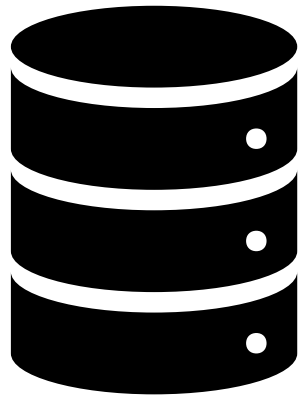
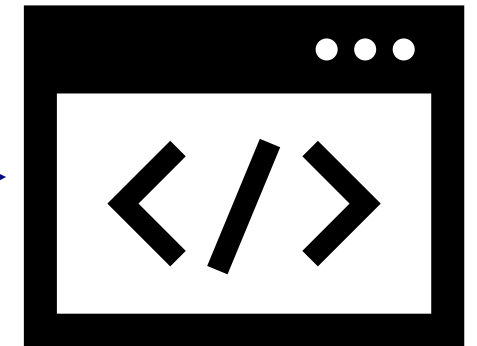


Scripting a Delft-FEWS configuration

“Scripting is the automated creation of parts of a Delft-FEWS configuration, based on metadata.”



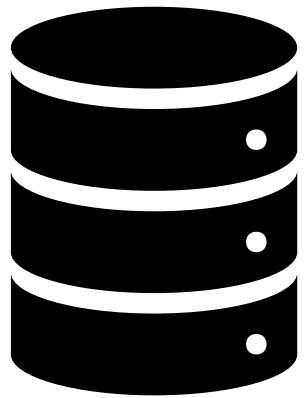
```
p['INPUT_{}'.format(i + 1)], p['INPUT_M  
[{}].format(i + 1)], {'unit':'minute', 'm  
citeMode='read only', lag={'unit': 'minu  
put', '$MODULE_INSTANCE_ID$', p['OUTPUT  
:'minute', 'multiplier':'15'}, {'unit':
```



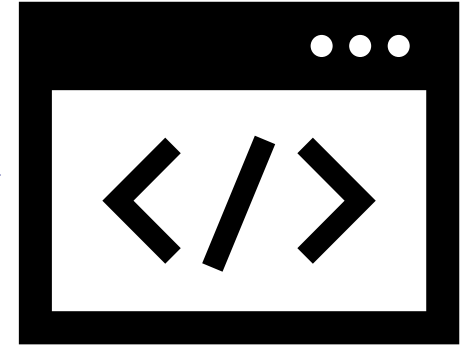
- Gauge locations
- Basin models
- Rating curves
- Thresholds
- ...

- Workflow files
- Map layer files
- Topology files
- ModuleDataSetFiles
- ...

Scripting a Delft-FEWS configuration



```
p['INPUT_{}'.format(i + 1)], p['INPUT_M  
{}'.format(i + 1)], {'unit': 'minute', 'm  
siteMode='read only', lag={'unit': 'minu  
put', '$MODULE_INSTANCE_ID$', p['OUTPUT  
: 'minute', 'multiplier': '15'}, {'unit': '
```



What? Why? How?

DF Delft-FEWS User Days 1 (DSD-I... ⋮

General 📺

1 Coffee Break – German corner

2 Coffee break – Latin American co...

3 Coffee break – Informal chit-chat

B-FEWS OpenDatabase – Andre Gri...

B-Meet the configuration expert – ...

B-Meet the configuration expert – ...

B-Meet the configuration expert – ...

B-Peter van der Wal and new meeting to

B-Scripting a configuration – Jan Verk...

B-Statistics, Thresholds, WQ, Time ...

17:05h



Deltares

Scripting a Delft-FEWS configuration

Dr Jan Verkade

November 2, 2020

“Scripting a Delft-FEWS configuration

1. Why at all relevant?
2. What do we mean by “scripting”?
3. Why script?
4. Approaches
 - what do we (not) script?
 - where do we script from?
 - what tools do we use?
5. Example: the Deltares global fluvial flow forecasting system
6. Where / how to start?



Some notes

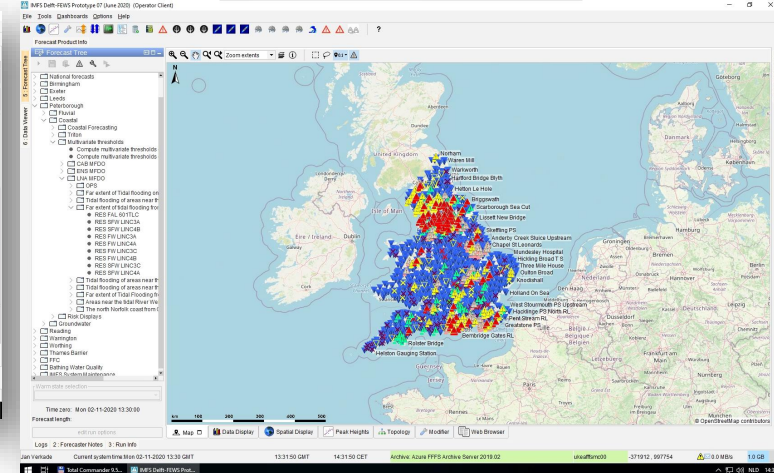
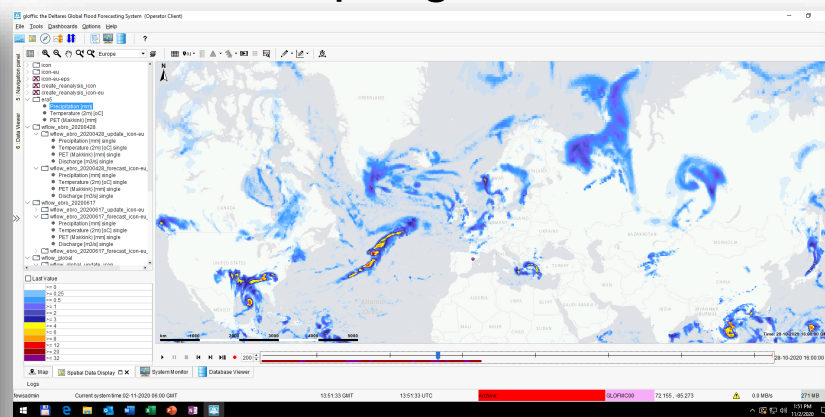
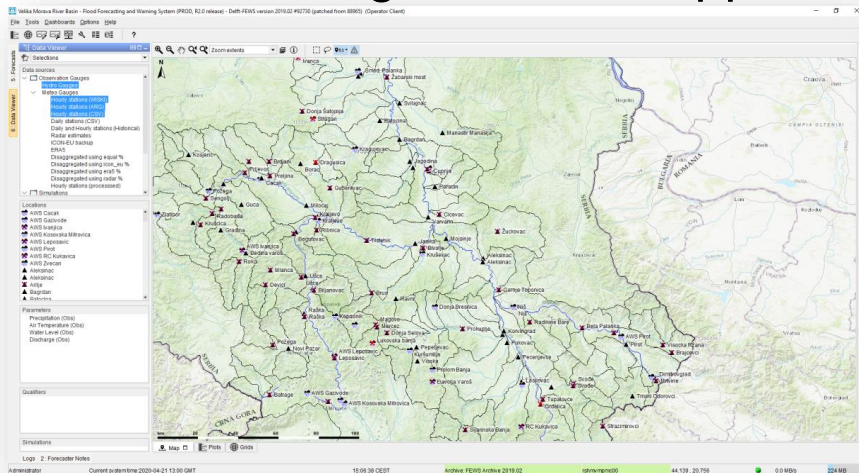
- Scripting is very much 'a field in progress'
- Not all questions have been asked
- No definitive answers have been given
- Slowly, some 'best practices' are forming



