

Use of SAF NoWCasting in Belgium

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1. Introduction

CURRENTLY

- twelve SAFNWC on MSG products are available for forecasters and visualized individually on HAWK (version 2.10)
- cloud products (like Cloud Type and Cloud Mask) are mostly used but not systematically
- forecasters find that the other products are not reliable enough and misleading
- no real interest for SAFNWC on PPS

NEXT FUTURE

The objective is to install and test a tool which integrates rapidly a set of different types of data of good quality. So a high resolution analysis and more objective hints for very short range forecasts (Nowcasting) will be interpreted by forecasters **to monitor the NWP forecasts in real time and make their weather reports.**

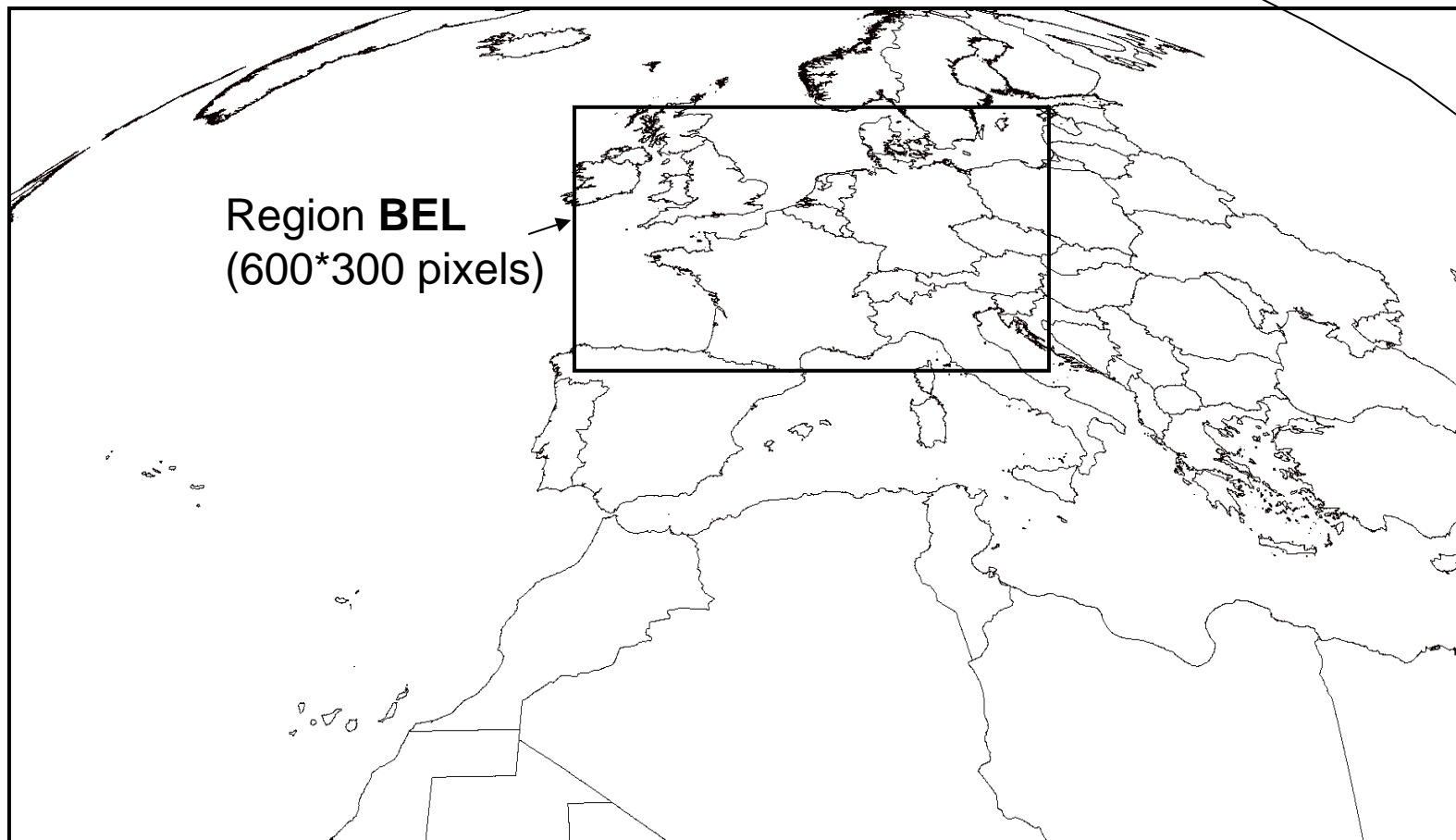
A development of new products especially for severe warnings is also needed.

Another objective is to organize a new role where forecasters will verify the previous forecasts (for the last week) **pinpointing and archiving documents for relevant case studies.**

