Practical aspects of SAF-NWC software use at IMWM – Poland

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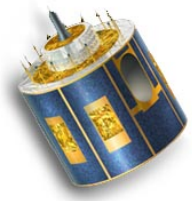
OUTLINE

- Introduction – Data processing
  - Processing chain
  - Regions
  - NWP data
  - Products
- Examples of use SAFNWC package
  - -Snow recognition at CT/CMa products
  - -Fog recognition at CT
  - -Convection development
  - -Other Small Ci over other clouds recognition
- Summary. Plans for the future.

Schematic diagram of data processing



Raw MSG segments from satellite receiving station (uncompressed)

SAFNWC processing system – SUN Blade 2000

Products converted to ASCII

Creation of graphics (overlaid with countries contour lines, date&time, added legend etc)

JPG
BMP

Presentation at Intranet web page

Retransmission to the users (aviation control)

Archivisation for further studies (mass storage)

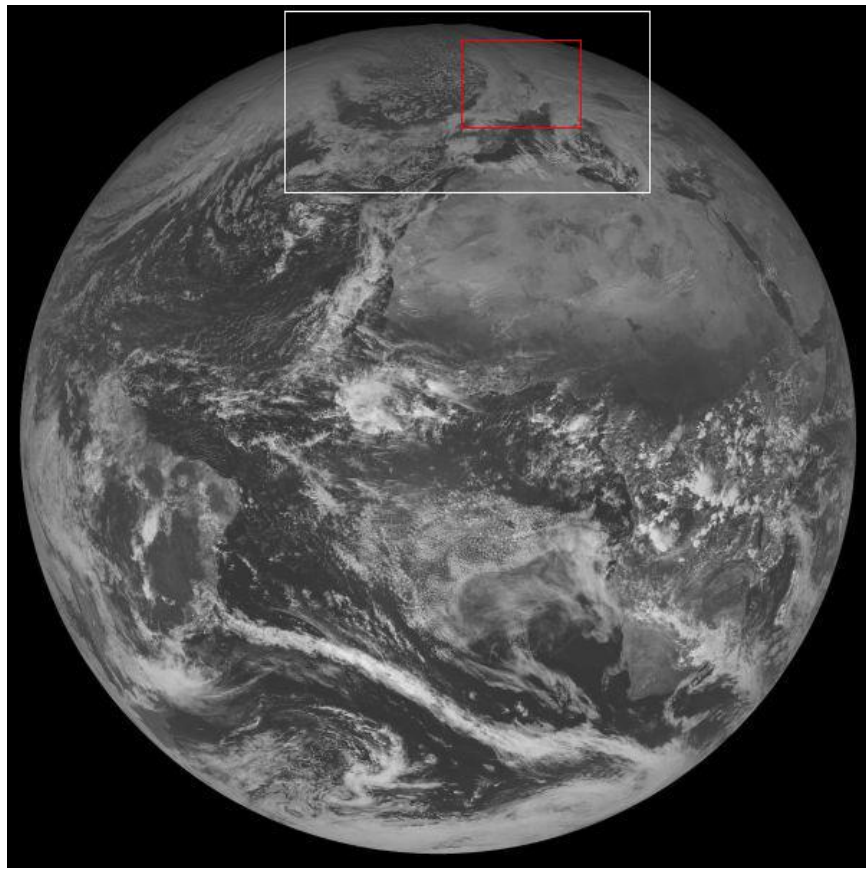
GFS Global NWP model data

Products archivisation in original format

SAFNWC at IMWM – Poland

Regions

SAFNWC software works at IMWM since 2005.



Computer / Operating System :

SUN BLADE 2000 with Solaris 8 System

Forte Developer C, C++, F95 Compiler

Regions :

- North Europe

REGION	safnwc_MSGN
REGION_CENTRE_P	510, 1857
REGION_SIZE	1019, 2200

- Poland

REGION	Polska
REGION_CENTRE_P	350, 2230
REGION_SIZE	400, 54

Numerical Weather Prediction Data :

- UK Met Office Global Hi-Res Model (from 2005 to 2009)
- Aladin – local version (only tested)
- GFS NCEP – Global Forecast System (since January 2010)

SAFNWC at IMWM – Poland

NWP Model Data

- In Poland we don't have operational access to recommended (tested) ECMWF, Arpege or Hirlam models data. It is necessary to implemented other available NWP model data.

- In the year 2004 – 2009 UK Met Office Global Atmospheric Model data was used.
- In this year (January 2010) implementation of the new Numerical Weather Prediction model data was done, and now GFS NCEP model is supporting NWC-SAF local processing.
- Data from local implementation of Aladin mesoscale model were also tested.

- Experiences in operational use of SAFNWC products with different type of input data are presented including limitations and benefits of used auxiliary data.

SAFNWC at IMWM – Poland

NWP Model Data

LACK of UK Model data

UK Model - Products partly generated

LACK of UK and GFS Model data

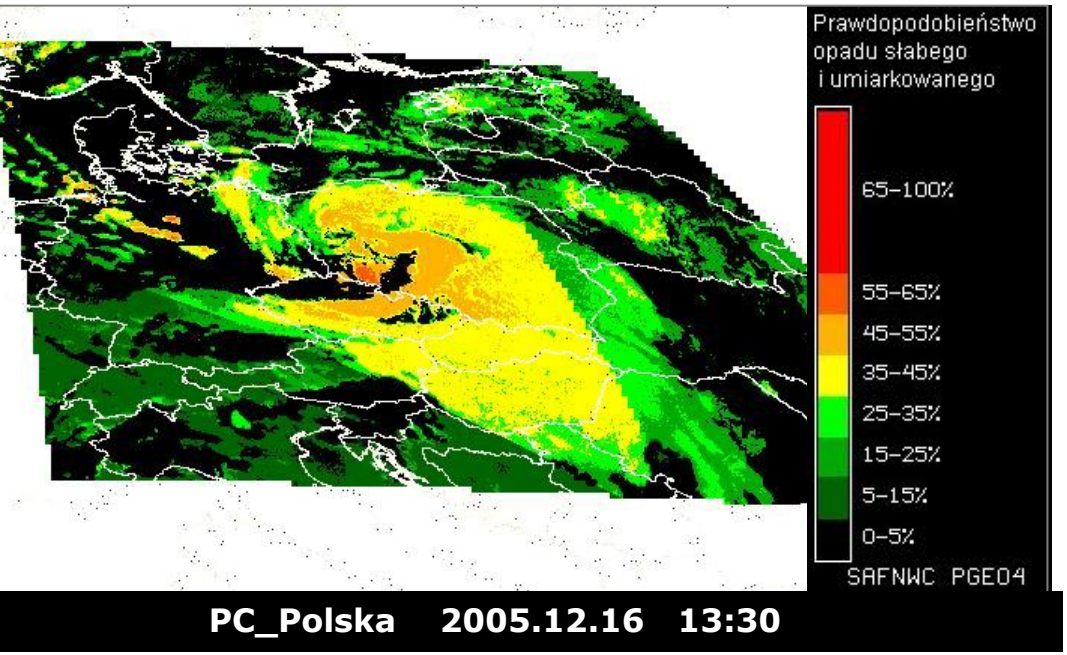
UK Model - Product not generated

NWP forecast \ PGE	01 CMa	02 CT	03 CTTH	04 PC	05 CRR	06 TPW	07 LPW	08 SAI	09 HRW	10 ASII	11 RDT	12 AMA
2m air temp.			✓		✓							
2m relative humidity			✓									
2m dew point temp.			✓		✓							
Surface temp.	✓	✓	✓	✓								
Surface Pressure			✓		✓							
Atmospheric WV content	✓	✓										
Temp. at various levels	✓	✓	✓		✓				✓	✓		✓
Humidity at various levels			✓		✓					✓		✓
Tropopause temp.		✓										
Wind velocity at various levels					✓				✓	✓		
NWP altitude model	✓	✓	✓									
NWP landsea	✓	✓										
Geopotential at surface	✓	✓	✓									
Geopotential										✓		

**AV_PRESSURE_LEVELS*: 1000, 925, 850, 700, 500, 400, 300, 250, 200

NWP Model Data - Aladin Poland

PGE04 PC Precipitation Probability



ALADIN

Mesoscale model NWP

Resolution : 13.5 km

Size : 169 x 169 gridpoints

31 layers

The domain of ALADIN mesoscale model data calculated in Poland not covered defined area.

NWP Model Data - UK Met Office Global Atmospheric Model

PGE04 PC Precipitation Probability - before

Met Office Global Atmospheric Model

Area A: Lat. 89.7°-0.3°N, Long. 18.75°W-71.25°E

Resolution : 0.56 deg N/S x 0.83 deg E/W

Size : 162 X 108 gridpoints

Longitude of first / last gridpoint : **341.25 deg** / 70.416 deg

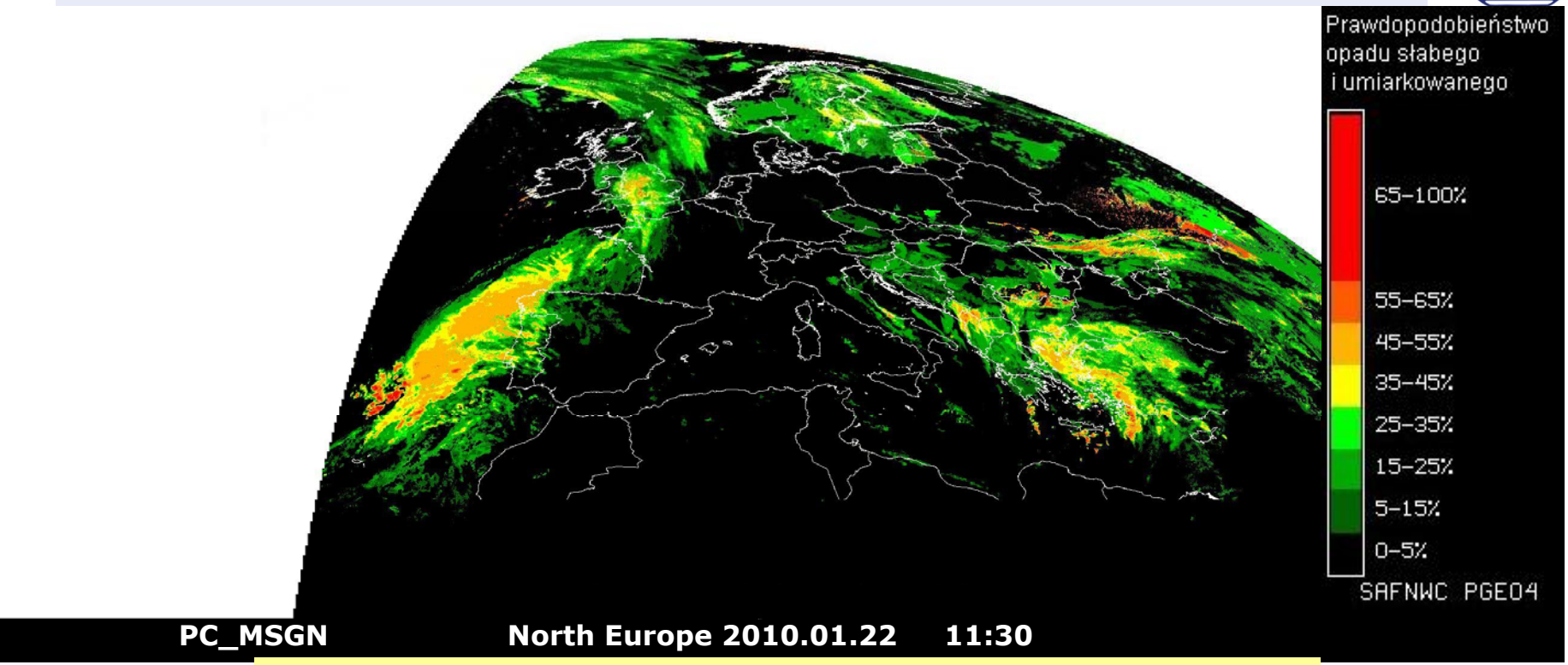
Latitude of first / last gridpoint : 0.279 deg / 89.722 deg

Due to different longitude coding scheme in this model and because UK Met Office Model was not tested as a recommended, problems with longitude calculation appeared and need to be resolved.

```
grib.range0_360=0
lon. range between
-180 and 180 (-180/180 )
```

NWP Model Data - UK Met Office Global Atmospheric Model
Little changes in longitude calculation in procedure :

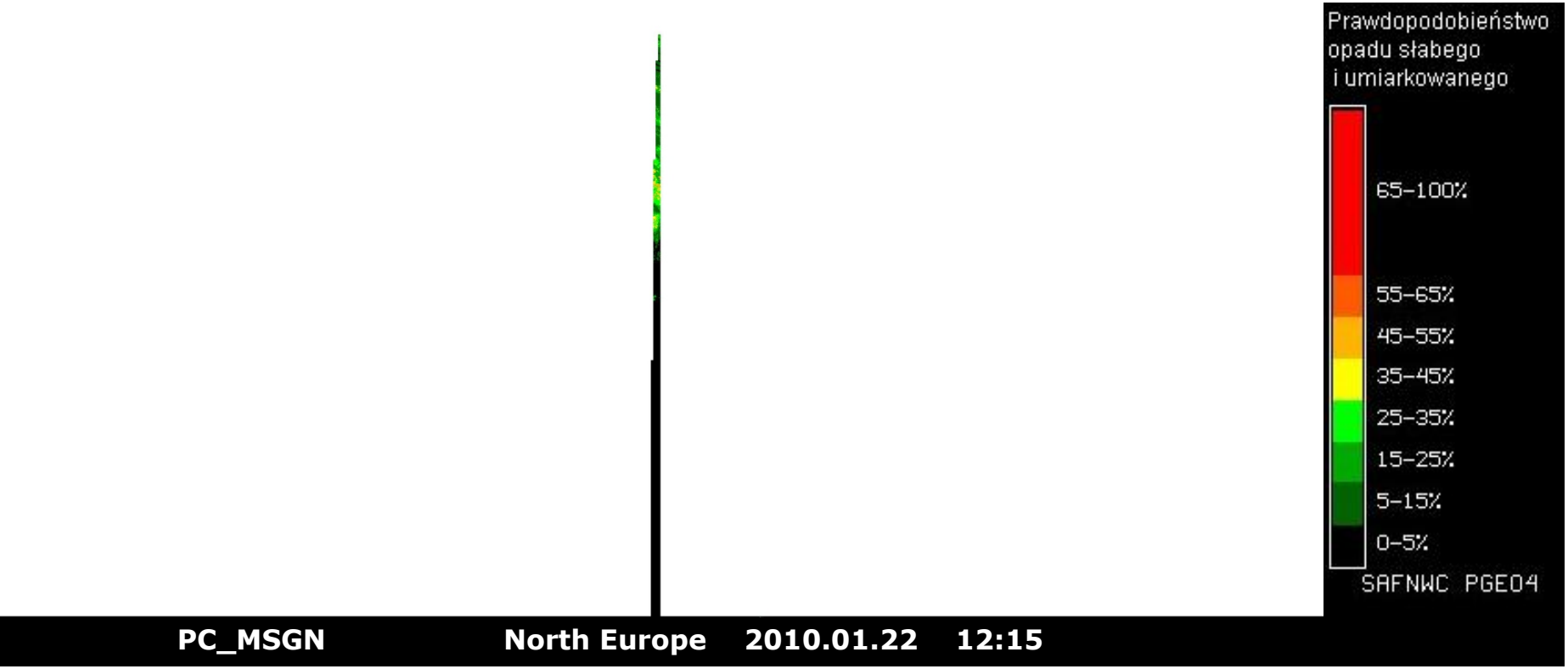
$SAFNWC/MSG_v3.0/src/NWCLIB/NWP/**InitGrid.c**




```
   if ((grid->first_lon<0) || (grid->first_lon>180))
     grid->range0_360=0;
   else
     grid->range0_360=1;
   if(grid->range0_360) {
    if (grid->first_lon<0)  grid->first_lon += 360.0;
    if (grid->last_lon<0)   grid->last_lon += 360.0; }
   else  {
    if (grid->first_lon>180)  grid->first_lon -= 360.0;
    if (grid->last_lon>180)   grid->last_lon -= 360.0; }
/* Compute the sign of the step for longitude */
   lon_diff=grid->last_lon - grid->first_lon;
```

