



Koninklijk Nederlands  
Meteorologisch Instituut  
Ministerie van Verkeer en Waterstaat

# Studying IMPACT of / with HARMONIE

**Emiel van der Plas**  
Jan Barkmeijer,  
Ben Wijchers Schreur,  
Tilly Driesenaar, Gerard Cats

KNMI



# The HARMONIE code

## Objective

- › High resolution Numerical Weather Prediction
- › Limited Area (typically 750 km x 750 km)
- › To be embedded in global (ECMWF) or local (Hirlam) model
- › Non-hydrostatic model
- › Developed within the Hirlam/ALADIN consortium



# HARMONIE: current status

Modern, state-of-the-art physics

- Non-hydrostatic
    - Better suited to capture
      - » Convection
      - » Vertical wind
      - » Large scale precipitation events
  - Resolution 2.5 km
  - Run on ECMWF environment
- 
- Case study of recent severe weather conditions
  - Study influence of a.o.
    - > Domain size
    - > variation of surface data (e.g. SST)
  - Comparison with e.g. Hirlam 11km

# Case study: Storm

Storm Kyrill,  
18 January 2007

- Fast cyclogenesis
- Strong winds in Schiphol area  
(10 Beaufort,  
gust up to 37 m/s)



Vr. 19 januari 2007 . Het laatste nieuws lees je het eerst op NU.nl



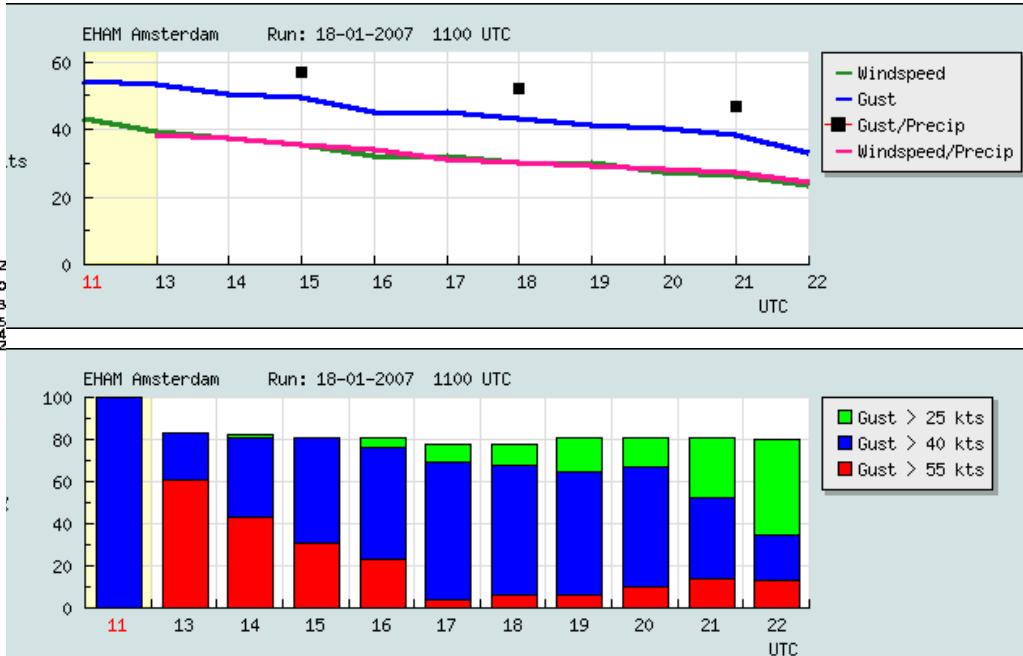
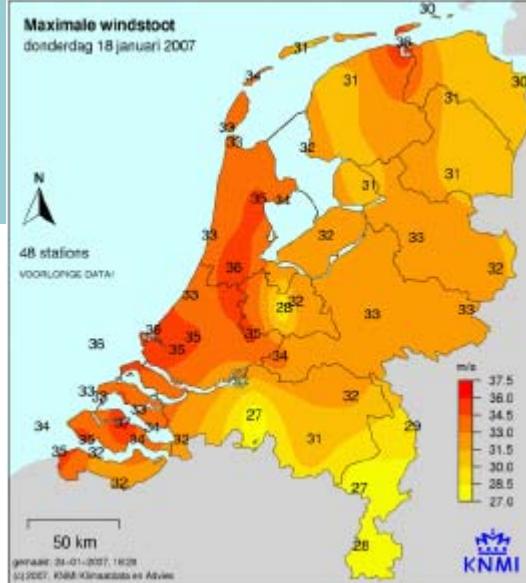
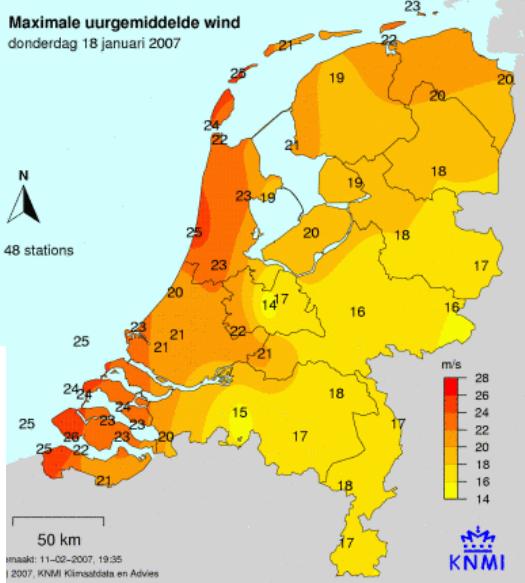
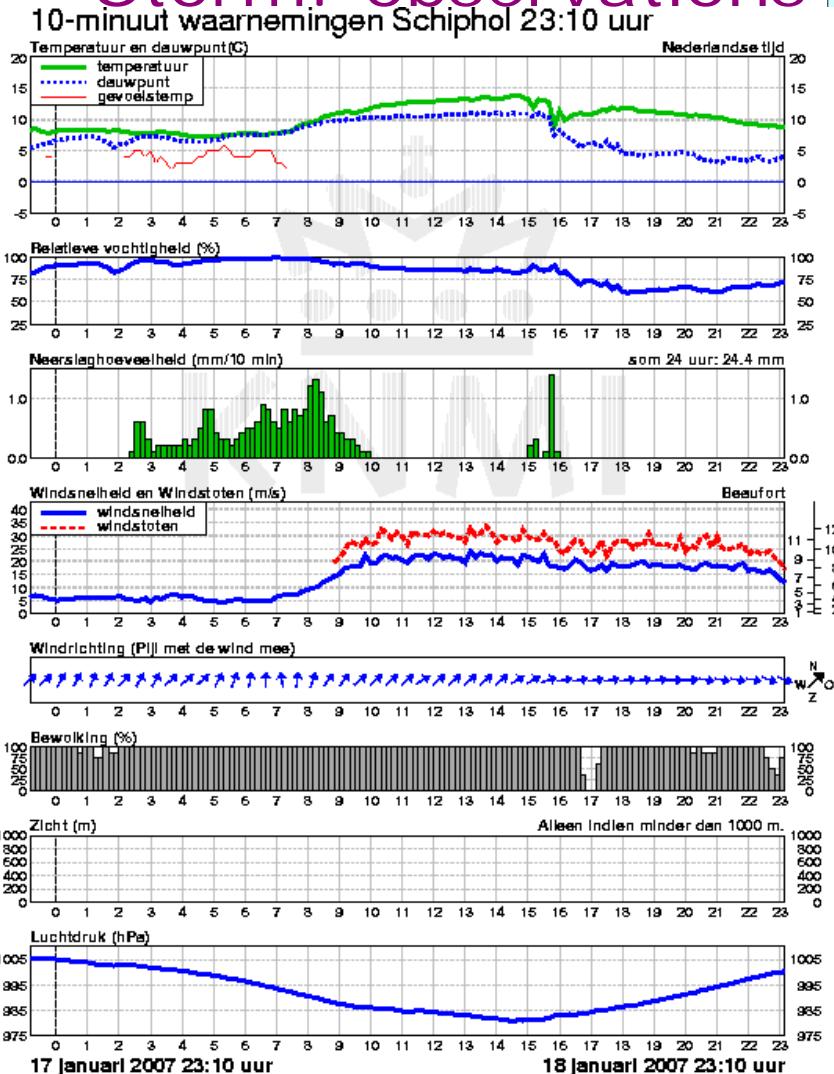
Voorpagina  
Algemeen