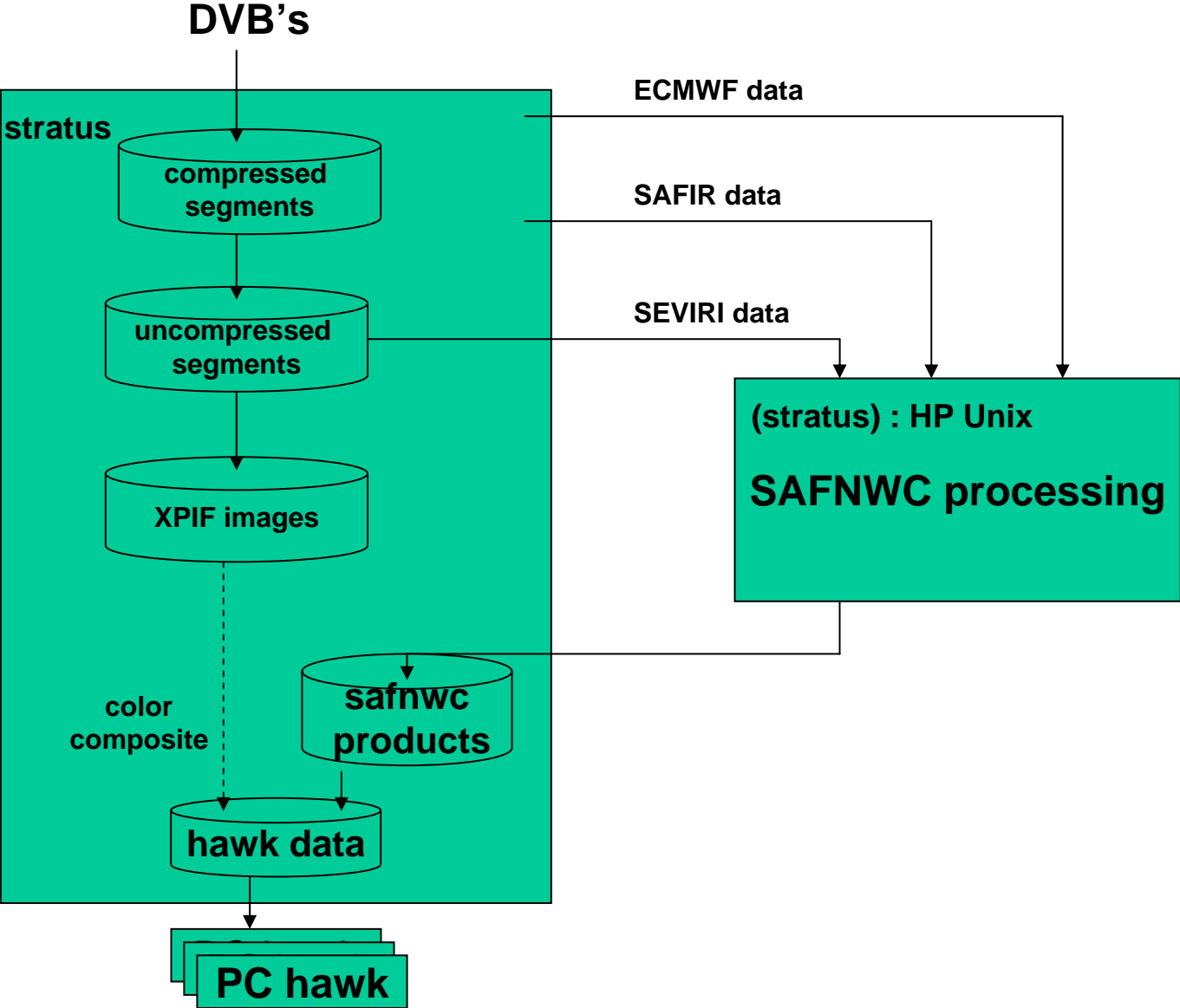
2. Current status of SAFNWC

SAFNWC Processing Regions at RMI

Region **EURO** (1854*926 pixels)



Installation of the SAFNWC at RMI



Ancillary data : NWP input of ECMWF model

Parameters : NWP forecasts every 6 hours	Unit	available
2m temperature	K	X
Surface temperature (<i>Skin Temperature</i>)	K	X
Surface pressure	Pa	X
Atmospheric Water Vapour content	mm	X
Temperature (standard pressure levels)	K	X
Relative humidity (standard pressure levels)	%	X
Wind (u,v) (standard pressure levels)	m/s	X
Geopotential (surface orography)	m^2/s^2	X
Geopotential (standard pressure levels)	m^2/s^2	X
2m dewpoint temperature	K	X
NWP land/sea mask	0 - 1	X

operational SAFNWC output products on MSG at RMI

PGE	Product	EURO	BEL	Format
01 : CMa	Cloud Mask	x	x	HDF5
02 : CT	Cloud Type	x	x	HDF5
03 : CTTH	Cloud Top Temp. Height	x	x	HDF5
04 : PC	Precipitating Cloud	x	x	HDF5
05 : CRR	Convective Rainfall Rate	x	x	HDF5
06 : TPW	Total Precipitable Water	x	x	HDF5
07 : LPW	Layer Precipitable Water	x	x	HDF5
08 : SAI	Stability Analysis Image	x	x	HDF5
12 : AMA	Air Mass Analysis	x	x	BUFR -> HDF5
09 : HRW	High Resolution Wind	-	x	BUFR -> HDF5
10 : ASII	Auto.Sat.Image Interpretation	REGION ZAMG		BUFR -> HDF5
11 : RDT	Rapid Dev. Thunderstorms	-	x	BUFR -> HDF5

Notes : - each product is generated every 15 minutes at full satellite resolution (3 km)
(in 2008 - every 5 minutes for a large number of products)

- HDF: Hierarchical Data Format

BUFR : BUffER data format

3. Current use of SAFNWC by forecasters

- twelve SAFNWC on MSG available in real time every fifteen minutes on two domains (EURO and BEL) at a resolution of about 5 kilometers

- ANALYSIS : no integrated analysis system (up to now)

Observations (Synops, Temps, radar, satellite, lightning images)

Model analysis (global and LAM NWP models)

SAFNWC products on MSG

>every three hours forecasters make a report on the current weather over Belgium including the situation and “sensible” weather parameters

- NOWCASTING (up to +3h) :

LAM forecasts (Alaro 4 and 7 km – UKmeso ...) with a usual timestep of 3h

SAFNWC products on MSG

>forecasters make a report on the expected situation and weather over Belgium for the next three hours

4. Illustration of a few types of weather situations

From four types of weather situations (case studies)

- A. cloud cover in stable situations or fog (thermal inversion)
- B. frontal situation : not too dynamic
- C. convective situations (isolated convection and/or convective systems)
- D. frontal situations : more dynamic with upper-air jet stream

Methodology

- short description of the situation
- information needed by forecasters for analysis and nowcasting
- data issued from observations, analysis, models and mostly SAFNWC on MSG products

**SAFNWC products tailored to help forecasters in their analysis and forecasts
(Nowcasting) ?**

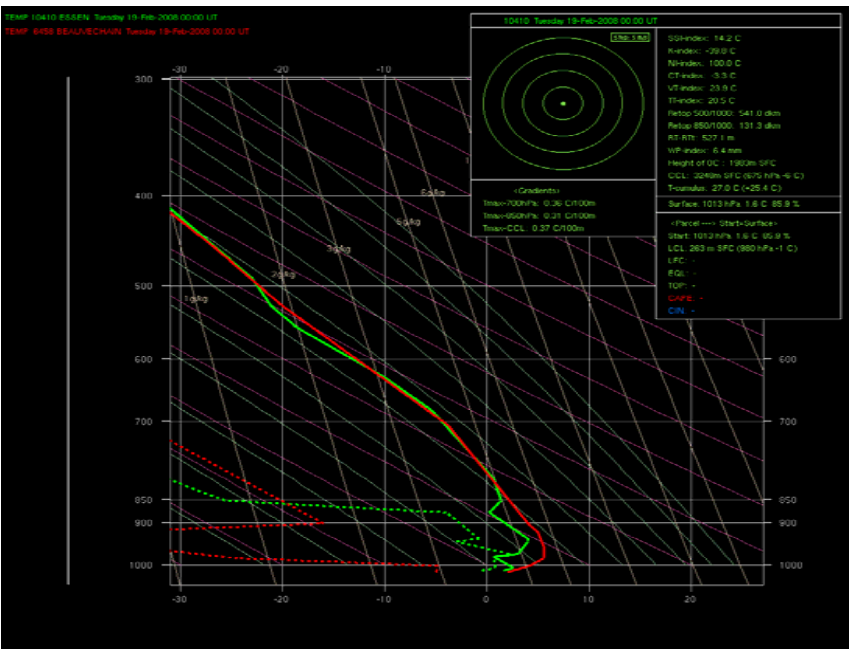
A. Low clouds or fog associated to stable situations (thermal inversion)

Radiosounding observations : 19/02/2008 - 00h00 UTC

2 stations: Beauvechain (red) – Essen (green)
(distance ~200 km)

