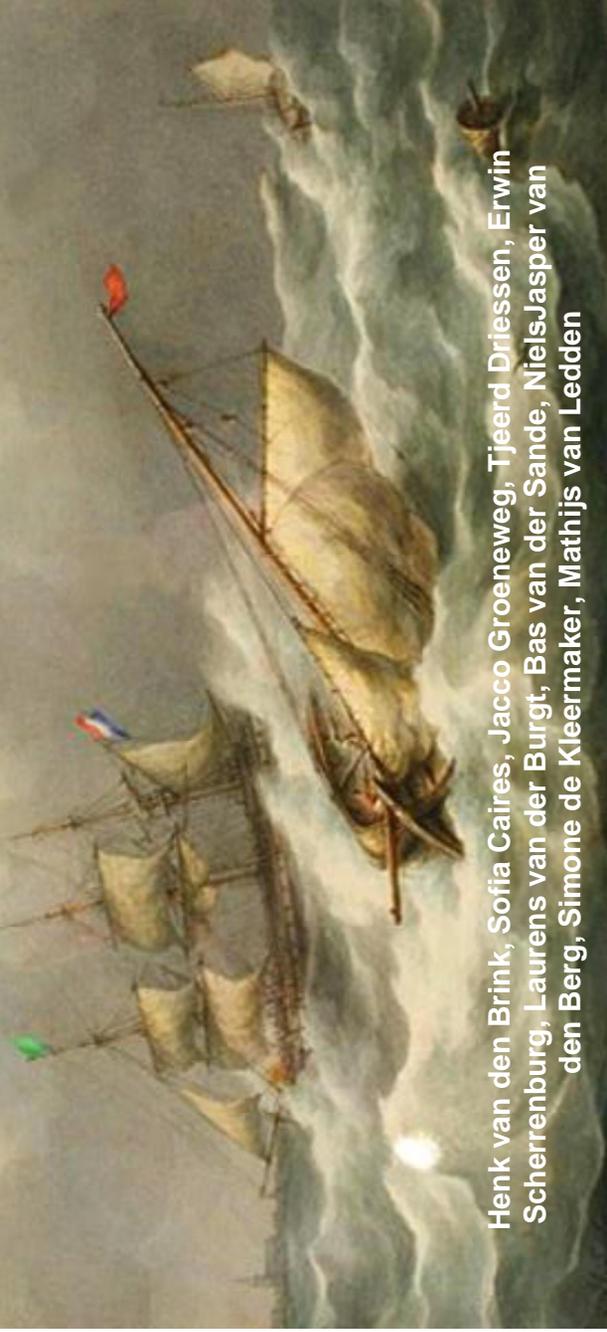
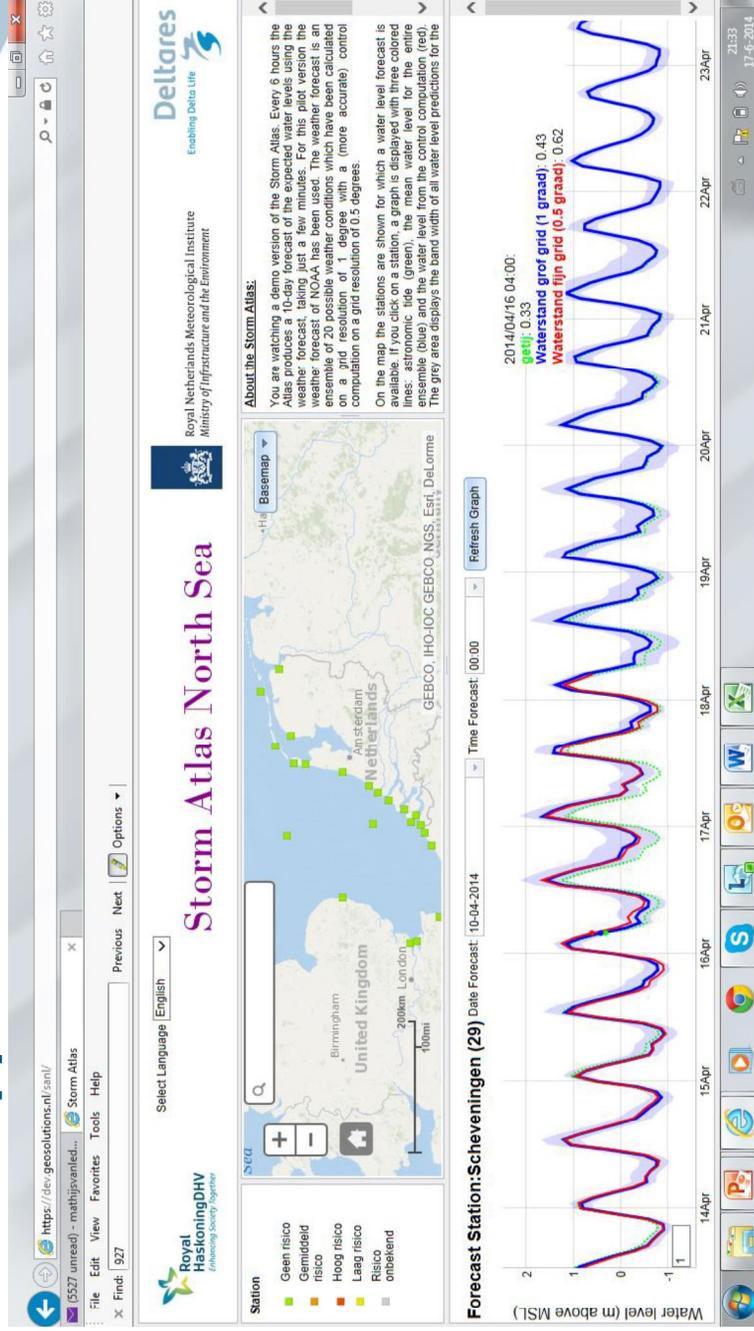


