

# Deltares

Enabling Delta Life



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**The Future of Hydrological Forecasting –  
Delft-FEWS 2025**

Nadine Slootjes

The Future of Hydrological Forecasting

# Brief introduction: Nadine Slootjes

- Expert in Flood Risk Management and hydraulics
- Department manager Deltares Operational Water Management
- Hydraulic expert operational team Maeslant barrier



# Outline



Background



Scenario analysis



Global Data Service



Delft-FEWS 2025





# Motivation scenario analysis

- Deltares and the Delft-FEWS community for real time hydrological forecasting currently use state-of-the-art expertise and tools
- We'd like that statement to be true in 2025
- The world is changing, hence we need to anticipate those changes
- If we want to adequately respond, we need to anticipate those changes:
  1. Exploration of the future
  2. Development of strategies



# Exploration of the future

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Typical questions we'd like to see answered:

- Will governments still be forecasting for the general public?
  - Will governments still be forecasting for the general public?
  - Will forecasting still be based on process models such as rainfall-to-runoff, streamflow propagation, storm surge estimation, etc?
  - Who will be the suppliers of forecasting systems?
  - ...
- We cannot know the answers to these questions with certainty.
- We *can* develop multiple, plausible scenarios





A satellite image of Earth showing South America and the surrounding Atlantic Ocean. A large hurricane is visible in the upper left quadrant. The text "The world is changing" is overlaid in the top left corner.

# The world is changing

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Our “macro environment” always changes

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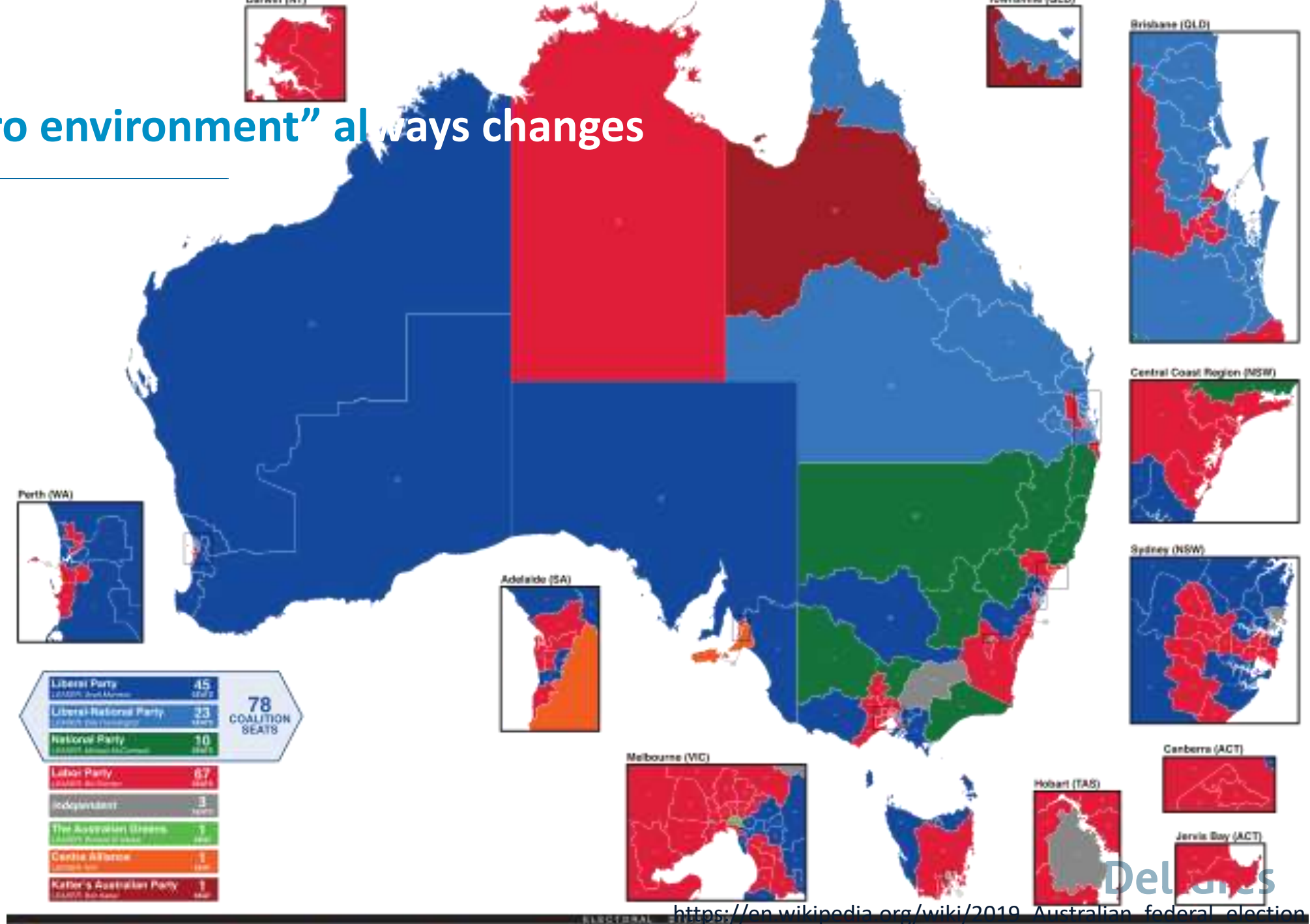


