FEWS Scotland: from developing forecasts to forecasting developments

FEWS USER DAYS 10TH NOVEMBER 2022

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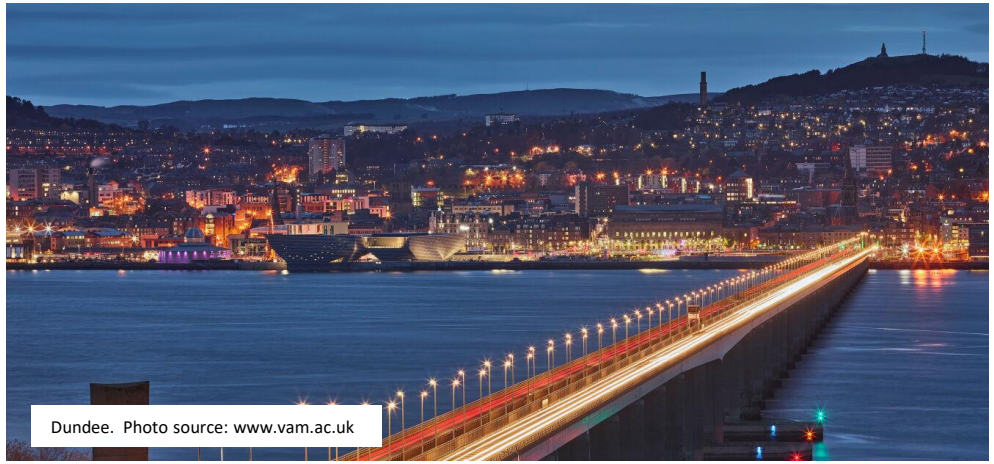
FEWS Scotland: from developing forecasts to forecasting developments

- Scotland's flooding context
- Creation of FEWS Scotland
- Development of FEWS Scotland – the first 16 years
- Current activities
- Future forecasting developments
- Reflections

SCOTLAND: HYDROLOGICAL LANDSCAPE

Ben Lui. @VisitScotland/Paul Tomkins

- >125,000 km of burns and rivers (3 x)
- >25,000 lochs
- ~18,000 km of coastline
- ~1600mm Average Annual Precipitation
- ~190 Average No of days of rainfall ≥1mm



Dundee. Photo source: www.vam.ac.uk

Lossiemouth @VisitScotland/Kenny Lam

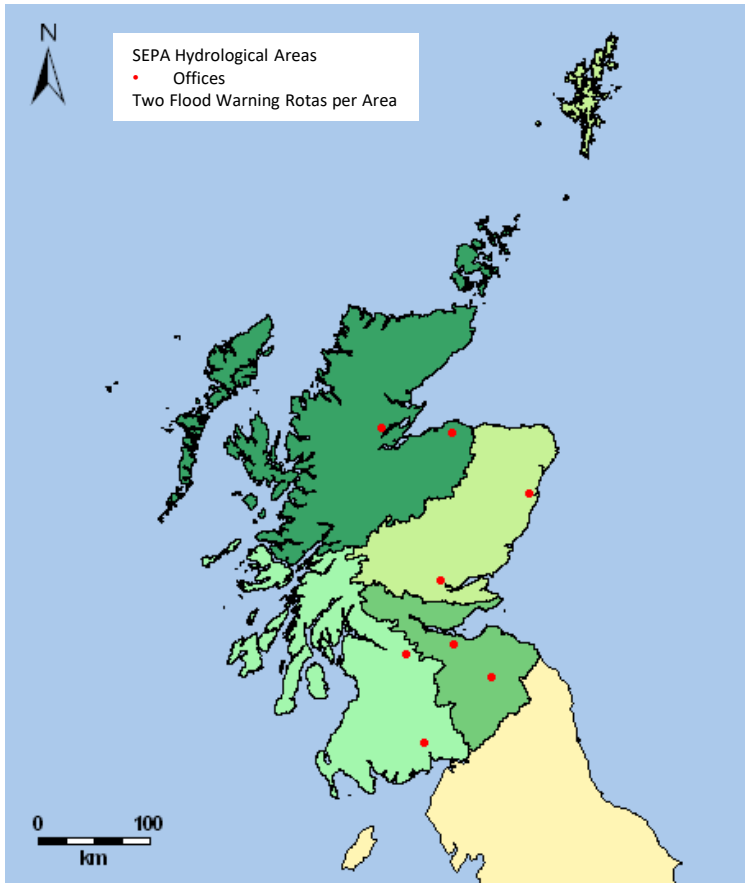
Dean Village, Edinburgh. Photo by Clark Van Der Beken on Unsplash

