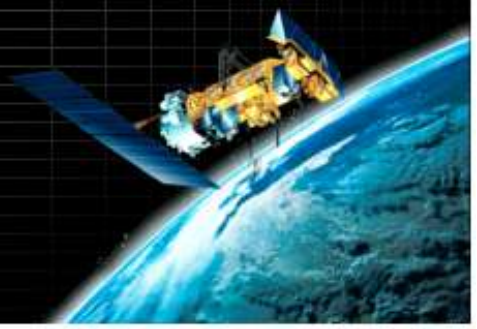
Satellitdata
Insamling, förädling och användning

Adam Dybbroe

Metodkonferens, Enköping, 2015



Agenda

- SATSA - Introduktion
- Satellitsystemen nu och närmsta framtid
- Att se i mörker
- Satellitdata i Mesan
- Instabilitetsindex i Mesan?

SATSA?

- SATellitSystem och Ananlys
- Förvalltningsobjekt med styrrgrupp bemannat från FM och SMHI
- SATSA tar emot och förädlar satellitdata
- Syftet: Organisera och samordna satellitproduktion (insamling, förädling och användning)

Vem?

Niclas Sköld

Christina Sverker

Hans Ödmark

Martin Raspaud

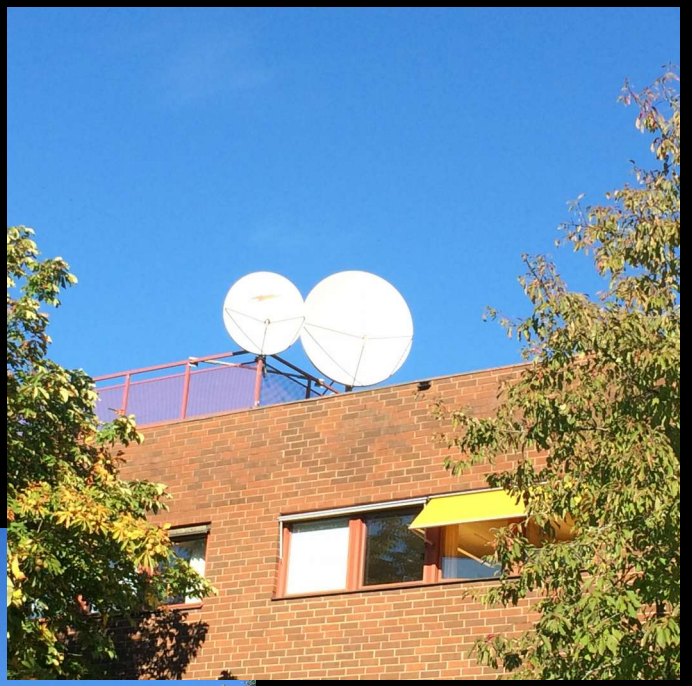
Anna Eronn

Adam Dybbroe

Sedan senast

- Helt ny EUMETCast mottagning:
  - DVBS-2
  - 2 nya paraboler
  - 2 nya mottagare
  - Full redundans

Hus 12



Hus 14

SMHI

Sedan senast

- Ny satellit: Sentinel-1A (April 2014)
- MSG4 => Meteosat-11 (Juli 2015)
- Helt nytt polärt produktionssystem (Feb 2015)
- NWCSAF/PPS v2014 (Feb 2015)
- Ny smart schedulering – polära mottagningen
- NWCSAF/MSG v2013 (Okt 2015)

Vad som kommer

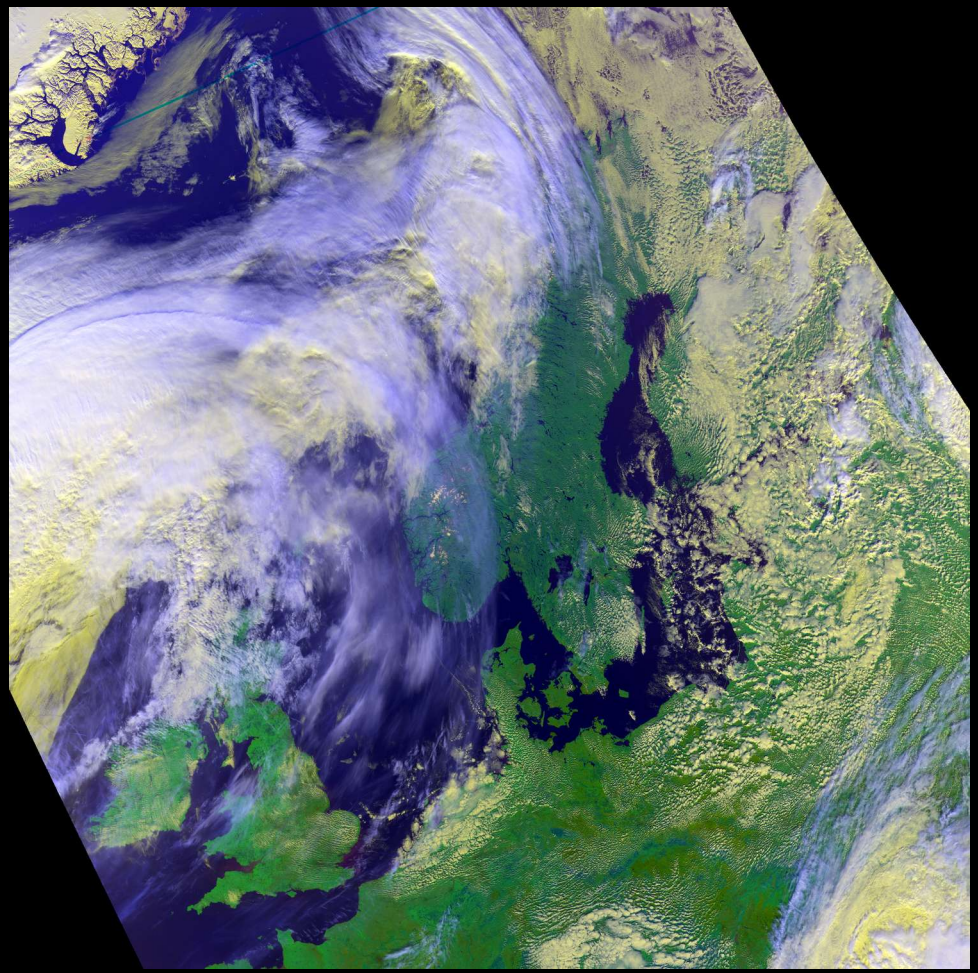
- Sentinel-3A (Dec 2015)
- FY3D (2016) – Ny imager MERSI-2
- JPSS-1 (2017) - Efterföljare till S-NPP
- MTG (2019/2021)
- EPS-SG (2021/2022)
- PCW? (“Geostationär” vy över Arktis)