NWP Model Data - GFS NCEP (Global Forecast System)

PGE04 PC Precipitation Probability - before



GFS NCEP (National Centers for Environmental Prediction)

Area : Lat. 90.0°N-90.0°S, Long. 0.0°E-1.0°W

Resolution : 1.0 deg N/S x 1.0 deg E/W

Size : 181 X 360 gridpoints

Longitude of first / last gridpoint : **0.0 deg / -1.0 deg**

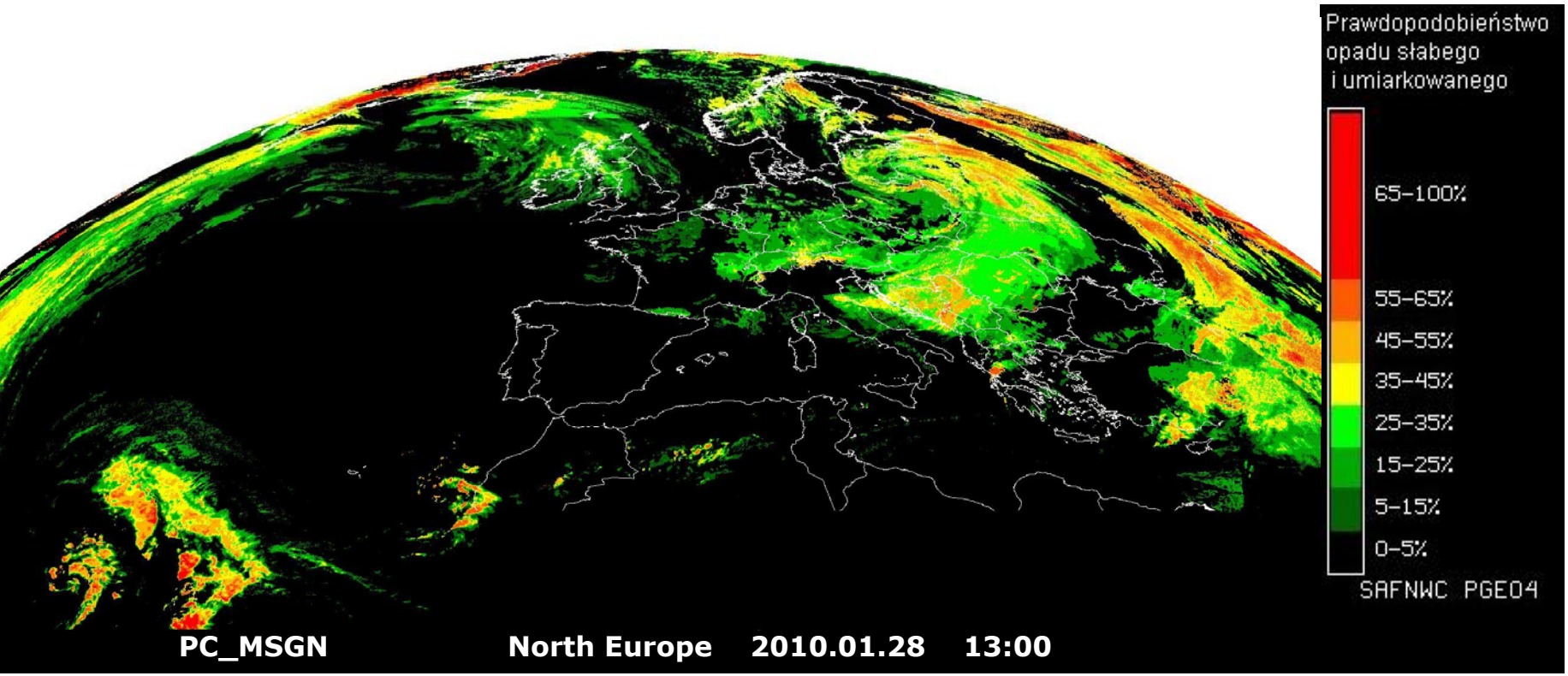
Latitude of first / last gridpoint : 90.0 deg / -90.0 deg

There was the same problem in longitude calculation because of the method of coding longitude in GFS Model

```
grib.range0_360=1
lon.range between
0 and 360 (0/360 )
```

NWP Model Data - GFS NCEP (Global Forecast System)

$SAFNWC/MSG_v3.0/src/NWCLIB/NWP/**InitGrid.c**



GFS NCEP (Global Forecast System - National Centers for Environmental Prediction)

This is the only one global model for which all output is available, for free,

over the internet (as a result of U.S. law).

http://www.nco.ncep.noaa.gov/pmb/products/gfs/

NWP Model Data - GFS NCEP (Global Forecast System)

Description

GFS NCEP (Global Forecast System - National Centers for Environmental Prediction)
This is the only global model for which all output is available, for free, over the internet (as a result of U.S. law).

http://www.nco.ncep.noaa.gov/pmb/products/gfs/

360 X 181 points (65160)

Horizontal Resolutin:
The model is run in two parts: the first part has a higher resolution 0.5 X 0.5 degree latitude / longitude. and goes out to 180 hours (7 days) in the future, the second part runs from 180 to 384 hours (16 days) at a lower resolution (1.0 X 1.0 degree latitude / longitude).

Vertical Resolution
64 unequally-spaced sigma levels. For a surface pressure of 1000 hPa, 15 levels are below 800 hPa, and 24 levels are above 100 hPa.

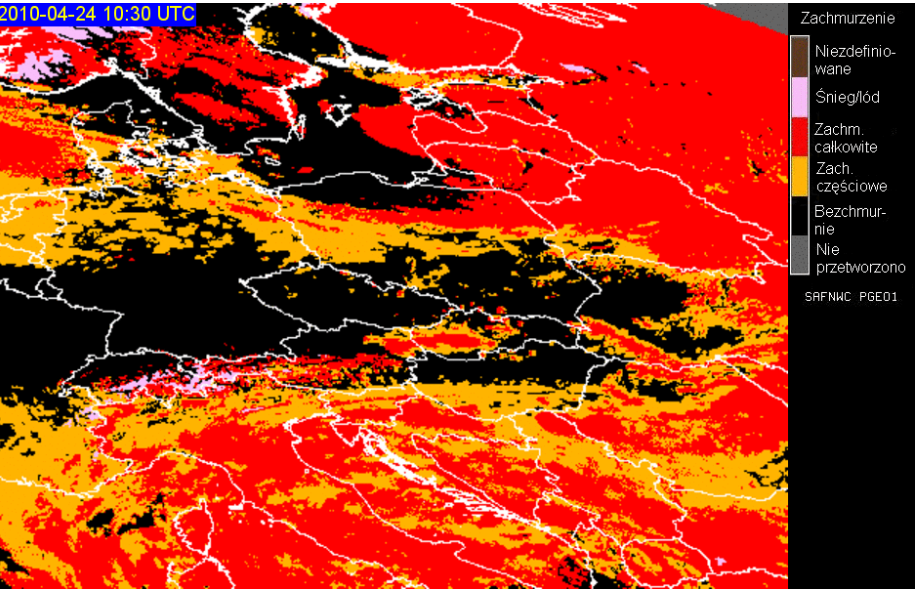
http://wwwt.emc.ncep.noaa.gov/gmb/moorthi/gam.html

Software for conversion grib1 and grib2 data:

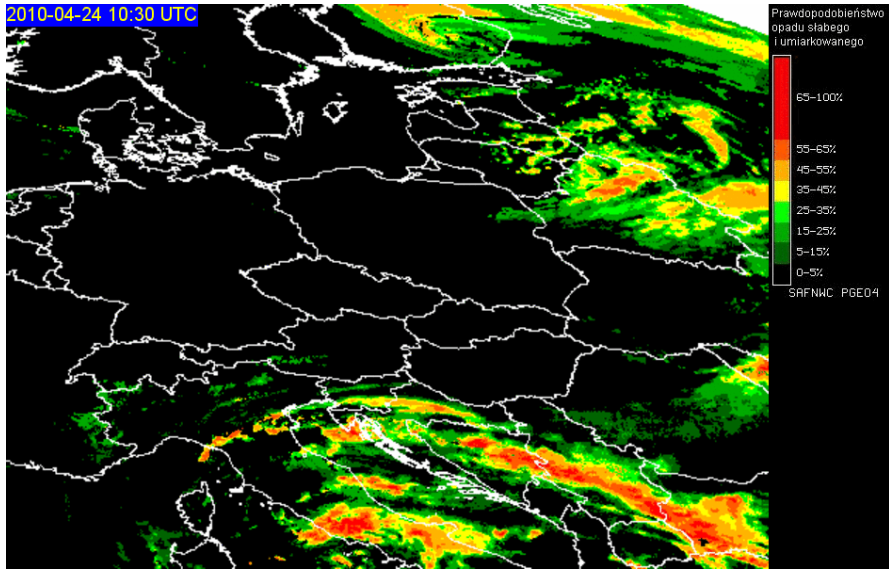
http://www.nco.ncep.noaa.gov/pmb/codes/GRIB1/
http://www.nco.ncep.noaa.gov/pmb/codes/GRIB2/

SAF-NWC products actually generated at IMWM and operationally available for the users