SEPA Flood Forecasting and Warning (2022):

- Estimated 284,000 homes, businesses & services at risk of flooding (with an increase of 110,000 by 2080s)

- 24/7, 365 service
- 72 river and 8 coastal flood warning schemes in 319 ‘Flood Warning Areas’
- Partnership working with Met Office in Scottish Flood Forecasting Service
- Regional flood alerting service,
- Daily guidance to responders and (beta) to public

- 1 national flood forecasting system – ☼ FEWS Scotland ☼



Creating flood forecasting capability:

1990s

Upstream trigger-based warnings, implemented in response to flood events (REACTIVE)

2002

SEPA Flood Warning Development Framework: *"SEPA should explore the value of flood forecasting systems"*

2006

Development of new flood warning schemes for Clyde, Kelvin and Irvine catchments – and associated catchment flood forecasting models in new FEWS Scotland system

PHASE: Creation of FEWS Scotland

Launch of new flood warning schemes

Can you spot Micha?

(Sadly no pictures of Michael Cranston as he was being interviewed by newspaper reporter…)

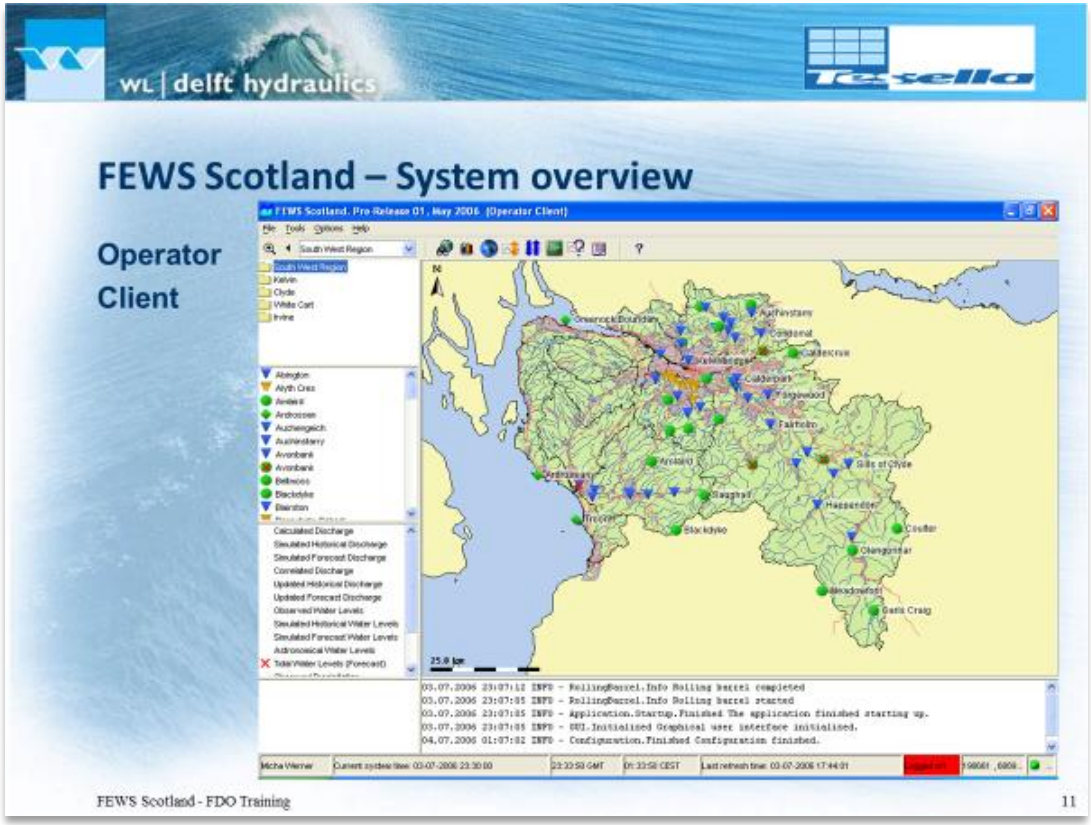
FEWS Scotland: the beginnings

Step change in approach:

- Science
- Skills
- Service
- Sharing information

Creation of FEWS Scotland (~2006)