## KNMI waarschuwt voor storm en regen

Uitgegeven: 16 januari 2007 19:14

AMSTERDAM - Nederland krijgt donderdag voor de tweede keer in korte tijd te maken met een storm. Dat meldt het KNMI. Het instituut verwacht zeer onstuimig weer met zeer zware windstoten van meer dan 100 kilometer per uur.

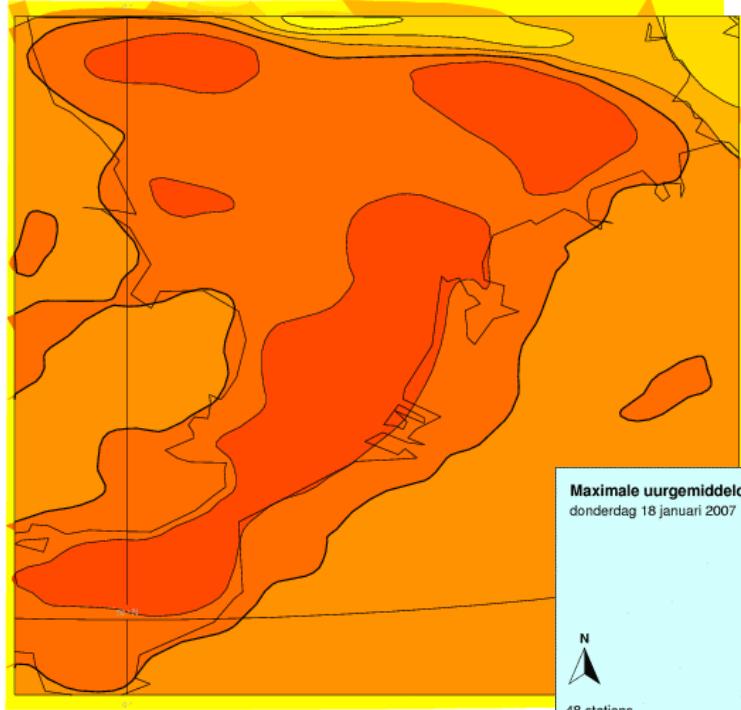
# Storm: observations





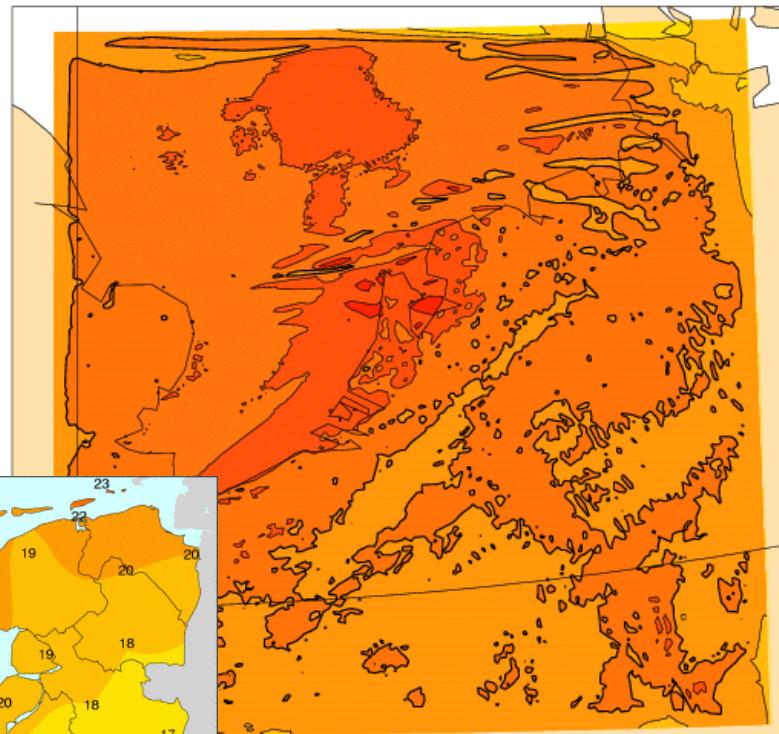
# Storm: models

Thursday 18 January 2007 00 UTC HELKI Forecast t+12 VT: Thursday 18 January 2007 12 UTC Model Level 40 \*\*u-component of wind



Total horizontal wind  
HIRLAM 12:00

Thursday 18 January 2007 00 UTC - Forecast t+12 VT: Thursday 18 January 2007 12 UTC Model Level 40 \*\*u-component of wind

