

Deltares

iMOD Suite 06/2023

Backwards compatibility met iMOD5

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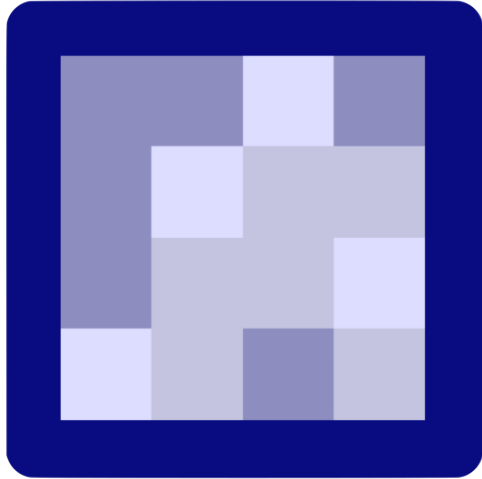
Luit Jan Slooten

Sunny Titus

Inhoudsopgave

- QGIS plugin
 - IDF lezer
 - CPT lezer
- iMOD Python
 - Projectfile
 - Converteer naar unstructured grid
 - Validatie modelinvoer
 - Tussentijds opslaan model
- Roadmap
- Work in Progress
- Vergelijking iMOD Python & Flopy

QGIS Plugin: IDF support



“Open and export IDF”

Open and export IDF

Open Export

MOD IDF File(s) es/Projects/IMOD_Presentations/DSD_2023/idf/TOP_L1.IDF

Predefined CRS

Filter

Recently Used Coordinate Reference Systems

Coordinate Reference System	Authority ID
Amersfoort / RD New	EPSG:28992
IRENET95 / Irish Transverse Mercator	EPSG:2157
WGS 84	EPSG:4326
WGS 84 / Pseudo-Mercator	EPSG:3857
NAD83 / UTM zone 10N	EPSG:26910
USA_Contiguous_Lambert_Conformal...	ESRI:102004

Predefined Coordinate Reference Systems Hide deprecated CRSs

Coordinate Reference System	Authority ID
Timbalai 1948 / RSO Borneo ...	EPSG:29872
Timbalai 1948 / RSO Borneo ...	EPSG:29873
Timbalai 1948 / RSO Sarawa...	EPSG:29874
World_Hotine	ESRI:54025
Oblique Stereographic Alternative	
ATS77 / New Brunswick Ster...	EPSG:2200
ATS77 / Prince Edward Isl. St...	EPSG:2290

Amersfoort / RD New

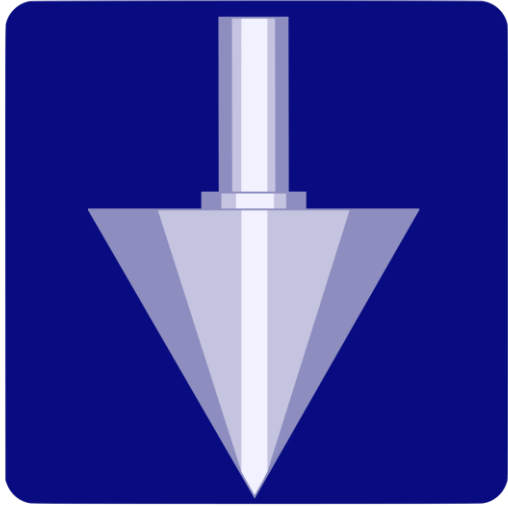
Properties

- Units: meters
- Static (relies on a datum which is plate-fixed)
- Celestial body: Earth
- Method: Oblique Stereographic Alternative