Mottagning – *Direct Readout*

- Egen “tracking” antenn (X/L-band) i Norrköping
  - Suomi-NPP, Aqua, Terra
  - NOAA-15,18,19, Metop-A, Metop-B
- Utbyte Norden - Trollcast
  - (X)/L stationer i Oslo, Köpenhamn, Helsinki
  - Senare Sodankylä (X-band)

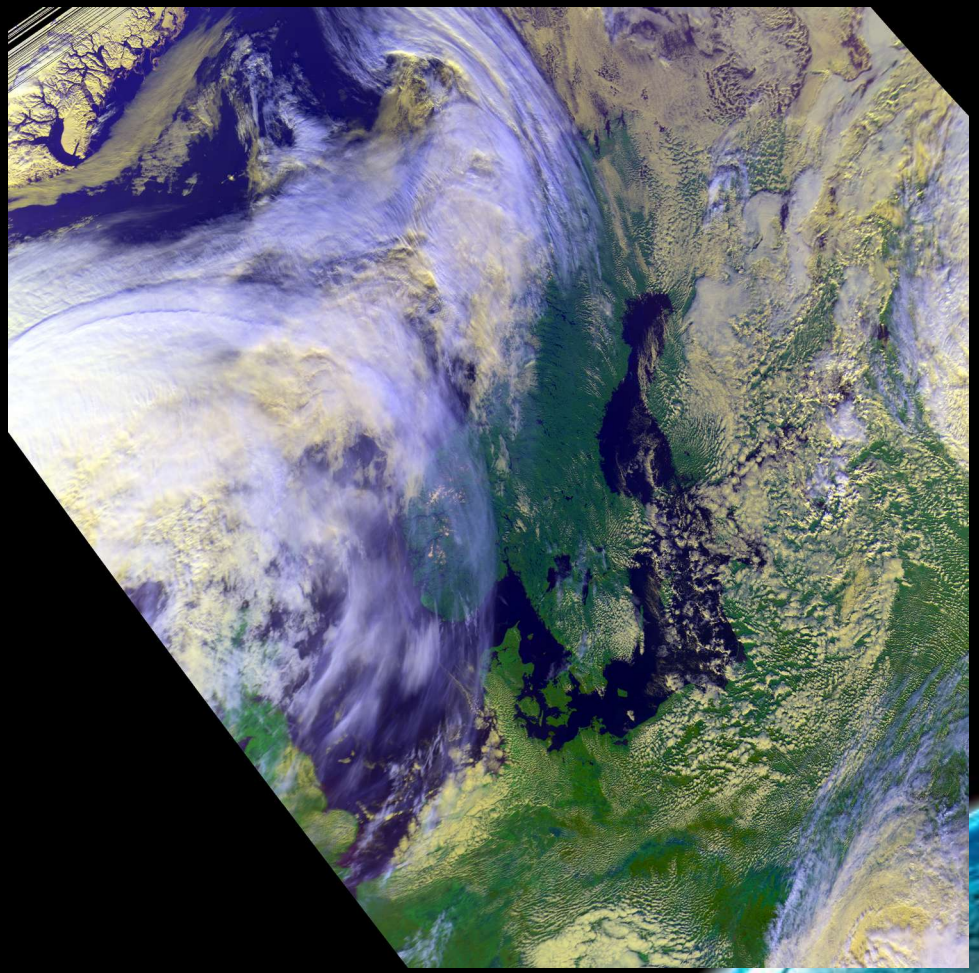
S-NPP och N19 samtidigt om man har mer än en antenn