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# Our “macro environment” always changes



Our “macro environment” always changes





Our “macro environment” always changes

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An aerial photograph of a city, likely New Orleans, completely inundated with floodwater. The water is a murky brown color, and numerous buildings, trees, and infrastructure are visible above the water level. The flooding is extensive, covering almost the entire visible urban area.

Our “macro environment” always changes



# Our “macro environment” always changes

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Our “macro environment” always changes





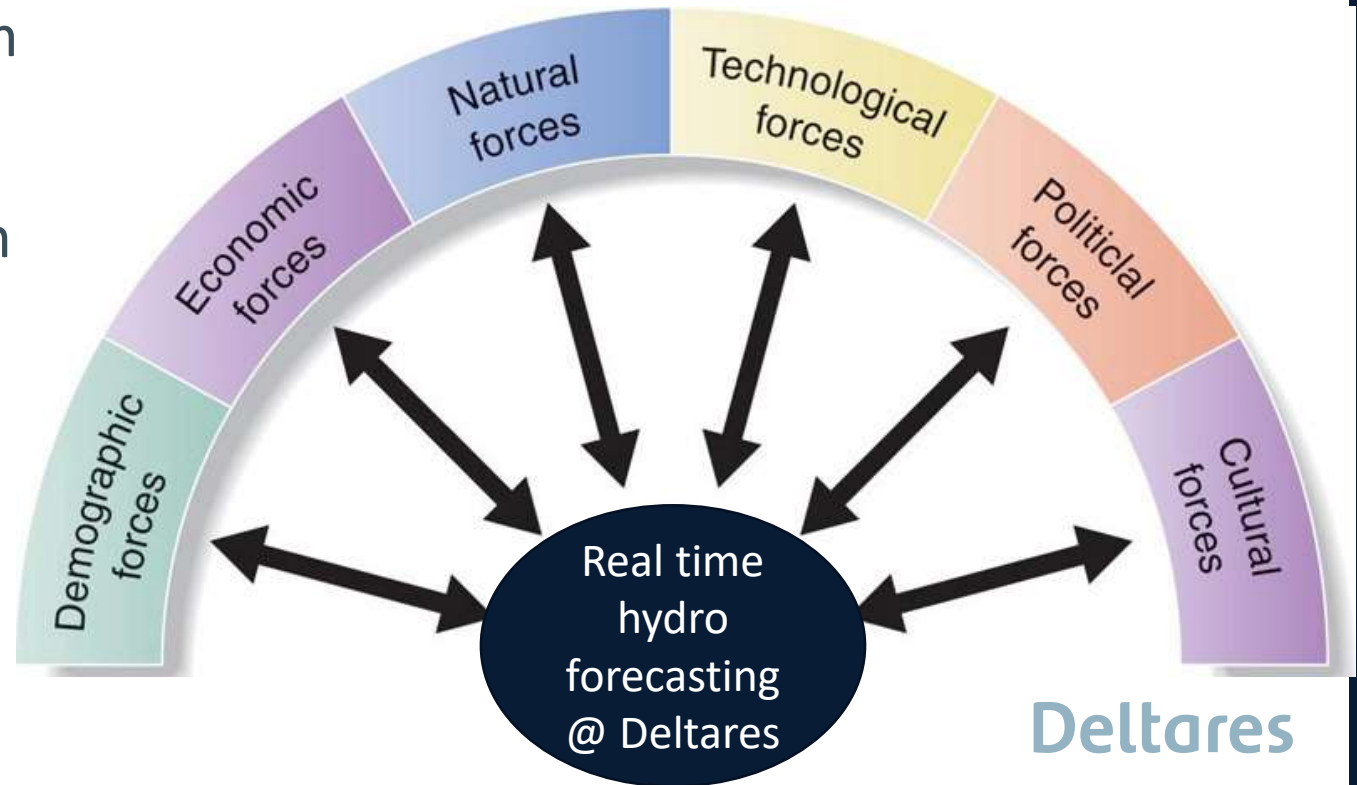
Our “macro environment” always changes

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# The world is changing

- Our macro-environment is changing.
  - increasing populations in flood prone areas;
  - composition of EU; US foreign policy choices;
  - shift of responsibilities from gov'm
  - ...
- Some of these changes may result in deterioration or loss of the current position in forecasting