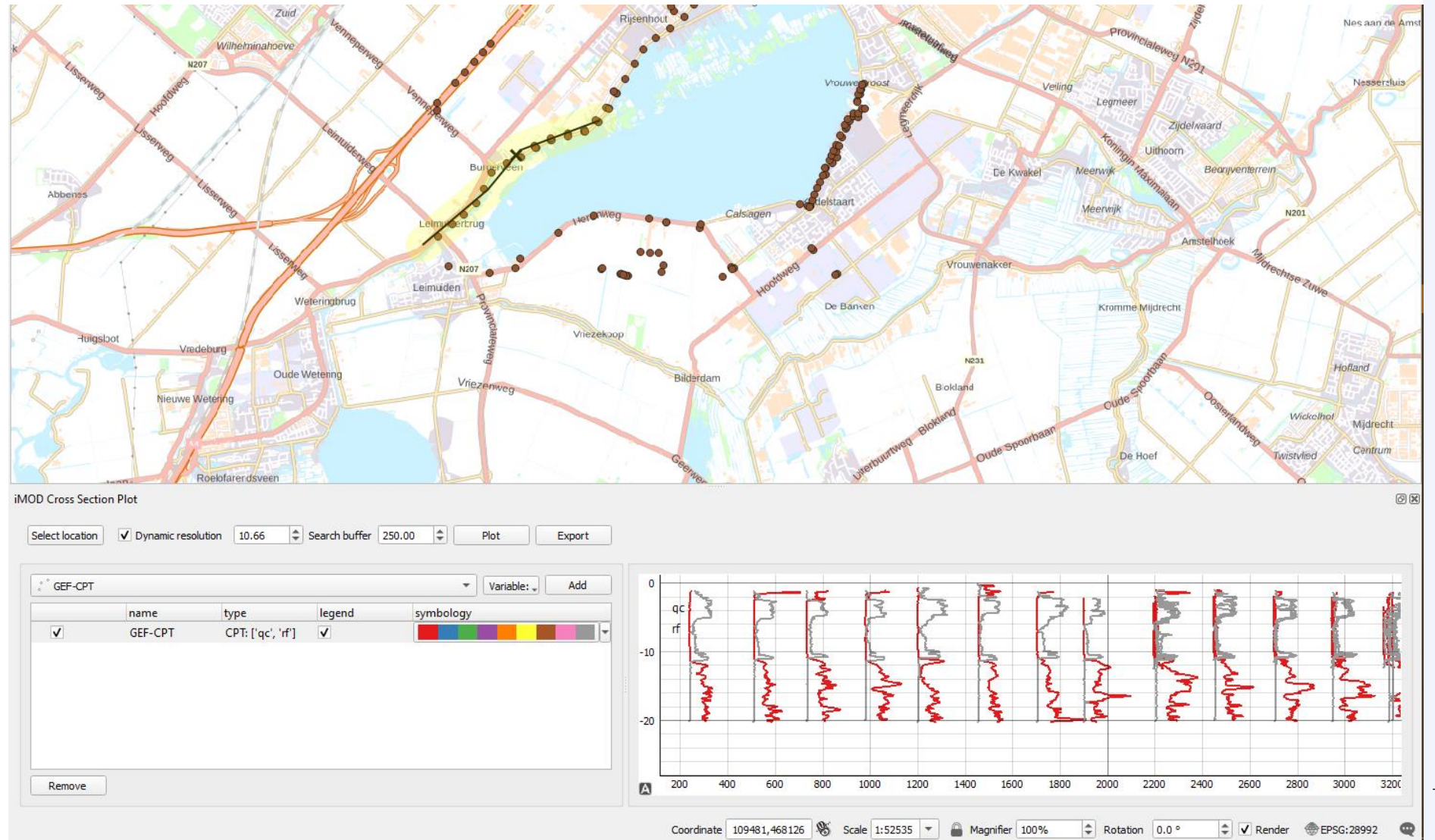
WKT

Close Add

QGIS Plugin: CPT support



“Open GEF”



QGIS Plugin

Voor nieuwe functionaliteit:

Installeer plugin versie 0.3.0

QGIS 3.28 of hoger!

The screenshot shows the QGIS Plugin Manager interface. The search bar contains 'imod'. The left sidebar shows the 'All' category selected. The main panel displays the details for the 'iMOD' plugin. The title is 'iMOD' with a logo. The description states: 'A plugin to visualize 4D geospatial data, to aid groundwater modellers'. It explains that the plugin aids in exploring 4D geospatial data and links to the iMOD 3D viewer. It is part of the 'iMOD Suite'. Mesh data can be used to store data with time, z, y, and x dimensions. Currently, the z-dimension is only scarcely supported by MDAL, so a mesh dataset is required for each vertical layer. The required variables are: `"{var}_layer_{nr}"`, `"top_layer_{nr}"`, and `"bottom_layer_{nr}"`. An example of preparing such a dataset in python is found at https://deltares.github.io/iMOD-Documentation/workflow_wq.html#convert-output-data. We expect to make this less specific in the future. The plugin has 3 rating vote(s) and 2303 downloads. The category is 'Plugins'. Tags include '3d, cross section, groundwater, geology, netcdf, modflow, time, time series, timeseries, ugrid'. More info links include 'homepage', 'bug tracker', and 'code repository'. The author is 'Deltares'. The installed version is '0.3.0', which is circled in red with an arrow pointing to it. The available version (stable) is '0.3.0 updated at Mon Jun 12 06:22:31 2023'. The changelog for 0.3.0 is '0.3.0 - New features & usability'. At the bottom, there are buttons for 'Upgrade All', 'Uninstall Plugin', 'Reinstall Plugin', 'Close', and 'Help'.

iMOD Python: projectfile

imod.formats.prj.read_projectfile

`imod.formats.prj.read_projectfile(path: Union[str, PathLike[str]])` → Dict[str, Any] [\[source\]](#)

Read an iMOD project file into a collection of nested dictionaries.

