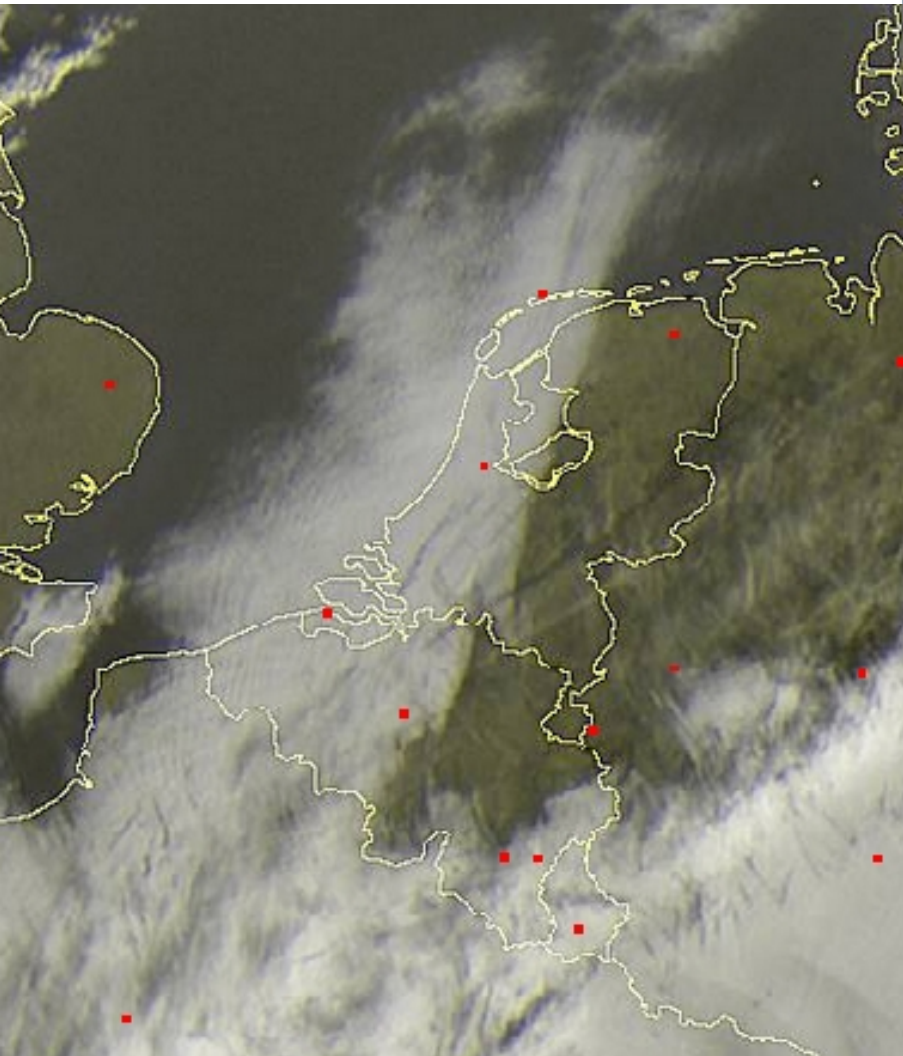




Royal Netherlands  
Meteorological Institute (KNMI)  
*Ministry of Infrastructure and the  
Environment*

# Experiences/Verification HARMONIE versions 36 & 38

Sander Tijm  
KNMI





## Question:

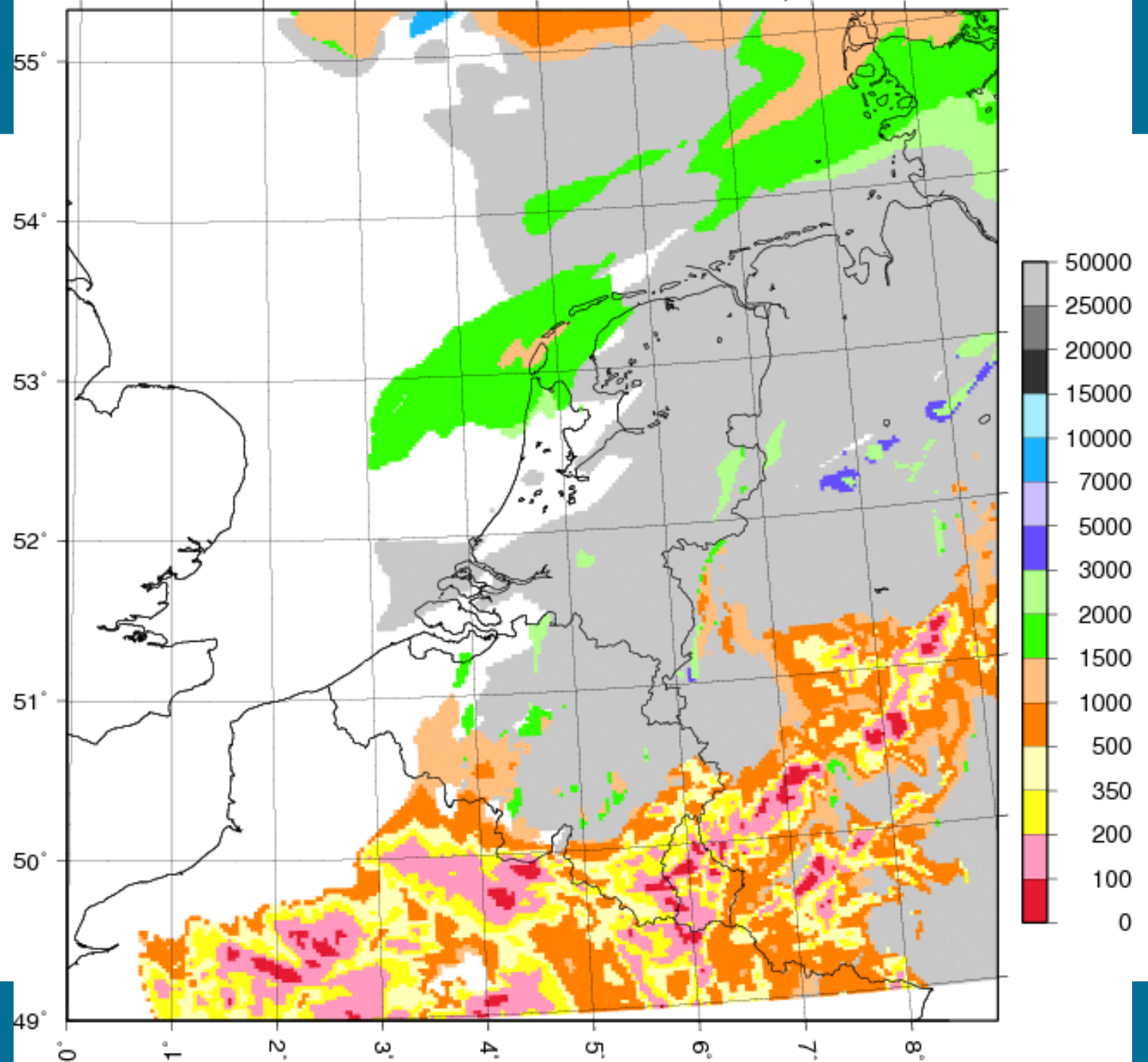
- Still running 36h1.4 operationally
- Should we move to 38h1.2 or not?



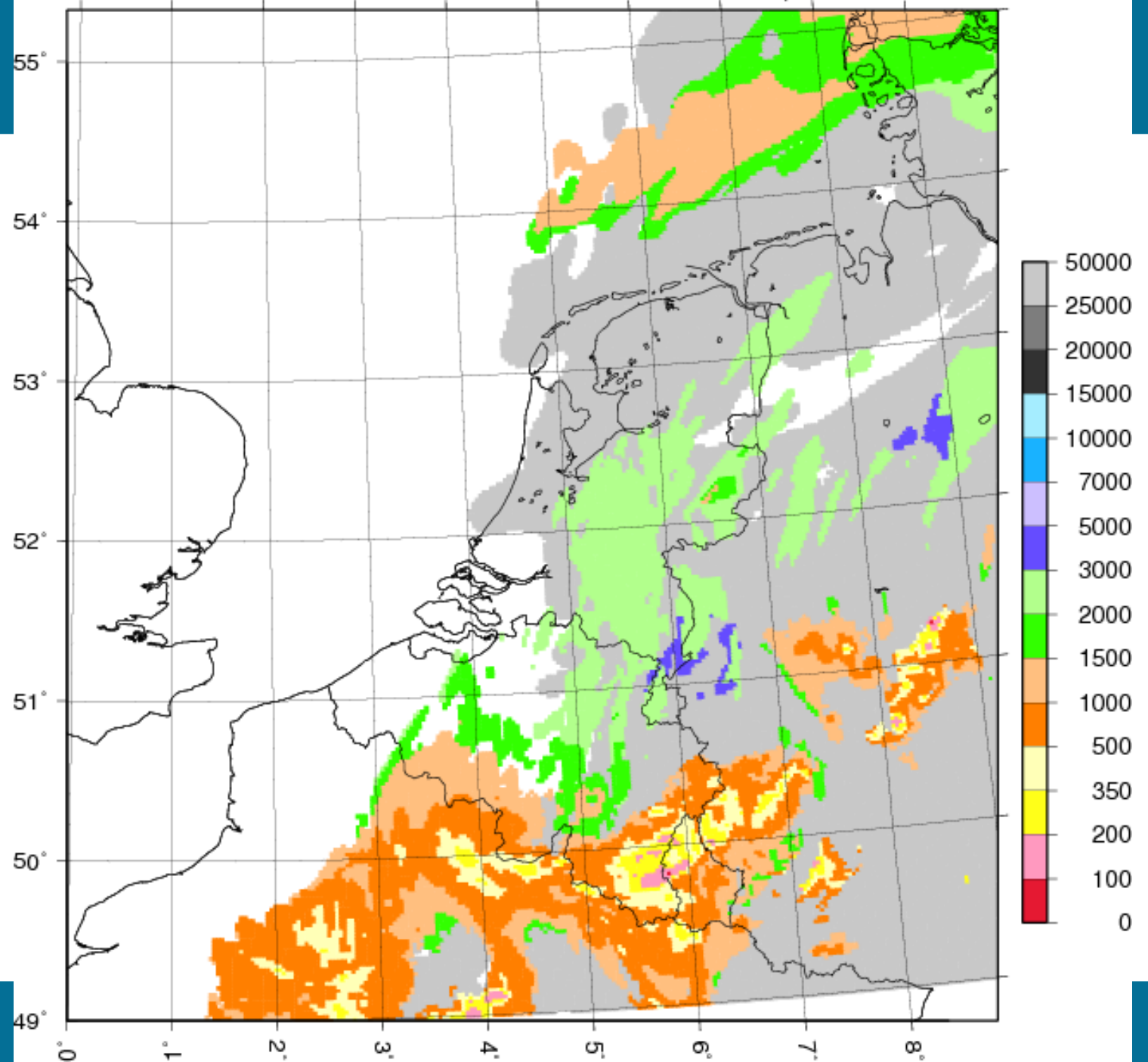
## Answer through validation/verification:

- Two cases met low clouds/fog Autumn 2014
- Verification:
  - Cloud cover
  - Temperature
  - Wind gusts
- Microphysics
- Snow

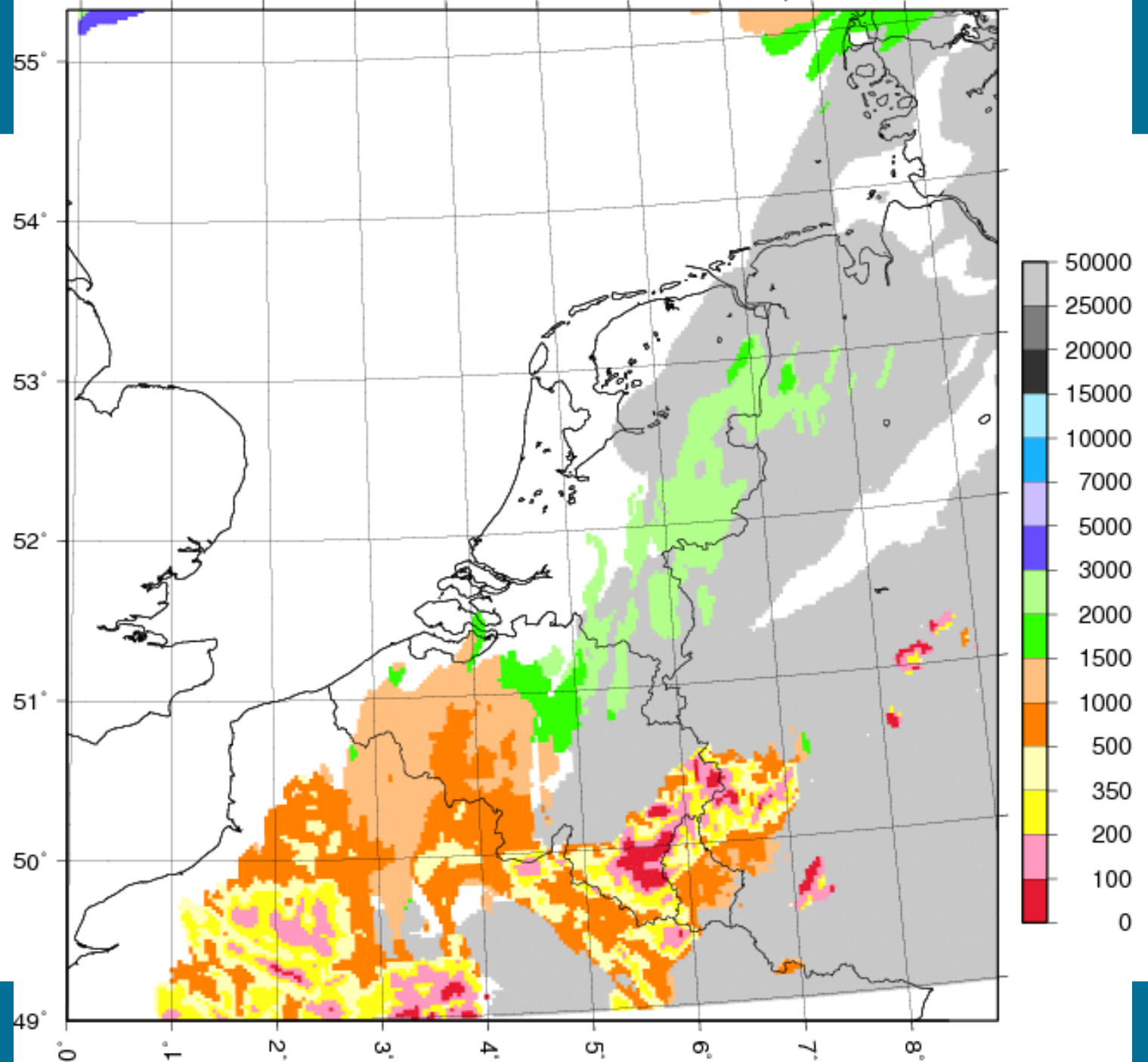
HARM36 cloud base an 2014102703 val 27 - 10, 12 UTC



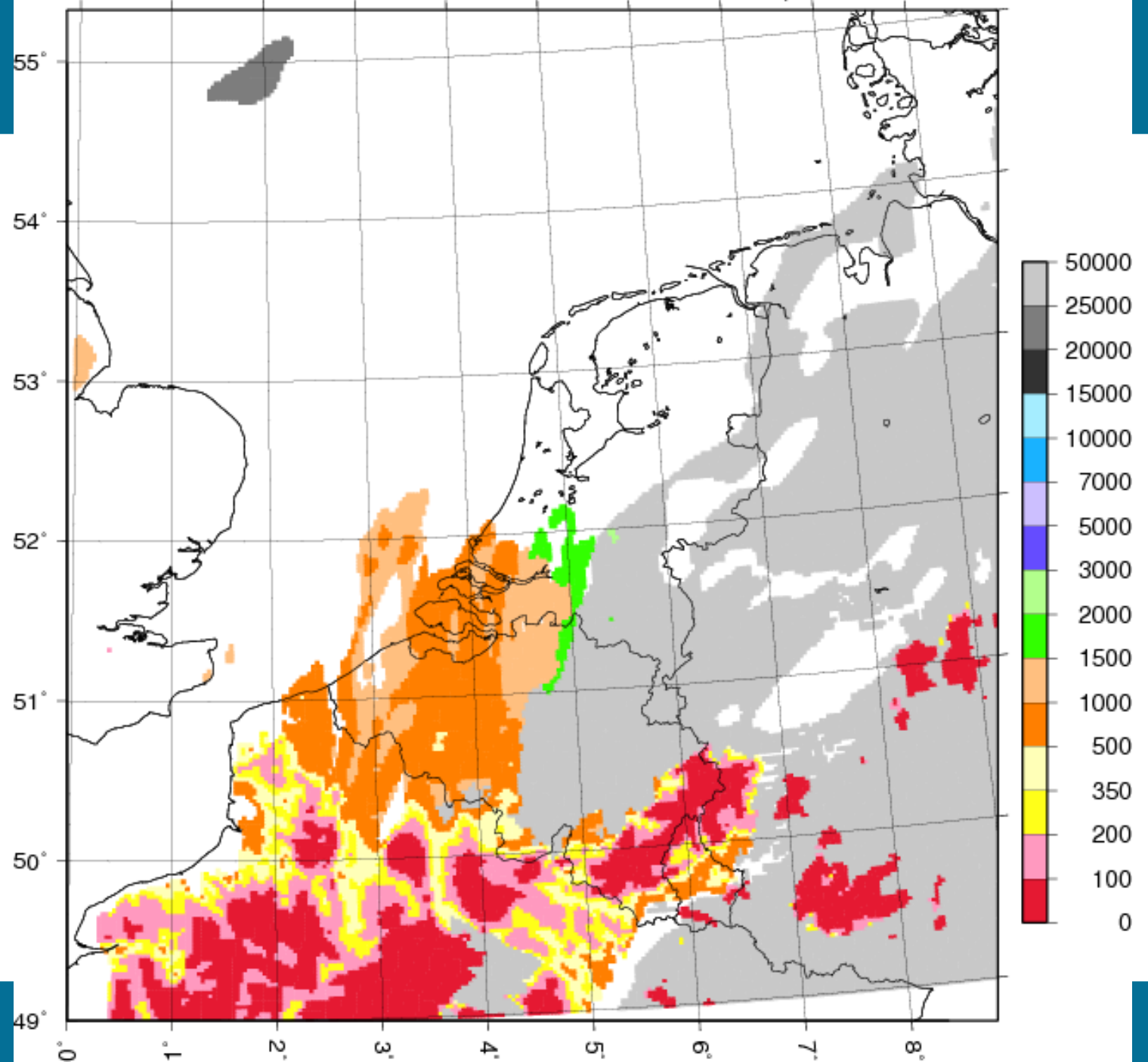
HARM36 cloud base an 2014102703 val 27 - 10, 15 UTC



