Delft-FEWS, Open Archive and WaterCoach
- connecting the dots -

### *Delft-FEWS User Days Australia 25.08.2022*

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August 2022

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  - Why?
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  - Highlights
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- WaterCoach
  - What is it?
  - Relation with Open Archive
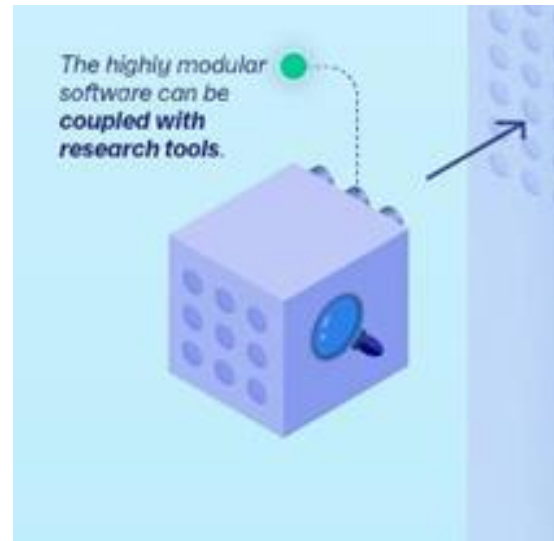 - Desired developments

As usual: Links for more info
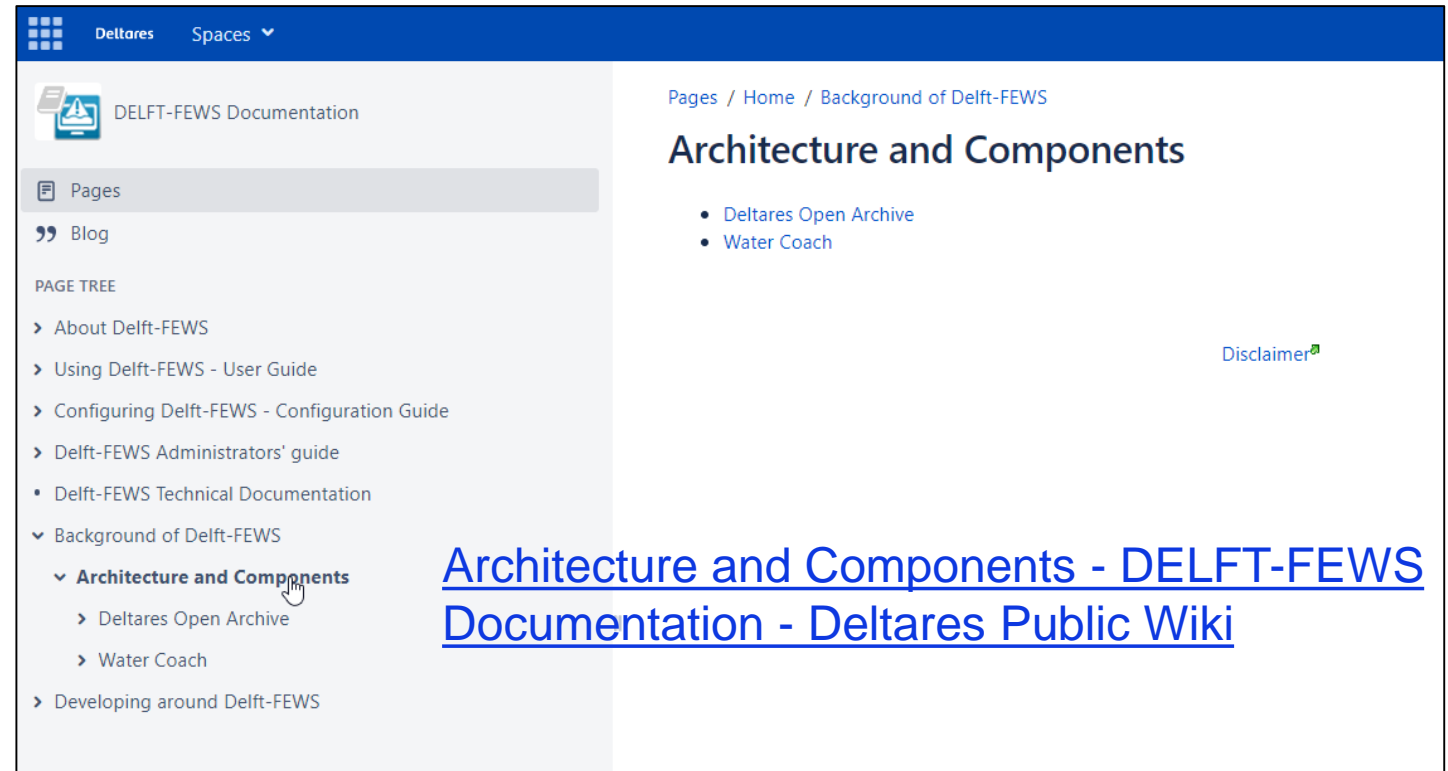
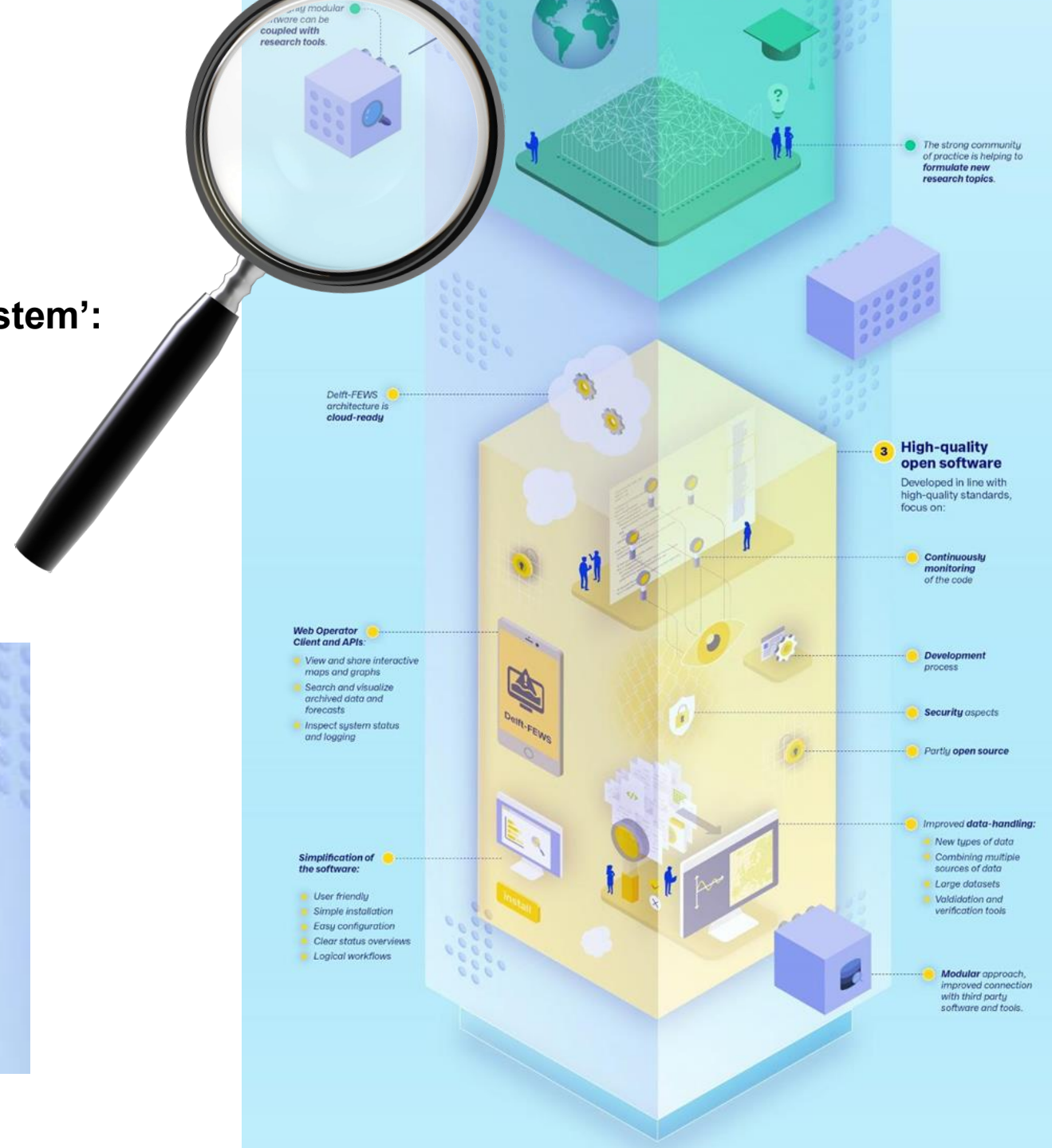Architecture and Components - DELFT-FEWS Documentation - Deltares Public Wiki

Introduction

Important components of the FEWS 'ecosystem':
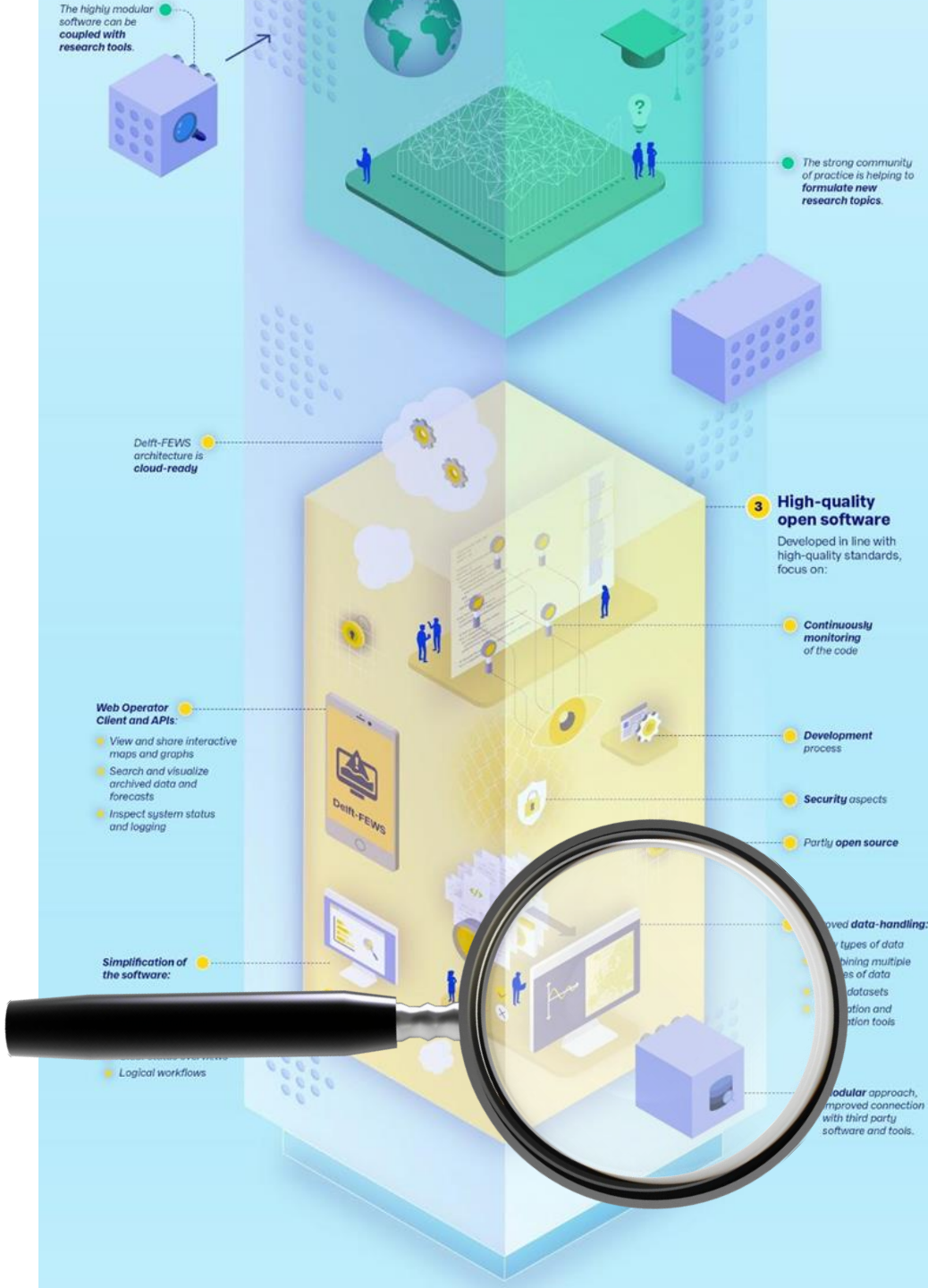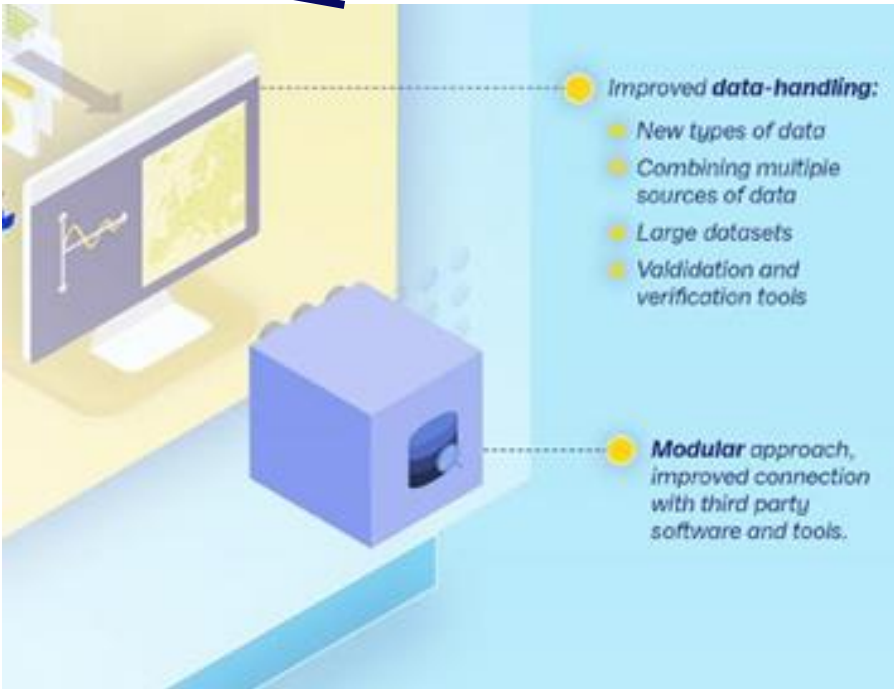
Open Archive   &   WaterCoach

