

# Flood forecasting & warning in Wales

**Andy Wall**  
**Flood Risk Manager**  
**Natural Resources Wales**





Penrhiwceiber



Aberaeron



Carmarthen



Llandysul



Llanybydder



Newcastle Emlyn

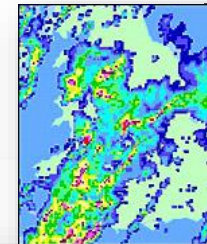


# Flood forecasting & warning in Wales

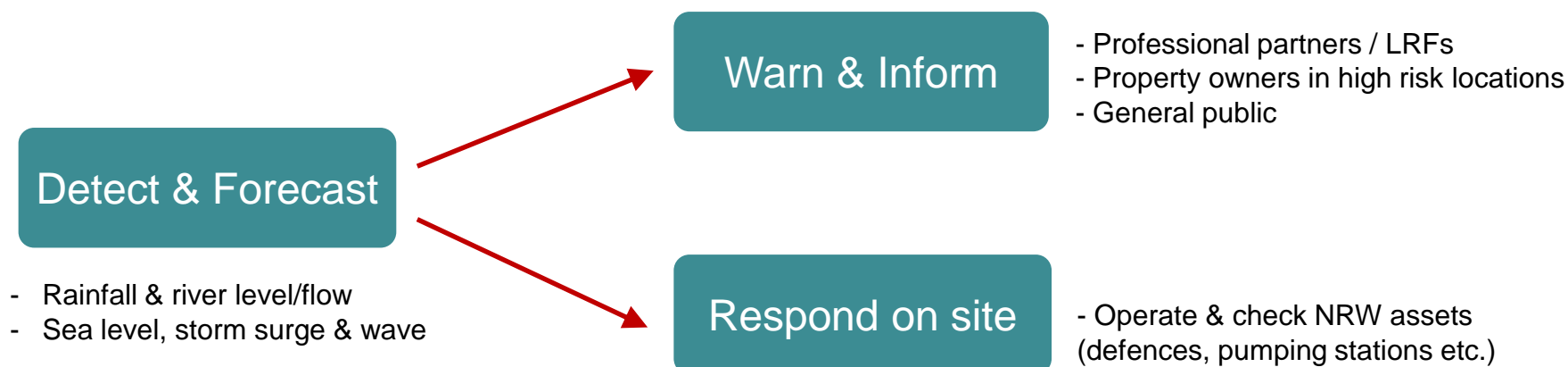


- ➔ Overview of our role
- ➔ Flood warning & informing
- ➔ Flood forecasting incl. challenges in Wales
- ➔ Why forecasts matter – North Wales coastal flooding, December 2013

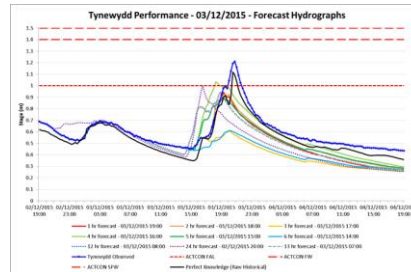
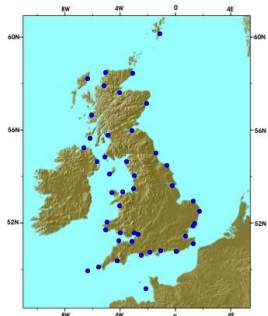




# Flooding – core operational roles



# Flood Forecasting & Warning

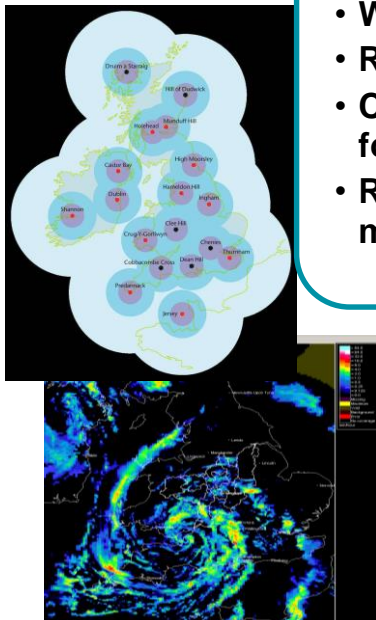


- Weather radar
- Rainfall, river & sea level monitoring (gauges)
- Site based observations (incl. CCTV)
- Weather forecasts
- Rainfall forecast data
- Coastal storm surge, wave & wind forecast data
- River & coastal flood forecasting models (real time)

## Warning & Informing

- Flood Advisory Services
- Direct Alerts & Warnings by phone, SMS or email
- NRW website – live warnings and 5 Day Flood Forecast
- Floodline call centre
- Open data feeds

## Detection & Forecasting





# The challenge...



# Why issue flood warnings?



## Shift in approach...

Flood “defence” to “risk management”

## Timely warning enables...

- people to respond effectively & mitigate possible effects (damage reduction)
- partner organisations prepare and plan their emergency response to help those at risk

Critical to get **correct message** to **people at risk** through **appropriate channels** and in **good time**.

Two tier approach - warn, then offer more information =  
**Warning & Informing**



## 1996 Ministerial Direction – Flood Warning



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Naturiol  
Cymru  
Natural  
Resources  
Wales

*From 1 September 1996, we took over primary responsibility for dissemination of flood warnings, pursuant to a Ministerial Direction...*

### WATER RESOURCES ACT 1991, SECTION 5 DIRECTION TO THE NATIONAL RIVERS AUTHORITY

In accordance with sections 5 and 221(7)(b) of the Water Resources Act 1991, the Minister of Agriculture, Fisheries and Food and the Secretary of State for Wales hereby jointly give the National Rivers Authority ("the Authority") the following direction with respect to the carrying out of its functions under sections 105(1) and 166(1) of the said Act.

1. The Authority shall ensure that, with effect from 1st September 1996, there is maintained at each of its area offices, or at an alternative office designated by the Authority, a record in writing of the arrangements for the time being in effect concerning the circumstances in which, the usual means by which and the persons or bodies to whom information will be transmitted (whether by the Authority or any other person or body) for the purpose of providing warning of any danger of flooding in the area for which that office has responsibility for flood defence matters.

2. The Authority shall ensure that, before the arrangements referred to in paragraph 1 (including any significant variation in those arrangements) take effect, there is consultation with the bodies providing relevant emergency services in, and the local authorities for, the area concerned.

3. The Authority shall take such steps as appear to it to be reasonable and practicable to provide warning of any danger of flooding in accordance with the arrangements referred to in paragraph 1 above.

This direction shall have effect until withdrawn or replaced by a further direction or directions.

Signed by authority of the Minister of Agriculture, Fisheries and Food

*JRPark*  
Head of Flood and Coastal Defence Division  
Ministry of Agriculture, Fisheries and Food

Date: 1 March 1996

Signed by authority of the Secretary of State for Wales

*R. Maughan*  
Head of Environment Division  
Welsh Office

Date: 5 March 1996

# Flood warning codes



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Naturiol  
Cymru  
Natural  
Resources  
Wales**

Warning issued	What it means
<b>Flood Alert</b> 	<p><b>Flooding is possible. Be prepared.</b></p> <p><b>When is it used?</b></p> <p>Between two hours and two days in advance of flooding.</p> <p><b>What to do</b></p> <ul style="list-style-type: none"> <li>• Be prepared to act on your flood plan</li> <li>• Prepare a flood kit of essential items</li> <li>• Monitor local water levels and the flood forecast on our website</li> </ul>
<b>Flood Warning</b> 	<p><b>Flooding is expected. Immediate action required</b></p> <p><b>When is it used?</b></p> <p>Between half an hour and one day in advance of flooding</p> <p><b>What to do</b></p> <ul style="list-style-type: none"> <li>• Move family, pets and valuables to a safe place</li> <li>• Turn off gas, electricity and water supplies if it is safe to do so</li> <li>• Put flood protection equipment in place</li> </ul>
<b>Severe Flood Warning</b> 	<p><b>Severe flooding. Danger to life.</b></p> <p><b>When is it used?</b></p> <p>When flooding poses a significant threat to life</p> <p><b>What to do</b></p> <ul style="list-style-type: none"> <li>• Stay in a safe place with a means of escape</li> <li>• Be ready to leave your home</li> <li>• Cooperate with the emergency services</li> <li>• Call 999 if you are in immediate danger</li> </ul>

# NRW Flood Warning & Informing Services

## Flood Alerts & Warnings

by phone, text and email sent directly to registered customers



## Floodline 0345 988 1188

for

- Flood Alerts and Warnings in force
  - check flood risk
  - sign up for flood warnings
  - reporting flooding
  - guidance & advice
- in Wales, England and Scotland.