The top-level keys are the “topic” entries such “bnd” or “riv” in the project file. An example structure of the dictionaries is visualized below:

```
content
├── bnd
│   ├── active: bool
│   └── ibound: list of dictionaries for each layer
├── riv
│   ├── active: bool
│   ├── conductance: list of dictionaries for each time and layer.
│   ├── stage: idem.
│   ├── bottom_elevation: idem.
│   └── infiltration_factor: idem.
etc.
```

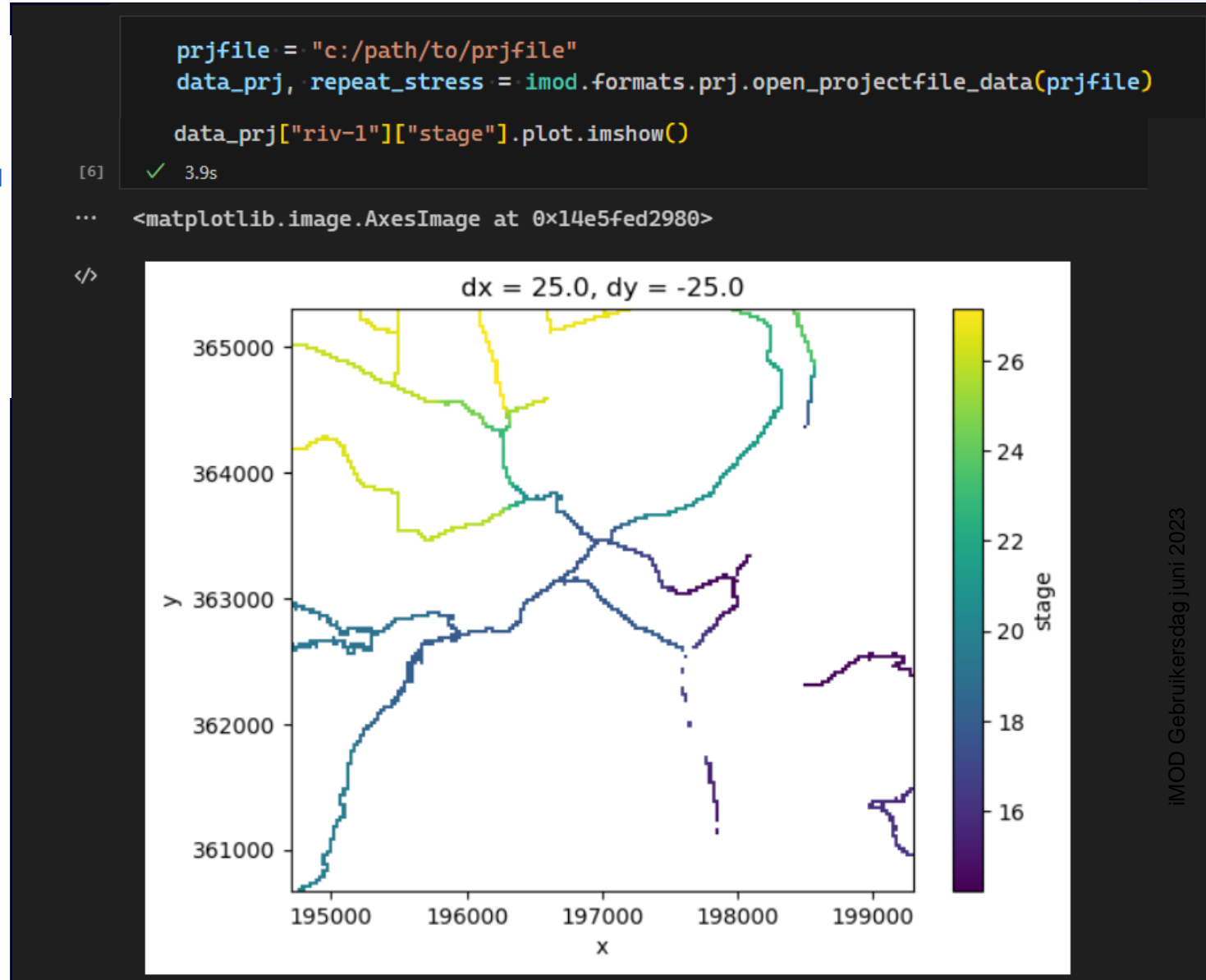
iMOD Python: projectfile

imod.formats.prj.open_projectfile_data

`imod.formats.prj.open_projectfile_data(path: Union[str, PathLike[str]]) → Dict[str, Any]` [\[source\]](#)