# North Sea Storm Atlas



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## Web application North Sea Storm Atlas



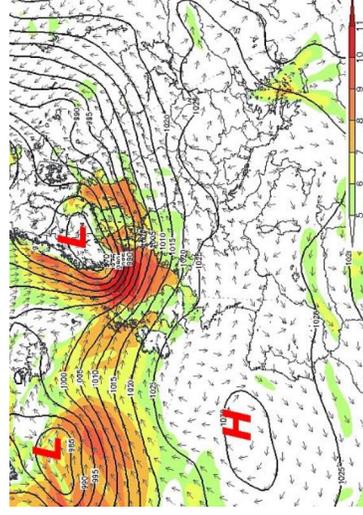
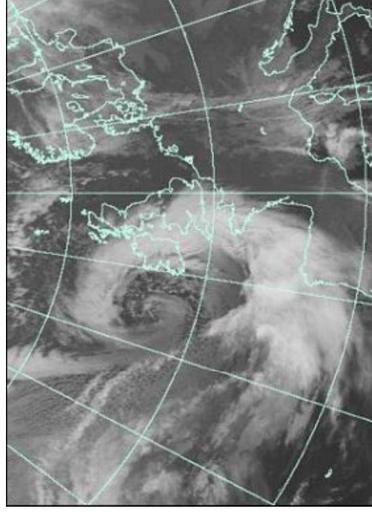
The screenshot shows a web browser displaying the Storm Atlas North Sea application. The browser address bar shows the URL: <https://de-geosolutions.nl/saml/>. The page header includes the logos for Royal HaskoningDHV, Deltares, and the Royal Netherlands Meteorological Institute. The main content area features a map of the North Sea region with a legend for station types: Geen risico (green), Gemiddeld risico (yellow), Hoog risico (orange), Laag risico (red), and Risico onbekend (grey). A search bar and map controls are visible. Below the map is a forecast graph for station 'Scheveningen (29)' for the date '10-04-2014'. The graph shows water level (m above MSL) over time from 14:00 to 22:00. The forecast is displayed as a blue line with a grey shaded area representing the prediction range. The current water level is 0.33, and the forecast for 04:00 is 0.43. The forecast for 05:00 is 0.62. The page footer includes the Royal HaskoningDHV logo and the tagline 'Enhancing Society Together'.

# Contents

1. Why this Storm Atlas?
2. How does the Atlas work?
3. How do we want to proceed with the Atlas?

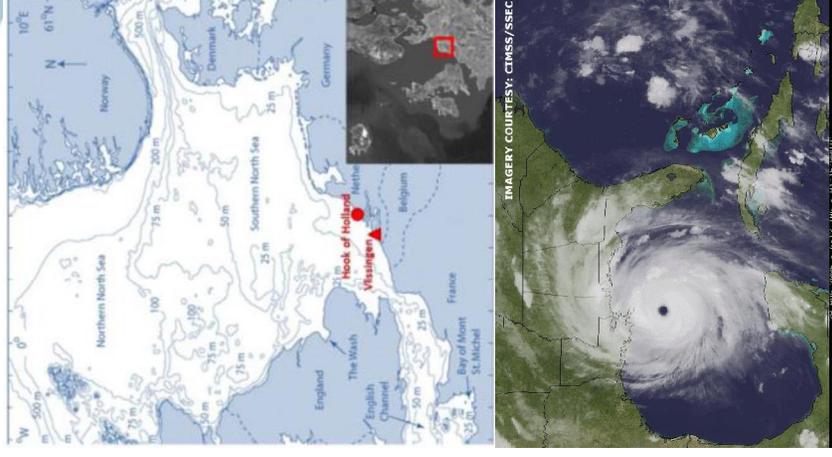
## 1. Why this North Sea Storm Atlas?