Suomi-NPP VIIRS 11:45 UTC



Norrköping, SMHI

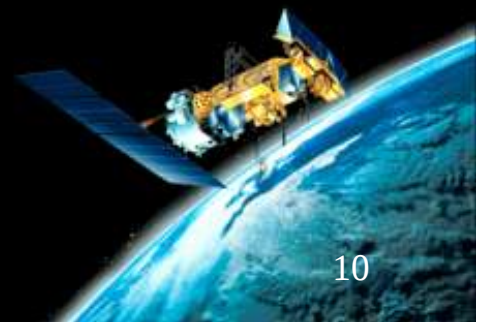
NOAA-19 AVHRR 11:41 UTC



Smidsbjerg, DMI

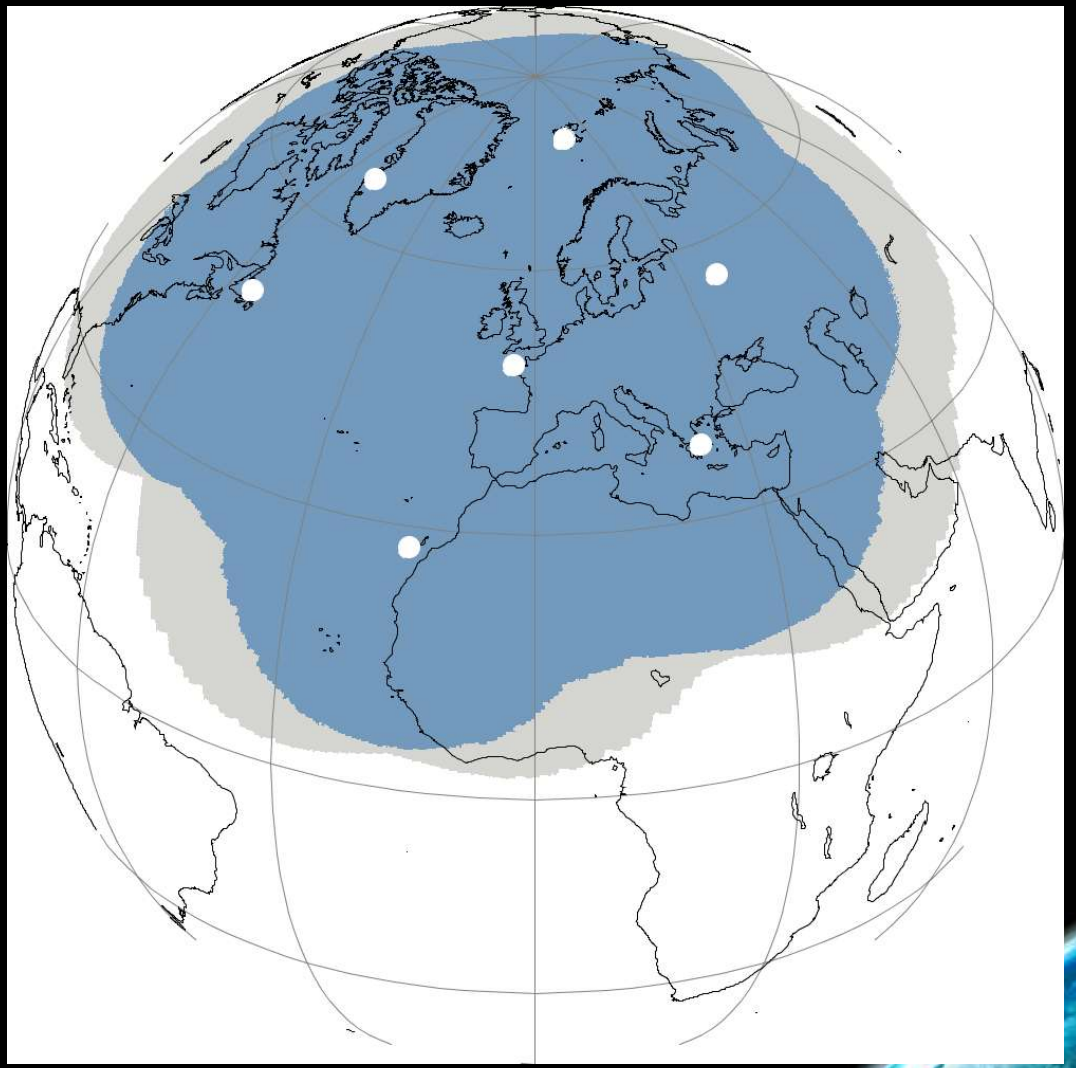
Mottagning

- EUMETCast
  - 0-deg service, RSS, IODC
  - All annan data (polärt och geo) – level-1&2
- Internet/FTP
  - ASCAT (KNMI/OSISAF), SST (Ifremer/OSISAF)
  - Radarsat (MyOcean) & Sentinel-1 (ESA)
  - MODIS level-2 (NASA)



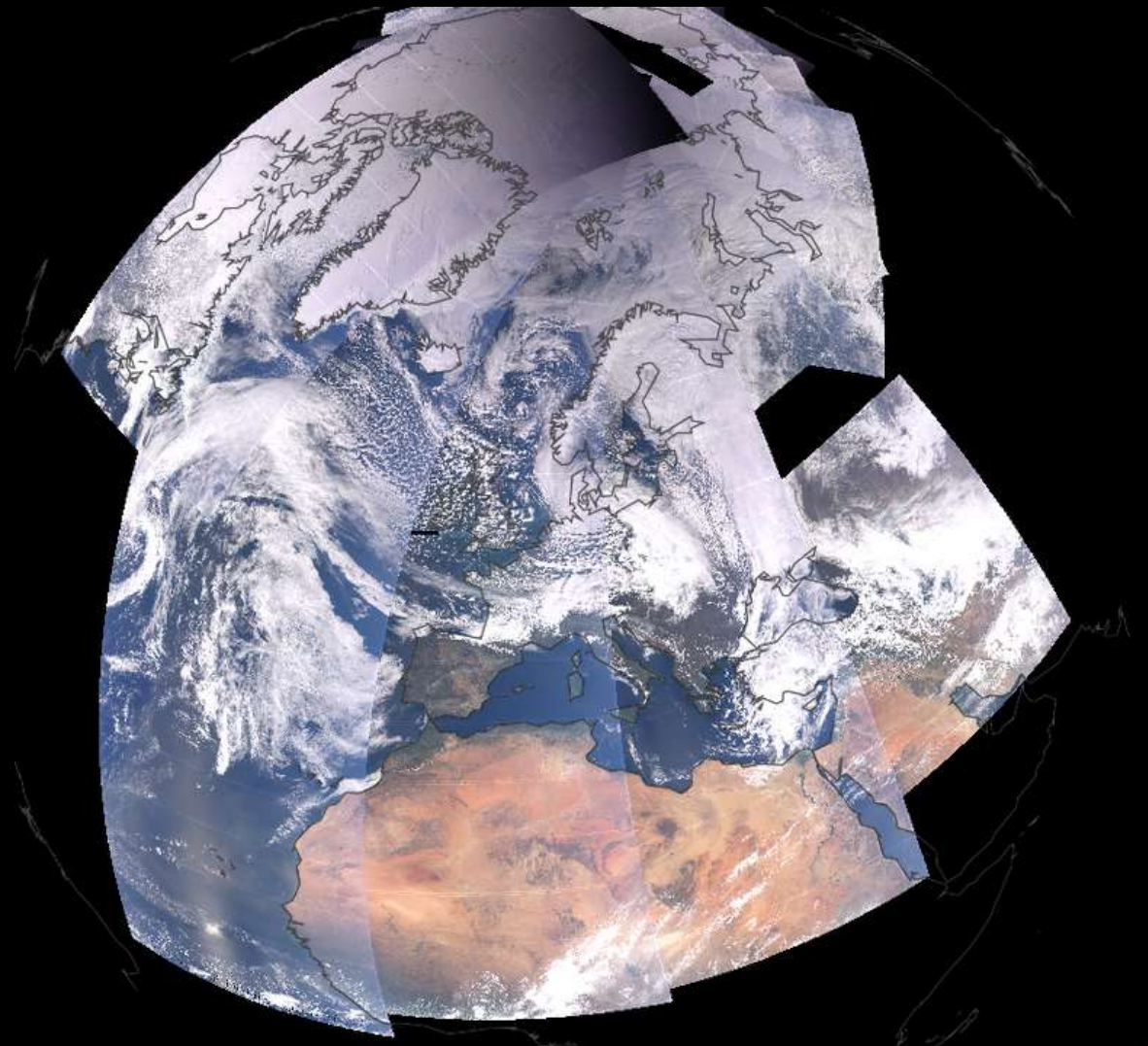
EUMETSAT Advanced Retransmission Service