Thermal inversion – low level humidity and cloudiness

Two different (T,Td) profiles



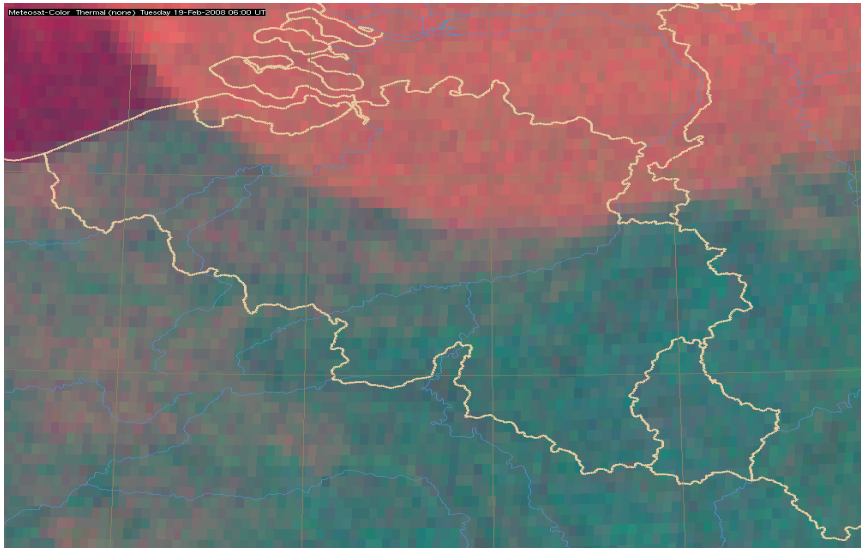
Analysis and Forecast (Nowcasting)

- low cloud area
- altitude of cloud tops
- risk of precipitation
- risk of fog (also freezing fog)
- area of the more humid low level layer
- low level winds
- thermal inversion area

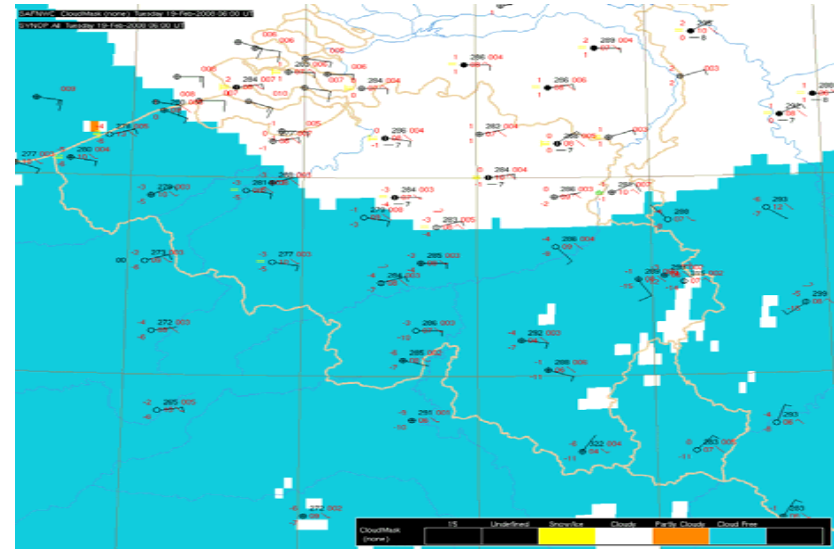
Which data can be used also for Nowcasting
e.g. for the 19/02/2008 at 06h00 UTC

- numerical models forecasts are (very) poor for low clouds
- synops, satellite and radar images not very helpful
- SAFNWC on MSG : which data or products ?

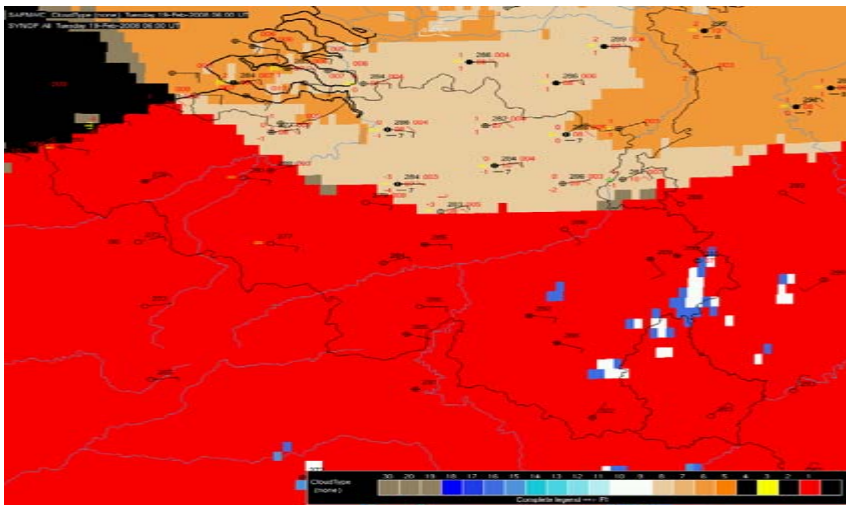
Situation over Belgium: 19/02/2008 at 06h00 UTC



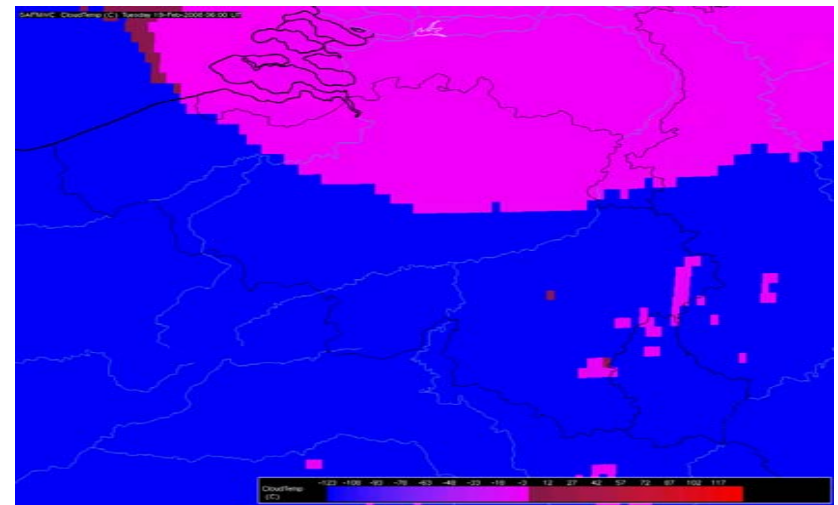
RGB (thermal) satellite picture: low clouds (reddish)