- Operational flood forecasting platform
- Support the development of timely flood warnings on the Clyde, Kelvin and Irvine
- Integration of newly developed models – PDM, KW and ISIS (now Flood Modeller)
- Integration of existing White Cart River Flow Forecasting System (RFFS) and Firth of Clyde 2D model Floodtide
- System for hydrologists *not* modellers



***FEWS Scotland**. New flood forecasting systems launched in 2006 to support new flood warnings schemes for the South West of Scotland covering major urban centres of Glasgow, Kilmarnock and Kirkintilloch.*

Implementing an operational flood forecasting system that supports the flood warning service operated by SEPA

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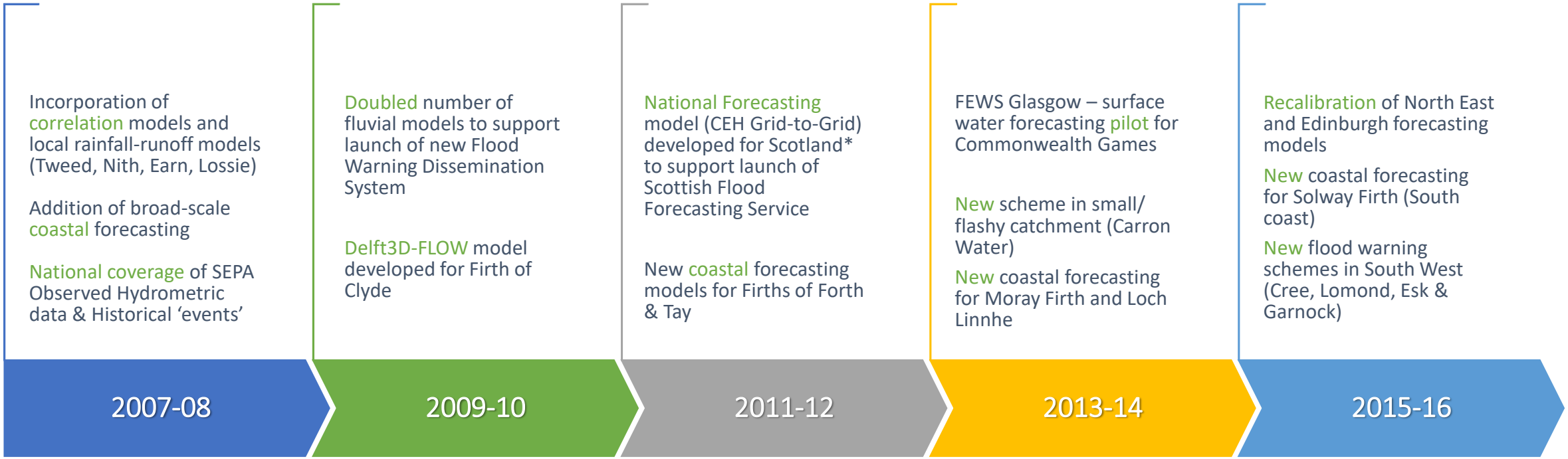


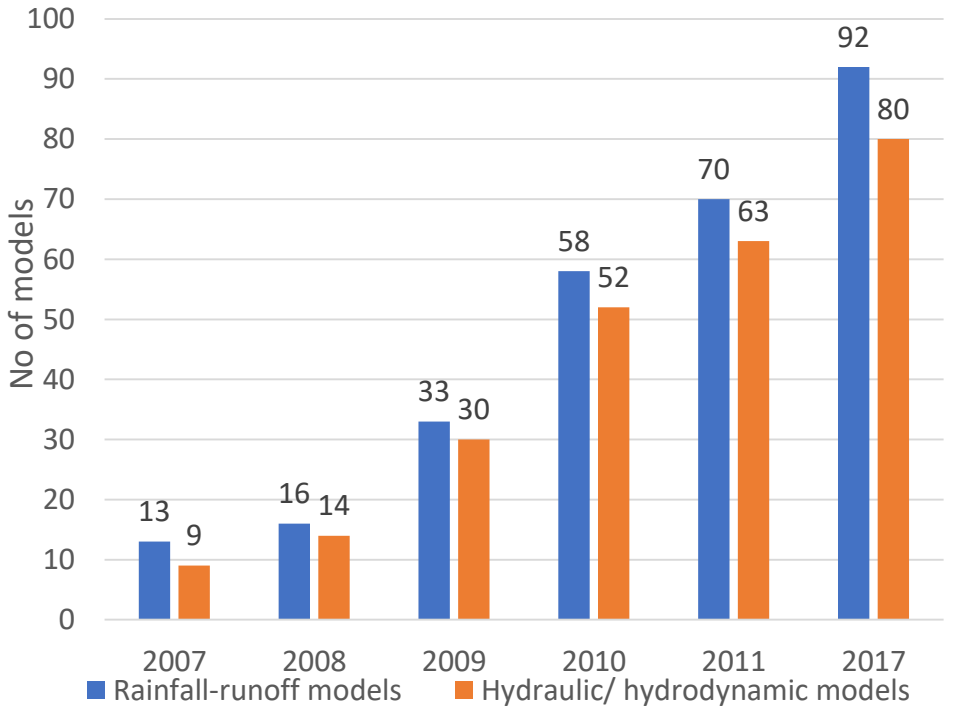
PHASE: Substantial geographical expansion of FEWS Scotland + beginnings of recalibration