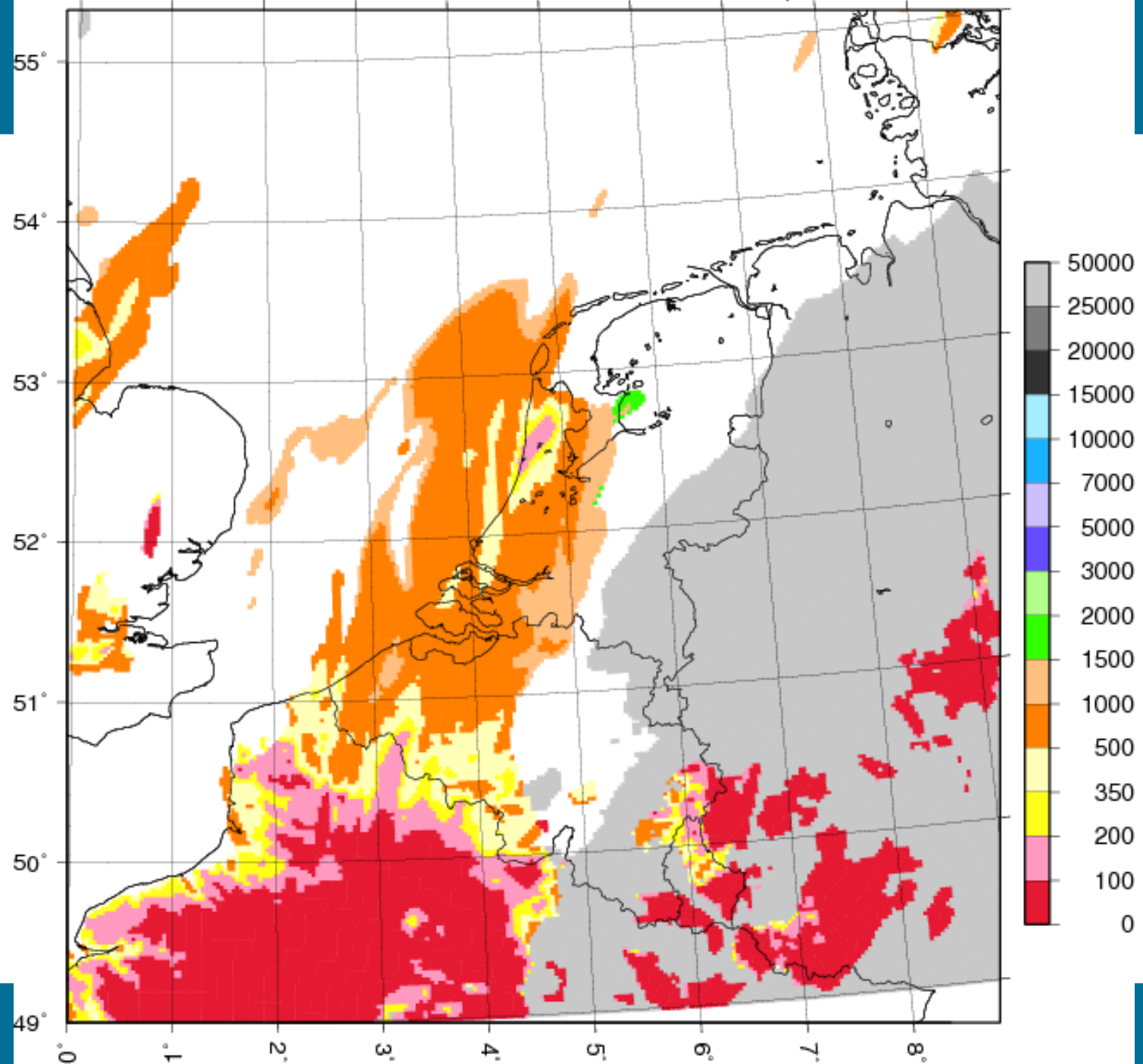
HARM36 cloud base an 2014102703 val 27 - 10, 18 UTC