Deltares

Introduction

Important components of the FEWS 'ecosystem':

Open Archive   &   WaterCoach
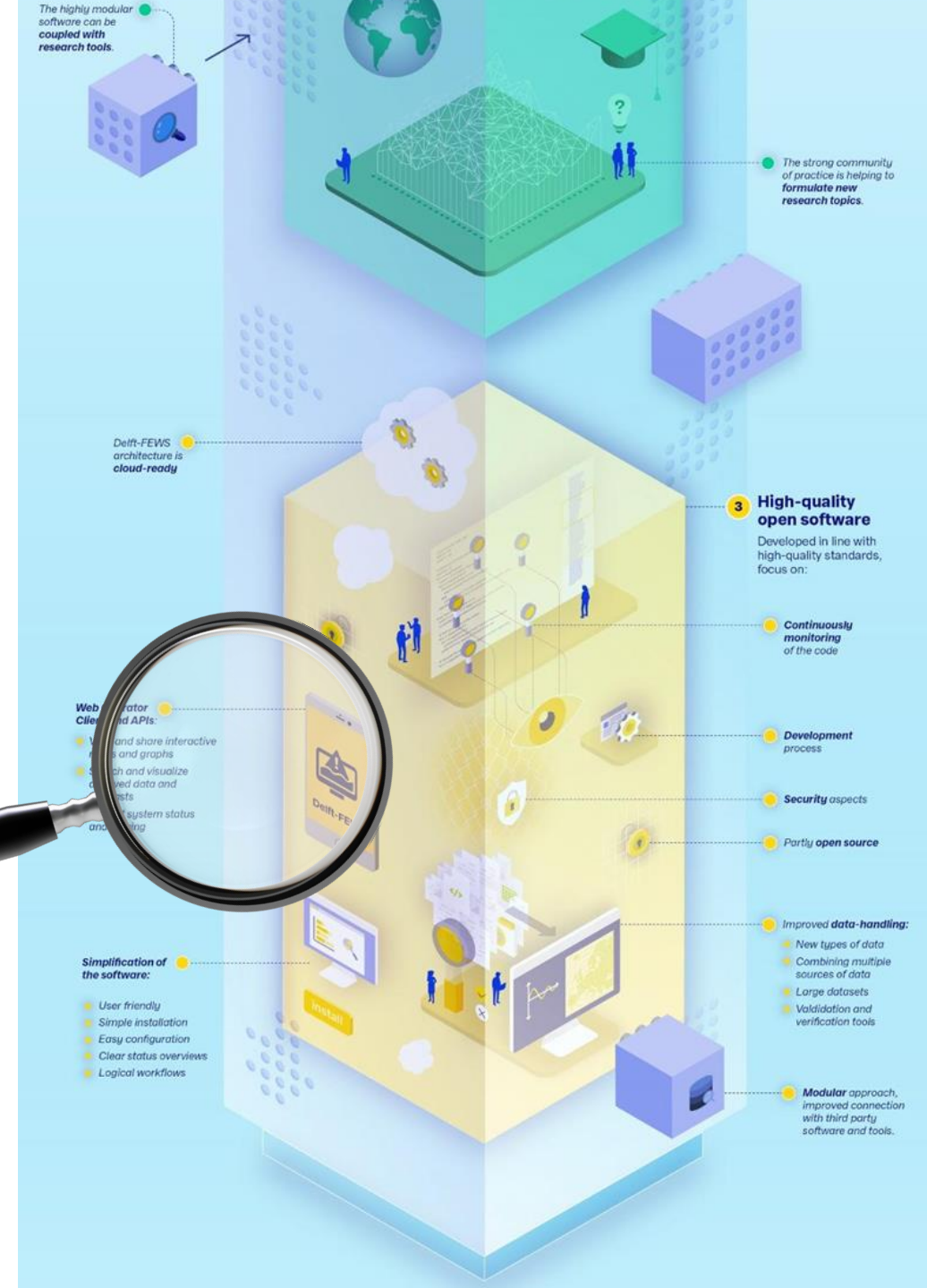

Deltares

Introduction

Important components of the FEWS 'ecosystem':

Open Archive & WaterCoach

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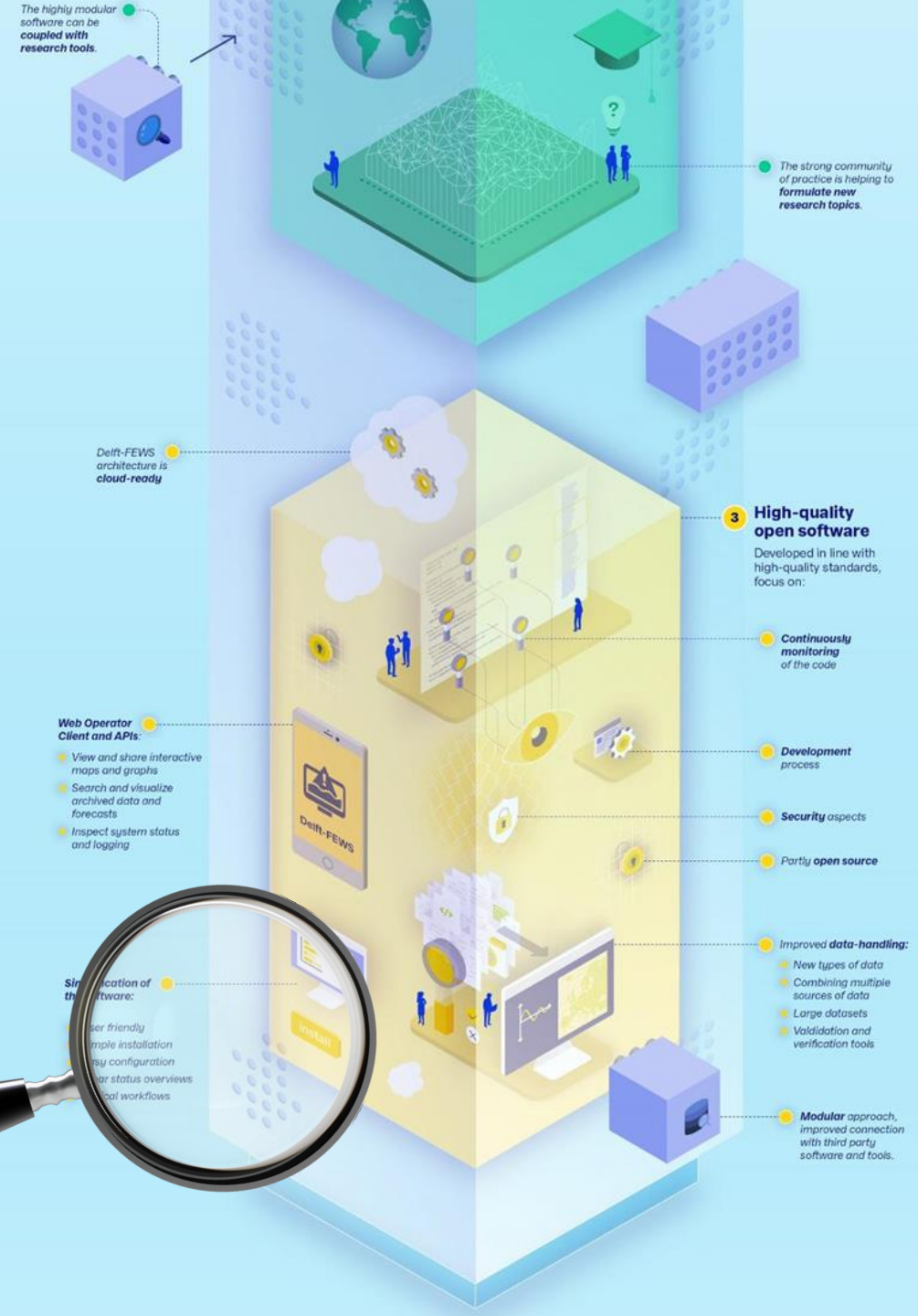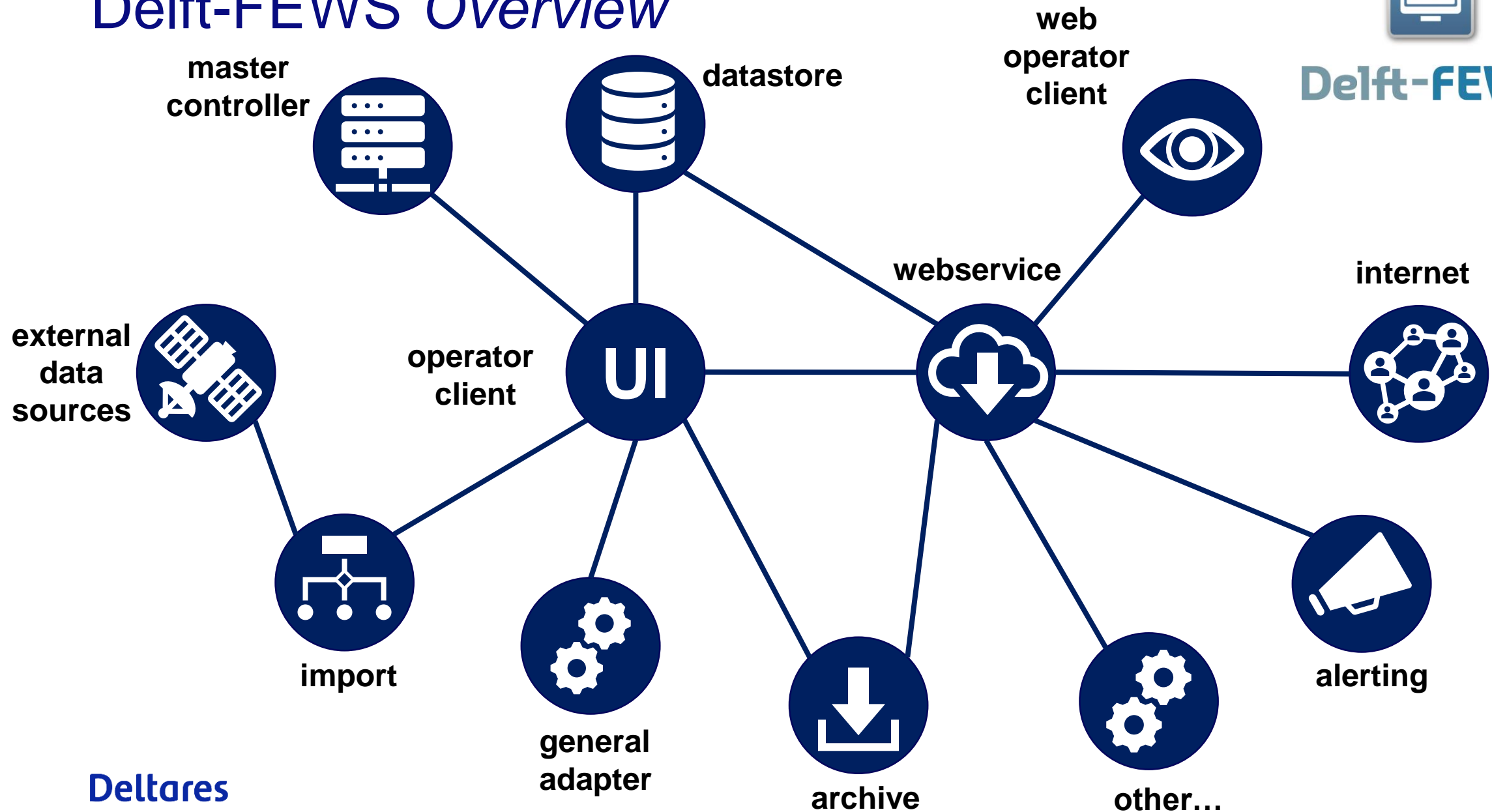
Open Archive   &   WaterCoach