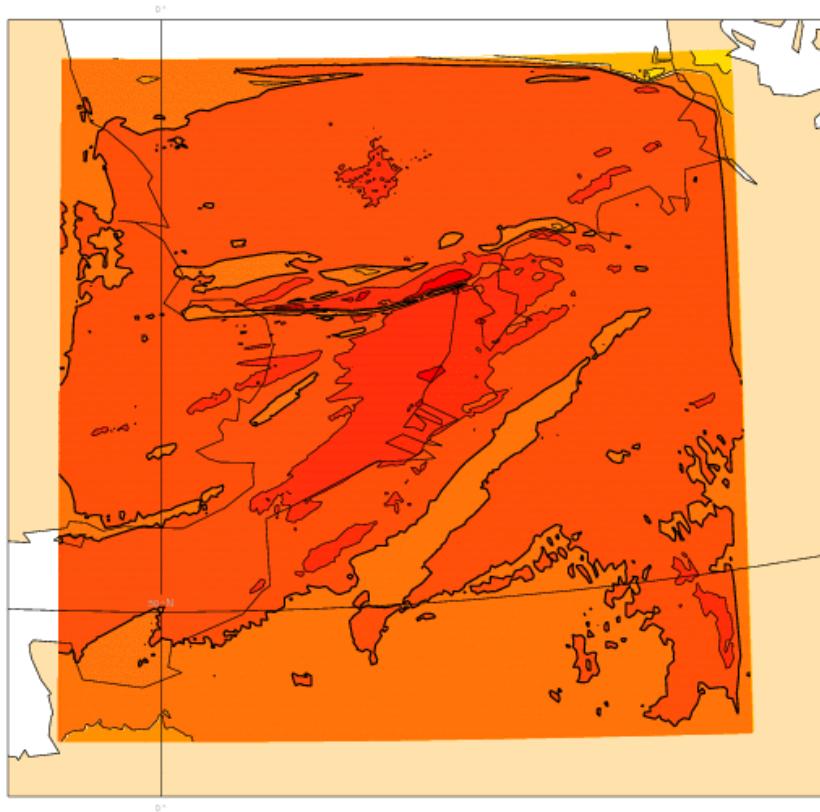


Horizontal wind velocity  
HARMONIE 12:00

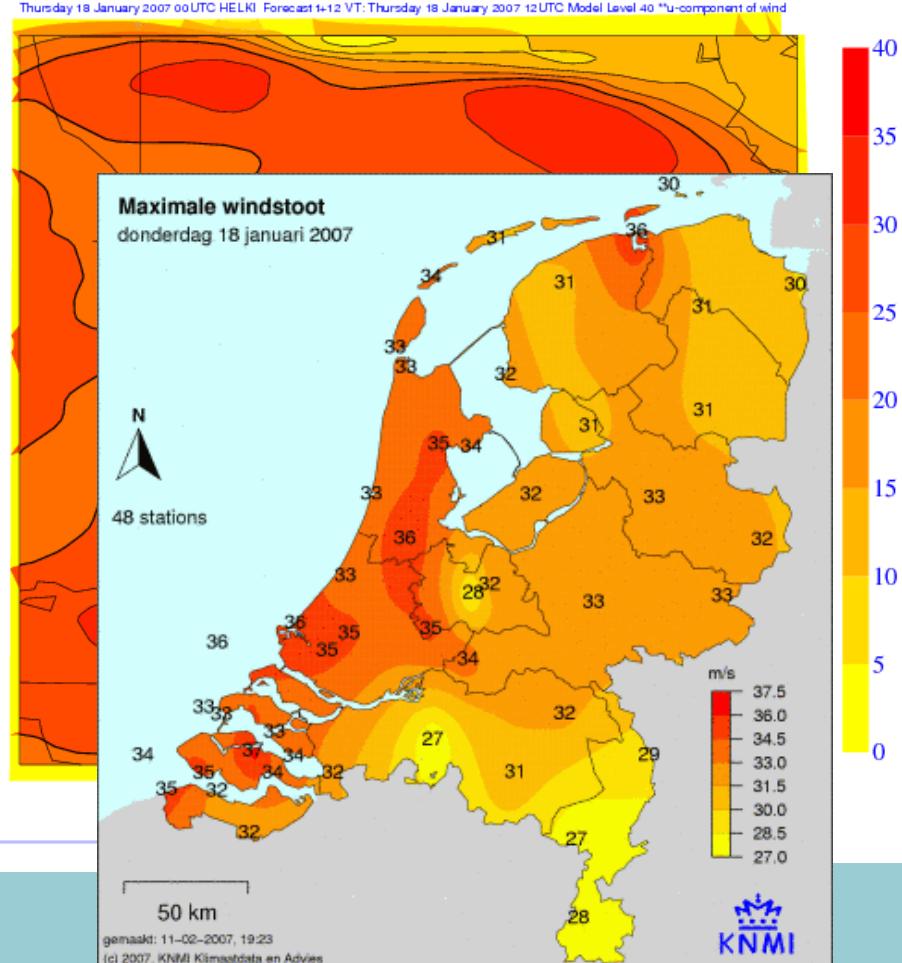


# Storm: Gust

Thursday 18 January 2007 00UTC Forecast 1+12 VT: Thursday 18 January 2007 12UTC Model Level 40 \*\*u-component of wind



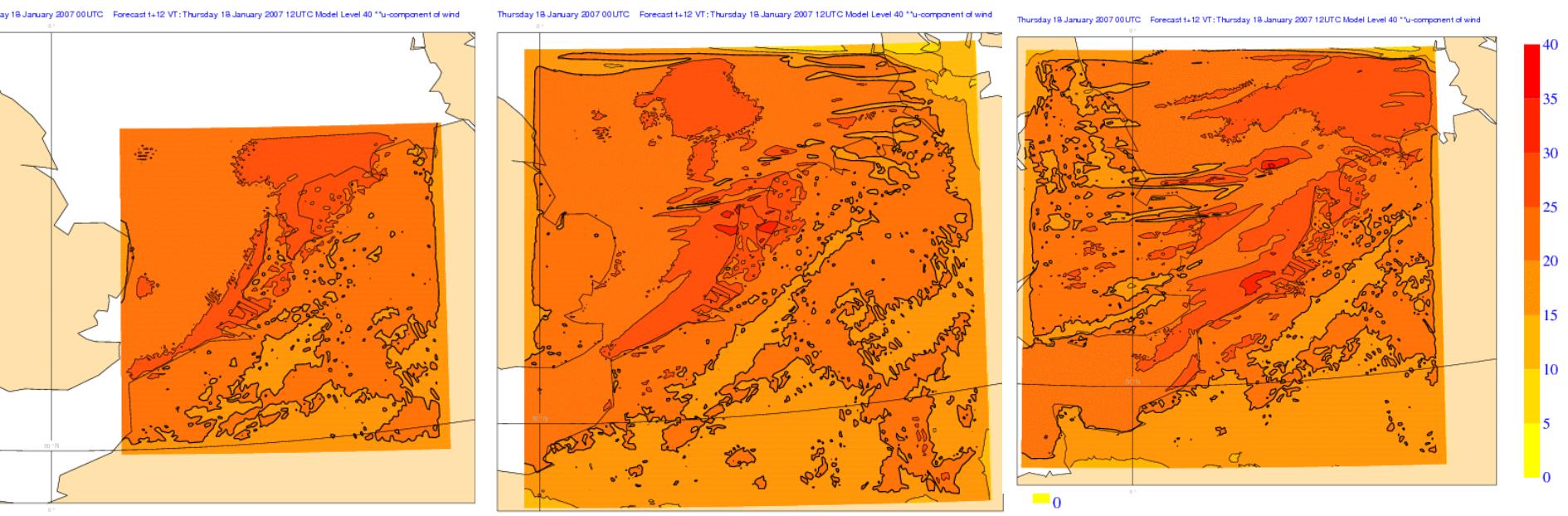
Thursday 18 January 2007 00UTC HELKI Forecast 1+12 VT: Thursday 18 January 2007 12UTC Model Level 40 \*\*u-component of wind





# Storm: effect domain

200 vs 300 gridpoints (2.5 km) vs west-shift: (wind speed @ 12:00)