HARM36 cloud base an 2014102703 val 27 - 10, 21 UTC

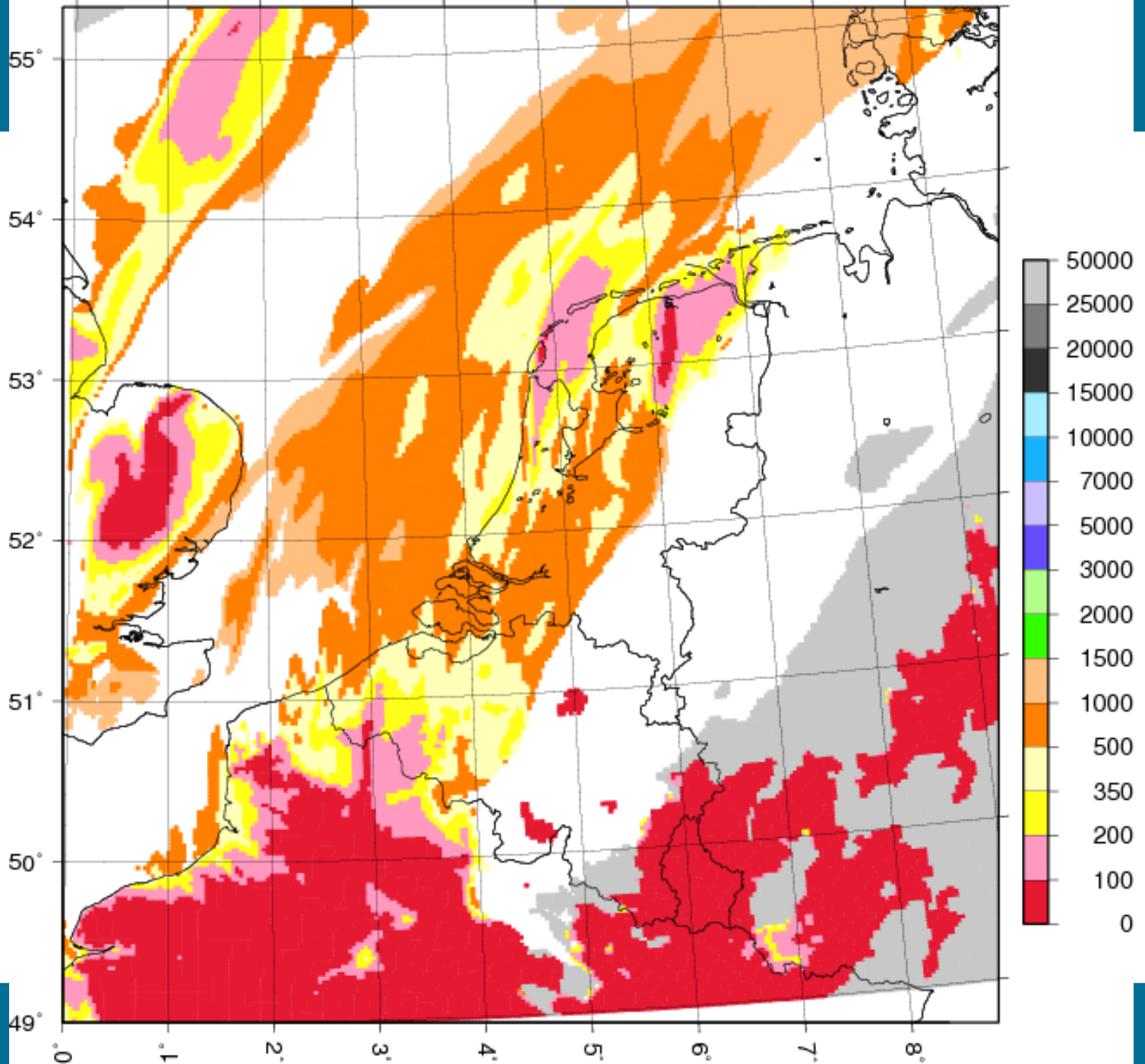


HARM36 cloud base an 2014102703 val 28 - 10, 00 UTC

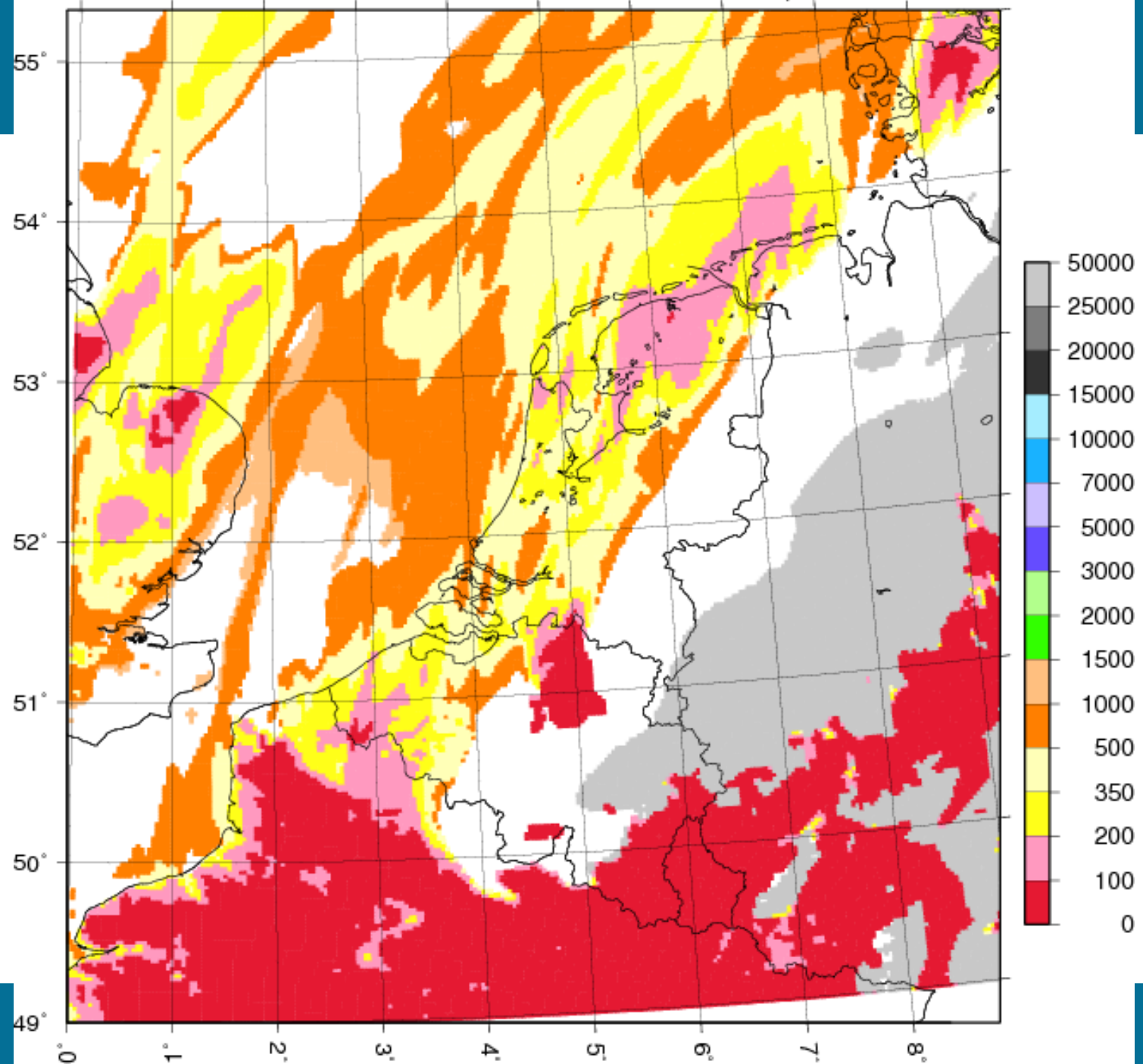


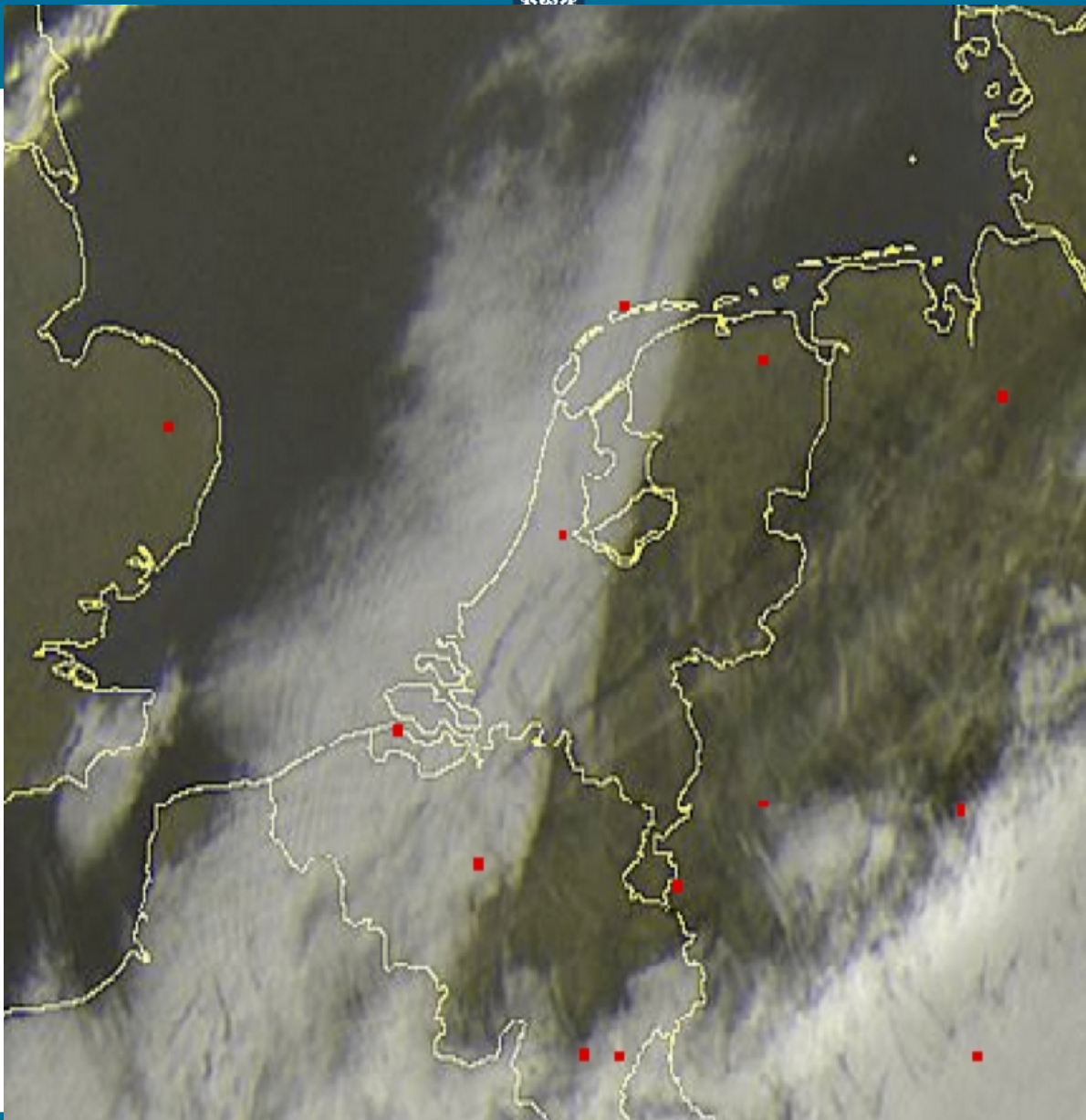


HARM36 cloud base an 2014102703 val 28 - 10, 03 UTC

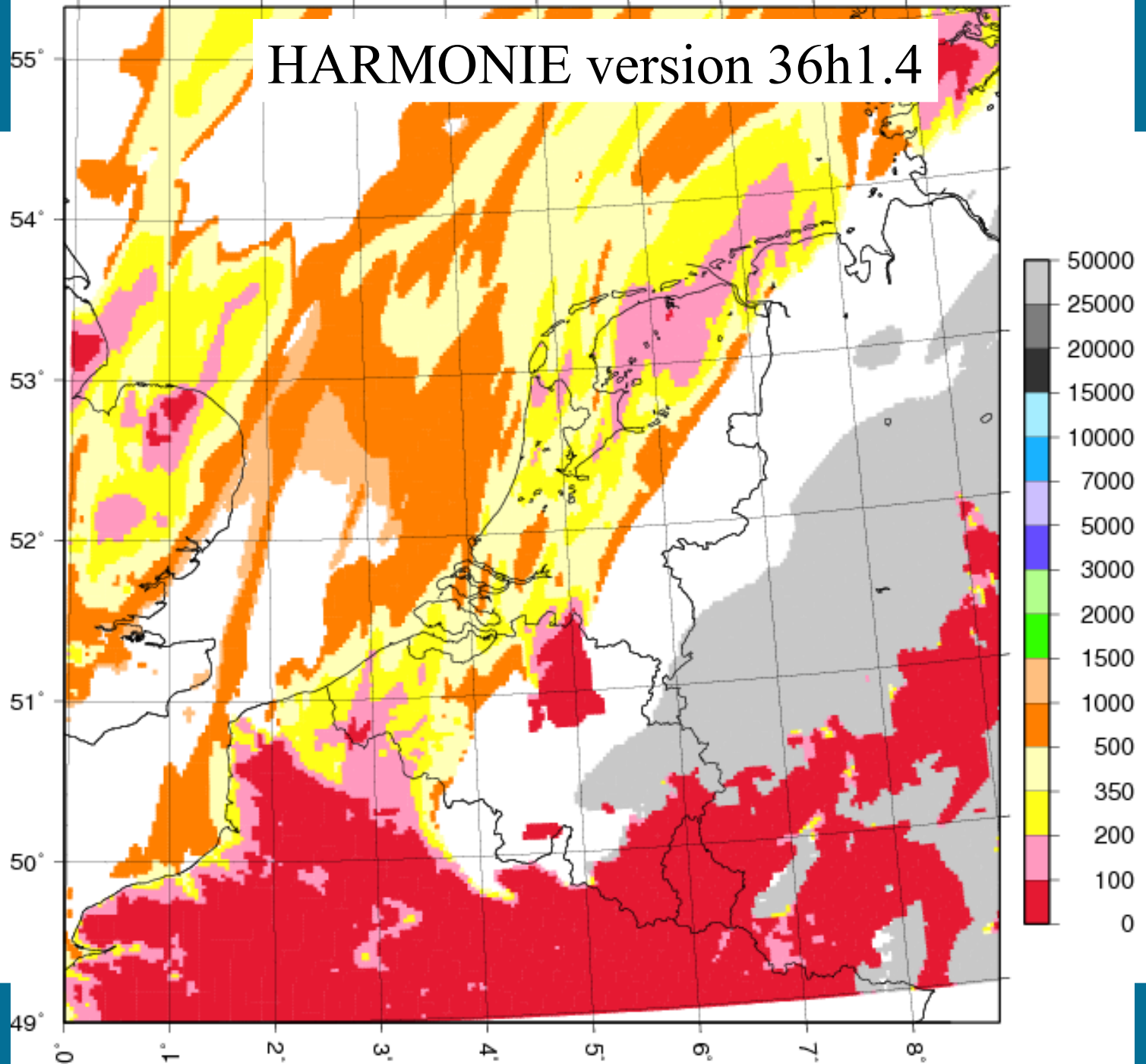


HARM36 cloud base an 2014102703 val 28 - 10, 06 UTC

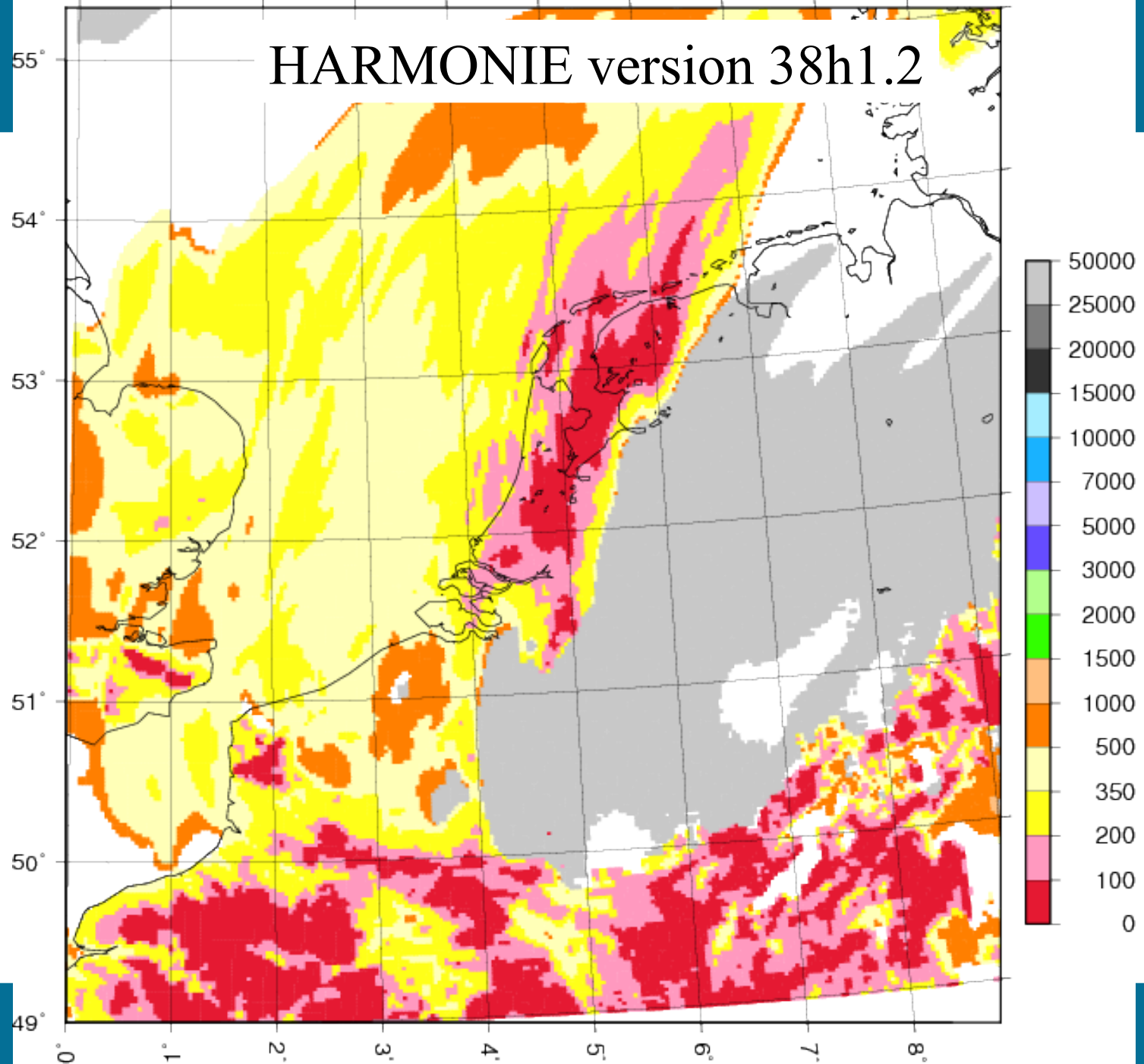




# HARMONIE version 36h1.4



# HARMONIE version 38h1.2

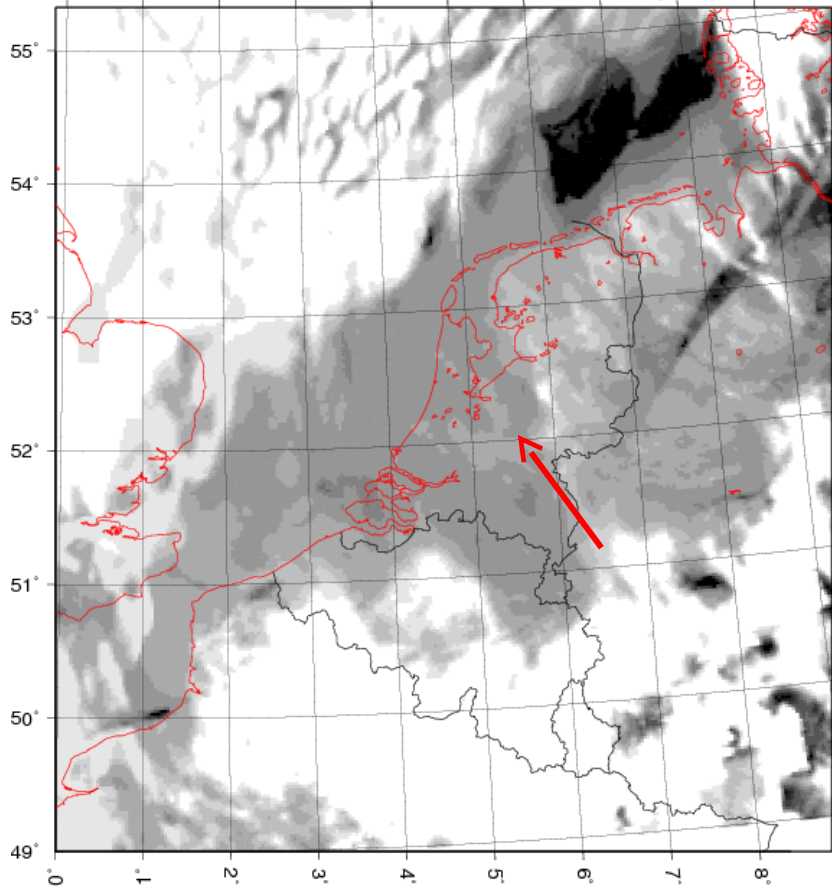




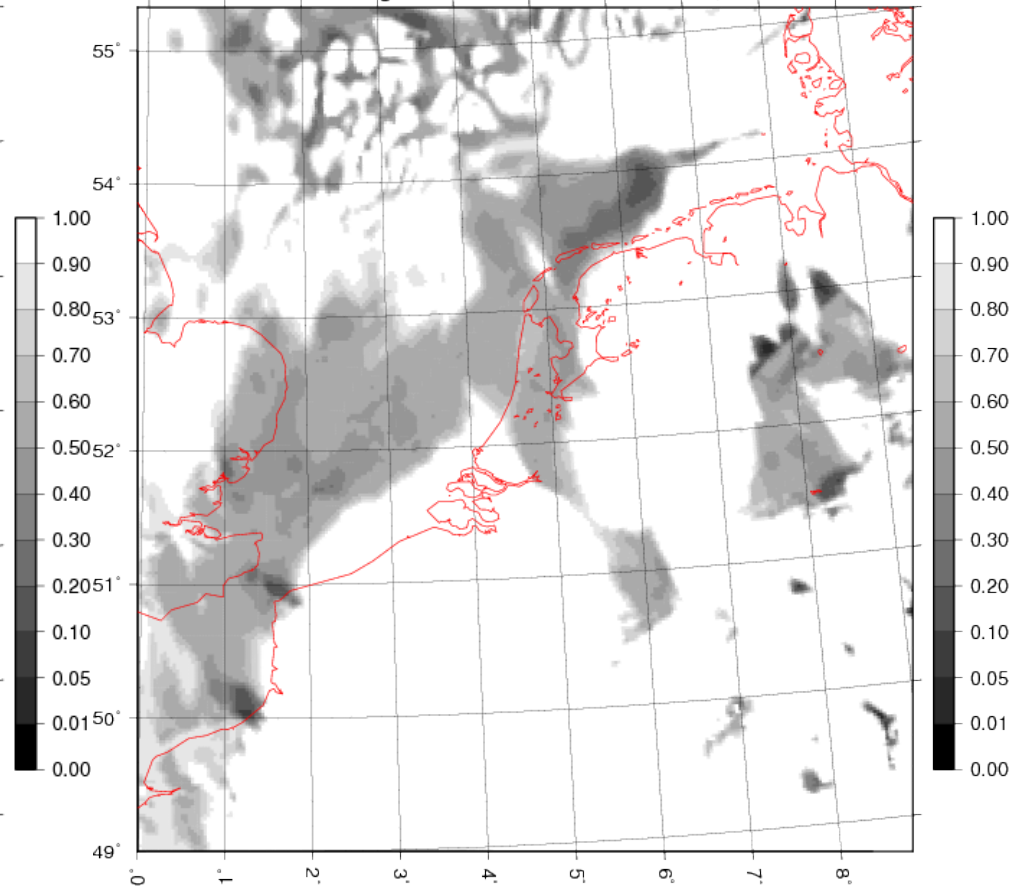
# 36h1.4

# 38h1.1

HARM36 Cloud cover an 2014111012 val 11 – 11, 06 UTC



HA38 bewolking an 2014111012 val 11 – 11, 6 UTC

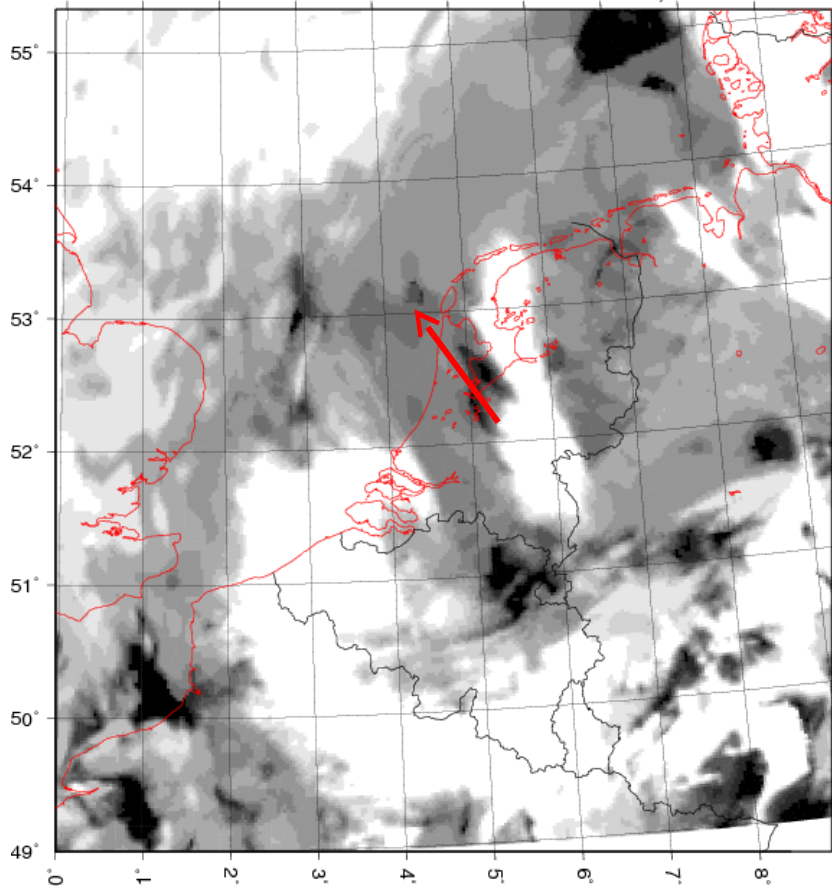




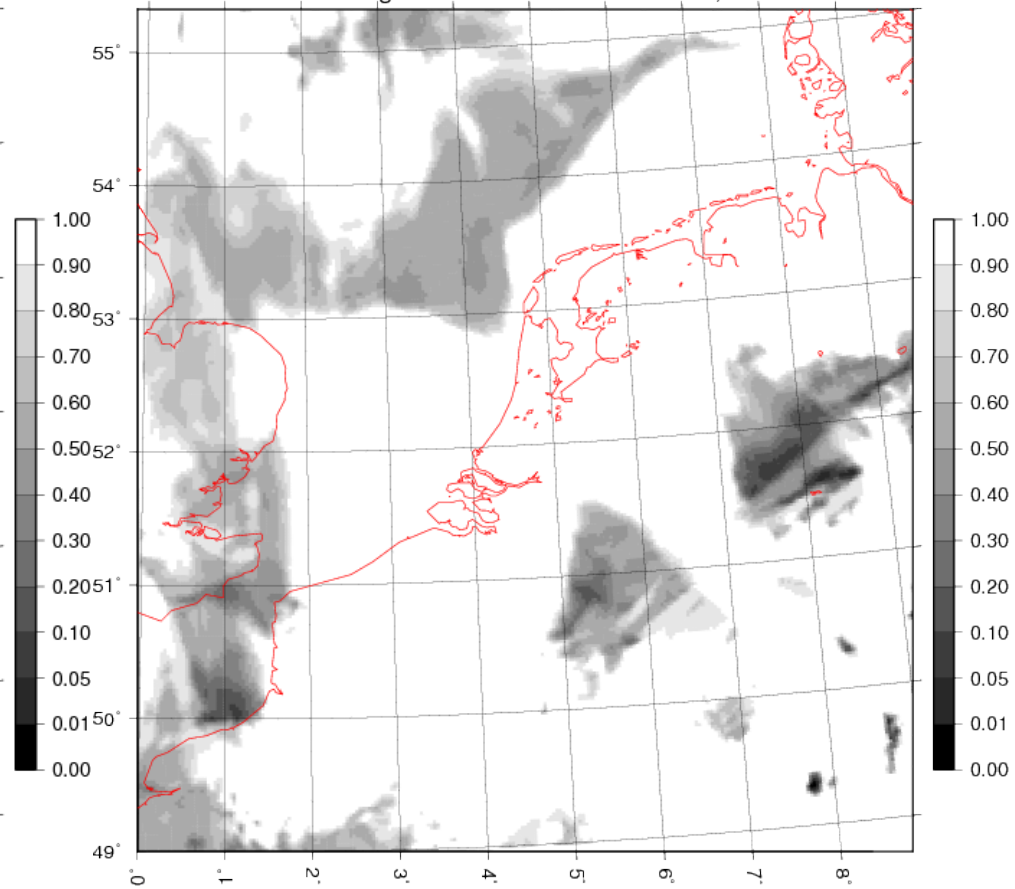
# 36h1.4

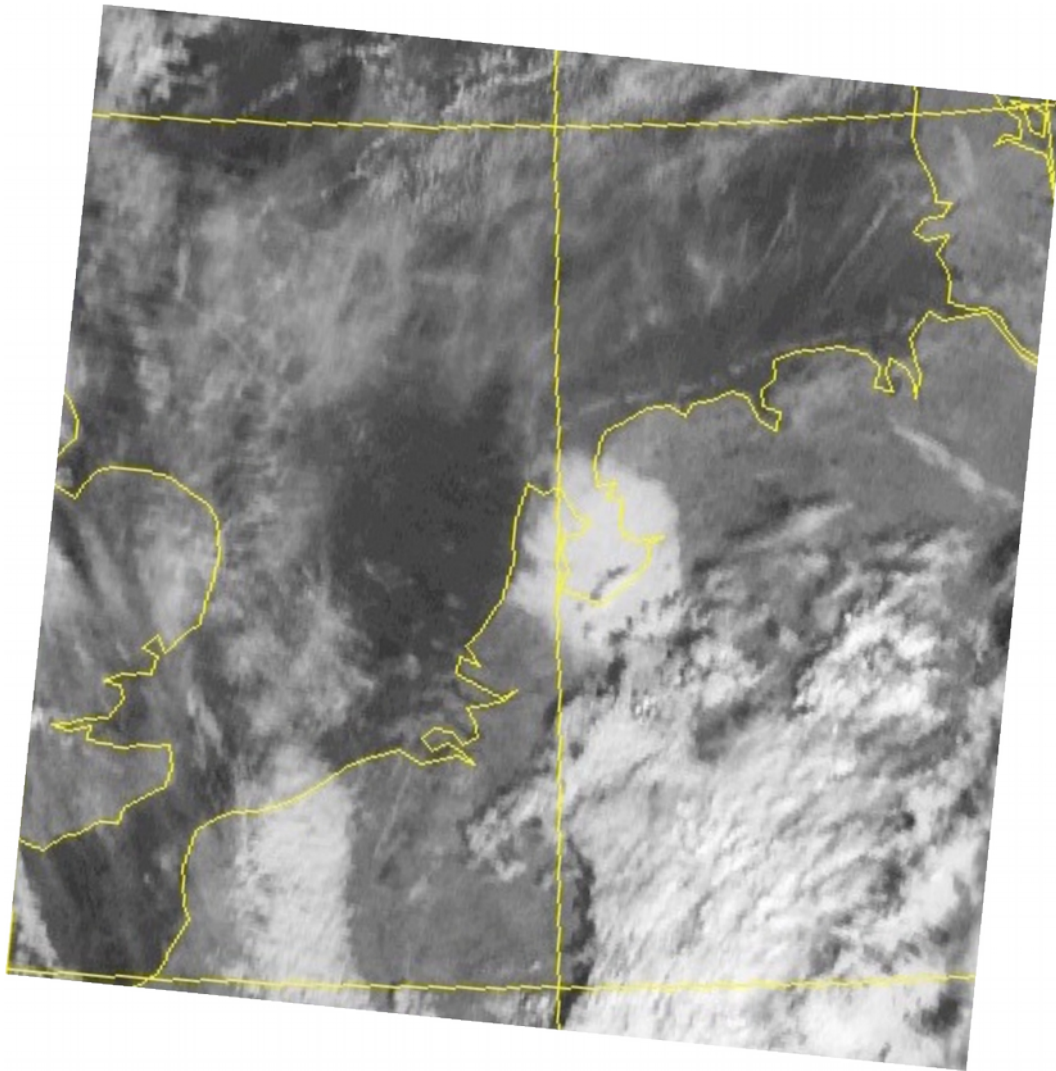