Synops + SAF Cloud Mask (CM): 4 classes



Synops + SAF Cloud Type (CT) : 21 classes

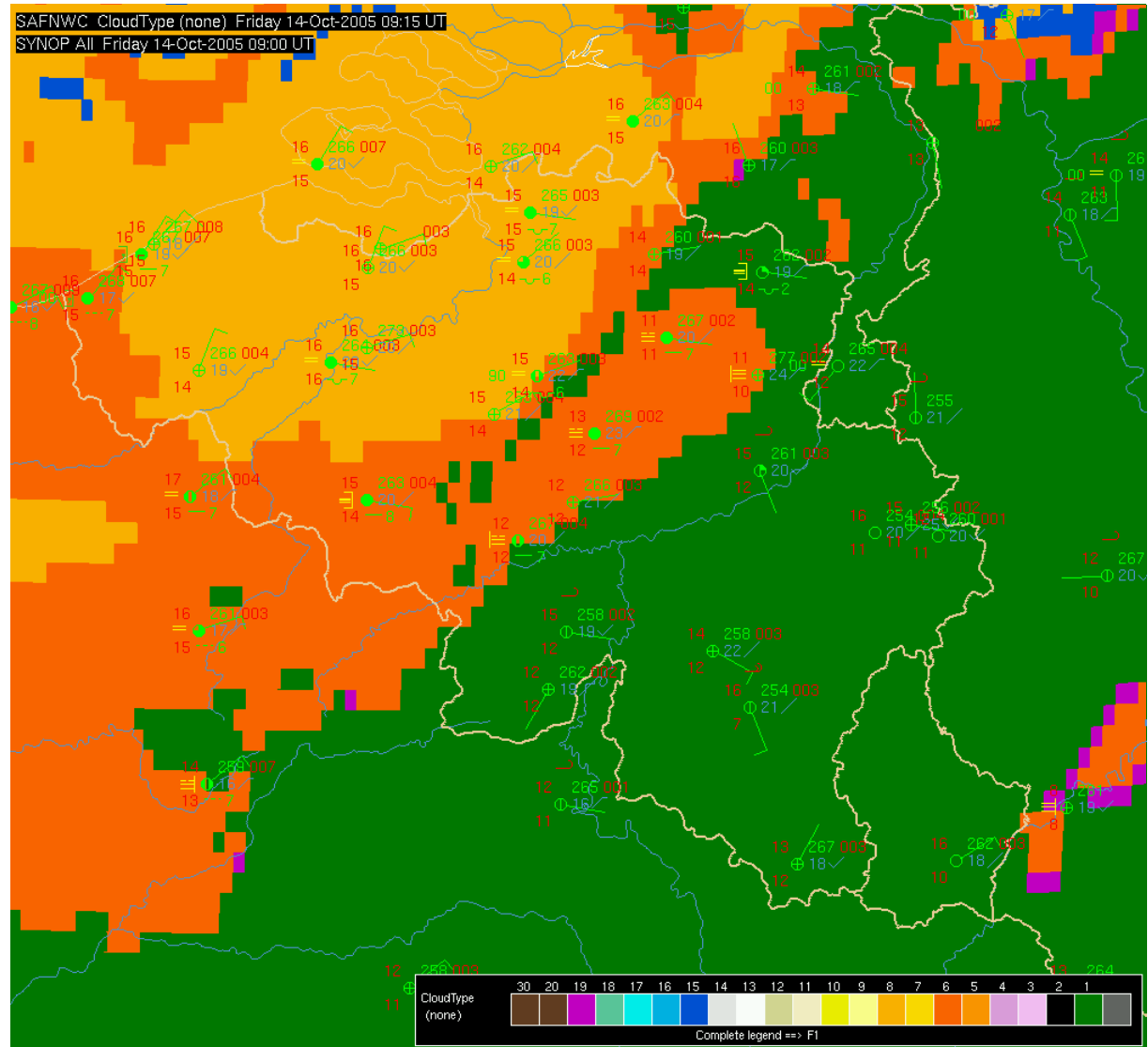


SAF Cloud Top Temperature (CTT)

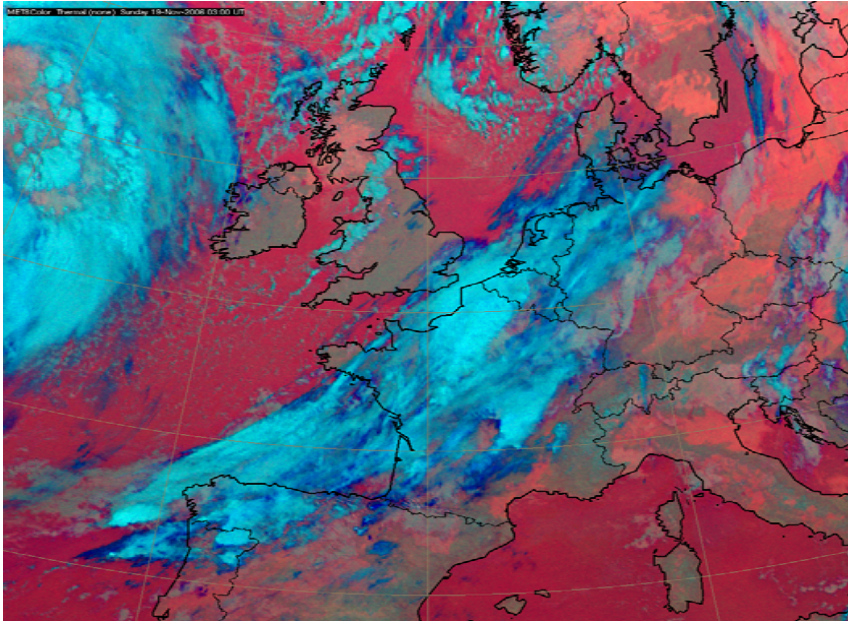
Fog detection – 14/10/2005 – 04h00 to 09h00 a.m. (u.t.c.)

Comments on the SAFNWC cloud Type products:

- Most of the fog are detected as “very low cloud”. Non detection rate (NDR) about 21% and 6% for optically thick fog. Non detection mainly due to the problem at low solar elevation (sunset/sunrise)
- On the other hand 97% of the very low cloud are NOT fog -> false alarm rate of 97%. NWCSAF cloud type product can be useful for the observation of fog but is not sufficient by itself. Ground based observations are needed.



B. Frontal situation (not too dynamic)



Infra-red satellite image (RGB): 19/11/2006 at 03h00 UTC

A frontal cloud band detected over western Europe :

- (very) high cloud tops (ice clouds in blue)
- (very) low cloud tops (water clouds in reddish colours)
- embedded convective clouds (cloud patterns, cold tops)

Analysis

- type, position of front + detection of frontal waves
- frontal “activity” : precipitating clouds
- areas of semi-transparent, multi-layered stratiform and convective clouds (Cb)

Forecast (Nowcasting)