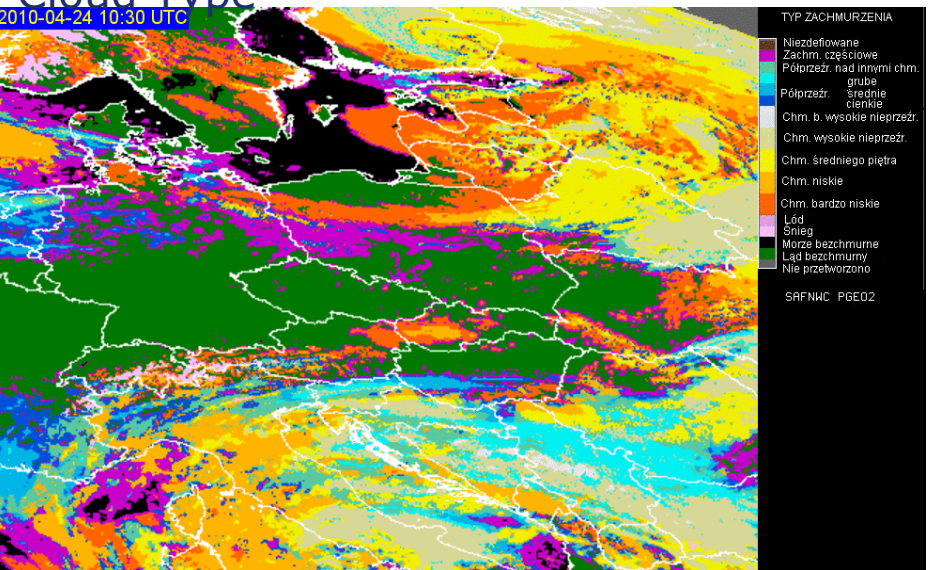
Cloud Mask



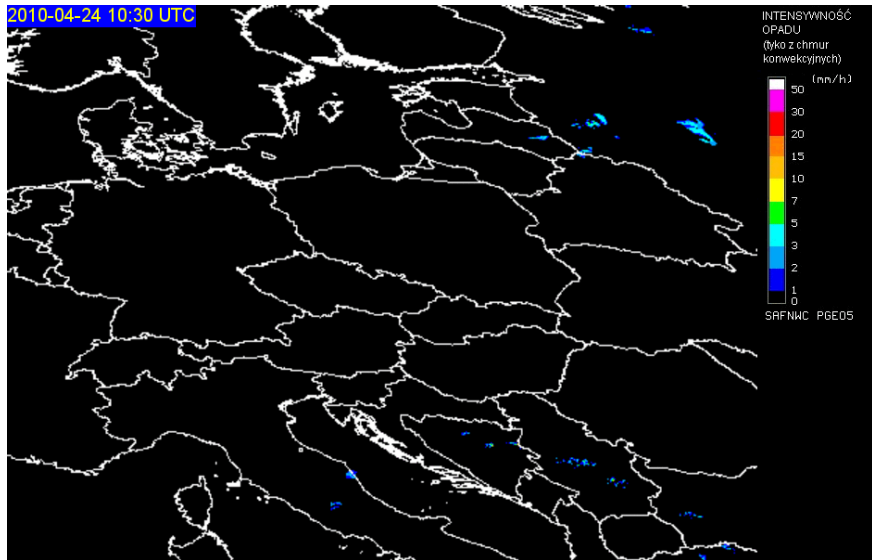
Precipitating Clouds



Cloud Type

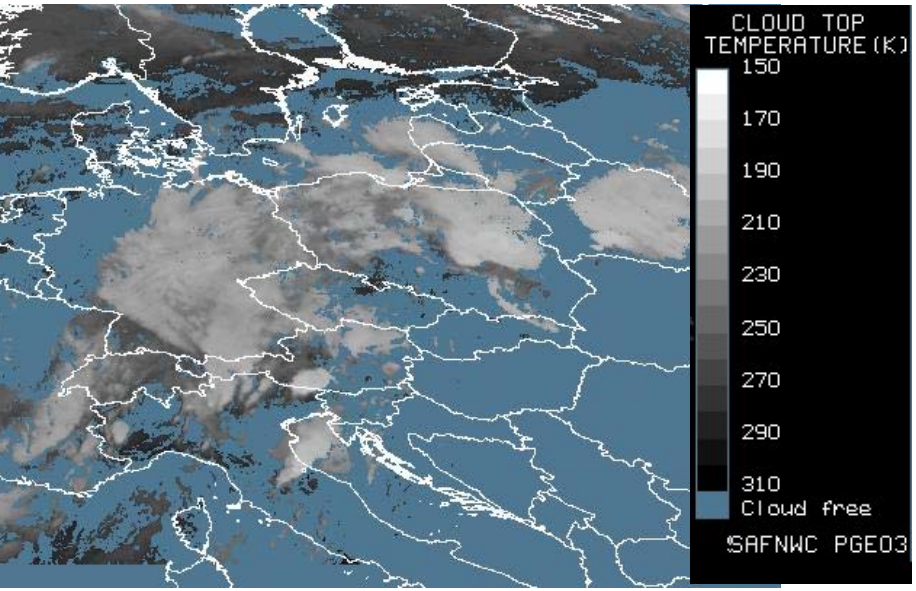


Convective Rainfall Rate

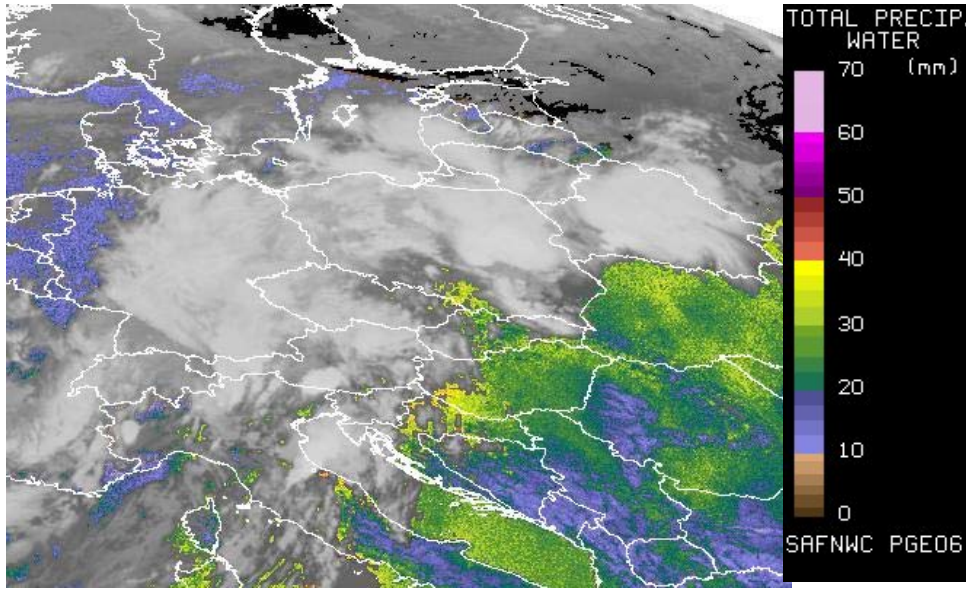


SAF-NWC products generated operationally but used mainly for research works

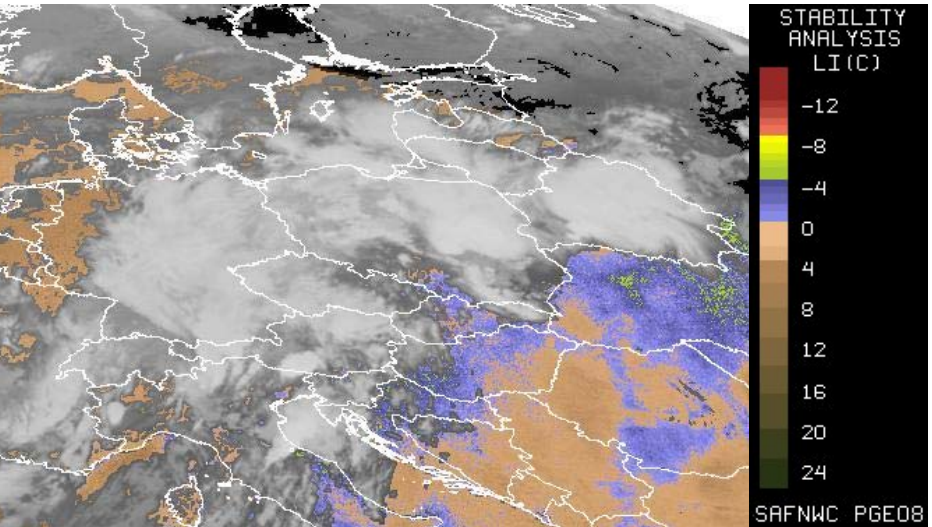
CTTH



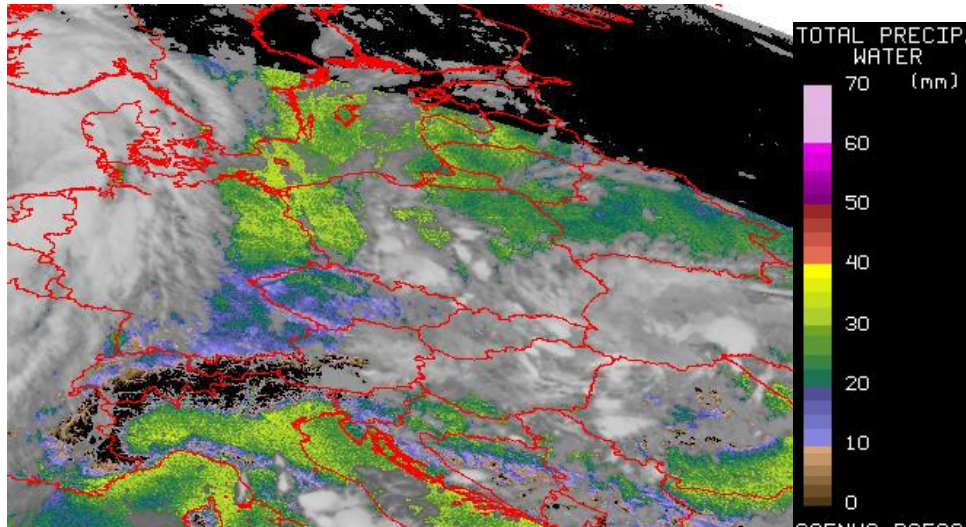
TPW



SAI

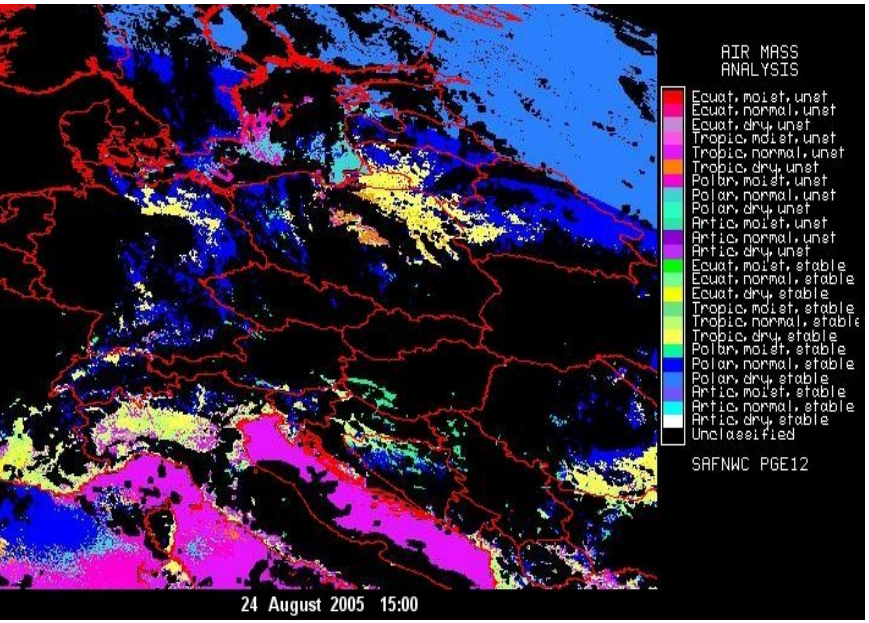


LPW – BL, ML, HL



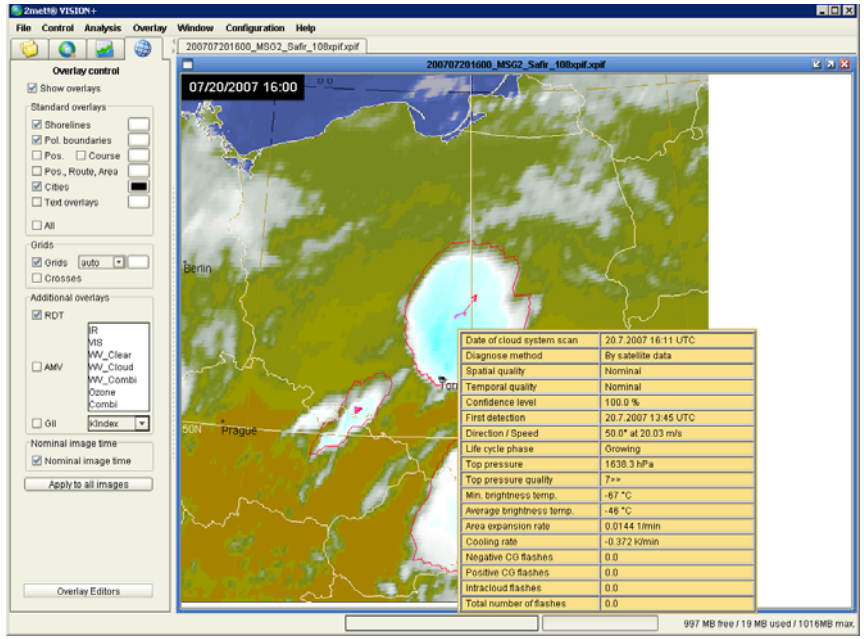
SAF-NWC products generated operationally but not used at the moment

AMA



No need from the users

RDT



Limited accuracy in our region

ASII
HRW

Lack of proper graphical presentation

Examples of use SAFNWC package

The users experiences and expectations for the most useful/needed products are discussed focusing on products mainly used in IMWM related to:

Snow recognition

Fog recognition and monitoring

Convection development and storm nowcasting

PGE02 CT CLOUD TYPE - SNOW DETECTION

2010.01.27 10:45 UTC

EXAMPLE OF GOOD SNOW DETECTION

IN THE CASE OF HIGH SUN ELEVATION

(calculated with GFS model data)

2010.01.27 14:30 UTC

EXAMPLE OF PROBLEMS WITH SNOW DETECTIO

IN THE CASE OF LOW SUN ELEVATION

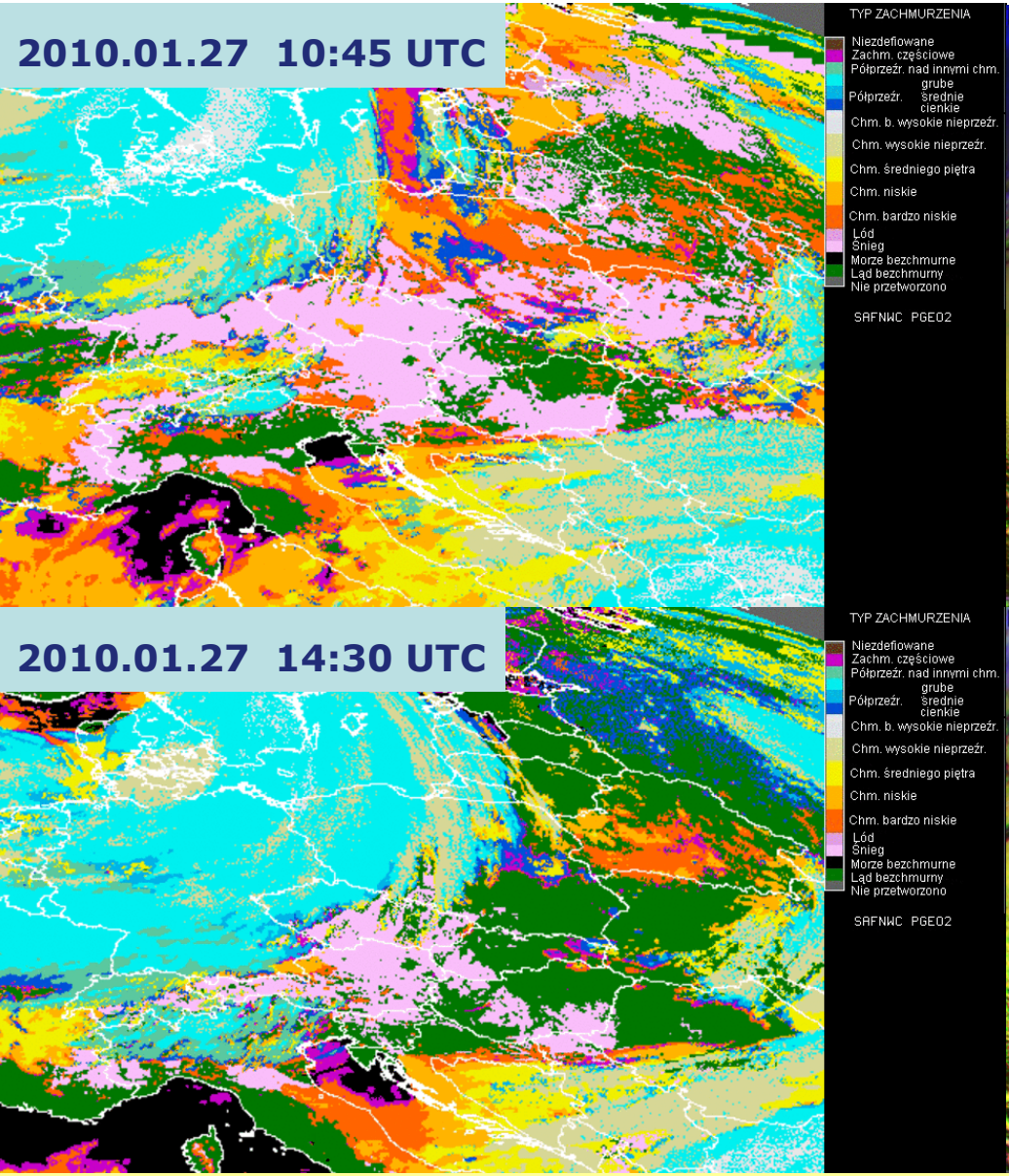
(calculated with GFS model data)