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Delft-FEWS *Overview*

Delft-FEWS *Overview*
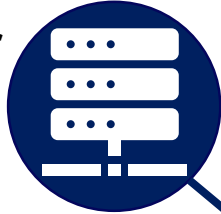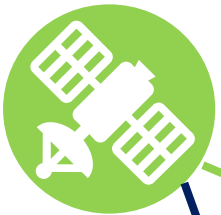
FEWS Open Archive

- Introduction – links to FEWS road maps 2025

- FEWS Open Archive
  - What's in a name?
  - Why?
  - How? (incl. new developments)
  - Highlights
  - Desired developments

- WaterCoach
  - What is it?
  - Relation with Open Archive
  - Desired developments

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Open Archive: What's in a name?

Archive (dusty)

**(Big) data lake
(or graveyard?)**

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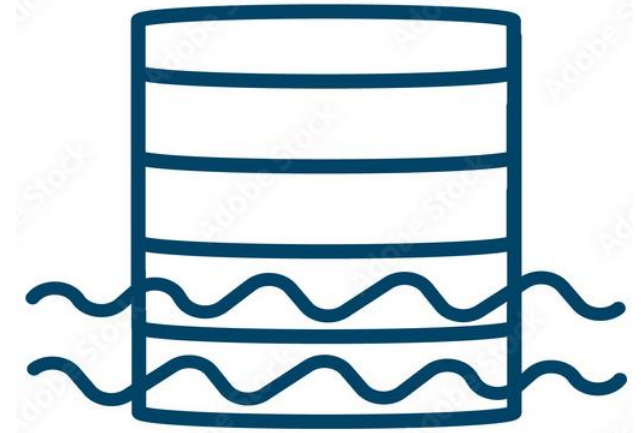
Open Archive: What's in a name?

- **Archive (dusty)**

- **(Big) data lake (or graveyard?)**

Library with magic

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Open Archive: What's in a name?

Why is it called **Open** Archive?

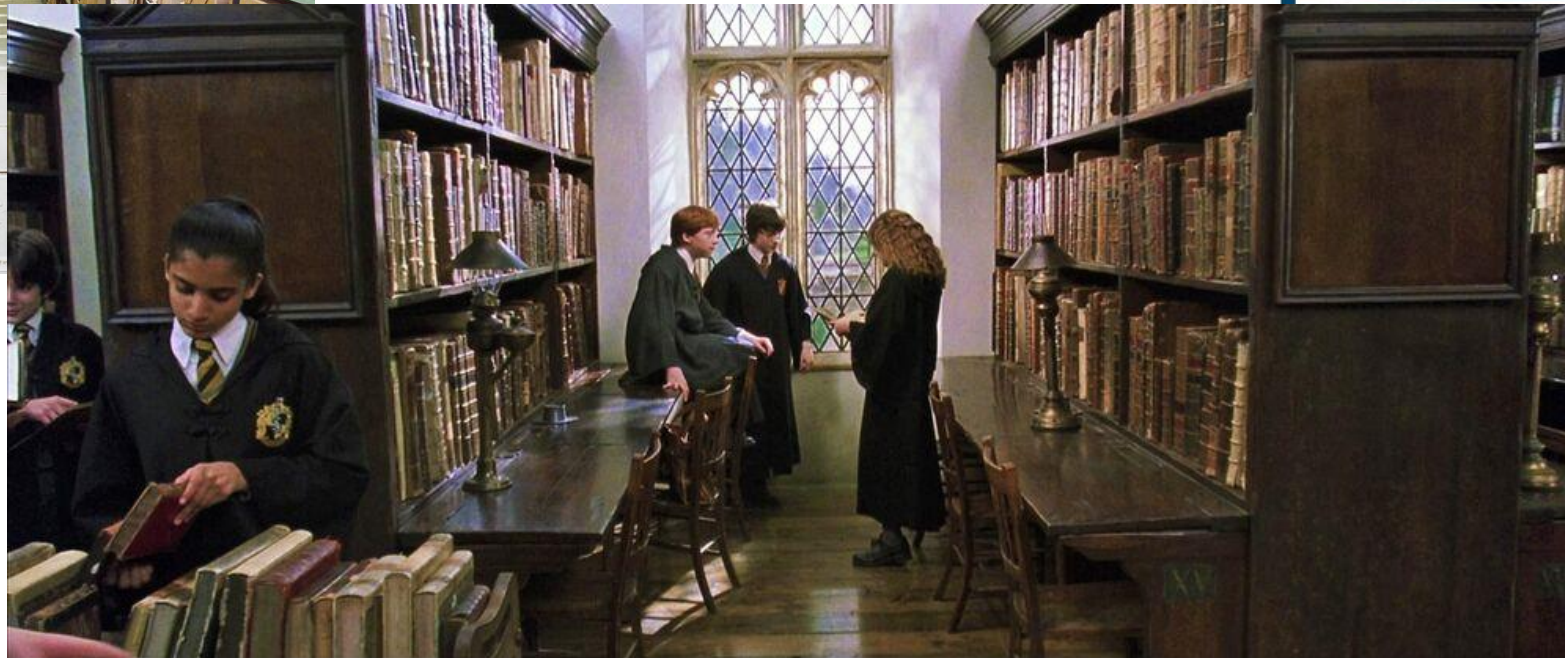- Started as FEWS's archive solution, filled by FEWS' exported files and **openly accessible** with FEWS' webservices *(if desired)*

- Then already possible to **store different data types** *(timeseries, states, reports, configuration, forecaster notes, database snapshots, rating curves)*

- Now **opened up** more:
  - catalogue can deal with NetCDF files produced by other systems
  - connects also to external archives via OpenDAP
  - data can be archived using a the webservice 'post' call
  - extended with archive database(s) like MongoDB

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The FEWS Open Archive – Why?

- Accountability: (raw) timeseries data, forecaster notes, database snapshots, etc.

- Dissemination to outside world → via FEWS webservices

- Event analysis
  - In OC by displaying historical floods a alongside current forecasts
  - Post-event analysis: FEWS Stand Alone or WaterCoach

- Training software and forecasting → FEWS WaterCoach

- Model development and scenario analysis → FEWS Comp. Framework

- Evaluation of models, forecasts and services

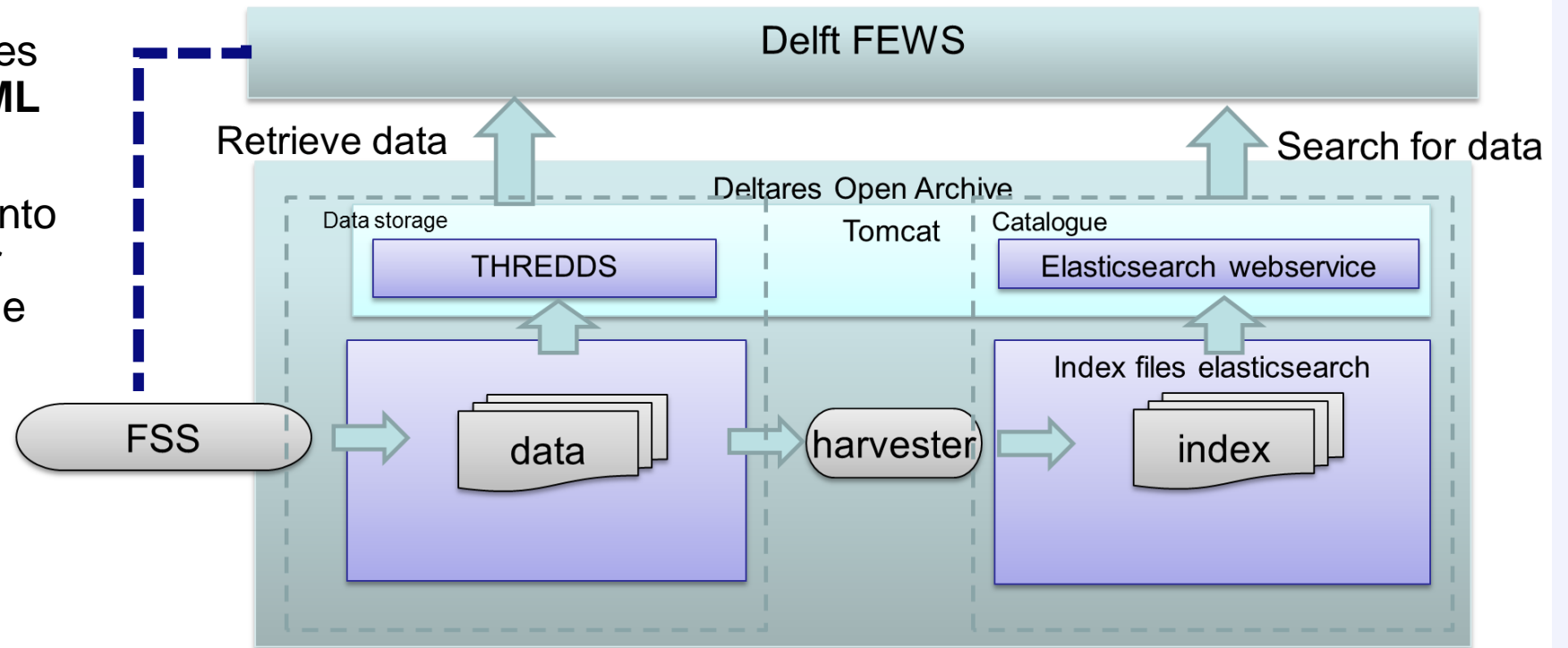- Forecast calibration (statistical pre- and postprocessing, machine learning)

Learning from the past

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The FEWS Open Archive – How?