# Development of scenarios

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- Brainstorm session
- Five authors, five scenarios, five days of full-time writing
- Two “key variables” were chosen:
  - governmental focus
  - technology focus



## Development of scenarios

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- Five (out of nine possible) scenarios were developed
  - Storyline:
    - The path to 2025
    - “A day in the life of...”
  - What are the effects in terms of knowledge development, collaboration and market
  - Completion in terms of additional macro-environmental factors





This project is not ONLY about Delft-FEWS  
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# Scenario analysis report



<https://www.deltares.nl/en/blog/the-future-of-realtime-hydrological-forecasting/>

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Factors and viewpoints

Government Focus

Traditional  
Government

Regulatory  
Government

Glocal

Opportunistic

User Oriented

Protectionist

Technology Focus

Scenario system

Government Focus

Traditional  
Government

Conditional for the development of a  
diversity of commercial activities

Caring  
Government

Regulatory  
Government

Conditional for the  
development of a diversity of  
commercial activities

Regulatory  
Facilitator

The market is directed by  
standards and certified  
partners to guarantee quality

The Moat

Glocal

International, technocratic  
interest and geographic networks  
for new opportunities

Google  
Forecasts

Target-group-specific, local  
interests and a diversity of  
data lead to conflicts between  
government and companies

Start-up  
Society

Opportunistic

User Oriented

Protectionist

Technology Focus



# The path to 2025

Caring  
Government

Collaboration between Rijkswaterstaat and the Water Boards has changed from information exchange to joint information provision. As a result the collaboration has become more efficient. The emerging idea that it should benefit the users has led to the creation of one joint organization for water reporting: a single contact point for clear, unequivocal information.

With a view to create greater efficiency and to avoid the duplication of work, political bodies pressed for a merger between Rijkswaterstaat and the Water Boards. However, a study revealed that there was almost no duplication of services with a joint approach would have added value for the users. It was found that extension of services with a joint approach would have added value for the users. To the satisfaction of those users and the political bodies, this change was implemented in a relatively short time.

The zeitgeist in which products were developed and offered top-down has almost completely changed in the last decade. Civic participation in design and implementation is now part and parcel of the normal functioning of the market. By bringing the right expertise and openness into the contacts with citizens (and other stakeholders in the provision of water information), better tailored products are used in a more timely manner. A party that provides the information is seen as increasingly valuable and reliable, an image which is also sustained in politics.

Thanks to the economic optimism of the 2020s, people no longer question the need for investments in public services, and there is a renewed sense of confidence in public services.

## Scenario: Caring government

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- Forecasting is organised in one central government organisation
- Government is responsible for the forecasts – also producing the forecasts
- Focus on end-user needs – additional products (farmers, navigation, ...)
- More or less “business as usual”



Scenario system

Government Focus

Traditional Government

Conditional for the development of a diversity of commercial activities

Caring Government

Regulatory Government

Conditional for the development of a diversity of commercial activities

Regulatory Facilitator

The market is directed by standards and certified partners to guarantee quality

The Moat

Glocal

International, technical interest and geographic networks for new opportunities

Google Forecasts

Target-group-specific, local interests and a diversity of government and companies

Start-up Society

Opportunistic

User Oriented

Protectionist

Technology Focus

# The path to 2025

Government policy between 2017 and 2025 emphatically states that the number of civil servants should be reduced. Vigorous implementation

...government has no longer executive tasks...

the weather and water market and are potentially able to deal with new

...new small business in the field of hydro forecasting...

research. This is new in research. Fundamental research is left to universities and applied research to commercial organizations.

Another trigger for change was the elimination of the 'safety divide', which had hitherto existed. No agreement had ever been reached on

...provision of safety in the field of hydrology and meteorology could be left to other parties than government...

concerned would keep to the specifications drawn up and monitored by KNMI and Rijkswaterstaat.

Although there is concern about the dependency on commercial parties (a

...many opportunities for innovation

wants to encourage the formation of small businesses. Thanks to this new policy, many such companies have emerged.

The disentanglement process in the field of research took time. Technological developments, such as improving and developing models and researching

...technological developments were transferred to other organisations...

research and operational tasks. This process was finally completed in 2023. In 2024, the production of water and weather forecasts (including alerts) was transferred to the commercial party that came with the best offer.

The Royal Netherlands  
Meteorological Institute (KNMI)  
and Rijkswaterstaat outsource not  
only tasks such as measuring and  
predicting but also research.



