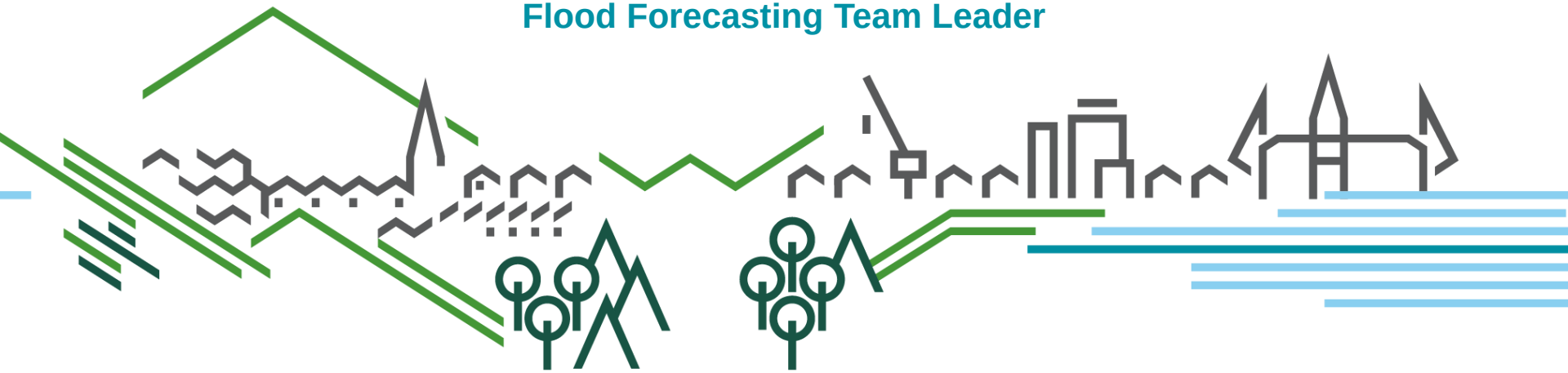
Cyfoeth Naturiol Cymru
Natural Resources Wales

FEWS Wales

Delft FEWS in the cloud

Andrew How

Flood Forecasting Team Leader



Overview

Cyfoeth Naturiol Cymru
Natural Resources Wales

- Flood risk in Wales
- Background to FEWS Wales
- Set up and constraints
  - Cloud computing
  - Implementation and issues
- Current capability
  - Forecast Web Service
- Future developments