[This Photo](#) by Unknown Author is licensed under [CC BY-NC](#)

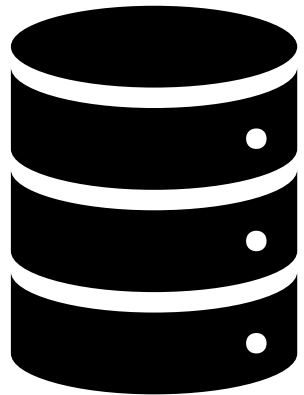
Why spend time talking about scripting?

- Delft-FEWS developments in place that allow for scripting to be done
 - templating of General Adapters, Transformations
 - storage of metadata in .csv, .dbf/.shp files
 - increased use of ‘functions’ in location set definition, threshold definitions, etc.
- Solves potential problems
 - efficient configuration building
 - separation of responsibilities: metadata management v. Delft-FEWS config management
 - near immediate uptake of metadata changes in forecasting applications
 - availability of configuration skills
- Growing number of applications where scripting is used to build configurations

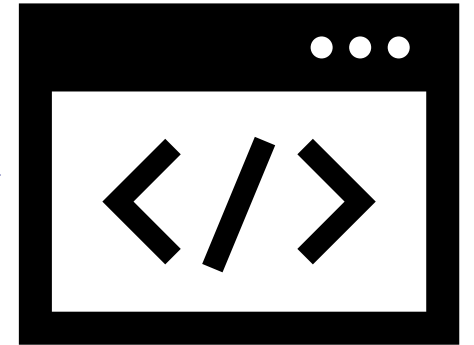


What do we mean by “scripting a Delft-FEWS config”?

“Scripting is the automated creation of parts of a Delft-FEWS configuration, based on metadata.”



```
p['INPUT_{}'.format(i + 1)], p['INPUT_M  
[{}].format(i + 1)], {'unit':'minute', 'm  
citeMode='read only', lag={'unit': 'minu  
put', '$MODULE_INSTANCE_ID$', p['OUTPUT  
:'minute', 'multiplier':'15'}, {'unit':
```



- Gauge locations
- Basin models
- Rating curves
- Thresholds
- ...

- Workflow files
- Map layer files
- Topology files
- ModuleDataSetFiles
- ...

Why script?

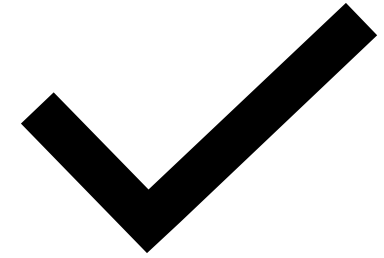
1. Ensure compliance between metadata and configurations
2. Quickly include metadata changes in a forecasting application
3. Impose uniformity on configurations
4. Cost efficiency
5. Allow for separation of tasks: management of metadata v management of configurations
6. ...



What do we (not) script?

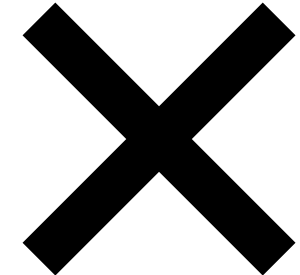
Do script:

- config elements that are subject to frequent updates
- elements that are repeated throughout the configuration



Do not script:

- elements that are highly custom (explorer.xml, global.properties, ...)
- elements that appear few times in your configuration only
- elements that don't change very often



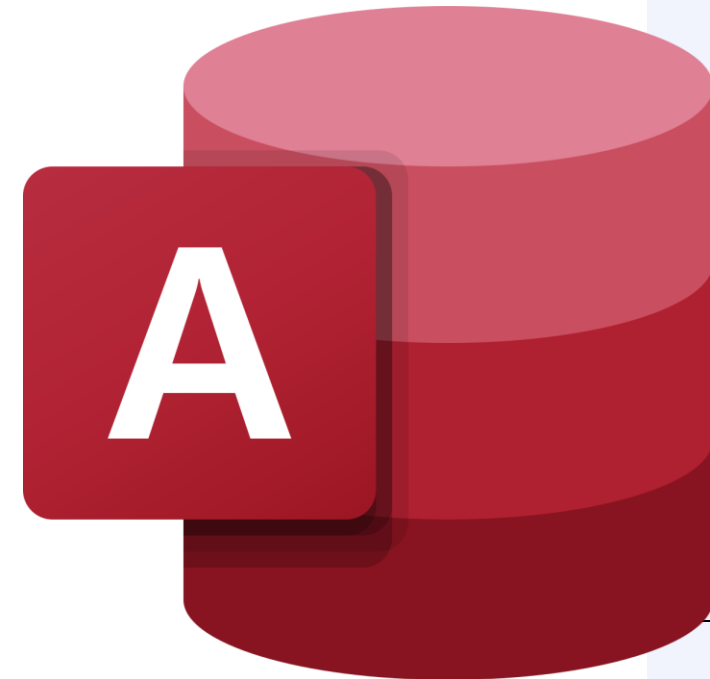
→ this varies from application to application

Approaches: where to script *from*?