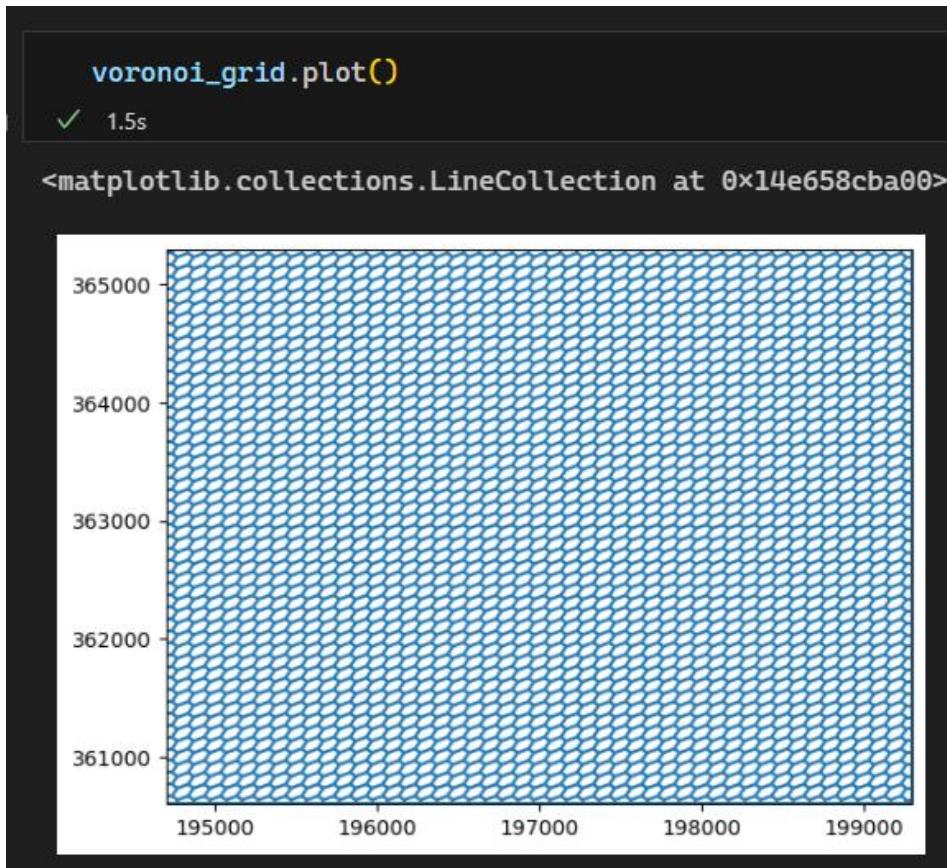
Read the contents of an iMOD project file and read/open the data present in it:

- IDF data is lazily loaded into `xarray.DataArrays`.
- GEN data is eagerly loaded into `geopandas.GeoDataFrames`
- IPF data is eagerly loaded into `pandas.DataFrames`
- Non-file based entries (such as the PCG settings) are kept as a dictionary.