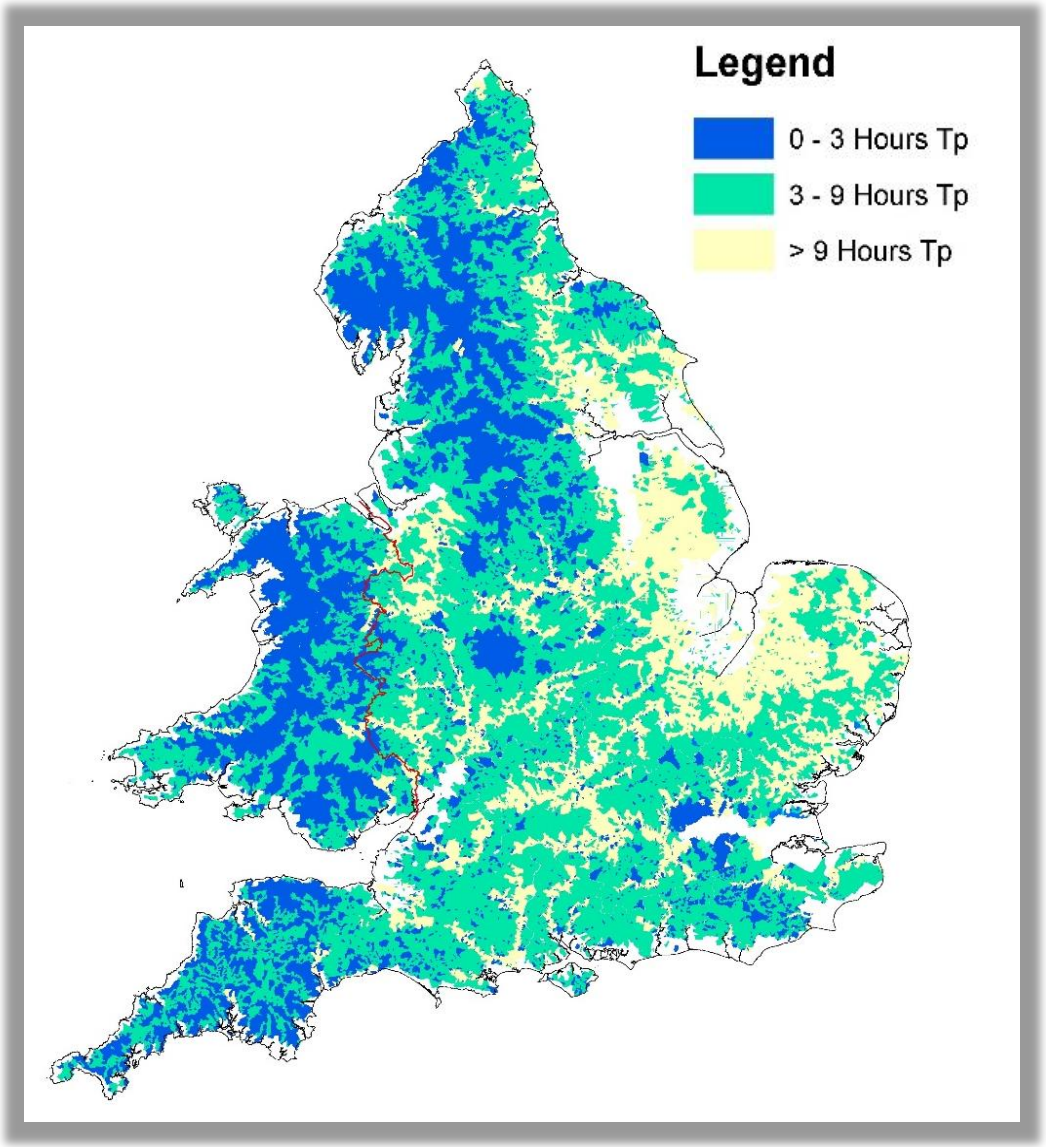
Flood risk in Wales

Cyfoeth Naturiol Cymru
Natural Resources Wales

Flood risk in Wales

Cyfoeth Naturiol Cymru
Natural Resources Wales

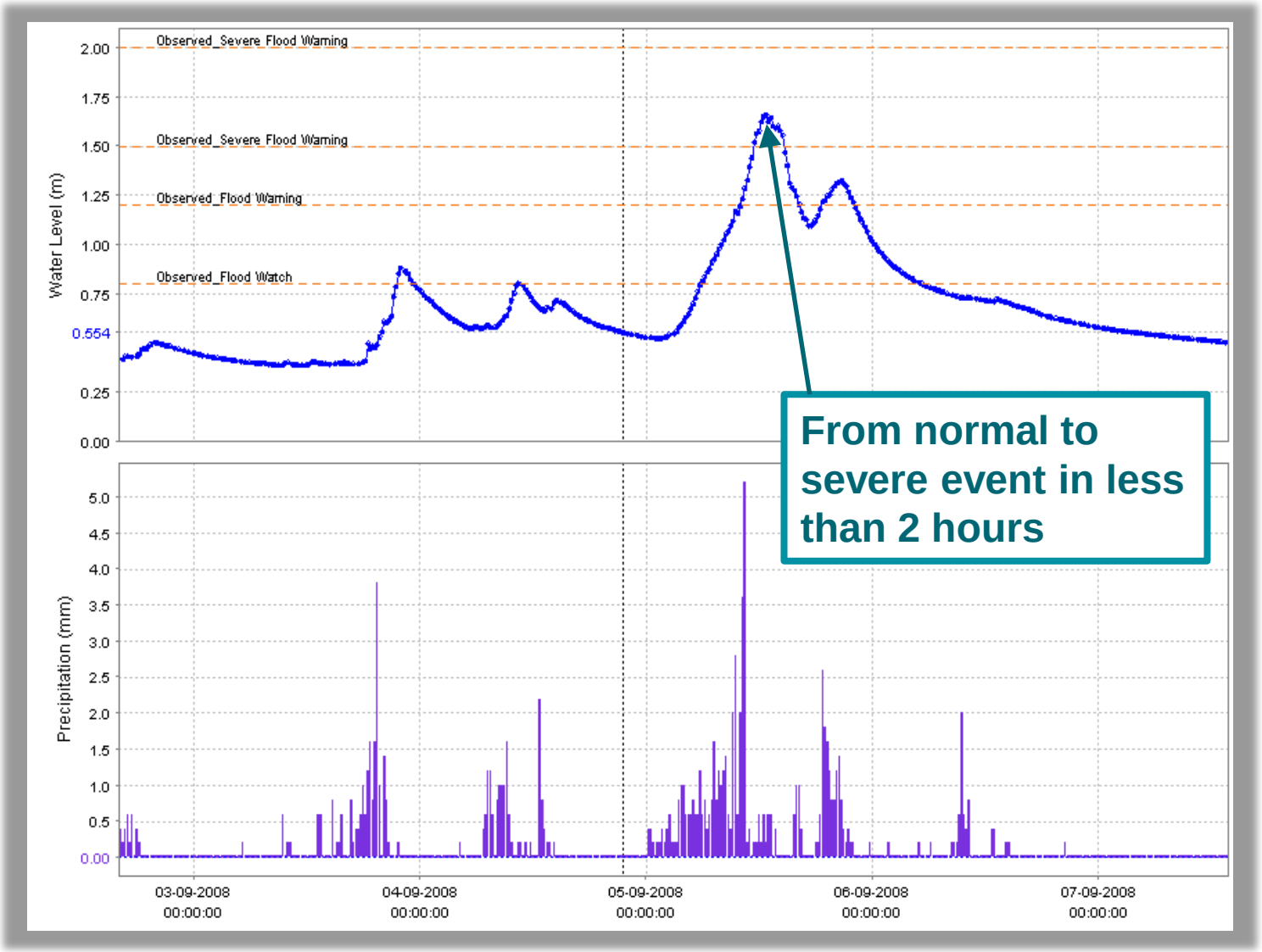
Fluvial food risk in Wales



Cyfoeth Naturiol Cymru
Natural Resources Wales

Typical river response …

Cyfoeth Naturiol Cymru
Natural Resources Wales

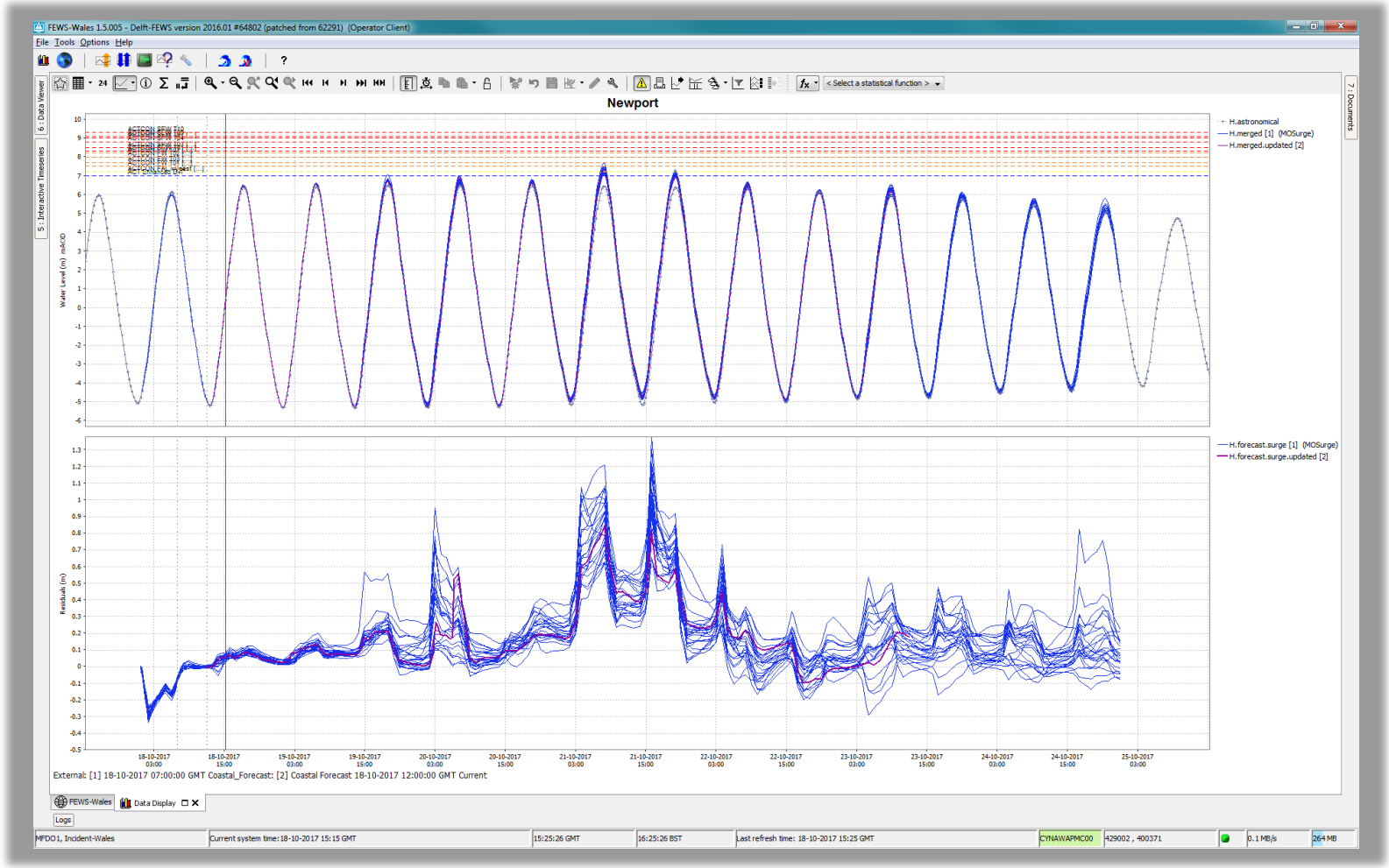


Coastal risk …

Cyfoeth Naturiol Cymru
Natural Resources Wales

Coastal risk …

Cyfoeth Naturiol Cymru
Natural Resources Wales



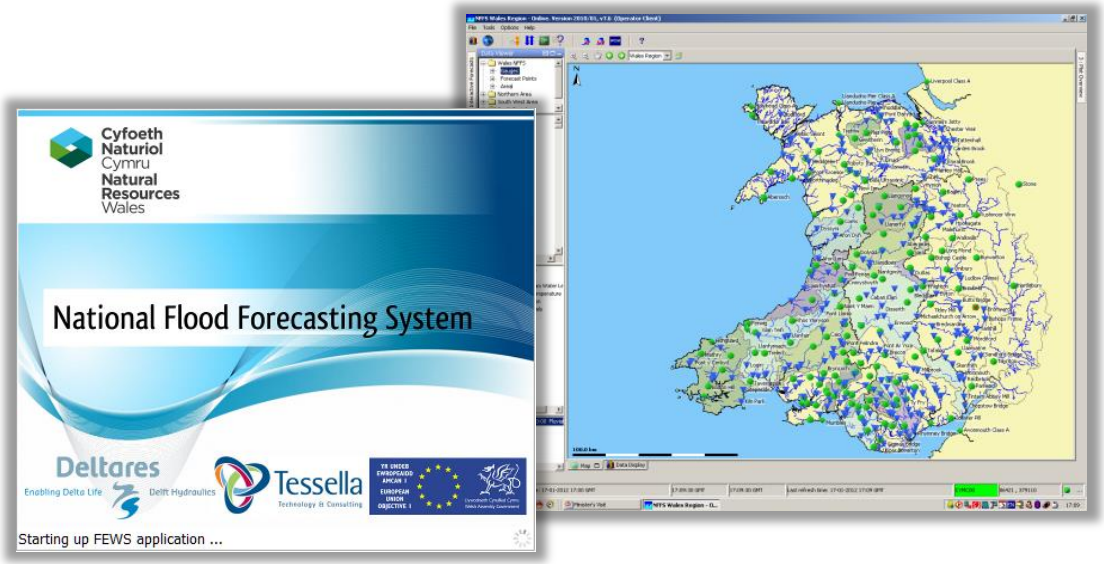
Flood risk in Wales

- 3 million population
- 220,000 properties at risk of flooding from rivers and sea
- Nearly 20% live or work in the floodplain
- £8 billion worth of assets at risk

Cyfoeth Naturiol Cymru
Natural Resources Wales

Background to FEWS Wales

Cyfoeth Naturiol Cymru Natural Resources Wales



Set up and constraints

Cyfoeth Naturiol Cymru
Natural Resources Wales

- Short timescales
- No NRW servers
- Cloud or justify mentality
- 15.01 version of FEWS
- Climate of reducing budgets and resources

Cloud computing

Cyfoeth Naturiol Cymru
Natural Resources Wales

Advantages

- Cost
- Upgrades
- Patch release
- Performance
- Analytics
- Scalability
- Storage
- Access
- Immediacy
- Flexibility

Disadvantages

- Reliability
- Downtime
- 3rd party fault resolution
- Resilience
- Contingency
- Reliance on connection to cloud
- Cost to download data

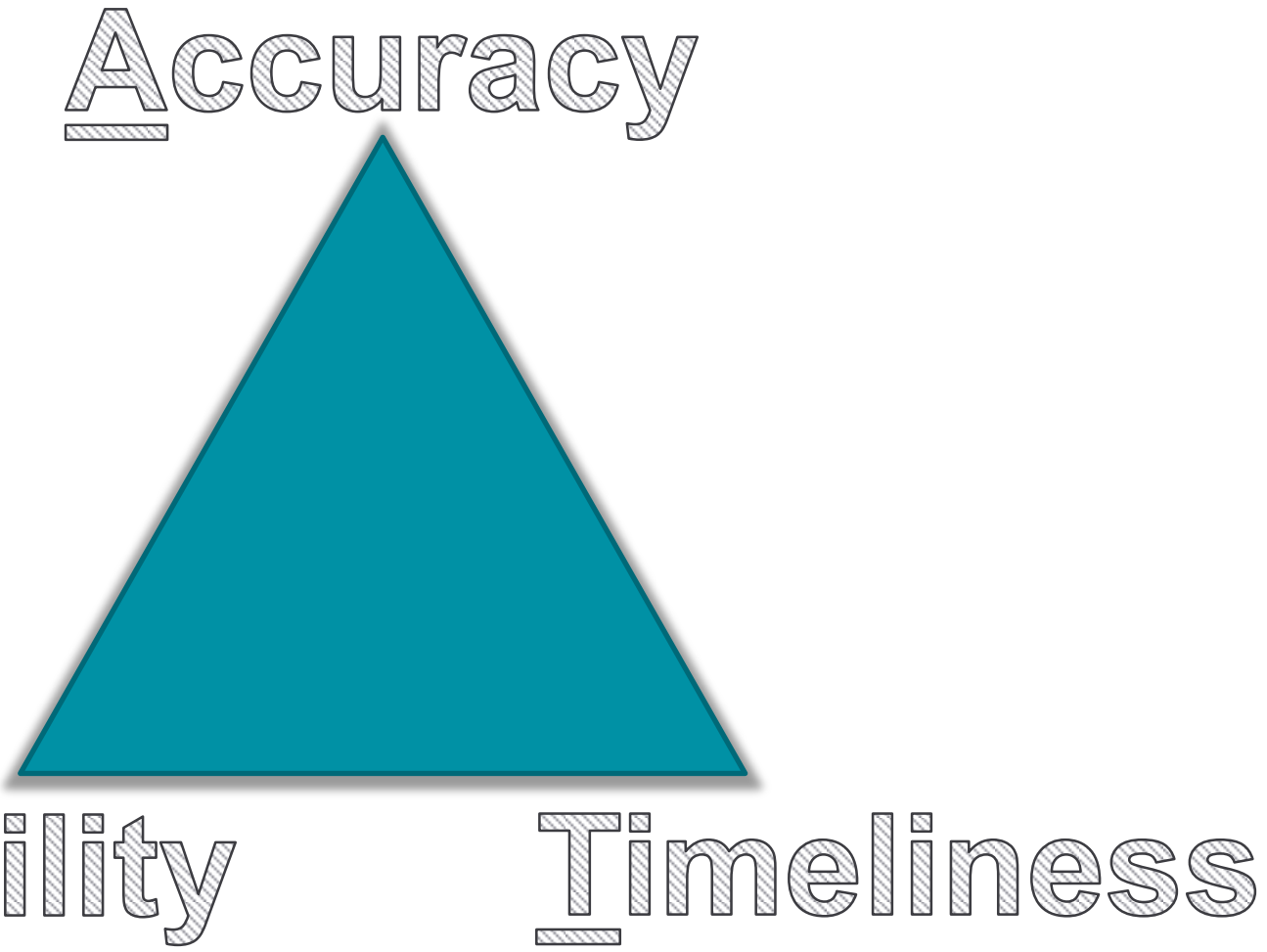
Unknowns

- Security
- 3rd party data
- FEWS setup
- Data dissemination

- Unknown unknowns!

ART of forecasting

Cyfoeth Naturiol Cymru
Natural Resources Wales



FEWS Wales

Cyfoeth Naturiol Cymru
Natural Resources Wales

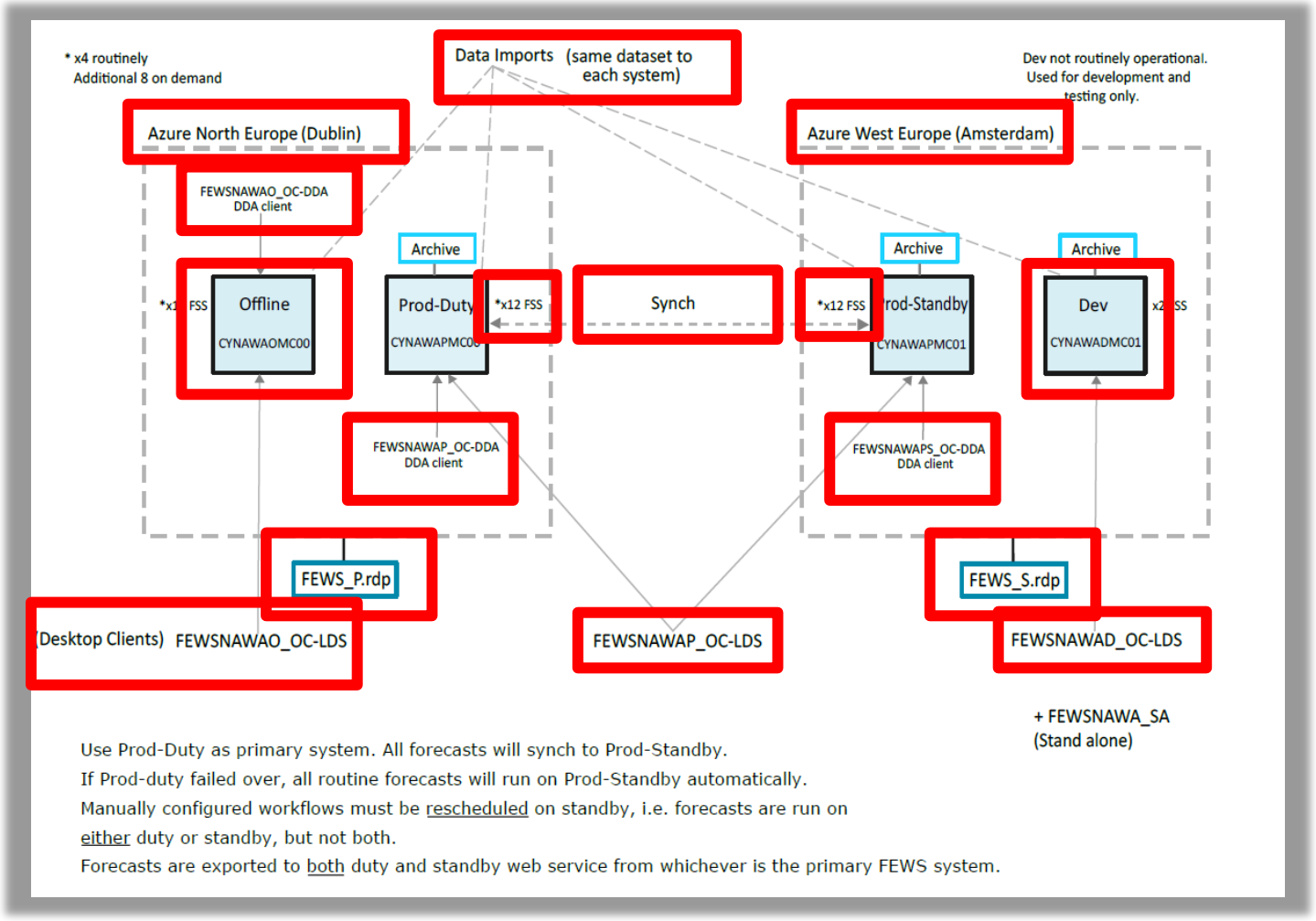
Minimal synch / no synch
Ability to run models and assess output
Operational functionality

Full synch
Ability to run standalone
Full application

App / web access
Tailored to mobile working
Access forecast meteorological / hydrological data
Operational functionality

FEWS Wales

Cyfoeth Naturiol Cymru
Natural Resources Wales



Implementation complexities

Cyfoeth Naturiol Cymru
Natural Resources Wales

- Upgrade of FEWS
  - From 15.01 to 16.01 managed alongside implementation
- Forecasting Shell Servers
  - Activating FSS
  - FSS registration
- Unable to use cloud database server – employ actual SQL server
- Errors and Fatal Errors
  - Taskruns
  - synching MCs
- Admin Interface
- Differences in error logging between DDA and LDS operator clients
- Connection problems between FSS and MC