REFLECTIONS (*Disclaimer: my own, and not representing entirety of SEPA!)

- Rapid learning curve (which never stops!)
- Completion of 'Project' – now incorporating with the ***support of*** Deltares, not ***by*** Deltares (thanks Alex!)
- The 'old ways' before creation of templates/variables… 24% of our current configuration (by number of files) is EOL in 2023.

- Enthusiastically adding more and more
  - ► 'exploding' database (problematic with LDS sync)
  - ►performance issues, ultimately led to reduction efforts &

  2013 User Days Presentation on how to reduce your database
  - ► more to maintain! = new versus maintenance
  - ► nationally consistent approach from start has been beneficial



More details: Cranston and Tavendale (2011) Water Management Journal

THE BEST GIFT TO OUR FUTURE SELVES?

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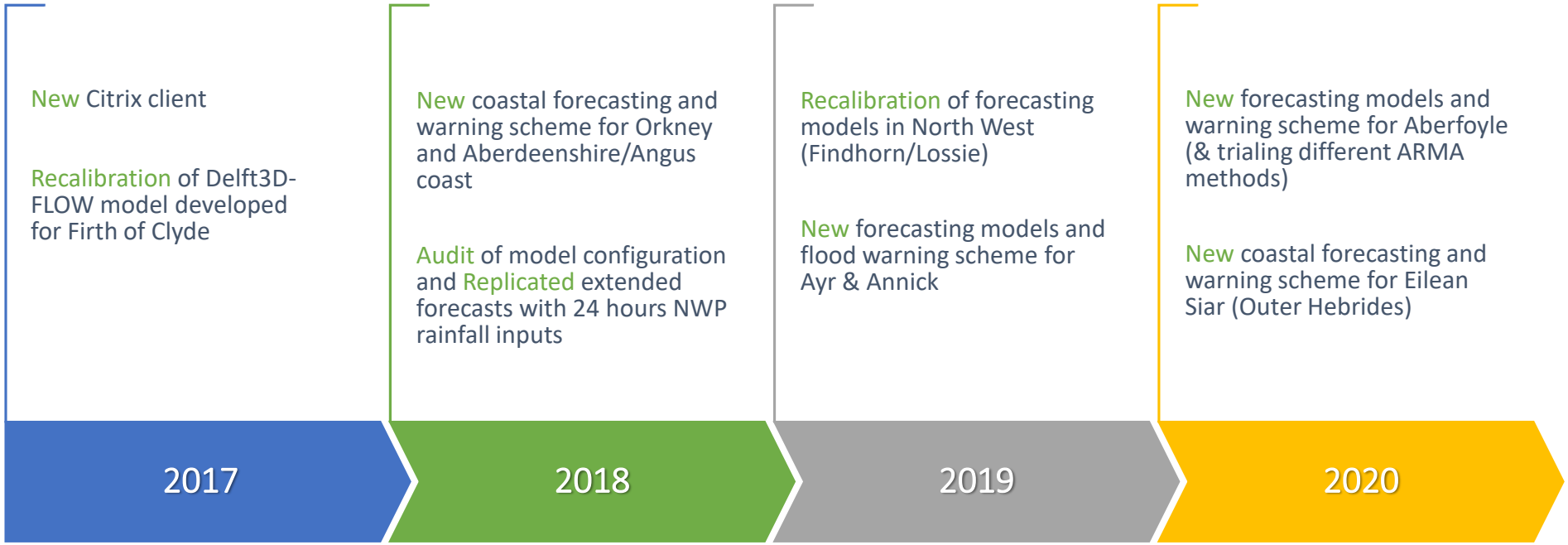
DOCUMENTATION!

