

# The concept of triggers – staying ahead of (severe) weather developments

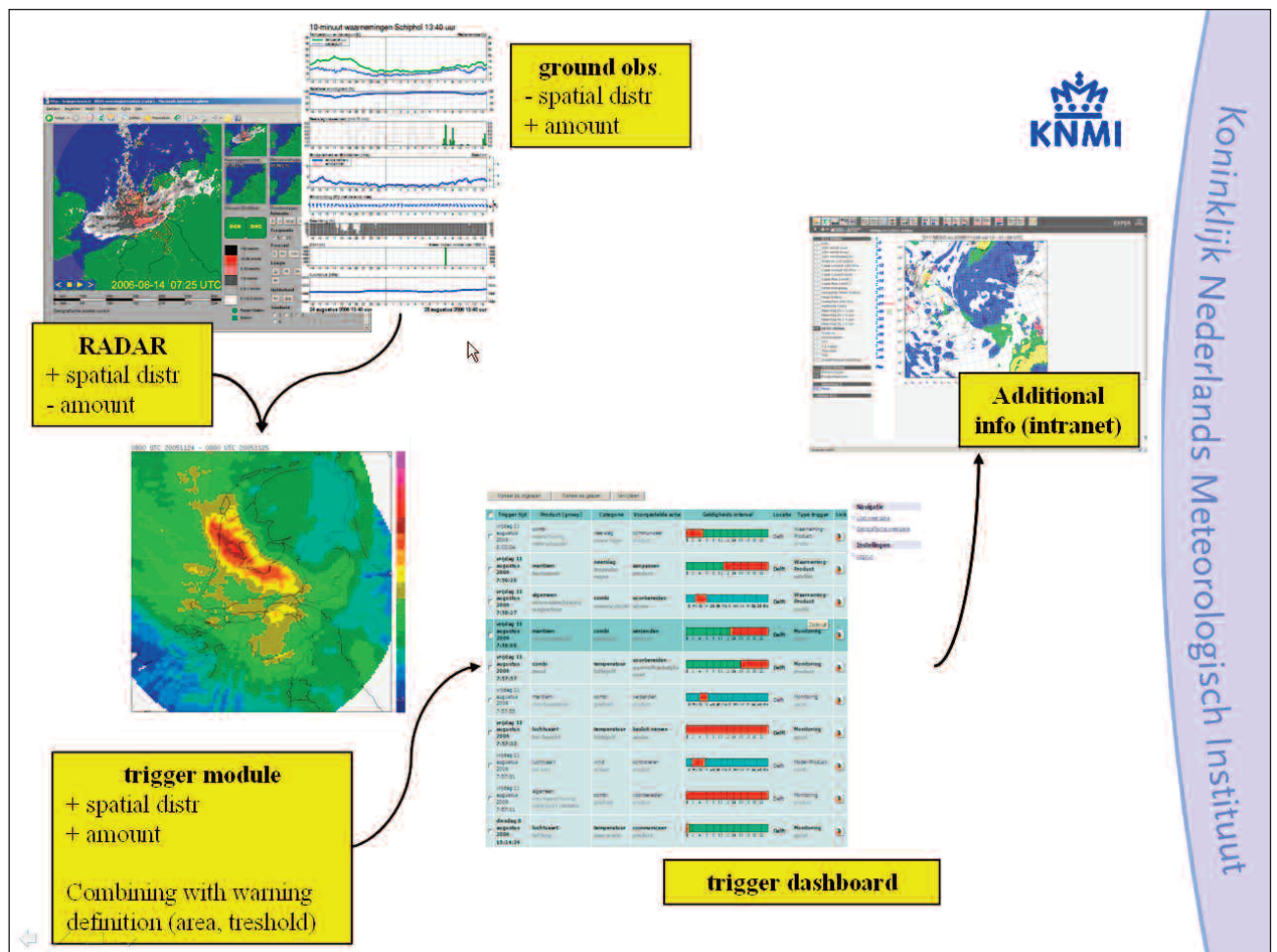
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In a modern Met Service, the issuing of weather alerts and warnings is core business. The number of warnings has risen significantly as a result of the availability of more detailed models and improved skill in forecasts. At KNMI, forecasters have to monitor more than 25 warnings and alerts, each for a different weather parameter, region and forecast lead-time. Since some of these warnings are only issued a few days per year, it is very hard for a forecaster to stay alert and ahead of (severe) weather developments.