For starters:

- **FEWS**' FSS's **export** files with **accompanying XML for metadata**

- Data can be **imported** into a FEWS Stand Alone or Operator Client using the **Archive Catalogue Display**
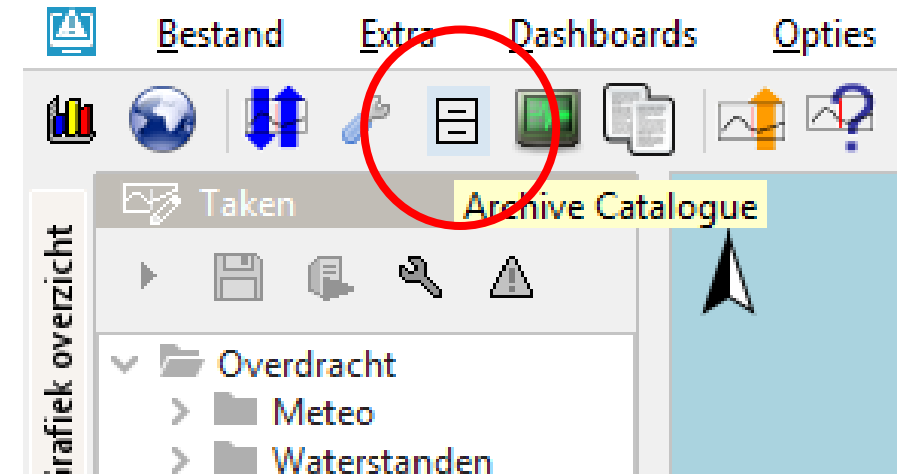

- Source: FEWS public wiki

powered by open source:

The FEWS Open Archive – How?

For starters:

- **FEWS**' FSS's **export** files with **accompanying XML for metadata**

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The FEWS Open Archive – How?

For starters:

- **FEWS'** FSS **exports** files with **accompanying XML for metadata**

- Data can be **imported** into a FEWS Stand Alone or Operator Client using the Archive Catalogue Display

- Same display for tagging event data for historic events and later use (e.g. WaterCoach)

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The FEWS Open Archive – How?

Dissemination with **webservices** coupled **directly** to Open Archive

Not only **read**, but also **write** to the archive
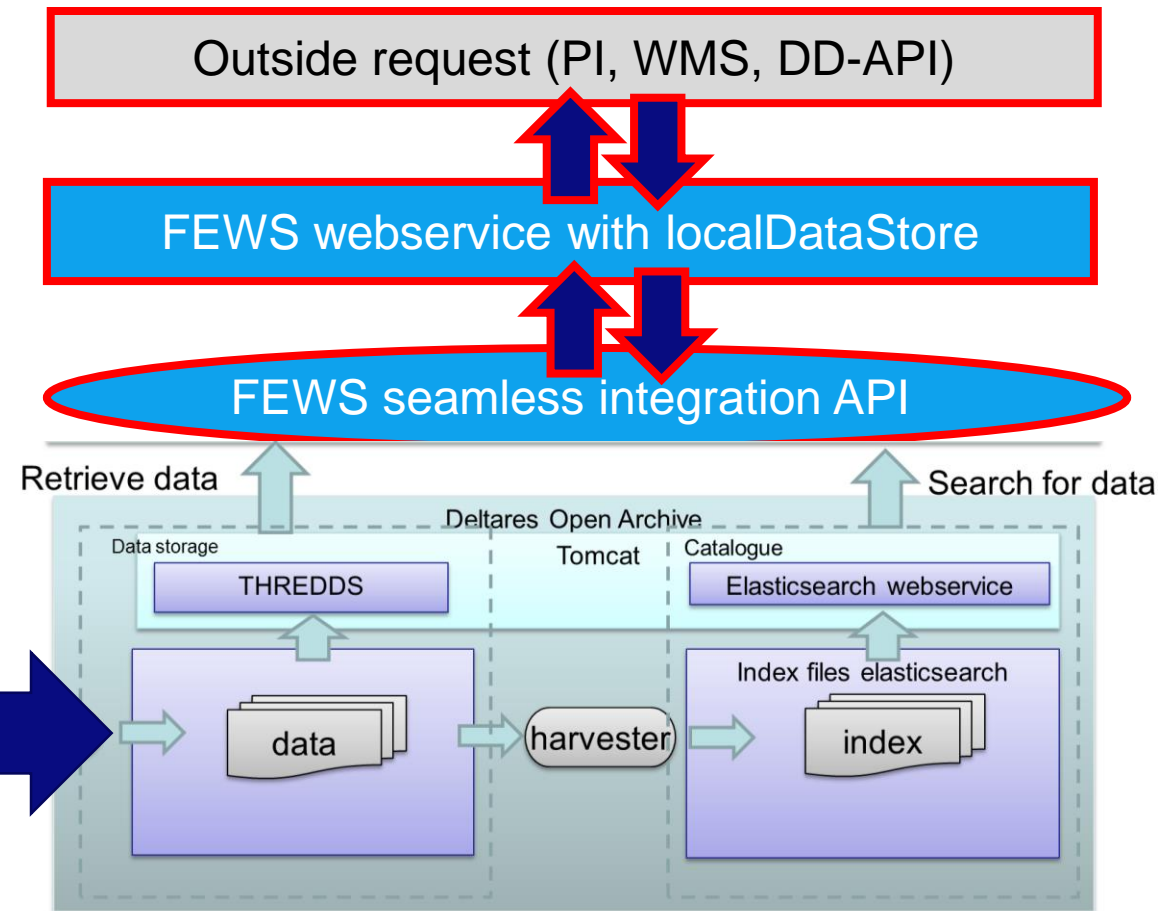
The FEWS Open Archive – How?

Dissemination with **webservices** coupled to the **operator client system**

Outside request (PI, WMS, DD-API)

FEWS webservice with localDataStore

FEWS OC with central database and FSS

FEWS seamless integration API

Retrieve data

Deltares Open Archive

Data storage

THREDDS

Tomcat

Catalogue

Elasticsearch webservice

Search for data

data

harvester

Index files elasticsearch

index

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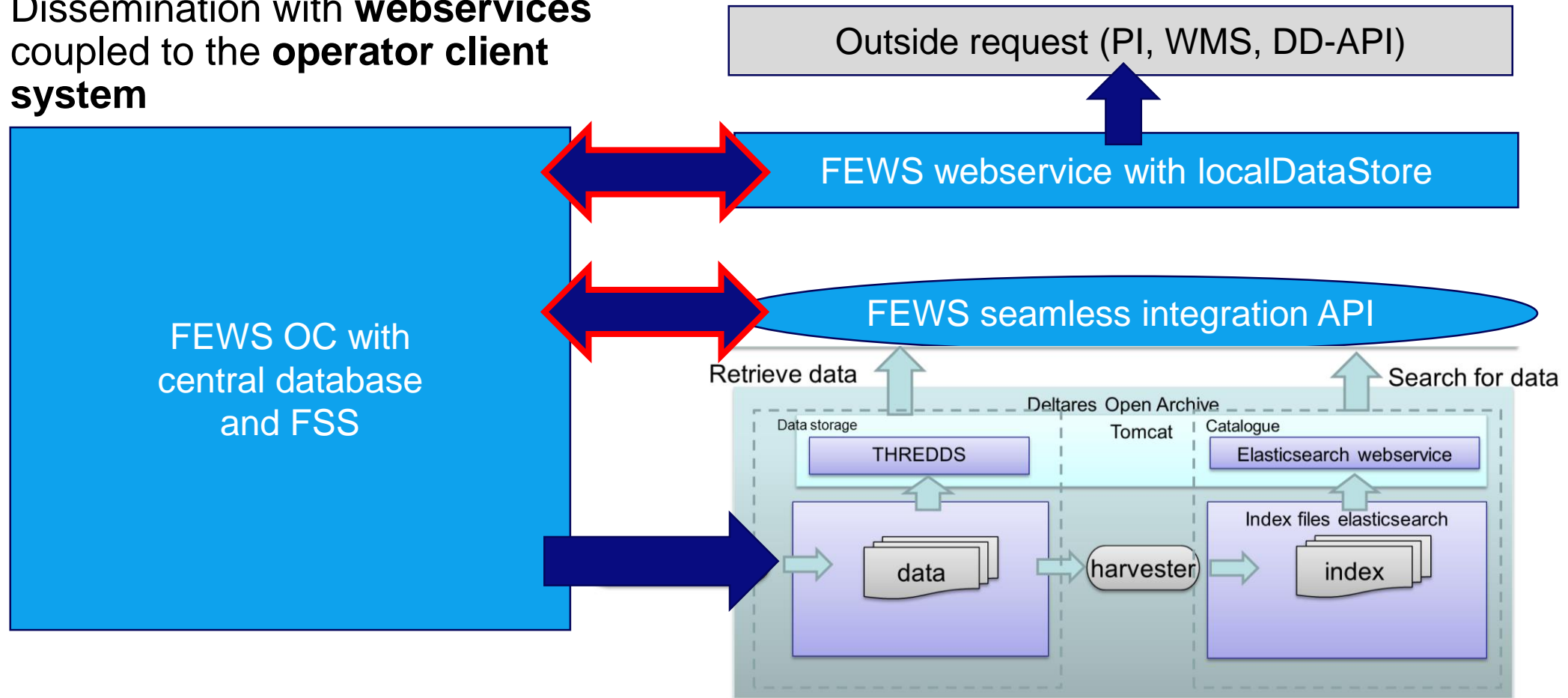
The FEWS Open Archive – How?

Seamless integration of
historical data usable in the OC
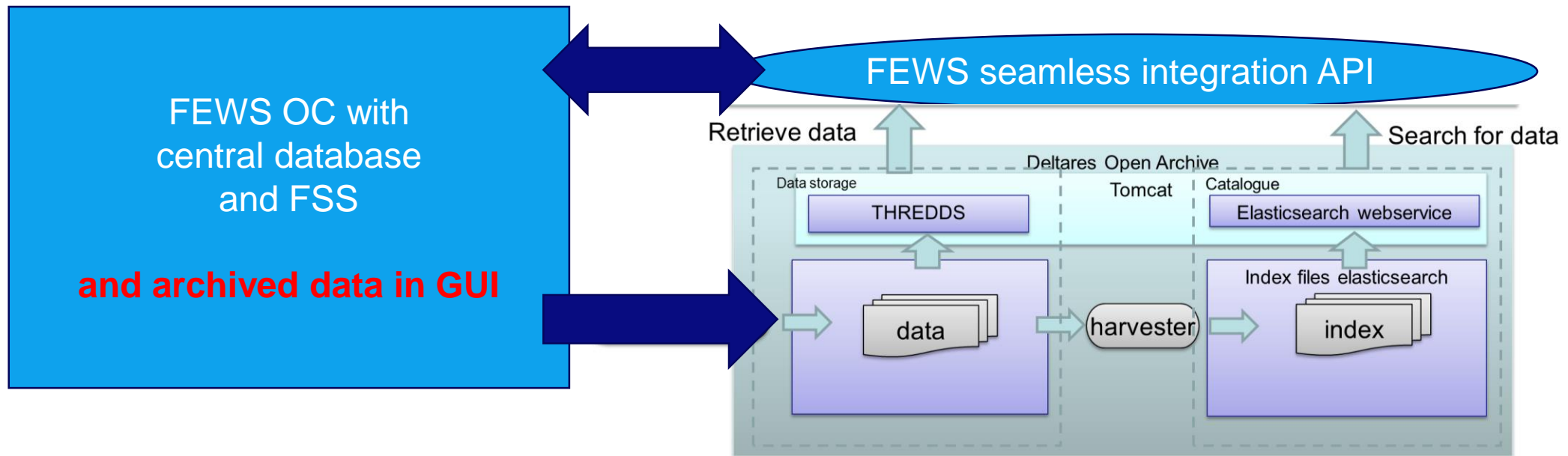
The FEWS Open Archive – How?