# 38h1.1

HARM36 Cloud cover an 2014111012 val 11 – 11, 09 UTC



HA38 bewolking an 2014111012 val 11 – 11, 9 UTC





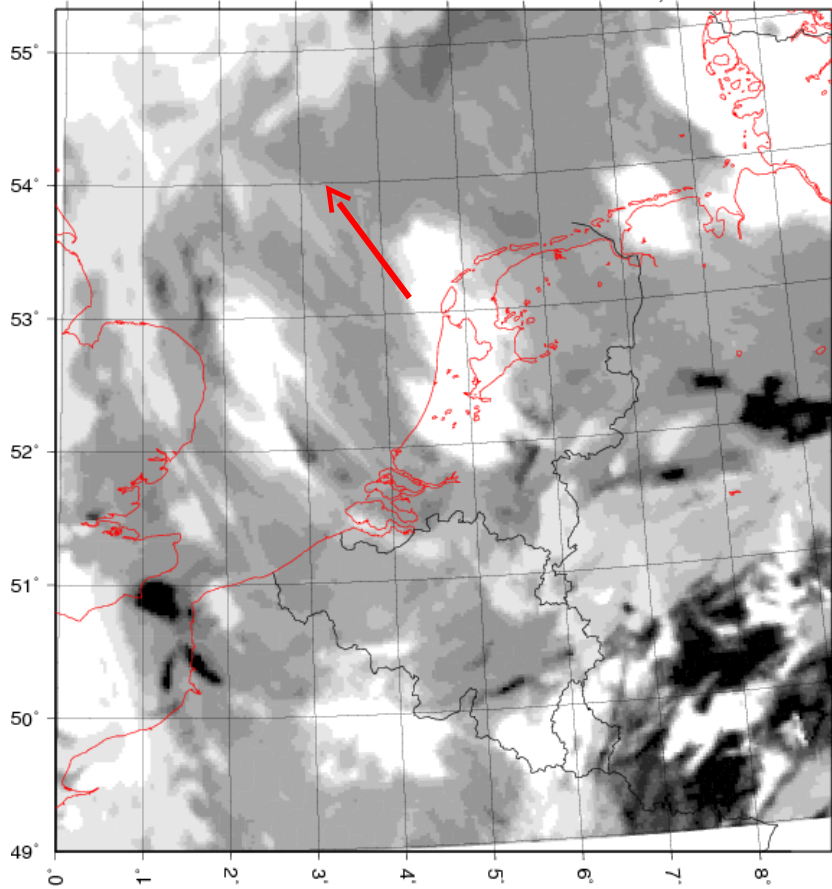




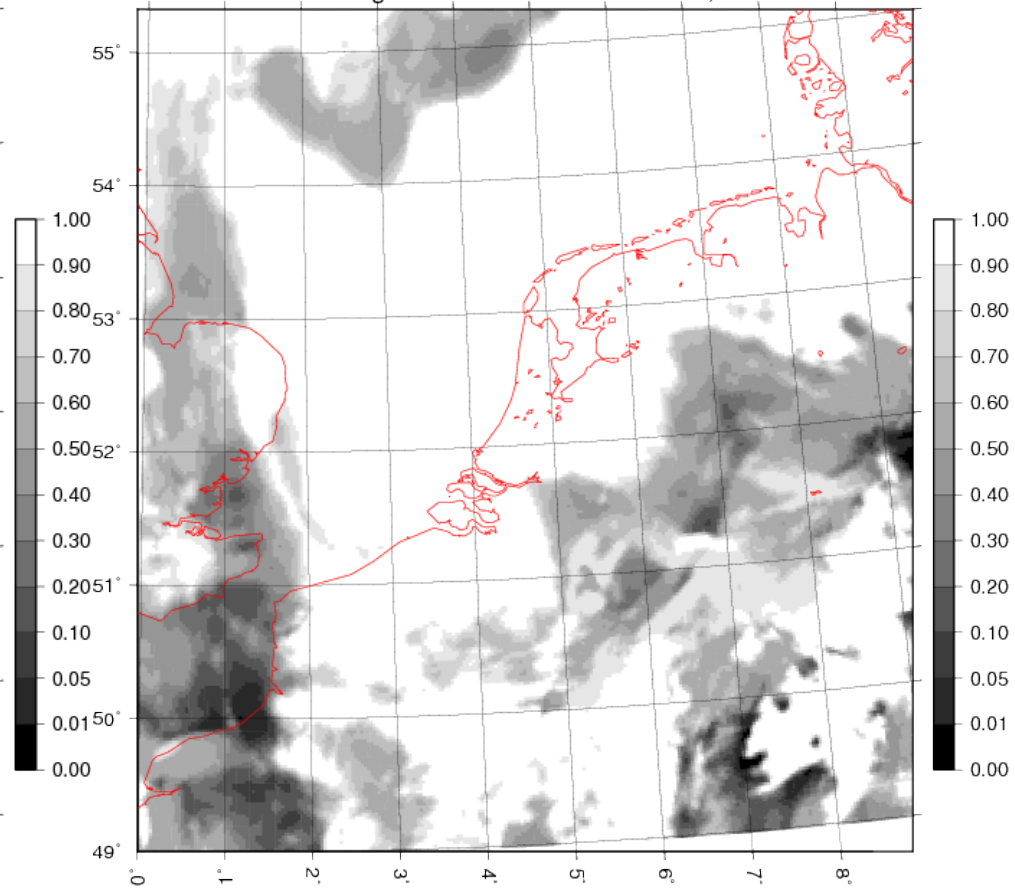
# 36h1.4

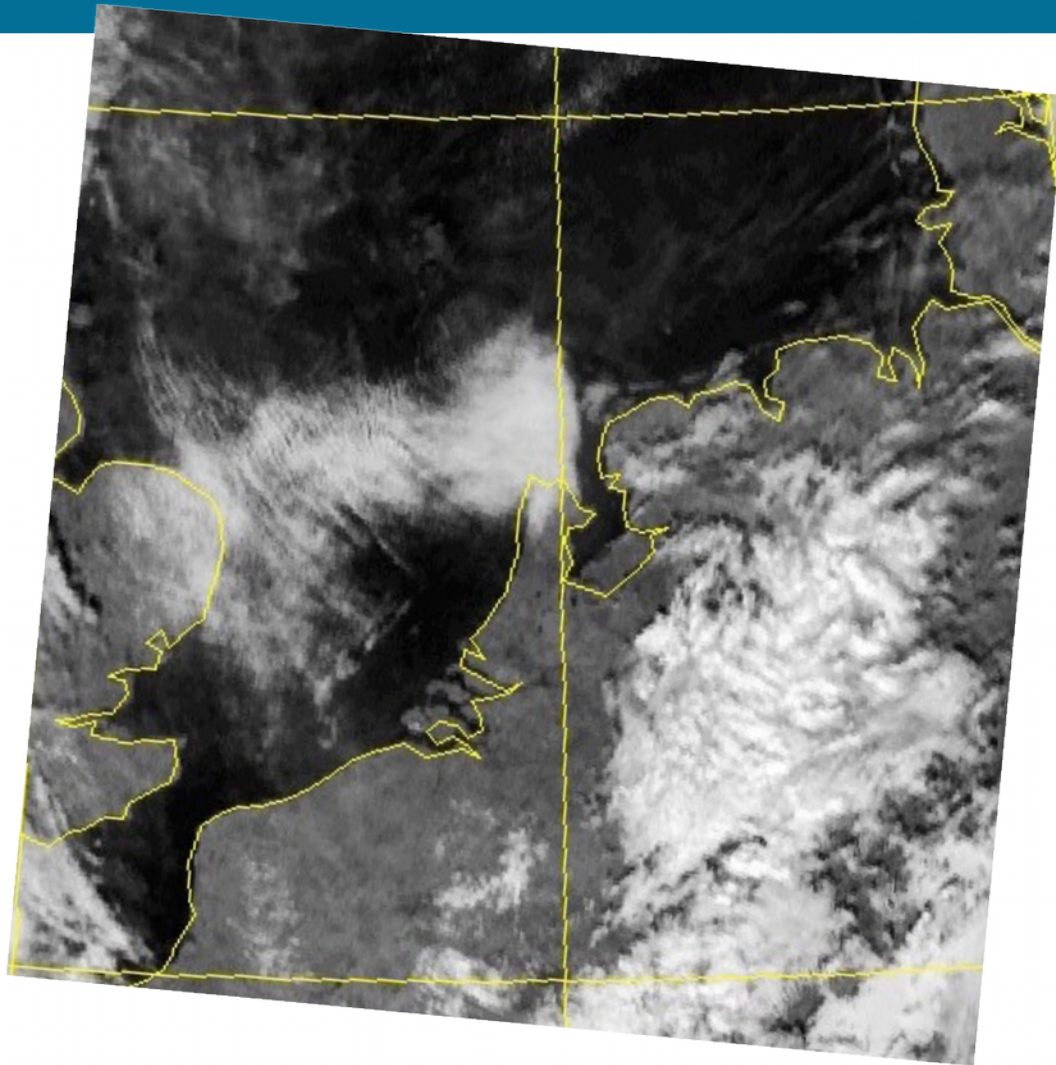
# 38h1.1

HARM36 Cloud cover an 2014111012 val 11 - 11, 12 UTC



HA38 bewolking an 2014111012 val 11 - 11, 12 UTC







## Low clouds experiences

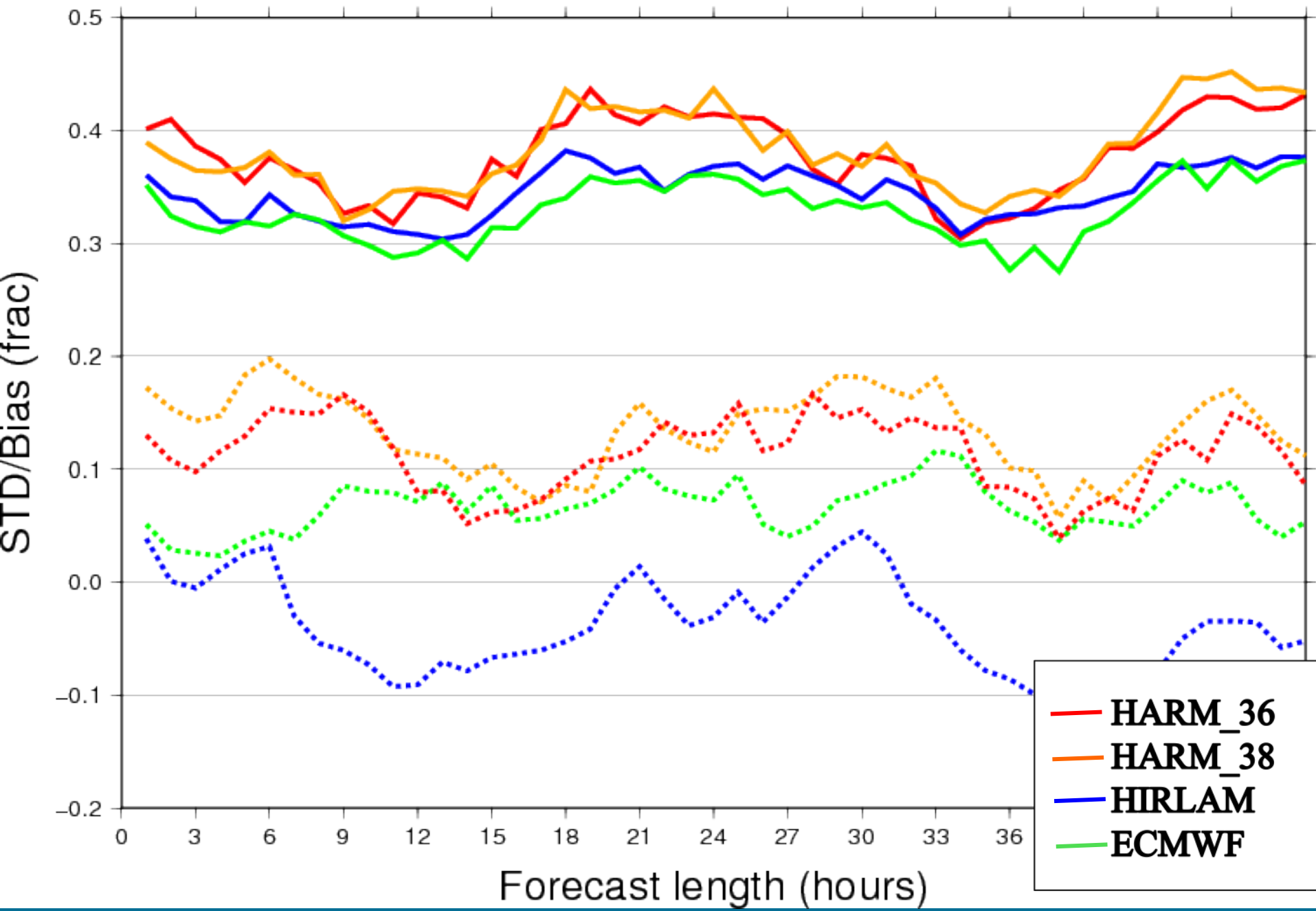
- HARMONIE version 36 gives quite good signals for low clouds and fog when fog and low clouds develop over land and are advected towards NL, and when temperatures are not too low
- HARMONIE version 38 more often overestimates the low clouds and fog cases
- The problems over sea remain the same or increase in version 38, due to increased fog/low clouds and dewpoint temperature over land