- Current operational forecast with detailed computer modeling for short-term
- Accurate, but computer intensive process, low flexibility, short forecast horizon, limited scenarios
- **Practice also requires:**
  - Scenario/uncertainty analysis
  - Waves, dune erosion, flooding
  - Mid-term forecasting



## Our vision: Interactive Storm Atlas

- **Purpose:** Quick insight (~ minutes) in impact of (a wide range of) storms for 5-10 days ahead
- **Added value:** Speed/flexibility, band width, scenario analysis (next to current operational tools) proven in New Orleans
- **Potential users:** Public and private parties with interests / assets along coast



## 2. How does the Atlas work?

Database of long period monthly seasonal forecasts of ECWMF

WAAQUA surge calculations

Decomposition of pressure fields in EOFs

Database of pressure EOFs and surges

Off line

Meteorological 10-day forecast

Projection of the pressure fields in EOFs

EOFs of 10-day forecast

Real-time

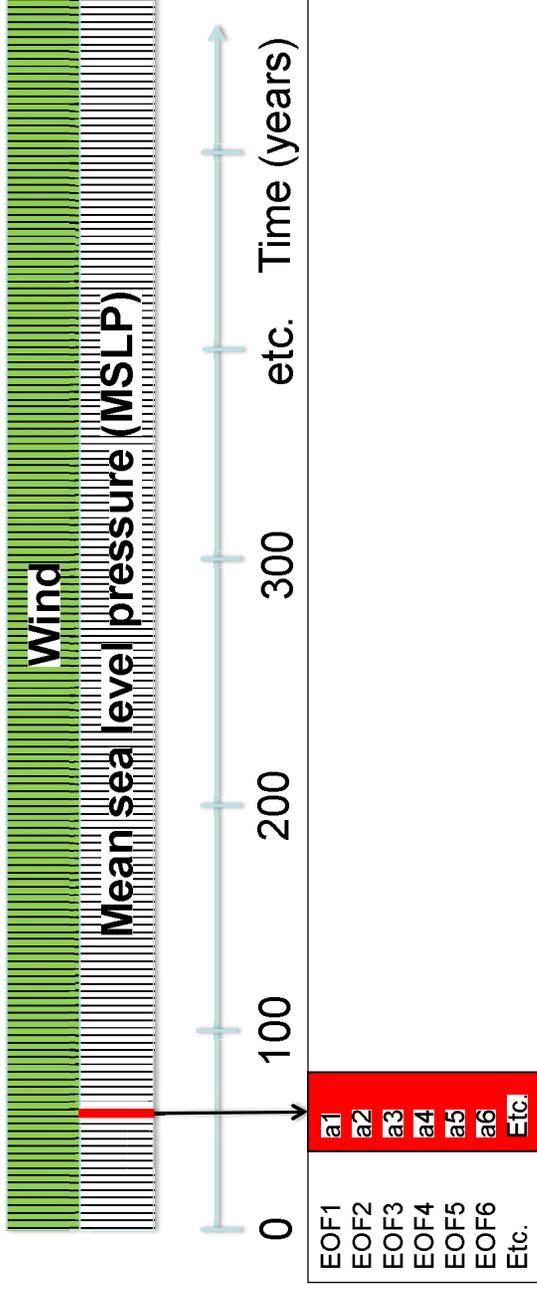
Search for best EOF-analogues in database