Seamless integration with the **FEWS GUI**

- [Time series display](#)

- [Grid Display](#)

- [Workflows](#)
  (downloadMissingDataFromAr...

The FEWS Open Archive – How?

Display **historic events** in the **FEWS GUI**

The FEWS Open Archive – How?

Recent developments: **external NetCDF storage**
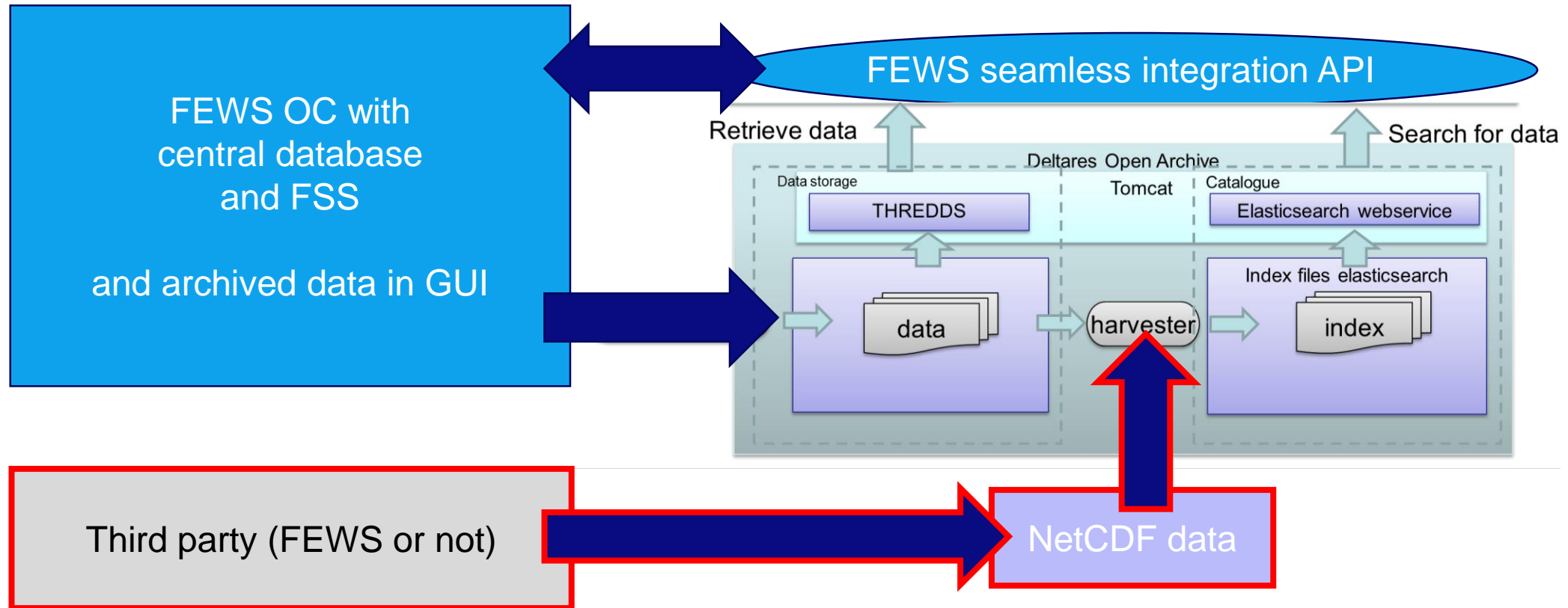
The FEWS Open Archive – How?

Recent developments: **external NetCDF storage**

- NetCDF files must be **CF 1.6 compliant**
- Files are **stored 'locally'** on disk with read access for archive server (harvester+catalogue)
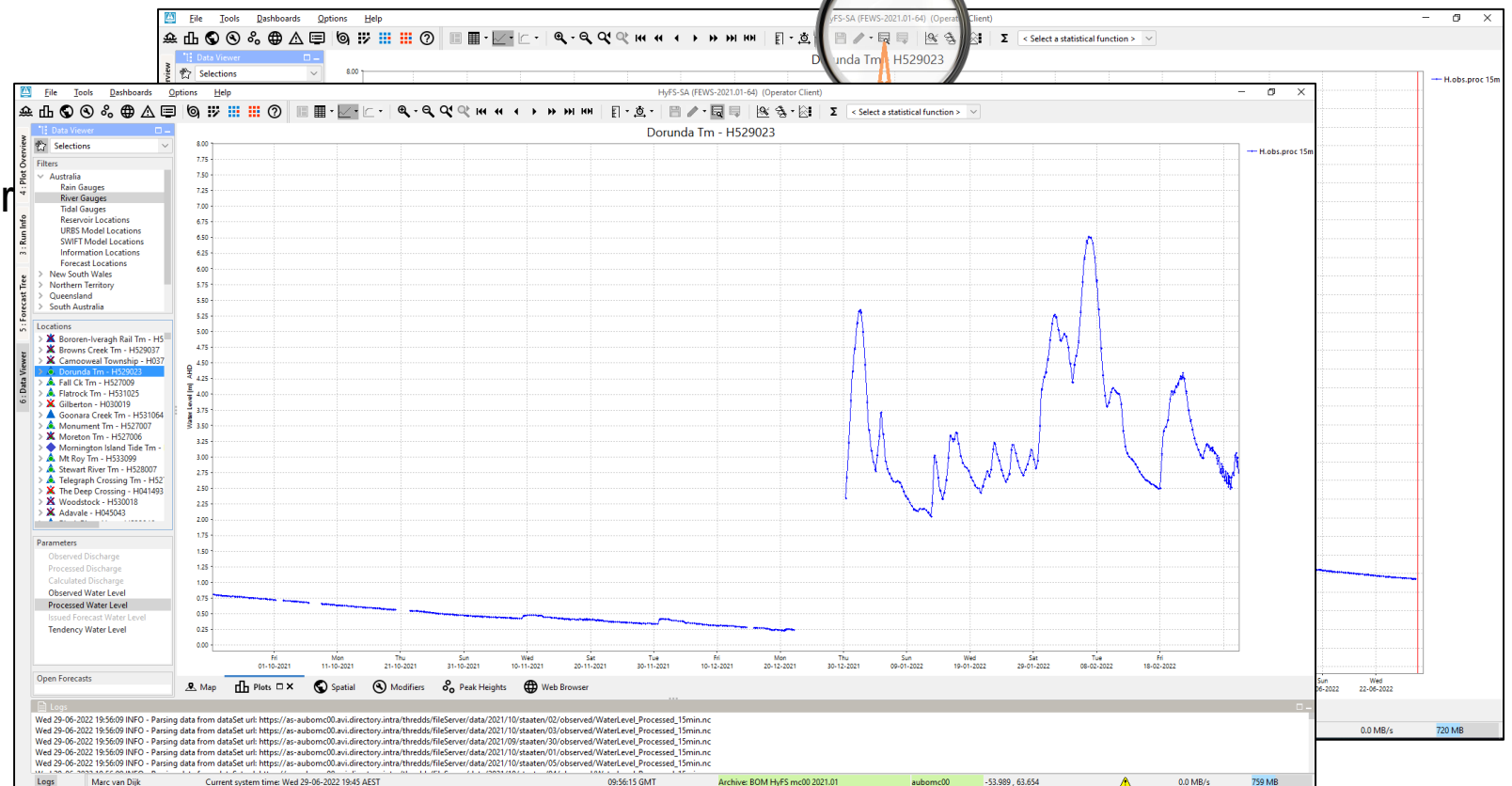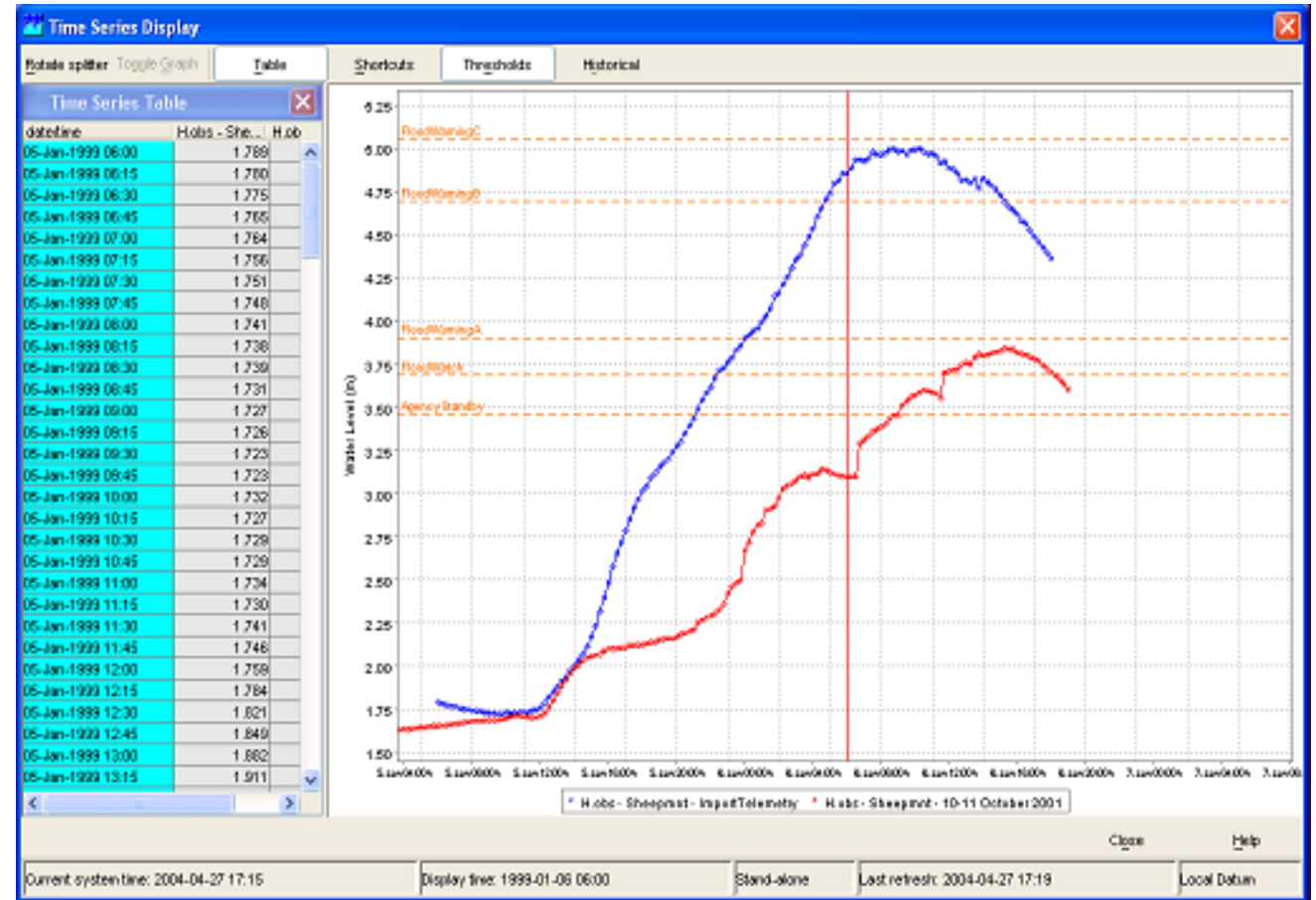- **Metadata** from files can be **put into** the **catalogue**
- Dissemination of data following **same protocols** as existing archive
- No need to also have a FEWS archive
- **Seamless integration works the same** as for the FEWS archive
- **Archive Catalogue Display works the same** as for the FEWS archive

FEWS se

Retrieve data

Data storage

THREDDS

data

NetCDF data

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The FEWS Open Archive – How?

Recent developments: **leverage OpenDAP**

The FEWS Open Archive – How?