- file based storage (e.g., .xlsx or .csv files)
- local database (e.g., MS Access Database)
- database on a server (e.g., SQL)
- ...

Considerations include...

- What's currently available?
- Who manages the metadata v. who builds the configuration
- Degree of referential data integrity required
- Costs
- ...



Approaches: tools for scripting

- Any scripting language. So far we've seen scripts in Visual Basic, Python and R.
- Export of data to .csv files is almost trivial
- Helpful if there is a good xml library available
 - Matlab: [XML toolbox](#)
 - Python: [xml.etree.ElementTree library](#)
 - R: [xml2 package](#)



Some examples

Scripting “*light*”: Velika Morava map layer files

Locations.xlsm - Excel

Jan Verkade

Share Comments

File Home Insert Page Layout Formulas Data Review View Help OFFICE REMOTE Tell me what you want to do

Clipboard Font Alignment Number Styles Cells Editing

AutoSave

Calibri 11 A A

B I U

Wrap Text

Text

Conditional Formatting

Format as Table

Title 3 Title 4 Total 2 Total 3 Total 4

Warning Text 2 Warning Text 3 Warning Text 4 Normal Bad

Insert Delete Format

AutoSum Fill Clear

Sort & Filter Find & Select

A1

CSV Export directory ..\MapLayerFiles

Export CSV

navigate to tab

hydro_gauges

meteo_gauges

grids

exp_met_hec-hms

imp_hec-hms

imp_wflow

locations of all hydro gauges as part of Velika Morava

placeholder of all grid locations

meteo locations used in HEC-HMS velika_morava model with their HEC-HMS location and parameter names as attribute columns

forecast locations of the HEC-HMS velika_morava model with their HEC-HMS location and parameter names as attribute columns

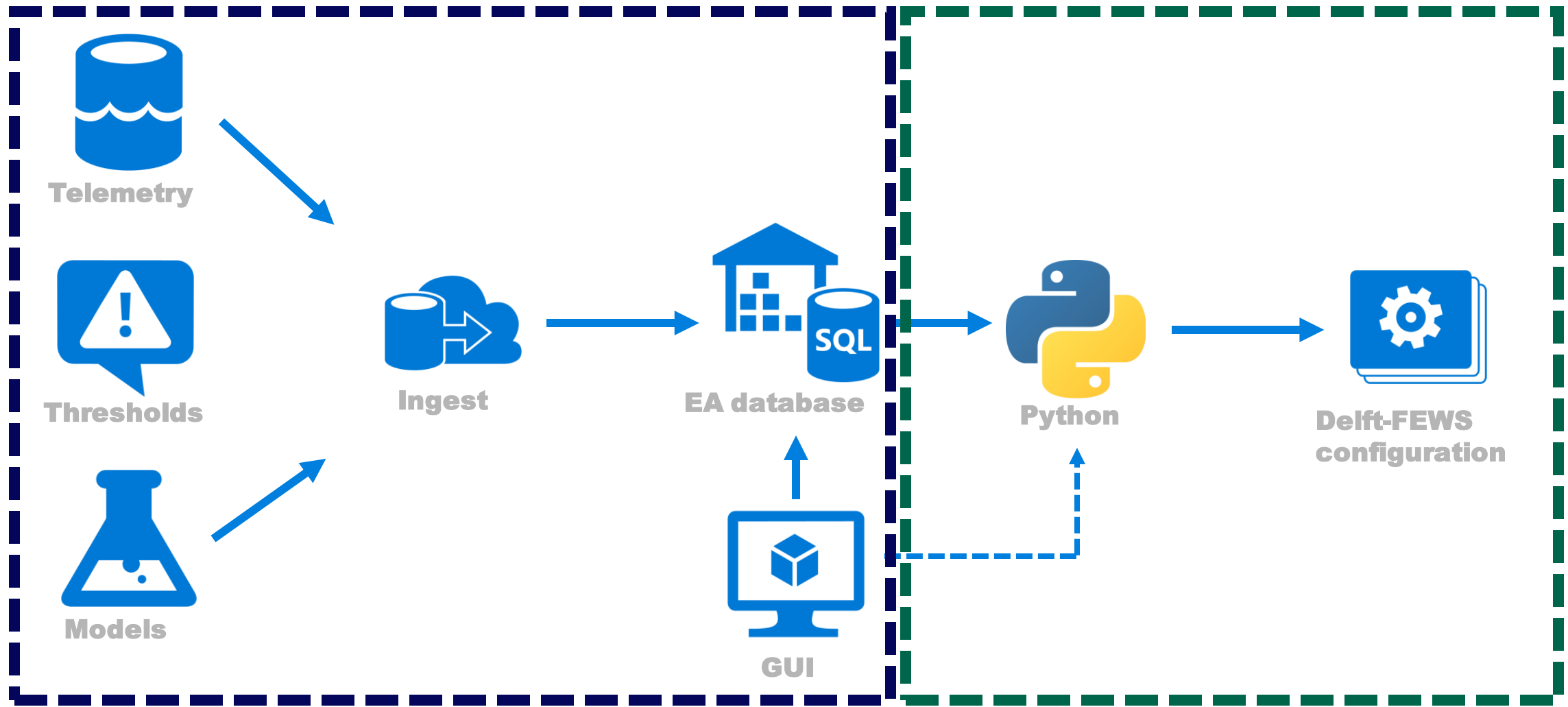
forecast locations of the Wflow Sava model with their Wflow location names as attribute column

General hydro_gauges.csv meteo_gauges.csv grids.csv exp_met_hec-hms.csv imp_hec-hms.csv imp_wflow.csv