- Imager data
  - EARS-AVHRR
  - EARS-VIIRS
  - EARS-NWC
  - EARS-MERSI
- Satelliter
  - N-19 & Metop-A/B
  - S-NPP
  - FY3-D



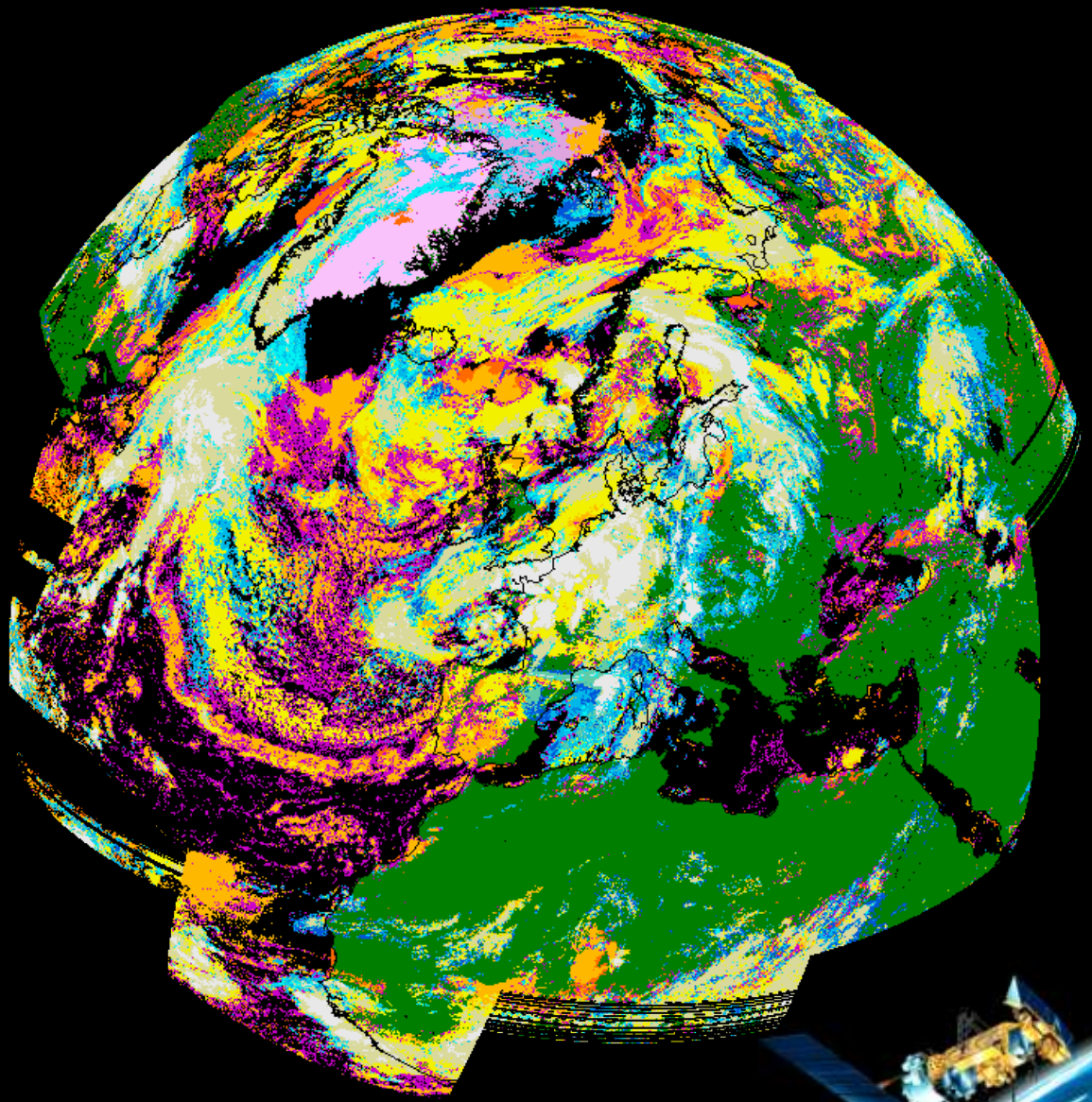
EARS

- Imager data
  - EARS-AVHRR
  - **EARS-VIIRS**
  - EARS-NWC



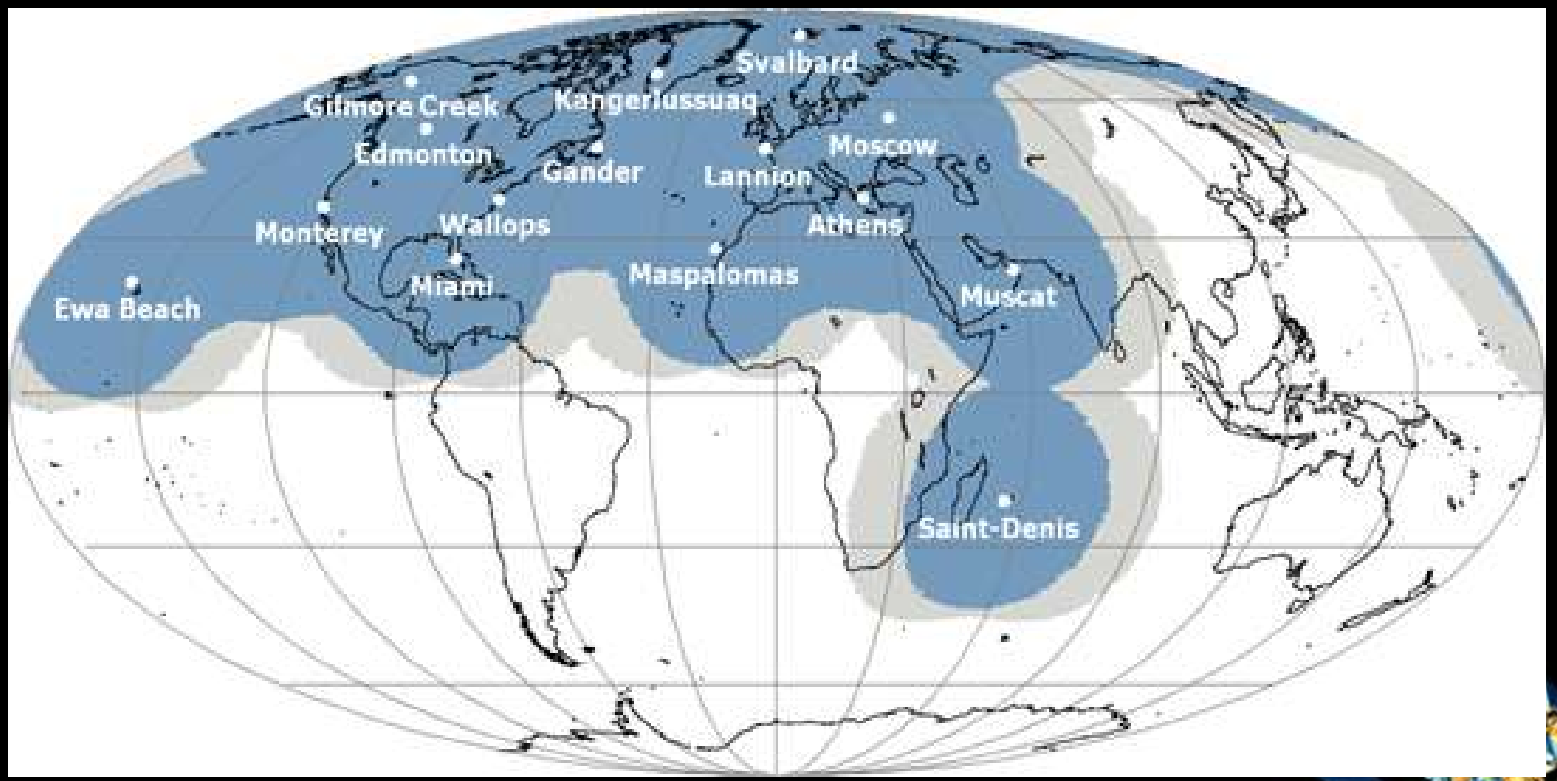
EARS

- Imager data
  - EARS-AVHRR
  - EARS-VIIRS
  - **EARS-NWC**



EARS-ATOVS – för regional NWP

- Metop-A/B, N-15, N18, N19



EARS

- Sounder data
  - EARS-ATOVS
  - EARS-IASI (Metop-A/B)
  - EARS-CrIS (S-NPP)
  - EARS-ATMS (S-NPP)
  - EARS-VASS (FY-3C/D)
- Scatterometer
  - EARS-ASCAT (Metop-A/B)

Meteosat