Forecast of the surge

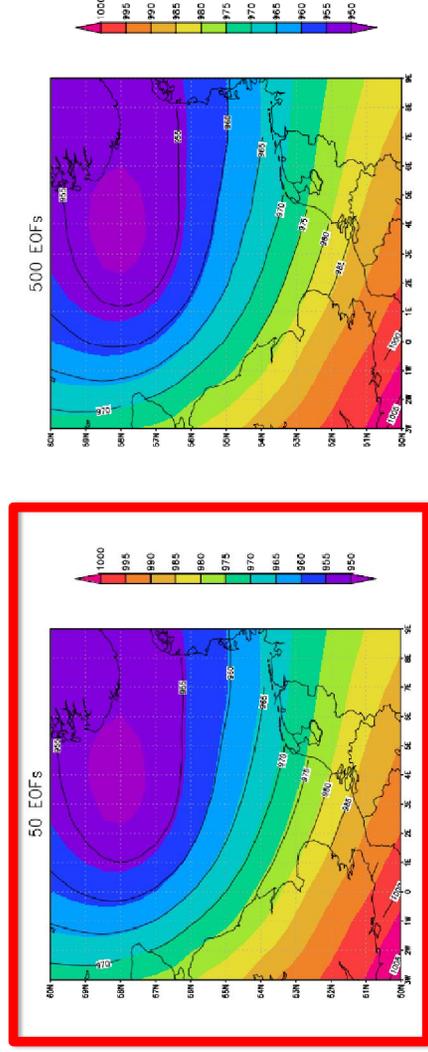
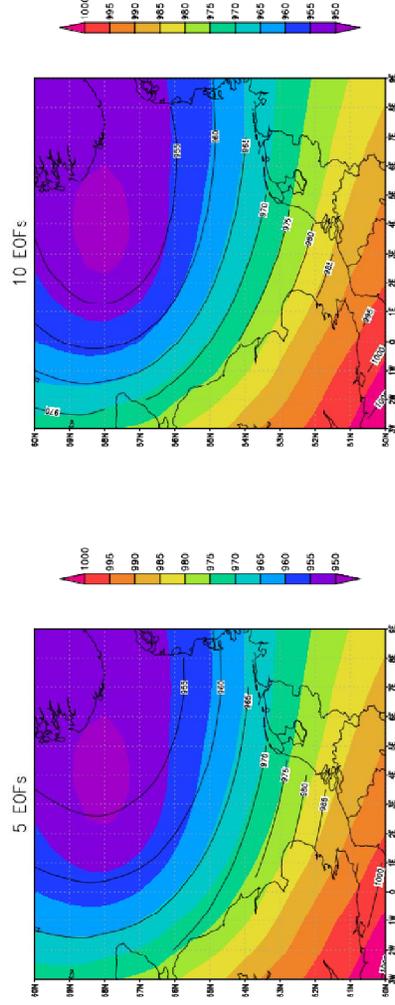
# Offline EOF analysis