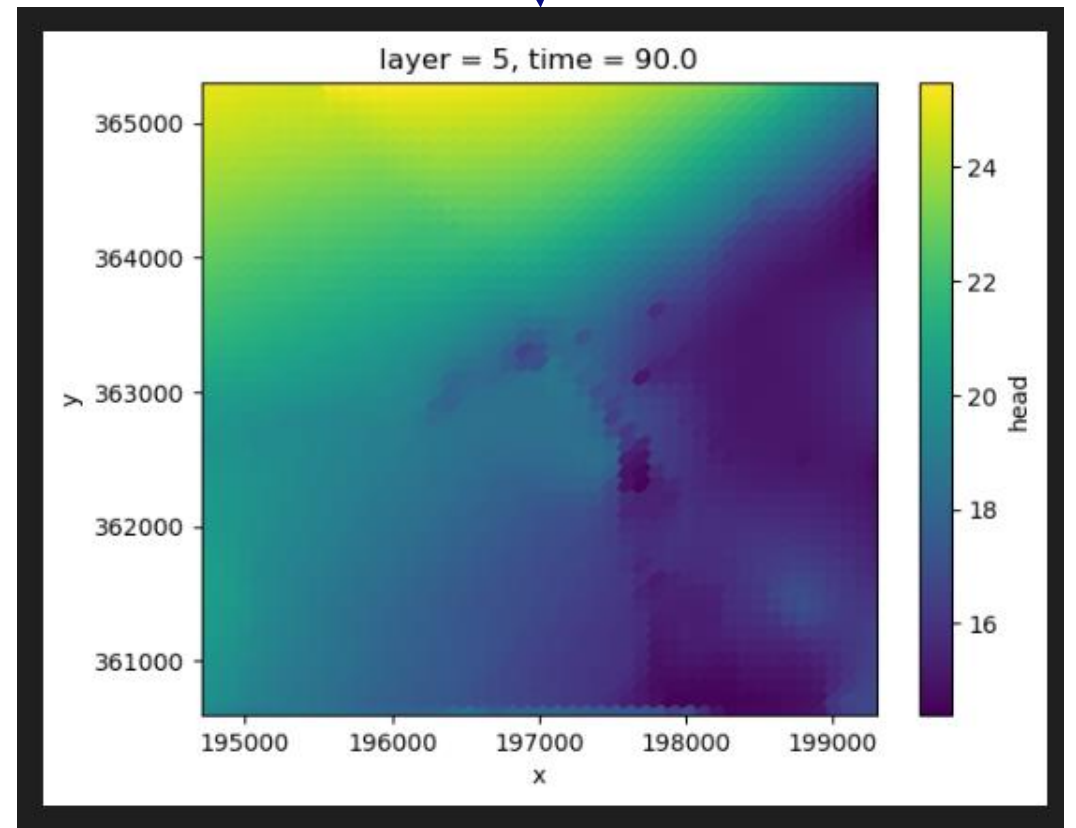


iMOD Python: unstructured grid converter

Experimental feature: Converteer iMOD5 model naar unstructured MF6 model

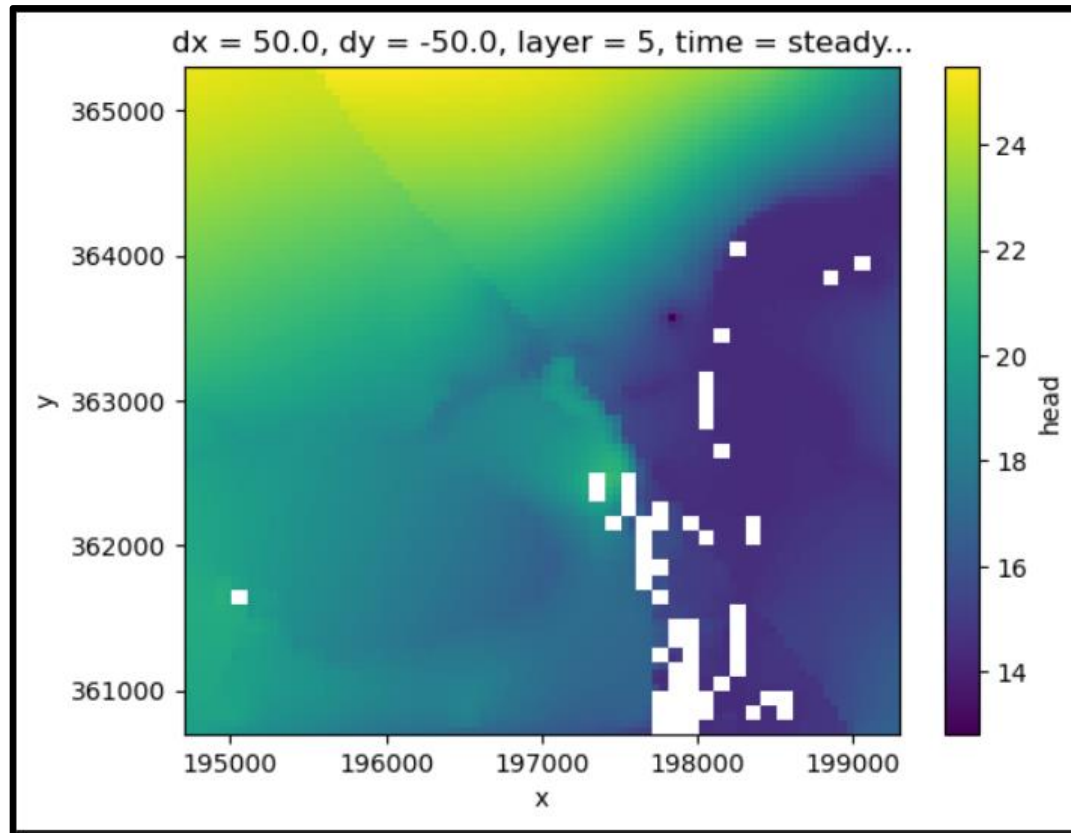


```
mf6_model = imod.prj.convert_to_disv(data_prj, voronoi_grid)
```