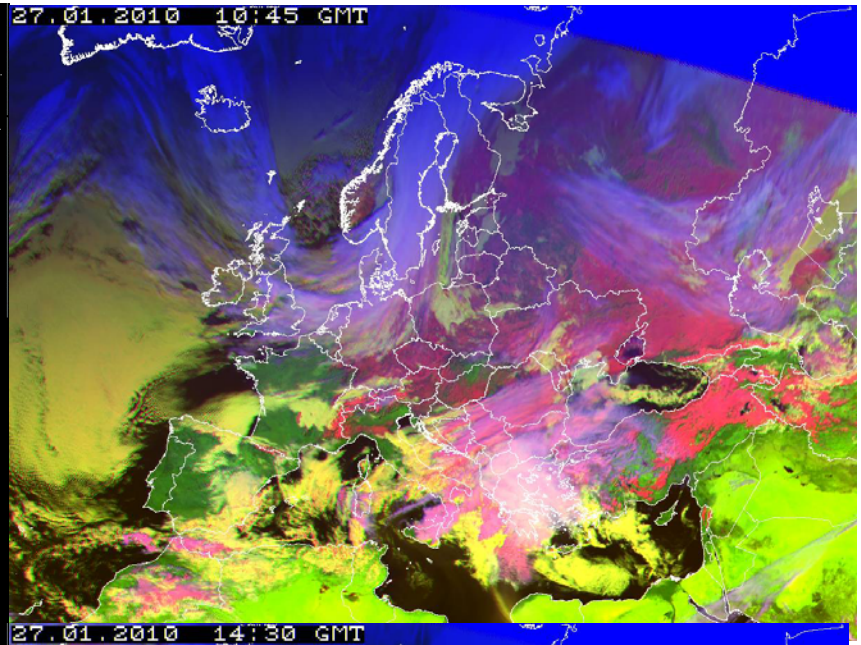
Fot.G.Beblot www.imgw.pl

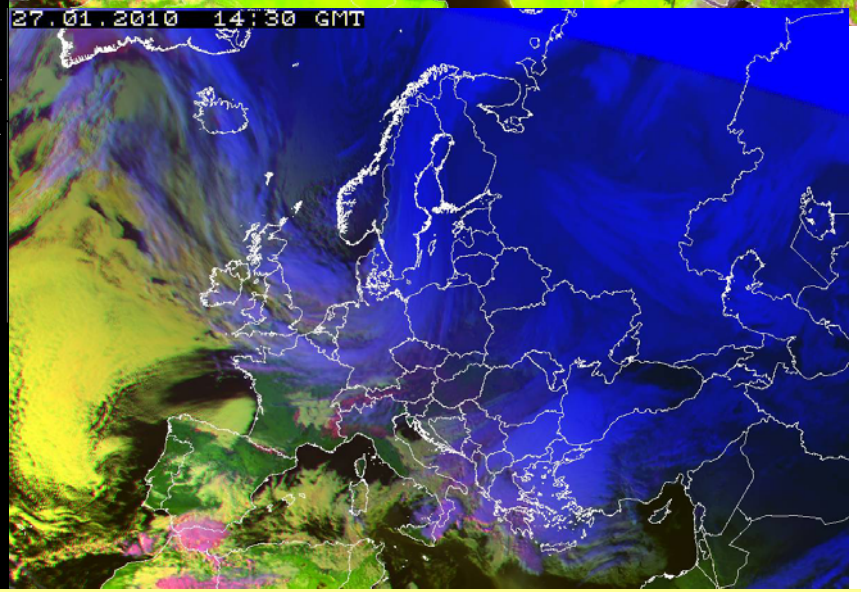
PGE02 CT CLOUD TYPE

SNOW DETECTION safnwc ver.2009

Met9 RGB ch 139i



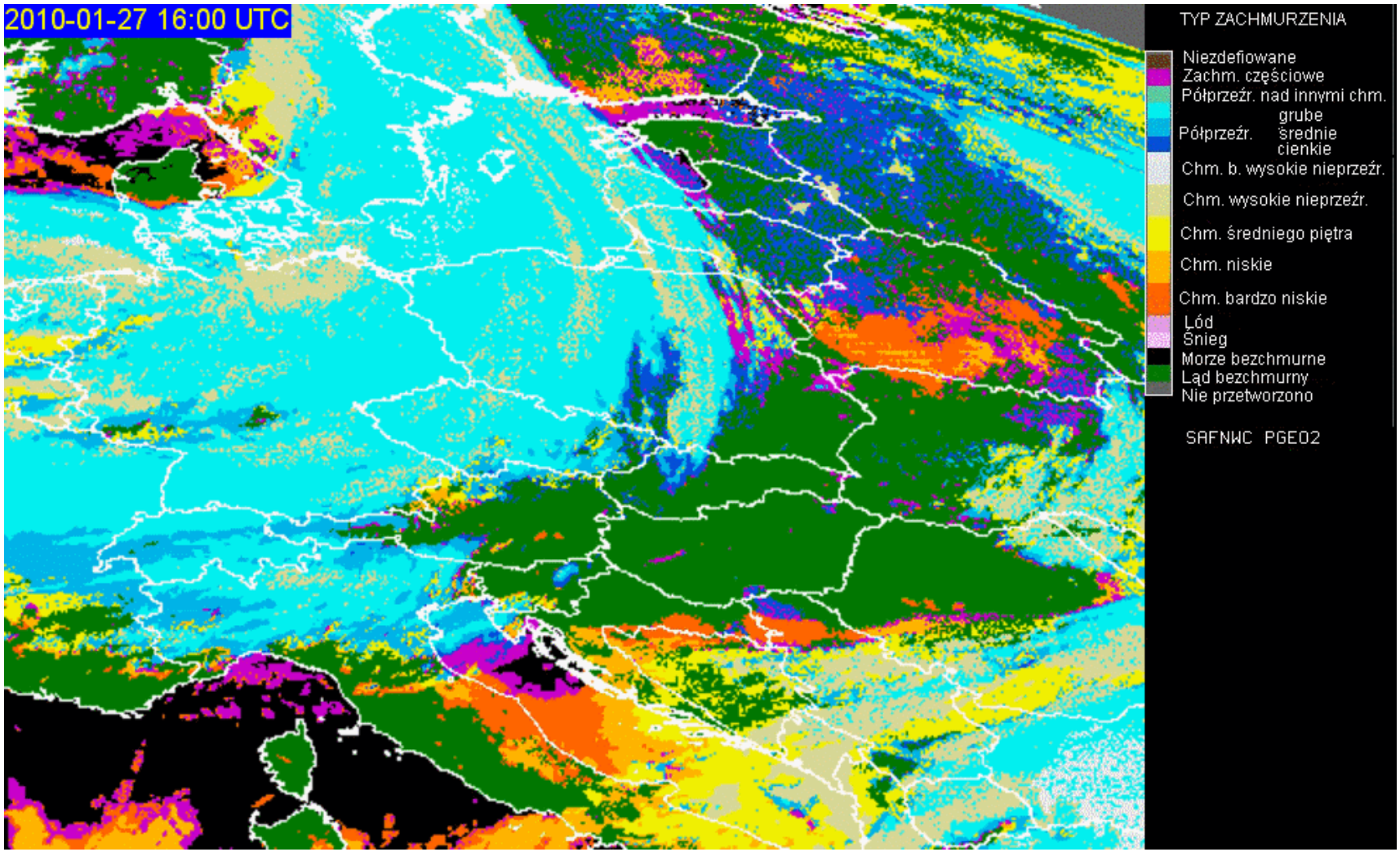




There was the problem with snow recognition because lack of 1.6 µm channel data in low sun elevation.

PGE02 CT CLOUD TYPE

SNOW DETECTION



PGE02 CT CLOUD TYPE - FOG DETECTION

2006.12.27 07:45 UTC

EXAMPLE OF PROBLEMS WITH FOG DETECTION

IN THE CASE OF LOW SUN ELEVATION

2006.12.27 12:00 UTC

EXAMPLE OF GOOD FOG DETECTION

IN THE CASE OF HIGH SUN ELEVATION

2010.03.11 05:45 UTC

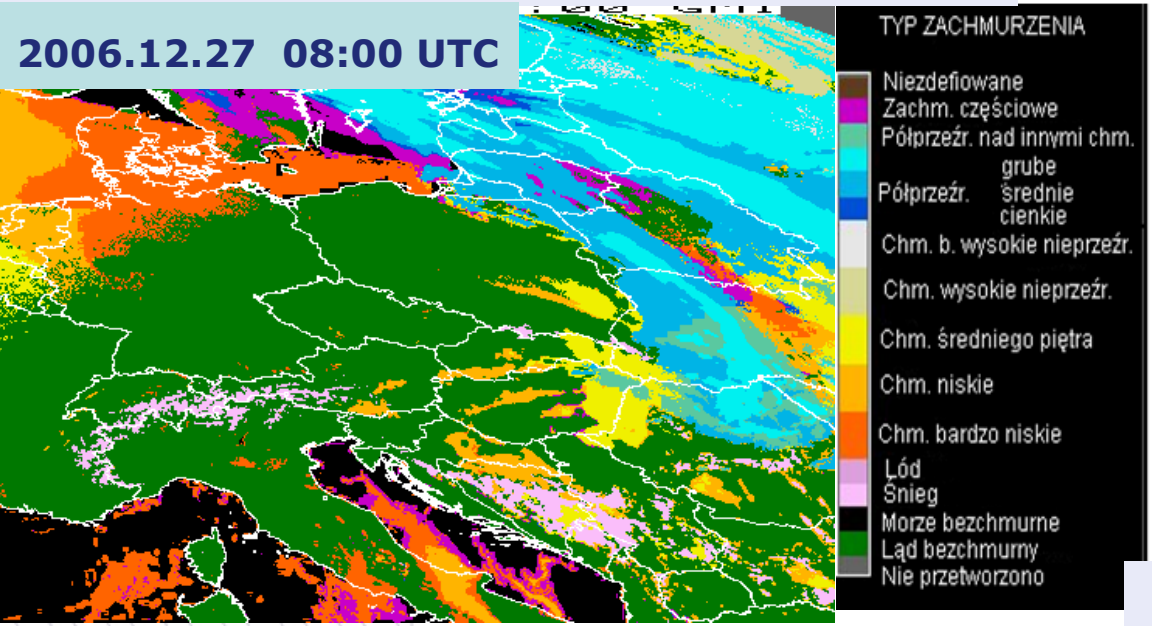
EXAMPLE OF GOOD FOG DETECTION

IN THE CASE OF LOW SUN ELEVATION (calculated with GFS model data)

PGE01 CMa Cloud Mask (b) ; PGE02 CT CLOUD TYPE (u)

FOG DETECTION safnwc ver.1.2

2006.12.27 08:00 UTC

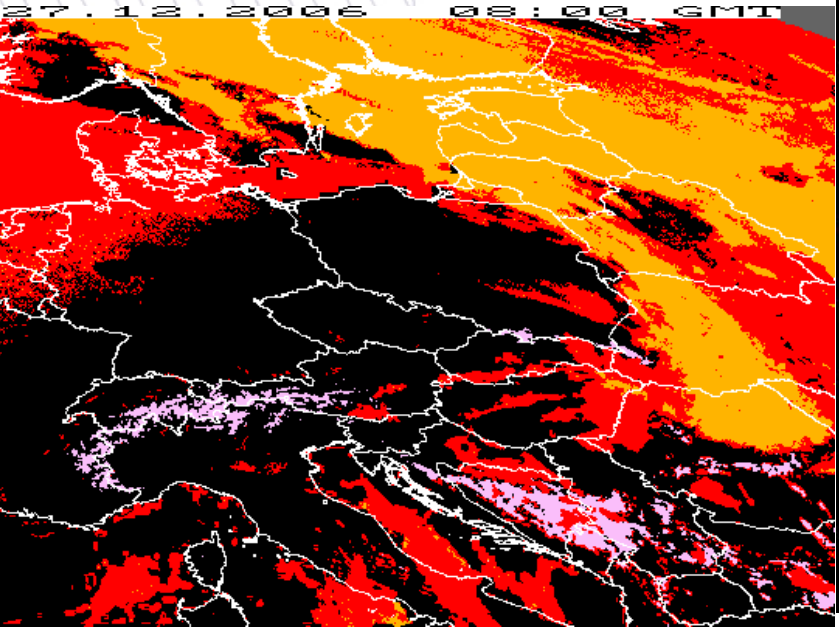


MIĘDZYNARODOWA KLASYFIKACJA CHMUR

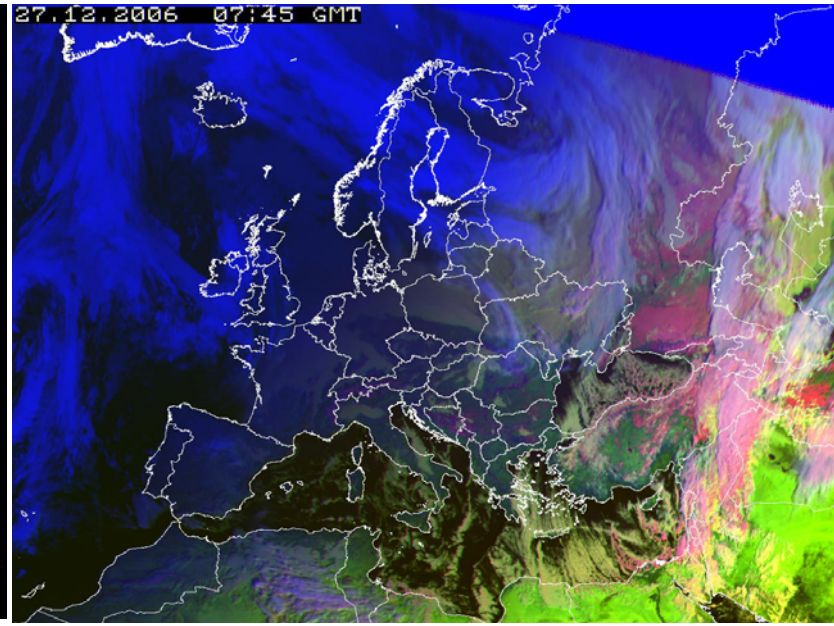
Ci nad St / Sc / Cu
Cs
Ci
Cb - pojedyncze lub w grupie
Cs nad Ac / As lub Ci nad Ac / As

Ac, As, Cu cong
Sc

Mgła, St, Cu



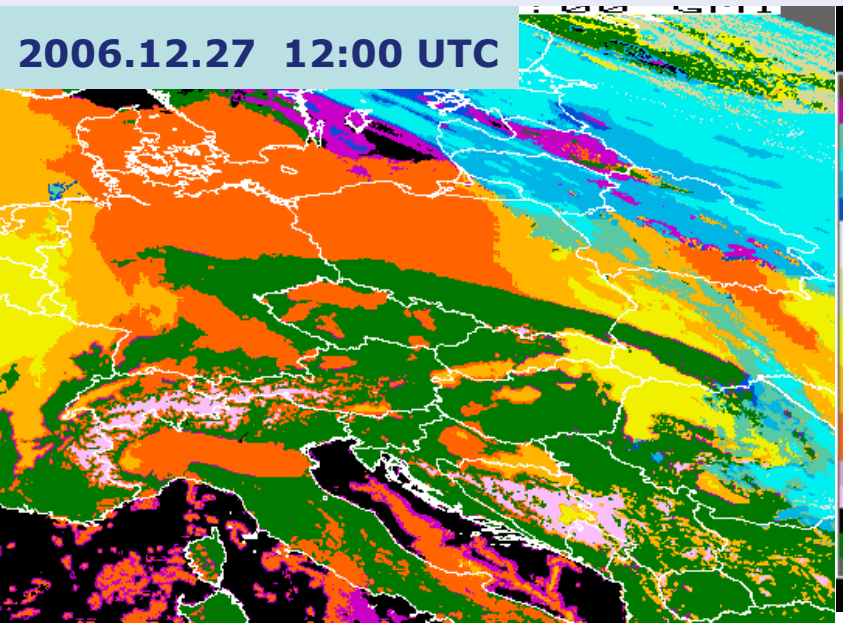
Met9 RGB ch 139i



PGE01 CMa Cloud Mask (b) ; PGE02 CT CLOUD TYPE (u)