In 2005 a pilot project started at KNMI in which the main goal was to explore whether automatic determination of (severe) weather events could help the forecaster in putting him on the right track, at the right moment. Relevant information (a “trigger”) is sent to the forecaster by a number of trigger-generating modules. These modules determine severe weather events by combining warning thresholds and area definitions with real time observations.

For example, in the post processing of the RADAR observations, the amount of precipitation in a predefined area (50x50 km) is calculated and, if the amount exceeds the threshold for a severe warning, a trigger is generated. Other modules determine upcoming severe weather events by combining warning threshold and area definition with model forecast (HIRLAM, ECMWF).



Trigger generation for deviations in actual products and observations will also be implemented. The trigger concept is also useable for monitoring automatic production. Here, a trigger is generated depending on the content of the product resulting in appropriate action (e.g. quality control) by the forecaster.

Trigger information is sent to a central dashboard in an XML trigger file. The information in the trigger is displayed on the dashboard and the forecaster gets a quick overview of relevant events. For further support, intranet pages are provided on which the forecaster can find more detailed information as well as production support.

The screenshot shows a web browser window displaying a 'Trigger Dashboard'. The main content is a table with the following columns: 'Geldigheidsinterval' (Validity period), 'Trigger tijd' (Trigger time), 'Product (groep)' (Product (group)), 'Categorie' (Category), 'Drempelwaarde' (Threshold value), 'Locatie' (Location), 'Voorgestelde actie' (Proposed action), 'Type', and 'Link'. The table contains several rows of trigger data, including wind speed and wind gust thresholds. Red arrows from the text above point to 'Valid period', 'parameter', and 'threshold value' in the table headers. To the right of the table, there are navigation and settings menus. A red arrow points from a 'url additional information' box to a globe icon in the table. Below the table, there is a 'detailed info' section with a red arrow pointing to it.

Geldigheidsinterval	Trigger tijd	Product (groep)	Categorie	Drempelwaarde	Locatie	Voorgestelde actie	Type	Link
[Calendar icon]		algemeen	Wind	40%, Windsnelheid >= 6 Bft		voorbereiden	FC-PROD	[Globe icon]
	Gisteren 9:13	Vroege voorwaarschuwing	Maximale windsnelheid overdag	42-65% kans		advies	ECMWF	
	Gisteren 9:13			40%, Windsnelheid >= 6 Bft	De Kooy			[Globe icon]
	Gisteren 21:13			62% kans				
	Gisteren 21:13			40%, Windsnelheid >= 6 Bft	De Kooy			[Globe icon]
	Gisteren 21:13			65% kans				
	Gisteren 21:13			40%, Windsnelheid >= 6 Bft	Vlissingen			[Globe icon]
	Gisteren 21:13			42% kans				
[+]		algemeen	Wind	40%, Windsnelheid >= 6 Bft		voorbereiden	FC-PROD	[Globe icon]
		Vroege voorwaarschuwing	Maximale windsnelheid overdag	40-58% kans		advies	ECMWF	
[+]		algemeen	Wind	40%, Windstoten >= 21 m/s	De Kooy	voorbereiden	FC-PROD	[Globe icon]
		Vroege voorwaarschuwing	Maximale windstoten overdag	52% kans		advies	ECMWF	
[+]		algemeen	Wind	40%, Windsnelheid >= 6 Bft		voorbereiden	FC-PROD	[Globe icon]
		Vroege voorwaarschuwing	Maximale windsnelheid overdag	46-65% kans		advies	ECMWF	
[+]		algemeen	Wind	40%, Windstoten >= 21 m/s	De Kooy	voorbereiden	FC-PROD	[Globe icon]
		Vroege voorwaarschuwing	Maximale windstoten overdag	58% kans		advies	ECMWF	
[+]		algemeen	Wind	40%, Windsnelheid >= 6 Bft		voorbereiden	FC-PROD	[Globe icon]
		Vroege voorwaarschuwing	Maximale windsnelheid overdag	42-64% kans		advies	ECMWF	
[+]		algemeen	Wind	40%, Windsnelheid >= 6 Bft		voorbereiden	FC-PROD	[Globe icon]
		Vroege voorwaarschuwing	Maximale windsnelheid overdag	42-44% kans		advies	ECMWF	