Implementation complexities

Cyfoeth Naturiol Cymru
Natural Resources Wales

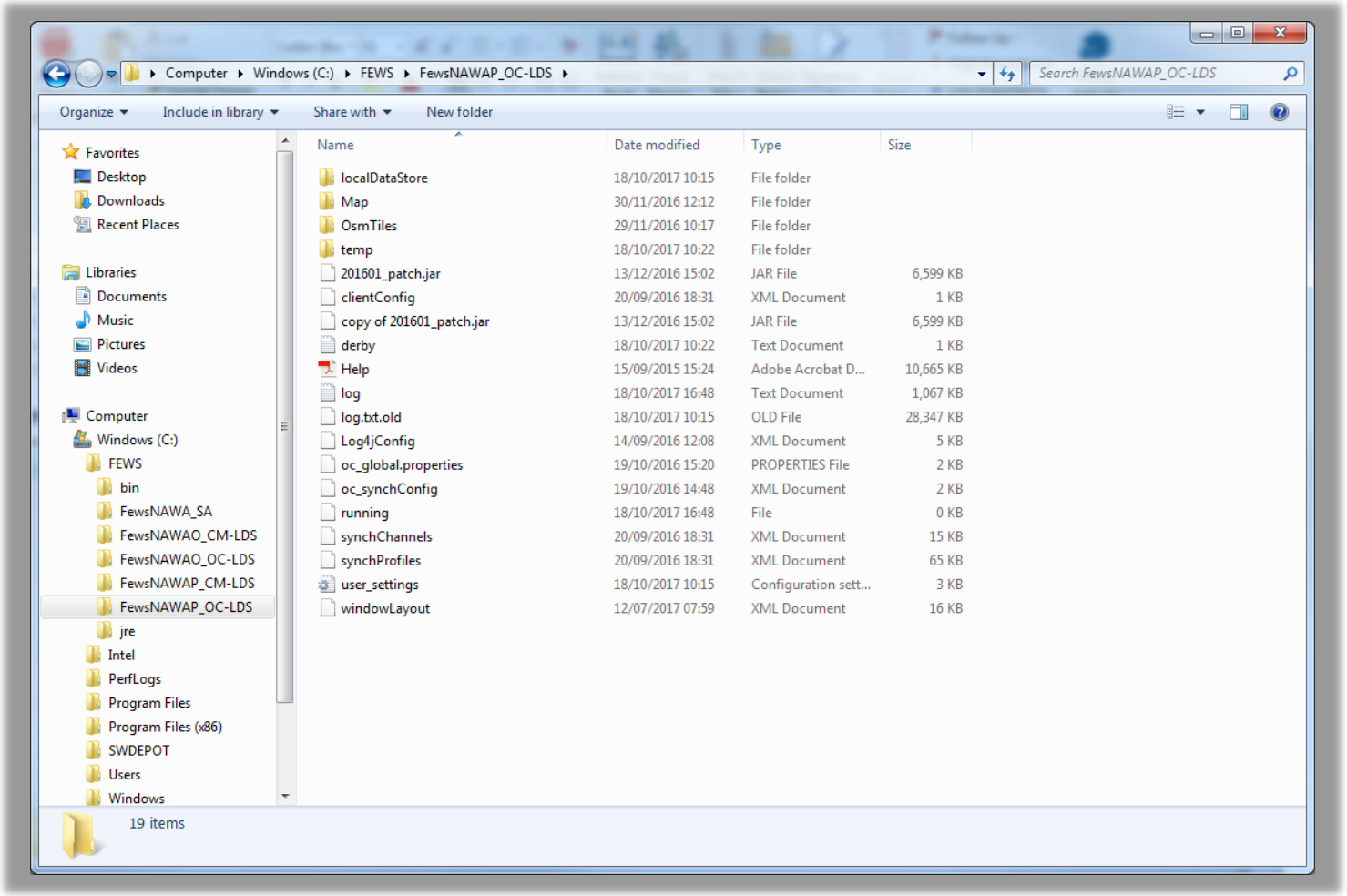
- Memory and Windows issues – had to adjust from 32 to 64 bit version of Java
- JMS disconnects between MC00 and MC01
- System architecture
- How to present / share information with others
- API service
- External influences