## Natural Resources Wales Website

providing

- 5 Day Flood Forecast
- Flood Alerts and Warnings in force
- check flood risk
- check river levels
- guidance & advice
- sign up for flood warnings



### Flood Alert

Flooding is possible. Be prepared



### Flood Warning

Flooding is expected. Immediate action required

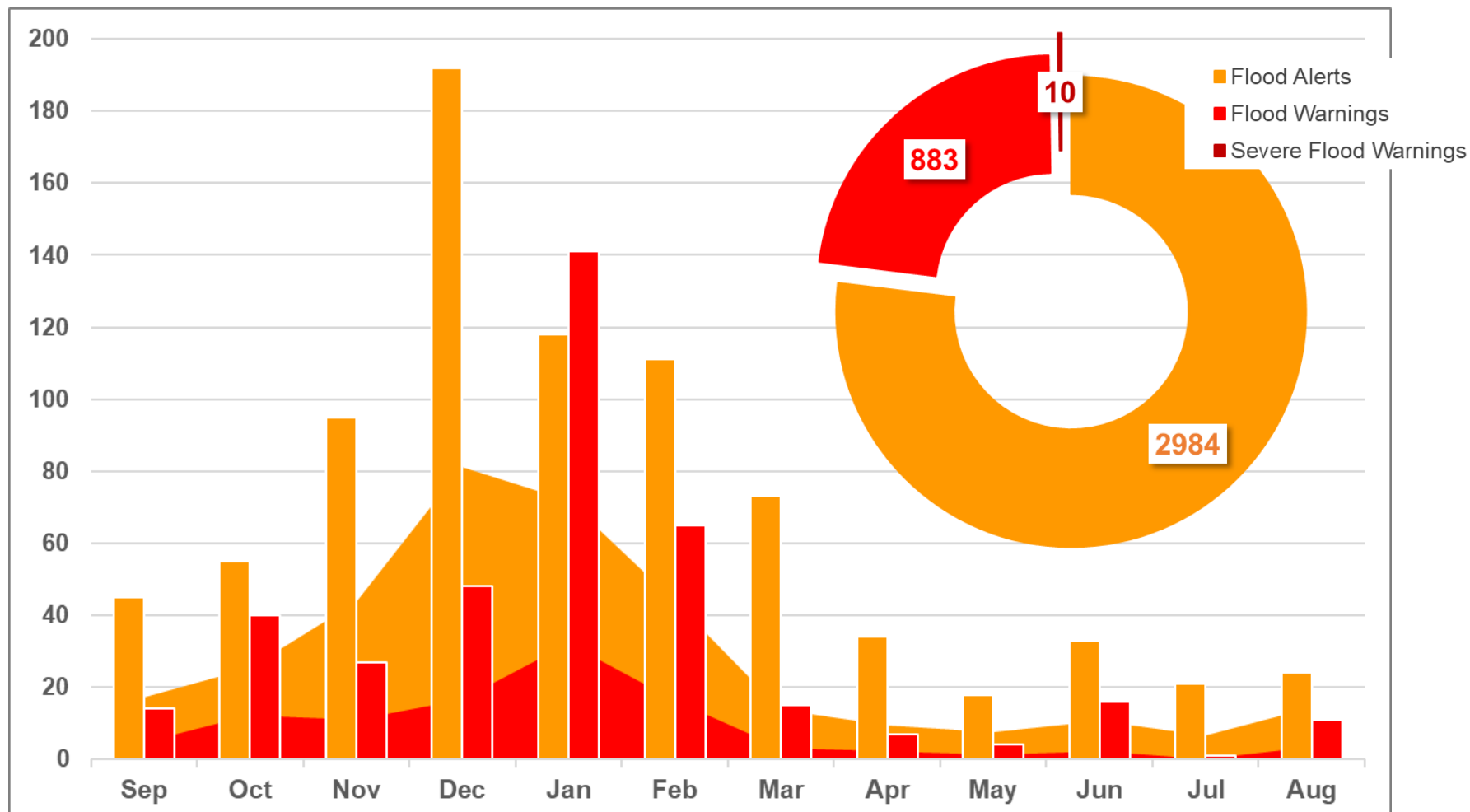


### Severe Flood Warning

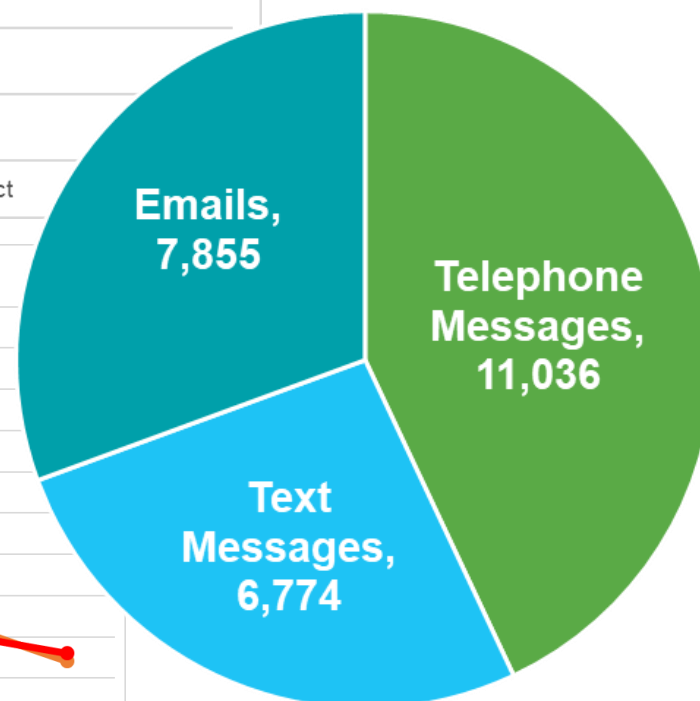
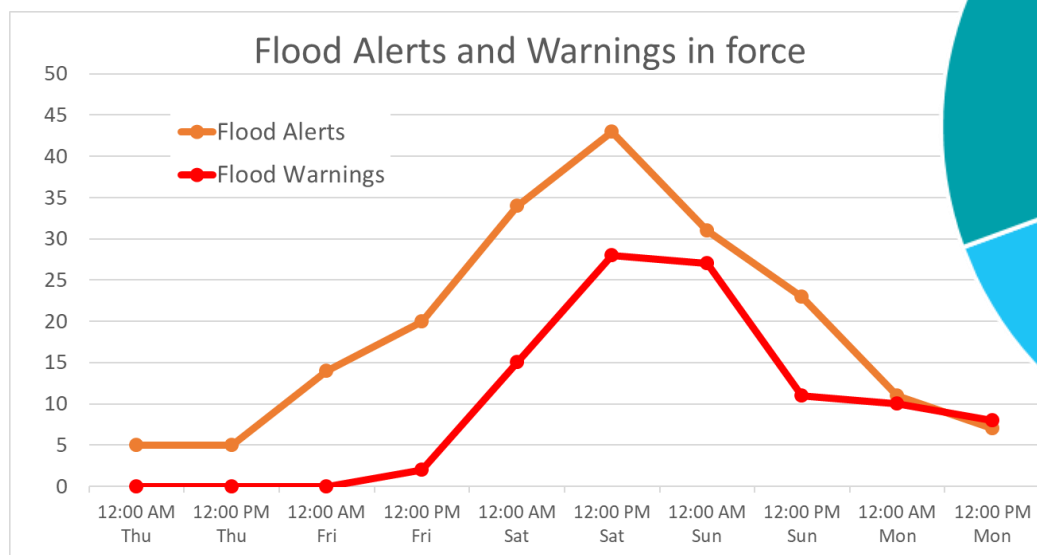
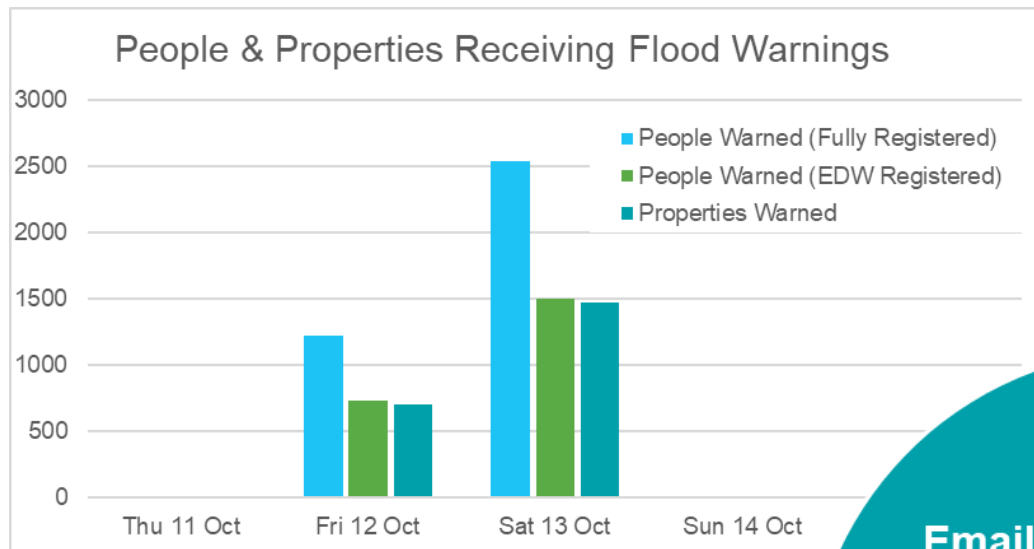
Severe flooding. Danger to life