$\Delta t = 6 \text{ hr}$

ECWMF data



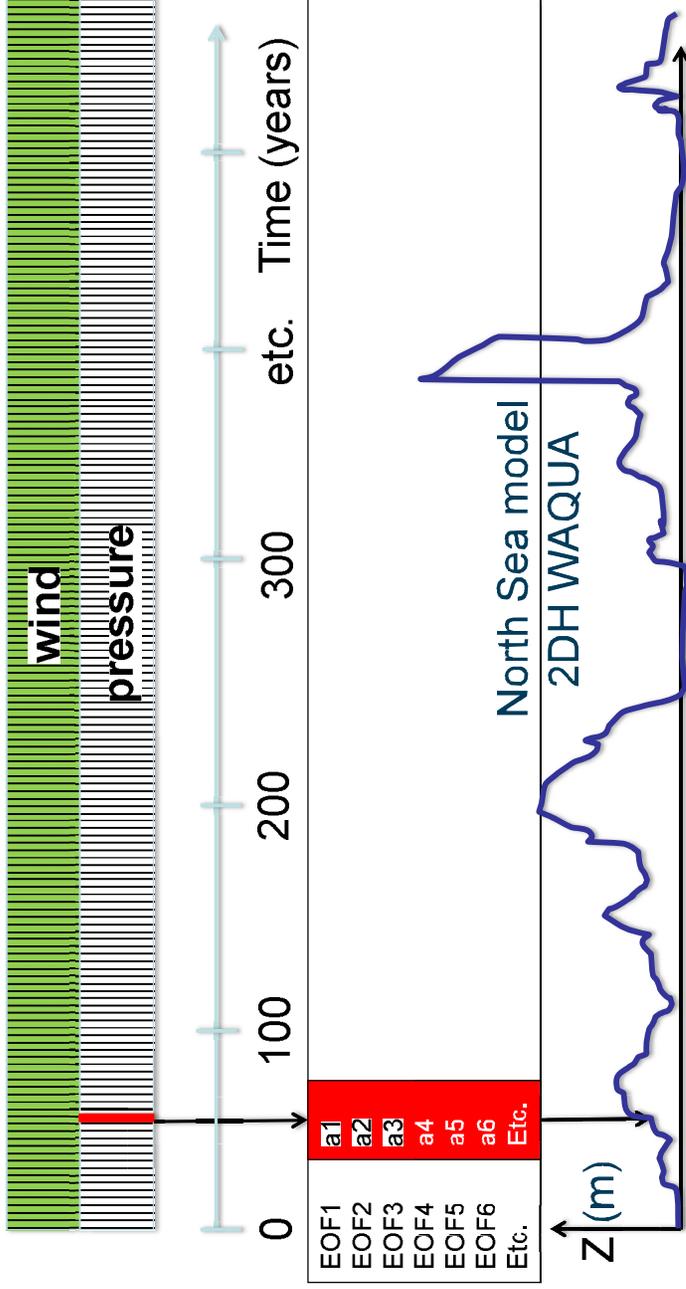
# Reconstruction of MSLP



# Offline: WAQUA surge

$\Delta t = 6 \text{ hr}$

ECWMF data

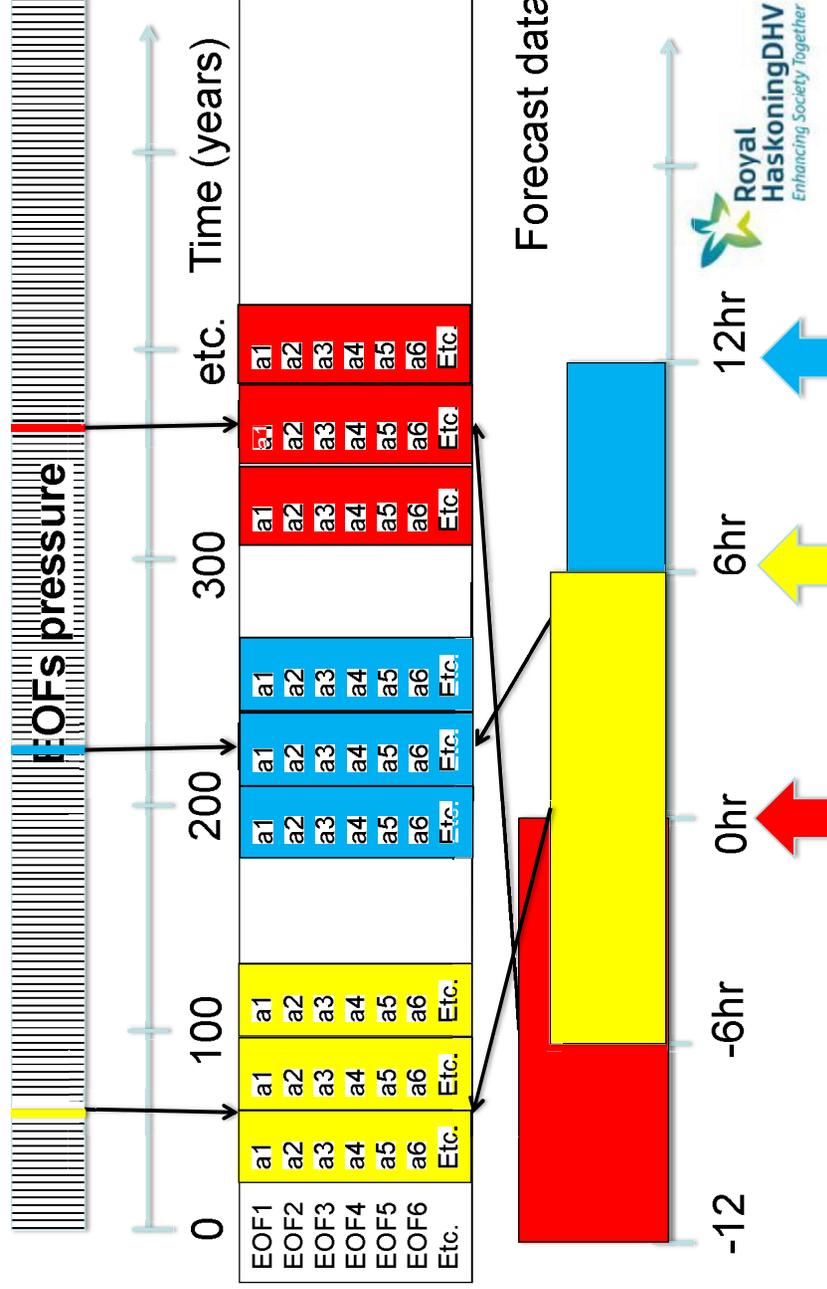


Surge time series at Hoek van Holland  
(or any other station along North Sea)