## Characteristics

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- Cost efficient government
- Government no longer has executive tasks, but responsible; hydrological forecasts are made by commercial companies
- Research at universities, applied research at private sector
- Market impuls forecasting as a service
- Strict requirements (data, production process) (Moat)
- Data property of the producer, certification (Moat)

Scenario system

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International, technocratic interest and geographic networks for new opportunities

Google Forecasts

Target-group-specific, local interests and a diversity of data lead to conflicts between government and companies

Start-up Society

Technology Focus

Opportunistic

User Oriented

Protectionist





# The path to 2025

2017 was a year of change. After the Dutch elections, a nationalist

... citizens have turned their backs on the government...

had turned their backs on the government. As a result, various social initiatives emerged, taking advantage of the revolution in information and communication technology, such as health, energy and security

...various social initiatives; regaining control over their own lives...

Over the years, that technological progress continued. More and more data became available to more and more people, and also became more easy to use thanks to new devices. Surprisingly enough, the government no longer functions as a major data supplier and other parties are also taking over its role of user and translator of data. Multinationals in particular but also a multitude of small businesses are taking advantage of the large amount of data that is made available. The nature of the required information has also changes. For example, hydrologists noticed

...more and more data become available, opportunity for new services...

Confidence in government remains low, mainly due to the inability to solve major problems in a highly polarized society. New social initiatives are therefore increasingly focused on involving all groups in society. Sustainable initiatives also remain popular, and are increasingly needed because of developments such as increasing population growth, economic growth and climate change.



The decrease in the amount of rules  
and the favourable tax environment  
created a breeding ground for small  
businesses and new initiatives from  
around the world

# The path to 2025

By 2021, the government decided to decrease public services. In recent years, it was found that there are enough suitable parties to take over

...weather services are shut down, knowledge institutes no longer funded...

this decision was taken, more and more services were hived off with the idea that "essential services will be taken care of by the market." The Royal Netherlands Meteorological Institute (KNMI) was closed down, the ministries became at least 50% smaller, and the funding of a large number of knowledge parties was stopped. Tens of thousands of employees were made redundant.

The decrease in the amount of rules and the favourable tax environment created a breeding ground for small businesses and new initiatives from around the world. One example is the multitude of courses that have

...successful capabilities: translating technology into practice, communication to the general public ...

Previously flourishing professions, such as those of hydrologists and civil engineers, appear to have become less attractive. Part of their work is being taken over by clever staff who can process large amounts of data and people who can translate the results of water system analyses for the general public.

Start-up  
Society

Communication tools such as flashu infographics, augmented reality apps

...IMPACT is the magic word...

long term. The international networks in which the start-ups operate also prove to be a breeding ground for new innovations. As far as hydrological forecasting systems are concerned, the players that can make the translation to the actual impact of forecasts are the most successful. They are able to answer all kinds of queries from customers (including more and more civil cooperatives) satisfactorily.



## Scenario: The start-up society

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- The start-up society is a society formed by citizens, start-ups and multinationals without strong government.
- Innovation flourishes and technological development is faster than ever, mainly driven by the growing amount of available data.
- Strong focus on end user: forecast use. Services in which information is translated into impact, i.e. impact on themselves and impact on society.

→ Attention to *impact forecasting*, and *effective use*

Scenario system

Government Focus

Traditional Government



Conditional for the development of a diversity of commercial activities



Regulatory Government

Conditional for the development of a diversity of commercial activities



The market is directed by standards and certified partners to guarantee quality



Glocal

International, technocratic interest and geographic networks for new opportunities



Target-group-specific, local interests and a diversity of data lead to conflicts between government and companies



Opportunistic

User Oriented

Protectionist

Technology Focus





# The path to 2025

In social policy the years from 2015 to early 2017 were a period in which global thinking, which had rapidly evolved in the previous years, was called to a halt. With emerging protectionism in the United States and Europe, it was as if someone had suddenly stepped on the brake.

... China and Russia evolved into openly sharing data...

behind. But the West could not hold the brake down for very long. Society came to the conclusion that protectionism was counterproductive. The route back to the open data and open source world was quickly found. The new worldwide sense of openness was at its peak in the period 2020-2025. The Chinese and the Russians could also not go back. It seemed a masterly strategy of the West, but it had not been planned like that.

These political developments undermined the public perception and any remaining image of the integrity of politicians even more. The lack of trust in the government never so low

government as the defender of their interests had been denied. Government was seen as the extension of the failed political order.