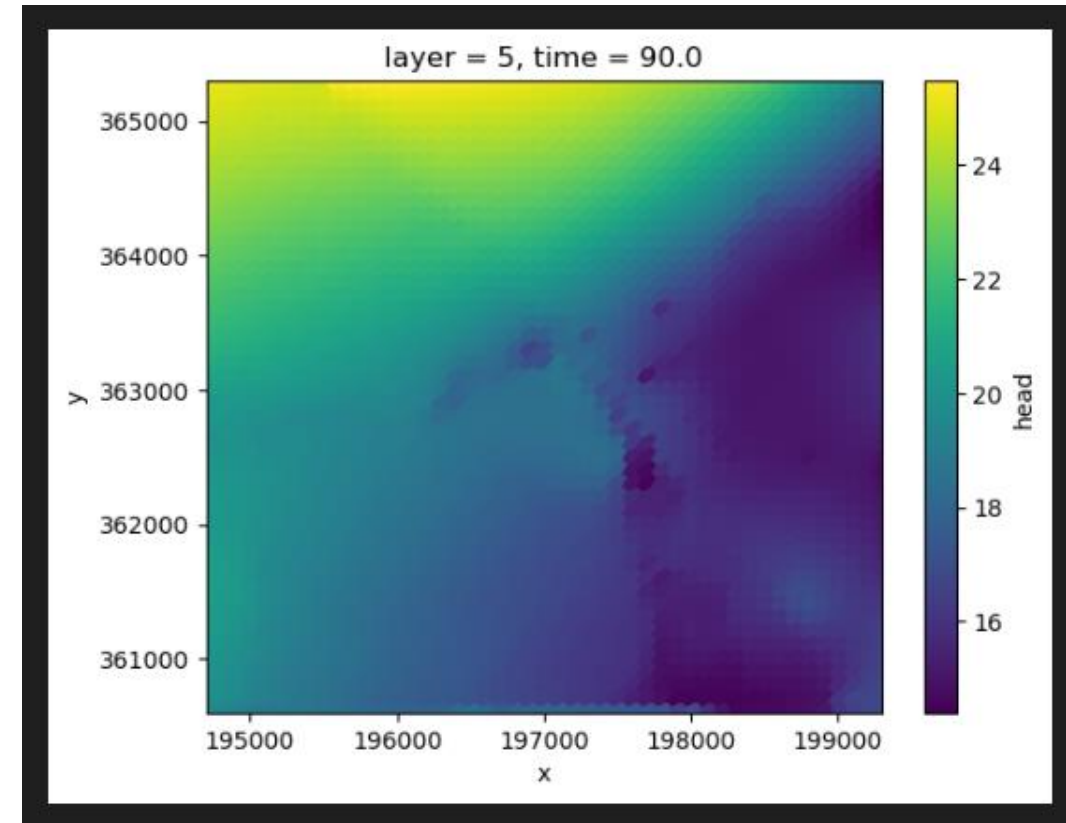


Vergelijking

Structured grid



Unstructured grid



iMOD Python: modelinvoer validatie

Valideer Modflow6 modelinvoer, alle invoerfouten in 1 boodschap:

```
ValidationError:
Simulation validation status:
  * gwfl model:
    * npf package:
      * k:
        * not all values comply with criterion: > 0.0
    * shd package:
      * start:
        * nodata is not aligned with idomain
    * rch package:
      * rate:
        * dtype int64 ≠
```

iMOD Python: Tussentijds opslaan model

```
mf6_sim.dump("path/to/dir")
```

Creates

↑ Name	Ext	Size	Date	Attr
↑ [..]		<DIR>	14/06/2023 11:25	----
📁 [gwf1]		<DIR>	14/06/2023 11:25	----
📄 ims	nc	16.7 k	14/06/2023 11:25	-a--
📄 mf6sim	toml	143 b	14/06/2023 11:25	-a--
📄 time_discretization	nc	8.7 k	14/06/2023 11:25	-a--