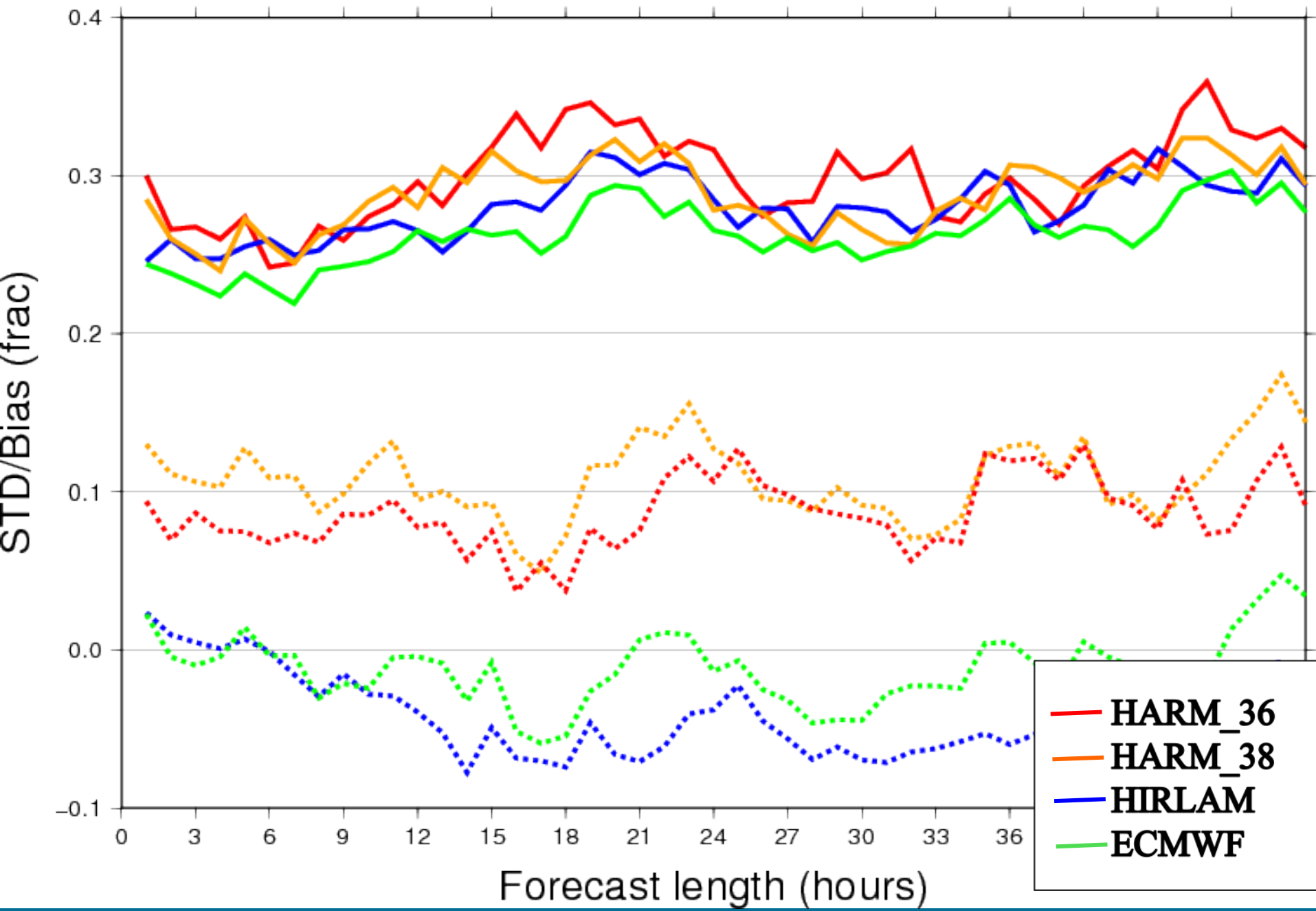
## Objective verification

- Timeseries made on station locations in the Netherlands and North Sea, selection of stations or areas afterwards possible (similar to HIRLAM/HARMONIE verification system)
- Models: Hirlam D11, HARMONIE version 36, HARMONIE version 38, ECMWF
- Time resolution 1 hour
- HARMONIE version 38h1.1 until December 2014, version 38h1.2 from 10 January 2015.
- Results for August, December, March