- Meteosat-7
  - 57°E
  - IODC: Indiska Oceanen
- Meteosat-8
  - 3.5°E
  - Backup för 0-deg och RSS
  - Trolig ersättare till Met-7 för IODC

Meteosat

- Meteosat-9
  - 9.5°E
  - Rapid Scan Service
- Meteosat-10
  - 0°E
  - Full scan 0-deg service
- Meteosat-11
  - “In-Orbit-Storage”

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Geo-ring

- GOES E/W (105/135 W)
- Met-10 0-deg
- Met-7 IODC (57 E)
- Himawari 8 (140 E)
- FY-2E (86.5 E)
- Elektro-L N2 (76 E)
- INSAT-3D (82 E)

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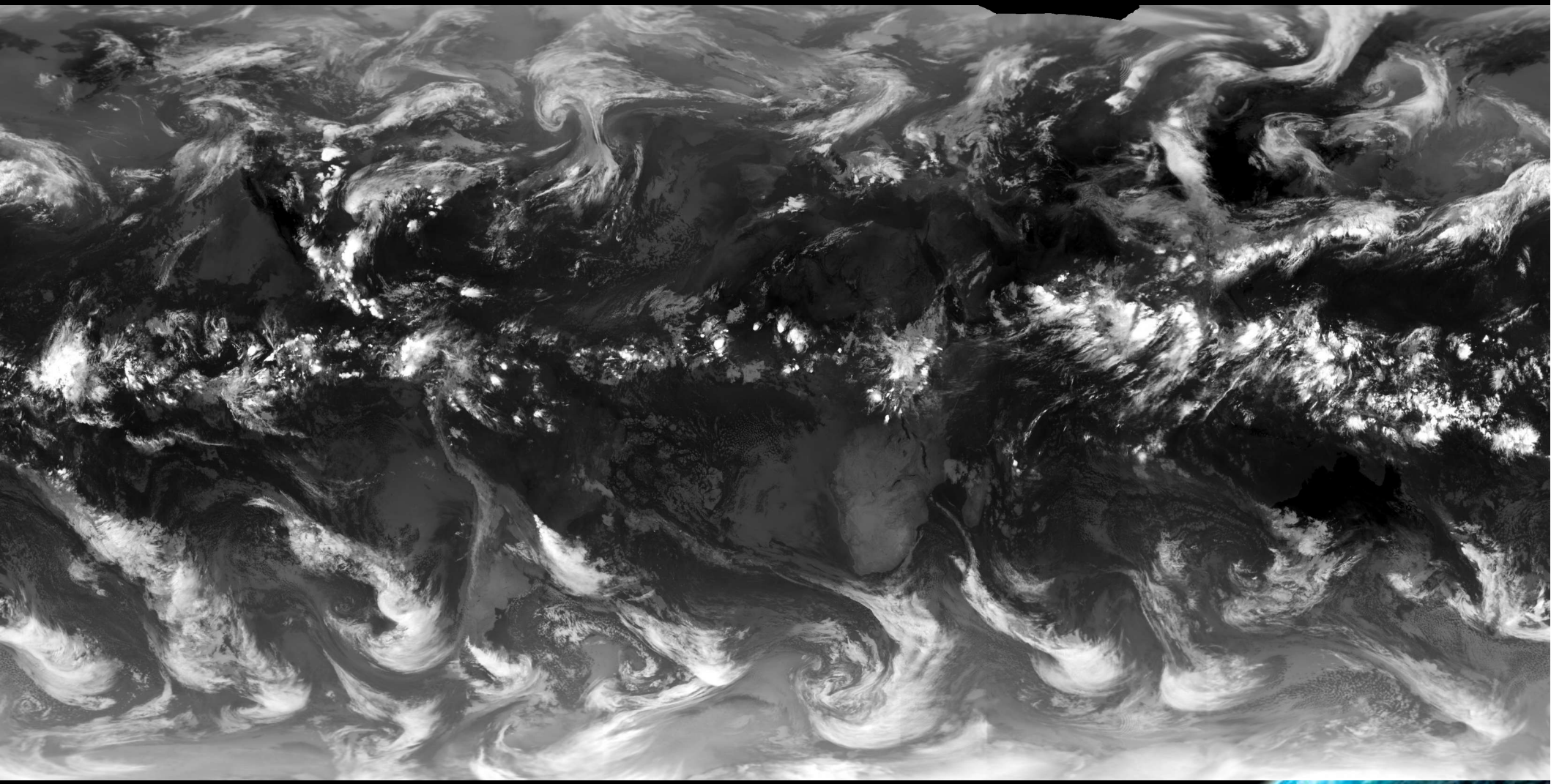
Geo-ring