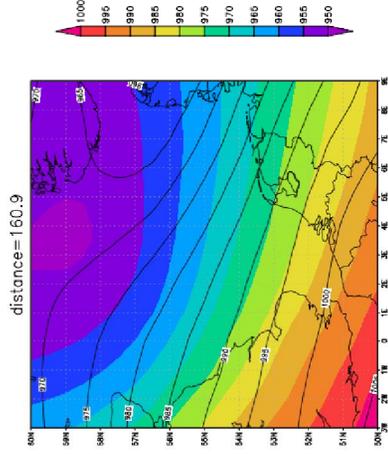
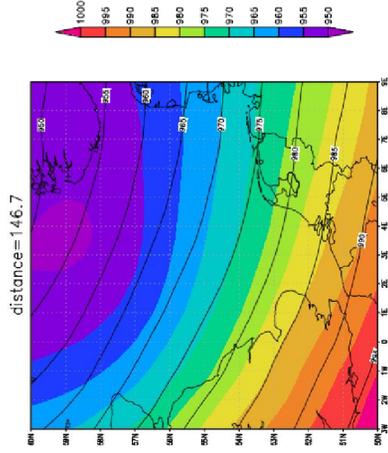
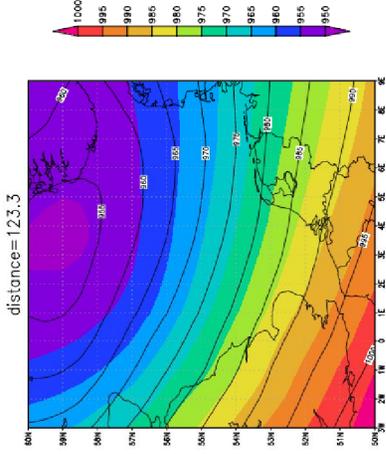
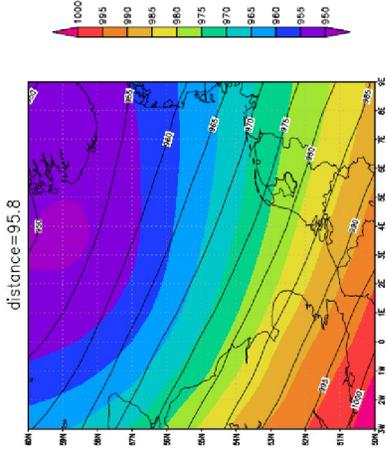
# Real time: Find the best analogue

$\Delta t = 3 \times 6 \text{ hr}$

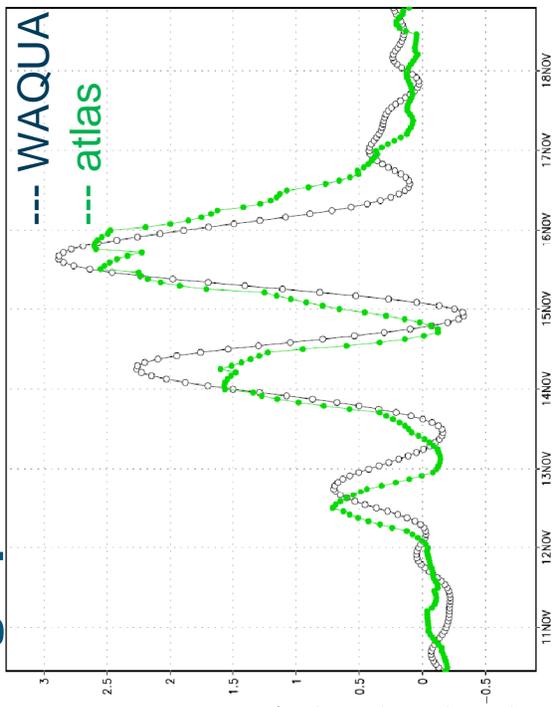
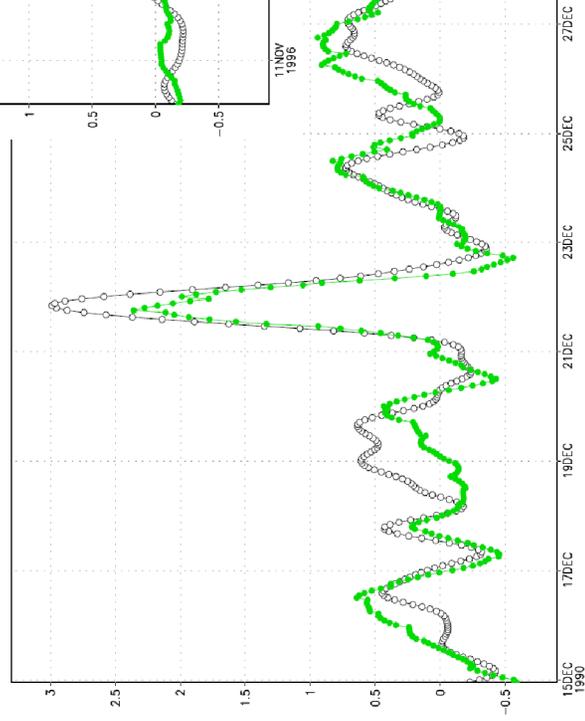
ECWMF data