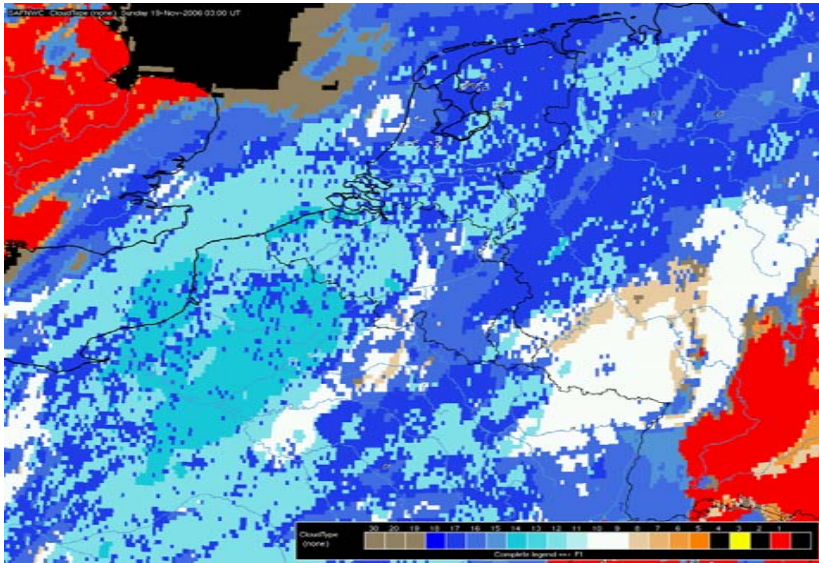
- displacement of the front + waves
- frontal evolution : impact on heavier precipitation or thunder + impact on the cloudiness

Which data can be used for Nowcasting

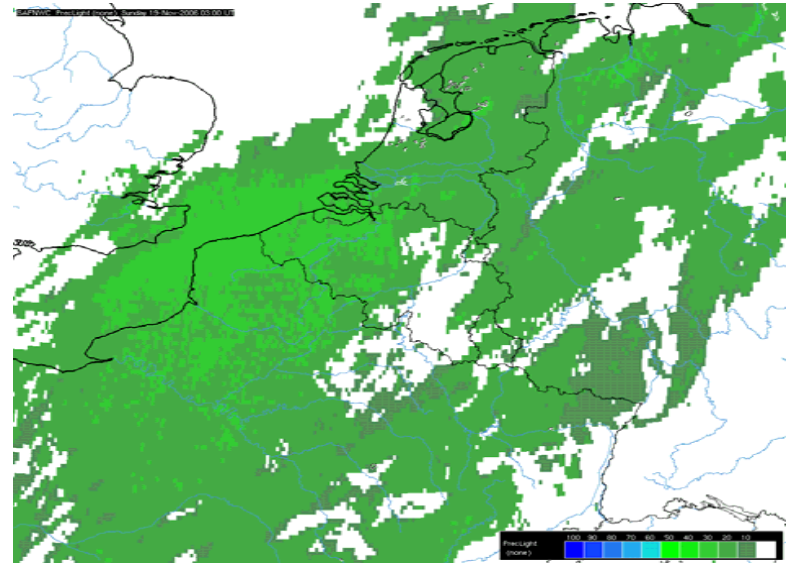
- numerical models products must be realistic (mesoscale perturbations, physics) and validated with observations in real time

- SAFNWC on MSG : which data or products?

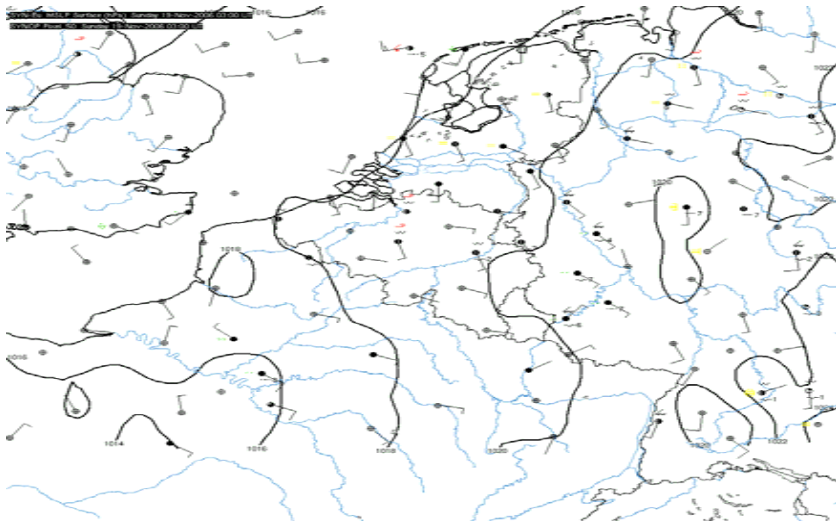
Situation over our areas : 19/11/2006 at 03h00 UTC



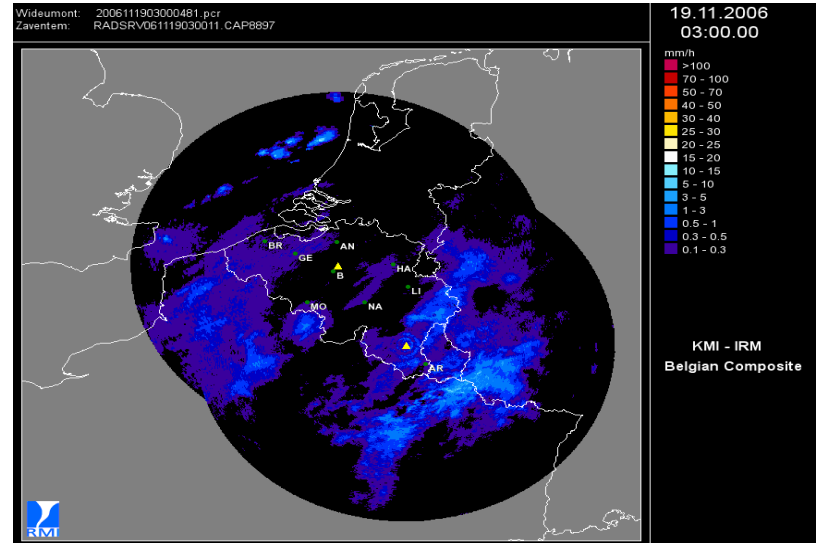
SAF Cloud Type (CT) : 21 classes



Precipitating clouds (PC) : 11 classes

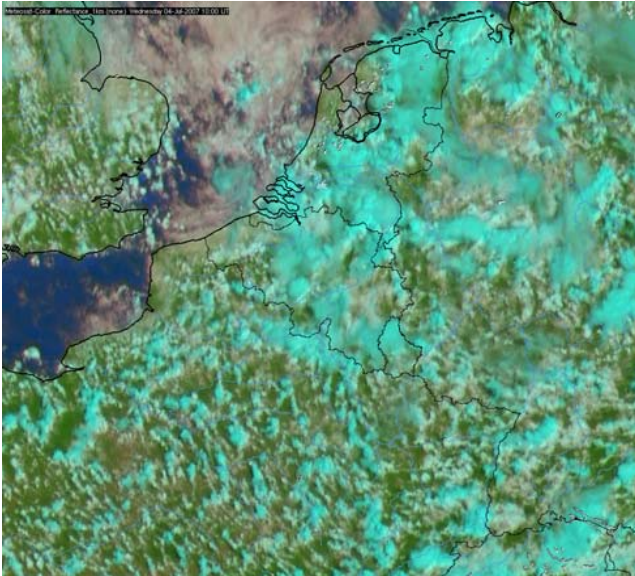


Surface analysis : MSLP (hPa) + synops (N, Wind, cl. types)



Composite radar image : PPI (mm/h)

C. Convective situation



Convective patterns: 4/07/2008 at 10h00 UTC

different convective cloud patterns (isolated, lines, clusters) detected over Belgium and the surrounding areas:

- HRV satellite picture (upper left)
- Thermal (IR composition - RGB) satellite picture (down left)

Analysis

-
- main perturbations (meso Low, convergence lines, ULL, Jet, ...)
 - severe convection (localisation, impact on weather...)