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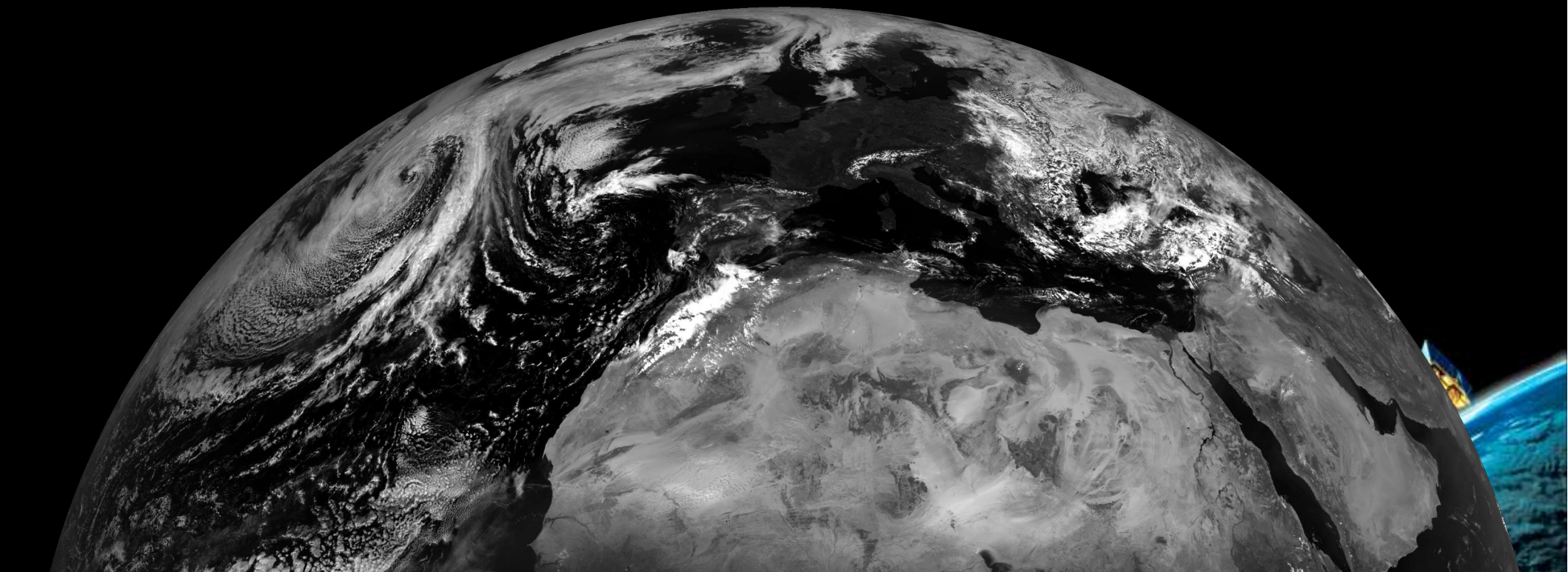
Rapid Scan Service

- Data från Meteosat 8/9 var 5:te minut
- Samma vy som Meteosat-10 (varje kvart)
- Bara norra halvklotet