Recent developments: **leverage OpenDAP**

FEWS OC with central database and FSS and archived data in GUI

- **OpenDAP** us was implemented to **improve download and import performance**

- By-product: possibility to **harvest external OpenDAP services**

Retrieve data

Data storage

FEWS seamless integration API

Search for data

Deltares Open Archive

Tomcat   Catalogue

THREDDS   Elasticsearch webservice

Index files elasticsearch

data → harvester → index

Third party OpenDAP service

The FEWS Open Archive – How?

Recent developments: **connecting an archive database**
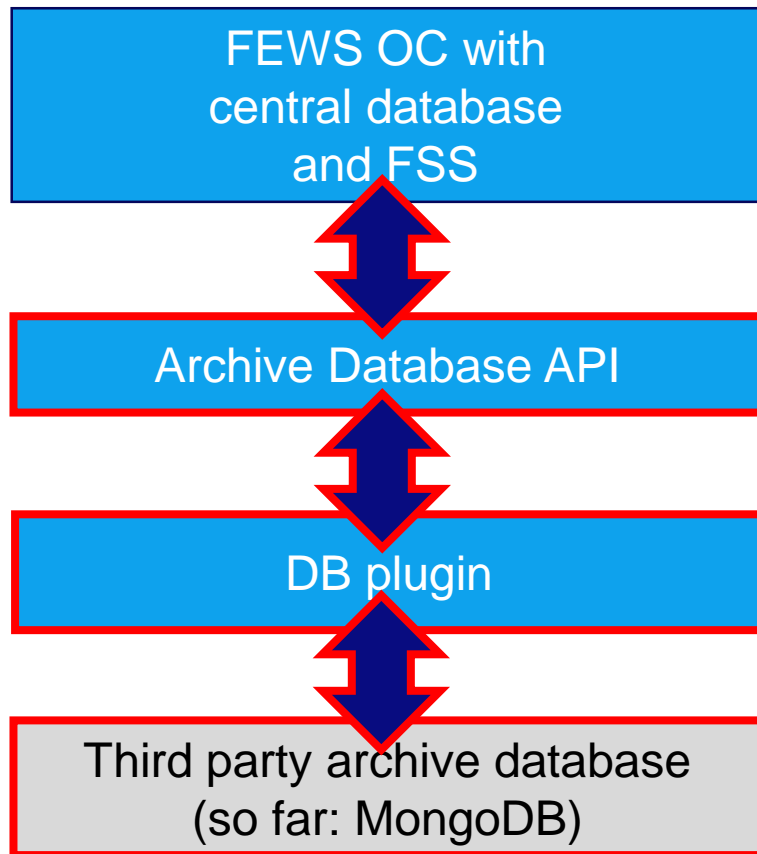
FEWS OC with central database and FSS	• **Adapter approach:** first flavor is **MongoDB**, but adapters can be made for other databases like WISKI, Aquarius, Hadoop, any SQL type
Archive Database API	• **MongoDB**: very powerful for **scalar timeseries** and can be coupled to analysis software like Tableau, SRRS, or PowerBI
DB plugin	• **Importing** and **exporting** possible; other software **can edit the database too.**
Third party archive database (so far: MongoDB)	• **Dedicated data panel**
	• **Seamless integration** with **GUI**

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The FEWS Open Archive – How?

Recent developments: **connecting an archive database**

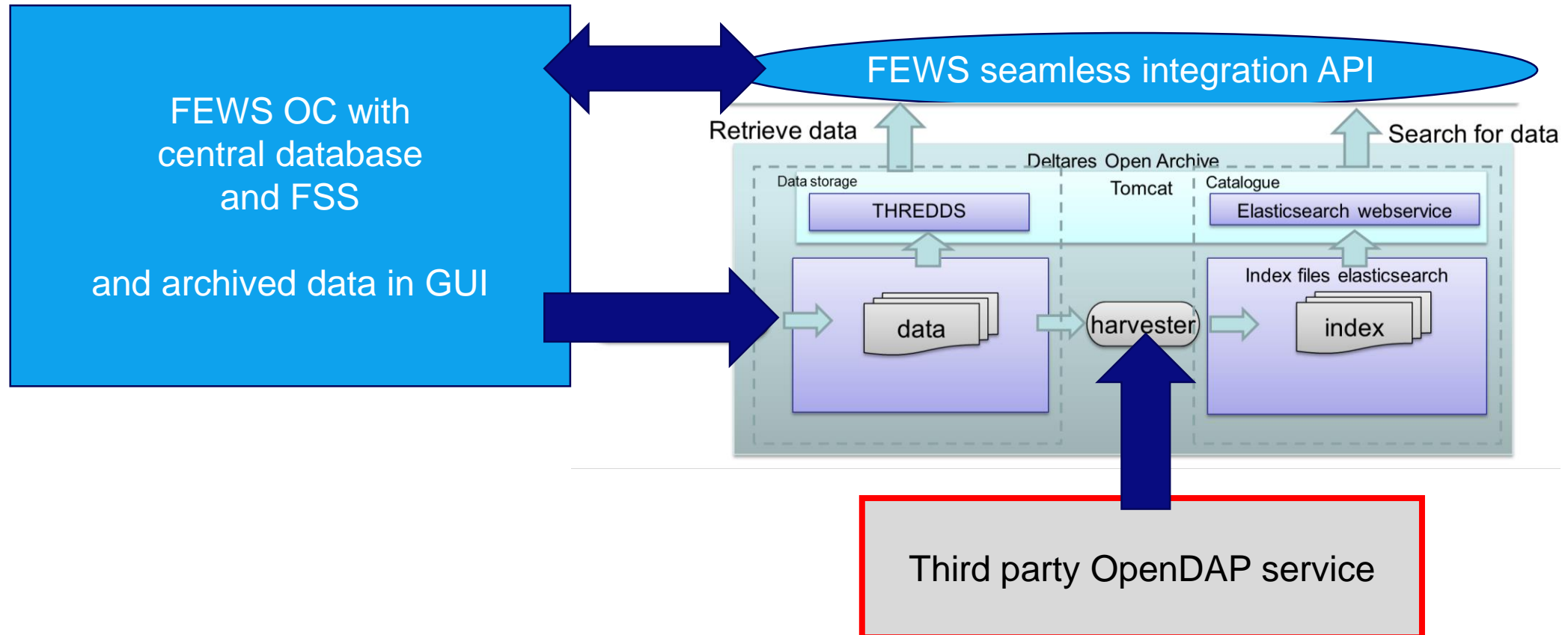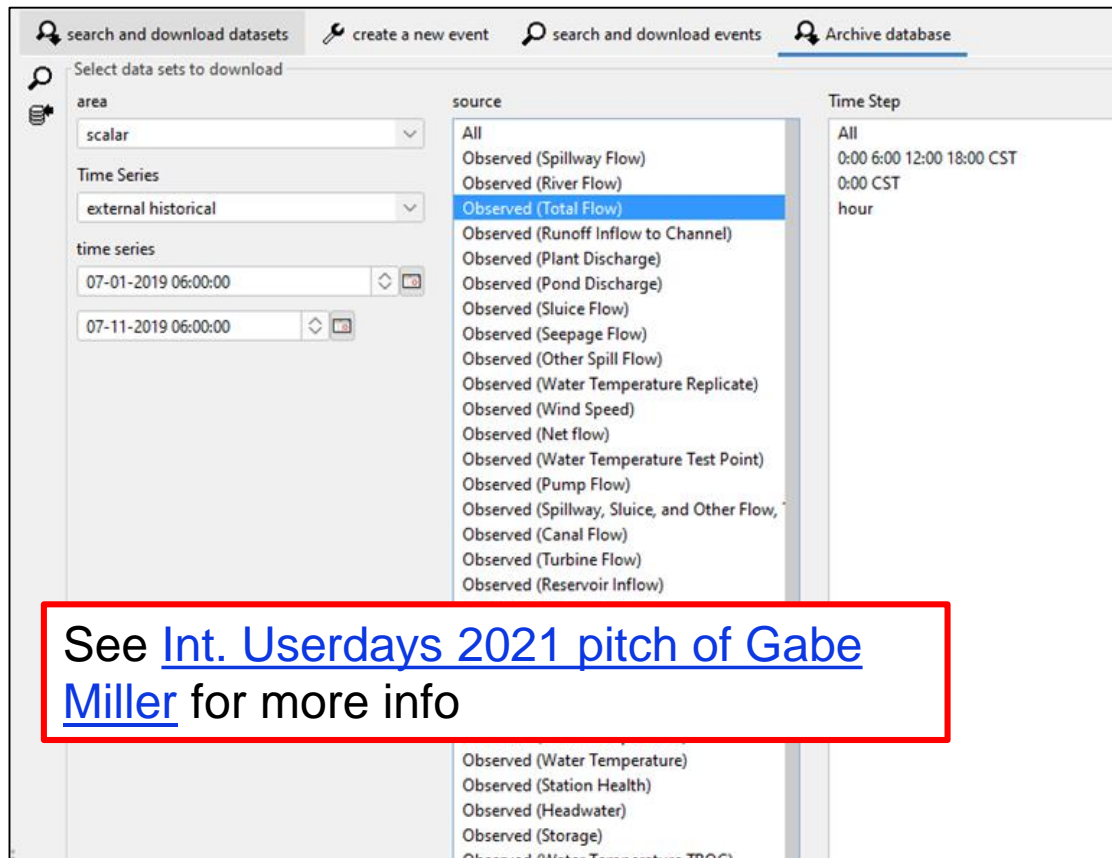> **Extensions for the Deltares Open Archive**
> • Alternative to file-based storage - Archive data
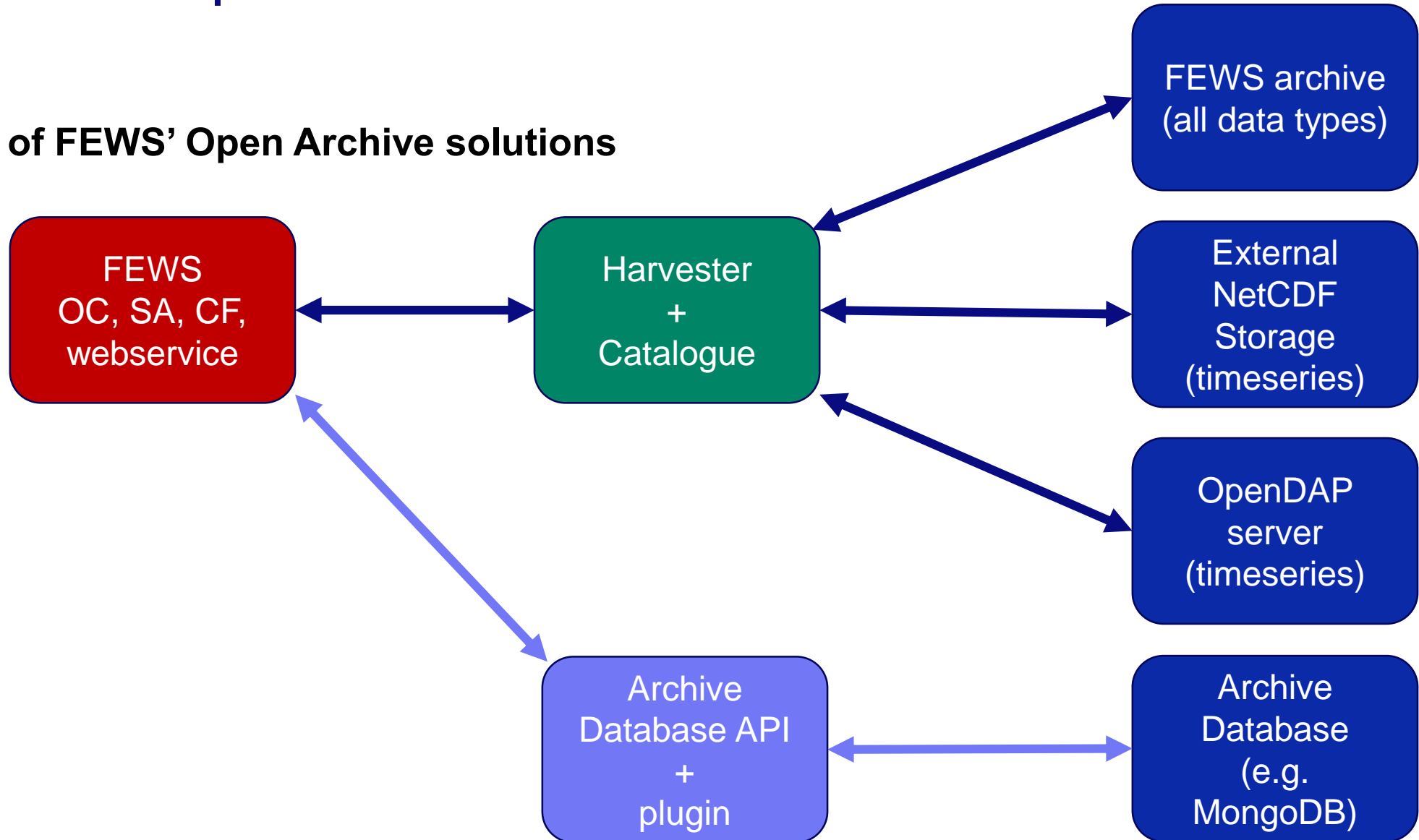> • External netcdf storage
> Water Coach

See Int. Userdays 2021 pitch of Gabe Miller for more info

Benefits

1. no harvester (for scalar data)

2. data integrity checks

3. fast analysis

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The FEWS Open Archive – How?