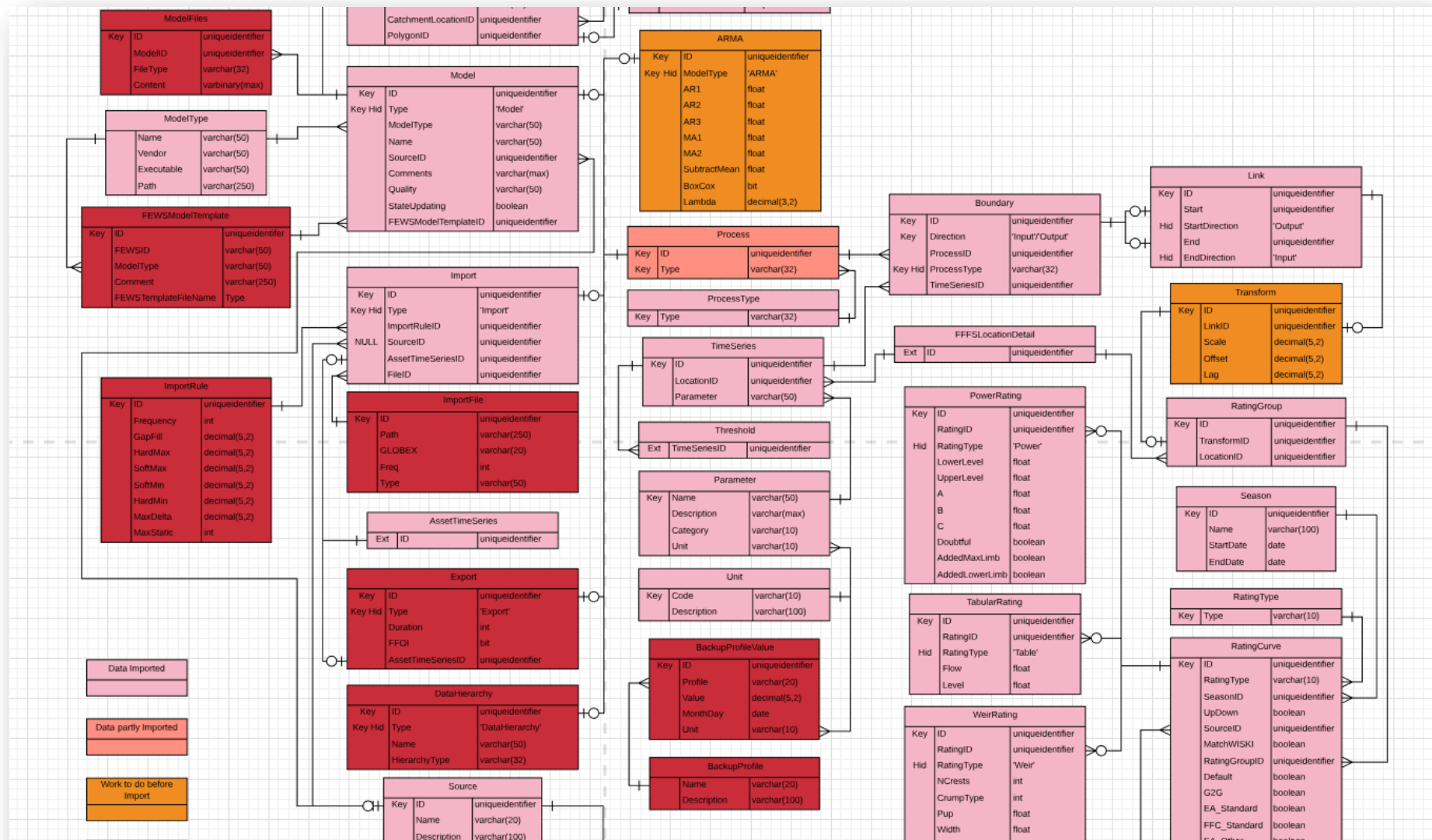
Ready

100%

IMFS: England's new flood forecasting system



IMRD: the metadata repository underlying IMFS



De Database and GUI developed by JBA. Additional information from paul.wass@jbaconsulting.com

ALPHA This is a new service – your [feedback](#) will help us to improve it.

- Dashboard
- Locations
- Geolocations
- Monitoring assets
- Models
- Network
- Rating curves
- Astrosums
- Thresholds
- Pending Edits
- MFDO Info
- Admin

[Home](#) > [Locations](#)

Locations

10

▼

entries

☐ RLOI only

☐ Scenario only

[Clear filters](#)

Search:

IMFS ID	Name	River	Centre	Area	Category description	Type	Group	Nav tree catchment	
▶ 2158	Llandrinio	River Severn ...	Birmingham	NRW	Gauge	Water Level	Fluvial	Upper Severn	Details - Edit
▶ 46121	Cobden Street	Willow Brook	Birmingham	DBNTLS	Gauge	Water Level	Fluvial	Soar	Details - Edit
▶ cINFLW03_SW_UG_SL_...	Stour Worcs Lat C3 Scal...	River Stour	Birmingham	STWKWM	Ungauged	FMP Model Node	Fluvial	Stour (Worcs)	Details - Edit
▶ bINFLW03_UG_SL_C05...	Teme Lat 3 Scaled Clun ...	River Clun	Birmingham	SHHRWG	Ungauged	FMP Model Node	Fluvial	Teme	Details - Edit
▶ VYRNWY5_UG_SL_C054...	Severn Lower Middle Sca...	River Severn	Birmingham	SHHRWG	Ungauged	FMP Model Node	Fluvial	Upper Severn	Details - Edit
▶ 3380_RK	Derwent Reservoir RG		Birmingham	DBNTLS	Gauge	Rainfall	Pluvial	Derwent	Details - Edit
▶ 3201	Atherstone		Birmingham	STWKWM	Gauge	Rainfall	Pluvial	Tame	Details - Edit
▶ 1748	Burwarton		Birmingham	SHHRWG	Gauge	Rainfall	Pluvial	Teme	Details - Edit
▶ 2207	Hall Green Road	River Sowe	Birmingham	STWKWM	Gauge	Water Level	Fluvial	Upper Avon	Details - Edit
▶ 055039	Peterchurch	River Dore	Birmingham	SHHRWG	Gauge	Water Level	Fluvial	Wye	Details - Edit

More actions

- [Create new location](#)
- [Bulk create new locations \(upload\)](#)

ALPHA

This is a new service – your [feedback](#) will help us to improve it.