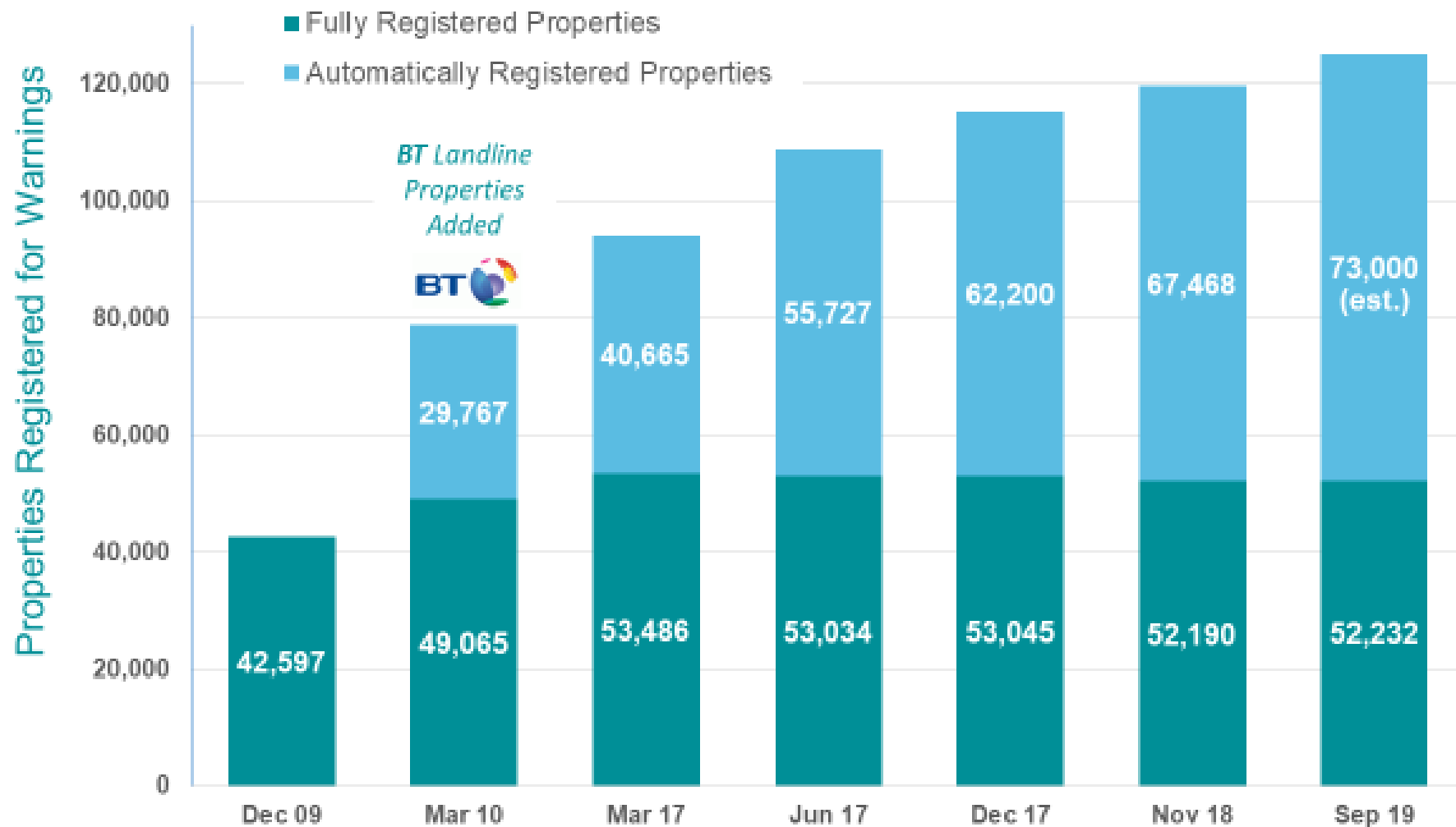
# Monthly Alerts & Warnings Issued Since November 2010



# Storm Callum – October 2018



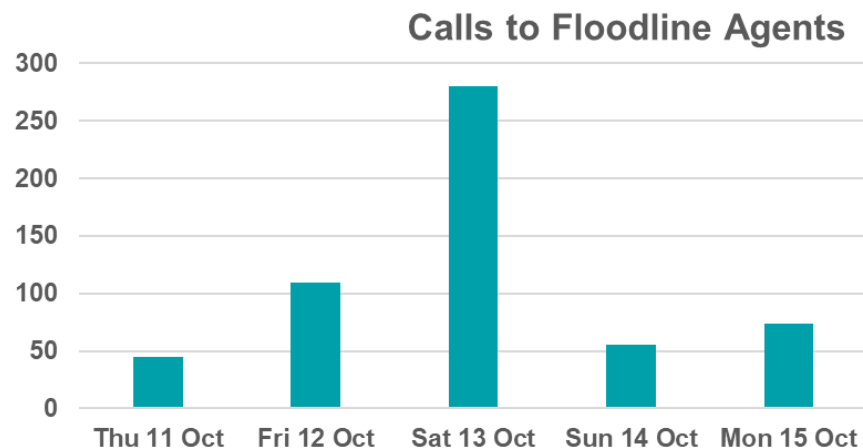
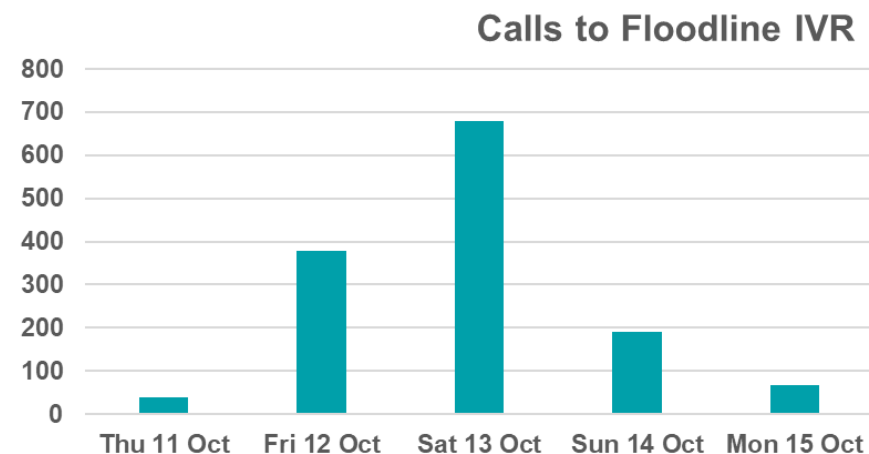
# Extended Direct Warnings



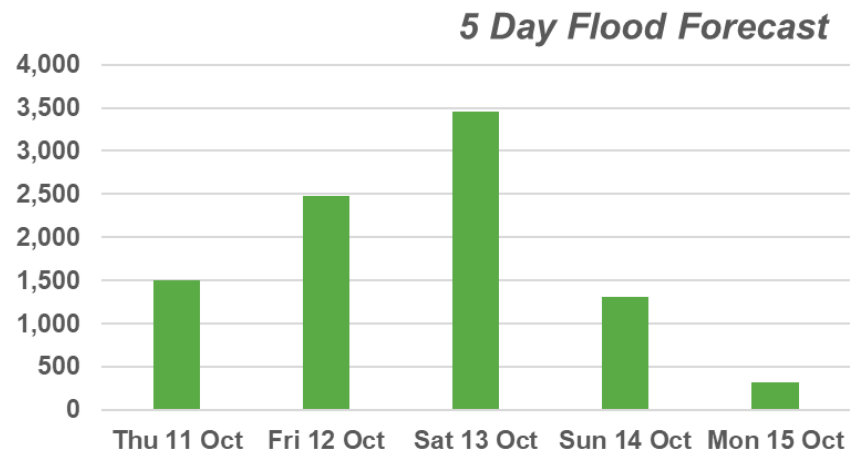
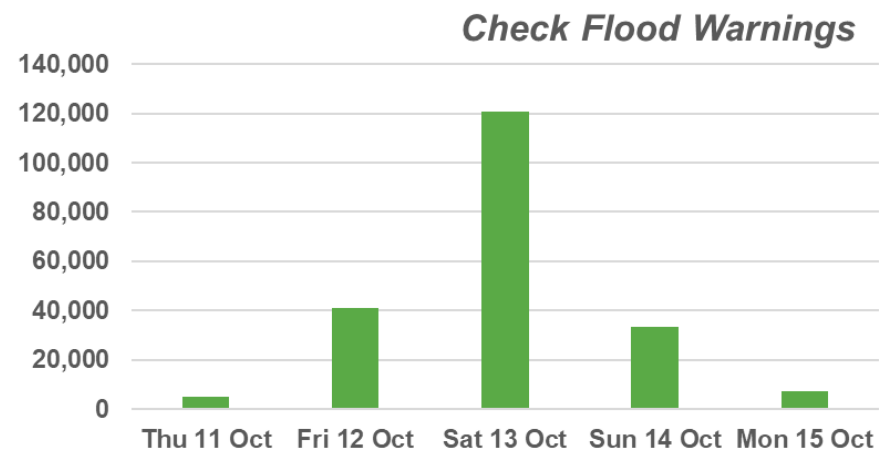


# Storm Callum – October 2018

## Floodline Service Usage

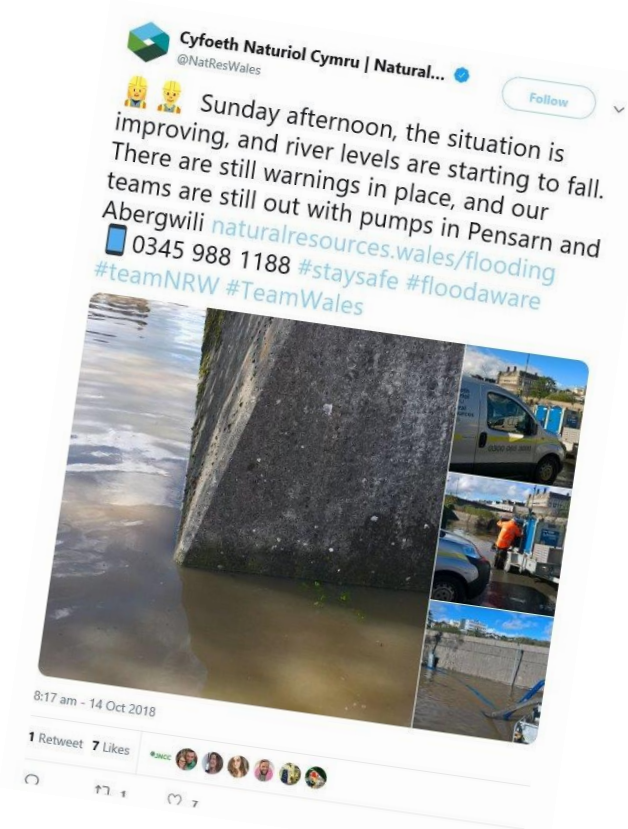


## NRW Website Page Views



# Social Media Activity

- Half a million views on website flood pages
- Social media posts reached over 110,000 people, with 20,000 engaging with those posts (liking / sharing / commenting etc).