FOG DETECTION safnwc ver.1.2

2006.12.27 12:00 UTC



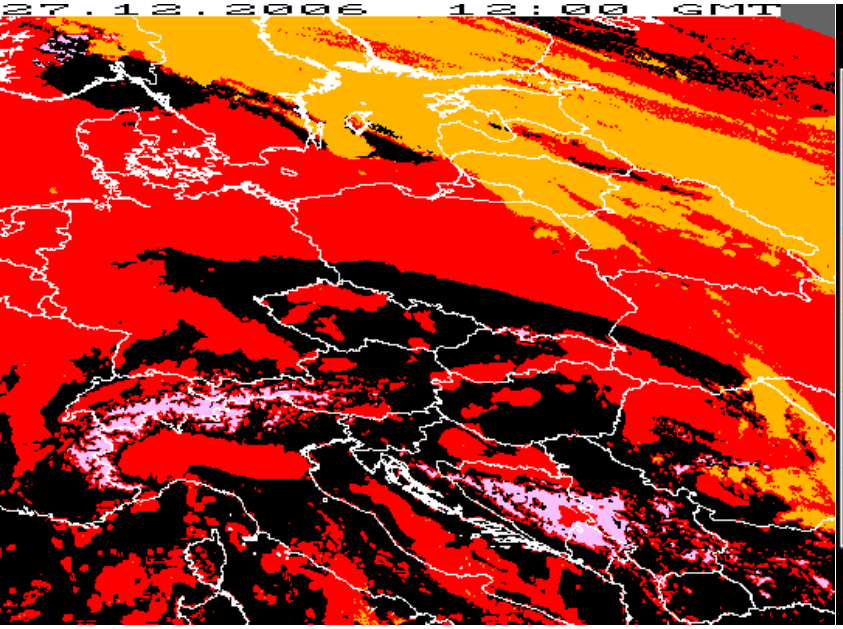
MIĘDZYNARODOWA KLASYFIKACJA CHMUR

Ci nad St / Sc / Cu
Cs
Ci
Cb - pojedyncze lub w grupie

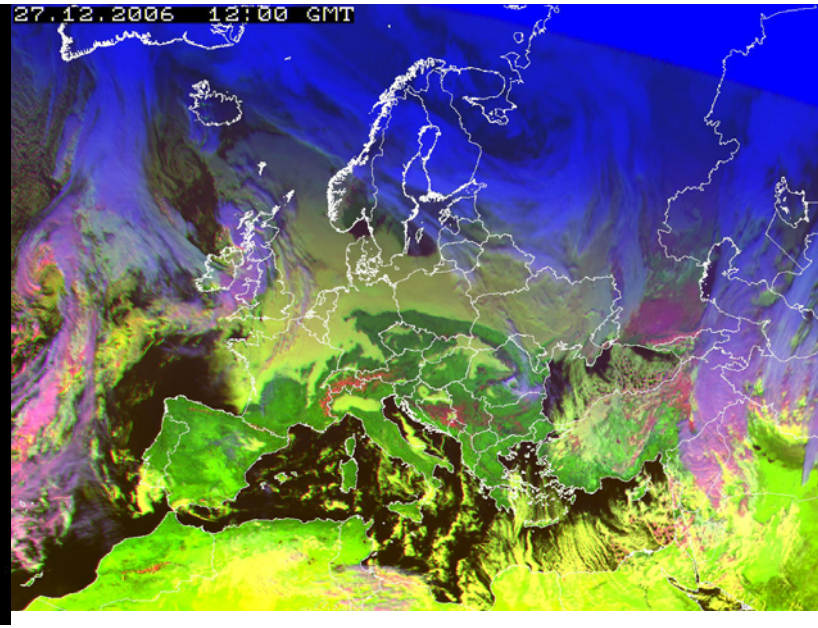
Cs nad Ac / As lub Ci nad Ac / As

Ac, As, Cu cong
Sc

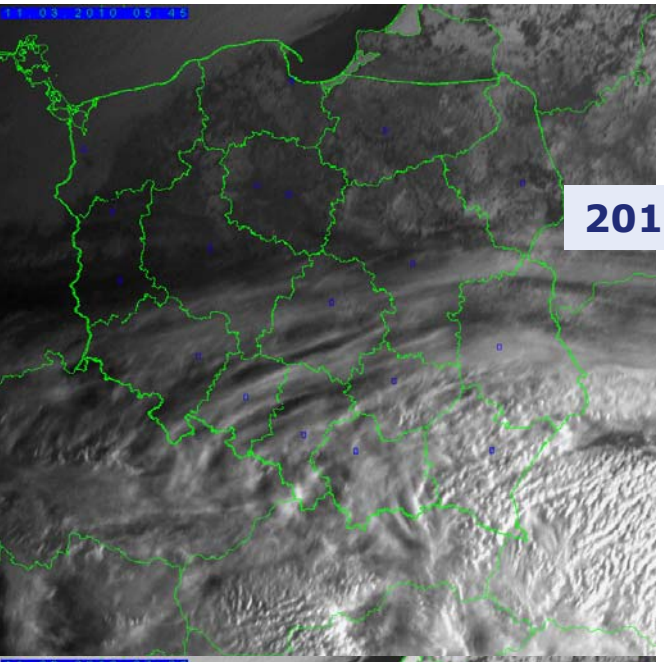
Mgła, St, Cu



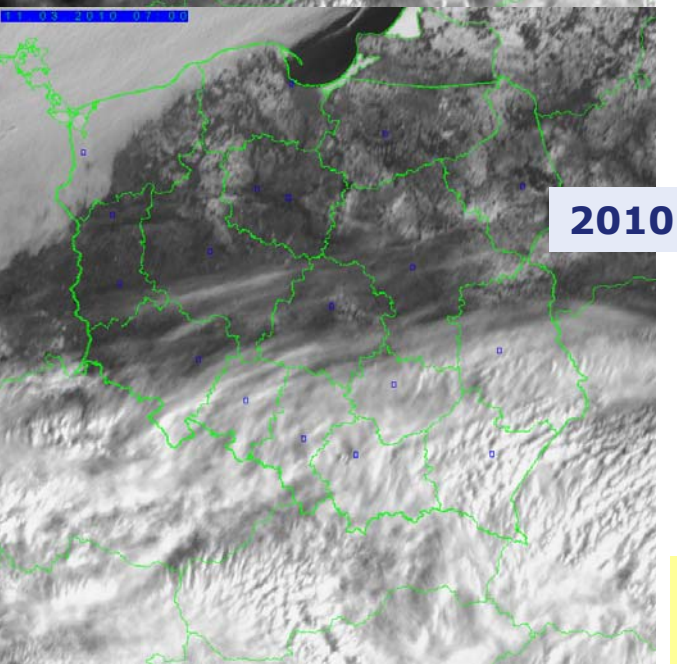
Met9 RGB ch 139i



HRVis Channel



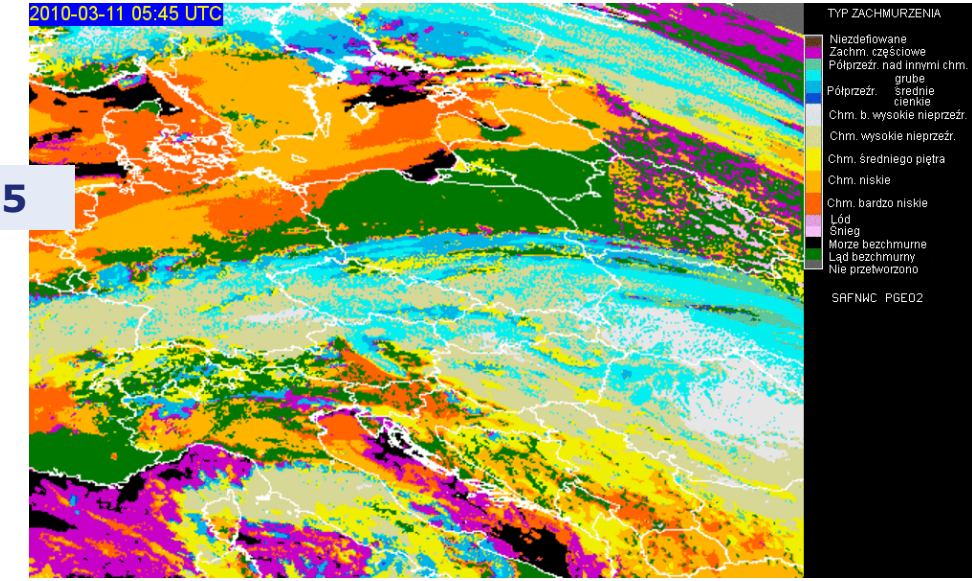
2010.03.11 05:45

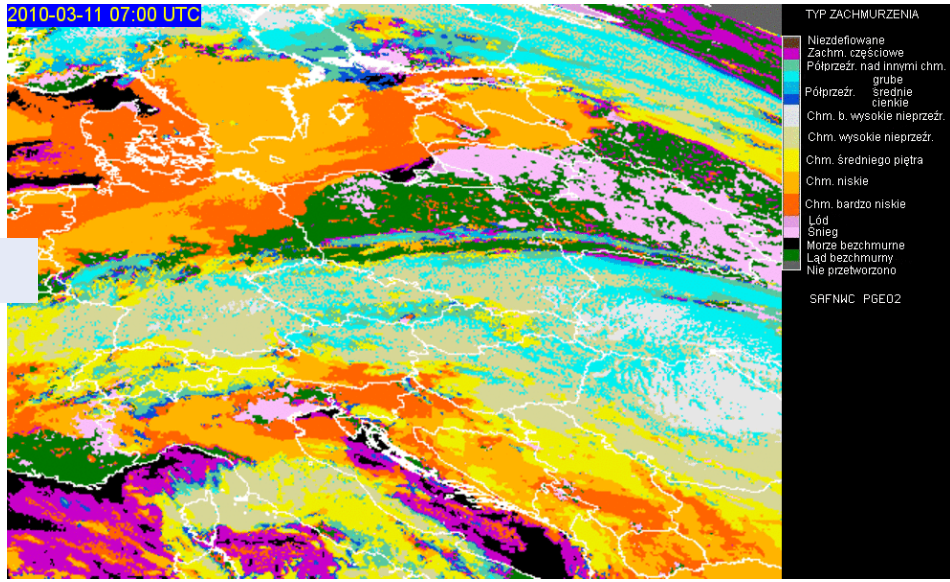


2010.03.11 07:00

PGE02 CT CLOUD TYPE

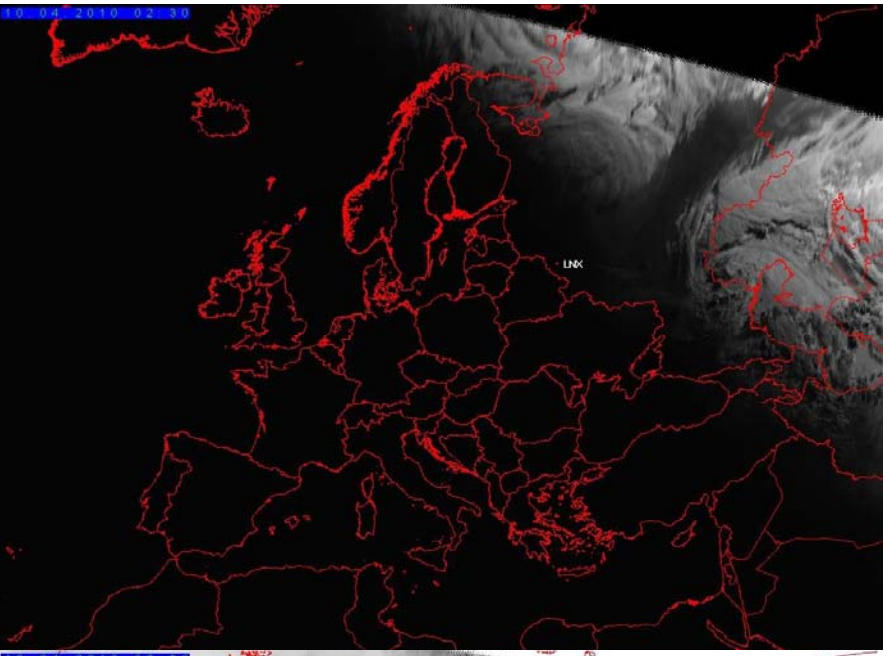
FOG DETECTION safnwc ver.2009

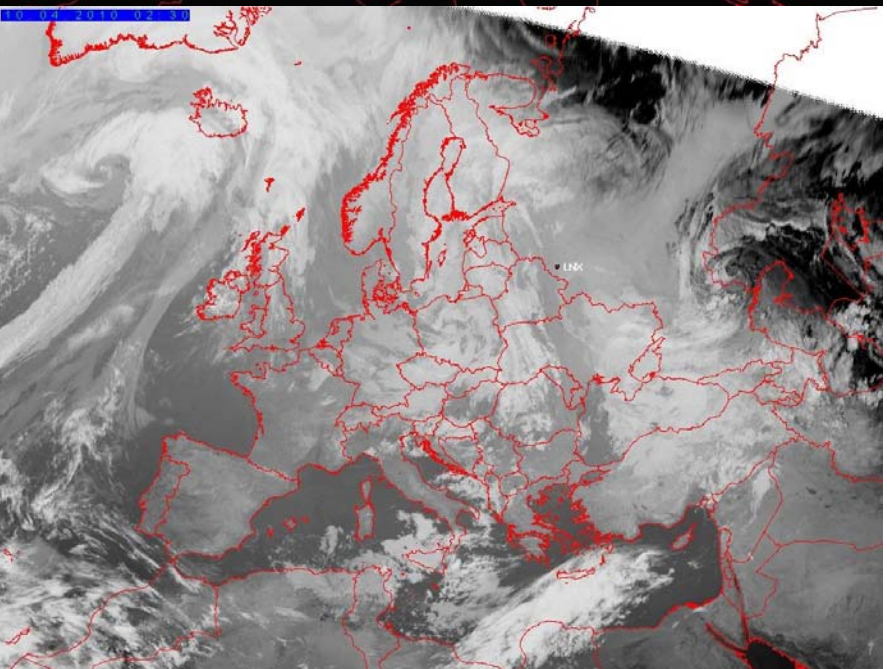


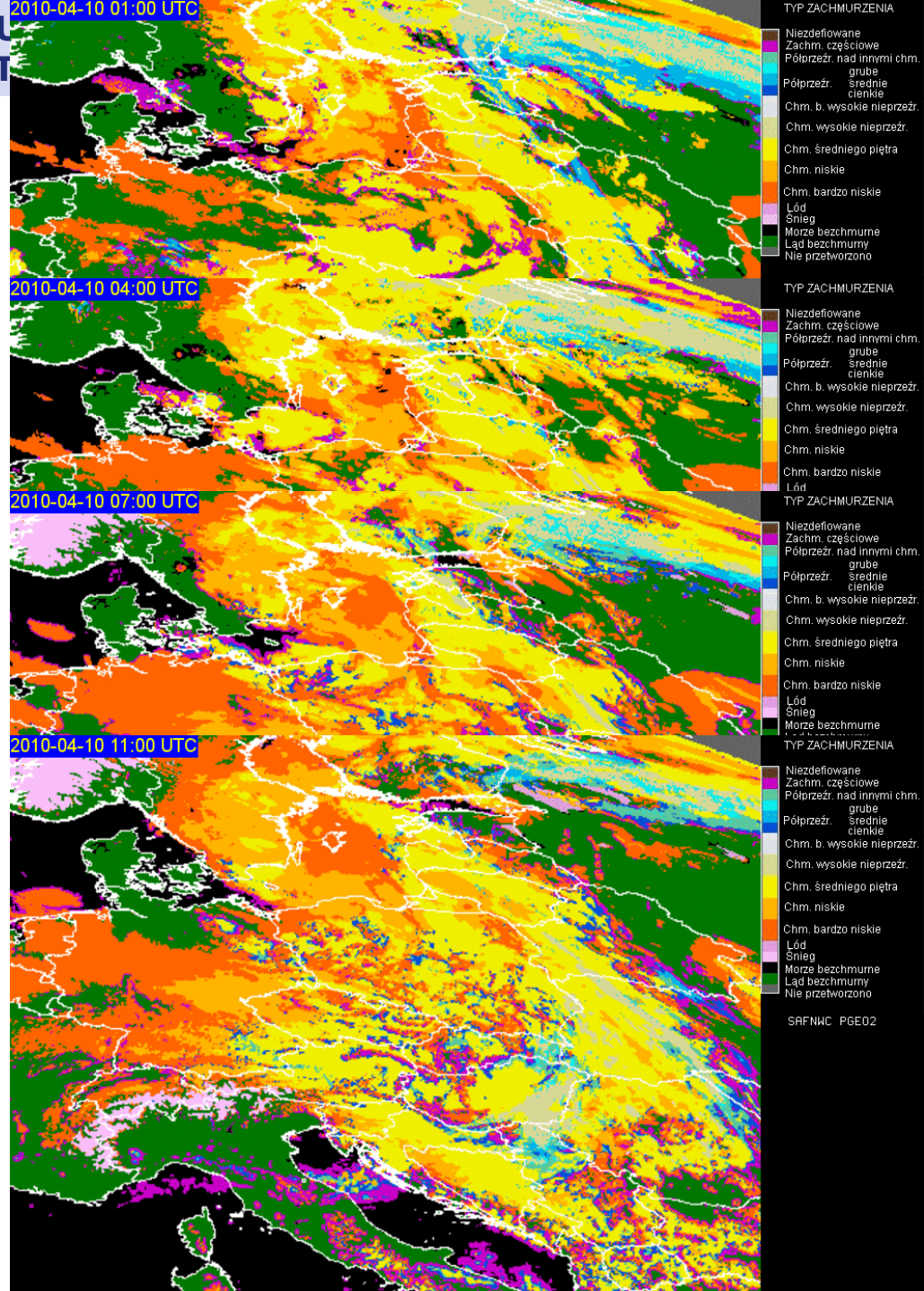


In this version improved fog recognition. Snow still not recognized properly.