500 km x 500 km

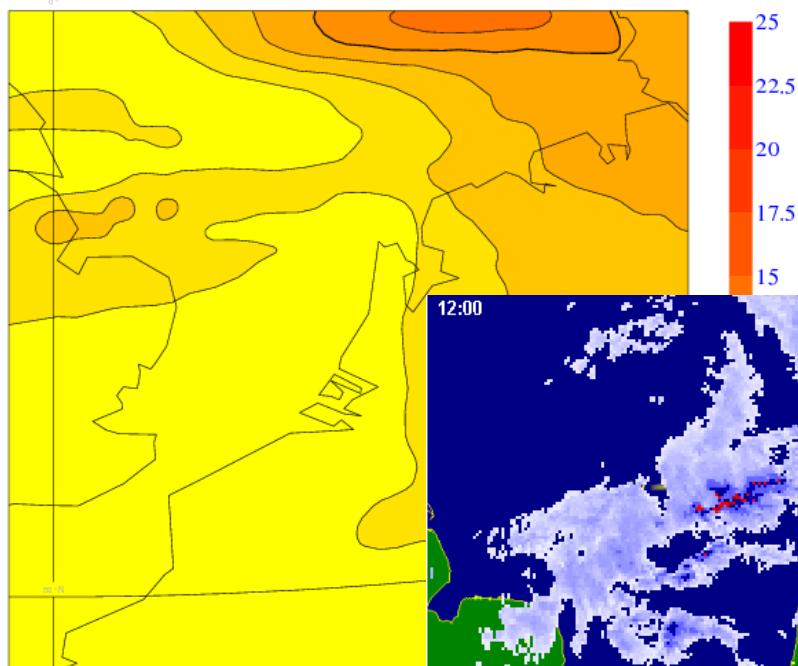
750 km x 750 km

750 km x 750 km  
shifted



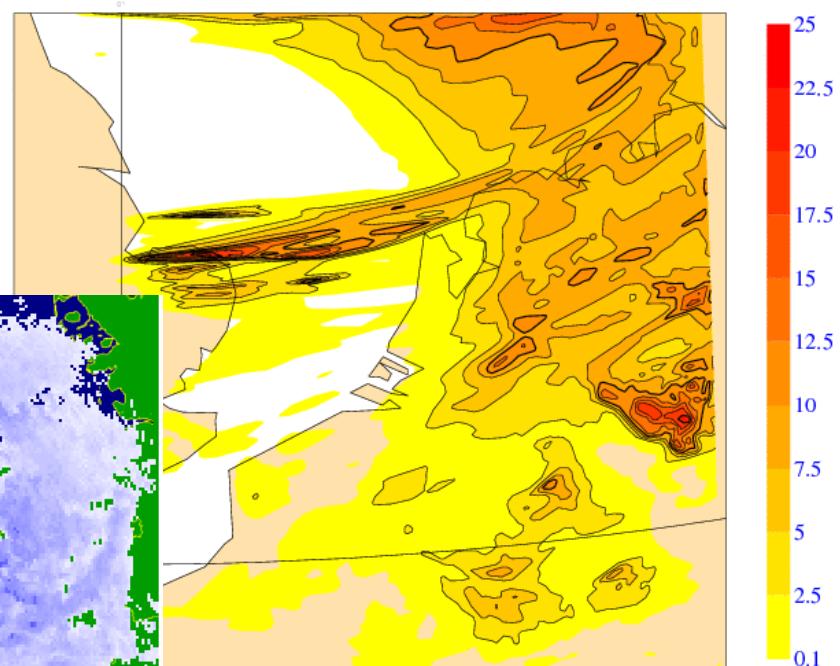
# Storm: precipitation

HELKI Accumulation of 0 Forecasts VT:00 UTC 18 January 2007 to 12 UTC 18 January 2007 0hPa total precipitation



Accumulated precipitation  
9:00 – 12:00  
Hirlam

Thursday 18 January 2007 00UTC Forecast t+12 VT: Thursday 18 January 2007 12UTC 0m \*\*large scale precip