Current capability

Cyfoeth Naturiol Cymru
Natural Resources Wales

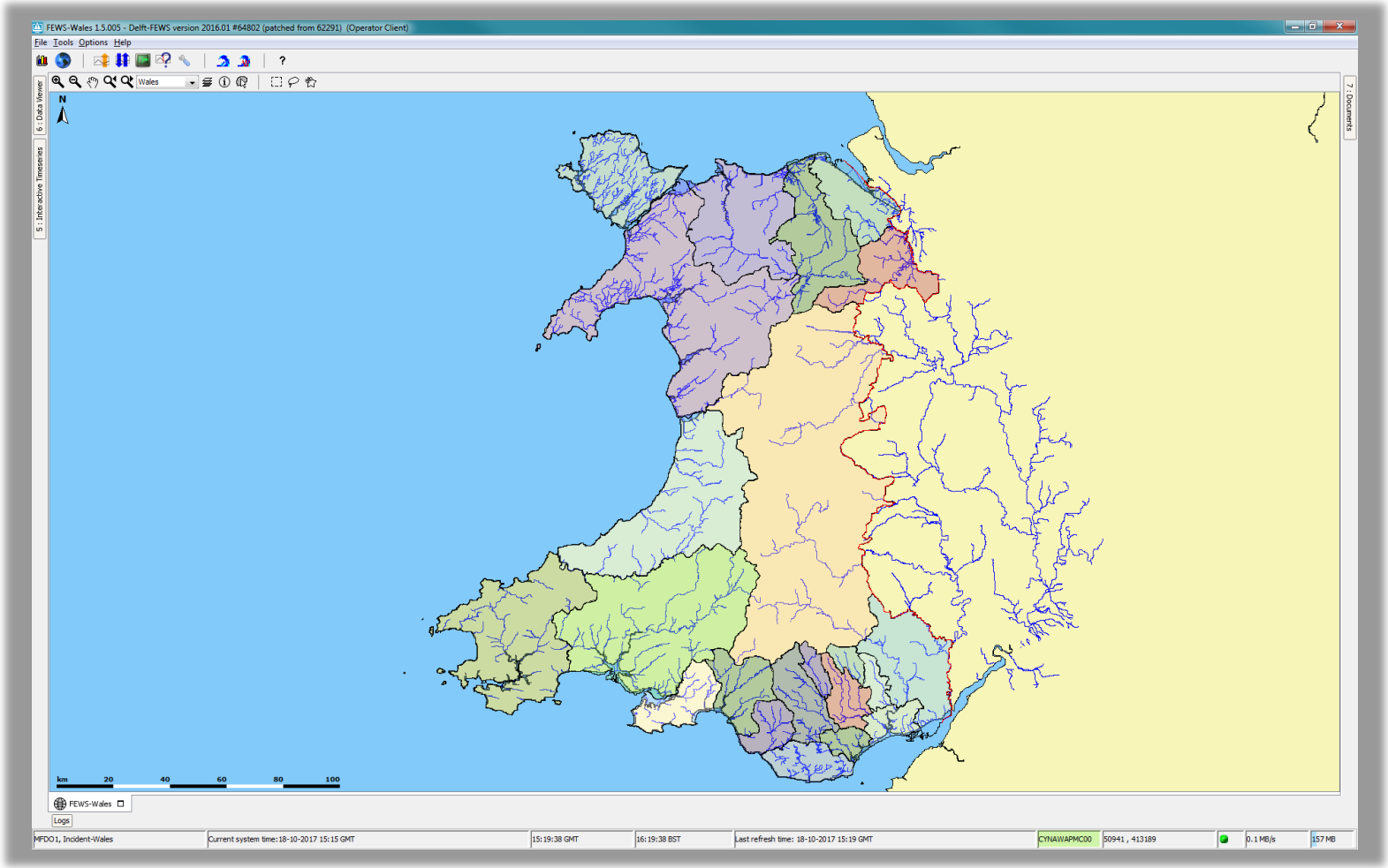
Local client

Cyfoeth Naturiol Cymru
Natural Resources Wales



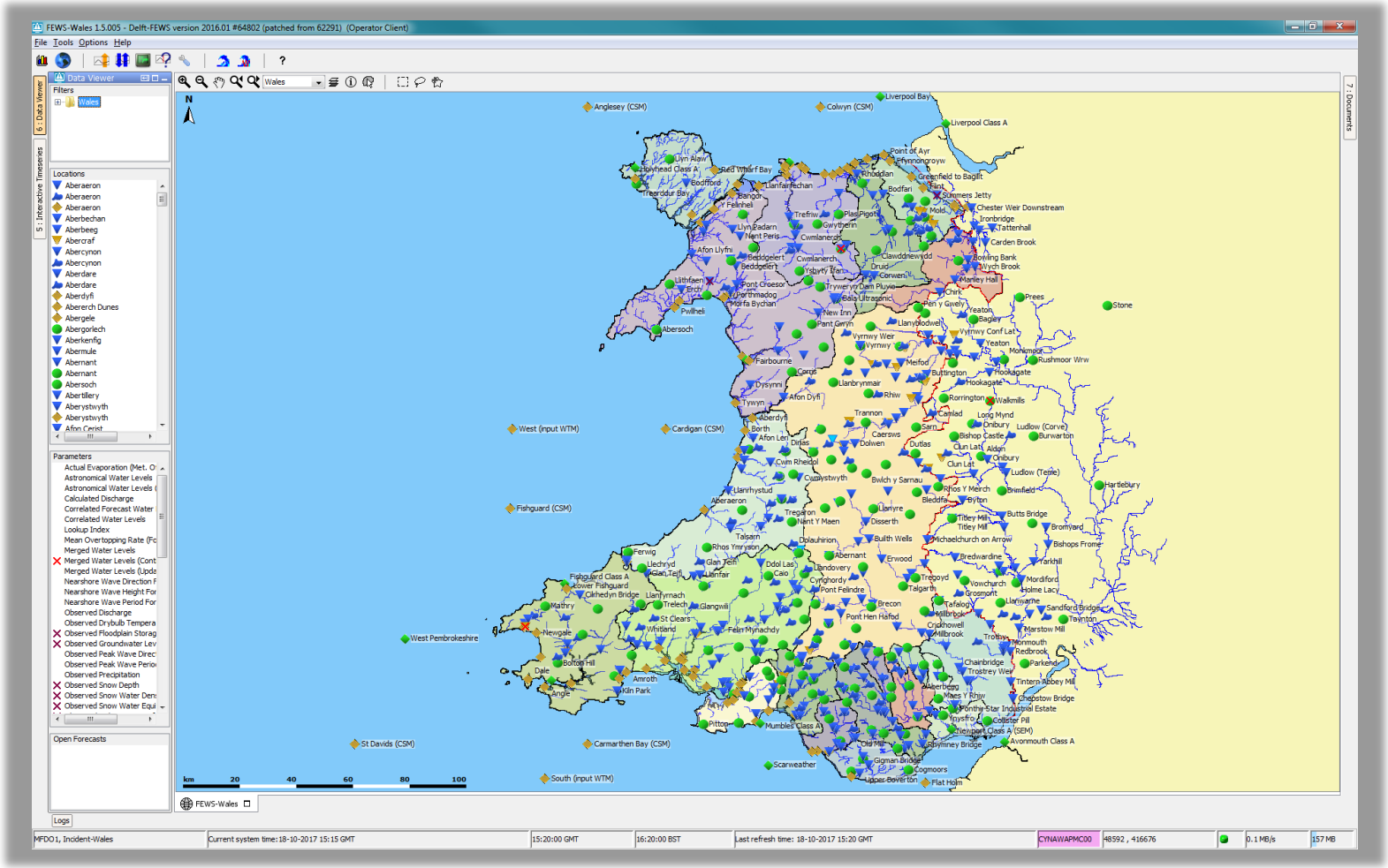
Local client

Cyfoeth Naturiol Cymru
Natural Resources Wales



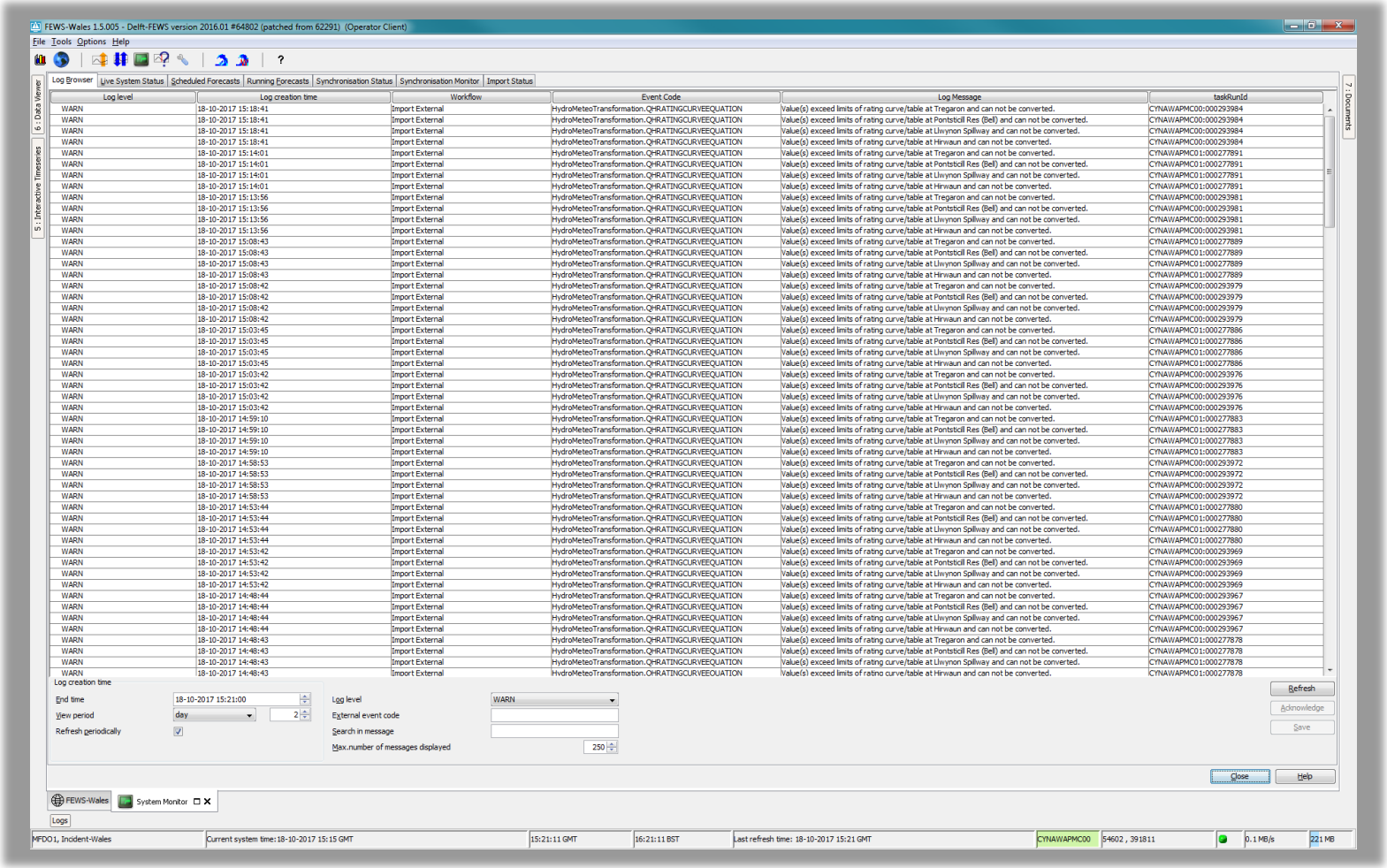
Local client

Cyfoeth Naturiol Cymru
Natural Resources Wales



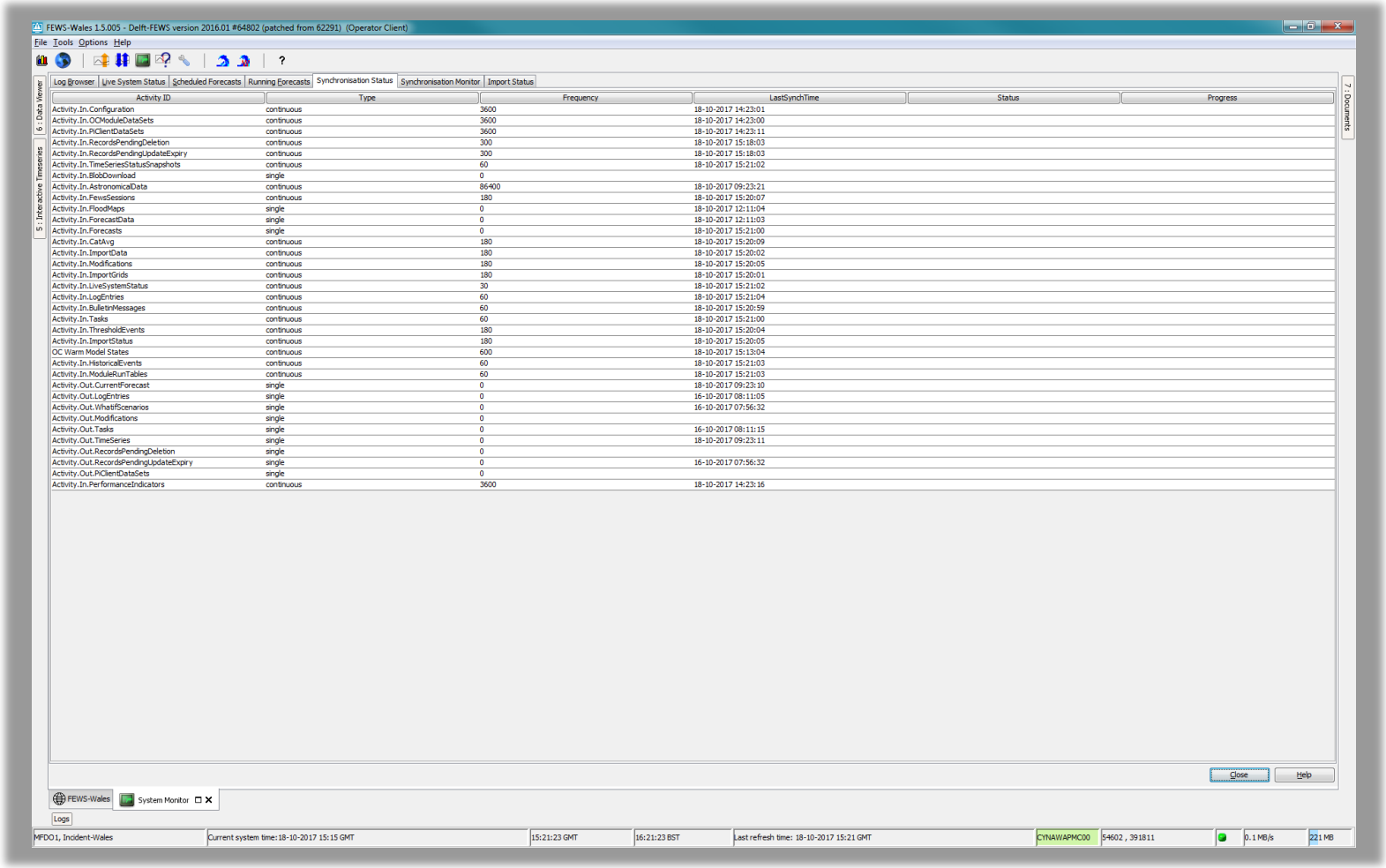
Local client

Cyfoeth Naturiol Cymru
Natural Resources Wales



Local client

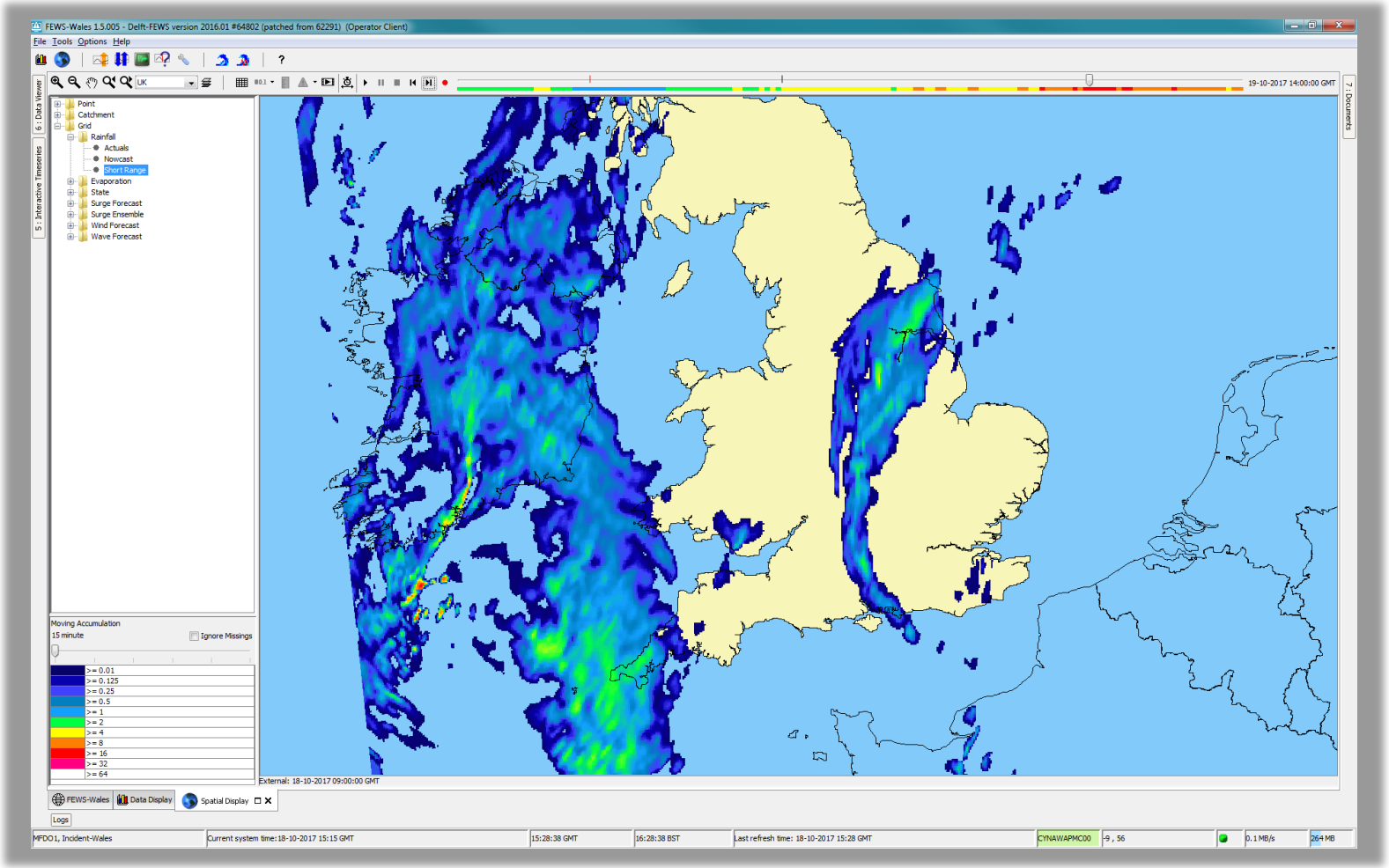
Cyfoeth Naturiol Cymru
Natural Resources Wales



Activity ID	Type	Frequency	LastSynchTime	Status	Progress
Activity.In.Configuration	continuous	3600	18-10-2017 14:23:01		
Activity.In.OCModuleDataSets	continuous	3600	18-10-2017 14:23:00		
Activity.In.PiClientDataSets	continuous	3600	18-10-2017 14:23:11		
Activity.In.RecordsPendingDeletion	continuous	300	18-10-2017 15:18:03		
Activity.In.RecordsPendingUpdateExpiry	continuous	300	18-10-2017 15:18:03		
Activity.In.TimeSeriesStatusSnapshots	continuous	60	18-10-2017 15:21:02		
Activity.In.BlobDownload	single	0			
Activity.In.AstronomicalData	continuous	86400	18-10-2017 09:23:21		
Activity.In.FewsSessions	continuous	180	18-10-2017 15:20:07		
Activity.In.FloodMaps	single	0	18-10-2017 12:11:04		
Activity.In.ForecastData	single	0	18-10-2017 12:11:03		
Activity.In.Forecasts	single	0	18-10-2017 15:21:00		
Activity.In.CatAvg	continuous	180	18-10-2017 15:20:09		
Activity.In.ImportData	continuous	180	18-10-2017 15:20:02		
Activity.In.Modifications	continuous	180	18-10-2017 15:20:05		
Activity.In.ImportGrids	continuous	180	18-10-2017 15:20:01		
Activity.In.LiveSystemStatus	continuous	30	18-10-2017 15:21:02		
Activity.In.LogEntries	continuous	60	18-10-2017 15:21:04		
Activity.In.BulletinMessages	continuous	60	18-10-2017 15:20:59		
Activity.In.Tasks	continuous	60	18-10-2017 15:21:00		
Activity.In.ThresholdEvents	continuous	180	18-10-2017 15:20:04		
Activity.In.ImportStatus	continuous	180	18-10-2017 15:20:05		
OC Warm Model States	continuous	600	18-10-2017 15:13:04		
Activity.In.HistoricalEvents	continuous	60	18-10-2017 15:21:03		
Activity.In.ModuleRunTables	continuous	60	18-10-2017 15:21:03		
Activity.Out.CurrentForecast	single	0	18-10-2017 09:23:10		
Activity.Out.LogEntries	single	0	16-10-2017 08:11:05		
Activity.Out.WhatIfScenarios	single	0	16-10-2017 07:56:32		
Activity.Out.Modifications	single	0			
Activity.Out.Tasks	single	0	16-10-2017 08:11:15		
Activity.Out.TimeSeries	single	0	18-10-2017 09:23:11		
Activity.Out.RecordsPendingDeletion	single	0			
Activity.Out.RecordsPendingUpdateExpiry	single	0	16-10-2017 07:56:32		
Activity.Out.PiClientDataSets	single	0			
Activity.In.PerformanceIndicators	continuous	3600	18-10-2017 14:23:16		