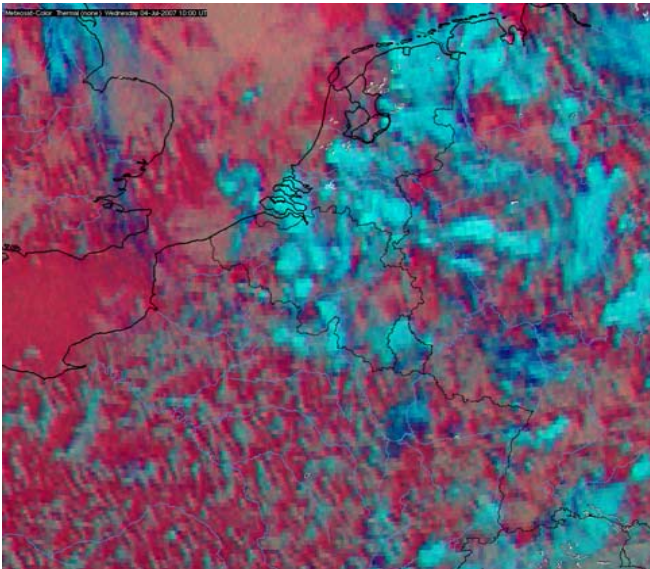
Forecast (Nowcasting)

-
- evolution of the main perturbations (mainly mesoscales)
 - evolution of convective cloud patterns (stage in the development)
 - impact on weather (risk of heavy precip. & thunder, risk of hail,...)

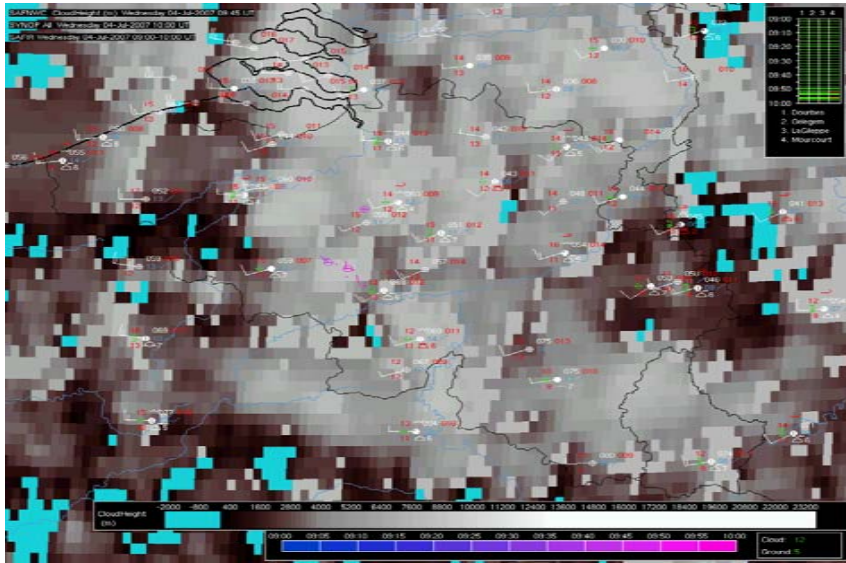
Which data can be used for Nowcasting

-
- numerical model products not very reliable for convection (physics)
- And must be validated in real time
- direct extrapolation of satellite and radar images are misleading

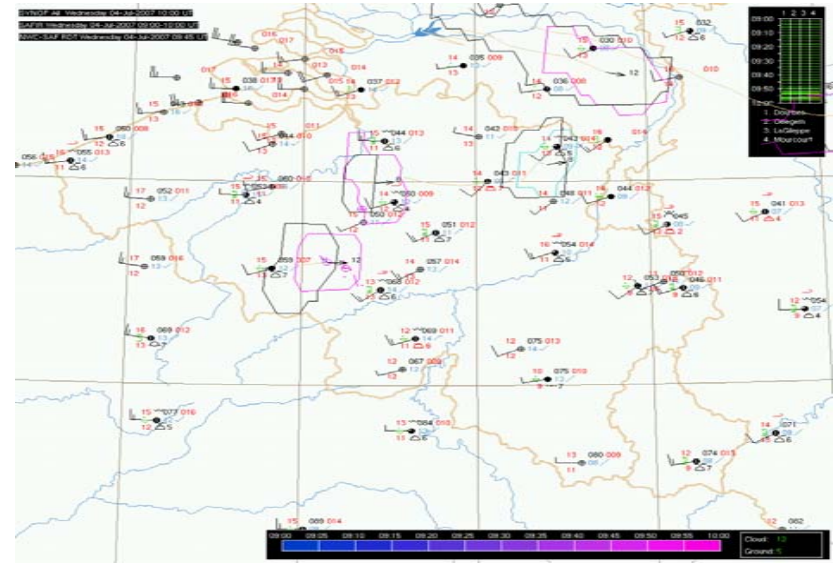
SAFNWC on MSG : which data or products – every 5 minutes ?



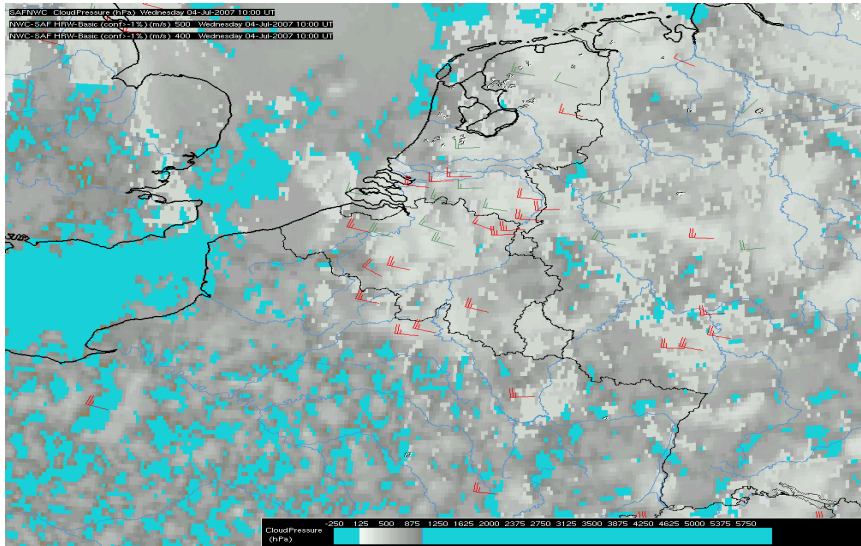
Situation over our areas : 4/07/2007 at 10h00 UTC