Dashboard

Locations

Geolocations

Monitoring assets

Models

Network

Rating curves

Astrosums

Thresholds

Pending Edits

MFDO Info

Admin

Home

>

Locations

>

Details

Immingham

UKCFF Tide Gauge

IMFS ID

Category

Description

Admin comment

Easting/Northing

Lat/Long

Coastal order

Centre

Additional centres

WISKI ID

Telemetry ID

Spatial layers
(Edit via Geolocation)

Target lead time

Geolocation

Last edited by

Last edited on

UKCFF_IMMI

Coastal - Water Level - Gauge

UKCFF Tide Gauge

National Coastal Location. Changed grid ref see spreadsheet Updated coastal references EM 07/06/2017

528062, 411612

53.5854618726218, -0.0669224937175655

439000

National Coastal

BWQ, FFC, Leeds, Peterborough, RLOI, Thames Barrier

L3360,

E71139, 5338N011W

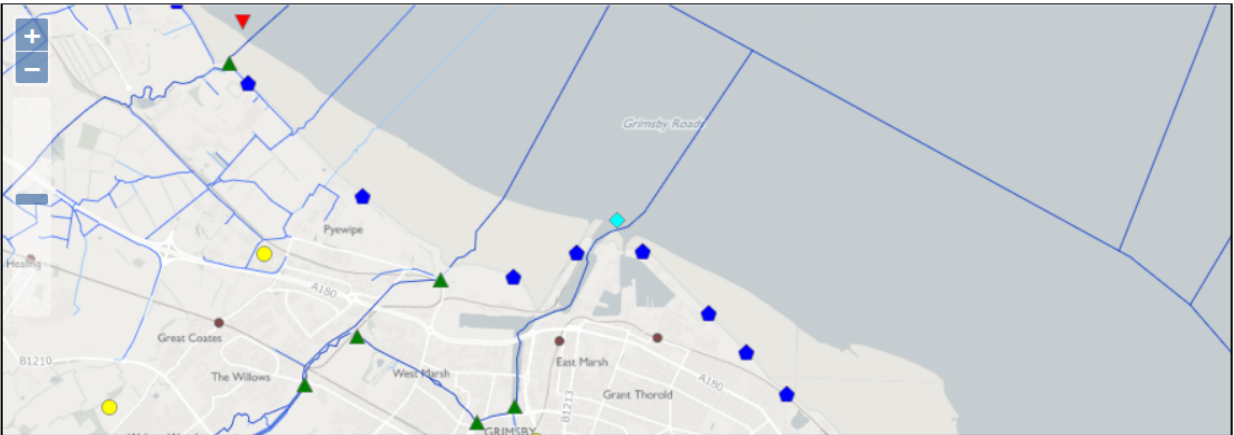
Immingham (CoastalReach)
North East Lincolnshire (LocalAuthority)
Humberside (LocalResilienceForum)
Lincolnshire and Northamptonshire (MFDOArea)
Great Grimsby Boro Const (MPConstituency)
Lincs and Northants (PFArea)
Lincs and Northants (WMArea)

120mins

[East Marsh Grimsby](#)

deborah.cooper@environment-agency.gov.uk

16/06/2020



[Recentre map](#)

[Show / hide map legend](#)

Time Series

UDO ID	External ID	Parameter	Qualifier	WISKI ID	WISKI parameter	Unit	Internal parameter	
	E71139	Water Level		L3360	L5	m	H.obs	View monitoring asset
Database and GUI developed by JBA. Additional information from paul.wass@jbaconsulting.com								
								Monitoring asset
								Monitoring asset

Scripts

- Python based; written by Martijn Kwant
- Produce over 5,100 configuration files
 - ~2,100 workflow files
 - ~1,800 ModuleDataSetFiles
 - ~80 mapLayerFiles jointly containing ~380,000 lines of metadata
- In future, outputs will automatically be included in the operational client-server system (!)

c:\Python\scripts\output\Config*. *				
↑ Name	Ext	Size	Date	Attr
↑ [..]		<DIR>	01/11/2020 11:29----	
📁 [AdminInterfaceFiles]		151,204	16/09/2020 10:52---	
📁 [ColdStateFiles]		1,713,265	01/11/2020 11:12----	
📁 [DisplayConfigFiles]		1,788,256	16/09/2020 10:47---	
📁 [IdMapFiles]		198,888	17/09/2020 10:40---	
📁 [MapLayerFiles]		35,924,975	17/09/2020 11:05---	
📁 [ModuleConfigFiles]		3,023,740	17/09/2020 10:40---	
📁 [ModuleDataSetFiles]		118,288,095	01/11/2020 11:30----	
📁 [RegionConfigFiles]		7,855,368	17/09/2020 10:42---	
📁 [SystemConfigFiles]		4,274,502	17/09/2020 10:43---	
📁 [TravelTimesFiles]		108,168	17/09/2020 10:36---	
📁 [WorkflowFiles]		30,749,903	17/09/2020 10:42---	

Deltares



Forecast Product Info

Forecast Tree

6 : Data Viewer 5 : Forecast Tree

- ☐ National forecasts
- ☐ Birmingham
- ☐ Exeter
- ☐ Leeds
- ☒ Peterborough
 - ☐ Fluvial
 - ☒ Coastal
 - ☐ Coastal Forecasting
 - ☐ Triton
 - ☒ Multivariate thresholds
 - Compute multivariate thresholds
 - Compute multivariate thresholds
 - ☐ CAB MFDO
 - ☐ ENS MFDO
 - ☒ LNA MFDO
 - ☐ OPS
 - ☐ Far extent of Tidal flooding on
 - ☐ Tidal flooding of areas near th
 - ☒ Far extent of tidal flooding fr
 - RES FAL 601TLC
 - RES SFW LINC3A
 - RES SFW LINC4B
 - RES FW LINC3A
 - RES FW LINC4A
 - RES FW LINC3C
 - RES FW LINC4B
 - RES SFW LINC3C
 - RES SFW LINC4A
 - ☐ Tidal flooding of areas near th
 - ☐ Tidal flooding of areas near th
 - ☐ Far extent of Tidal Flooding fr
 - ☐ Areas near the tidal River We
 - ☐ The north Norfolk coast from C
 - ☐ Risk Displays
- ☐ Groundwater
- ☐ Reading
- ☐ Warrington
- ☐ Worthing
- ☐ Thames Barrier
- ☐ FFC
- ☐ Bathing Water Quality
- ☐ IMFS System Maintenance