Implementing an operational flood forecasting system that supports the flood warning service operated by SEPA



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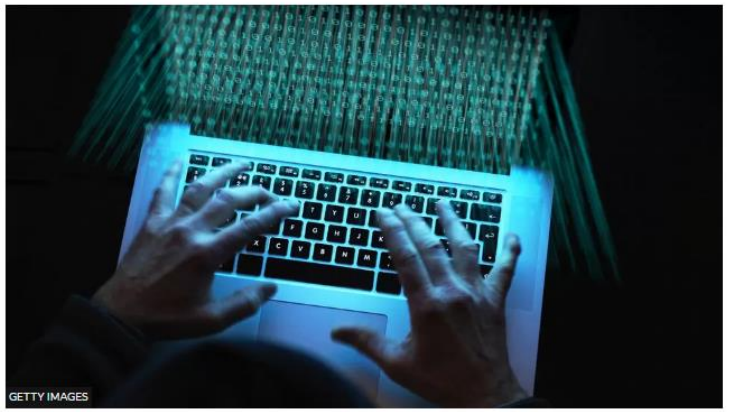
Sepa subject of 'significant cyber attack'

24 December 2020



The Scottish Environment Protection Agency says it is being subjected to a "significant and ongoing cyber attack".

Sepa says the attack was launched just after midnight and is affecting its communications systems.

SEPA CYBER ATTACK

SEPA is responding to a significant cyber attack affecting our contact centre and internal systems. Core regulatory, monitoring, flood forecasting and warning service continue but communication into the organisation is significantly impacted.

Report urgent pollution only to 07917 883 455
or via Facebook or Twitter
Check flooding information at **floodline.sepa.org.uk**

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Stephen Boyle, Auditor General for Scotland, said:

> This incident highlights how no organisation can fully defend itself against the threat of today's sophisticated cyber-attacks. But it's crucial that organisations are as well-prepared as possible.
>
> SEPA was in a solid starting position but it will continue to feel the consequences of this attack for a while to come. Everyone in the public sector can, and should, learn from their experience.

https://www.sepa.org.uk/about-us/cyber-attack/

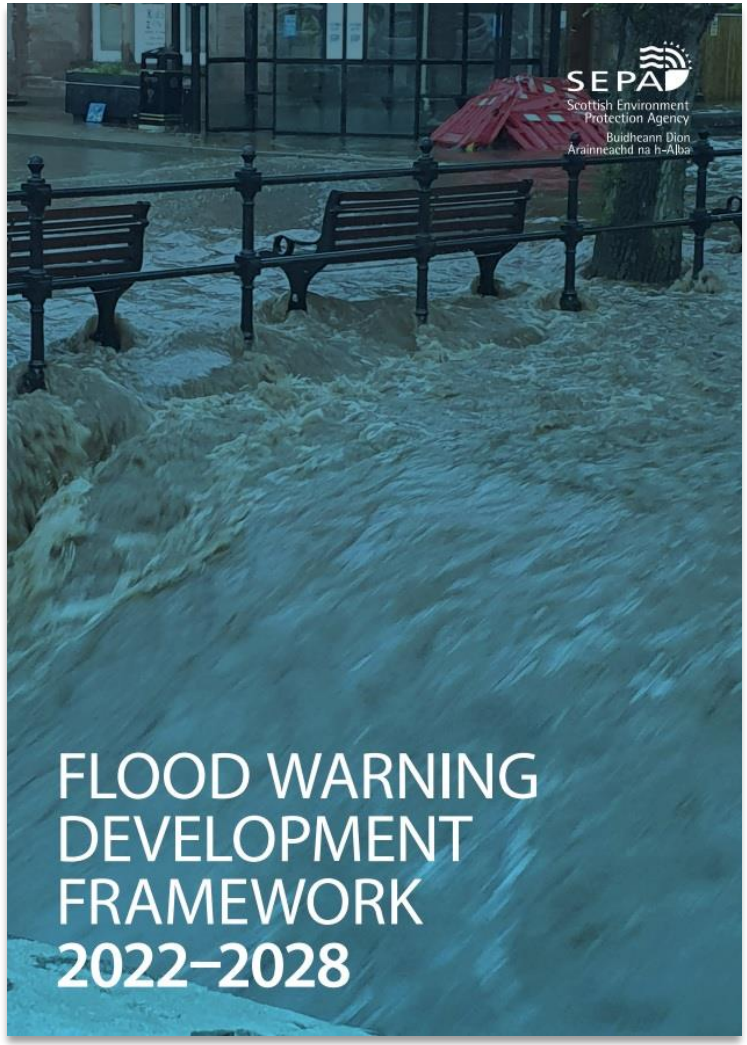
‘RECOVERY’