Rapid Scan Service

- För snabba utvecklingar, t.ex:
  - Kraftig konvektion
  - Dimma

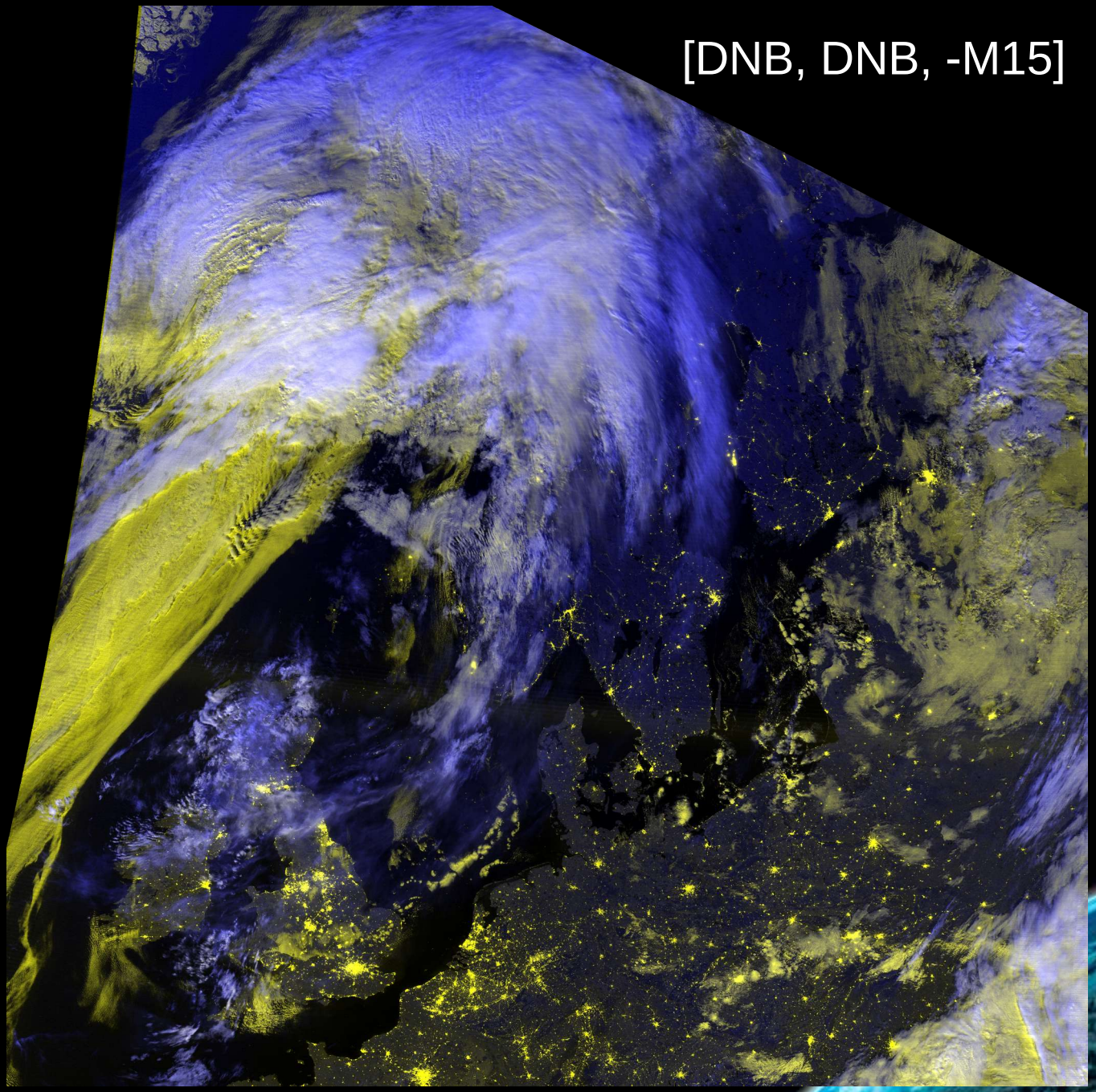
SMHI

VIS radianser nattetid

- Suomi-NPP VIIRS
- Day Night Band
- Super känslig pan-kromatisk CCD sensor
- ~740 m horisontell (kvasi-konstant) upplösning
- Över hela svepet (3200 km)

VIIRS DNB

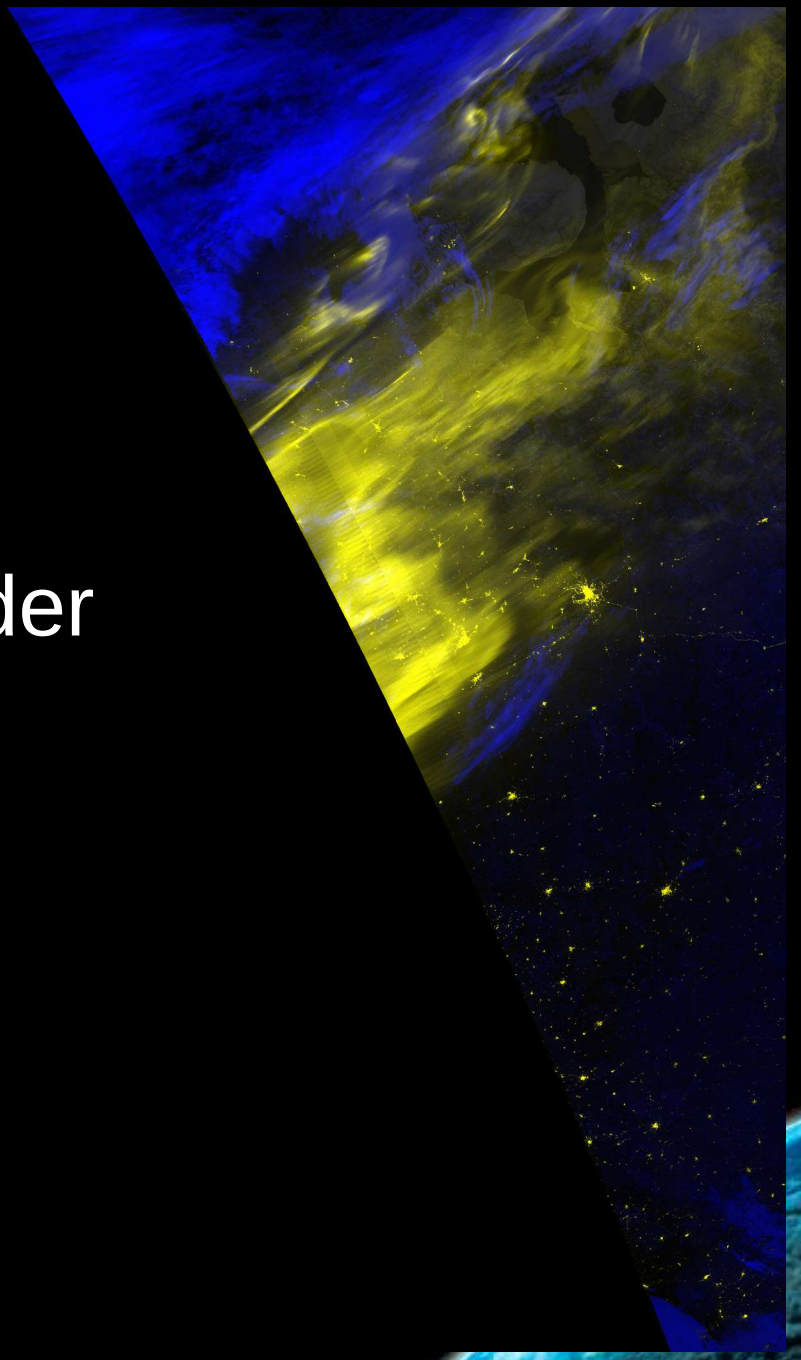
- Ljuskällor:
  - Månen
  - Stadsljus
  - Norrsken
  - “Nightglow”



[DNB, DNB, -M15]

Suomi-NPP:
2015-09-29 01:30 UTC

VIIRS DNB



Ibland är det annat än väder som dominerar bilden...