Warm state selection

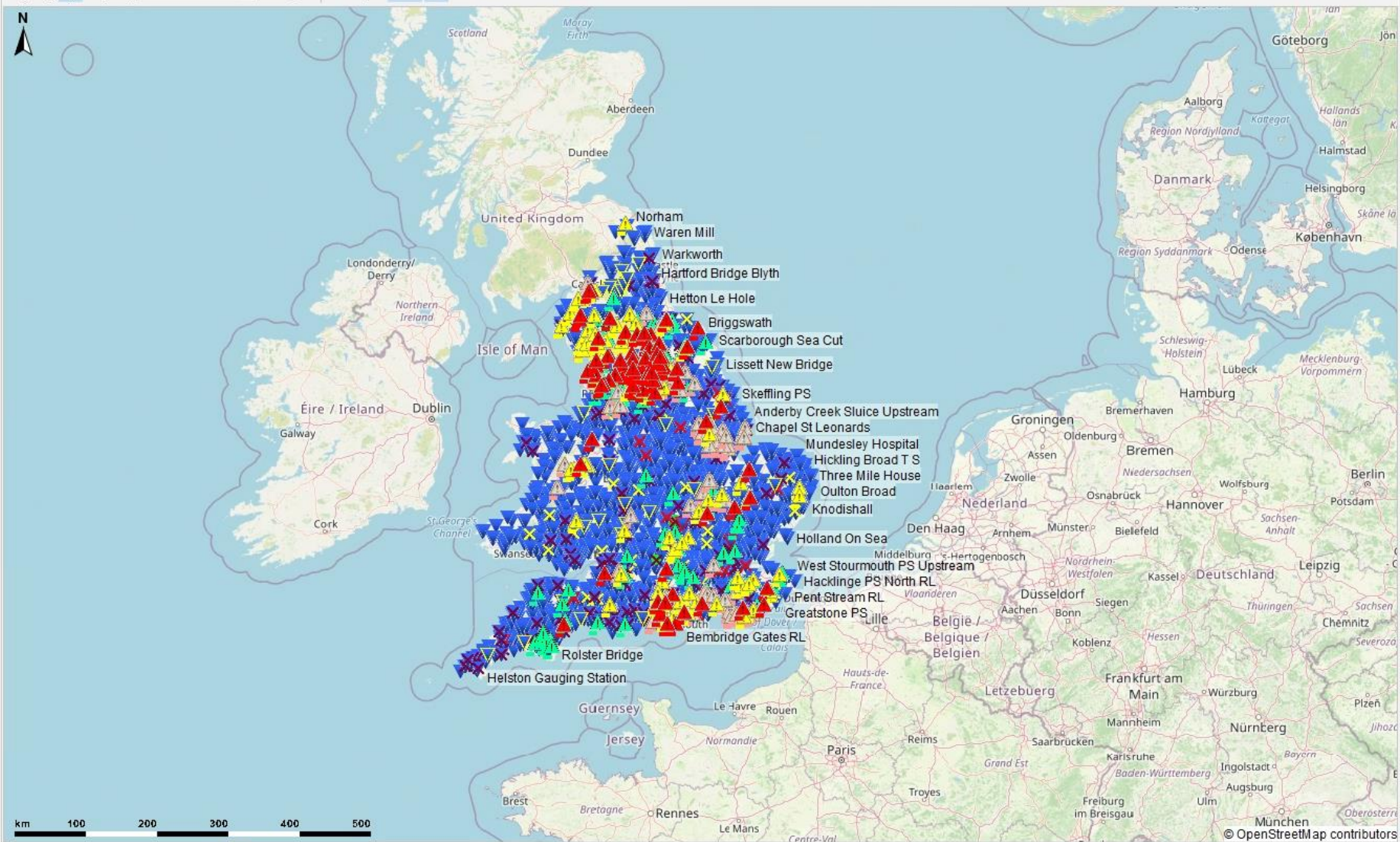
Time zero: Mon 02-11-2020 13:30:00

Forecast length:

edit run options

Logs 2 : Forecaster Notes 3 : Run Info

Zoom extents



Map Data Display Spatial Display Peak Heights Topology Modifier Web Browser

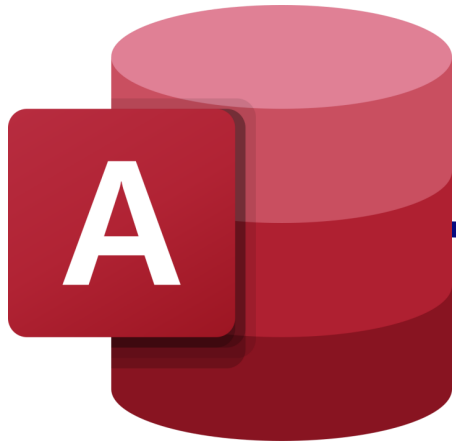
8 : Plot Overview

gloffis: the Deltares global fluvial flow forecasting system

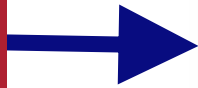
- patchwork of multiple models that can jointly cover the earth's land
- firmly based on wflow models, made possible by 'three clicks to a model' principle
- models vary in
 - coverage (and may, and indeed *do*, overlap)
 - temporal and spatial resolution
 - model type (sbm, hbv, ...)
 - required wflow.exe version (2019.1, 2020.1 ...)
- workflows vary in
 - model that is called
 - weather forecast product that is used
(currently, choice between various DWD ICON products: regional/global, ensemble/deterministic)

→ this is where the scripting rationale is: NWP forecasts, wflow models and workflows

gloffis

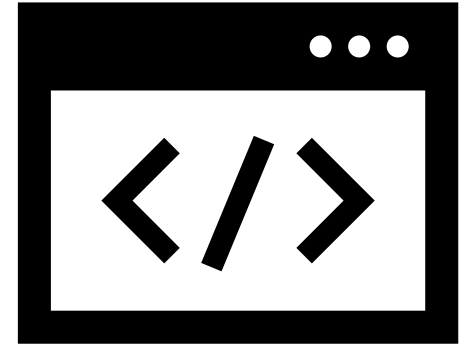
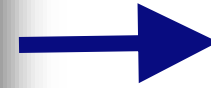


