

Deltares



QGIS-Tim

A QGIS plugin for analytic elements:
TimML and Ttim

Huite Bootsma

Introduction

MODFLOW models are complex.

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Reality is an ~~unceasing~~ nightmare

Introduction

Analytic element models are (necessarily) simple.

MODFLOW models are (often) complex.

Reality is an ~~unceasing~~ nightmare

A syllogism

We need complex models to understand reality.

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QGIS



QGIS provides an enormous amount of functionality, for free:

1. Full desktop geographic information system (GIS)
2. Fully open source, freely downloadable
3. Extensible via a Python plugin system

Analytic elements are directly represented by:

- Points (wells)
 - Lines (river)
 - Polygons (inhomogeneities: zones of other conductivity)
- i.e. GIS vector data

(Far from the first GIS – AEM connection^{1,2})

1. Steward, D. R., Barnard, E. A. The synergistic powers of AEM and GIS geodatabase models in water resources studies. *Groundwater* 2006, 44.1, 56-61.
2. Artesia, ARTTIM, at: <https://www.artesia-water.nl/software/arttim/>

Screening models

E.g.: Review of complex numerical models

Desired:

- Open source
- First-class Python scripting
- Integration with modern GIS functionality
 - enormous variety of basemaps, web-accessible open datasets
 - Cross-checking with measurements, sites of interest
 - Flexible presentation of input and output

1. Haitjema, H. M. *Analytic element modeling of groundwater flow*. Academic Press Inc: San Diego, California, 1995.
2. Hunt, R. J. Ground water modeling applications using the analytic element method. *Groundwater* **2006**, *44.1*, 5-15.
DOI: <https://doi.org/10.1111/j.1745-6584.2005.00143.x>

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A Tim speedbump

Manual coordinate entry is cumbersome!

Obvious solution:

1. Enter coordinates in QGIS
2. Convert GIS data to Tim input
3. Run Tim computations
4. Write results
5. Visualize in QGIS

QGIS-Tim formalizes these steps into a QGIS plugin and an associated Python package.

```
river = timml.HeadLineSinkString(  
    model=model,  
    xy=[  
        [77830.62, 448910.70],  
        [78560.25, 449802.46],  
        [79722.24, 450153.76],  
        [80559.96, 450883.39],  
        [81208.51, 451964.31],  
        [81208.51, 452666.91],  
    ],  
    hls=2.0,  
    res=1.0,  
    wh=10.0,  
    order=0,  
    layers=0,  
    label=None,  
)
```

“Never do a live demo in a talk”
— mentally sane people

Status, and going forward

Last years: Rijkswaterstaat within the context of a “Groundwater Risk Toolbox”

QGIS plugin available online

Python package available on PyPI & conda-forge (& soon Deltaforge!)

TKI project with 20 parties (mostly dewatering context)

- Consolidate: testing, documentation
- Expand TimML & TTIm features
- Replace Deltares MWELL software
- Part of iMOD Suite

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Artesia Water
Bouwend Nederland
CRUX
CWIG
Fugro
Heijmans
Geonius
Mos Geo
TNO
RHDHV
RWS WVL
SIKB
Sweco
Tjaden
TU Delft
Henk van Tongeren Water & Techniek
Waterschap Scheldestromen
Wiertsema

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