Import again

```
mf6_sim_continue = imod.mf6.Modflow6Simulation.from_file("path/to/dir/toml_file")
```

```
[NodePropertyFlow]
npf = "npf.nc"

[VerticesDiscretization]
disv = "disv.nc"

[OutputControl]
oc = "oc.nc"

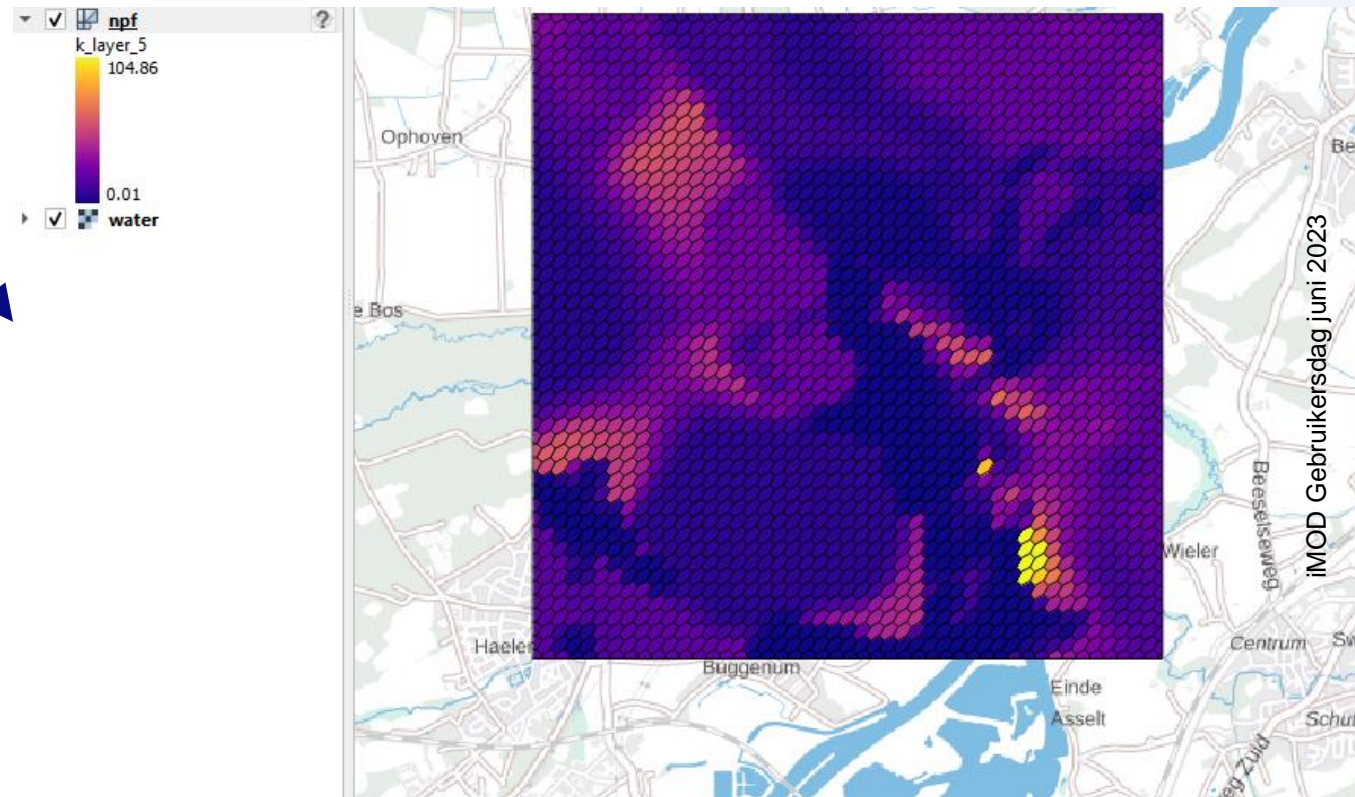
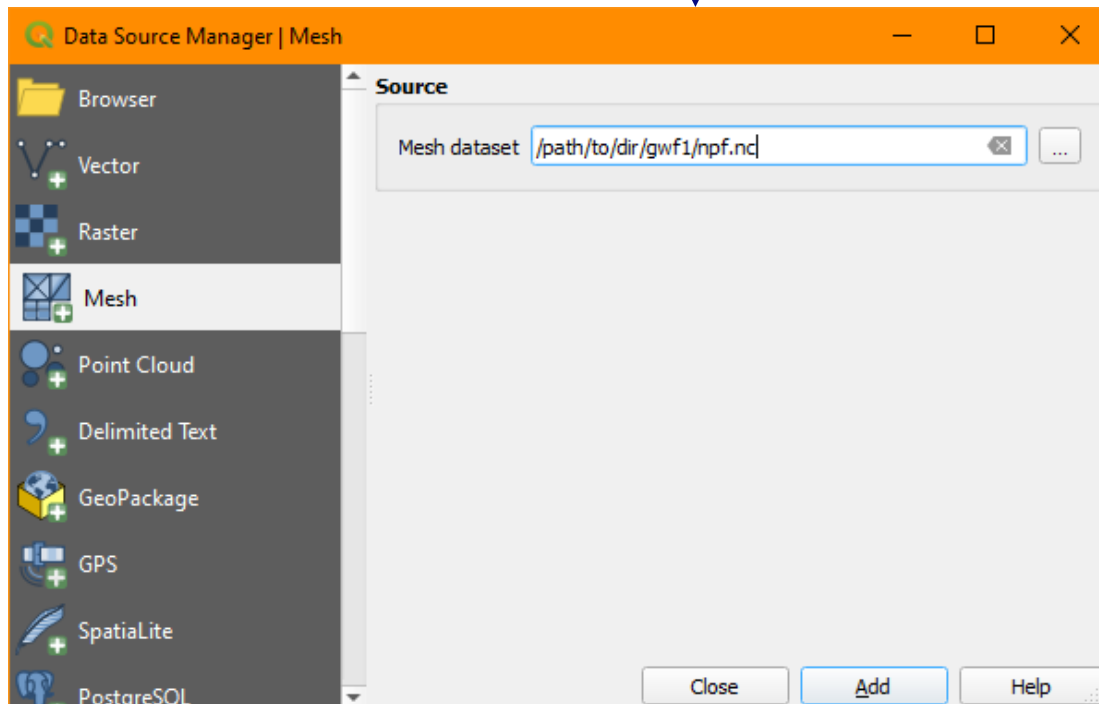
[InitialConditions]
shd = "shd.nc"

[Drainage]
riv-1-drn = "riv-1-drn.nc"
riv-2-drn = "riv-2-drn.nc"
drn-1 = "drn-1.nc"
drn-2 = "drn-2.nc"

[River]
riv-1 = "riv-1.nc"
riv-2 = "riv-2.nc"
```

iMOD Python: sla model op en bekijk in QGIS

```
mf6_sim.dump("path/to/dir", mdal_compliant=True)
```



Roadmap

- July 2023:
 - Afronden iMOD5 backwards compatibility (bijv. support MetaSWAP)
- November 2023 (international iMOD day!):
 - iMOD Python ondersteuning om modellen naar submodellen te partitioneren
 - Parallel Modflow 6 tutorial
- 2024
 - HydroMT iMOD plugin
 - Nog nader te bepalen

Work in progress

- Issues 165
- List
- Boards
- Service Desk
- Milestones**
- Requirements

Deltares > iMOD > imod-python > Milestones

Open 7 Closed 4 All 11

Filter by milestone name

sprint 3

May 30, 2023–Jun 9, 2023

Expired Deltares / iMOD / imod-python

35 Issues · 2 Merge requests 31% complete

Epic: TOML file and regridding/clipping models; backwards compatibility with iMOD 5