Fog over SMOLENSK 10.04.2010 006:56 U
MET9 IR1,6um ; MET9 IR 3,9um ; PG02 CT







PGE02 CT CLOUD TYPE

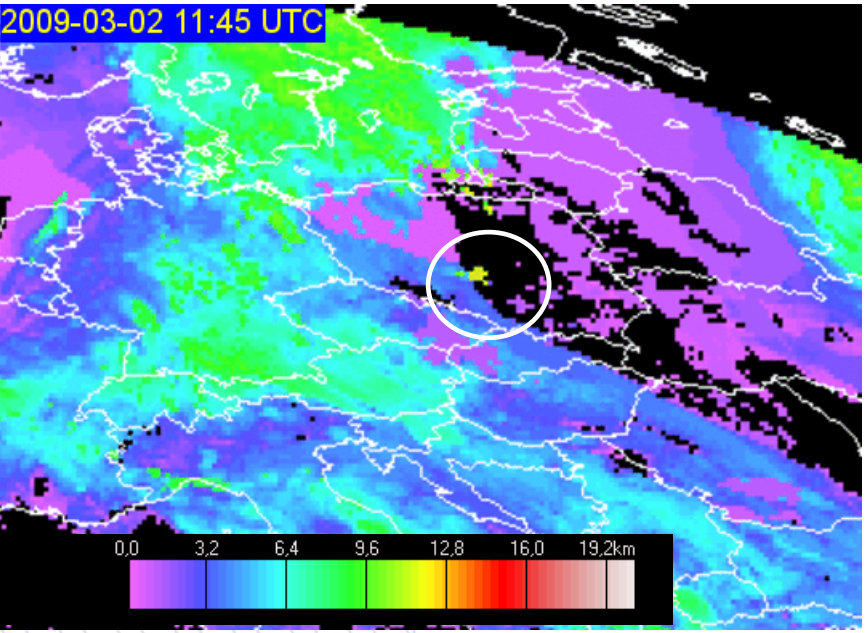
CLOUD MONITORING

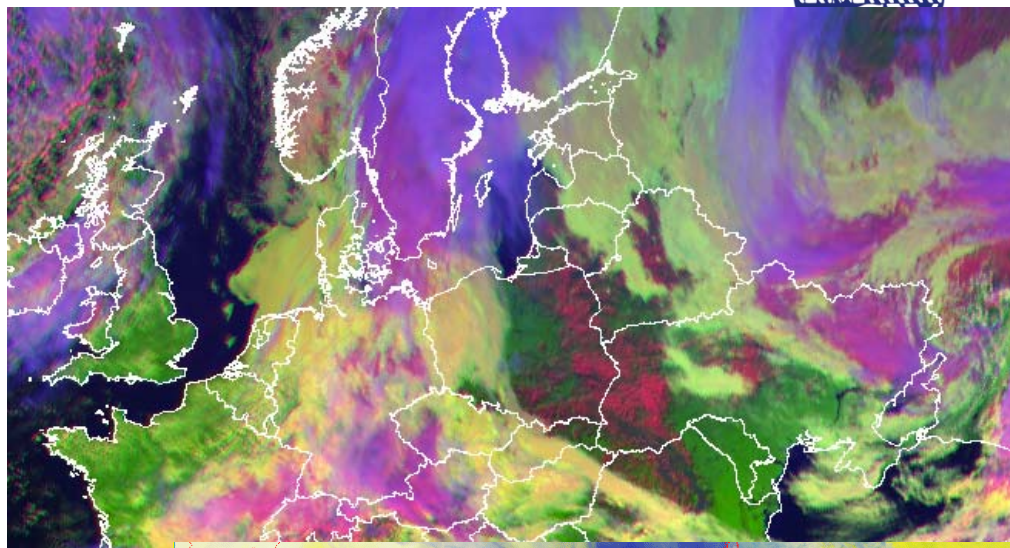
2009.03.02 11:45 UTC

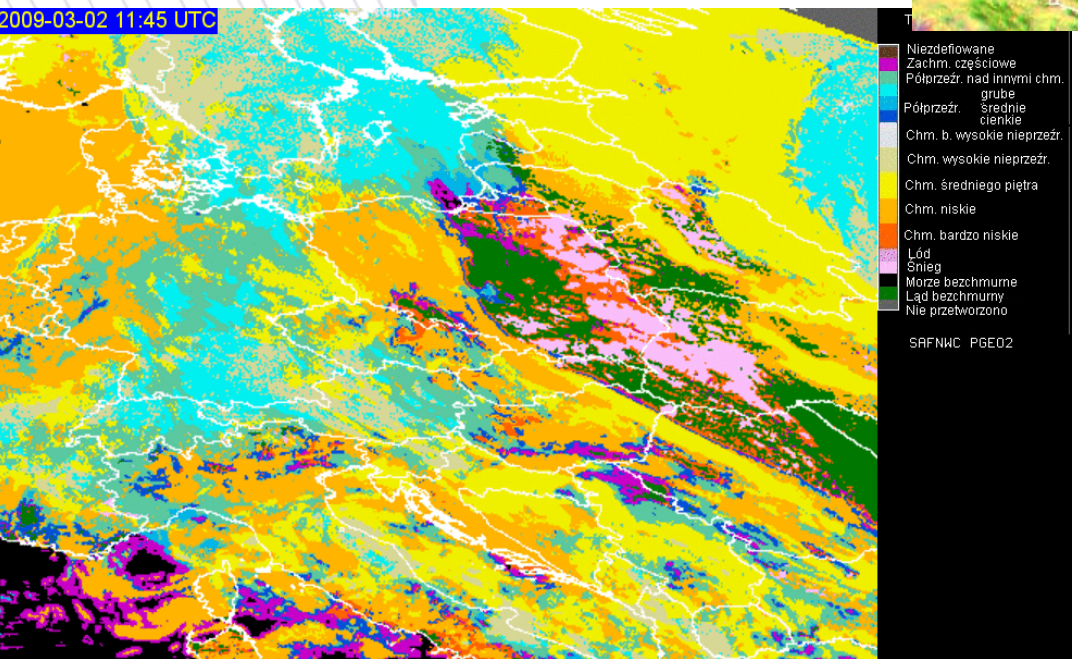
EXAMPLE OF SMALL HIGH CLOUD OVER OTHER CLOUDS AND GROUND

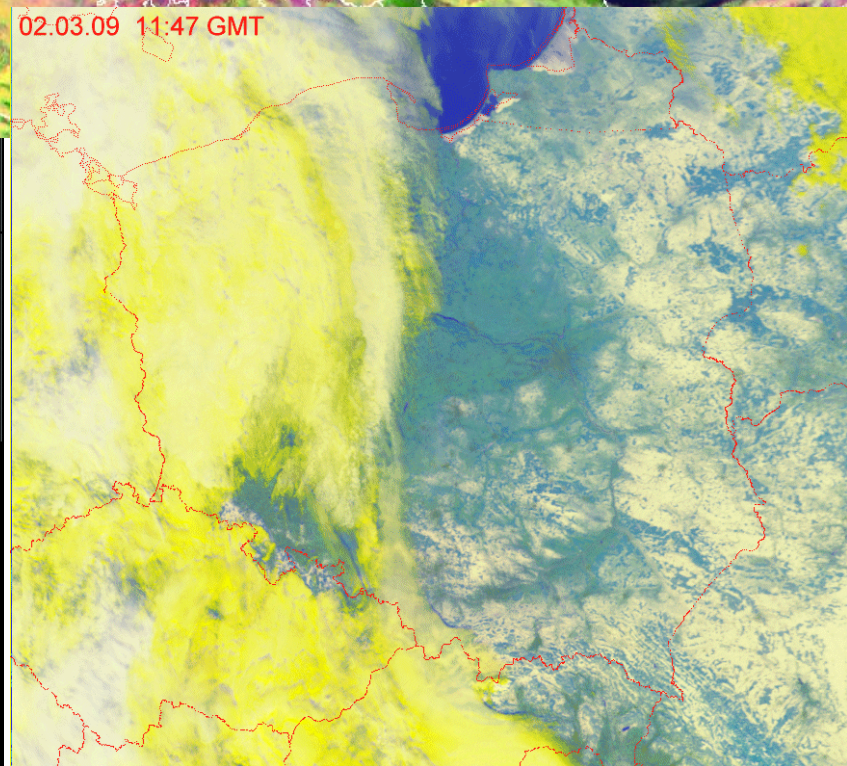
PGE02 CT CLOUD TYPE

CLOUD MONITORING









SAFNWC PRODUCTS USED IN IMWM

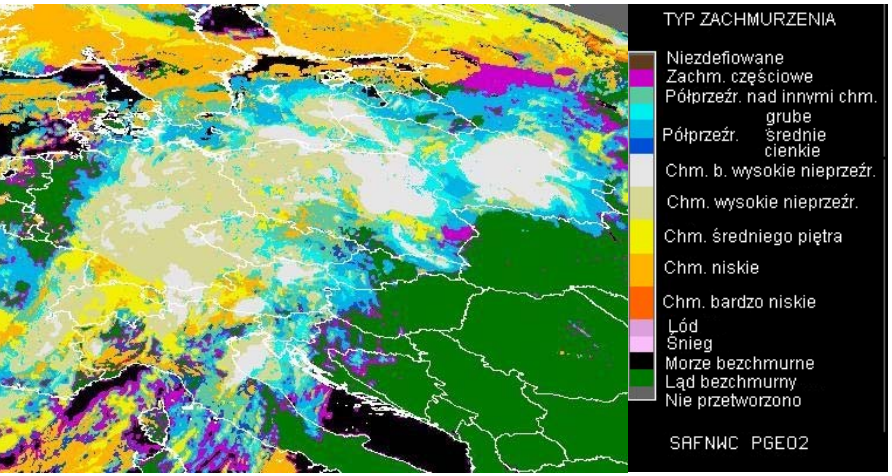
CONVECTION DEVELOPMENT

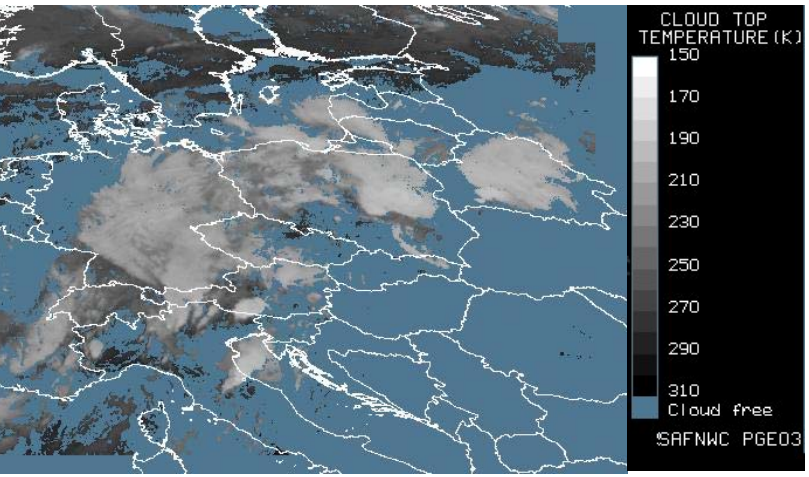
2008.08.15 07:45 UTC

EXAMPLE OF CONVECTION DEVELOPMENT

Convection Monitoring PGE02 CT ; CTT

2008.08.15 09:00





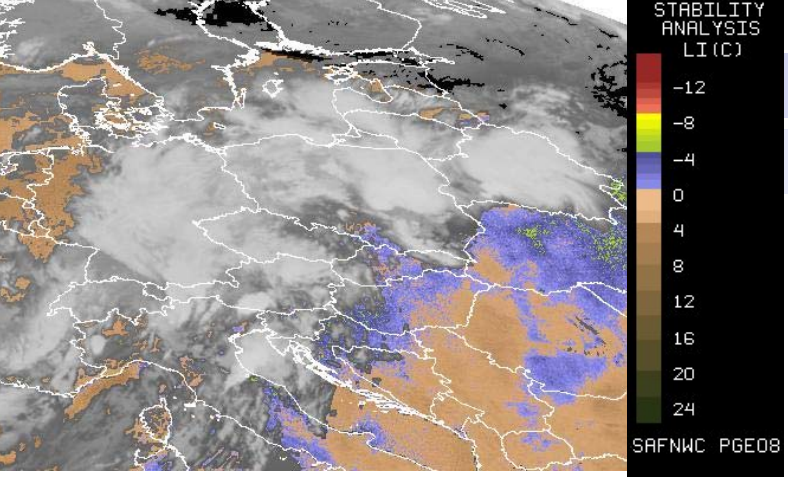
Tornado and strong storm event in Poland.

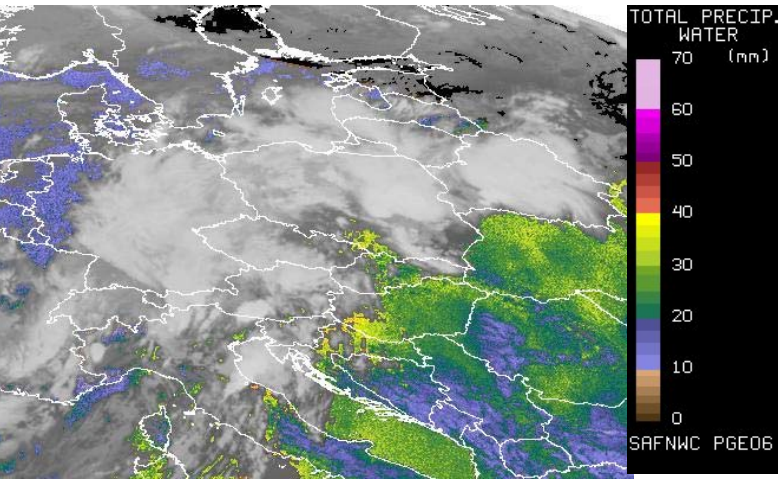
Clear Air Products (SAI, TPW , LPW) were discussed during previous NWCSAF workshop.