Technology had not stood still in the meantime. Big Data, the rising concept in 2015, had become commonplace in 2025. Concerns about privacy and misuse had been replaced by visions of the unprecedented opportunities all

...technology push...  
own interests. Society had surrendered to the rapidly globalizing and openly accessible data and information. Galloping at full speed on the public digital racecourse, but with the reins firmly in hand.

Therefore, large investments were made in technology. Citizens clearly realized that by combining forces at the local, national and international levels, they would locally be able to make full use of what was globally

...global hydrological models have been brought down to a very detailed scale...

population lived in cities, and the need for information and forecasts specifically aimed at the city and its citizens was the most urgent. The increasing occurrence of weather extremes, such as storms, flooding and drought, which climate scientists had forecast, increased people's awareness of climate change.

...High-resolution global hydrological forecasts had become a reality, offered by companies such as Google...

measurable at a level of detail relevant to society – everywhere in the world. Global hydrological models had quickly been brought down to a scale at which hydrological information about one's house or the ditch

...the weather service stopped making hydrological forecasts mid 2022. The distance between the global scale of Google Forecasting and the reliability and relevance at the local scale are very short in 2025....

Google  
Forecasts

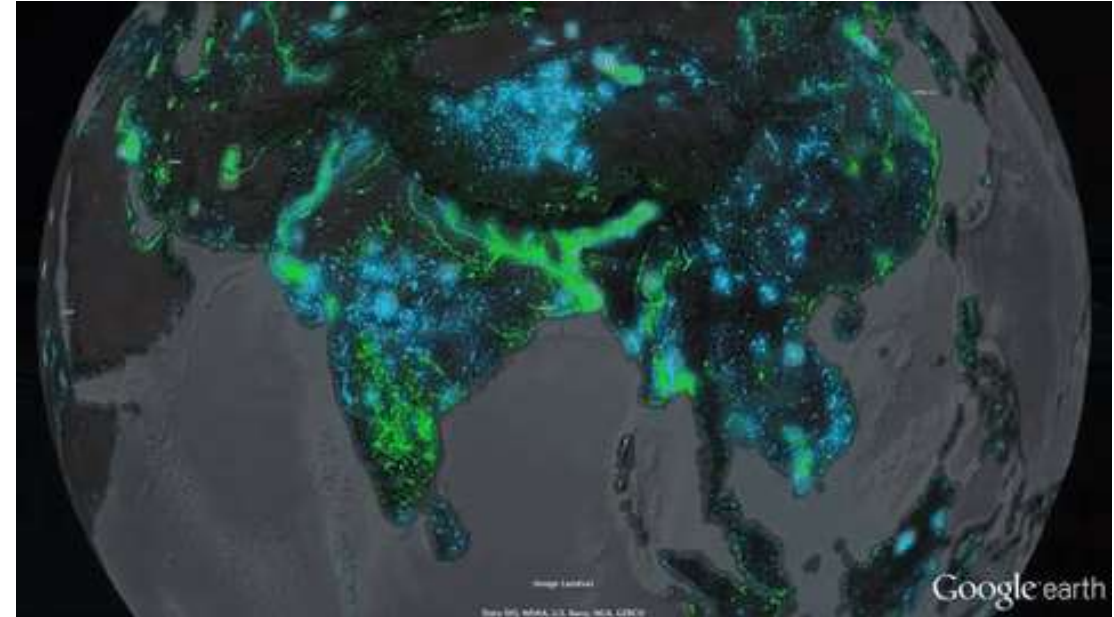
# Scenario: Google Forecasts

- Globalization is back – welcome China and Russia!
- (Big) Data everywhere, no protection
- Global hydrological predictions based on high-resolution models, improved by the research community
- No predictions from government agencies anymore
- Glocal: Innovative businesses and citizen initiatives will combine global predictions providing multitude of services aiming at satisfying local information needs



# Strategy development

- The future will look like a combination of aspects of the different scenarios
- Based upon these scenario, we decided to focus on:
  - Further development of global models
  - Development Global Data Services
  - Focus on impact forecasting
  - Webviewer development





# Deltares Global Data Services – What is it about?

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- Global data = data with global coverage which is enriched by Deltares
- Offering and delivering of global data
  - Download
  - Streaming
- Digital platform
  - Inter active viewer
  - Order forms



# Deltares Global Data Services – Why?

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- Discover new models of *knowledge transfer, cooperation* and *co-creation*
- Boost and align our research on global modelling
- Get access to new customer (segments) and partners
- Opportunities to discover combinations of Global Data Sets