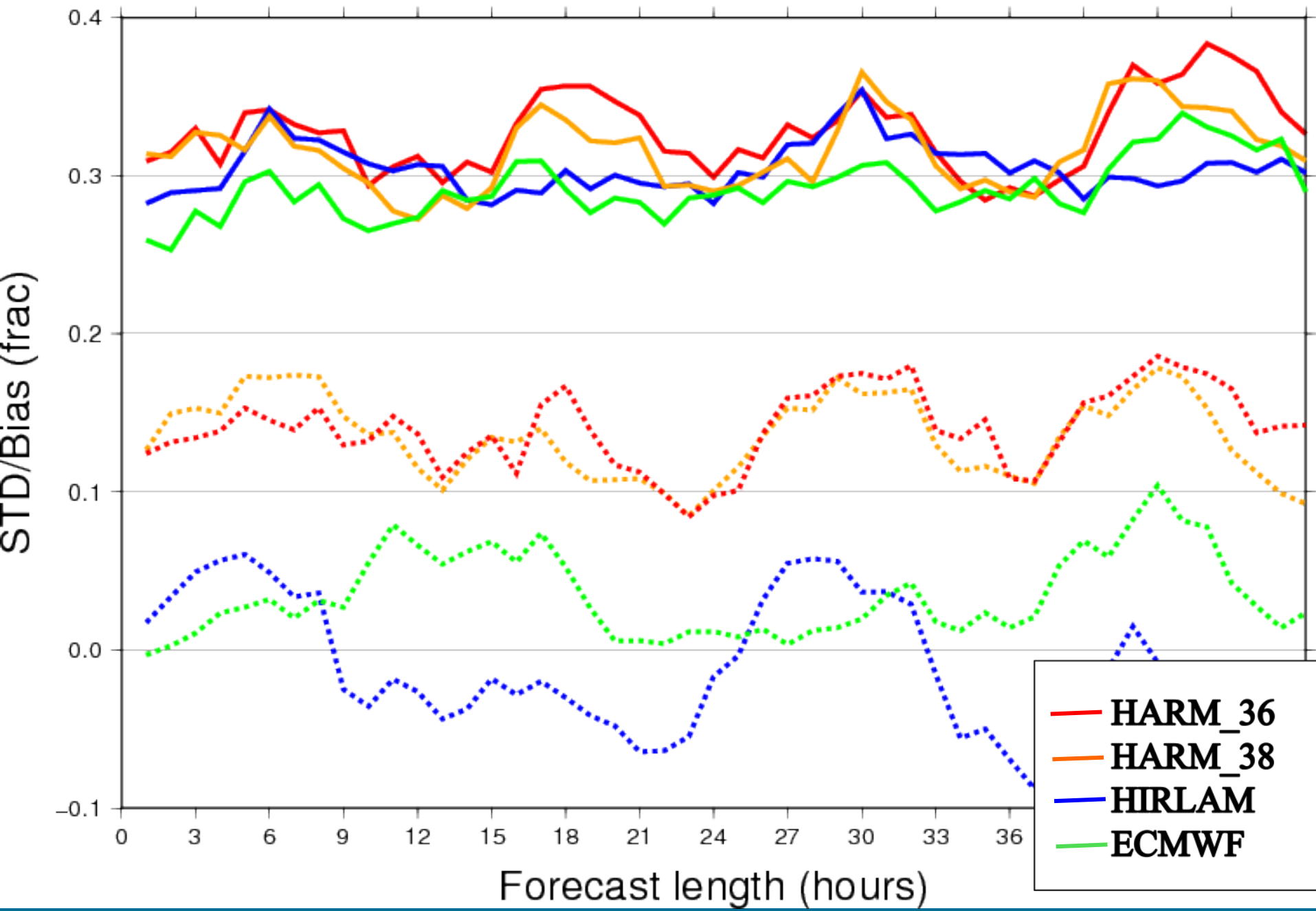
## Verif Clc 201408 an00 NL



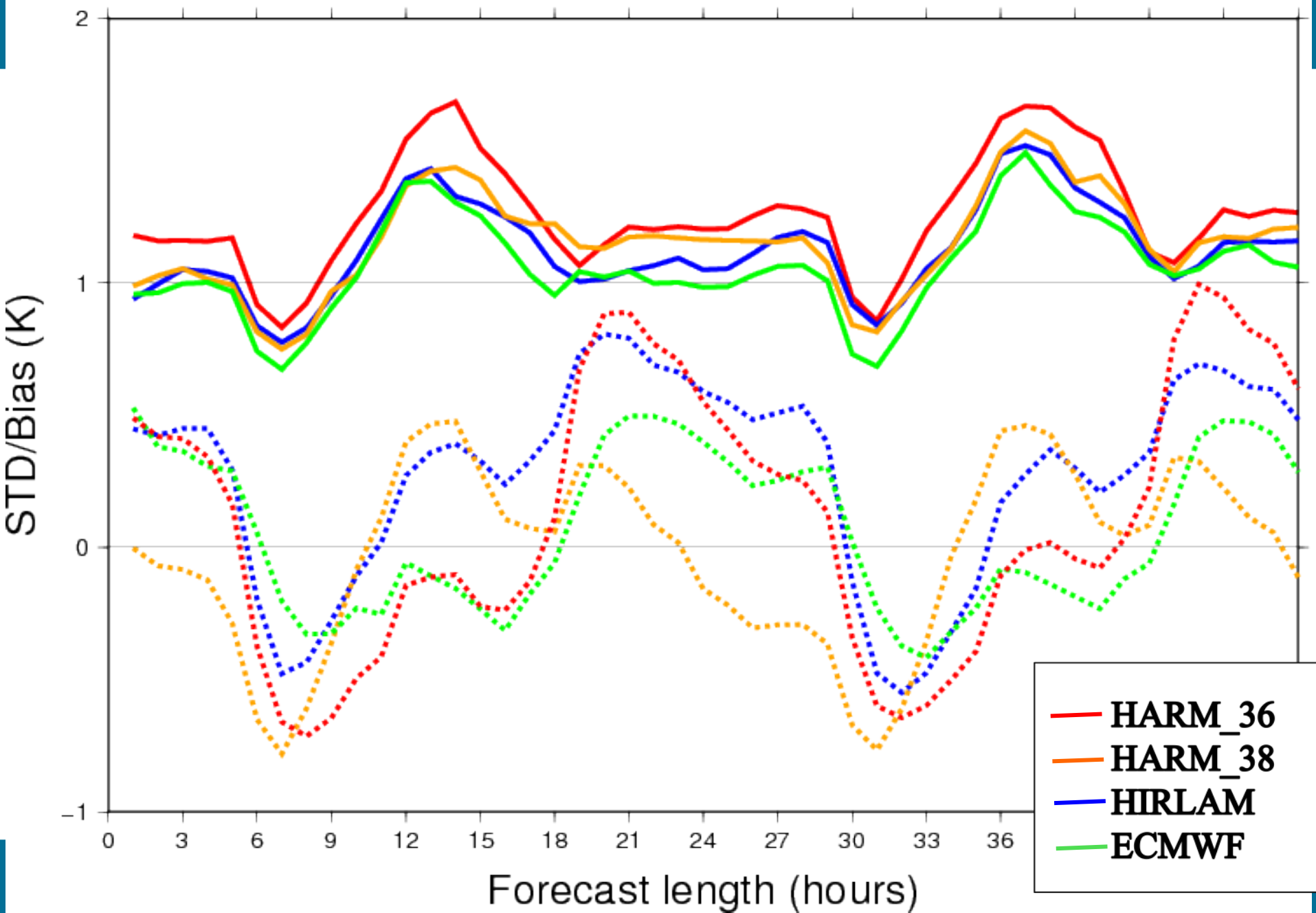
## Verif Clc 201412 an00 NL



## Verif Clc 201503 an00 NL

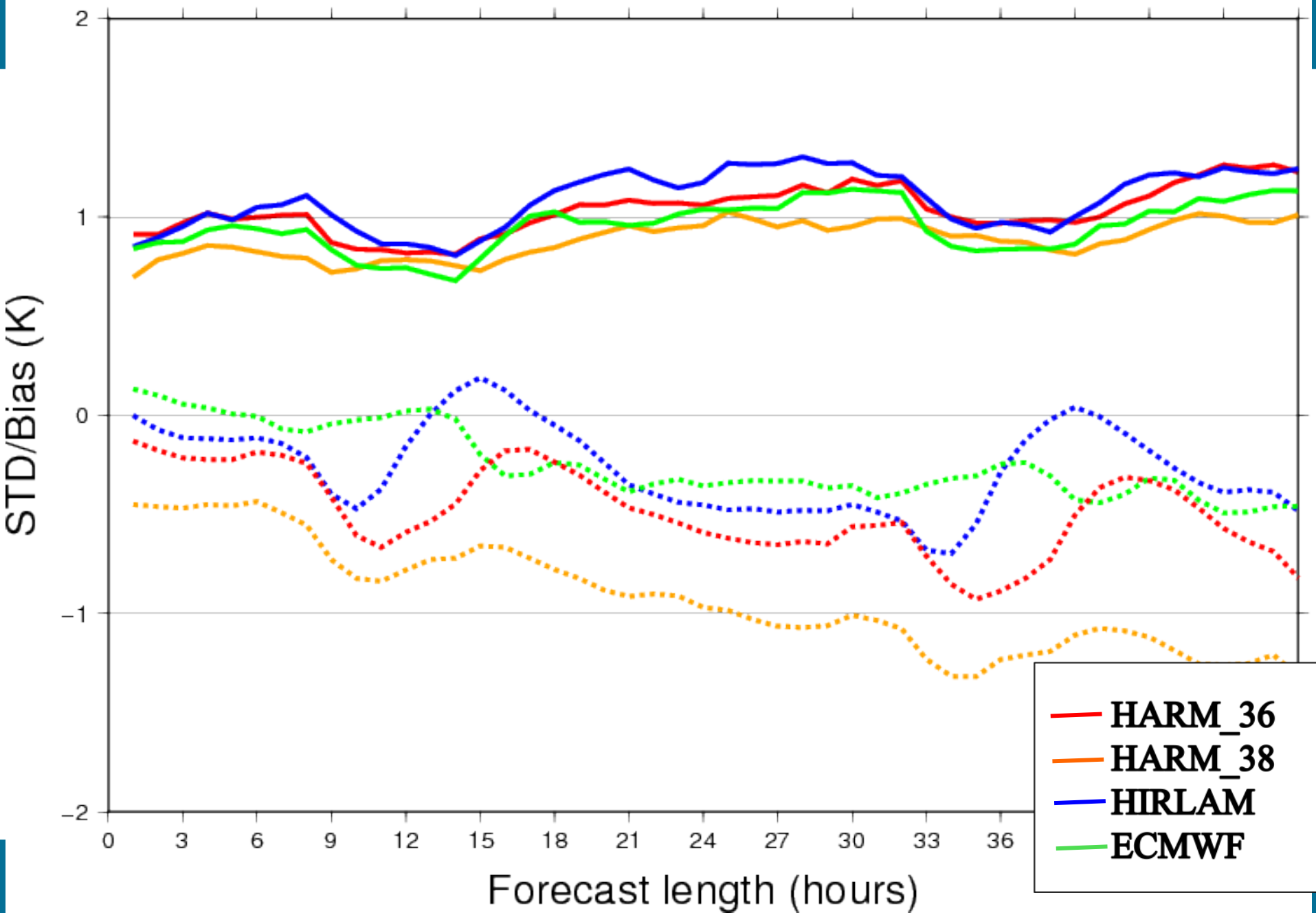


## Verif T2m 201408 an00 NL

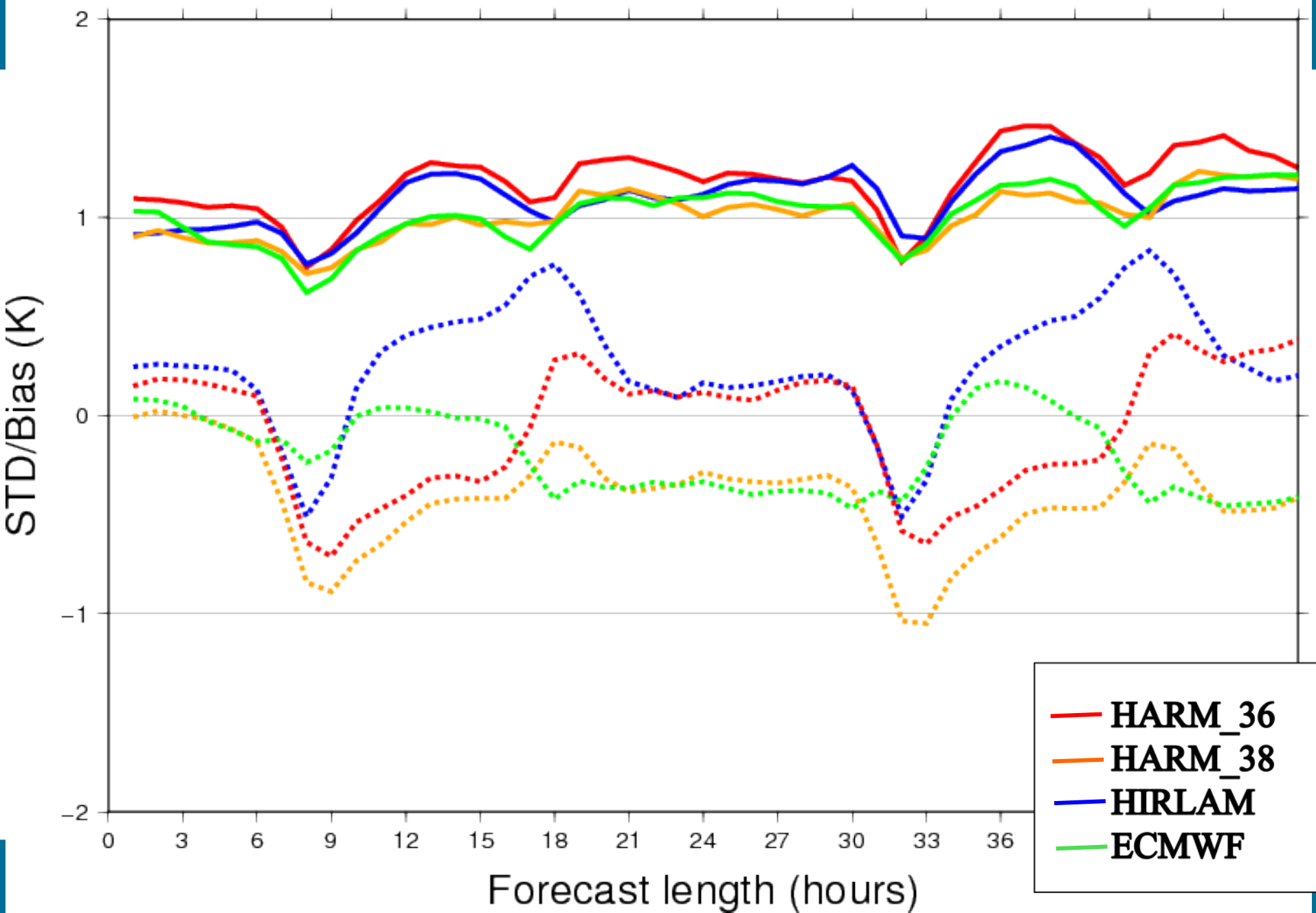


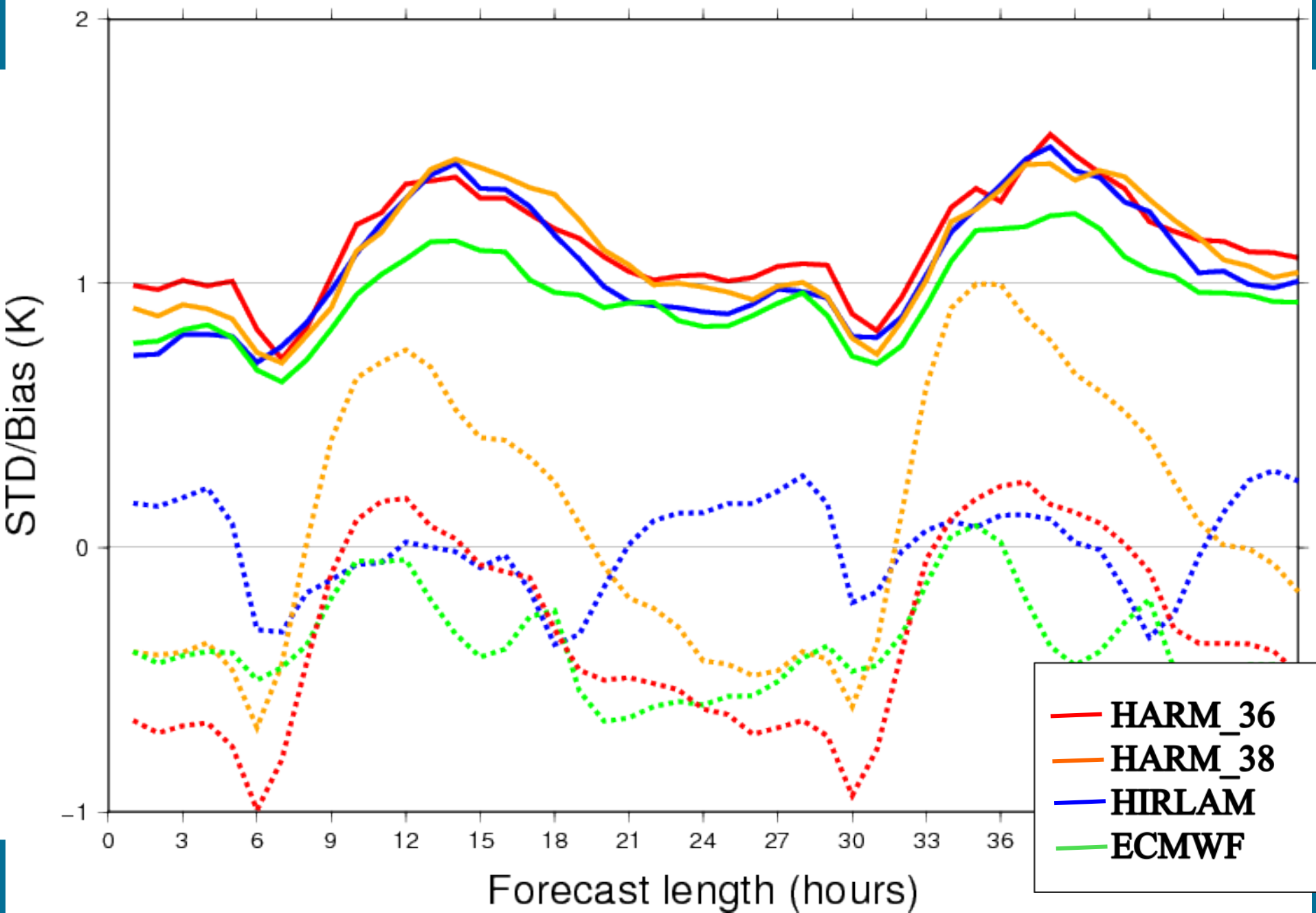


## Verif T2m 201412 an00 NL

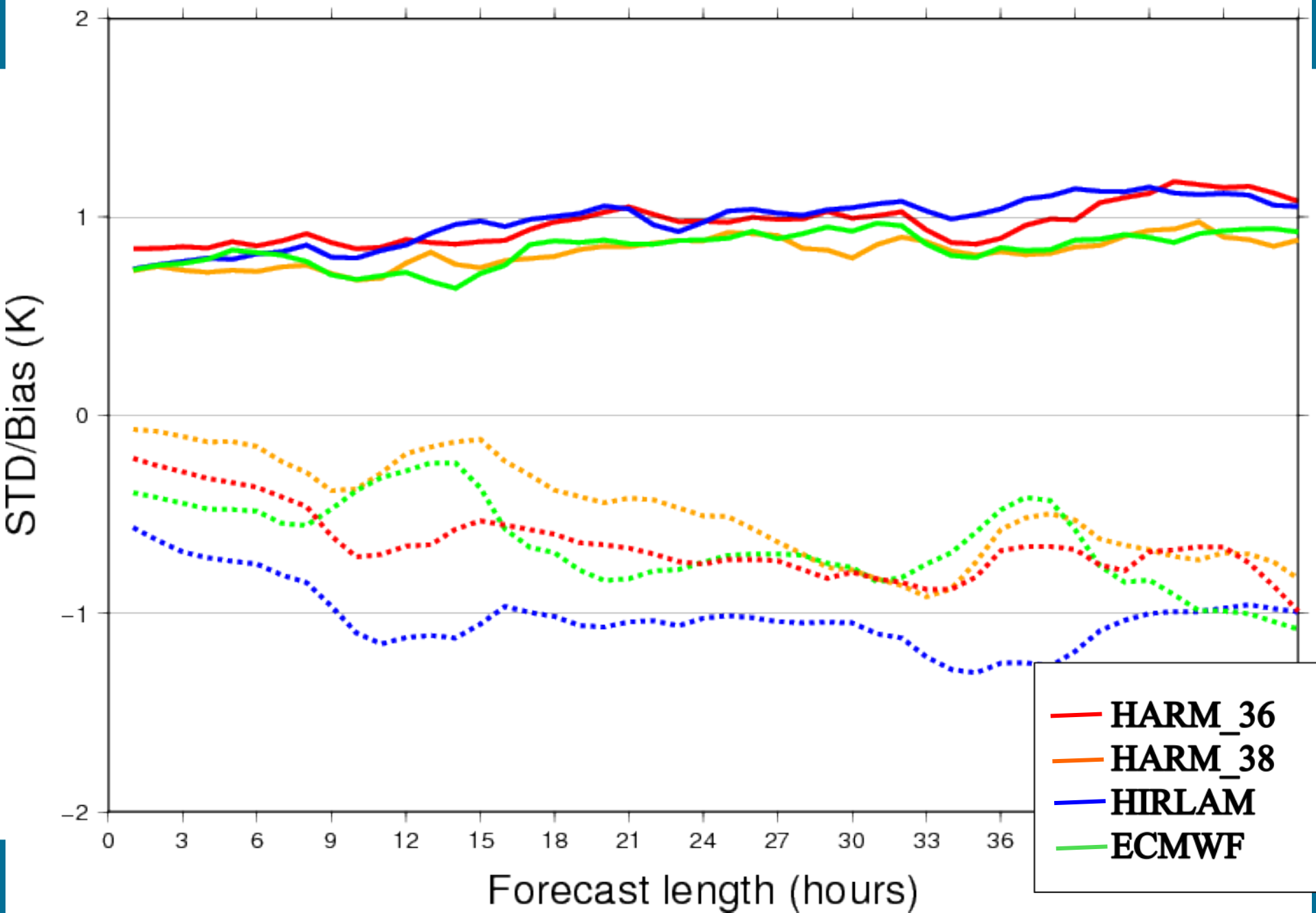


## Verif T2m 201503 an00 NL

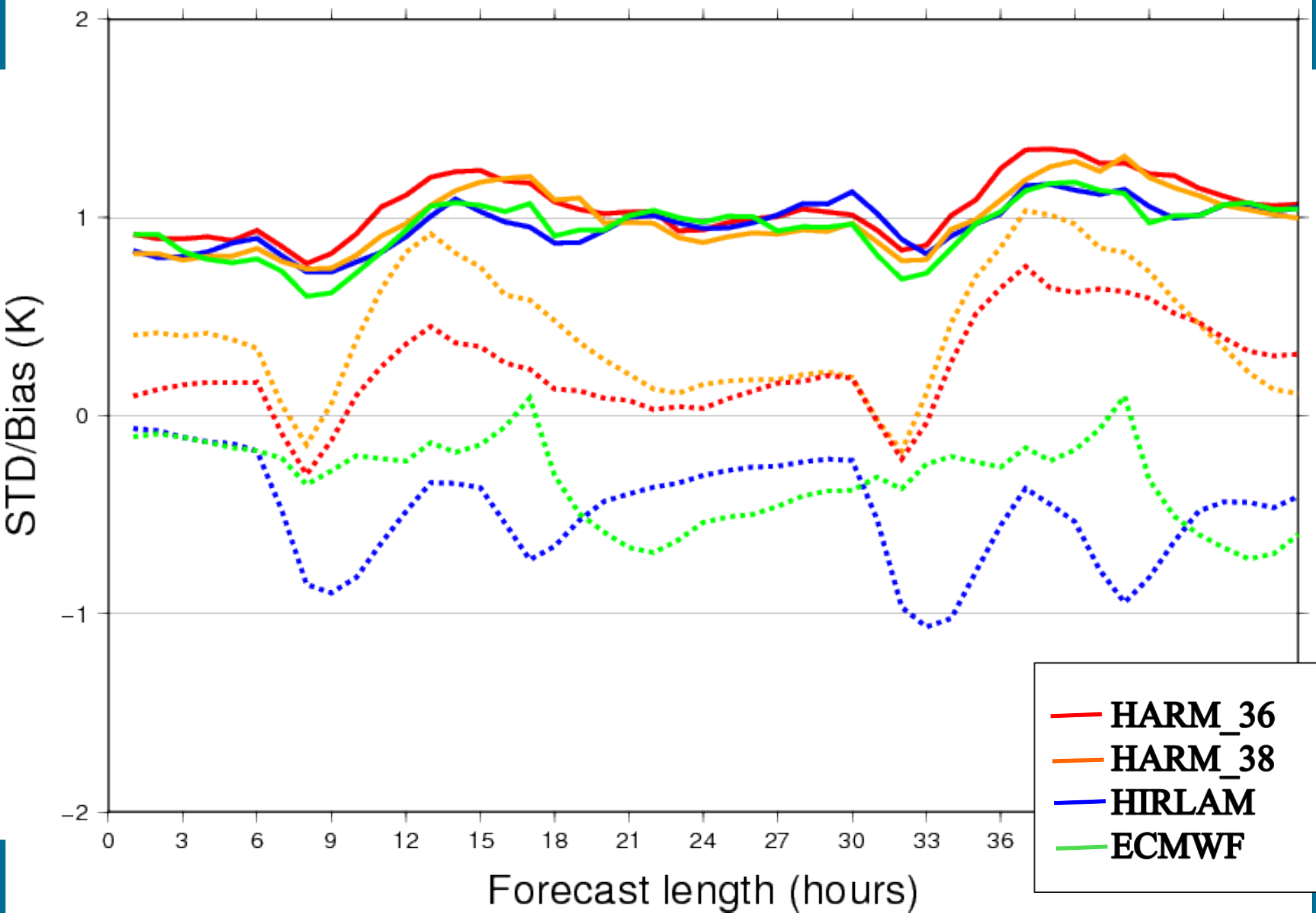




# Verif Td2m 201412 an00 NL



# Verif Td2m 201503 an00 NL





## Temperature, dewpoint and cloud verification

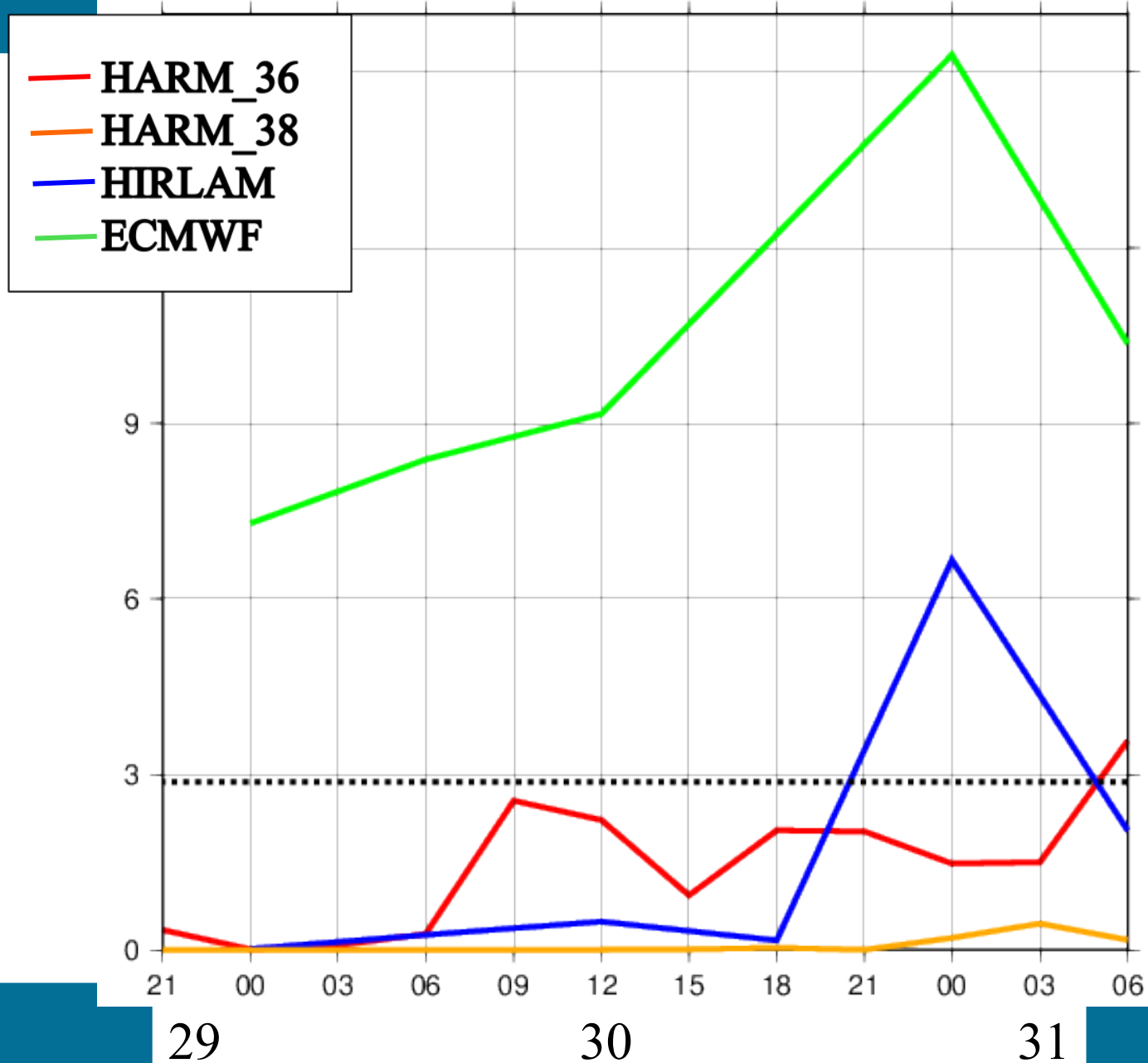
- Large overestimation of cloud cover for HARMONIE, larger for 38h1.1, 38h1.2 comparable to 36h1.4
- HARMONIE not able to follow the heating at the start of the day, too slow surface scheme?
- Strong overestimation of Td2m during the day in Summer, understimation of entrainment at top PBL and/or too strong evaporation?
- Increasing negative bias in T2m and Td2m during the forecast in Winter