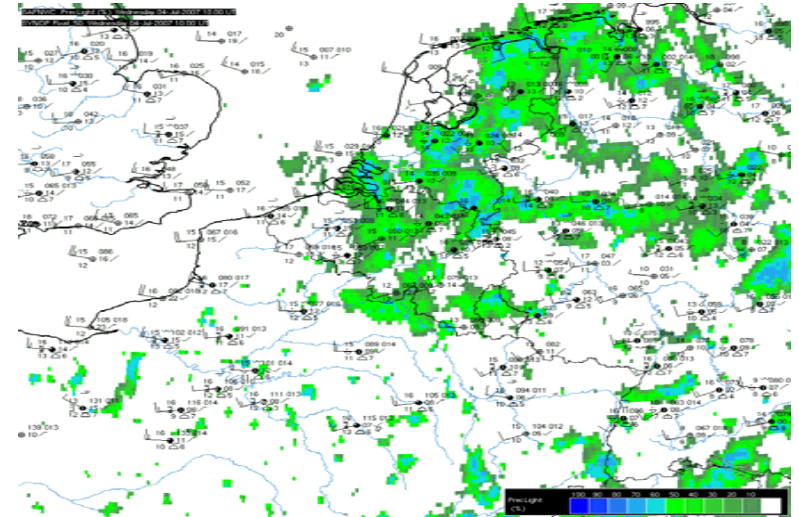
Cloud Top Height (CTH) – synops – lightnings (SAFIR)



RDT (four cells) – synops – lightnings (SAFIR)

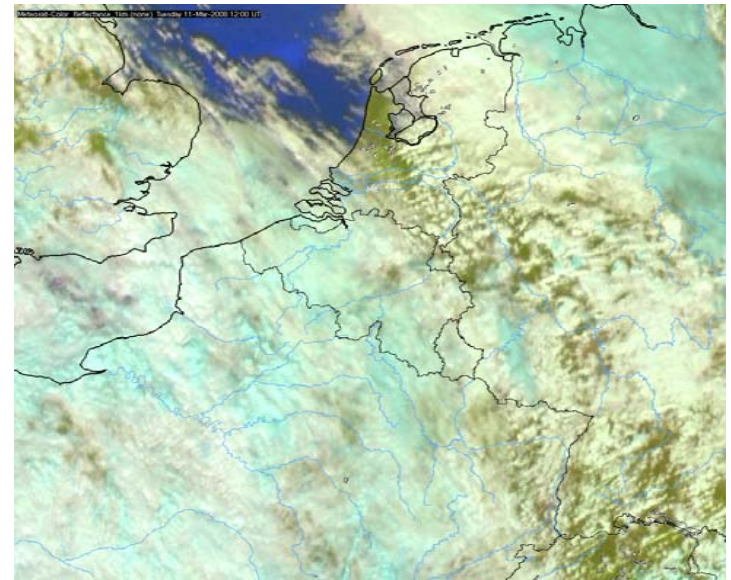
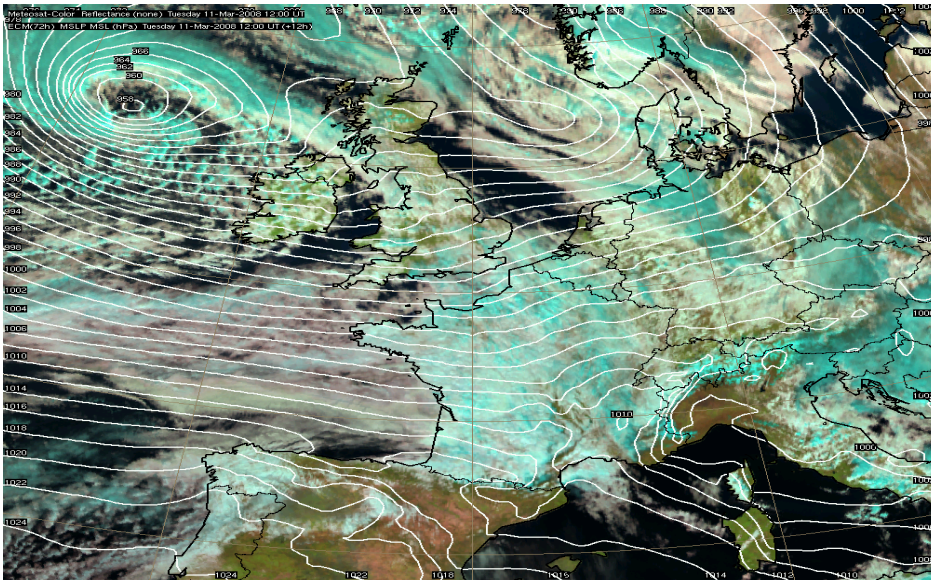


Cloud top Pressure (CTP) – HRwinds (2 levels: 400 - 500)



Precipitating Clouds (PC): 11 classes - synops

D. Frontal situation (highly dynamic)



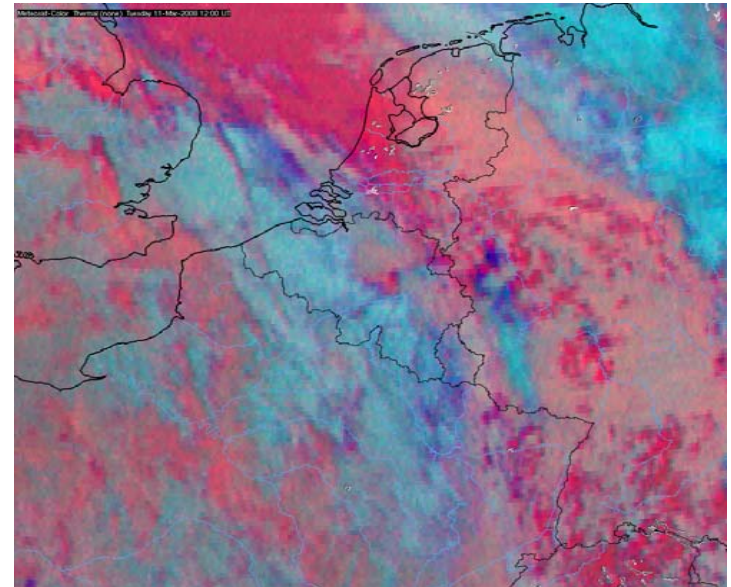
Frontal system embedded in a highly dynamic circulation
over western Europe 11/03/2008 at 12h00 UTC

- satellite picture (visible – RGB) and MSLP (isobars/2hPa)
- HRV satellite picture (upper right)
- Thermal (IR composition – RGB) satellite picture (down right)