**Type** FC-PROD  
**Subtype** ECMWF  
**Trigger tijd** maandag 12 maart 2007 21:13:53  
**Productgroep** algemeen  
**Product** Vroege voorwaarschuwing  
**Categorie** Wind  
**Subcategorie** Maximale windsnelheid overdag  
**Geldigheids interval** van 17-mrt-2007 6:00:00 tot 17-mrt-2007 18:00:00  
**Locatie** Vlissingen  
**Omschrijving** Maximale Windsnelheid overdag (Bft)

**Module naam** Ensemble verwachting  
**Module status** EXPERIMENTAL  
**Bron naam** EPS  
**Tijd van brongegevens** 12-mrt-2007 21:13:21  
**Drempel waarde** Er is een kans van 40% dat Windsnelheid (maximum) >= 6 Bft  
Er is een kans van 42.3% dat  
**Berekende waarde** Er is een kans van 42.3% dat Windsnelheid (maximum) >= 6 Bft

The challenge of the project is to present a variety of triggers in such a way that forecasters find the system supportive, i.e. to make a system that effectively filters the amount of information, in stead of increasing it. If this challenge is met, the way forecasters work will change. They will most certainly more easily find the needle in the haystack of meteorological information.

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Koninklijk Nederlands Meteorologisch Instituut

## Storm surge support at KNMI

- EPS winds in North sea coupled to
  - WOMOD (statistical model)
  - WAQUA (dynamic wind surge model)
  