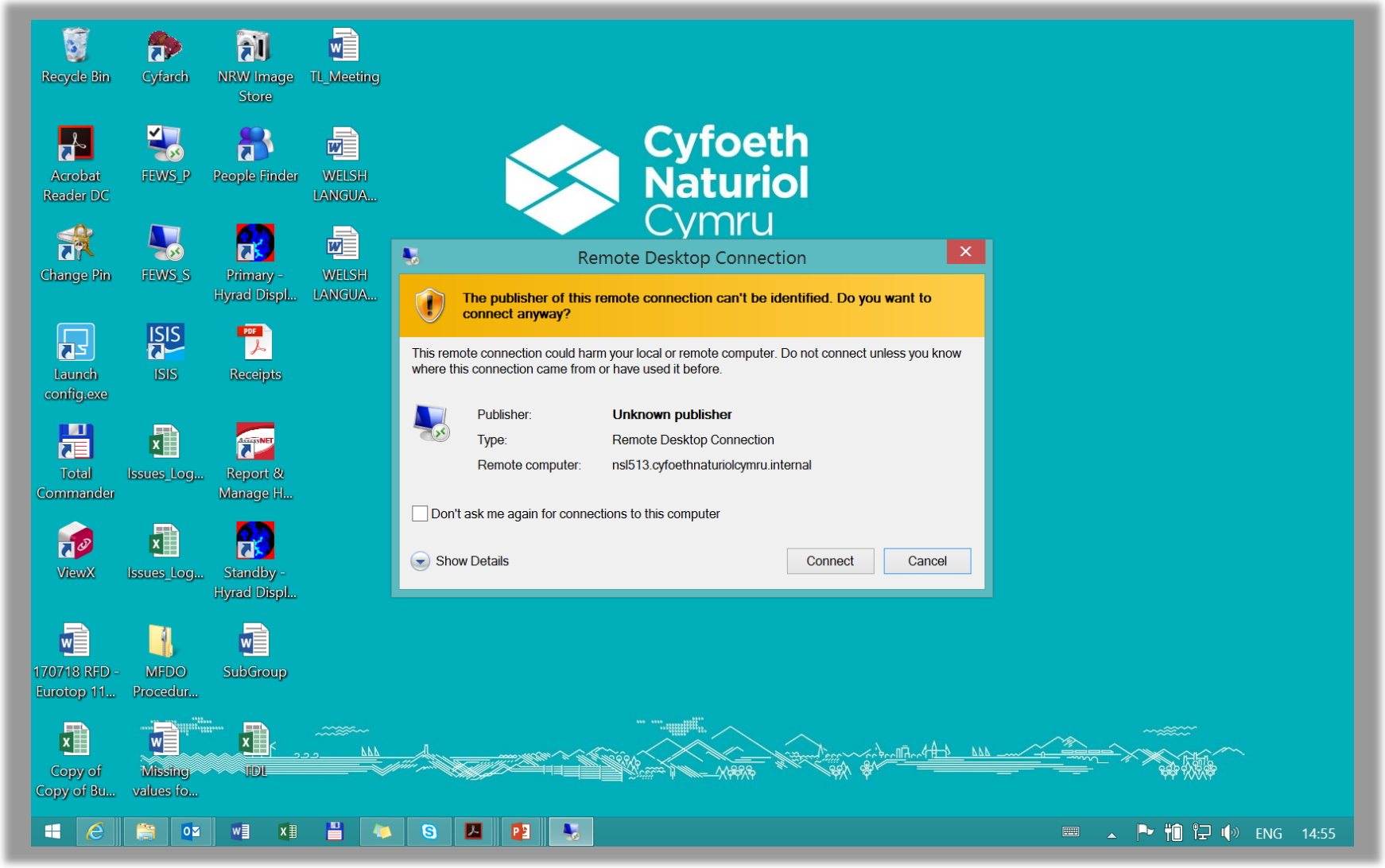
Local client

Cyfoeth Naturiol Cymru
Natural Resources Wales



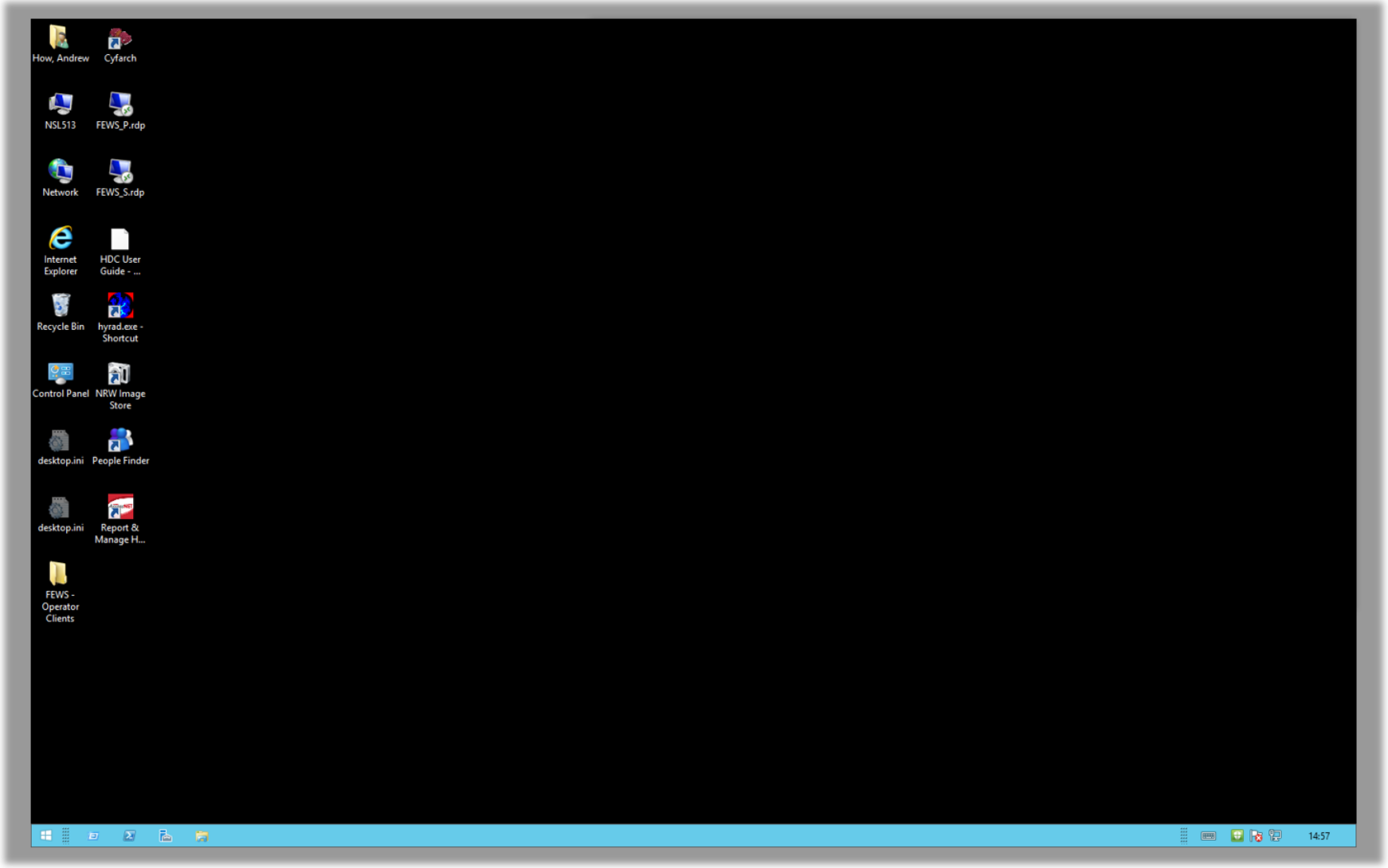
Remote client

Cyfoeth Naturiol Cymru
Natural Resources Wales



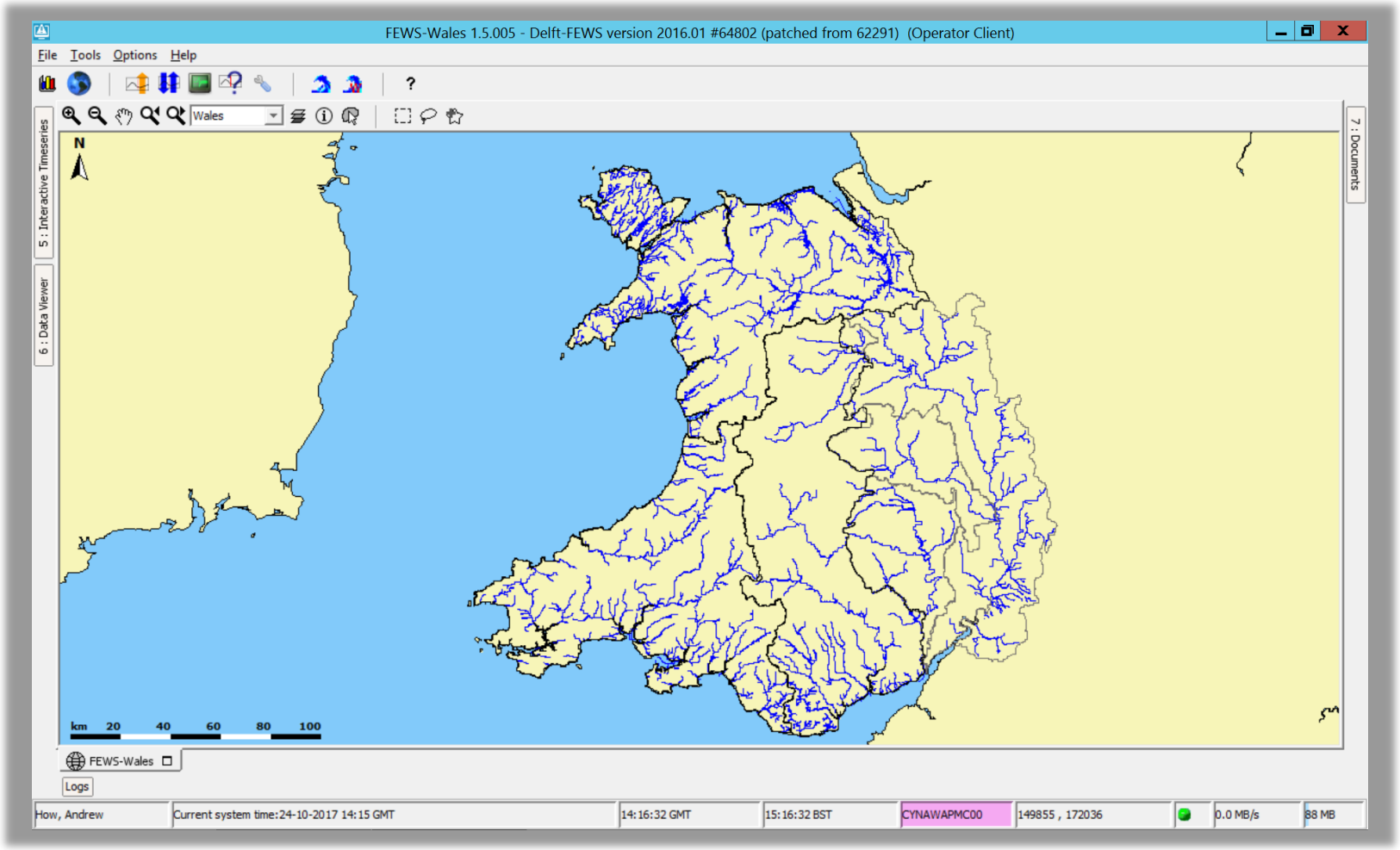
FEWS Wales

Cyfoeth Naturiol Cymru
Natural Resources Wales



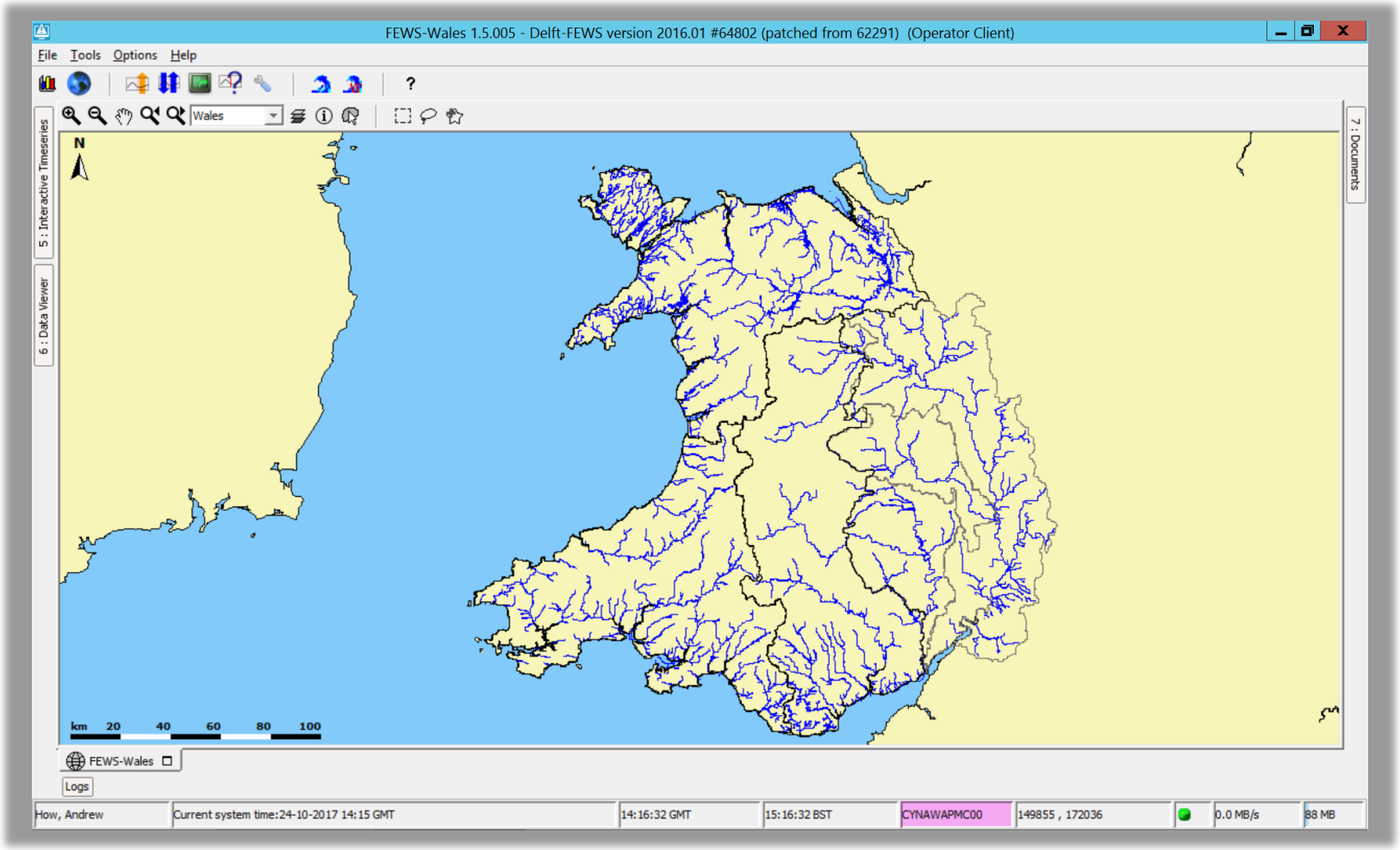
FEWS Wales

Cyfoeth Naturiol Cymru
Natural Resources Wales



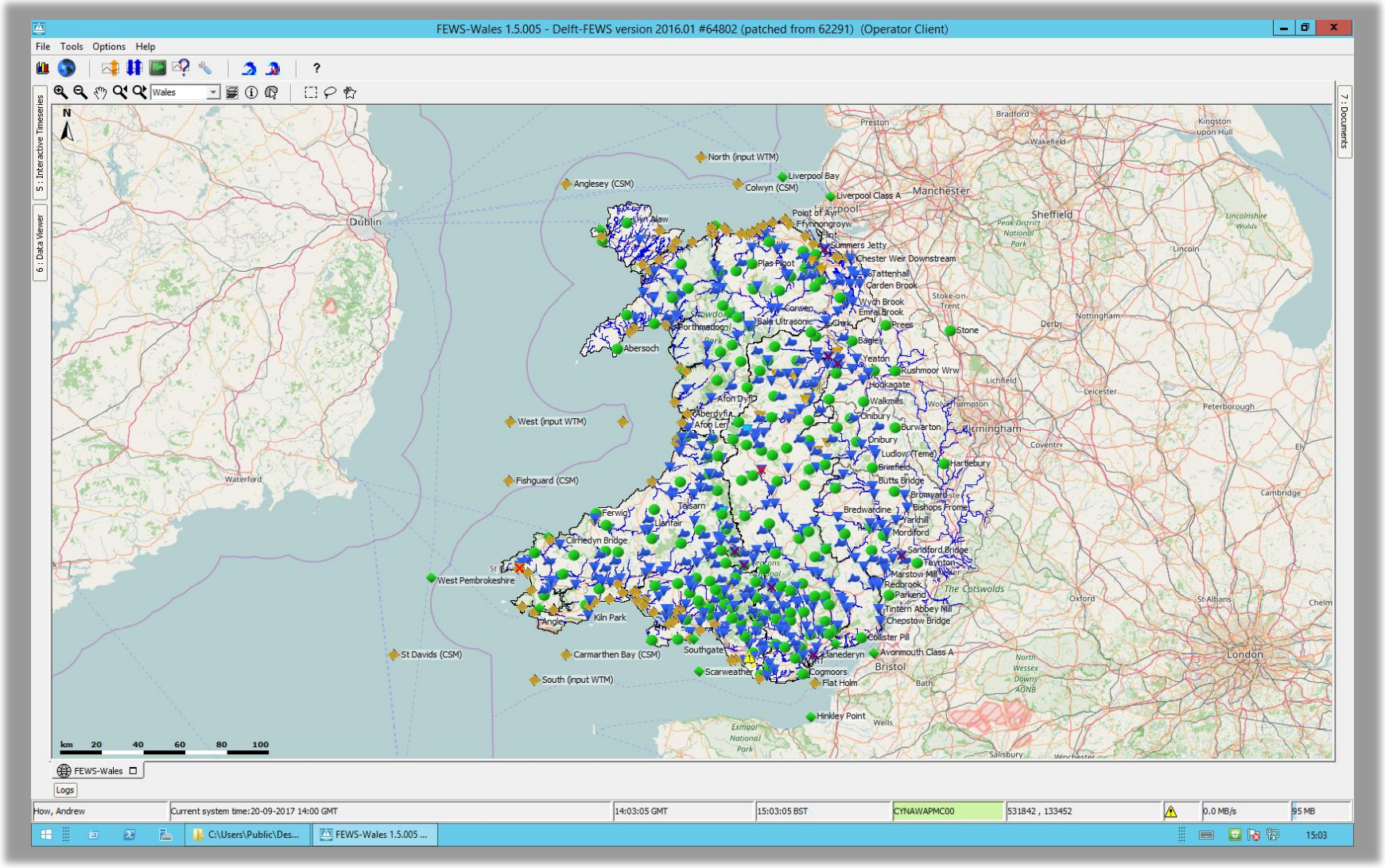
FEWS Wales

Cyfoeth Naturiol Cymru
Natural Resources Wales



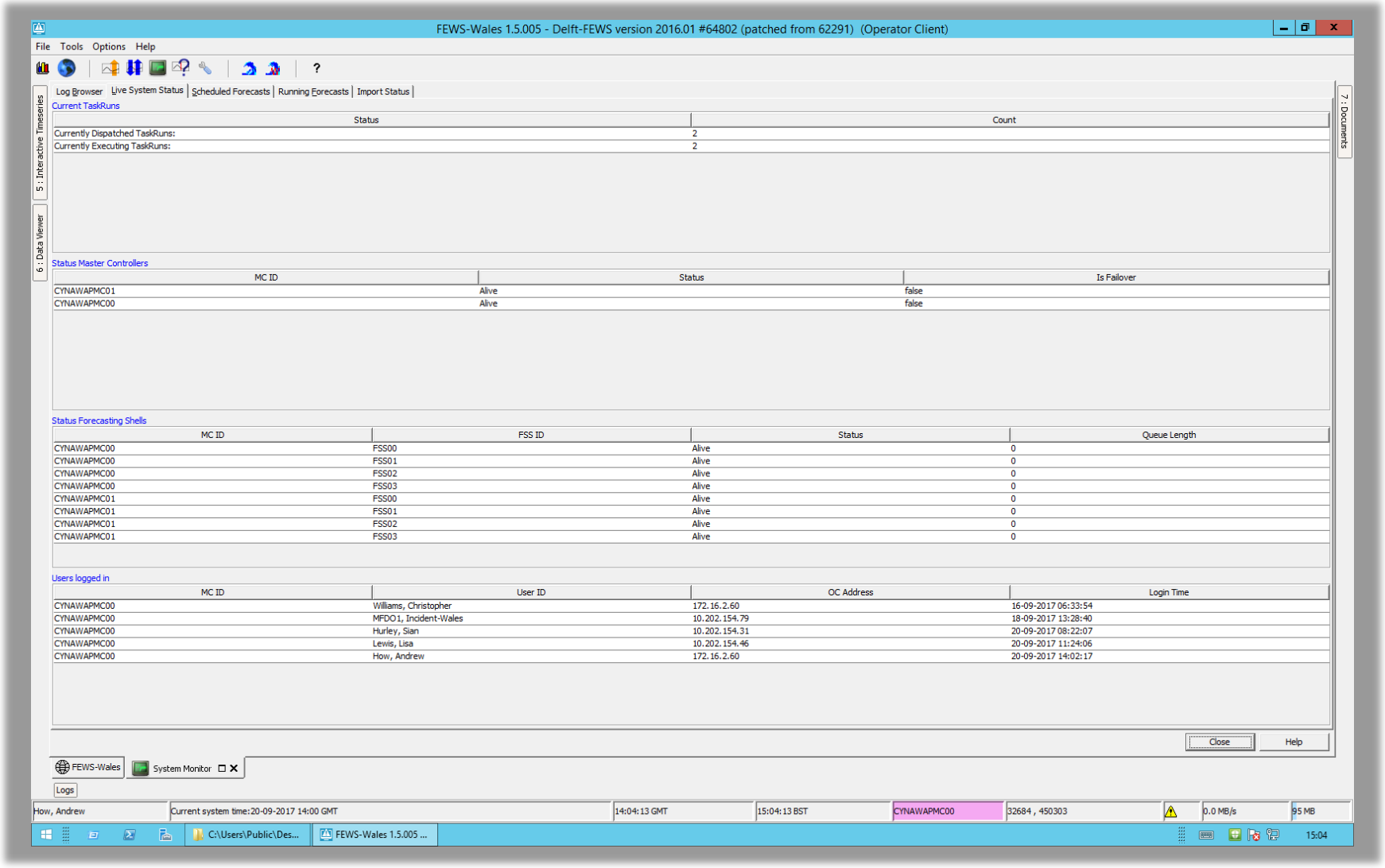
FEWS Wales

Cyfoeth Naturiol Cymru
Natural Resources Wales



FEWS Wales

Cyfoeth Naturiol Cymru
Natural Resources Wales

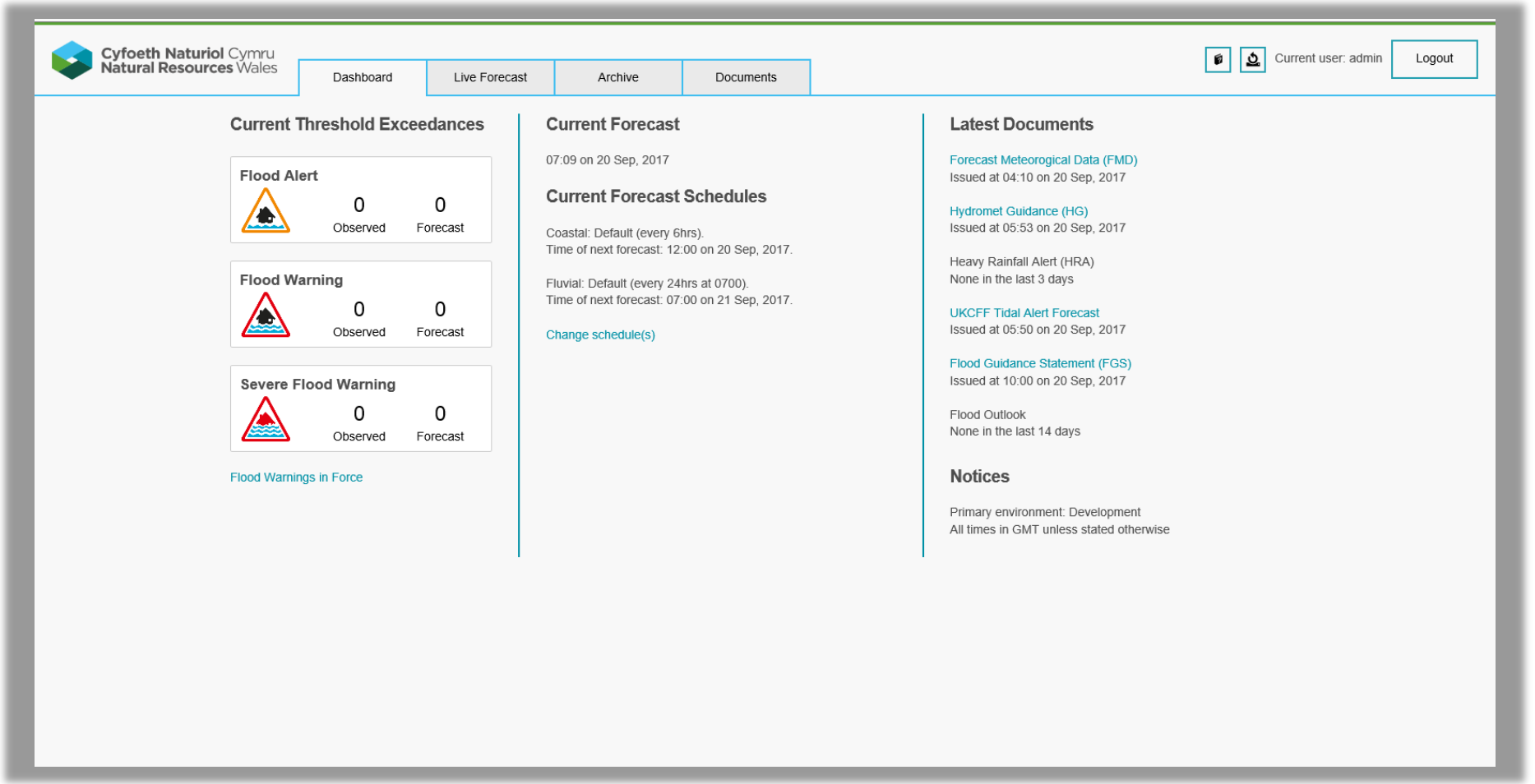


Presentation solution

Cyfoeth Naturiol Cymru
Natural Resources Wales

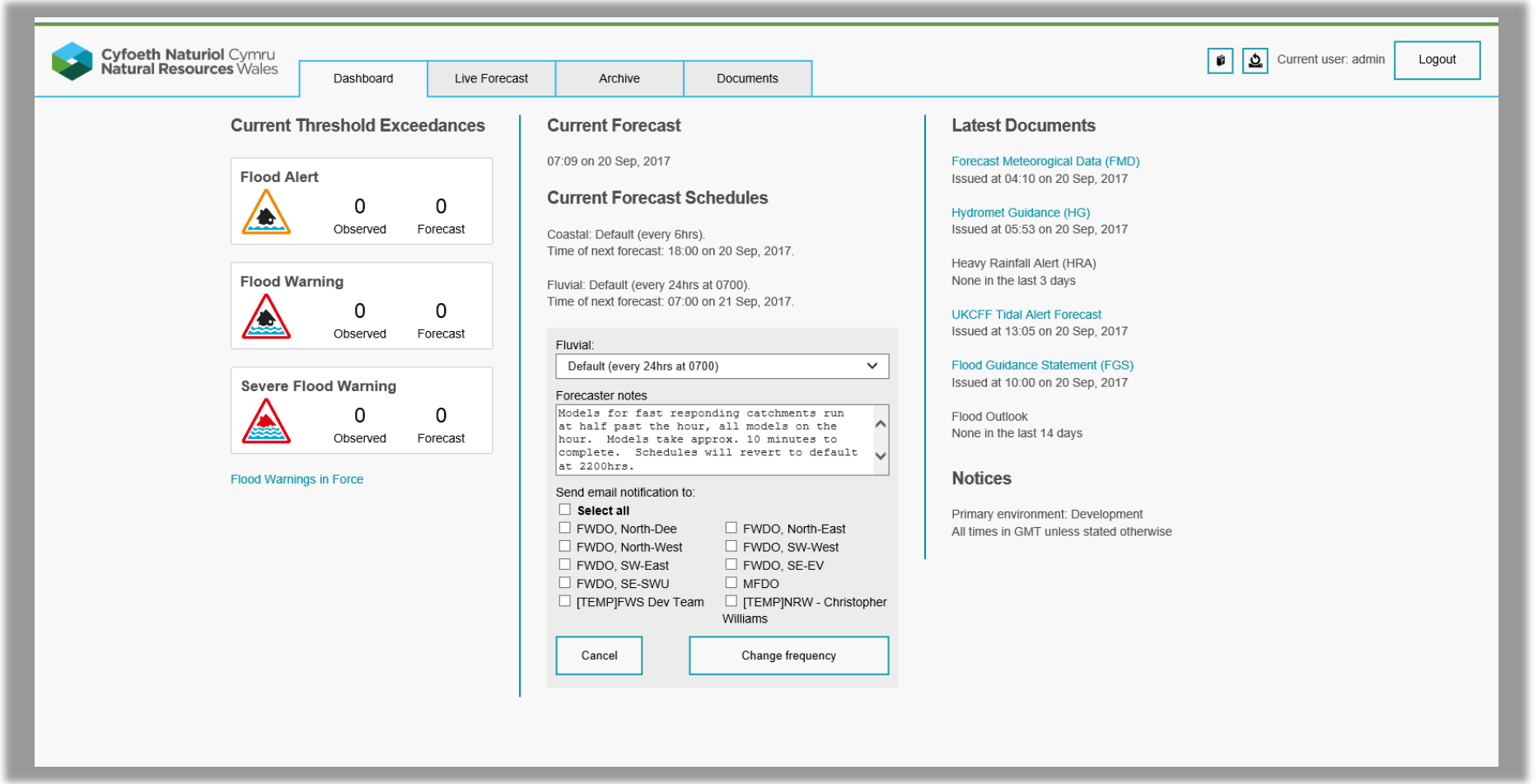
Forecast Web Service

Cyfoeth Naturiol Cymru Natural Resources Wales



Forecast Web Service

Cyfoeth Naturiol Cymru Natural Resources Wales



Forecast Web Service

Cyfoeth Naturiol Cymru
Natural Resources Wales

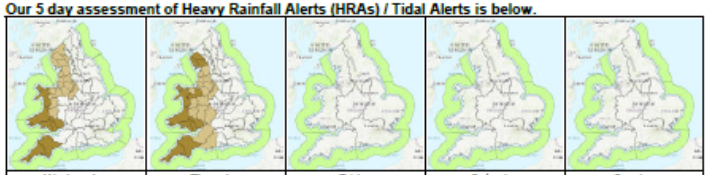
Hydrometeorological Guidance

FLOODFORECASTINGCENTRE

a working partnership between Environment Agency | Met Office

Issued by the Flood Forecasting Centre on 20/09/17 at 04:52 GMT (05:52 local time)
Unique Reference No. 2326 Version 1 Original

Our 5 day assessment of Heavy Rainfall Alerts (HRAs) / Tidal Alerts is below.



Wednesday 20th September 2017	Thursday 21st September 2017	Friday 22nd September 2017	Saturday 23rd September 2017	Sunday 24th September 2017

HRA Assessment

Low | Medium | High

This is the likelihood of issuing a HRA.
Please refer to the Hazard Manager map view for the latest HRA situation

Coastal Assessment

No Tidal Alerts & No large waves | Tidal Alerts but No Large waves
No Tidal Alerts but large waves | Tidal Alerts & large waves

Large waves are defined as >=3m for South East, Anglian, Yorkshire and North East. For all other EA regions and NRW they are defined as >=4m

Section 1: England and Wales Overview

Headline

Frontal rain arriving in the west on Wednesday afternoon into Thursday.

General Overview Days 1 to 5

Wednesday afternoon sees the arrival of rain into western parts of England and Wales. This rain will turn persistent and heavy at times on Wednesday night and during early Thursday morning. High ground over the south of Wales, the south-west of England and parts of north-west England are likely to be the wettest places, but lower lying areas in these places may also see heavy rain. Through Thursday afternoon the rain will make erratic progress eastwards, and may be heavy for a time over parts of the Midlands, before eventually easing and clearing eastwards through the evening.