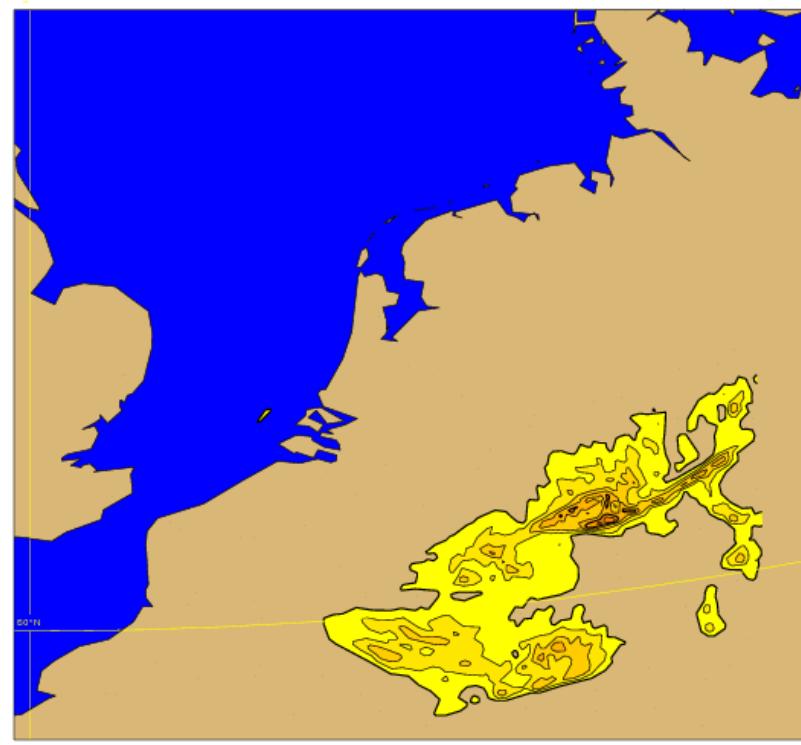


Accumulated precipitation  
9:00 – 12:00  
Harmonie

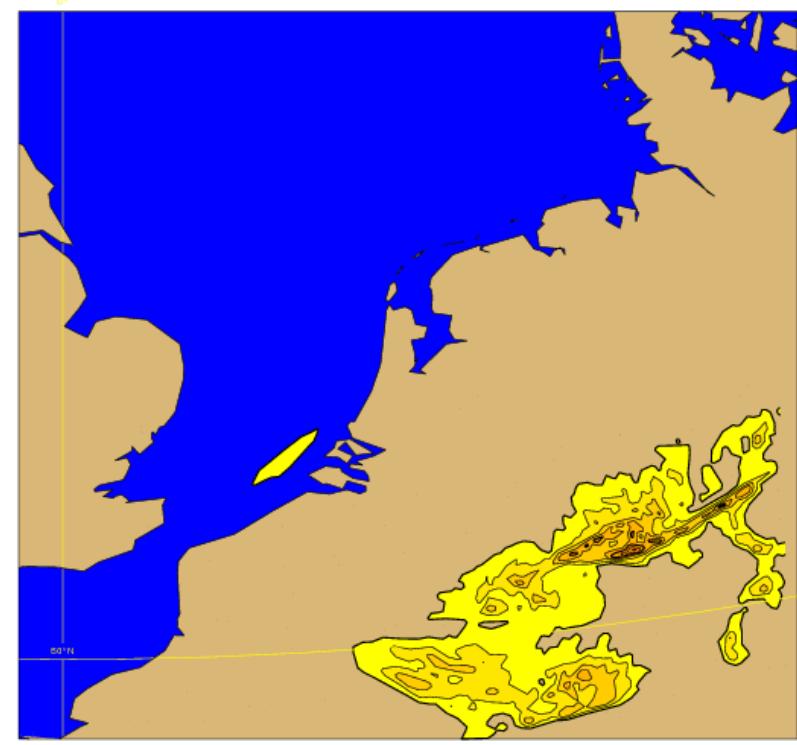


## Effect SST (normal or +2°) on precipitation

Thursday 18 January 2007 00UTC ATHEN Forecast t+2 VT: Thursday 18 January 2007 02UTC 0m \*\*large scale precip



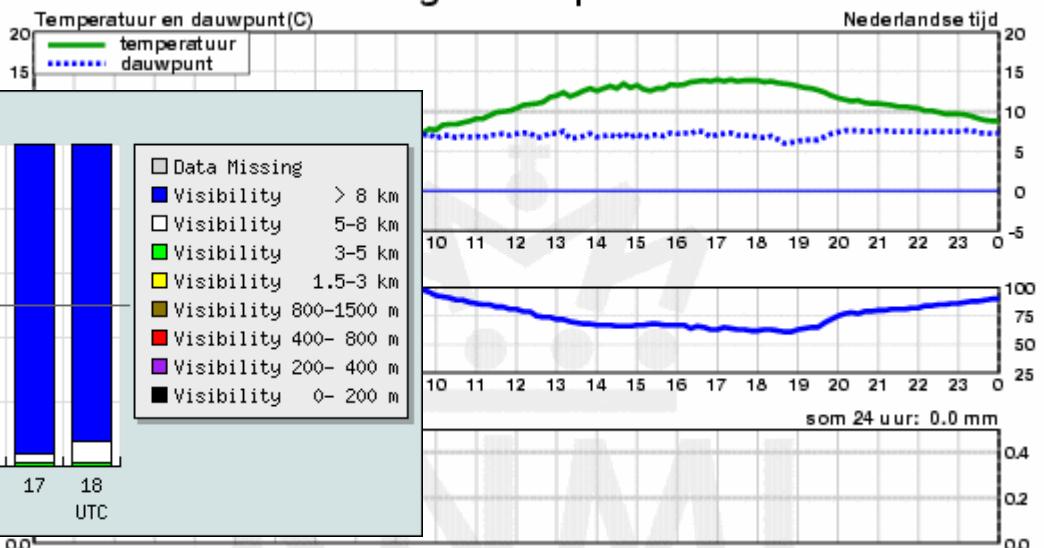
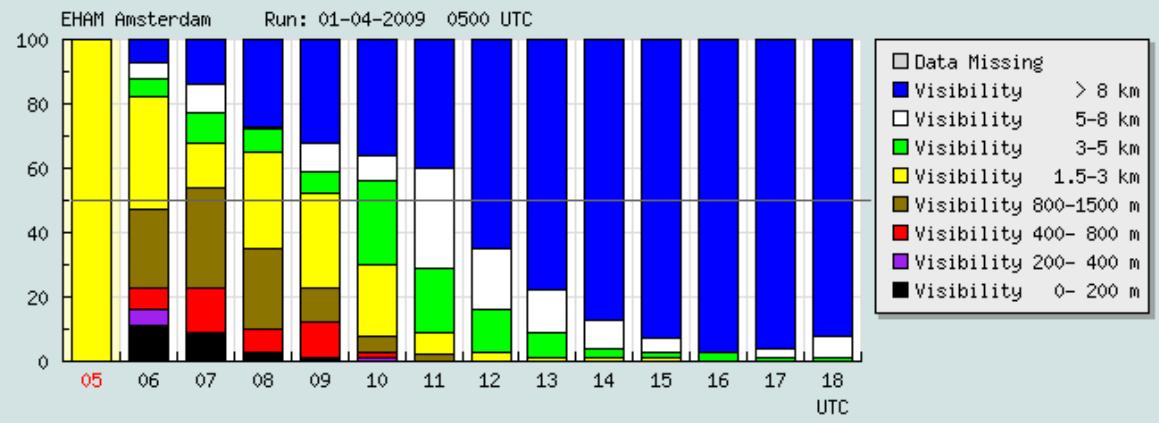
Thursday 18 January 2007 00UTC ATHEN Forecast t+2 VT: Thursday 18 January 2007 02UTC 0m \*\*large scale precip