## Deltares Global Data Services – Which data?

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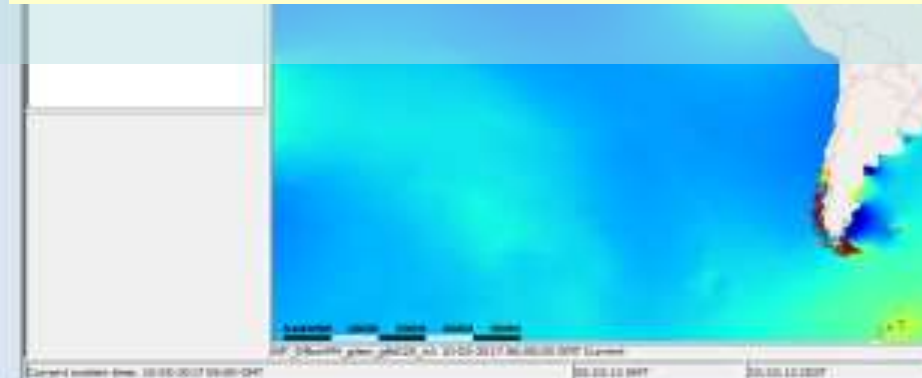
6 data services to start with:

- Flood Forecast data
- Storm Surge Data
- MetOcean data
- Aquamonitor data (shoreline and generic)

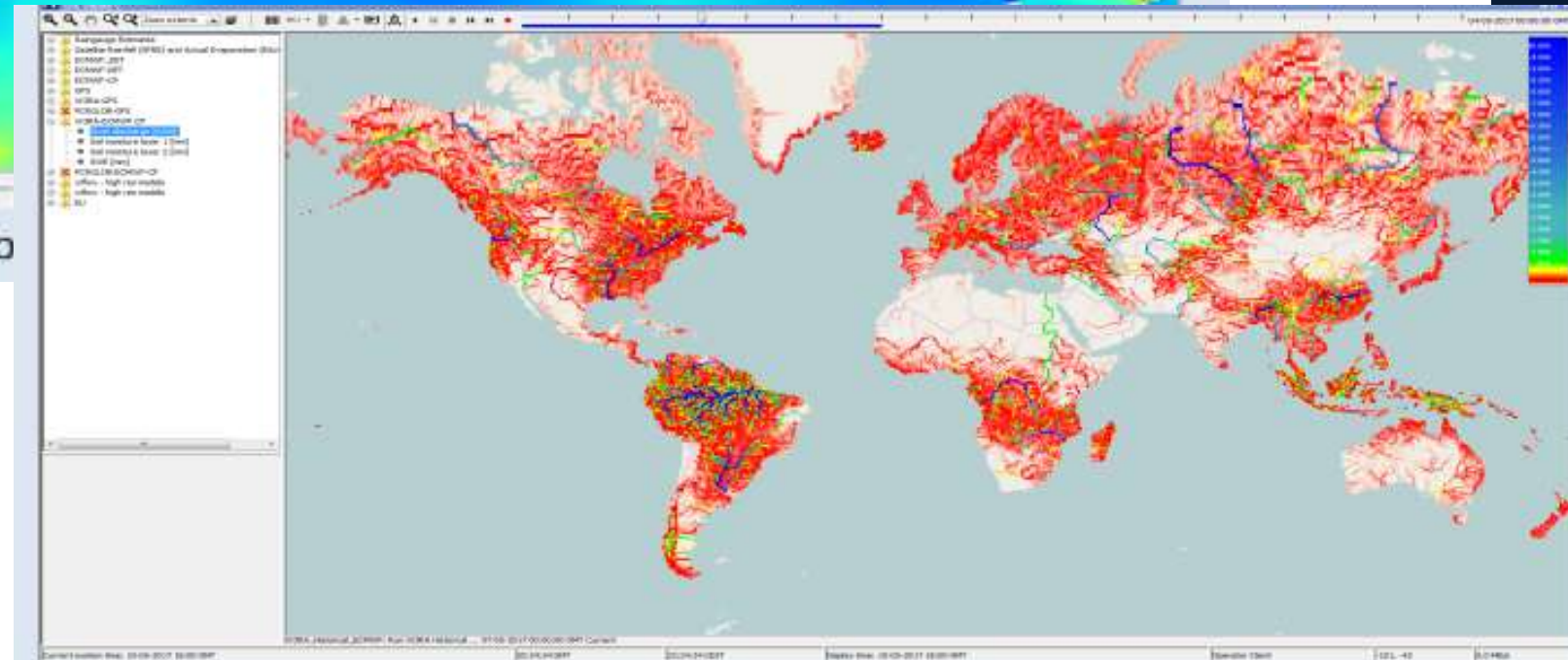


# Global hydro forecasting: GLOSSIS & GLOFFIS data services

The models run operationally 2-4 times a day and provide forecasts for the upcoming 7-10 days on soil moisture, discharge, snow water equivalent, water level and surge