Turning dry thereafter before a brief spell of mainly light rain spreads in from the west on Friday afternoon; quickly easing as it heads eastwards.

The weekend will start dry for many, before more rain spreads in from the west on Sunday morning, edging eastwards through the day as a weakening feature. This rain is unlikely to be disruptive.

Spring tides peak through the period, but no coastal flooding issues are expected, despite strng southerly winds developing along western coasts on Saturday.

General Overview Days 6 to 10

A west-east split in the weather is likely through this period. Remaining changeable in the west with rain and strong winds at times with more settled weather in east of the UK. Then a low probability of all parts seeing settled weather towards the end of the period.

Tide levels continue to fall away to neaps during this period and no coastal flooding issues are expected.

Known technical issues

Munduff and Druim a Starraig radars are out of the composite due to maintenance work. Dublin radar is also out of composite due to interference.

Section 2: Amplification - All EA regions & NRW

North West

Precipitation amplification

Wednesday 20 and Thursday 21 September
- Periods of frontal rain coming in from the west on Wednesday and into Thursday.
- The heaviest of the rain is expected to be over the high ground in Cumbria and Lancashire where HRA thresholds may be reached.
- Southerly to south-westerly facing high ground should see the higher rainfall accumulations but heavy rain could also affect lower lying areas at times.
- Best forecast short and medium range data can be used as hydromet best estimate.
- See MAE and rainfall map (Figure 1) for further details.

Coastal amplification

Nil Amplification

North East

Precipitation amplification

Wednesday 20 and Thursday 21 September
- Frontal rain coming in from the west on Wednesday afternoon and evening and into Thursday.
- The heaviest of the rain is expected to be over the high ground in the Pennines, Cheviots and North Yorkshire Moors where HRA thresholds may be reached.
- Best forecast short and medium range data can be used as hydromet best estimate.
- Southerly to south-westerly facing high ground should see the higher rainfall accumulations but heavy rain could also affect lower lying areas at times.
- See MAE and rainfall map (Figure 1) for further details.

Coastal amplification

Nil Amplification

Midlands

Precipitation amplification

Wednesday 20 and Thursday 21 September
- Frontal rain coming in from the west on Wednesday and into Thursday.