MS Access Database



```
p['INPUT_{}'.format(i + 1)], p['INPUT_M  
{}'.format(i + 1)], {'unit': 'minute', 'm  
citeMode='read only', lag={'unit': 'minu  
put', '$MODULE_INSTANCE_ID$', p['OUTPUT  
: 'minute', 'multiplier': '15'}, {'unit': '
```

Python

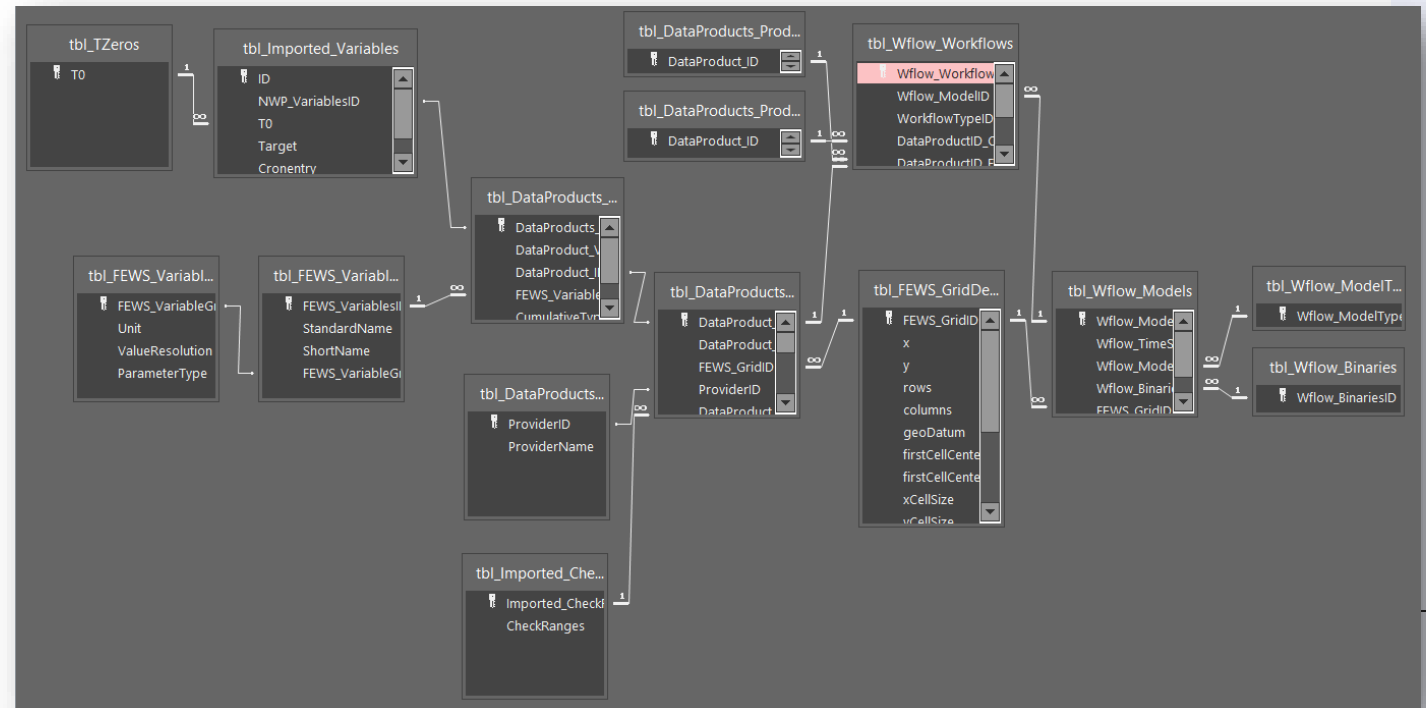


- RegionConfigFiles
- WorkflowFiles
- DisplayConfigFiles

(plus some)

gloffis metadata repository: MS Access database

- Enforces referential data integrity
- Allows for user-friendly access and editing of data using forms
- Not centrally hosted → pros and cons



Edit and add entries related to wflow models and data products

Manage data products information

Manage wflow models information

Data Product Grid

Add new data product grid

Edit data product grid

Data Product Information

Add new data product

Edit data product

Data Product Variables

Add new variable to import

Edit variable to import

Wflow Model Grid

Add new model grid

Edit model grid

Wflow Model Information

Add new model record

Edit model record

Wflow Model Workflow

Add new model workflow

Edit model workflow

Manage FEWS Internal Variables and Variable Groups

FEWS Internal Variables

Add new internal variable

Edit internal variable

FEWS Variable Groups

Add new variable group

Edit variable group

(1) Be sure to fill all required fields * in the form.
(2) Keep in mind that records can be deleted only if other records do not depend directly on them.

Navigation Pane

frm_FEWS_GridDetails

Grid Details

Name of grid*	wflow_ebro_20200428_grid
x*	0
y*	0
rows*	341
columns*	787
geoDatum*	WGS 1984
firstCellCenter_x*	-4.3958335
firstCellCenter_y*	43.179165
xCellSize*	0.0083333
yCellSize*	0.0083333
description	grid for ebro model for a resolution of 1k
GridType*	wflow_model