## Last year: Storm classification

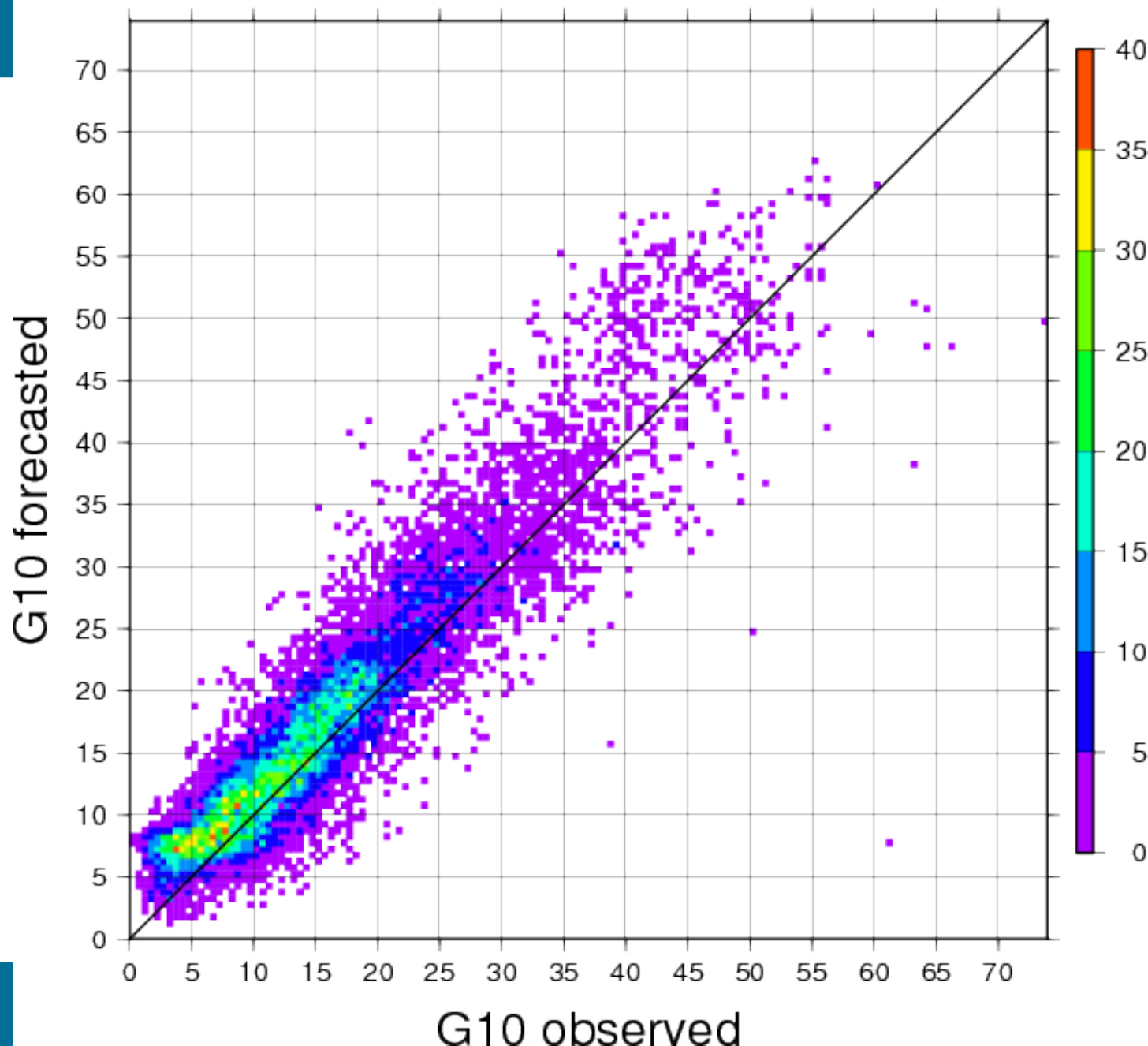
- Using hard limit of 30 m/s unsatisfactory
- Severe storms inland are not taken into account in this way
- Therefore improving storm classification with stations climatology
- $X=f(G>C(2y)) * \text{avg}(G-C(2y))[G>C(2y)]$
- Applied for storm on 31-03-2015

# Storm numbers for storm 31-03-2015

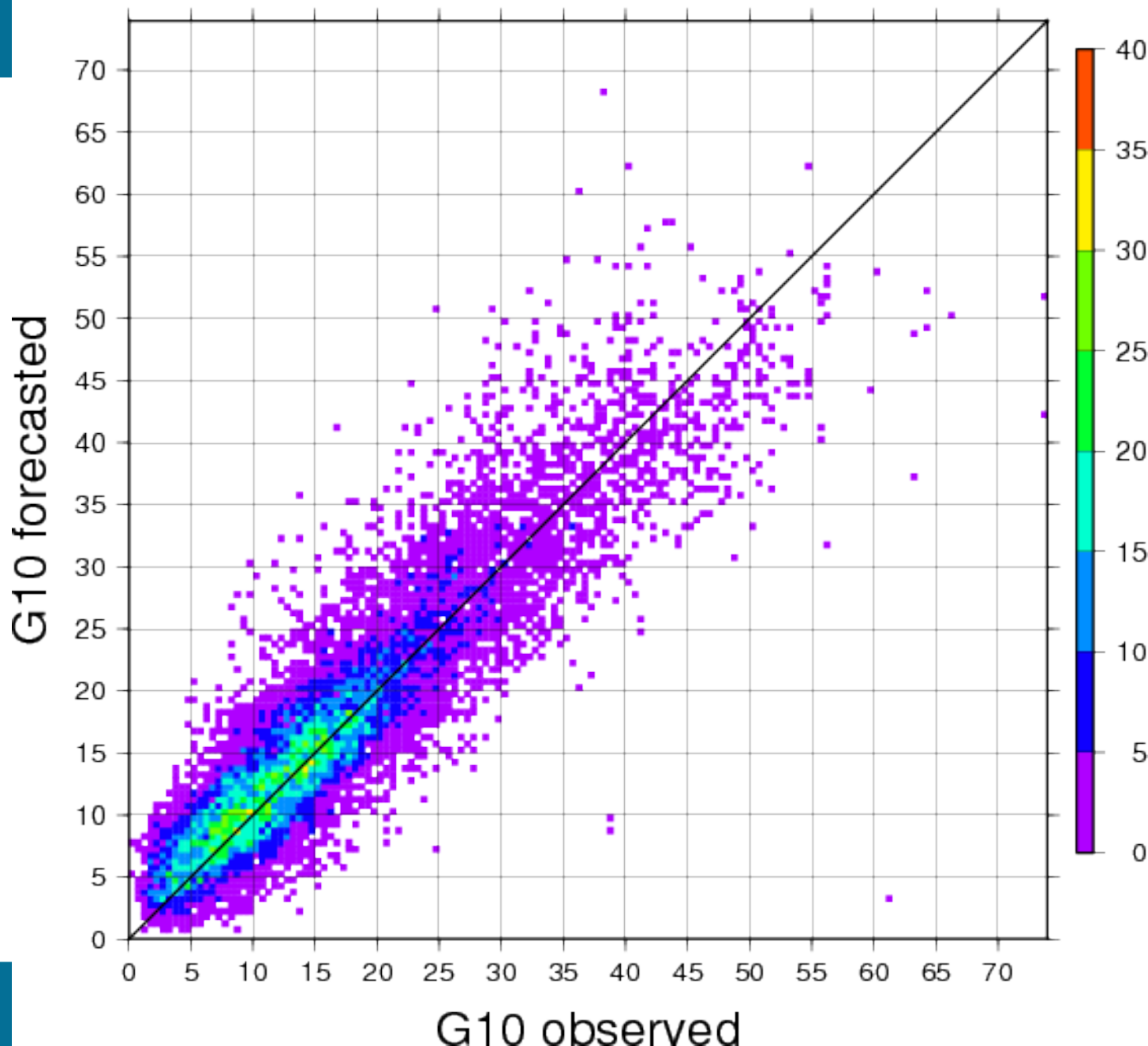




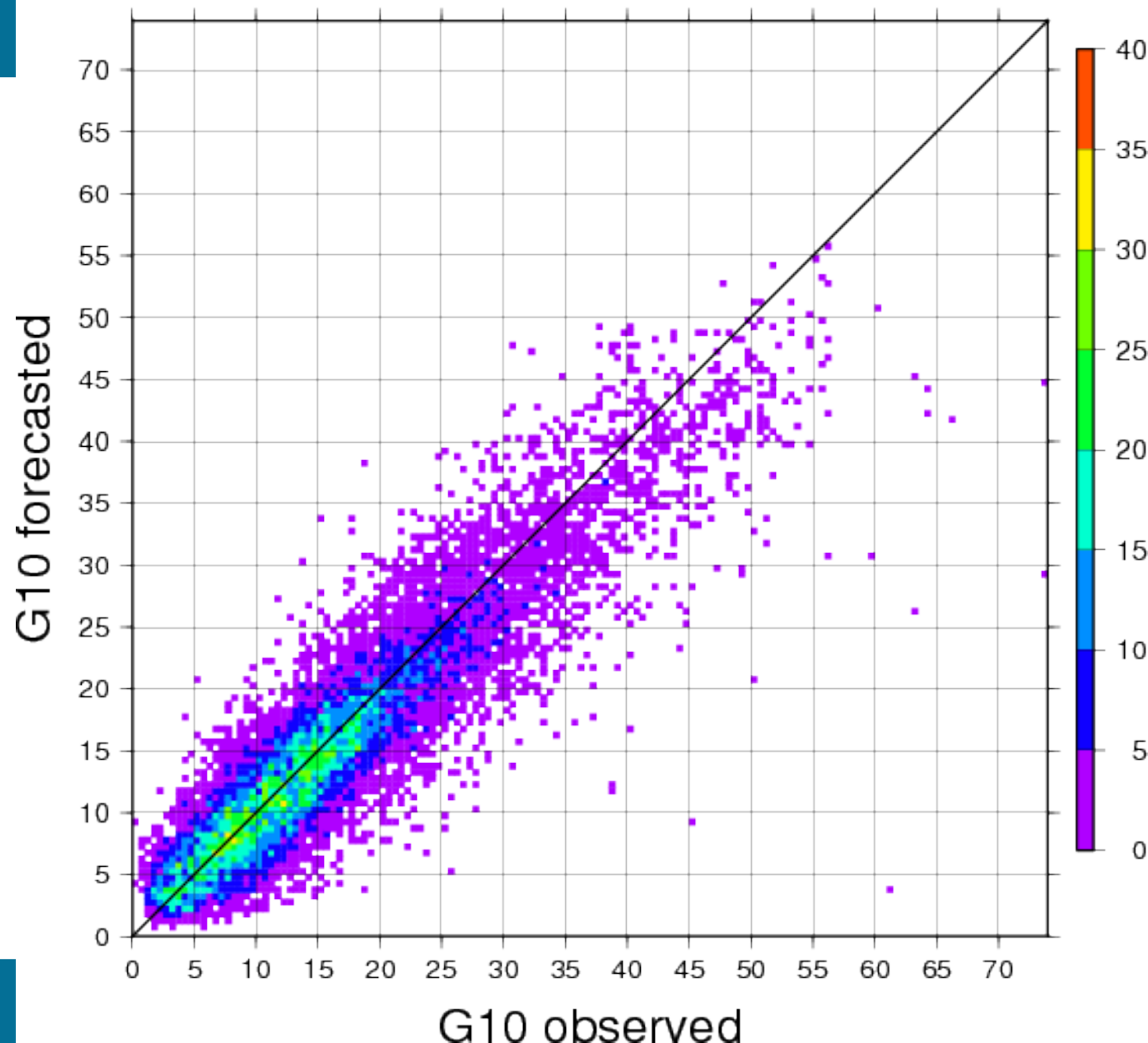
Verif ECMWF G10 201503 all NL, fr=18-24 (kts)



Verif HARM G10 201503 all NL, fr=18-24 (kts)



Verif HA38 G10 201503 all NL, fr=18-24 (kts)



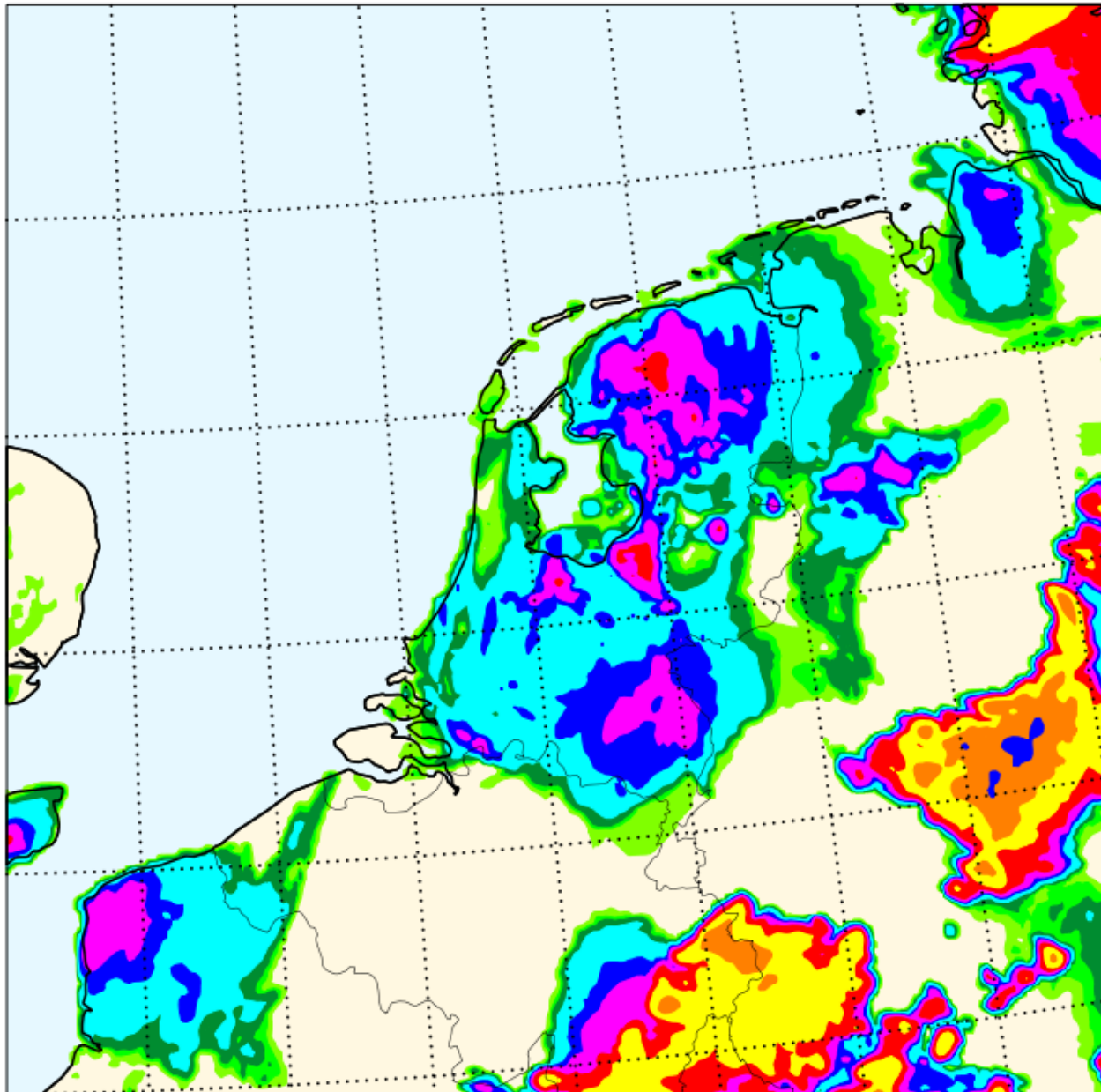


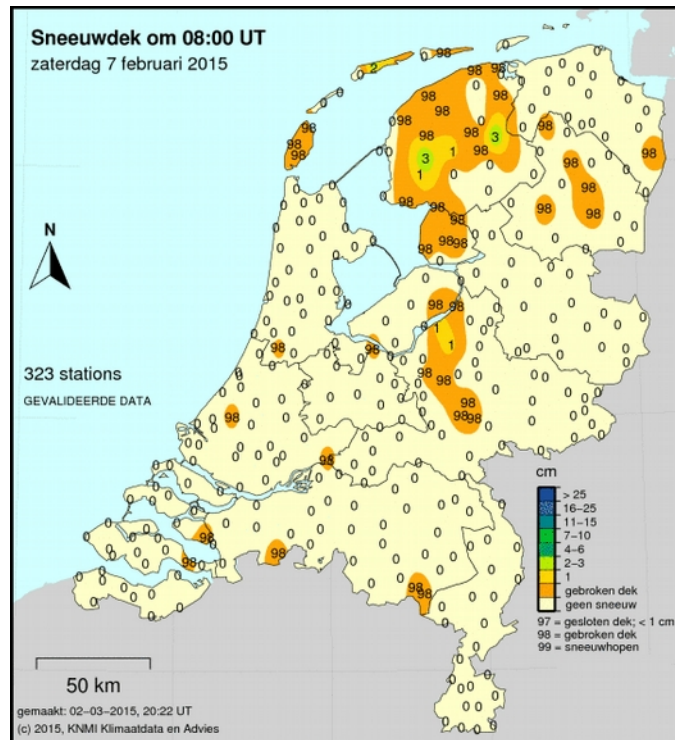
## Scorecard

Parameter	HARM 38 Bias	HARM 38 STDev
Temperature	-/+	+
Dewpoint	-/+	+
Cloud cover	-/+	~
Low clouds	-	
Wind	+	+
Wind gusts	-	