- The heaviest of the rain is expected to be over the high ground in the Pennines and Wales, with a marked rain shadow over the Midlands at first. However as the weather front moves eastwards, heavy rain may affect western and northern parts of the regions and HRA thresholds may be reached.
- Best forecast short and medium range data can be used as hydromet best estimate.
- Southerly to south-westerly facing high ground should see the higher rainfall accumulations, but heavy rain could also affect lower lying areas at times.
- See MAE and rainfall map (Figure 1) for further details.

Coastal amplification

Nil Amplification

South West

Precipitation amplification

Wednesday 20 and Thursday 21 September
- Frontal rain coming in from the west on Wednesday afternoon and into Thursday morning.
- The heaviest of the rain is expected to be over the high ground such as Bodmin Moor and Dartmoor where HRA thresholds may be reached but heavy rain could also affect lower lying areas at times.
- Best forecast short and medium range data can be used as hydromet best estimate.
- See MAE and rainfall map (Figure 1) for further details.

Coastal amplification

Nil Amplification

South East

Precipitation amplification

Nil Amplification

Coastal amplification

Nil Amplification

Anglian

Forecast Web Service

Cyfoeth Naturiol Cymru
Natural Resources Wales

Flood Guidance Statement
10:30hrs Wednesday 20 September 2017

FLOODFORECASTINGCENTRE

Wednesday	Thursday	Friday	Saturday	Sunday
20 Sep 2017 10:30-23:59	21 Sep 2017	22 Sep 2017	23 Sep 2017	24 Sep 2017
Trend since last FGS				
Increased ↑	Steady →	Steady →	Steady →	Steady →

Minor flooding impacts are possible on Wednesday and Thursday in parts of Wales and south-west England.

Specific Areas of Concern Map 1: Wednesday 20 and Thursday 21 September

RISK AREA **A**
Impact **MINOR**
Likelihood **LOW**

Source **Surface**
Likely duration **2 Days**

Urban areas most at risk.

Flood Guidance Statement
10:30hrs Wednesday 20 September 2017
FLOODFORECASTINGCENTRE

Assessment of flood risk

Surface water

The surface water flood risk is VERY LOW for the next five days.

Minor surface water flooding impacts are possible on Wednesday and Thursday in parts of Wales and south-west England as shown in Specific Areas of Concern Map 1. Minor impacts are possible but not expected in the north of England. Urban areas are most prone. Prolonged and at times heavy rain may affect these areas from late Wednesday and through Thursday morning.

Rivers

The river flood risk is VERY LOW for the next five days.

Minor river flooding impacts are possible but not expected on Thursday in parts of Wales and south-west England. Prolonged and at times heavy rain may affect these areas from late Wednesday and through Thursday morning.