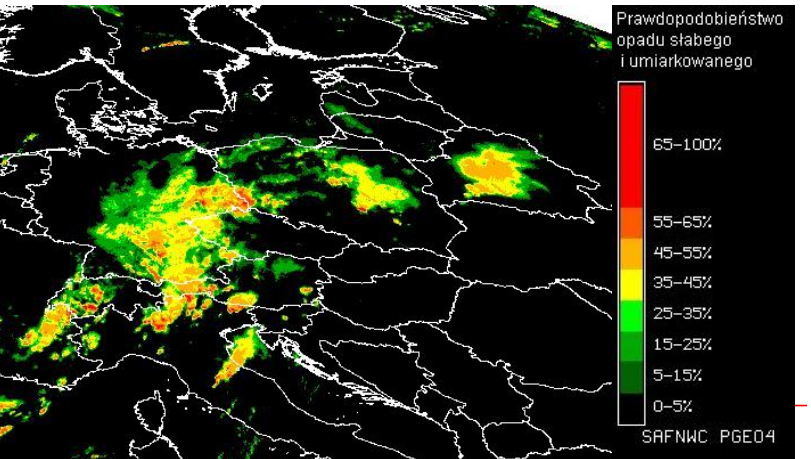
PG0 13 product strongly awaited

Strong storms in Poland

2008.08.15 09:00 SAI, TPW, PC



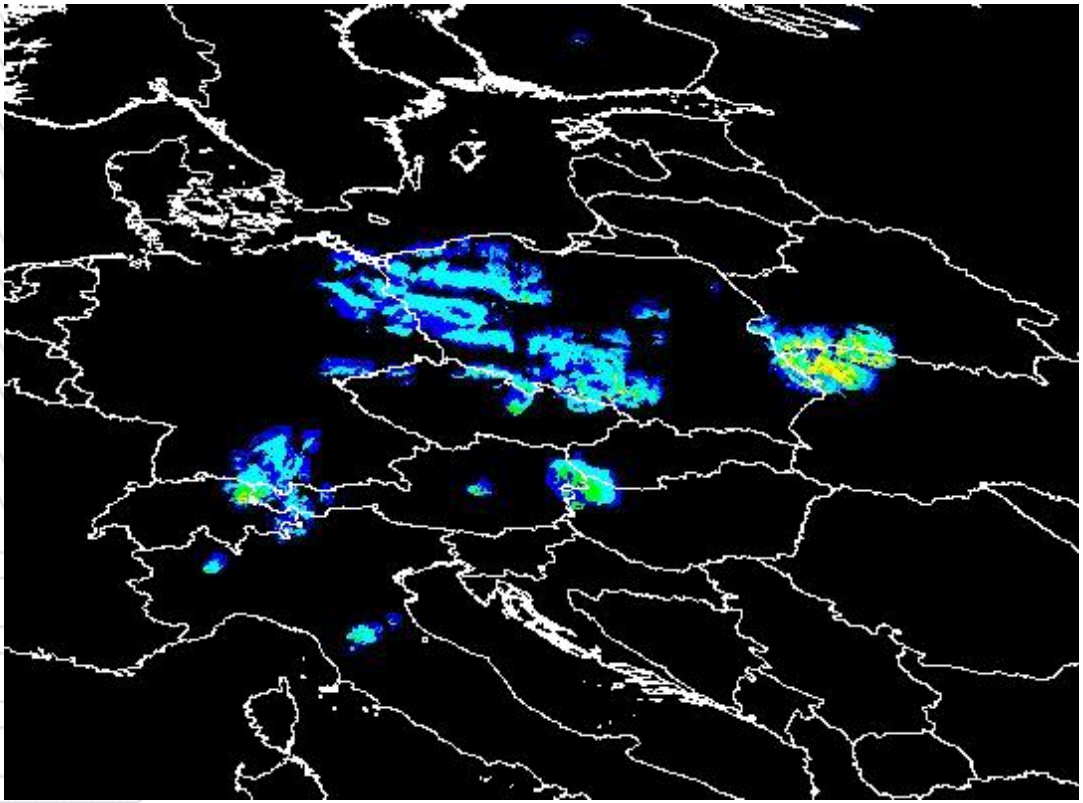


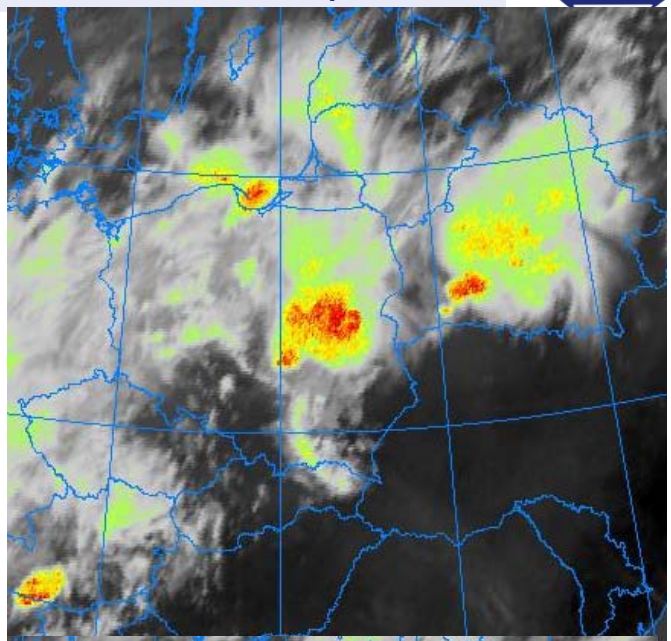


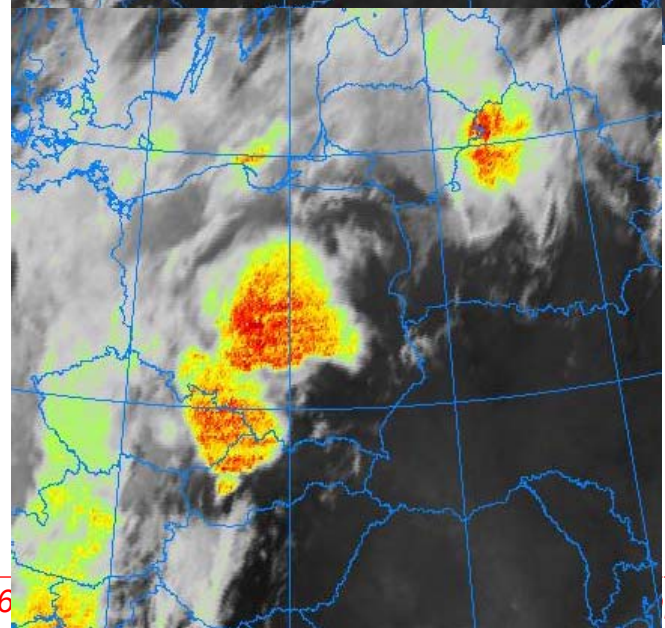
2008.08.15 15:00 UTC Whirlwind – Śląsk, Poland www.onet.pl

PGE05 CRR Convective Rainfall Rate safnwc ver.2008

2008.08.15 09:00 (anim) **MET9 OST WV-IR 09:00, 1600**





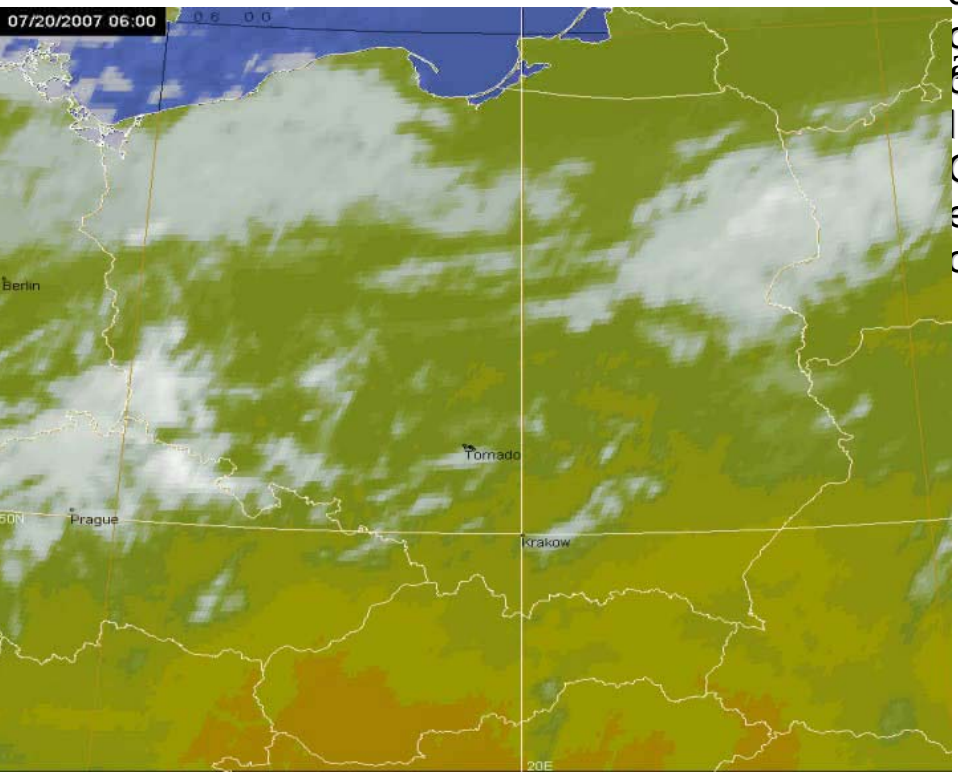


Animacja - kliknij

RDT RApid Developing Thunderstorm safnwc ver.2.1

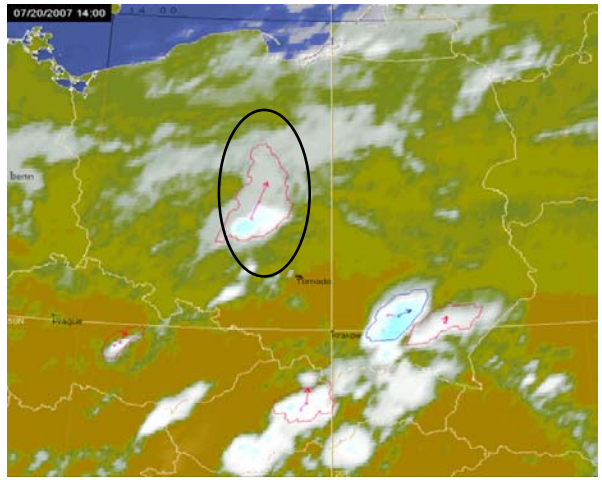
2007.07.20 06:00 (anim)

MET9 IR 10,8 masked as a background

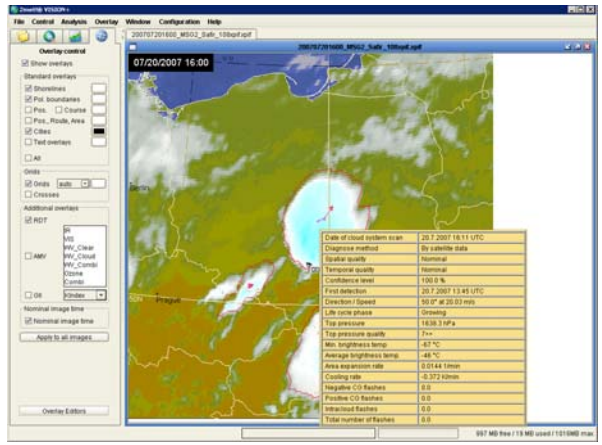


1400 UTC

First detection of rapidly developing convective cloud – part of later MCS. Cirrus clouds embedded to convective cell.

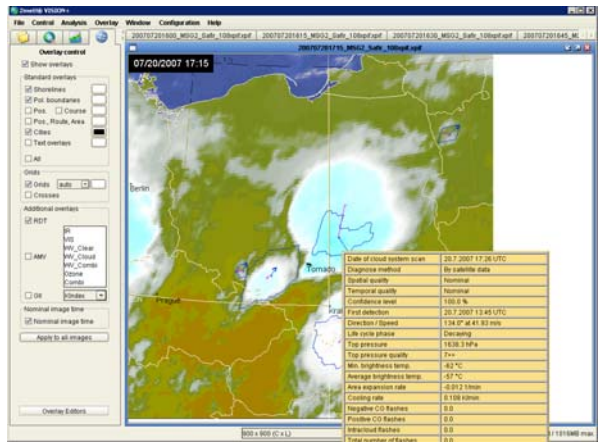


1600 UTC
Good recognition of size and movement.



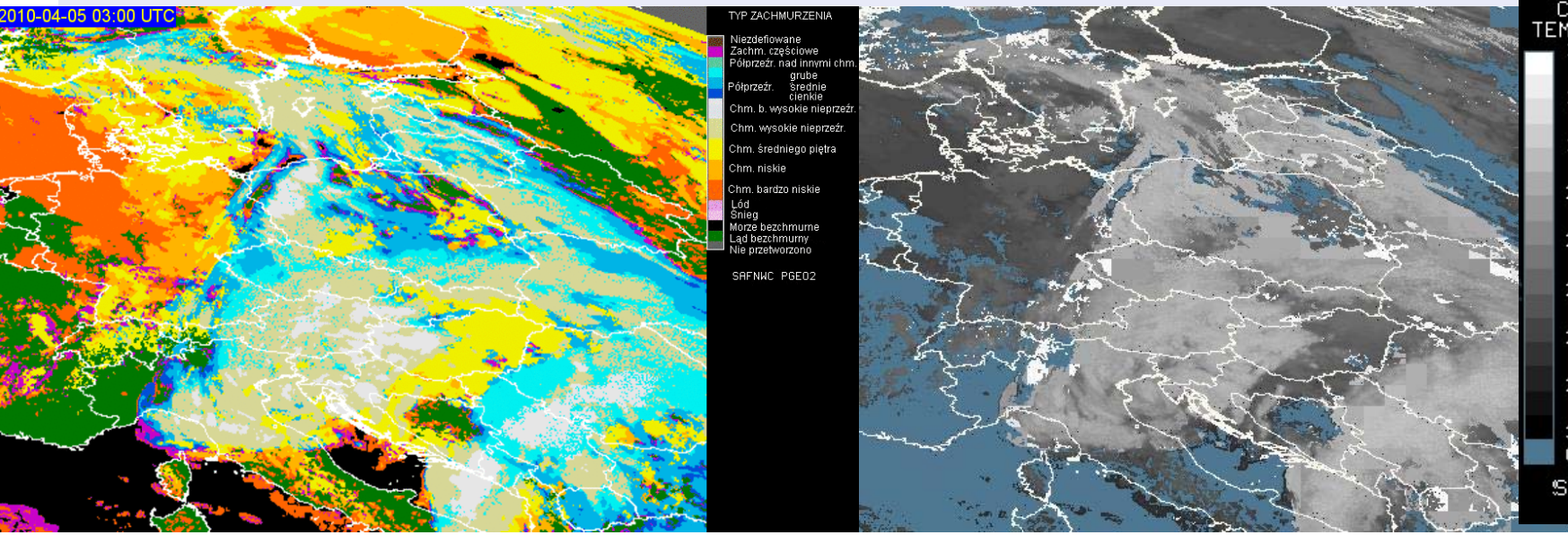
Some problems in stable recognition of cells in time sequence. Product behaviour makes it difficult for operational use by forecasters..

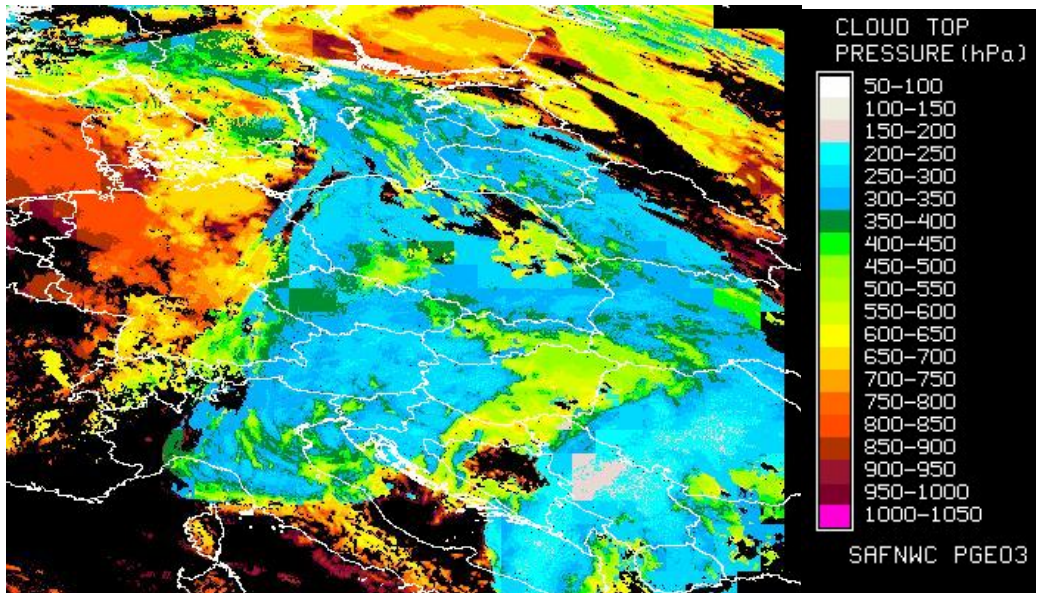
1715 UTC
Wrong recognition of size and movement.