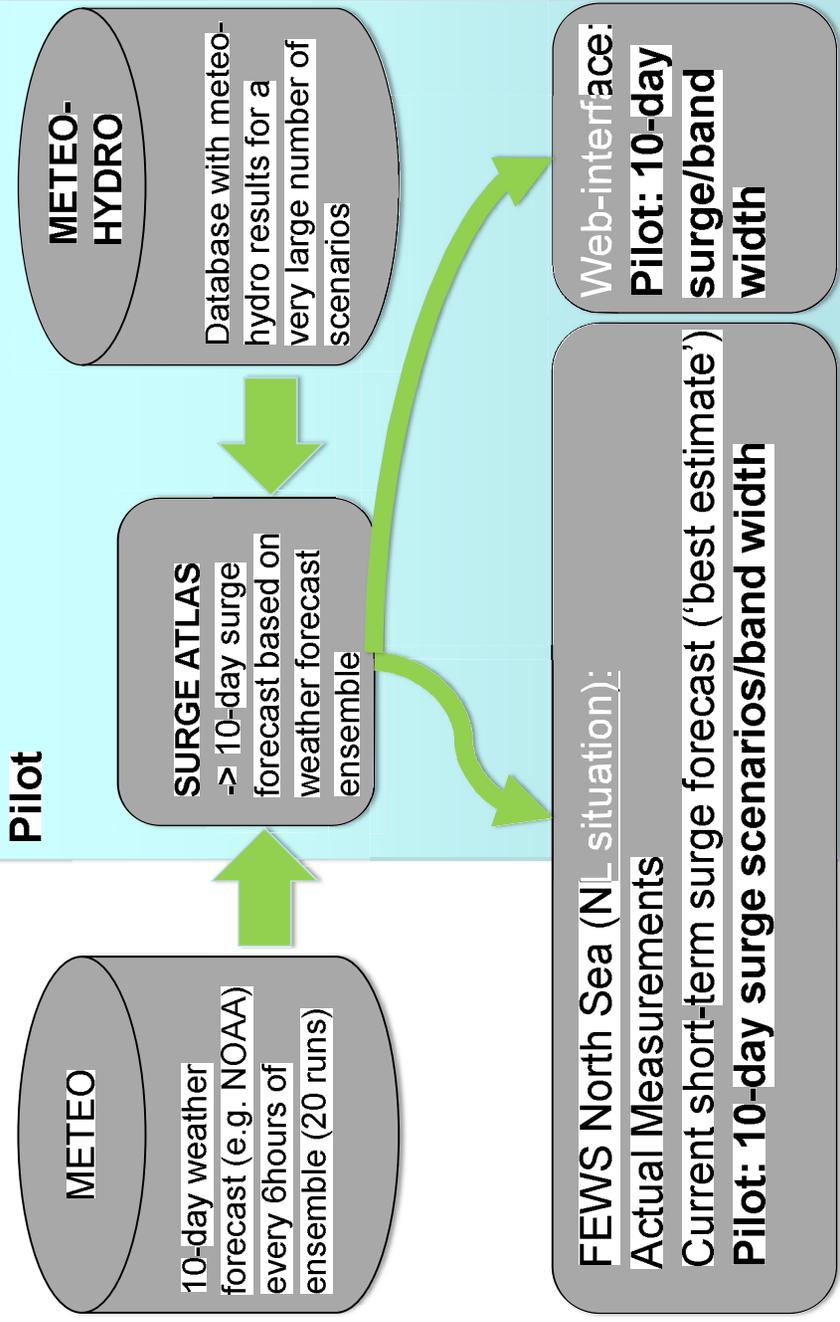
# Example: Best analogues



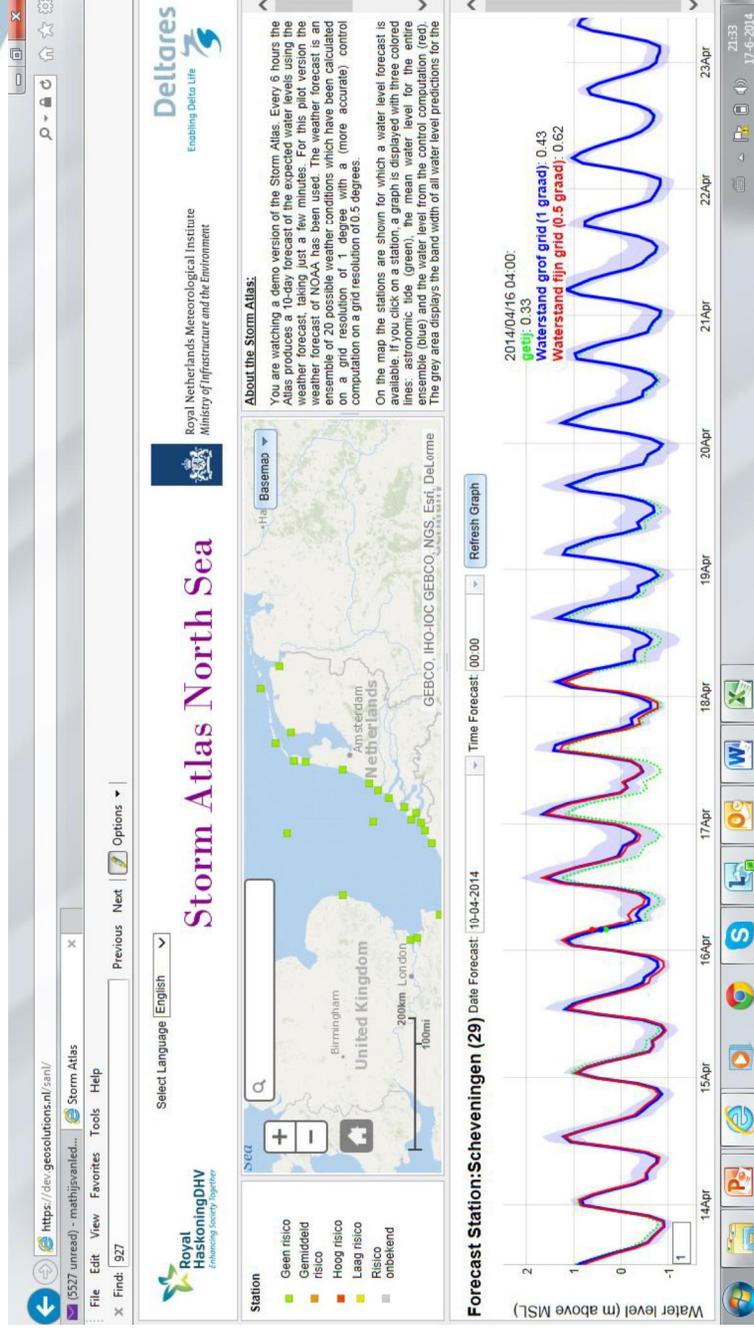
# Performance of surge prediction



# Data flow Pilot North Sea Surge Atlas

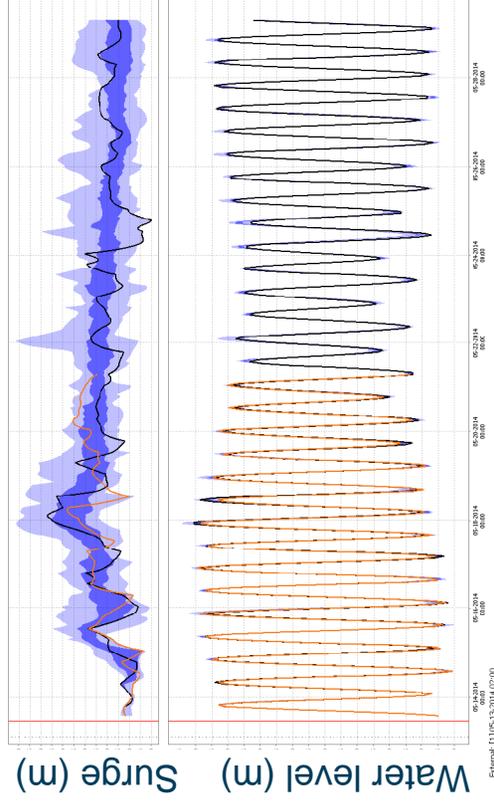


## Web-based Storm Atlas North Sea



## Storm atlas in FEWS North Sea

- Storm Atlas output is converted into FEWS-compatible Netcdf files
- Configuration for import and viewing within FEWS North Sea is available
- DisplayGroup showing Storm Atlas storm surge and waterlevel including observations
- Output for 36 locations



## 3. How to proceed with the Atlas?

- **End workshop 1<sup>st</sup> July 2014**
    - International workshop with participants from the North Sea region
    - Presentation to end-users (water boards, RWS, private parties)
    - Discussion about results en added value
  - **More research Storm Atlas North Sea 2014 and beyond**
    - The concept works, but:
      - Validation with storms?
      - Reduce uncertainties?
      - Alternative algorithm(s)?
- **Student started per 1<sup>st</sup> April 2014**
- **Operationalization of this method?**
    - Further refinement of end-user needs (e.g. scenario's)
    - Pilot version appropriate for operational process
    - Integration in existing operational systems

# Conclusions

- Pilot version of North Sea Storm Atlas provides possibility to do mid-term surge forecasting in several minutes based on weather forecast
- Results of North Sea Storm Atlas have been made accessible through web-interface and also FEWS-Noordzee
- Current surge forecast performance is reasonable, various options to further refine/improve forecasting performance
- Atlas provides opportunity for scenario analysis by end-user (changing weather patterns) and also other aspects can be included in the future (waves, dune erosion, flooding)

# Questions