- Developing **new twin system** in cloud under new policies

- More new flood warning **schemes**
- Forecast **uncertainty**: ensembles, snowmelt, Ratings and error correction
- **Verification** & performance analysis of all elements
- Post-event **review** & model re-schematisation
- **Scripting** for analysis
- Catchment averaging **review** (impact of partial cell exclusion)
- **Consistent** thresholds across all systems and manuals

Forecasting Developments

- Should our system focus now turn to turning forecast hydrographs into likely flooding impacts?
- How far do we need to go to ensure we have competent staff to enable confident decision making in uncertainty?
- Whilst our capabilities for river and coastal forecasting are advanced, do we need a new step change in capabilities to address the challenge of pluvial forecasting?



SEPA Flood Warning Development Framework. *The framework defines the direction of travel for our flood forecasting and warning services with the aims to: maintain and improve existing, and deliver new, operational flood warning services; upgrade capabilities through development and innovation; and deliver enhanced digital communications and an engaged and customer focused service.*

Forecasting developments – system requirements:

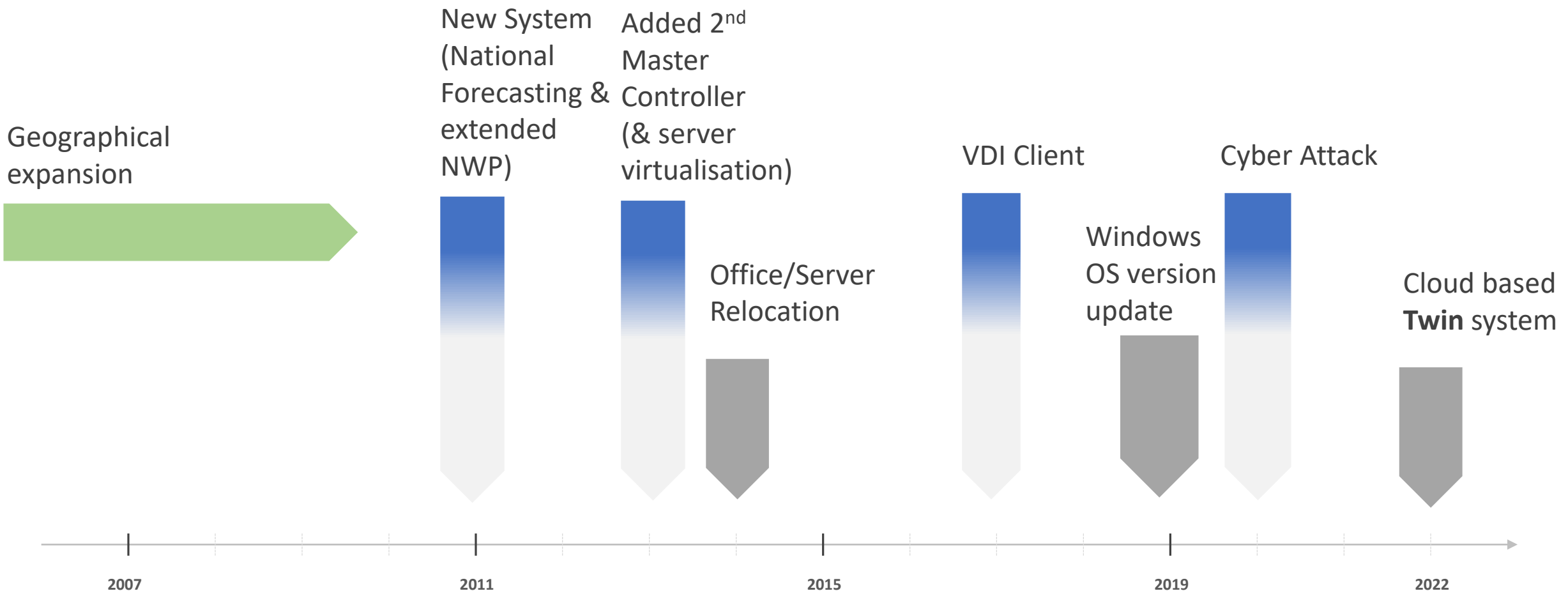
- System needs to be able to accept these new developments