Summary of FEWS' Open Archive solutions

FEWS
OC, SA, CF,
webservice

Harvester
+
Catalogue

FEWS archive
(all data types)

External
NetCDF
Storage
(timeseries)

OpenDAP
server
(timeseries)

Archive
Database API
+
plugin

Archive
Database
(e.g.
MongoDB)

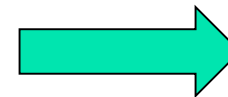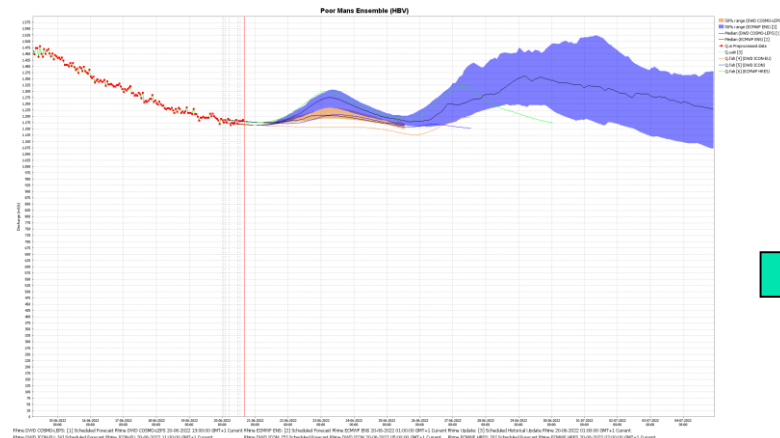Delft-FEWS Australian Userdays 2022 – Open Archive and WaterCoach

The FEWS Open Archive – Highlight 1
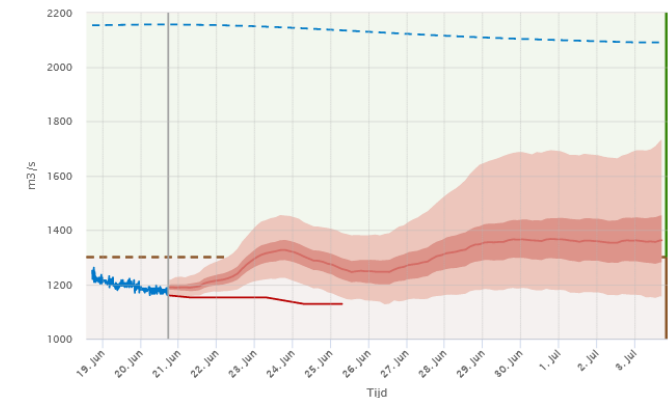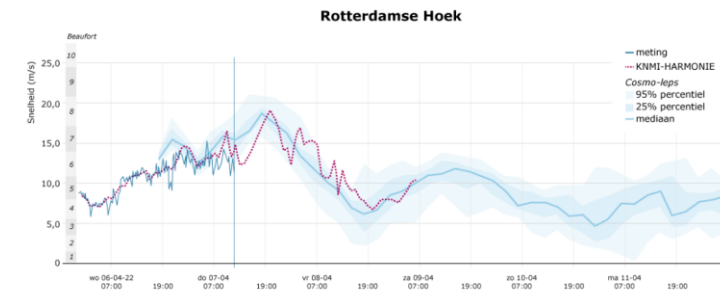## *Automatic and collaborative reporting at Rijkswaterstaat*

Problem

- ## Collaboration on reports during events is
  - Too cumbersome
  - Error prone (data selection from FEWS by hand)
  - FEWS' graphs not readable enough
  - Little possibility to change format if desirable
  - Not traceable

Collaboration of Deltares (Tom Bogaard) and Vortech
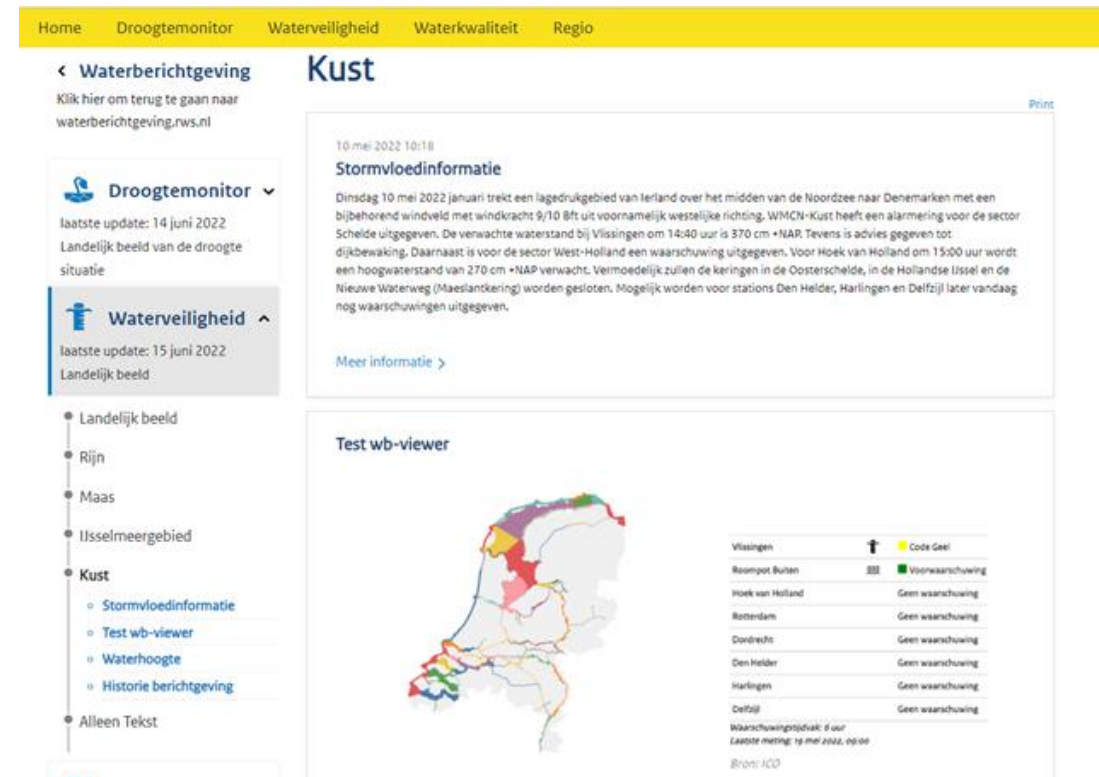
The FEWS Open Archive – Highlight 1
Automatic and collaborative reporting at Rijkswaterstaat

Goals

- **Harmonize way of working** and **report look&feel** for the **different forecasting groups**

- **Prevent copy+paste** as much as possible

- Data and reporting are **traceable**

- Align style with new info and data website

The FEWS Open Archive – Highlight 1
Automatic and collaborative reporting at Rijkswaterstaat

FEWS Product Service

POST

/archive/products

file:

parameters:

key	value
timeZero	2021-06-21T08:00:00Z
attribute(product_id)	Hoogwaterbericht Maas
attribute(source_id)	RWS
attribute(status)	draft
…	

Product

Metadata

- onderdeel van Fews Archief
- centrale plaats voor aanlevering
- gearchiveerd / traceerbaar

GET

/archive/products

- timeZero (tijd van uitgifte)
- Laatste actuele bericht
- Specifieke versie van een eerder bericht

GET

/archive/productsmetadata

- Lijst met beschikbare producten
- Binnen een bepaalde tijdperiode
- Filteren op metadata

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The FEWS Open Archive – Highlight 1
Automatic and collaborative reporting at Rijkswaterstaat

Steps

1. FEWS exports inputs as much as possible (data, graphs, tables)

2. Operators iterate in web interface:
   1. Add text
   2. Add additional graphs
   3. Set status (draft / final)

3. Store new version in Open Archive
   → Full report as well as separate components get separate Id's

The FEWS Open Archive – Highlight 1
Automatic and collaborative reporting at Rijkswaterstaat

Data editing can be very flexible!

Example: probability of exceedance table per lead time

The FEWS Open Archive – Highlight 2
Model and forecast verification at Rijkswaterstaat

1. **Statistics are computed in OC, and exported to an External NetCDF Storage**
2. **Lightweight website queries FEWS webservice for metadata and data**
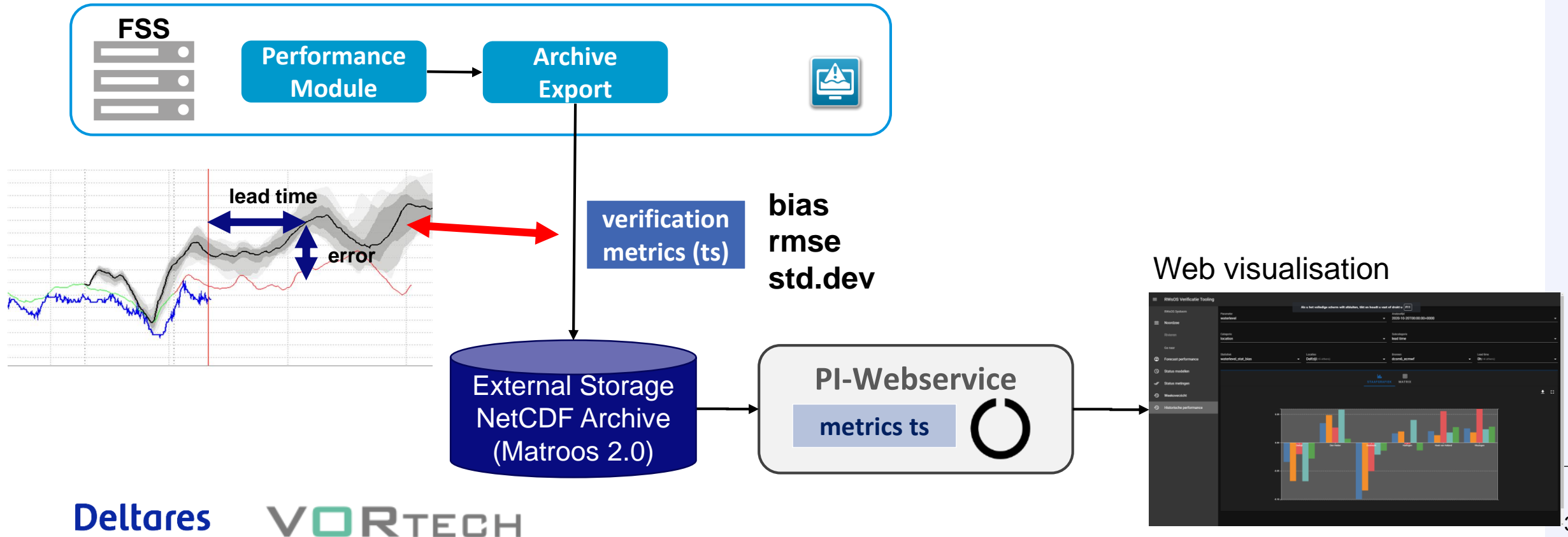
The FEWS Open Archive – Highlight 1
Model and forecast verification at Rijkswaterstaat

- Example diagrams

The FEWS Open Archive – Highlight 1
Model and forecast verification at Rijkswaterstaat

Planned next steps

- GOAL: Verify ensemble forecasts stored in the archived

- Use FEWS' General Adapter + Python + [EVS](#) software for the analysis

- Scheduled regularly to produce raw metrics and diagrams

- Dissemination using the automatic and collaborative reporting web interface

The FEWS Open Archive – Desired developments

- Align with Web-OC developments:
    - Web-interface for searching, selecting (and tagging)
    - Leverage same visualization code on archived data

- Improve archive maintenance tooling

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WaterCoach, a FEWS serious game

- Introduction
- FEWS Open Archive
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  - Desired developments
- WaterCoach
  - What is it?
  - Relation with Open Archive
  - New developments

Do I find it *engaging, immersive,* and *fun*?