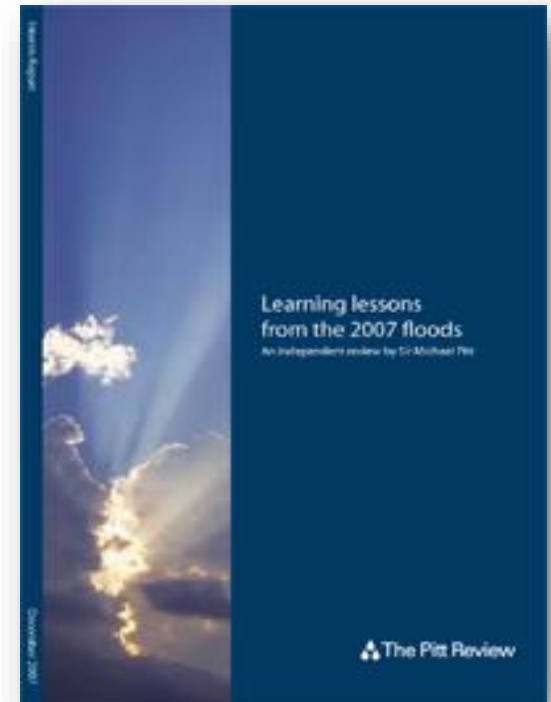


# 2007 floods & Pitt Review



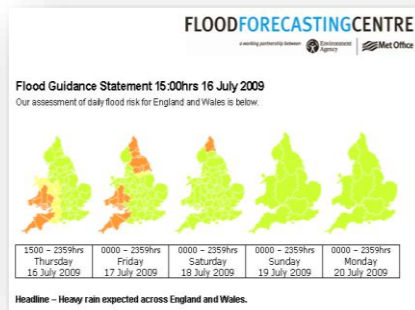
Environment Agency & Met Office should :

- Work together, through a joint centre, to improve their technical capability to forecast, model and warn against all sources of flooding.
- Issue warnings against a lower threshold of probability to increase preparation lead times for emergency responders.
- Issue joint warnings and impact information on severe weather and flooding emergencies to responder organisations and the public.





# Informing – one “flood story”



**Sharing  
information  
more openly &  
earlier**



**Flood Advisory  
Services - LRF  
partners & Wales  
Government**

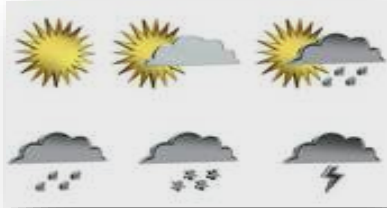


**Engaging the  
media**



**Warning people  
at risk**

# Typical flood timeline



## Prepare

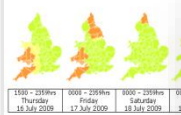
= "what if"

= how bad could it be?

FLOODFORECASTINGCENTRE

Flood Guidance Statement 15.00hrs 16 July 2009

Our assessment of daily flood risk for England and Wales is below:



Headline - Heavy rain expected across England and Wales.



**Inform professional partners, raise awareness, begin our response**



## Gather real time data

= what is happening?

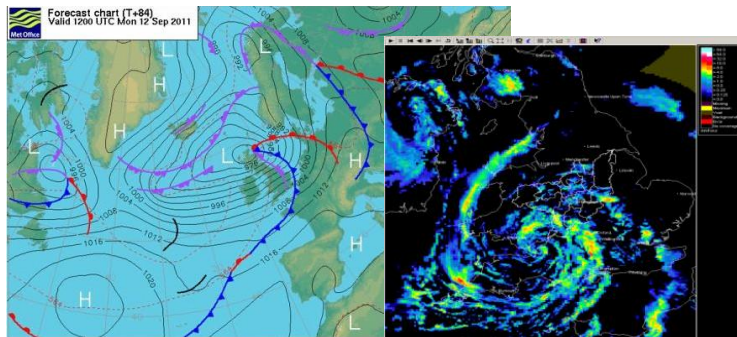


## Interpret data, make decisions

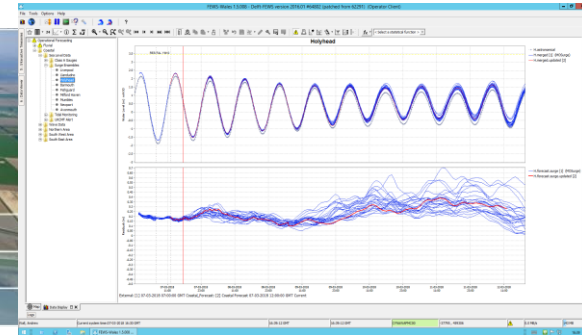
**Warn public & professional partners**

**Respond on the ground**

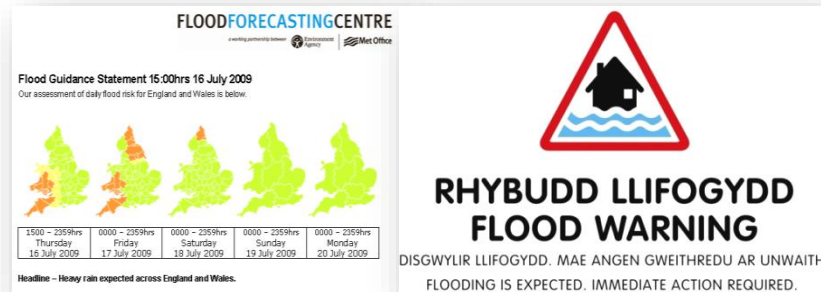
< Before the storm > < When storm hits >



**Met Office/FFC meteorological data & advice - *how much rain, where, likelihood, storm surge risk?***



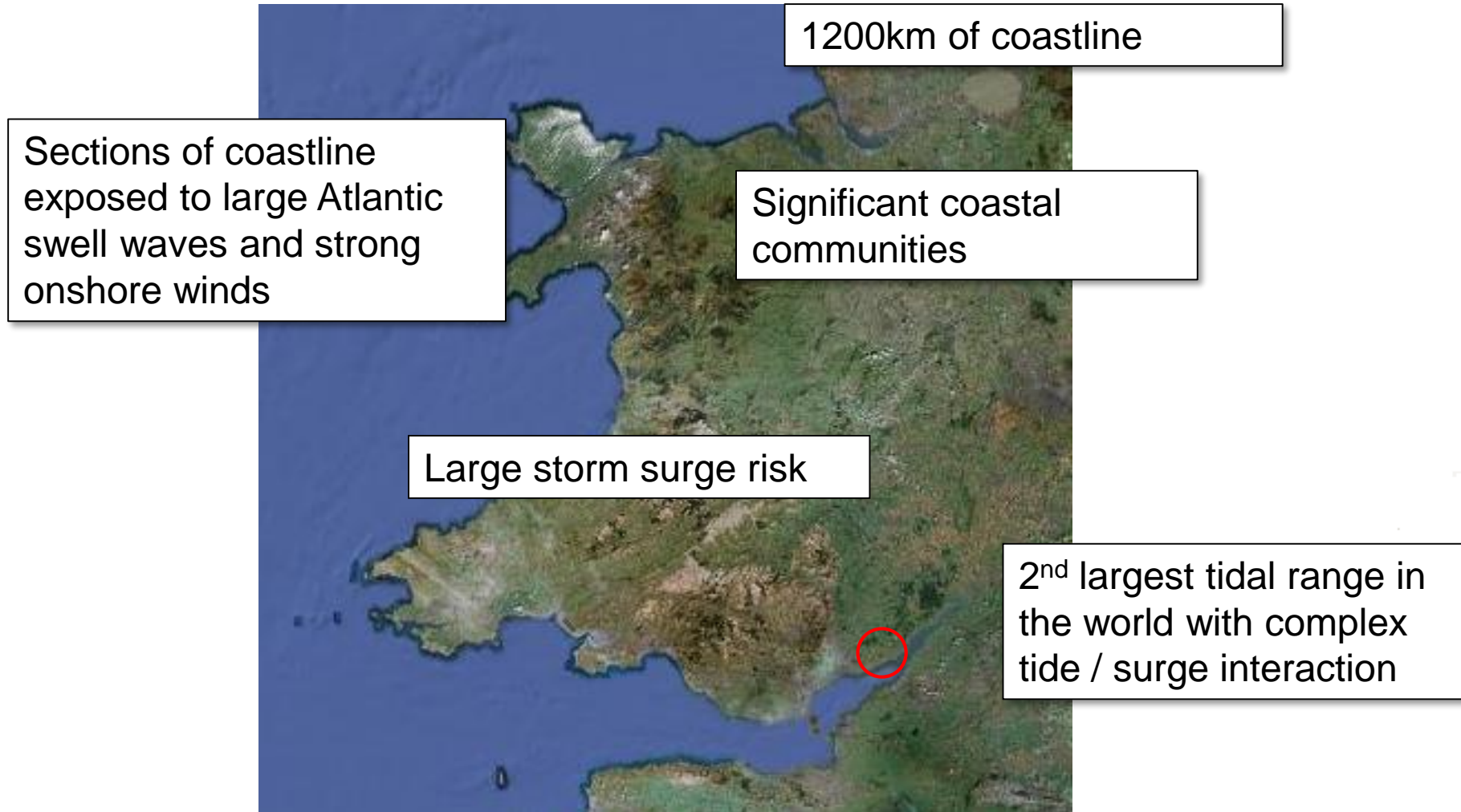
**NRW forecasting models & data - *predict river & tide levels & local flood risk***