- System, Service and Expectations have, and will continue to, evolve
  - Much bigger, more functionality
  - Greater coverage, new products and advisory service to support
  - System readiness and resilience is higher

- System therefore has to:
  - Be security compliant
  - Be cloud-friendly (native functionality, e.g. containers, disaster recovery/backup)
  - Be cost-effective
  - Deal with more data, faster, transferable, accessible
  - Also enable existing code/functionality to be maintained
  - Continue to meet user requirements

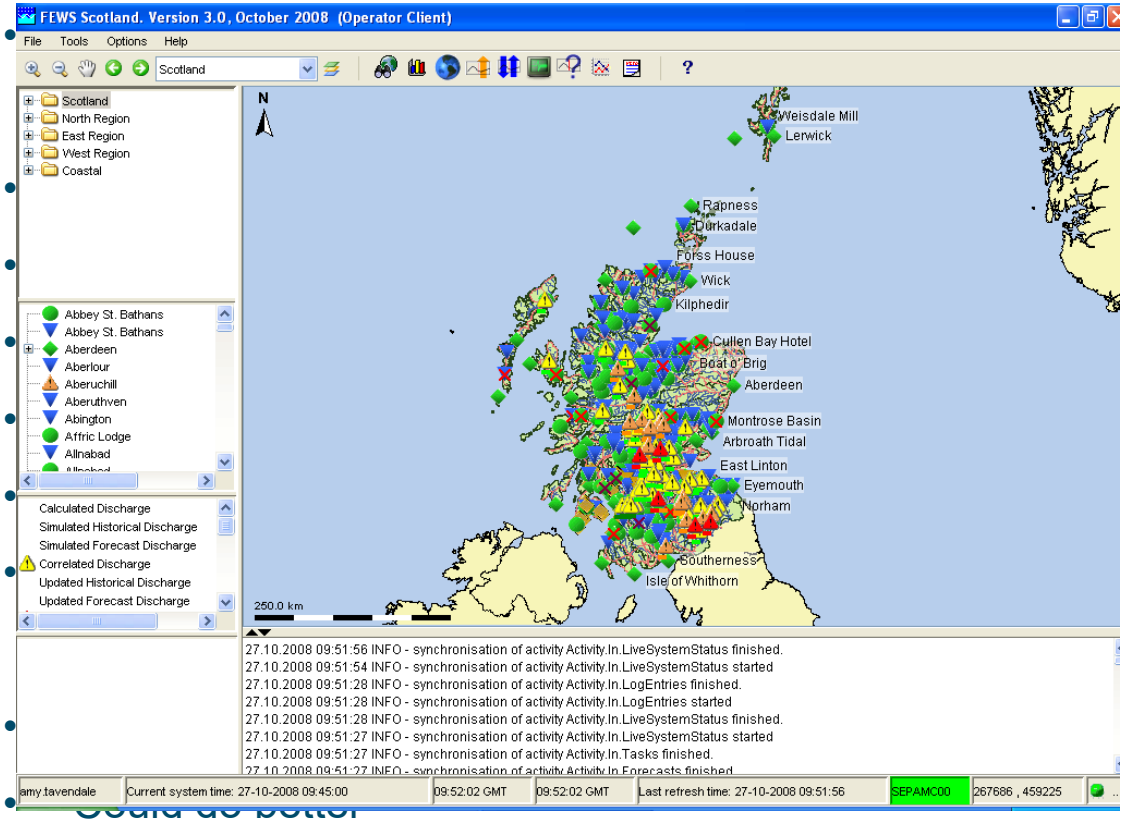
(Images courtesy of Deltares: Roadmaps 2022)