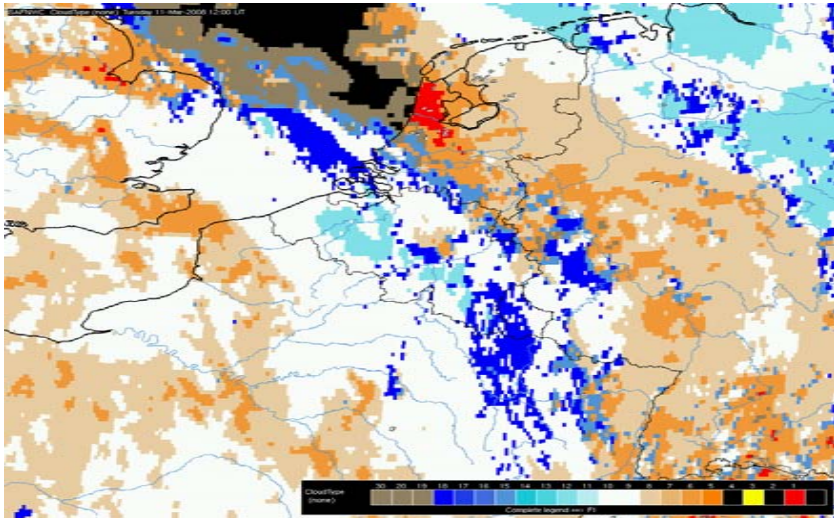
Analysis and Forecast

- interactions between frontal system and upper-air jet
- impact on cloudiness and precipitations (even thunder)

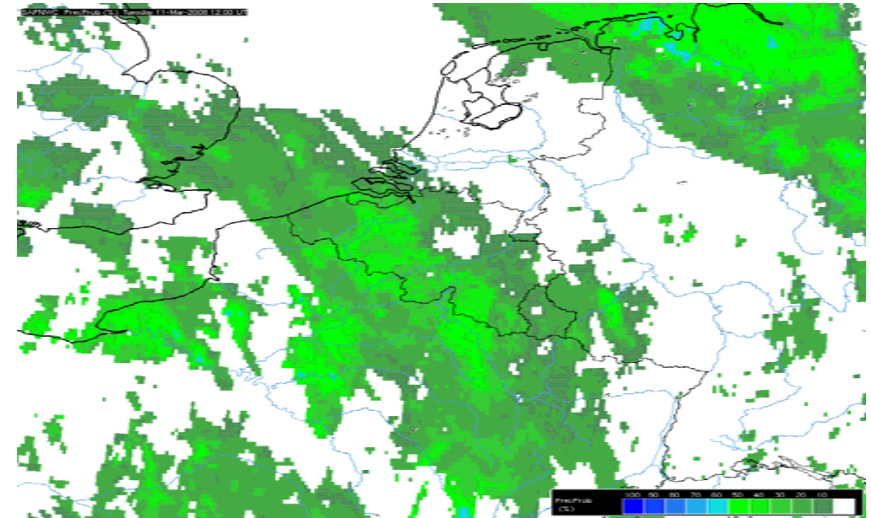
Which data useful for Nowcasting : SAFNWC on MSG ?



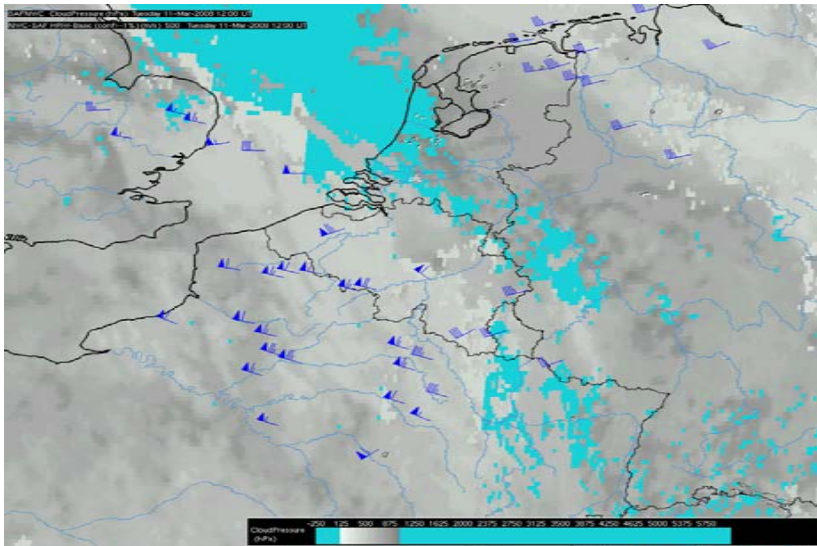
Situation over our areas : 11/03/2008 at 12h00 UTC



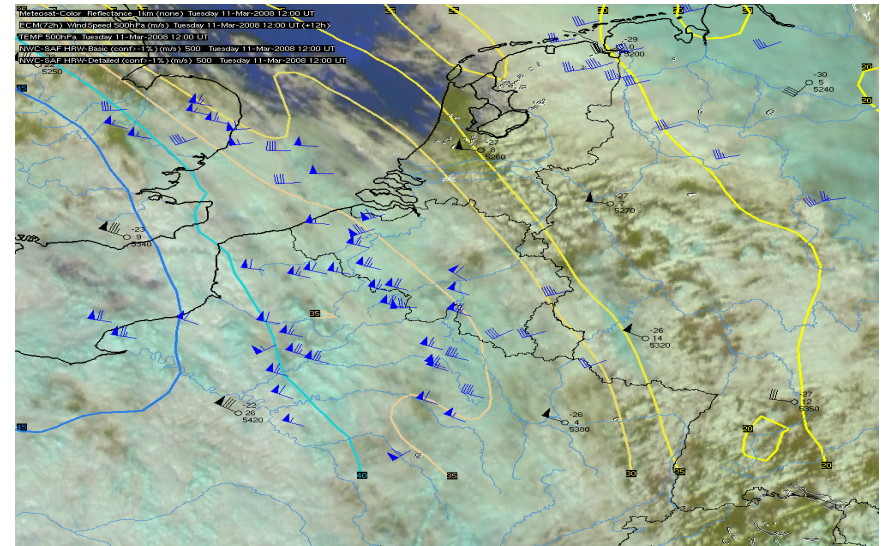
Cloud Type (CT): 21 classes



Precipitating Clouds (PC): 11 classes



Cloud Top Pressure (CTP) and HRW (~500 hPa)



HRVIS-RS 500 hPa - HRW (~500 hPa)
Wind Speed (isotachs at 500 hPa) ECMWF (FCT + 12h)

5. Perspectives

- a more objective use of SAFNWC data on MSG is needed
 - a selection of SAFNWC data as input data for the INCA system (tests in 2010)
 - analysis and nowcasting products issued of INCA must be tested by forecasters to make updated (new) products (reports, severe warnings,...)
- An updated quality assessment of SAFNWC data on MSG is needed
 - impact of SAF data (advantages, deficiencies) on forecasters products (validation procedures against observations)
- use of SAFNWC on PPS ? (only a few products per day)

Questions and comments

Thank you for your attention