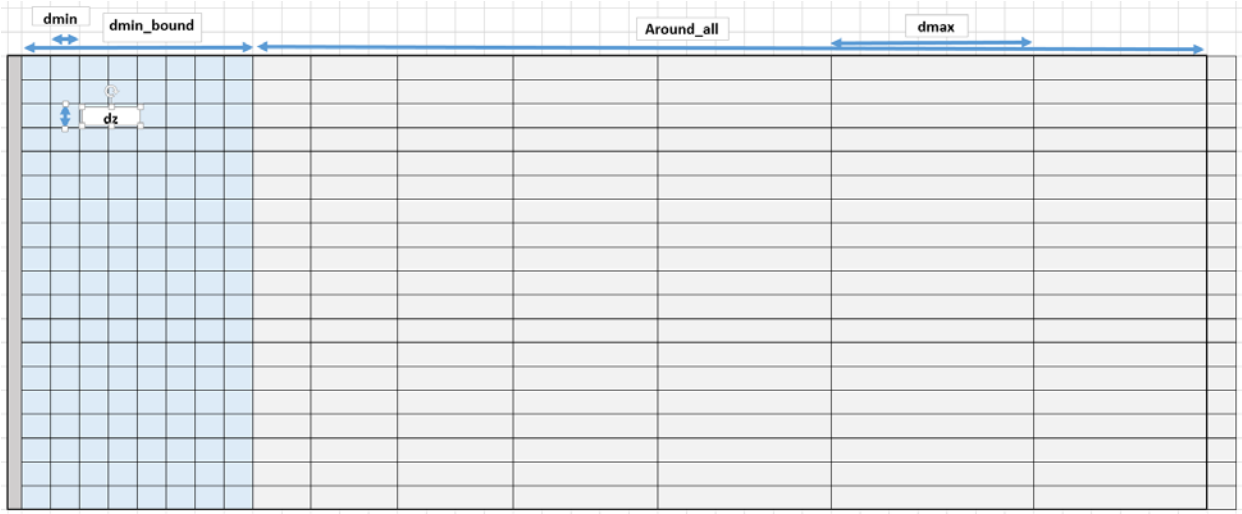
3D, topview, logarithmic

[No ‘dmin_bound’]



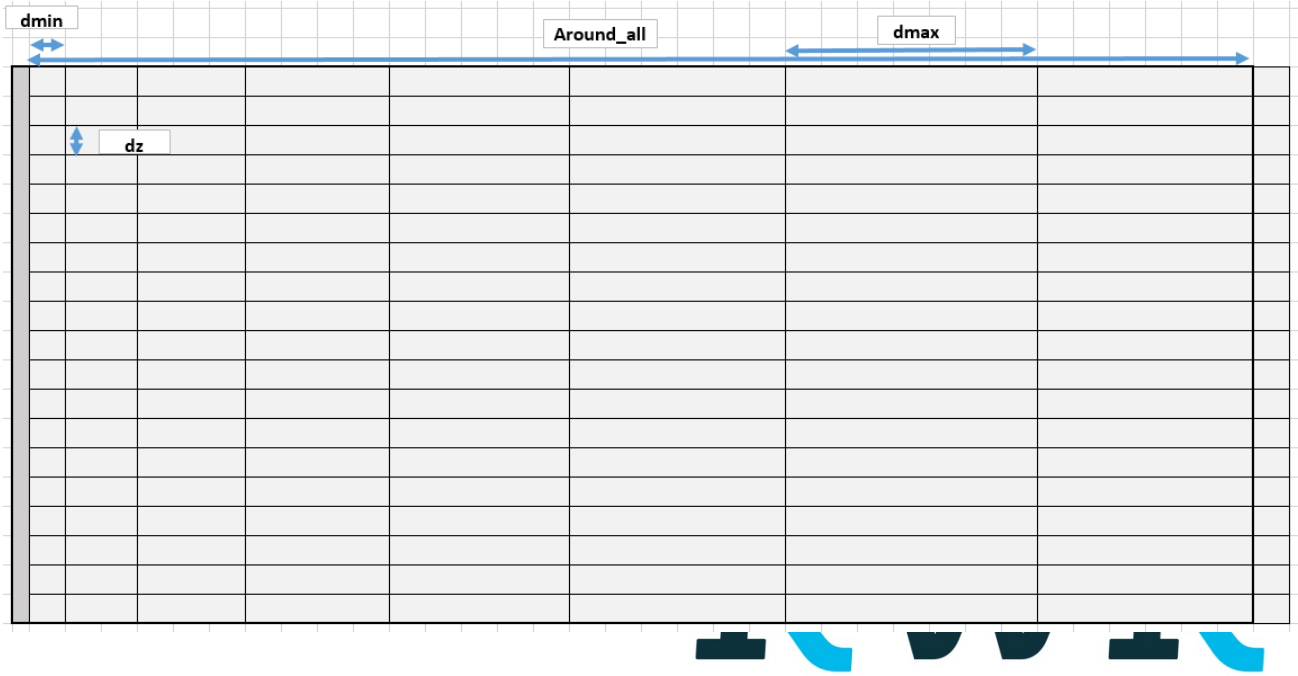
Grid settings Axial symmetric

AXI, sideview, linear



AXI, sideview, logarithmic

[No ‘dmin_bound’]



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You are using the pyhton code developed to simulate
Aquifer Thermal Eneregy Storage (ATES) systems in MODFLOW/MT3D-MS/SEAWAT
This code is developed at Delft University of Technology and
KWR water research institute Various researchers have contributed to
key elements of this code: dr. Martin Bloemendal, dr.Marc Jaxa-Rozen,
prof.dr.Theo Olsthoorn, Stijn Beernink. If you have any questions or
remarks please contact:

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The authors take no responsibility for any damage the may follow from
using or implementing (the results produced by) this model infrastructure

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