Can I use this in (or relate this to) the *real world*?

Do I retrieve any *value* from it?
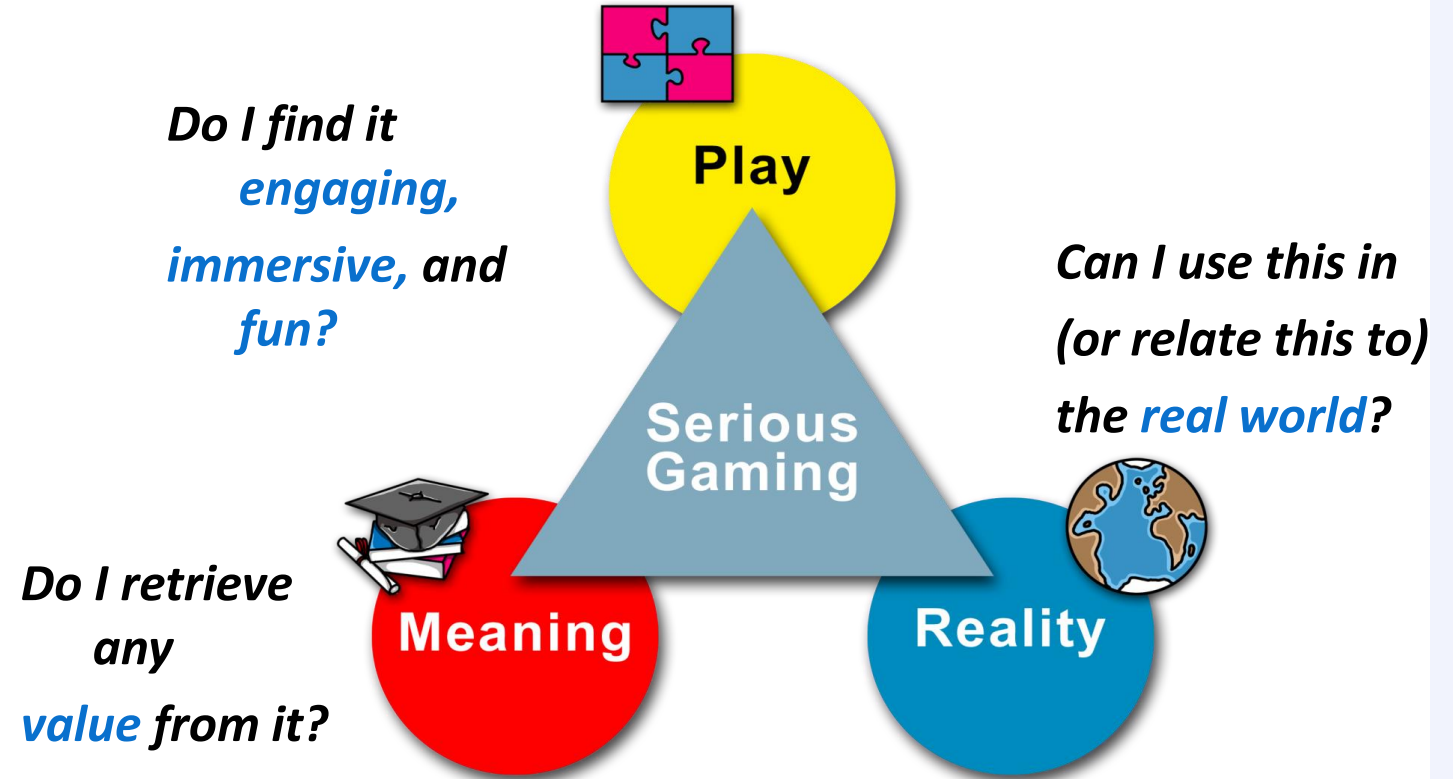
Detailed info and course material: https://publicwiki.deltares.nl/display/FEWSDOC/Water+Coach

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WaterCoach – what is it?
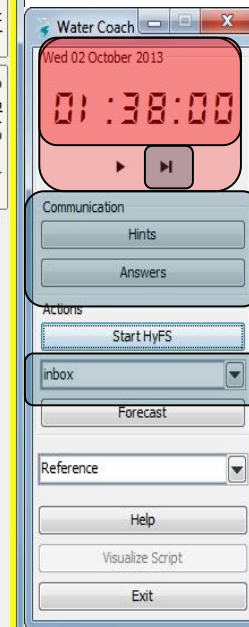
Delft-FEWS and WaterCoach arranged side by side

Yellow border = Training Mode

System Time in dictated by WaterCoach

Observations in "the future" are hidden

WaterCoach sends messages to Forecaster Notes

Water Coach (clock) always on top
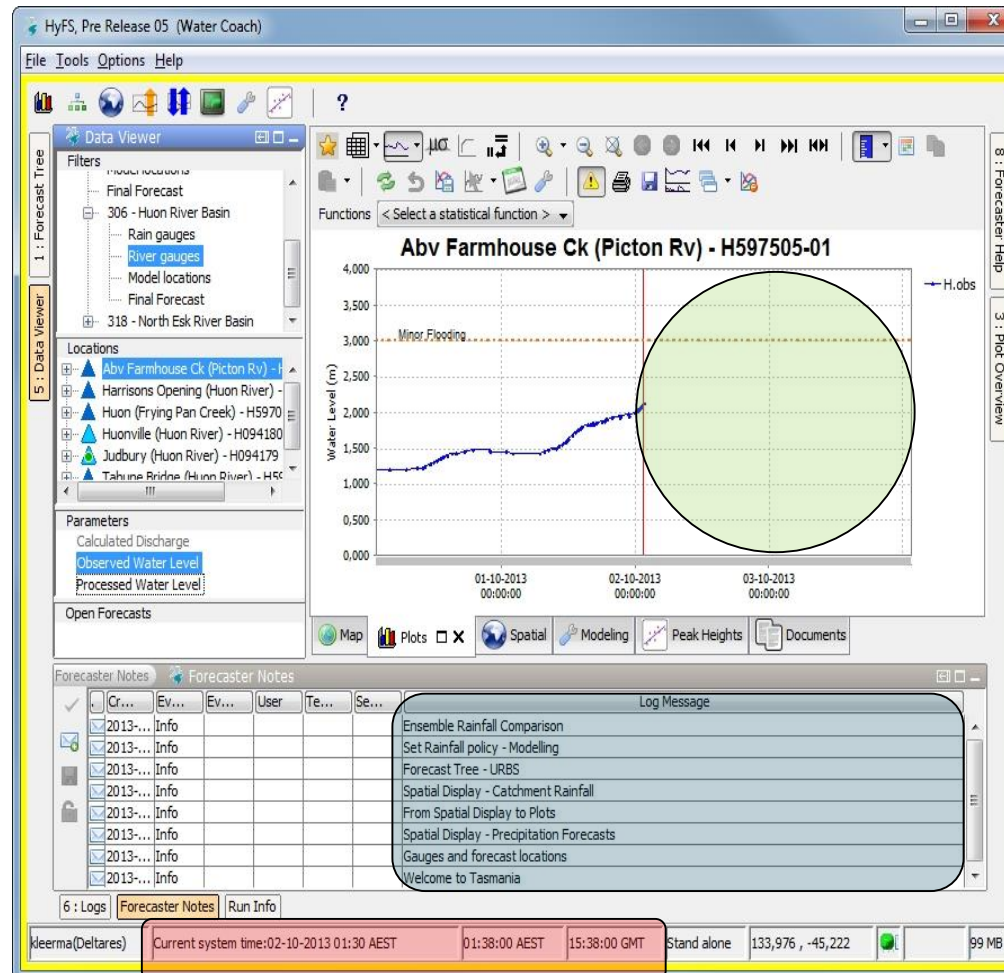
WaterCoach – what is it?

WaterCoach can be used in a

- Exercise (team)
  - Script not required (or at least not the focus)
  - Focus on team interaction, communication with externals
- Training (individual)
  - Both scenario and script need to be developed
  - Focus on training skills, content, procedures

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WaterCoach – relation with Open Archive

A **scenario** consists of data, preferably **realistic** data

The FEWS Archive Catalogue Displays can be helpful here; steps:

1. **Tag an event** in the OC; relevant data is marked in the catalogue
2. Open an **SA with empty localDataStore**
3. **Select** the **event** and **import the data**

Next steps:

4. Make a **script** (XML); can be just exercise title, start and end time
5. **Store** script with configuration and localDataStore in dedicated **folder structure**
6. Open WaterCoach panel and select the script of interest
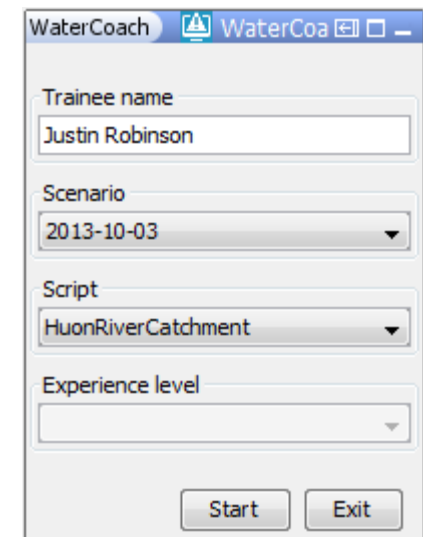
WaterCoach – new developments

Finished:

- Data in external NetCDF storage can be tagged together with FEWS archive data

Planned:

1) WaterCoach-on-the-Fly (enter start+stop times and let FEWS do steps 1-6)

   User Story: quickly load WC with empty script for training or event analysis

2) Add option to import grids as reference only

   User Stories: fast starting of WC-on-the-Fly, and use for large (offline) analyses (computational framework)
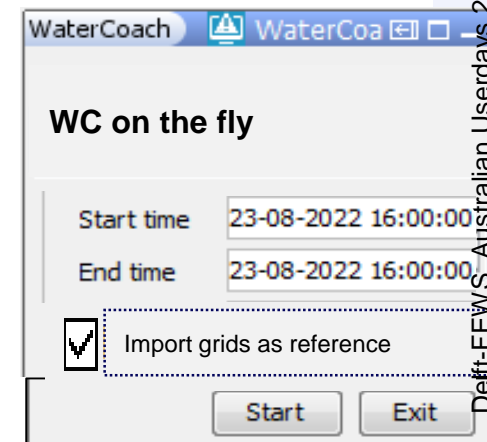
Summary

FEWS' Open Archive opens up many ways to **learn from the past, e.g.**

- Training (WaterCoach)

- Verification

- Event analysis

- Etc.

FEWS' Open Archive with **webservices** can facilitate **lightweight, interactive web front-ends** for **dissemination, analysis and collaboration**

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Contact

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f facebook.com/deltaresNL

Thank you for your attention

Looking forward to your questions and feedback

Deltares