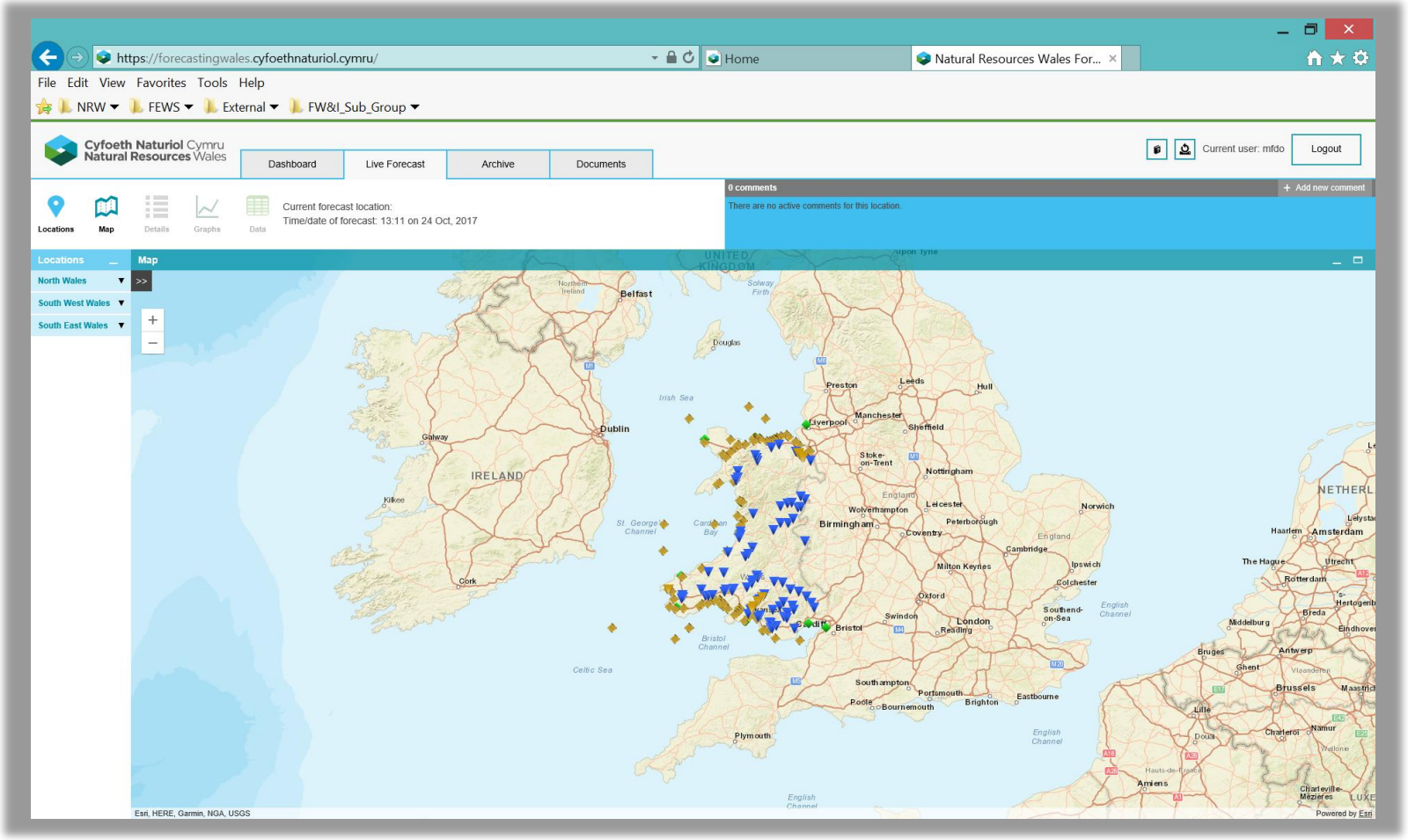
Coastal/Tidal

The coastal/tidal flood risk is VERY LOW for the next five days, despite high spring tides through this week.

Groundwater

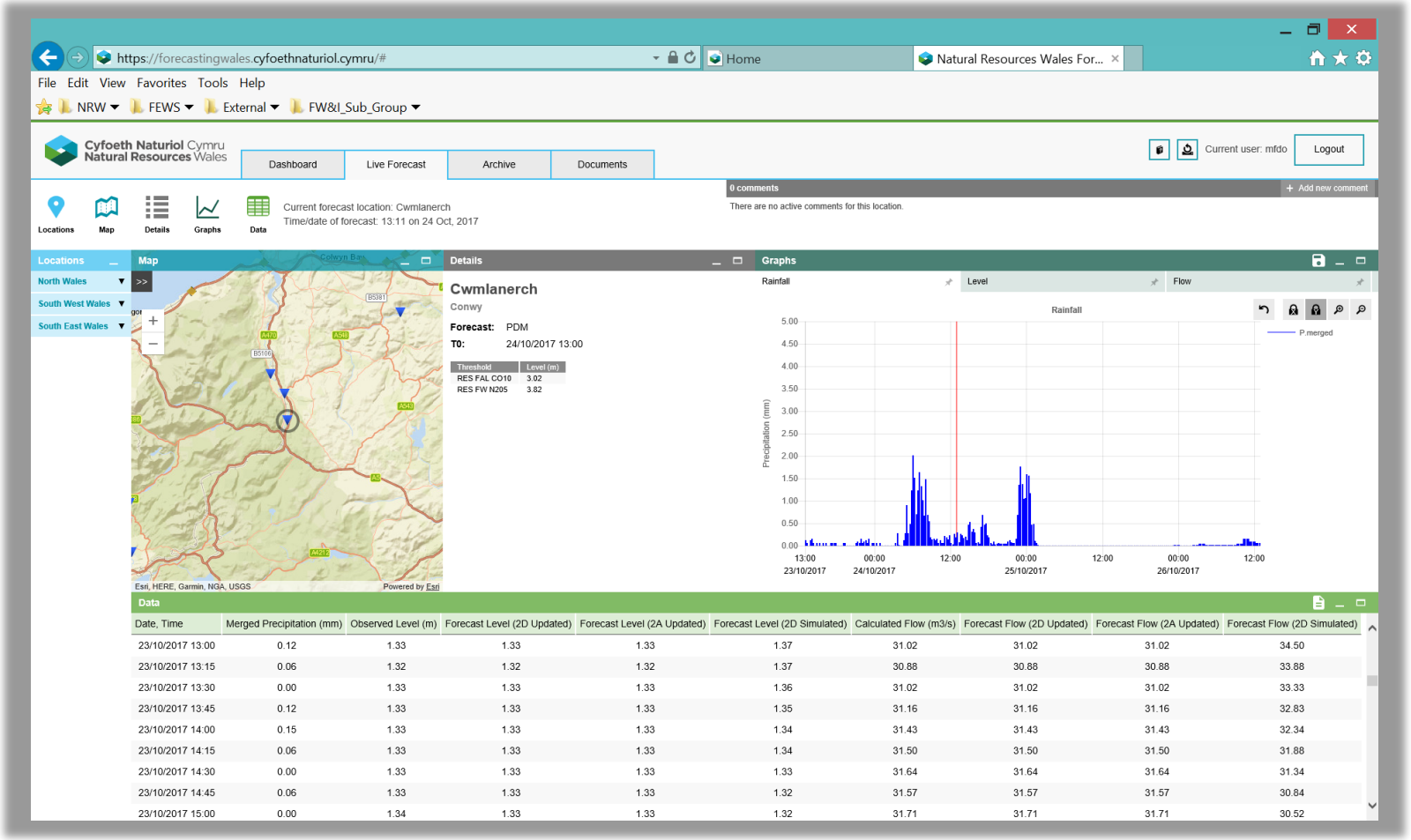
The groundwater flood risk is VERY LOW for the next five days.

Forecast Web Service



Forecast Web Service

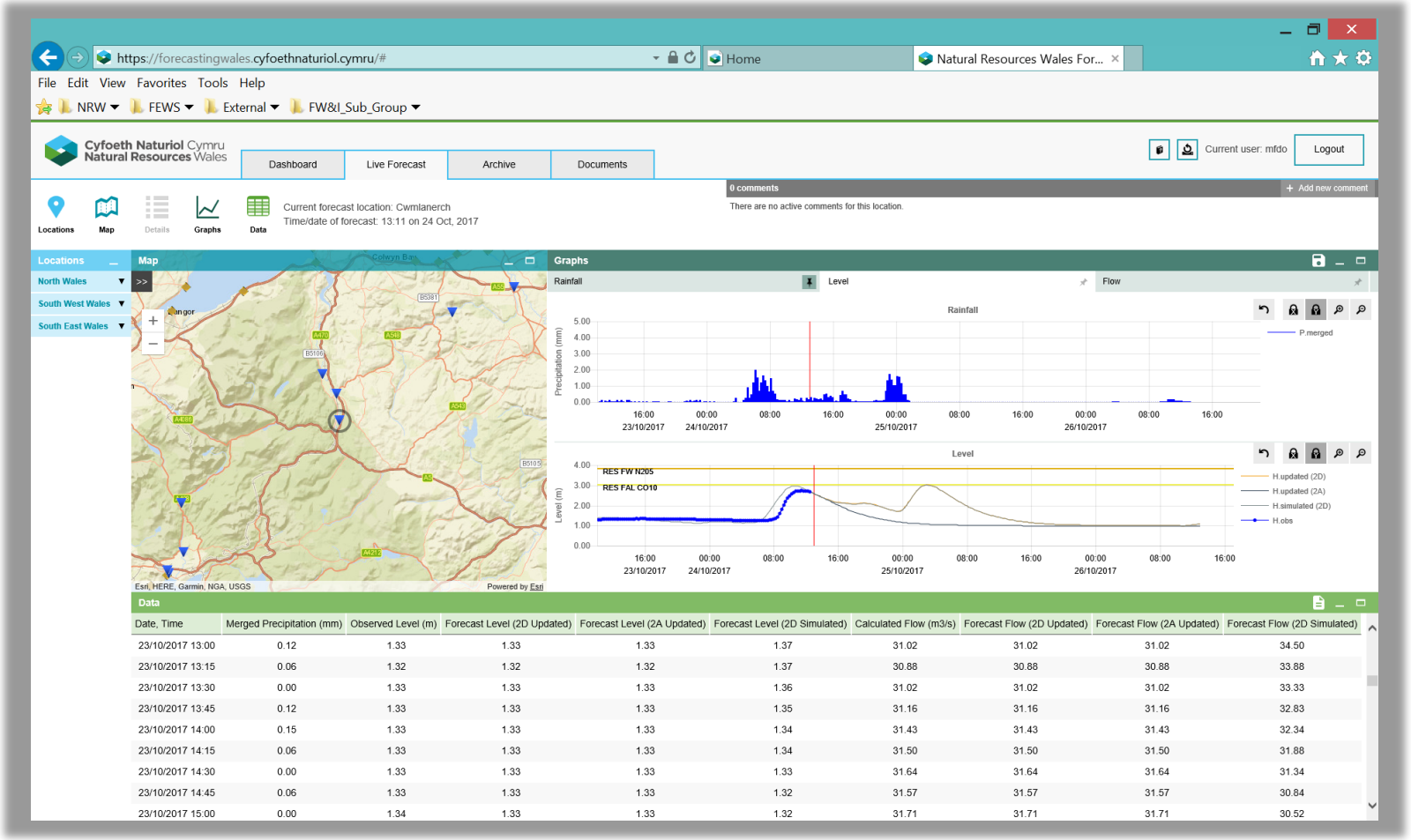
Cyfoeth Naturiol Cymru Natural Resources Wales



Date, Time	Merged Precipitation (mm)	Observed Level (m)	Forecast Level (2D Updated)	Forecast Level (2A Updated)	Forecast Level (2D Simulated)	Calculated Flow (m3/s)	Forecast Flow (2D Updated)	Forecast Flow (2A Updated)	Forecast Flow (2D Simulated)
23/10/2017 13:00	0.12	1.33	1.33	1.33	1.37	31.02	31.02	31.02	34.50
23/10/2017 13:15	0.06	1.32	1.32	1.32	1.37	30.88	30.88	30.88	33.88
23/10/2017 13:30	0.00	1.33	1.33	1.33	1.36	31.02	31.02	31.02	33.33
23/10/2017 13:45	0.12	1.33	1.33	1.33	1.35	31.16	31.16	31.16	32.83
23/10/2017 14:00	0.15	1.33	1.33	1.33	1.34	31.43	31.43	31.43	32.34
23/10/2017 14:15	0.06	1.33	1.33	1.33	1.34	31.50	31.50	31.50	31.88
23/10/2017 14:30	0.00	1.33	1.33	1.33	1.33	31.64	31.64	31.64	31.34
23/10/2017 14:45	0.06	1.33	1.33	1.33	1.32	31.57	31.57	31.57	30.84
23/10/2017 15:00	0.00	1.34	1.33	1.33	1.32	31.71	31.71	31.71	30.52

Forecast Web Service

Cyfoeth Naturiol Cymru Natural Resources Wales



Date, Time	Merged Precipitation (mm)	Observed Level (m)	Forecast Level (2D Updated)	Forecast Level (2A Updated)	Forecast Level (2D Simulated)	Calculated Flow (m3/s)	Forecast Flow (2D Updated)	Forecast Flow (2A Updated)	Forecast Flow (2D Simulated)
23/10/2017 13:00	0.12	1.33	1.33	1.33	1.37	31.02	31.02	31.02	34.50
23/10/2017 13:15	0.06	1.32	1.32	1.32	1.37	30.88	30.88	30.88	33.88
23/10/2017 13:30	0.00	1.33	1.33	1.33	1.36	31.02	31.02	31.02	33.33
23/10/2017 13:45	0.12	1.33	1.33	1.33	1.35	31.16	31.16	31.16	32.83
23/10/2017 14:00	0.15	1.33	1.33	1.33	1.34	31.43	31.43	31.43	32.34
23/10/2017 14:15	0.06	1.33	1.33	1.33	1.34	31.50	31.50	31.50	31.88
23/10/2017 14:30	0.00	1.33	1.33	1.33	1.33	31.64	31.64	31.64	31.34
23/10/2017 14:45	0.06	1.33	1.33	1.33	1.32	31.57	31.57	31.57	30.84
23/10/2017 15:00	0.00	1.34	1.33	1.33	1.32	31.71	31.71	31.71	30.52

Forecast Web Service

Future developments

Cyfoeth Naturiol Cymru
Natural Resources Wales

- Open Archive
- Improved utilisation of cloud environment
  - Scalable shell servers
  - Greater running of large datasets
- More data sharing via API service
  - Gridded data
  - Live data feeds
- Improving run times of forecasts
- Better utilisation and visualisation of ensemble forecasts

Cyfoeth Naturiol Cymru
Natural Resources Wales

Any questions?