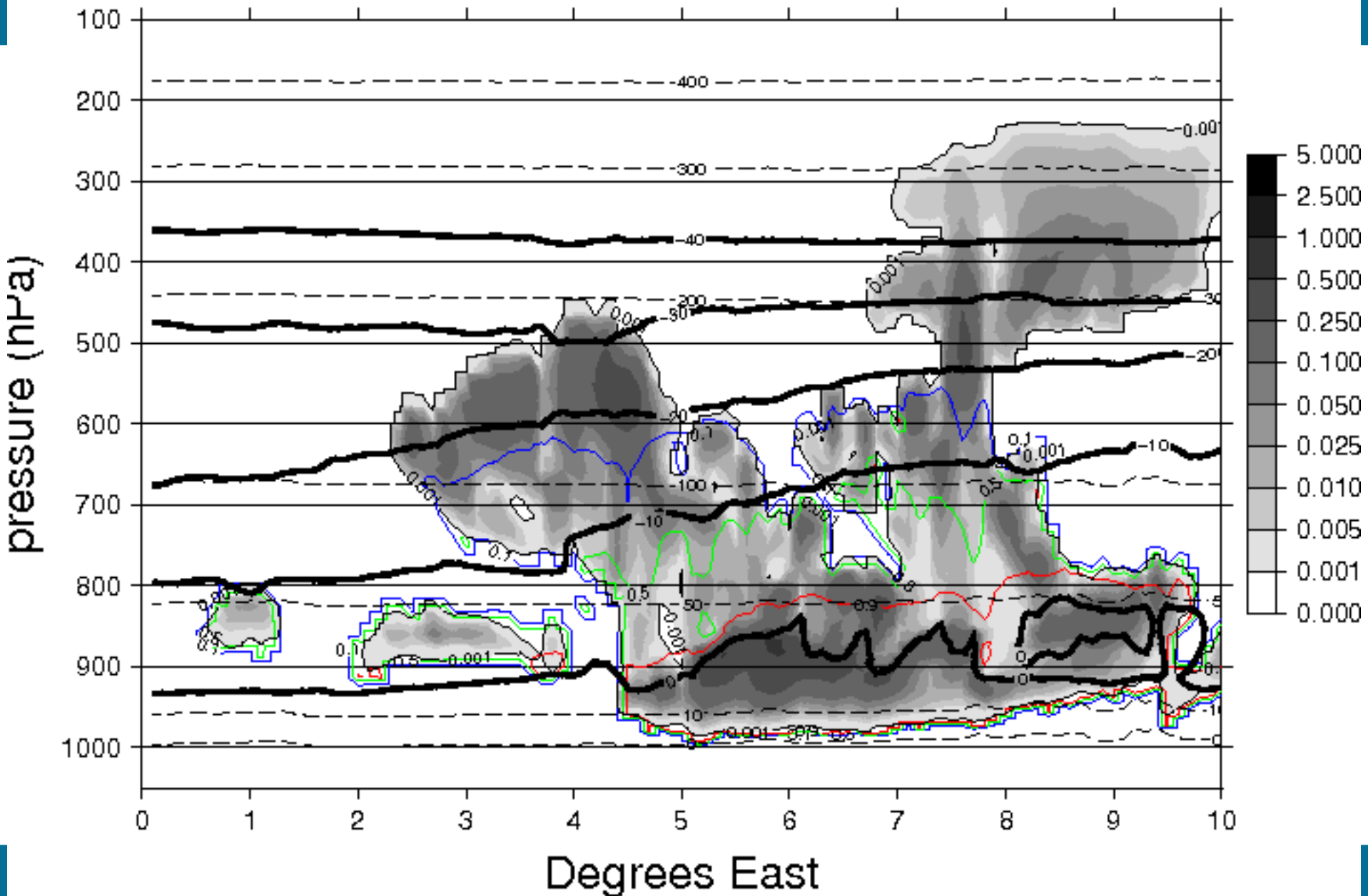
HARM\_36 t+8 Sneeuwdikte an: 2015020700, fc: Za 7-2 2015, 8UTC

0.1 0.3 0.5 1 3 5 10 20 40 100 200 500 1000

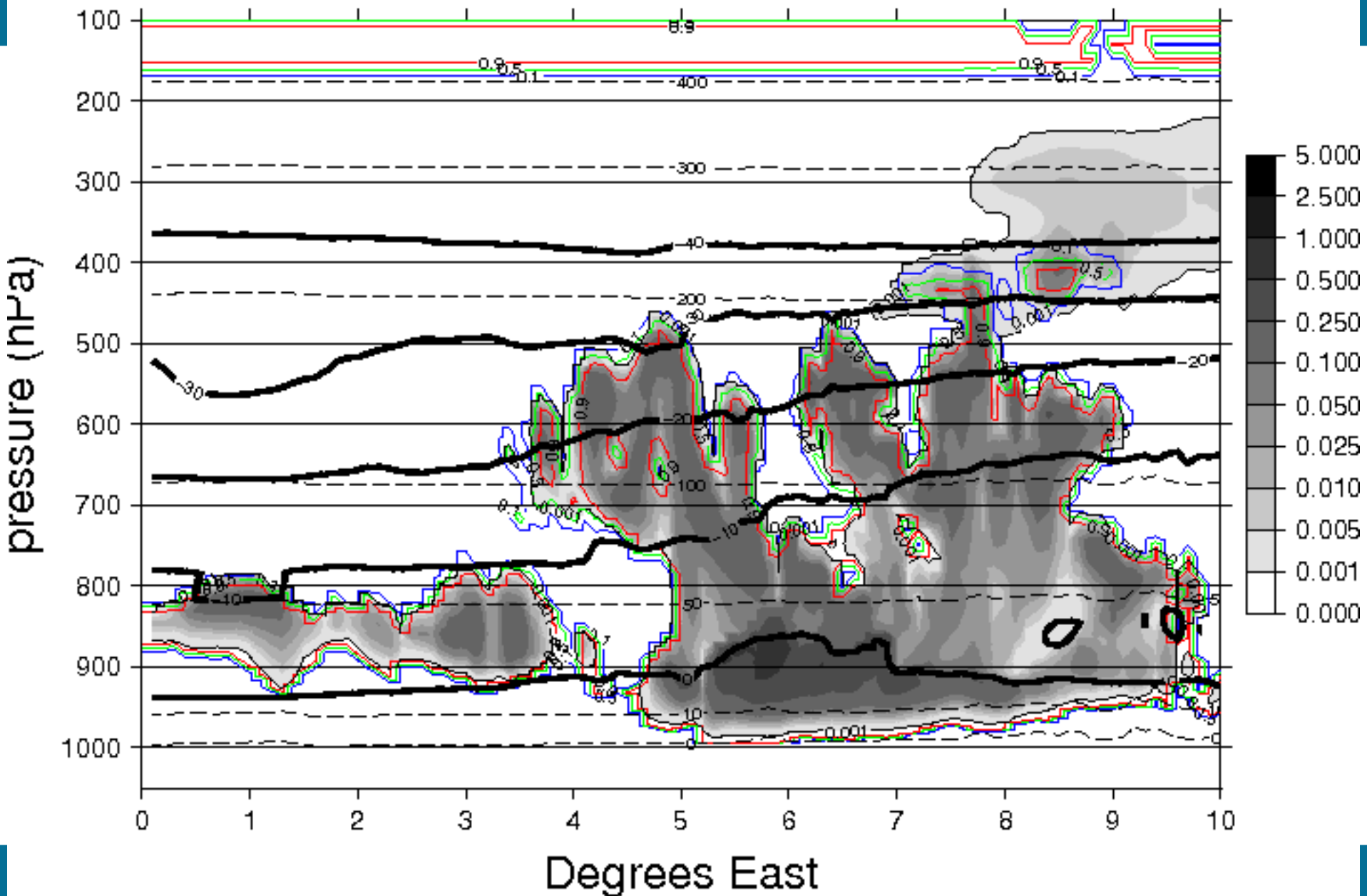




# HARM cl water & % wwoo +09 fcst 2015012815 in g/kg

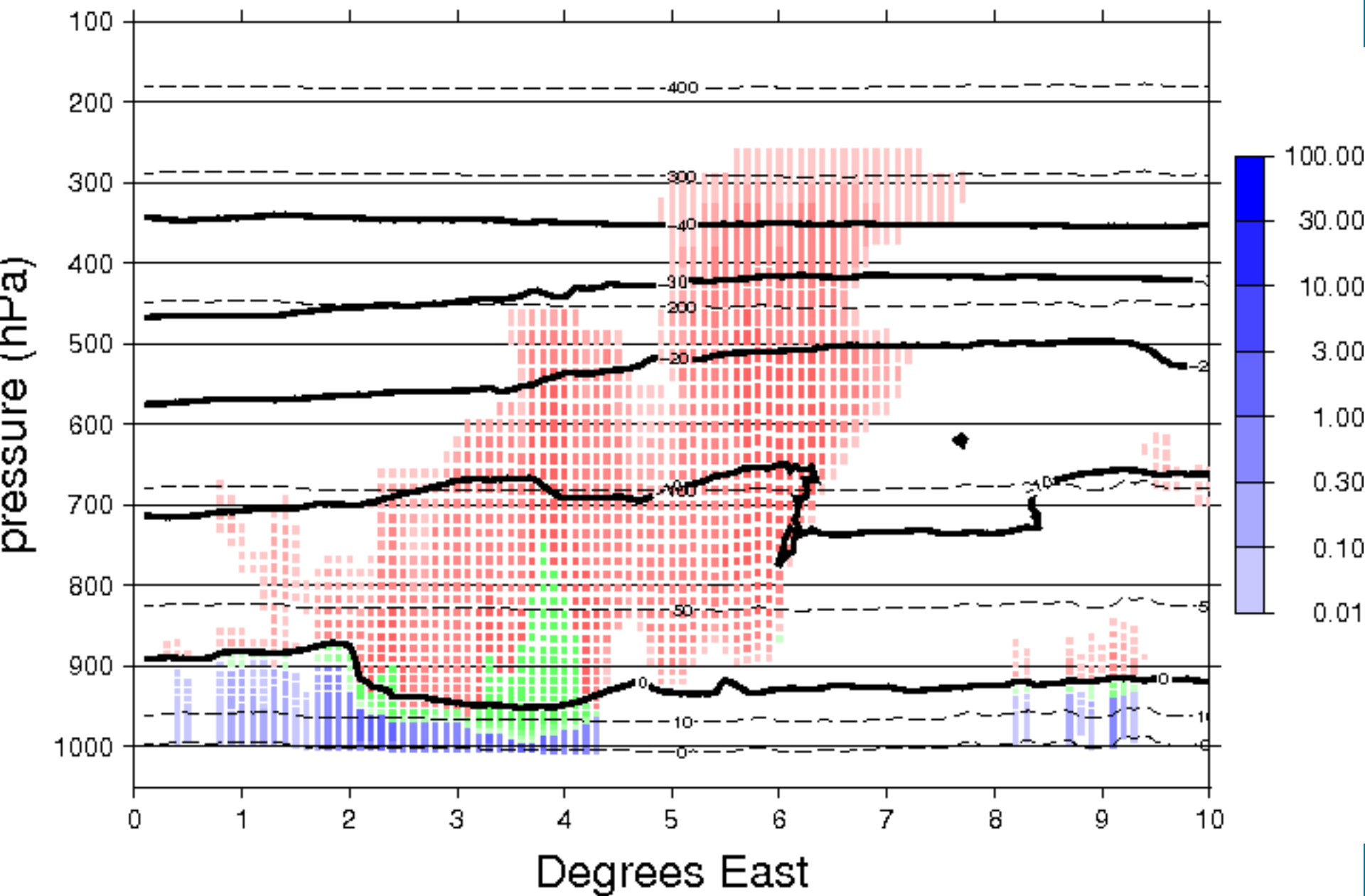


# HA38 cl water & % wwoo +12 fcst 2015012815 in g/kg

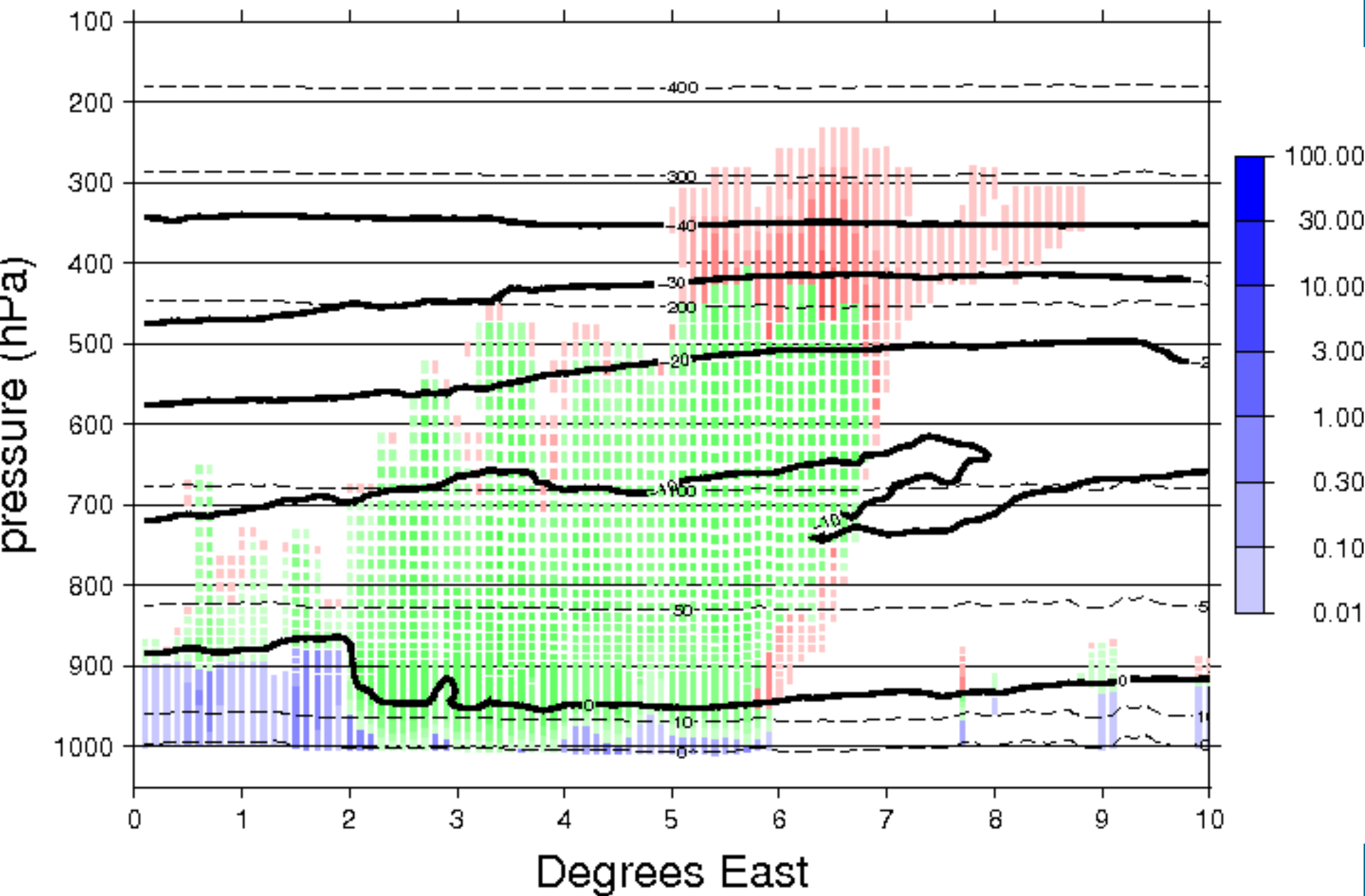




# HARM Prec wwoo +06 fcst 2015032612 in mm/uur



# HA38 Prec wwoo +06 fcst 2015032612 in mm/uur





## From first slide:

- Still running 36h1.4 operationally
- Should we move to 38h1.2 or not?



## From first slide:

- Still running 36h1.4 operationally
- Should we move to 38h1.2 or not?
- Not yet: need for similar quality or improvement of
  - low clouds/fog
  - T2m/Td2m bias
  - Wind gusts