Record: 1 of 19 2 of 19 Filtered Search

Model Information

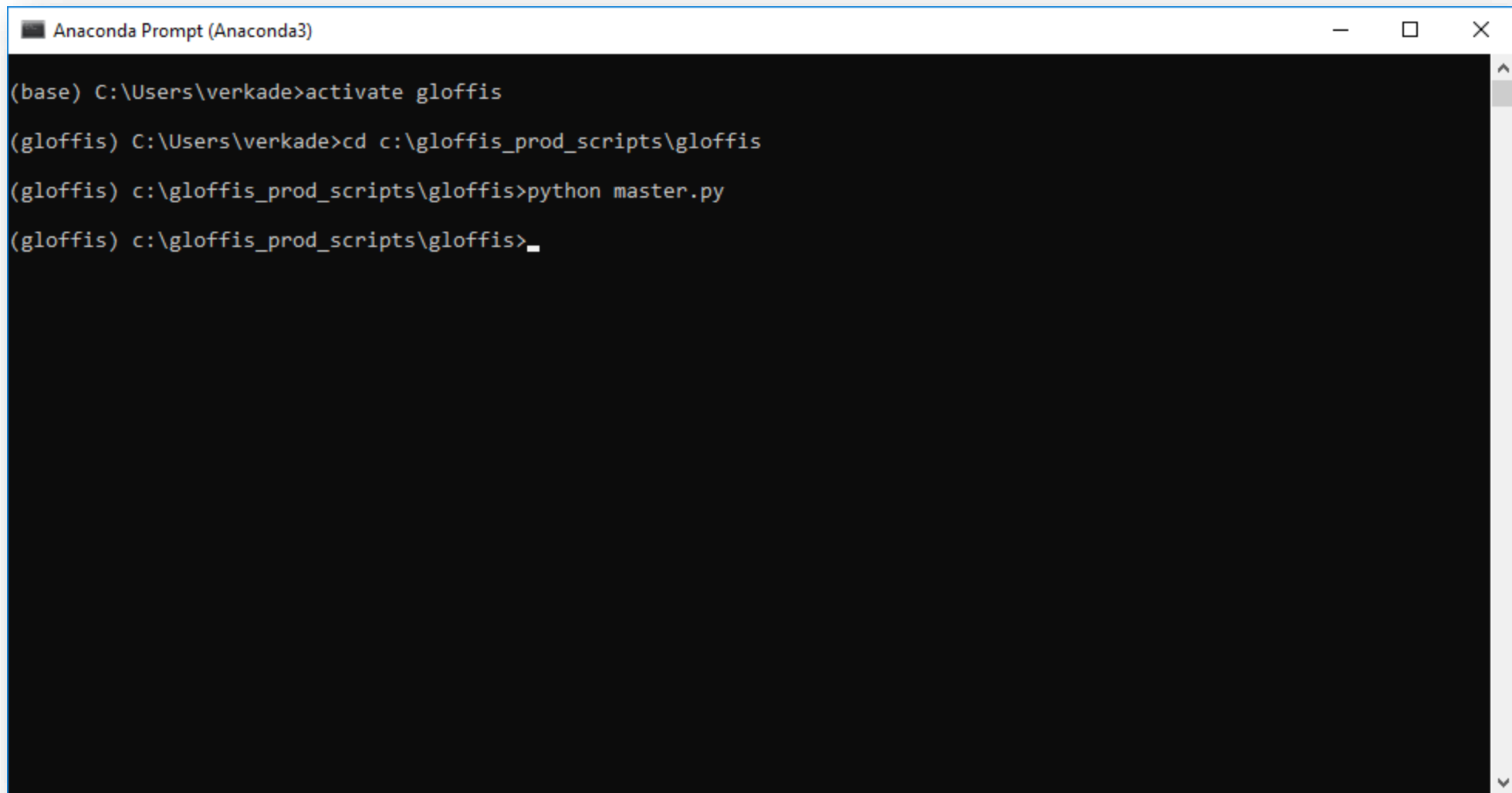
Wflow model name*	wflow_angermanalven_20200720
Time step of wflow model*	6
Type of wflow model*	sbm
Wflow binary used*	2020.1.1
Name of grid of wflow model*	wflow_angermanalven_20200720
Make active*	<input type="checkbox"/>

Save Cancel Delete

Wflow Workflow Information

Wflow model name*	wflow_ebro_20200428
Workflow type*	update
NWP used for online reanalysis*	icon-eu
NWP used for forecast*	icon-eu
Reanalysis used as observation*	era5
Reanalysis used as observation*	6

Save Cancel Delete



```

Anaconda Prompt (Anaconda3)
(base) C:\Users\verkade>activate gloffis
(gloffis) C:\Users\verkade>cd c:\gloffis_prod_scripts\gloffis
(gloffis) c:\gloffis_prod_scripts\gloffis>python master.py
(gloffis) c:\gloffis_prod_scripts\gloffis>_

```

*temp Config				
c:\Vews\2019.02\gloffis-prod-sa\Config*.*				
Name	Ext	Size	Date	Attr
[..]		<DIR>	24/08/2020 13:29--	
[CoefficientSetsFiles]		<DIR>	24/08/2020 13:29--	
[ColdStateFiles]		<DIR>	02/11/2020 12:03---	
[DisplayConfigFiles]		<DIR>	02/11/2020 12:03---	
[IconFiles]		<DIR>	24/08/2020 13:29--	
[IdMapFiles]		<DIR>	02/11/2020 12:03---	
[MapLayerFiles]		<DIR>	24/08/2020 13:29--	
[ModuleConfigFiles]		<DIR>	24/08/2020 13:28--	
[ModuleDataSetFiles]		<DIR>	01/11/2020 12:07---	
[RegionConfigFiles]		<DIR>	02/11/2020 12:03---	
[ReportImageFiles]		<DIR>	24/08/2020 13:29--	
[ReportTemplateFiles]		<DIR>	24/08/2020 13:29--	
[RootConfigFiles]		<DIR>	01/11/2020 12:07---	
[SystemConfigFiles]		<DIR>	01/11/2020 12:07---	
[UnitConversionsFiles]		<DIR>	24/08/2020 13:29--	
[WorkflowFiles]		<DIR>	02/11/2020 12:03---	

Changes that are made, are conveniently highlighted by version control software

video

Scripting: where and how to start?

- Does it make sense for me to invest in 'scripting'?
- How 'dynamic' is my configuration? Where, in the config, are the dynamics?
- How is my metadata organized?
- Do I have expertise in scripting available?
- ...

→ feel free to ask for help!



Whom to talk to about scripting

- First and foremost: your 'account manager'
- Any of below Deltares staff members...



Marc van Dijk
marc.vandijk@deltares.nl



Jan Verkade
jan.verkade@deltares.nl



**Bart van Osnabrugge –
de Vries**
Bart.vanOsnabrugge@deltares.nl



Martijn Kwant
Martijn.Kwant@deltares.nl

Questions to the audience

Have you considered moving to a 'scripted configuration'?
If so, what were/are your considerations?

Jan Verkade

jan.verkade@deltares.nl, +31 6 5161 6107