**NRW staff judgement & knowledge = DECISION**

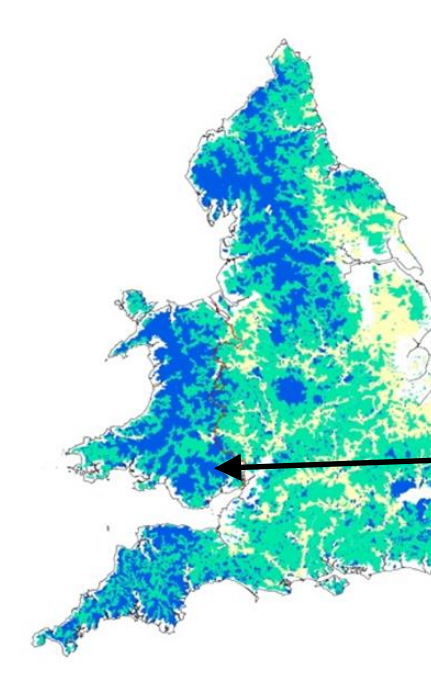
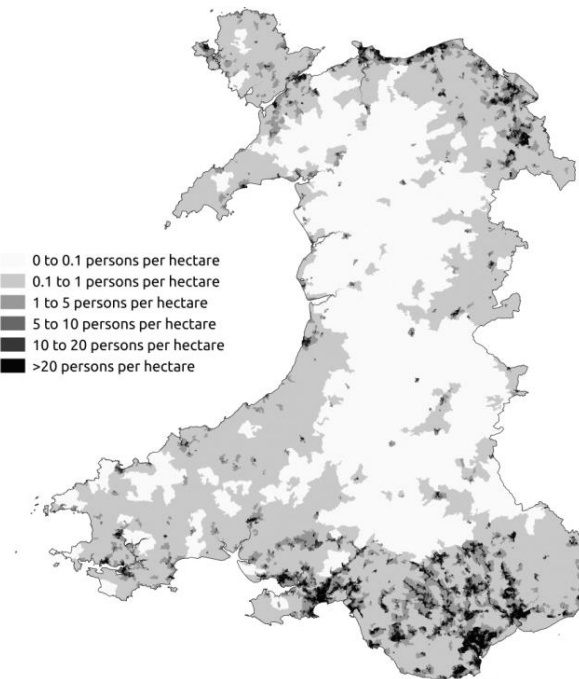


# Challenges of forecasting - coastal

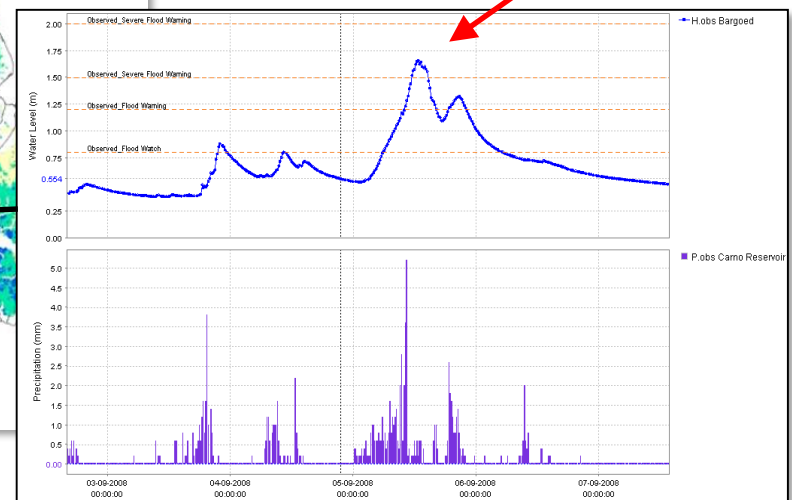


# Challenges of forecasting - rivers

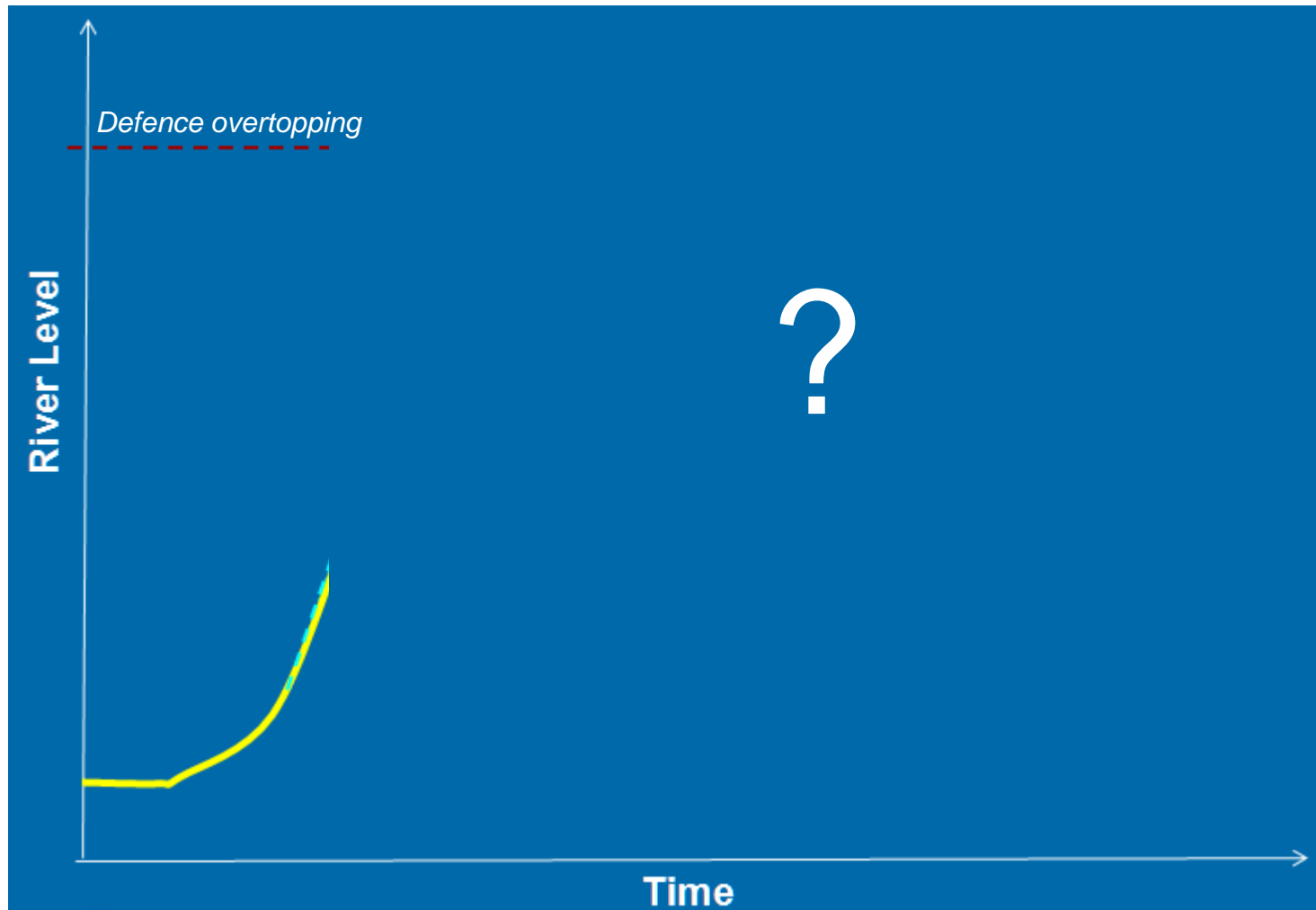
- Steep topography = very fast responding rivers
- Small upland catchments = hard to forecast rainfall (sensitivity/uncertainty)
- ➔ All where large urban populations



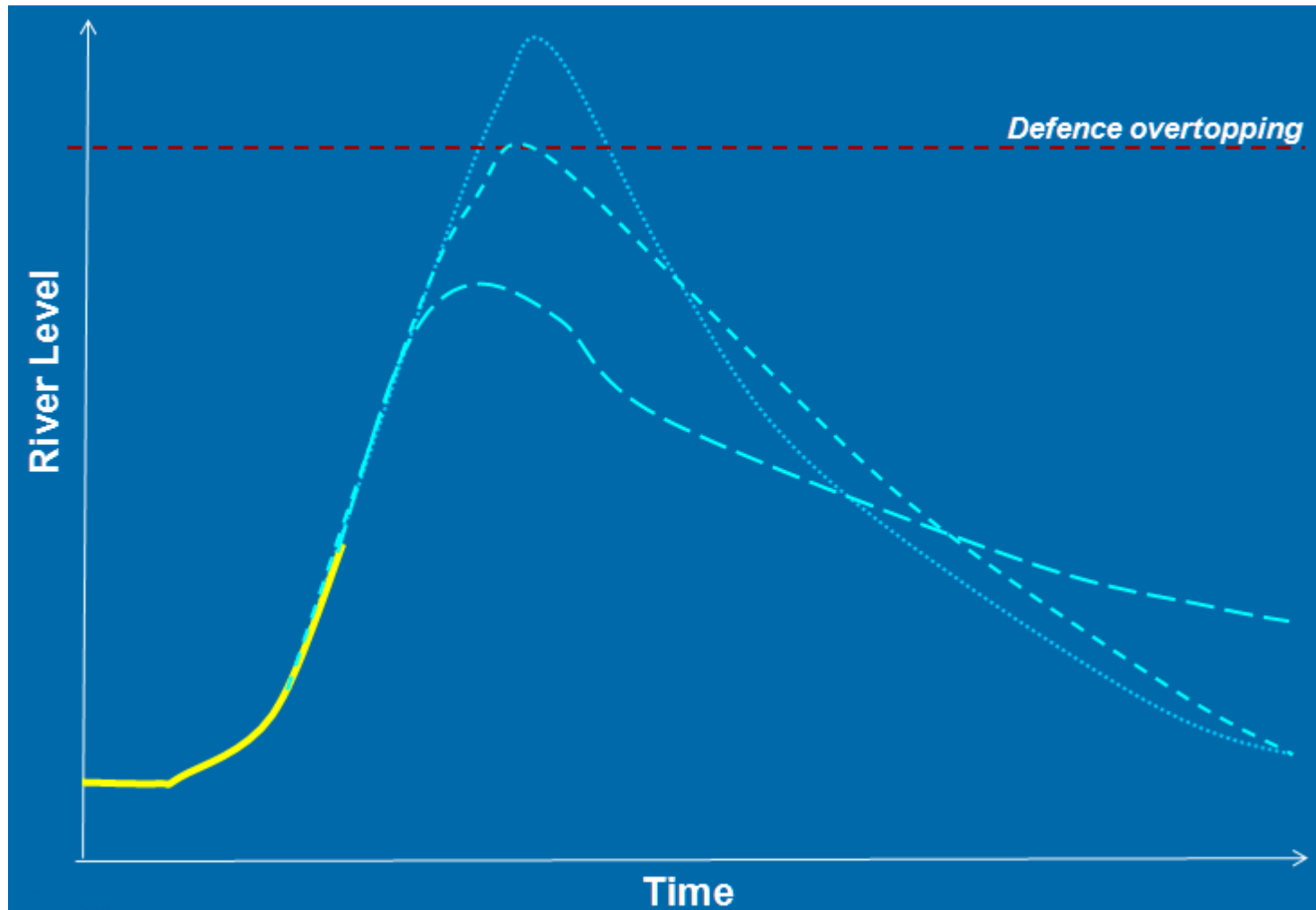
**From a normal  
to severe  
flood in < 2 hours**