Jan 26, 2023–Sep 1, 2023

Open Deltares / iMOD / imod-python

28 Issues · 2 Merge requests 39% complete

Epic: Multi-model support - MF6

Jan 26, 2023–Nov 1, 2023

Open Deltares / iMOD / imod-python

2 Issues · 0 Merge requests 0% complete

Epic: v1.0 release

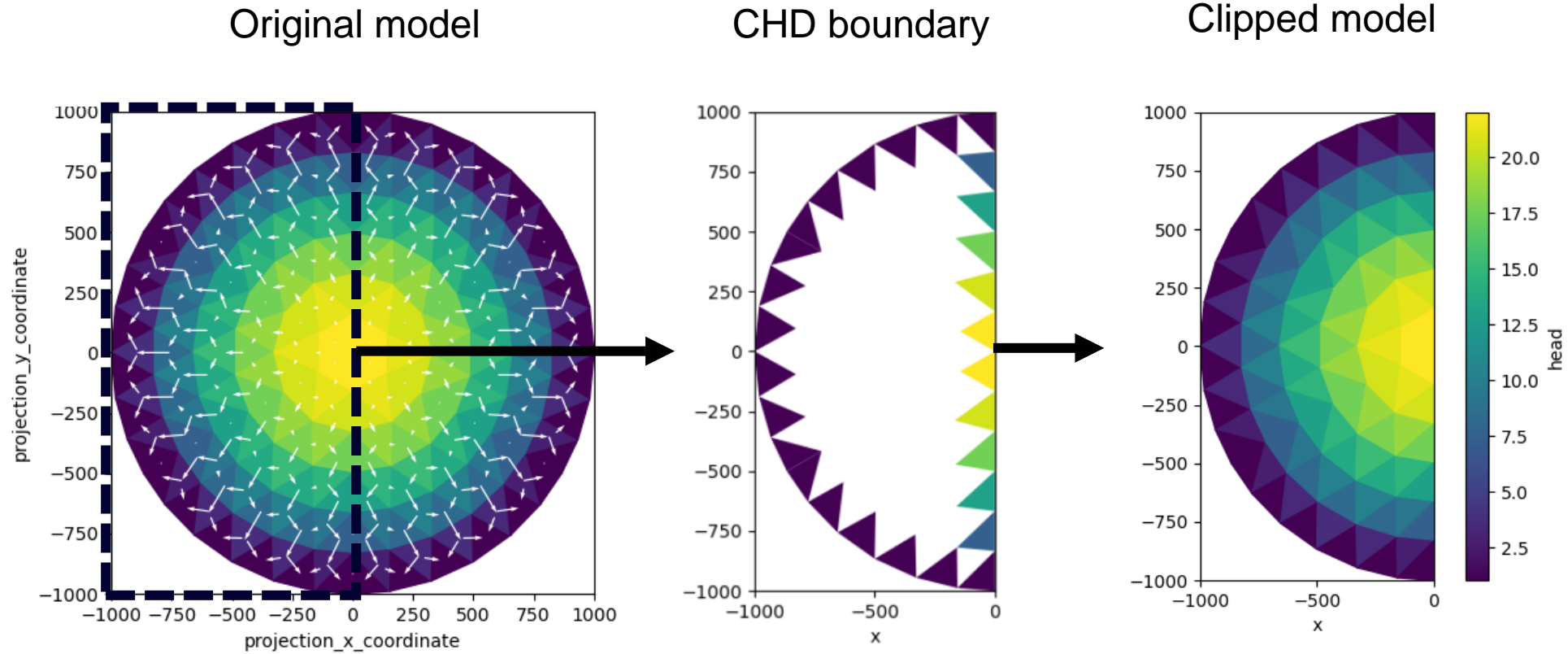
Open Deltares / iMOD / imod-python

4 Issues · 0 Merge requests 0% complete

Epic: Modflow 6: Differentiate Package objects into low-level and

12 Issues · 1 Merge request 22% complete

iMOD Python: model clippen, randvoorwaarden toevoegen



iMOD Python vergelijking Flopy

Functionaliteit	Flopy	iMOD Python
Modelcodes	7 USGS modelcodes	iMODFLOW, iMOD-WQ, Modflow 6, MetaSWAP
Alle Modflow 6 functionaliteit ondersteunt?	Ja	Nee
Datastructuren	Numpy	Xarray
Package afhankelijkheden	Weinig	Veel
Gelimiteerd door beschikbaar werkgeheugen?	Ja	Nee

iMOD Python vergelijking Flopy

- Voorbeeld:
 - Modflow 6 heads inladen
 - Selecteer punt op x, y locatie
 - Bereken gemiddelde over tijd op dit punt

```
import flopy

hds = flopy.utils.binaryfile.HeadFile("GWF_1/GWF_1.hds")
head = hds.get_alldata()

simulation = flopy.mf6.MFSimulation.load(sim_ws=".")
model = simulation.get_model("GWF_1")
grid = model.modelgrid
row, column = grid.intersect(50_000.0, 30_000.0)
selection = head[:, :, row, column]

mean_head = head.mean(axix=0)
```

```
import imod

head = imod.mf6.open_hds("GWF_1/GWF_1.hds", "GWF_1/GWF_1.grb")

selection = head.sel(x=50_000.0, y=30_000.0, method="nearest")
mean_head = head.mean("time")
```

Rijke datastructuur (xarray) zorgt voor minder regels code, en verbetert leesbaarheid!

Contact

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