- Extra surge shift
- Close cooperation with Dutch Storm Surge Warning Service
  
- Triggers not yet implemented

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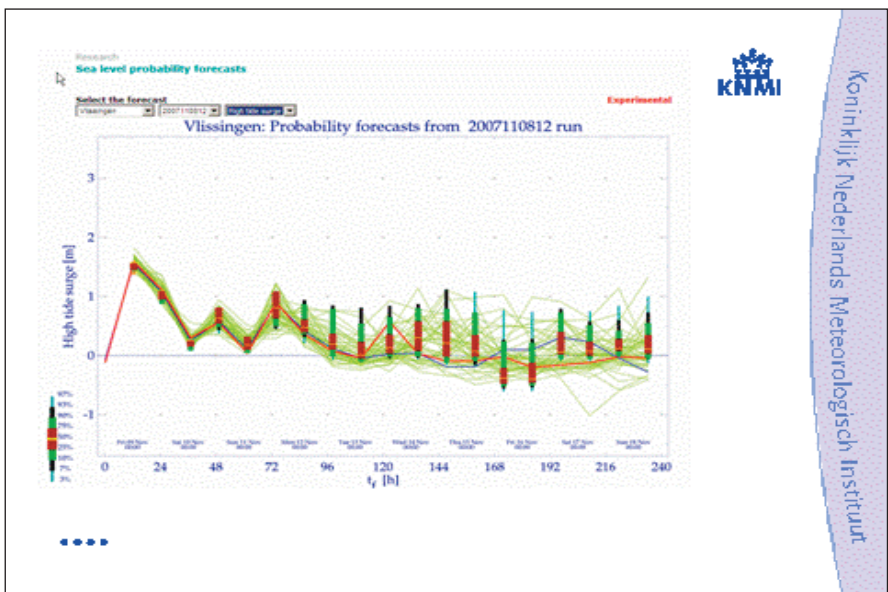
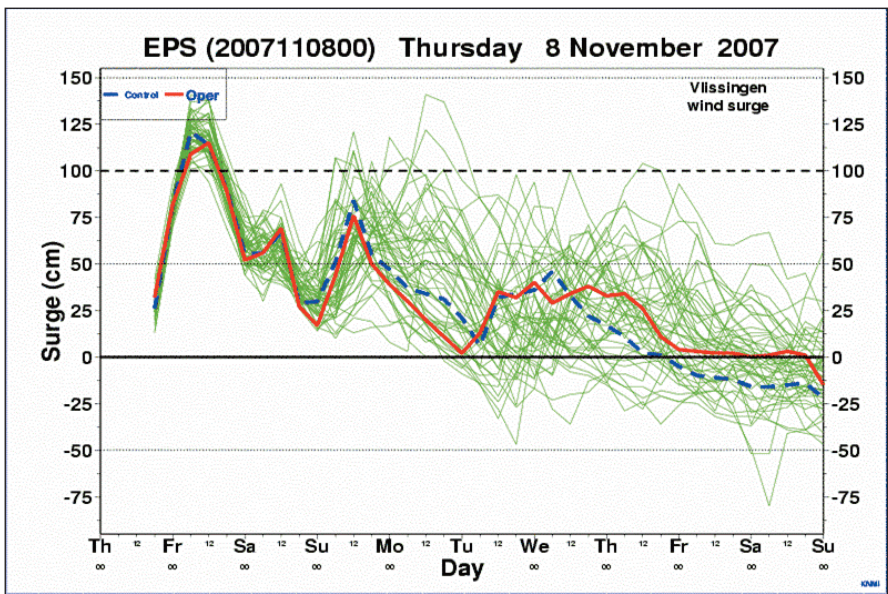
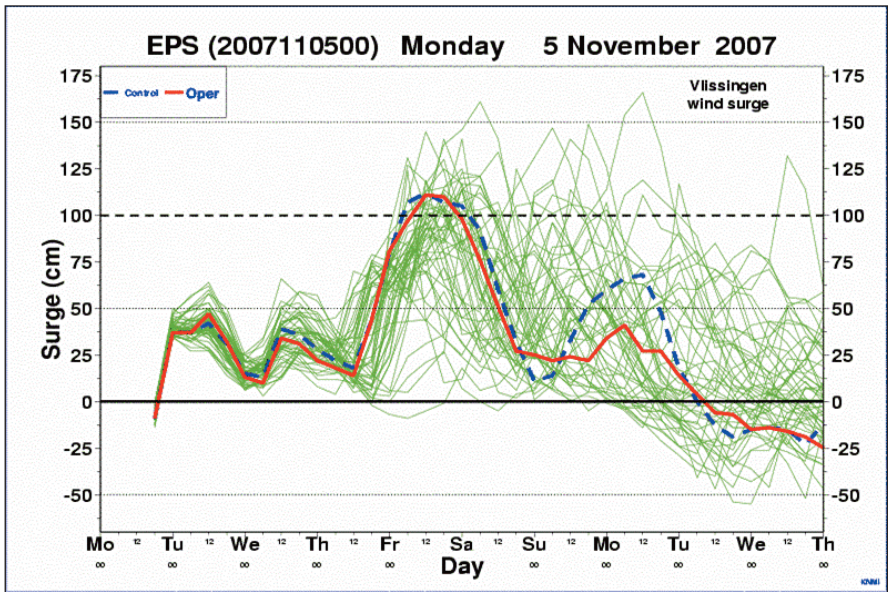
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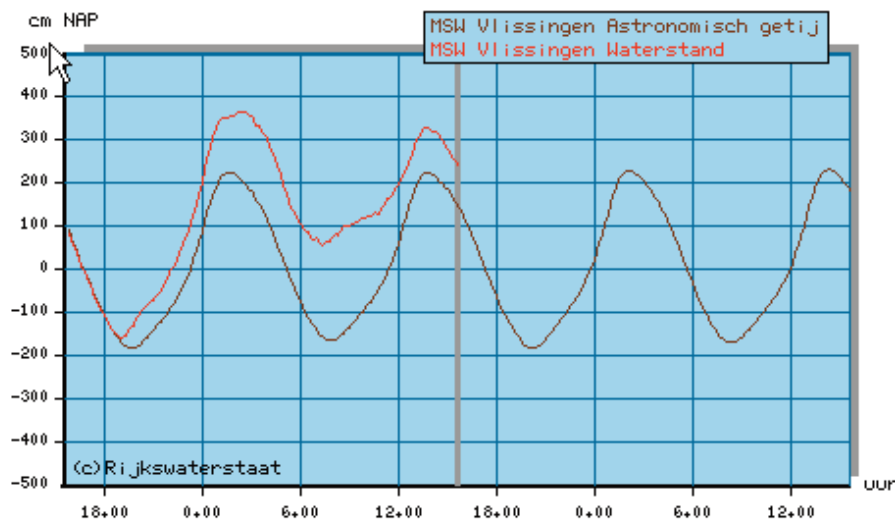
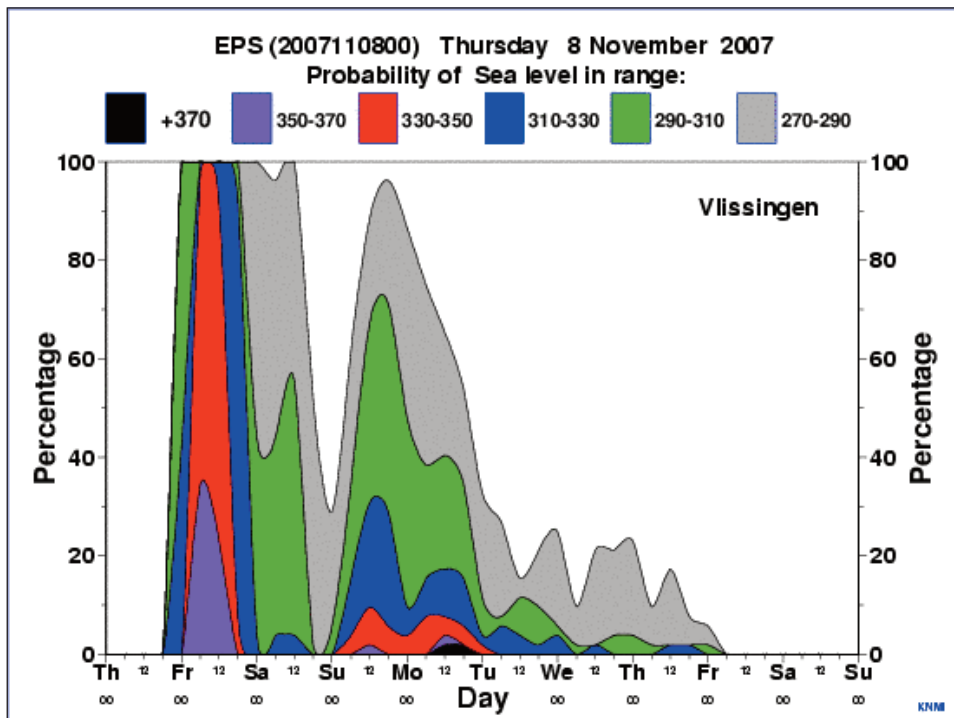
  
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Area's and tidal barriers of the Dutch  
Storm Surge Warning Service

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**Het astronomisch getij op 09 november, 15:30 uur is 149 cm NAP**  
**De waterstand op 09 november, 15:30 uur is 243 cm NAP**

N.B. Bovenstaande gegevens worden ca. 6 keer per uur ververs.

**Top-5 van de hoogste waterstanden sinds 1900 (in cm +NAP):**

1.	455	1 februari 1953
2.	394	3 januari 1976
3.	392	12 maart 1906
4.	387	28 januari 1994
5.	384	27 februari 1990