Global tidal and storm surge forecasts by GLOSSIS



Global discharge and water level forecasts by GLOFFIS



# MetOcean: Wind and Wave climates

<http://dw-009.xtr.deltares.nl/metoceandb/index.htm>

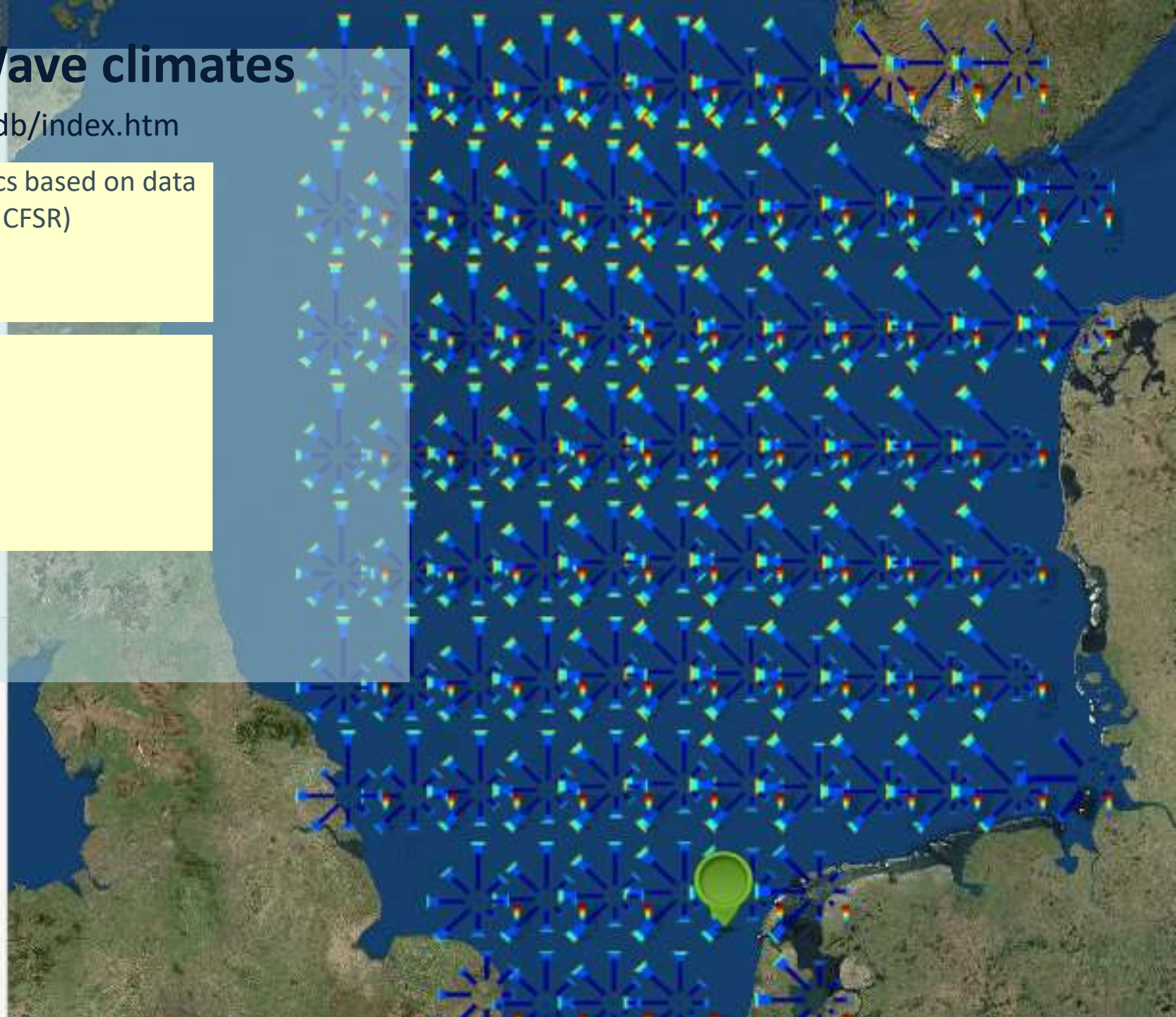
- **Data:** Historic wind and wave climates + statistics based on data of global (external) models (ERA-Interim, ERA5, CFSR)

**Availability:** Global

**Period:** 1979 - 2015

**Type:** Point and map data

Windroses





# AquaMonitor: Land / water changes

[aquamonitor.deltares.nl](http://aquamonitor.deltares.nl)

- **Data:** Historic land / water changes.