# Interpret data, make decisions



# Interpret data, make decisions

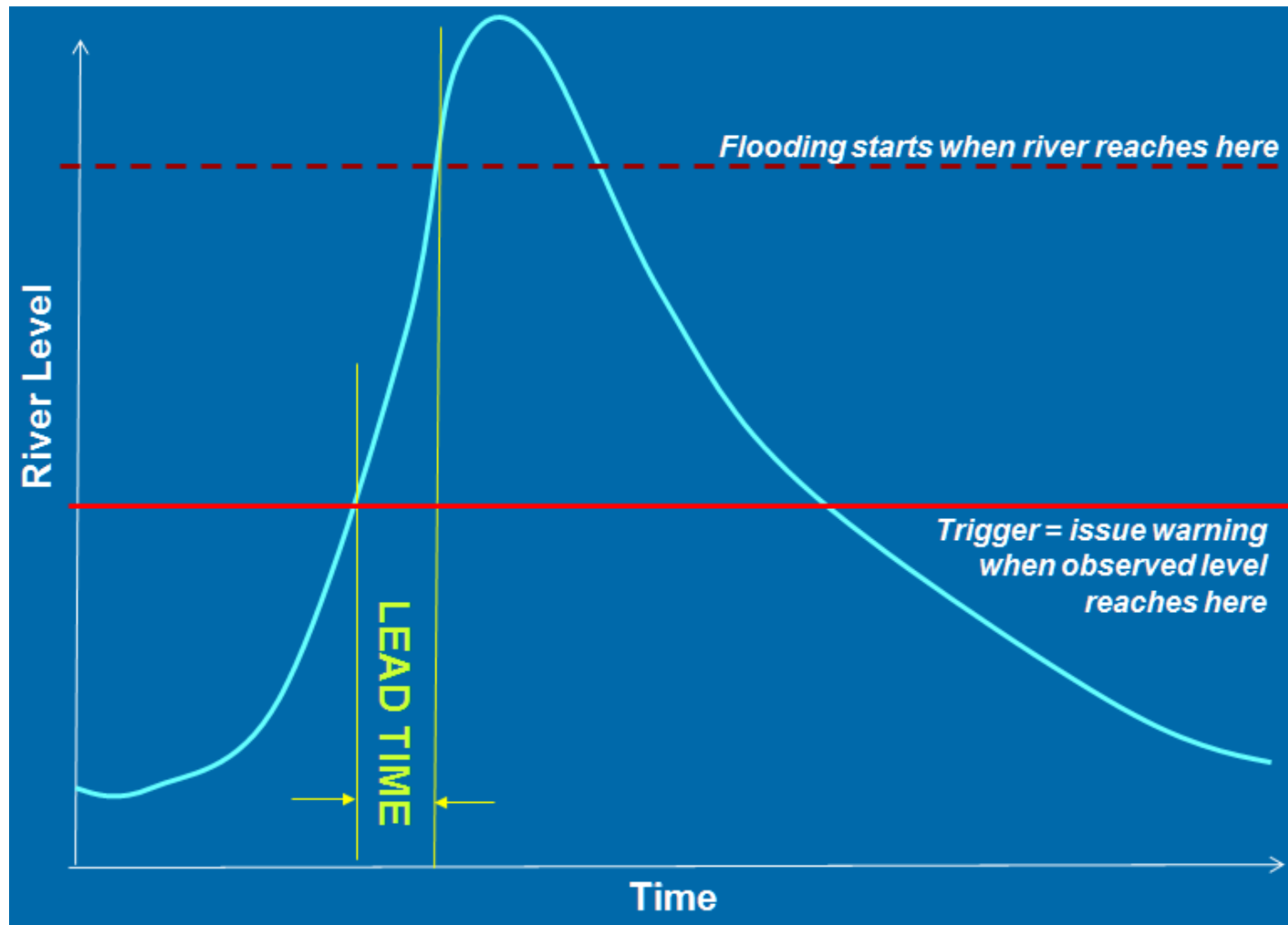




# Warning triggers (when no forecast)



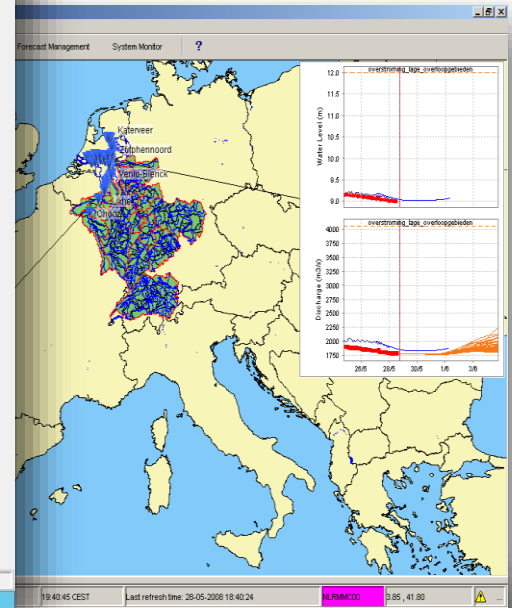
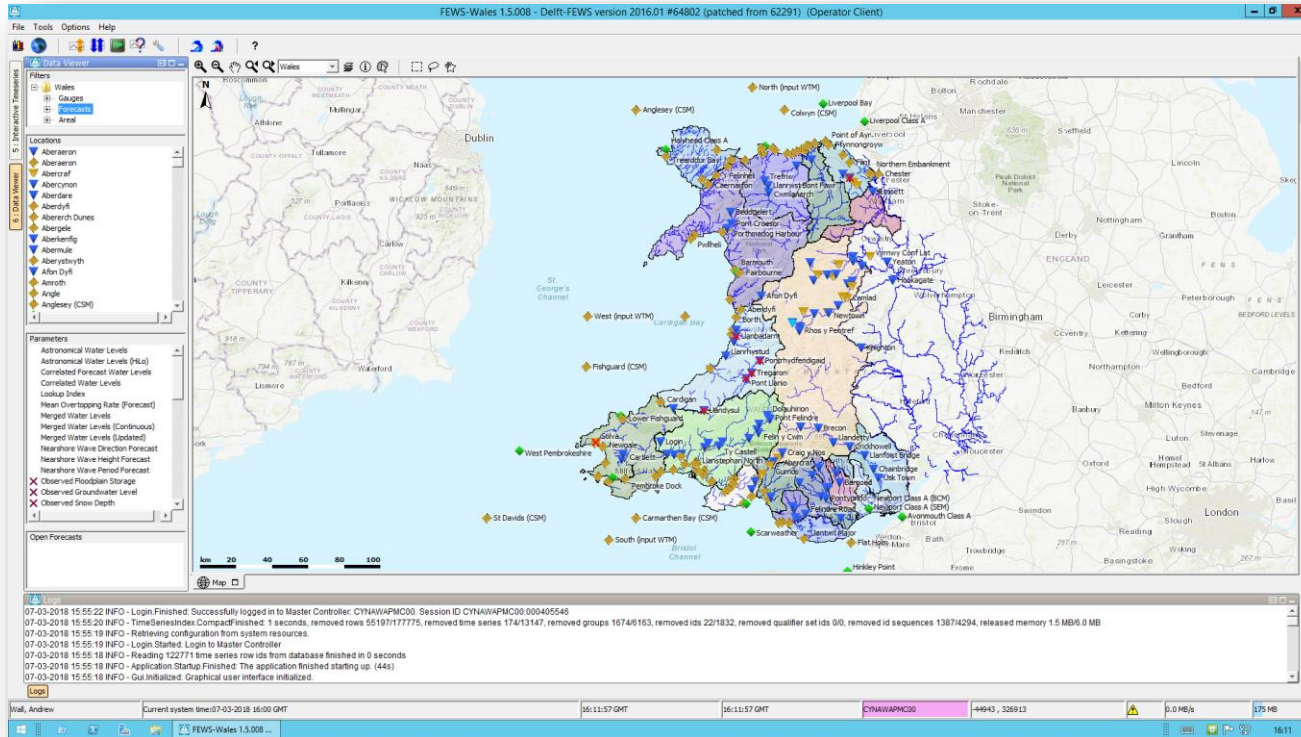
Cyfoeth  
Naturiol  
Cymru  
Natural  
Resources  
Wales