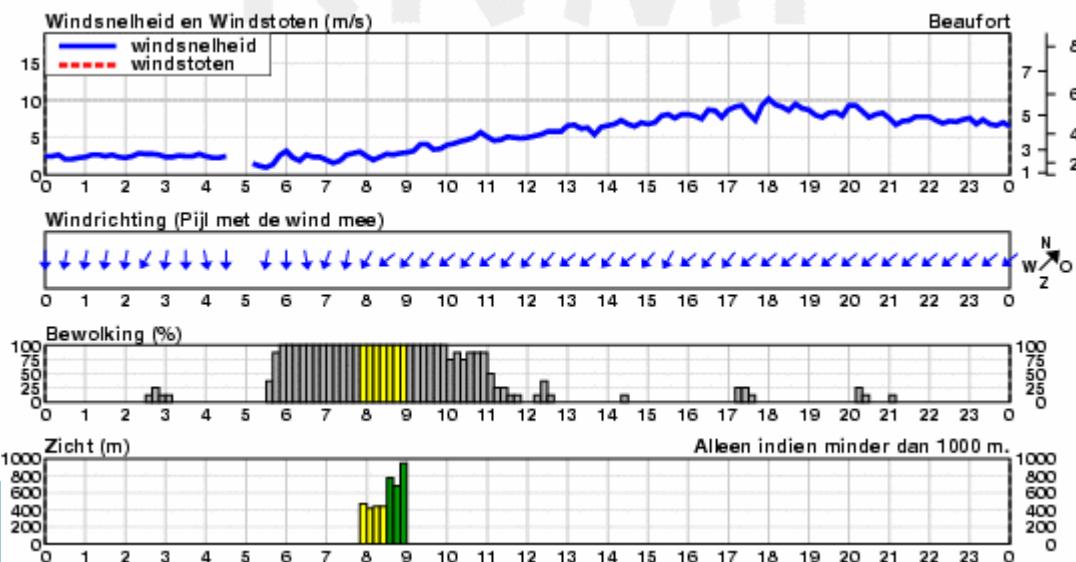


## 10-minuut waarnemingen Schiphol 00:00 uur

# Fog: 1<sup>st</sup> April 2009



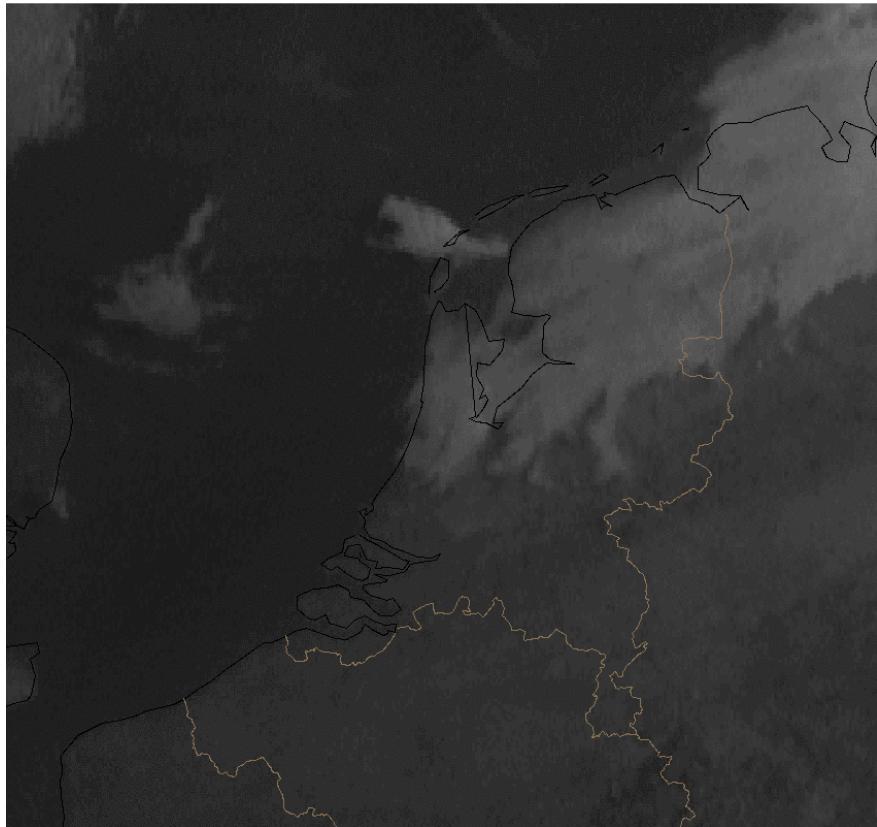
Fog at Schiphol at important time slot





# Fog: observations

MSG EUROPE POLAR HIRES VIS Wed 01 Apr 2009 0600z

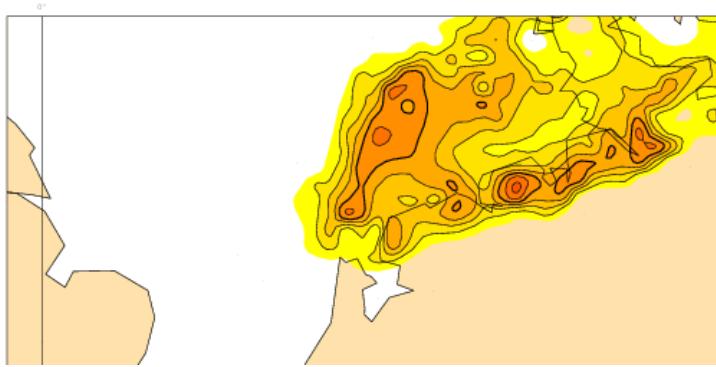


- Wind decreases,  
warm front with high humidity  
negligible influence Amsterdam
- Fog field very irregular