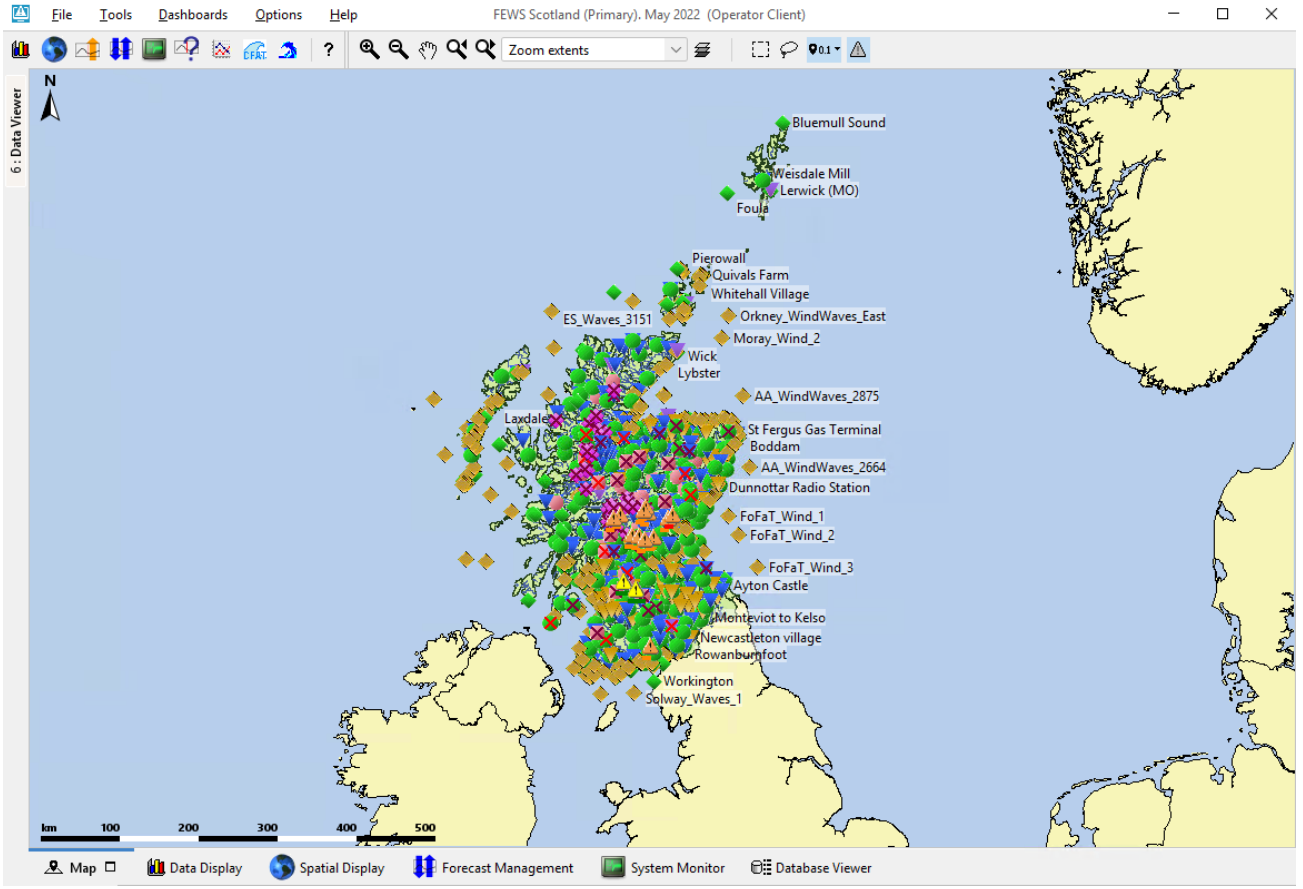
‘SYSTEM’ CHANGES SINCE LAUNCH – DID IT KEEP UP?



FEWS Scotland: the change

2007





FUTURE

- Delft-FEWS in 2040
- Can you imagine the changes?
- Our FEWS User community will be behind these changes
- All our communities will benefit

"ROADS? WHERE WE'RE GOING, WE DON'T NEED ROADS"

Dr. Emmett Brown

ACKNOWLEDGEMENTS & THANKS!

- Thanks to organisers for invitation to present
- Thanks to Michael Cranston for opportunity to present a system focused presentation

- SEPA Flood Forecasting & Warning, IS, Hydrometry, Comms, Duty staff,
- Deltares
- Fluvial and coastal forecasting model consultants (Jacobs, Jba Consulting, Haskoning DHV, RAB Consultants, Plan B, Catchment Consulting)

We'd love to work together with others – please get in touch!

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