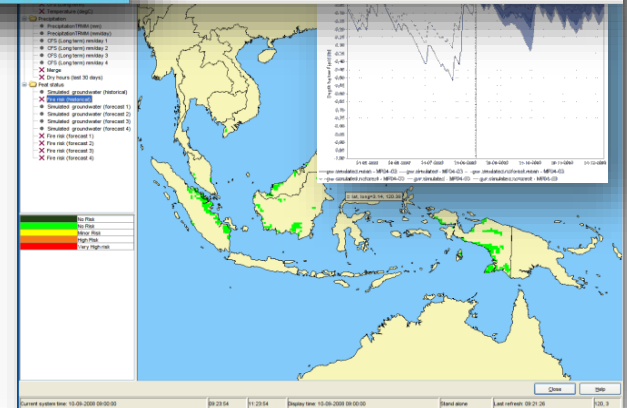
# Forecasting developments in Wales

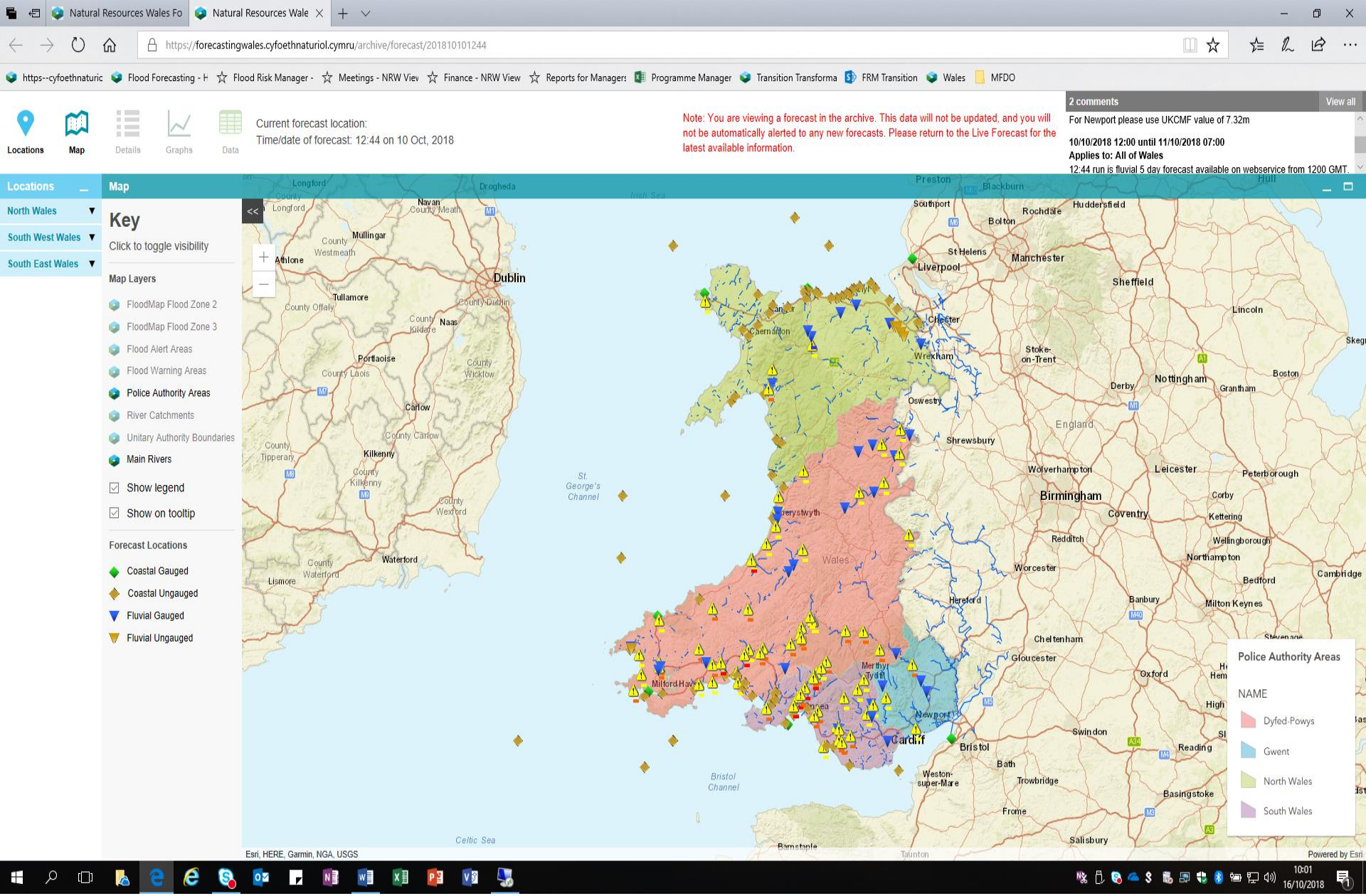


**Cyfoeth  
Naturiol  
Cymru**  
**Natural  
Resources  
Wales**



- >400 NRW telemetred rain & river gauges
- Polling all this data within 10mins
- All river models run in ~10mins
- River forecasts max. half hourly
- Coastal forecasts 4 x per day
- Forecasts out to 5 days ahead





# Forecasting – where is the risk?



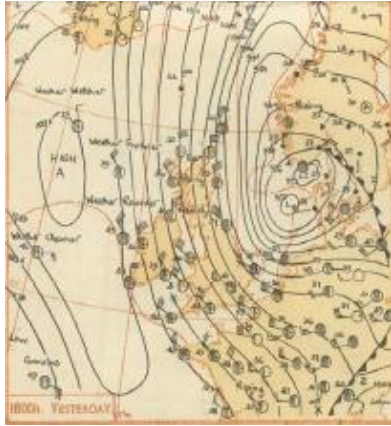




# Forecasting - community scale



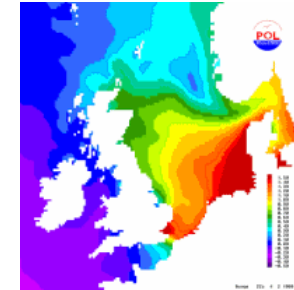
# 1953



Little  
information or  
forecasts

Less time to  
plan response

Poor/late  
communication  
of risk



*Monitoring  
data, river flow  
models, storm  
surge & wave  
forecasting*

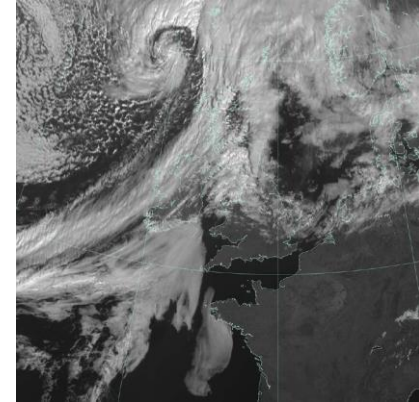


**RHYBUDD LLIFOGYDD  
FLOOD WARNING**

DISGWYLR LLIFOGYDD. MAE ANGEN GWEITHREDU AR UNWAITH.  
FLOODING IS EXPECTED. IMMEDIATE ACTION REQUIRED.

*Flood warning  
systems, call  
centres, multi-  
agency flood  
plans, open  
data*

# Today



Forecasts  
several days  
ahead

More time to  
think

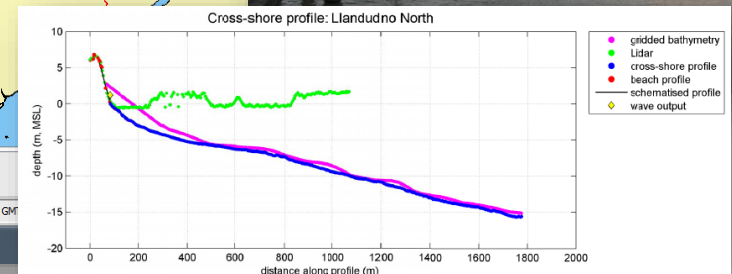
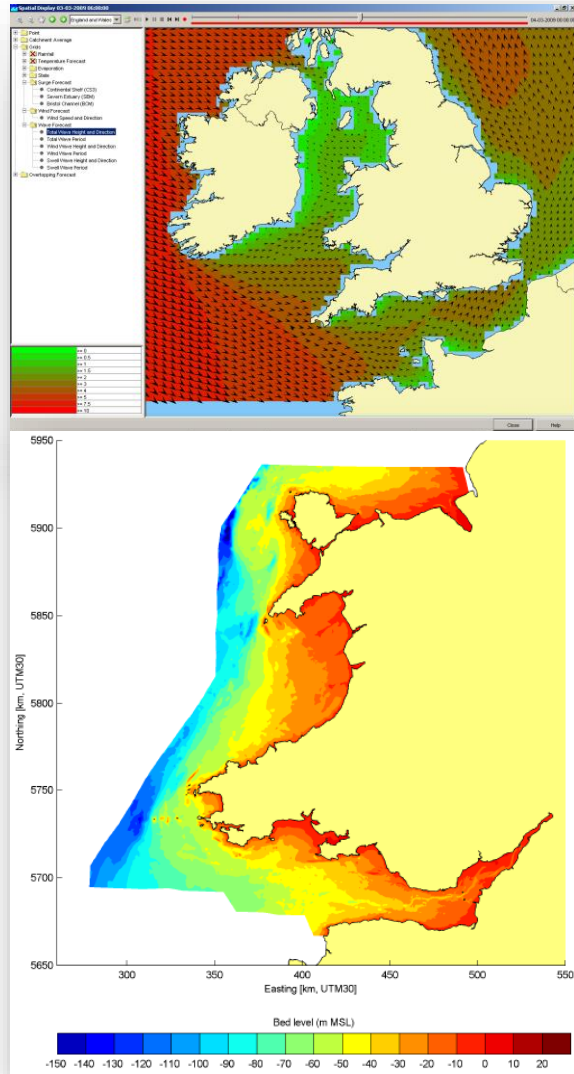
Earlier  
communication  
of risk