**Availability:** Global

**Period:** 1984 - 2018

**Type:** Map data





# ShorelineMonitor: Shoreline changes

Shorelinemonitor.deltares.nl

- **Data:** Historic shoreline erosion and accretion

**Availability:** Global

**Period:** 1984 - 2016

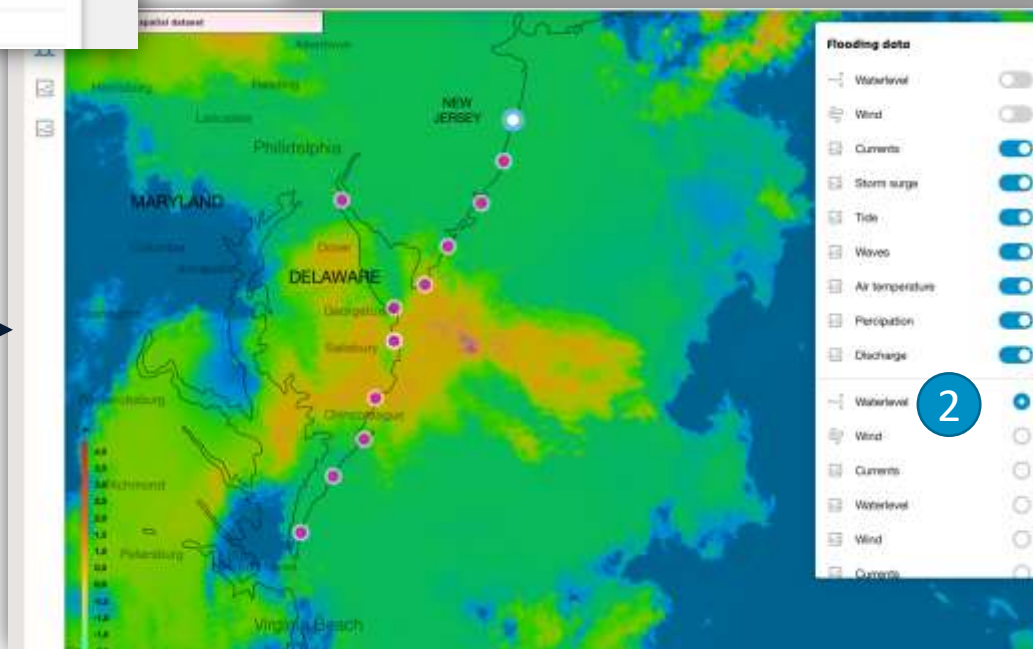
**Type:** Point data every 500 m alongshore



## Deltares Global Data Services – The platform

## Development screen dumps

1. Select theme
2. Switch on/off parameters
3. Show/download graphs
4. Select area with boundary box
5. Download
6. Etc.



Free download after registration



Free access to view the data

# Strategy development in relation to Delft-FEWS

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Finalising the Delft-FEWS 2020 Roadmap

Next step: Development vision for Delft-FEWS 2025

- In close relation with the Community strategy board and users
- User Days US, Australia, Netherlands, German speaking countries, international User Days
- Break out session in the afternoon



**Thank you for your attention**

**Deltares**



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www.deltares.nl



**Hydrological Forecasting**

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## Brainstorm 1: identification of trends into near future (2025)

Which current trends/developments do we expect to shape our world in 2025?



# 1 - Anmerkungen und Ideen

- Grosse Mengen an Informationen muessen verarbeitet, intepretiert, bereitgestellt werden
- Gesamtbetrachtung von wasserwirtschaftlichen Themen
- Global Datenmengen lokal verfuegbar machen – entgegengesetzte Trends lokal vs. global
- Verlaessliche Verfuegbarkeit von Daten zum richtigen Zeitpunkt an erreichbaren Orten
- Was koennen wir tun? Was sollen wir tun? Welches Mandat haben wir?
- Gesteigerte Ansprueche an Visualisierung von Daten und Prozessen
- Vertrauen in veroeffentlichte Messungen und Simulationen
- Auditive vermittlung von Informationen
- Einwirkungs-basierte Informationen
- Druck von populistischen Tendenzen auf Mandatstraegern aber auch Vorhersagern
- Verstaerkte Extremereignisse erhoehen Aufmerksamkeit fuer Umweltschutz und deren Beobachtung und Vorhersagung
- Mehr Konkurrenz fuer oeffentliche Institutionen
- Mehr Output, bei weniger Mitteln

## Brainstorm 1: identification of trends into near future

### SHARE YOUR FINDINGS



## Brainstorm 2: important developments for Delft-FEWS 2025

What are important new developments  
in relation to Delft-FEWS for the coming years?



## 2 - Anmerkungen und Ideen

## Brainstorm 2: identification of Delft-FEWS developments

### SHARE YOUR FINDINGS