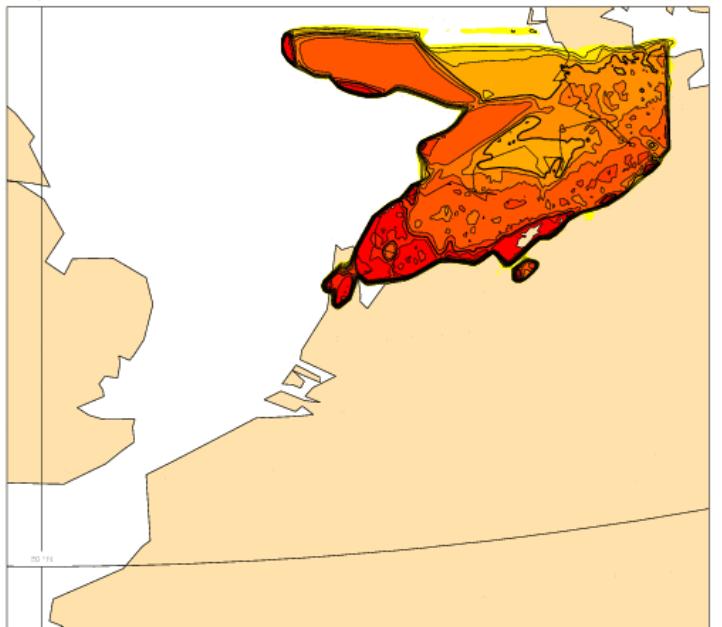


# Fog: Hirlam vs HARMONIE

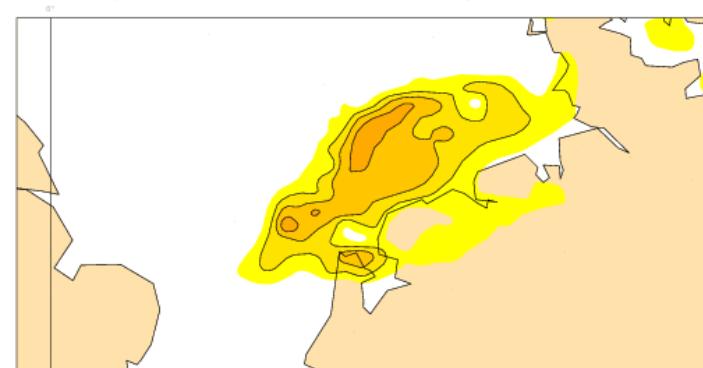
Wednesday 1 April 2009 00UTC HELKI Forecast t+6 VT: Wednesday 1 April 2009 06UTC 1000hPa cloud water



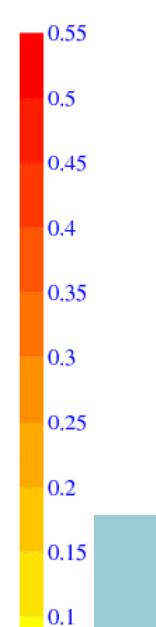
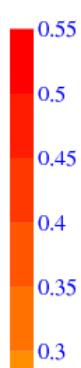
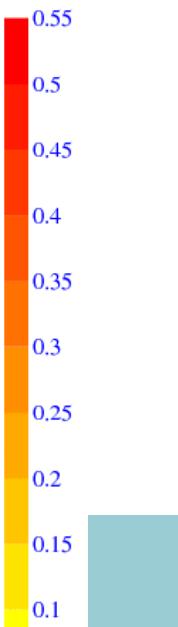
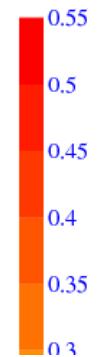
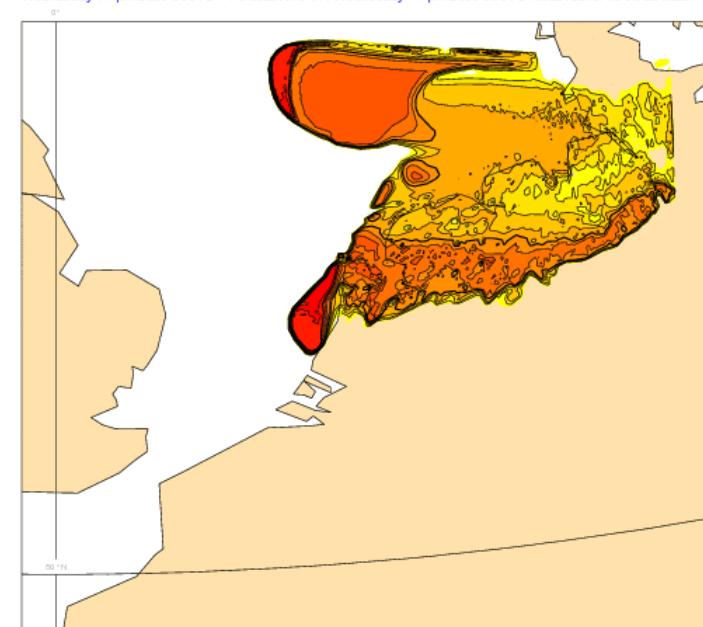
Wednesday 1 April 2009 00UTC Forecast t+6 VT: Wednesday 1 April 2009 06UTC Model Level 40 cloud water



Wednesday 1 April 2009 00UTC HELKI Forecast t+9 VT: Wednesday 1 April 2009 09UTC 1000hPa cloud water



Wednesday 1 April 2009 00UTC Forecast t+9 VT: Wednesday 1 April 2009 09UTC Model Level 40 cloud water





# CHAPEAU, academic version

Common Hirlam Aladin Package for Educational and Academic Use

## Objective

- › HARMONIE being used at various academic institutions to facilitate continuous development
  - » Internet distribution
  - » On local computer
  - » Support for experiments
    - scenario's: easy modification of input
    - Parameterization/sensitivity studies
    - source code modification

# Academic version

- use the WRF interface
- Single core: local code
- Ensure data portability
- Simplify Harmonie
  - No assimilation
  - ...