Convection Monitoring

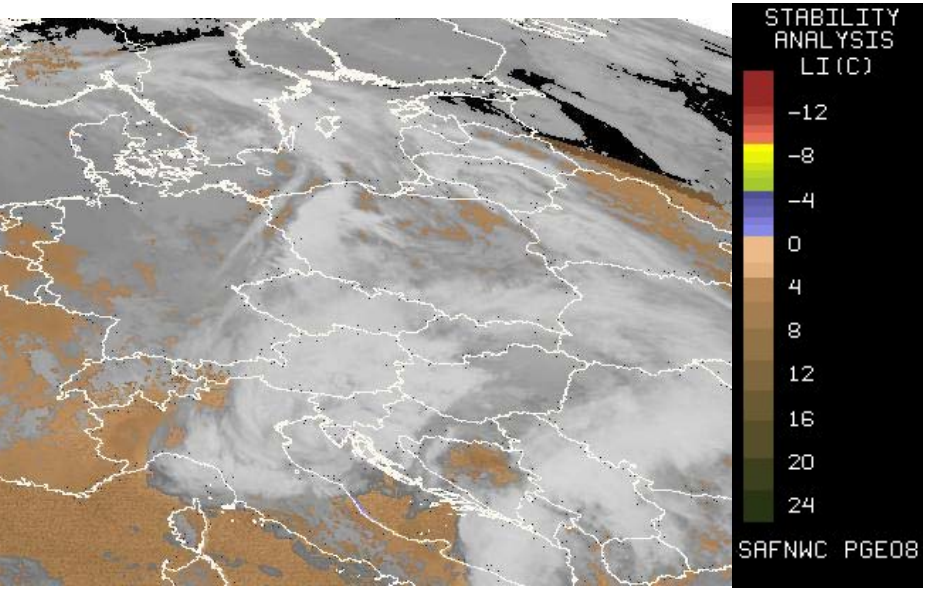
2010.04.05 03:00 UTC
Cloud Top Pressure product (gfs implementation) own palette similiar to CT

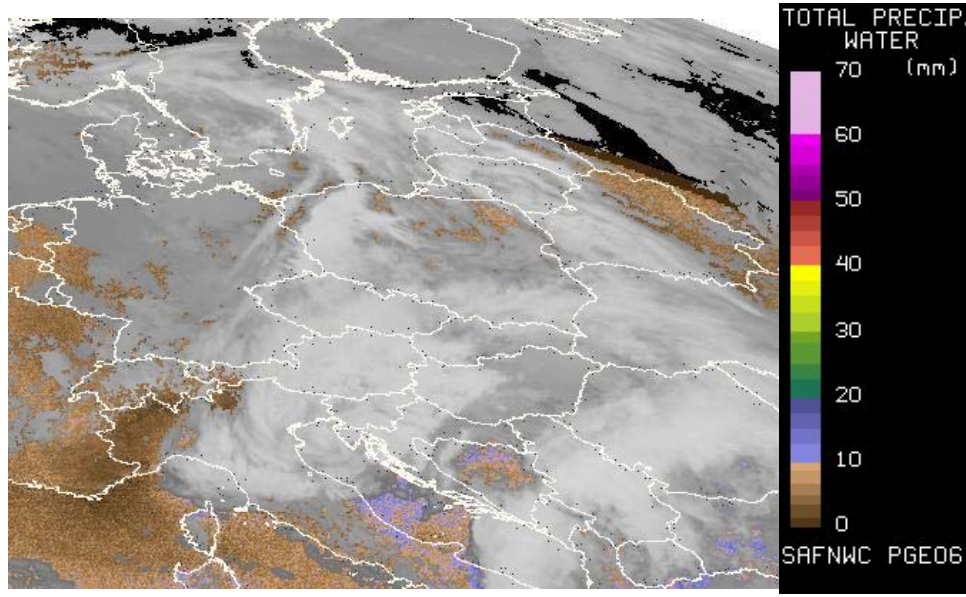


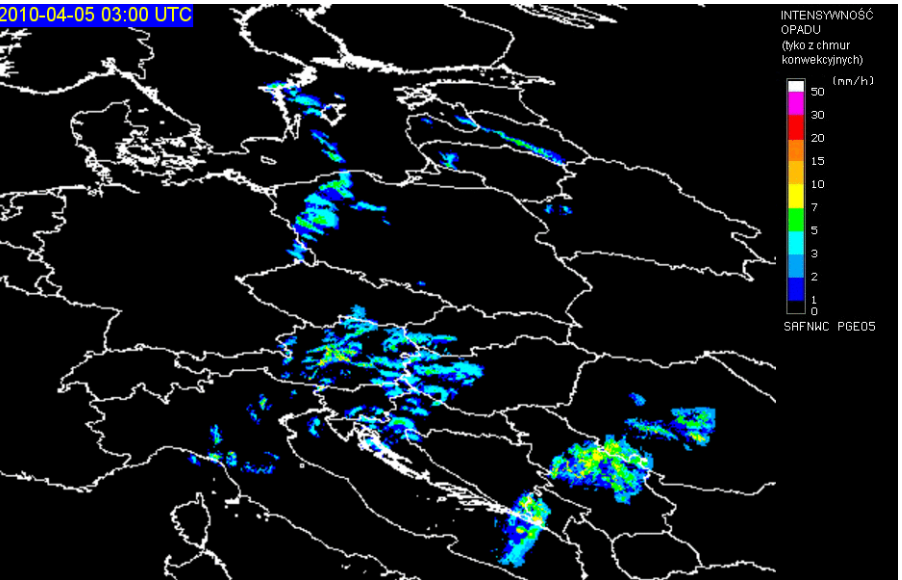


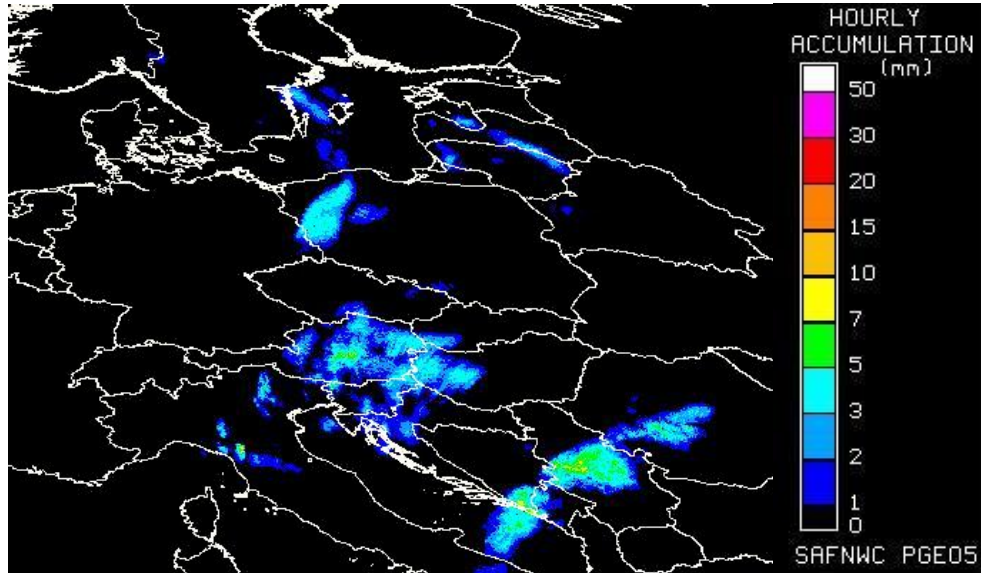
Convection Monitoring

2010.04.05 03:00 UTC

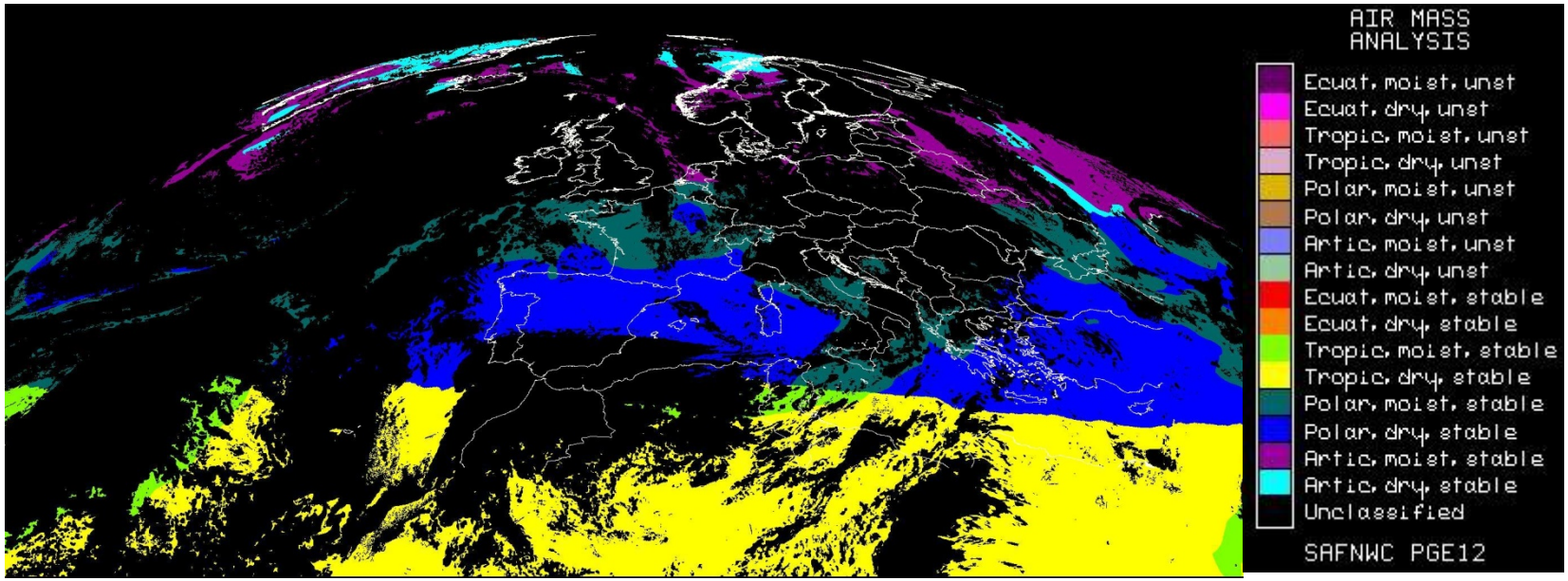








PGE12	AMA	Air Mass Analysis
2010.04.05	03:00 UTC	



Conclusions

1.SAFNWC software is operationally used in Poland since 2005, established users: forecasting offices, state avaition control.

2. SAFNWC software is easy to implementation, well defined and persistent. Help-Desk user-friendly and helpful.

3.Several product proved their usefulness either in operational weather forecasting or in case studies (research).

4.Products interseting not only for atmosphere monitoring but also for land surface monitoring (snow).

5. Increasing interest for NWC SAF products from researchers (longer data series) and NWP models developers (as an input).

6.Satellite software available on market have limited capability for presentation of NWC SAF products: VCS Vision+, Satsignal Viewers, different freeware programmes (SUMO, MSGView, xrit2pic, Ilwis, etc. This is one of the factors limiting use of NWC SAF products.

6. NWC SAF products among other products used in forecasting offices provide complementary information with other satellite product. (interpretation)

Plans

–Implementation of Rapid Scan SAFNWC software,

-Implementation of 2010 SAFNWC version,

- Developing graphical presentation of products,

- Continuously testing/verification of the newest products usefulness for Poland.

THANK YOU FOR YOUR ATTENTION

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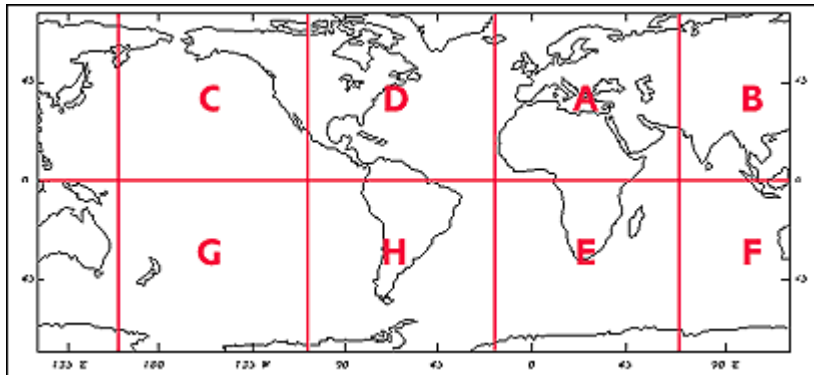
piotr.struzik@imgw.pl

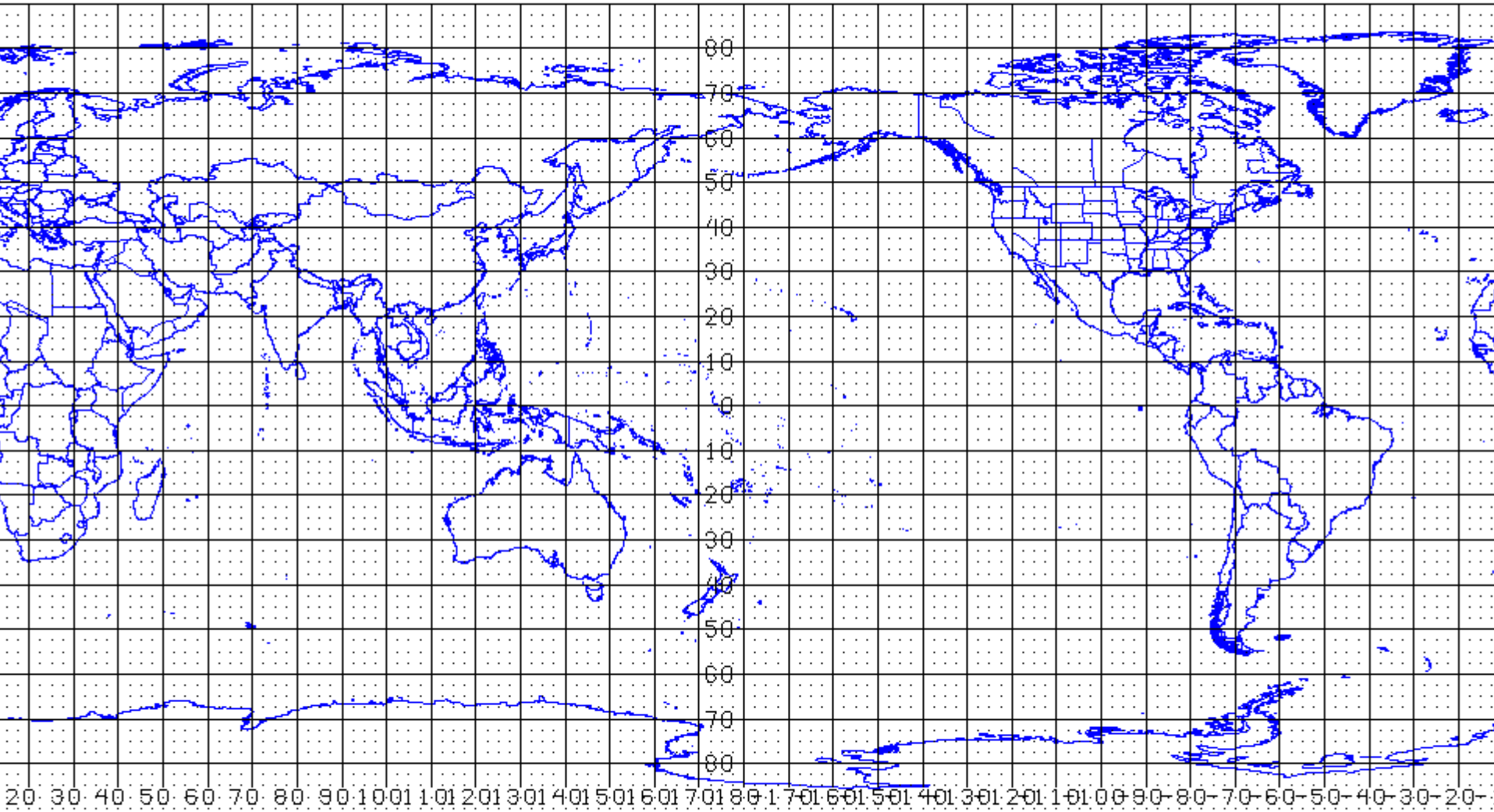
www.imgw.pl, www.pogodynka.pl

TYTUŁ SLAJDU



Met Office Global Atmospheric Model
Area A: Lat. 89.7°-0.3°N, Long. 18.75°W-71.25°E
Analysis – 00 UTC and 12UTC
Resolution - 0.56 deg N/S x 0.83 deg E/W
Size - 108 X 162 gridpoints
Longitude of first / last gridpoint : 341.25 deg / 70.416 deg
Latitude of first / last gridpoint : 0.279 deg / 89.722 deg

Surface parameters – 10m wind U, 10m wind V, low cloud amount, medium cloud amount, high cloud amount,1.5m temperature, 1.5m specific humidity, total accumulated precipitation
Multi-level parameters – geopotential height, temperature, wind U, wind V, relative humidity
Levels – 1000, 980 (surface parameters), 970 (tropopause ICAO height in metres, pressure in Pa, temperature in K), 960 (maximum wind ICAO height in metres, maximum wind U and V in metres per second), 950, 925, 850, 700, 500, 400, 300, 250 hPa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NCEP Grid 2