High public  
expectation

# North Wales coastal flooding December 2013

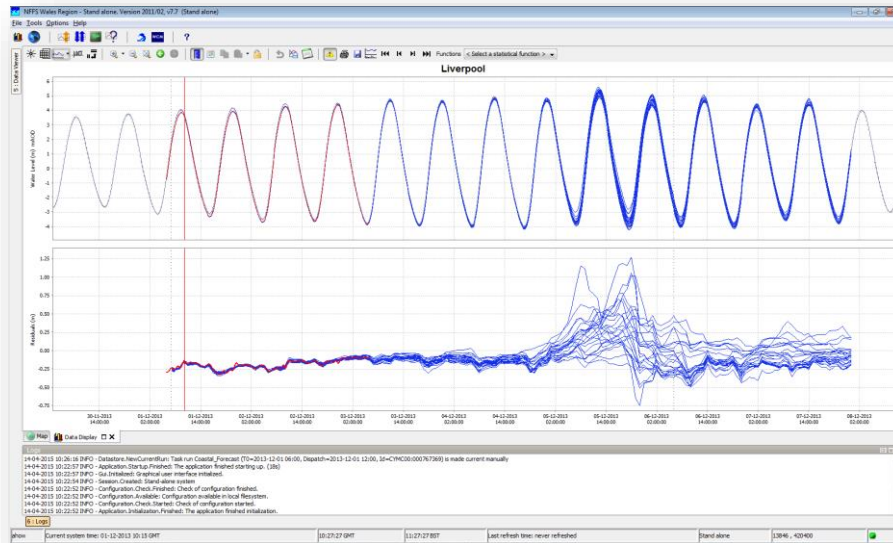


# Coastal forecasting - community scale



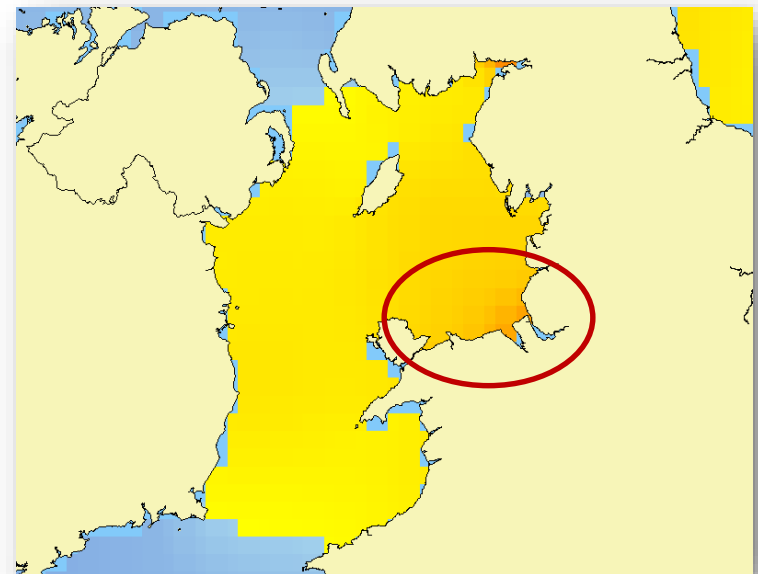


# Getting an early understanding of risk

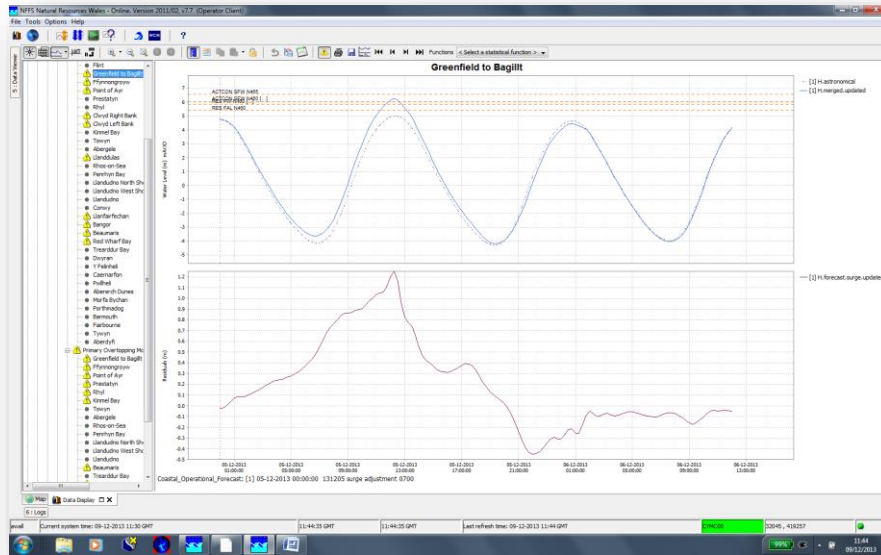


Surge ensemble forecasts enabled an early discussion of potential risk 5 days ahead – understanding uncertainty and the possibility of a large storm surge coinciding with a high tide.

Spatial visualisation of the storm surge allowed for better understanding of where the greatest risk was.

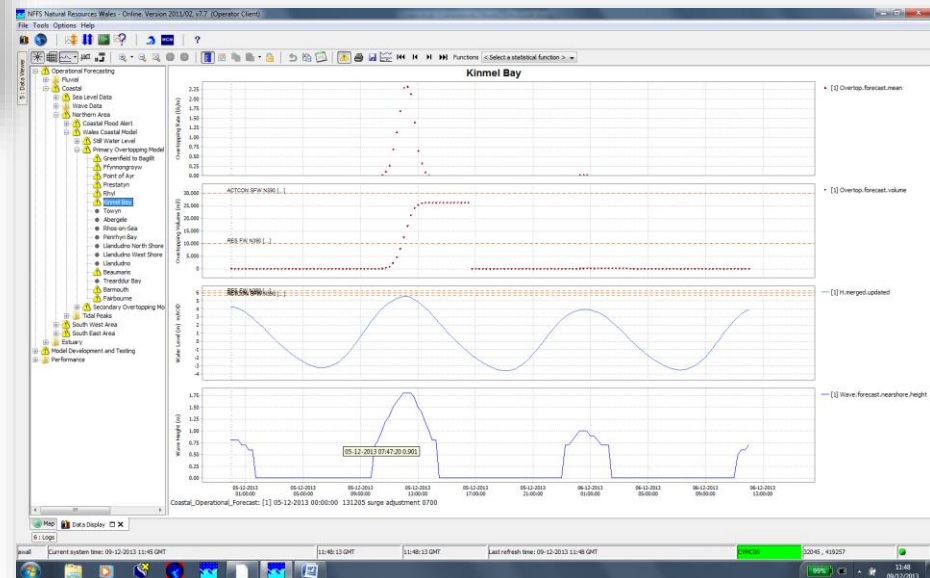


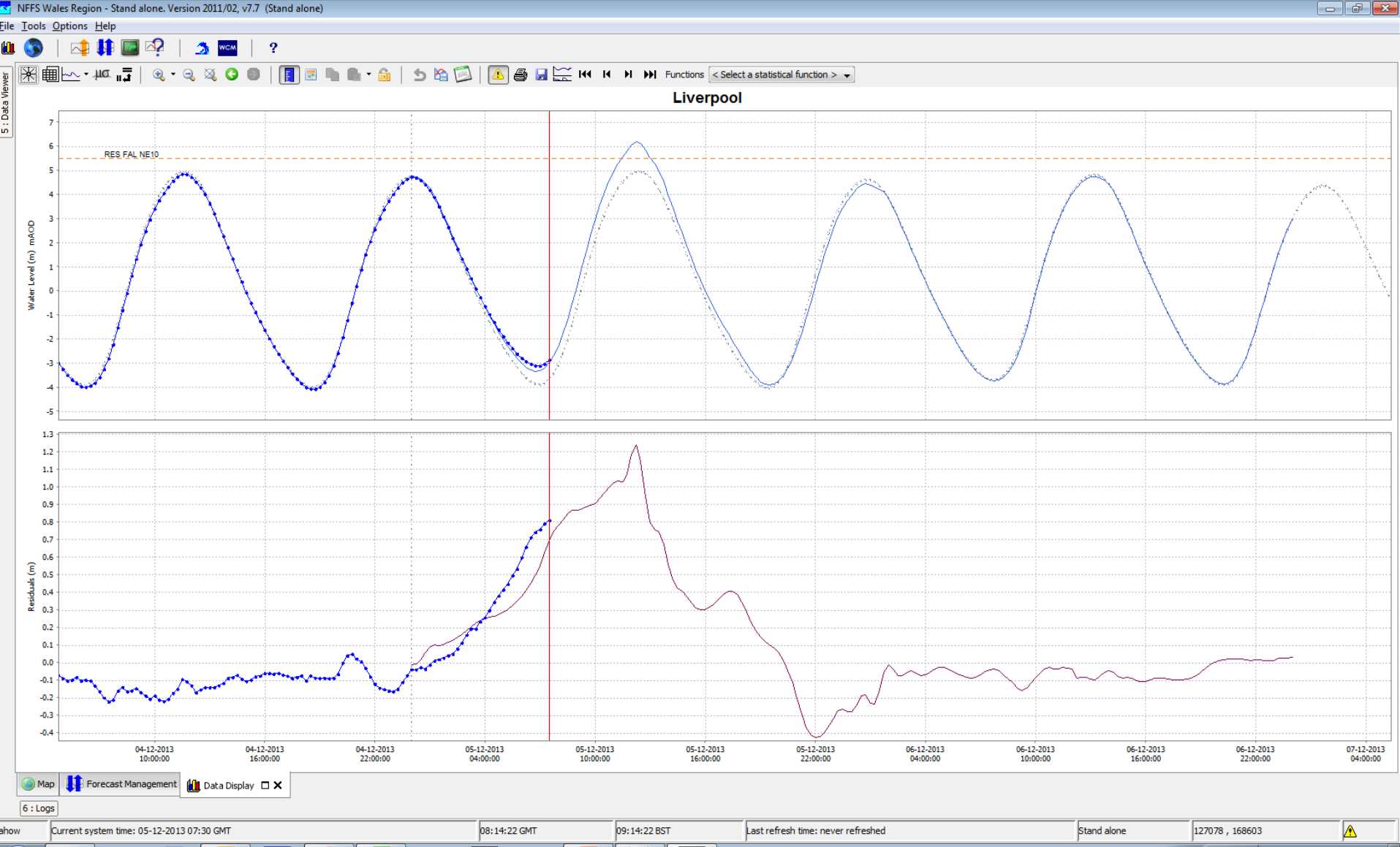
# Local predictions for emergency response



Our Wales Coastal Model provided storm surge and nearshore wave forecasts at community scale – used to inform issue of warnings and evacuation decisions by LRFs

First major event using our new wave model – significant step forward in capability of forecasting locations where wave overtopping a significant risk





**We still need experienced forecasters, not just models...**

# Questions