Suomi-NPP:
2015-03-17 23:09 UTC

Satelitdata till Mesan

- Geo: SEVIRI
- Polar: AVHRR
- Molnighet
- Molnhöjd

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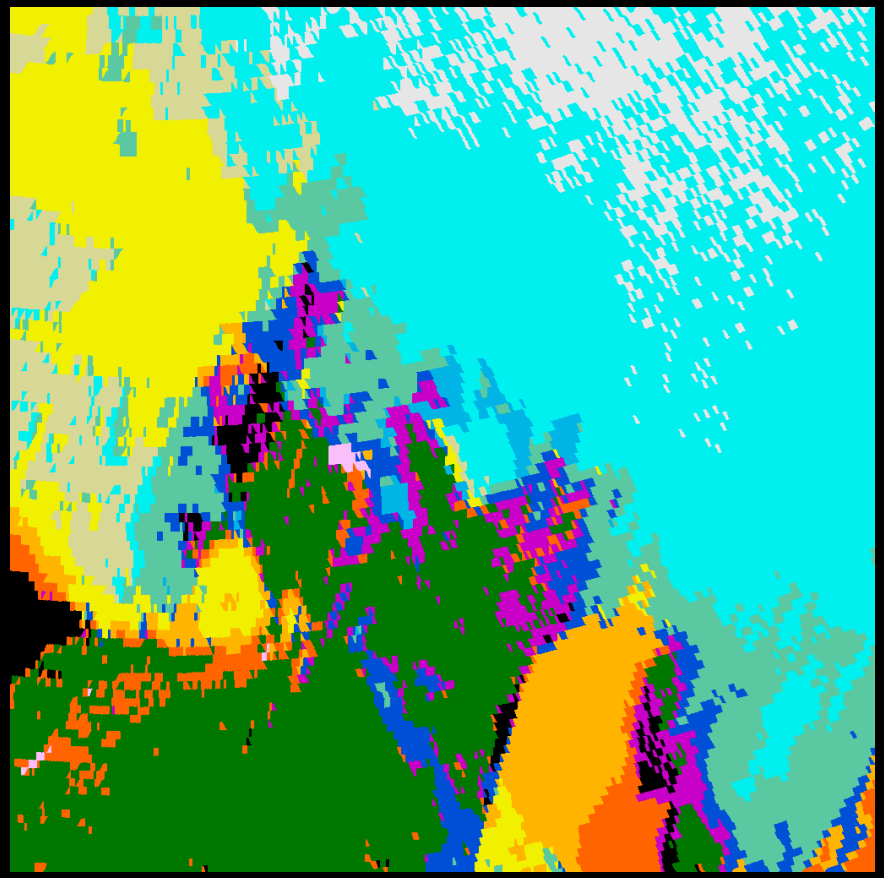
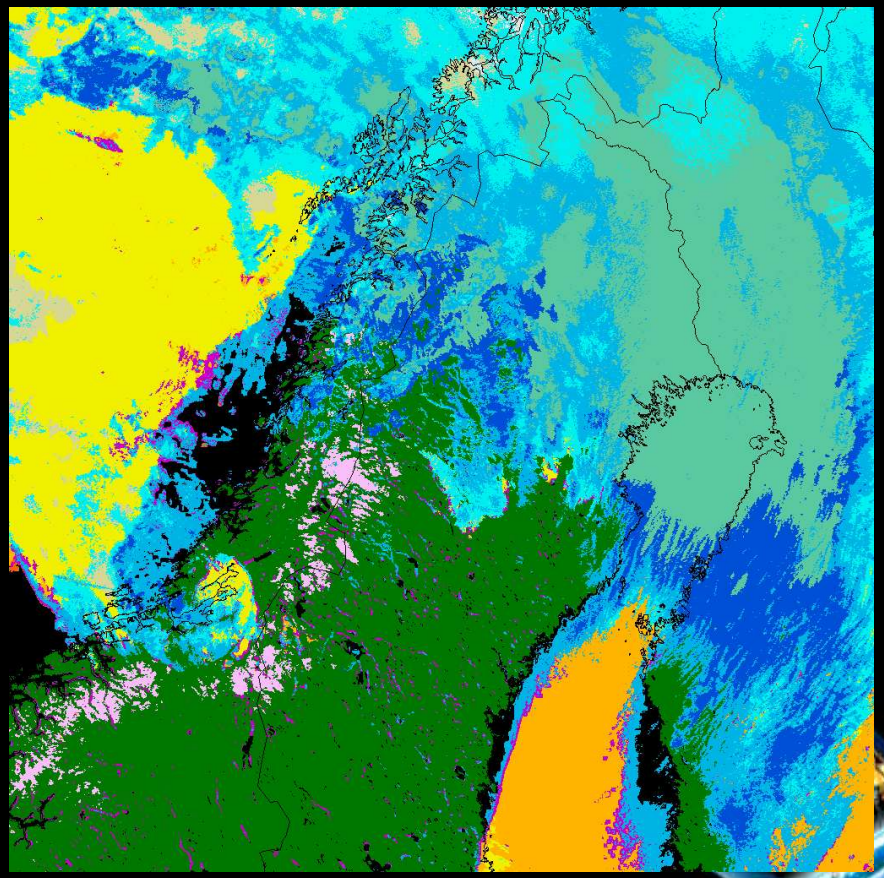
SEVIRI Cloud Type



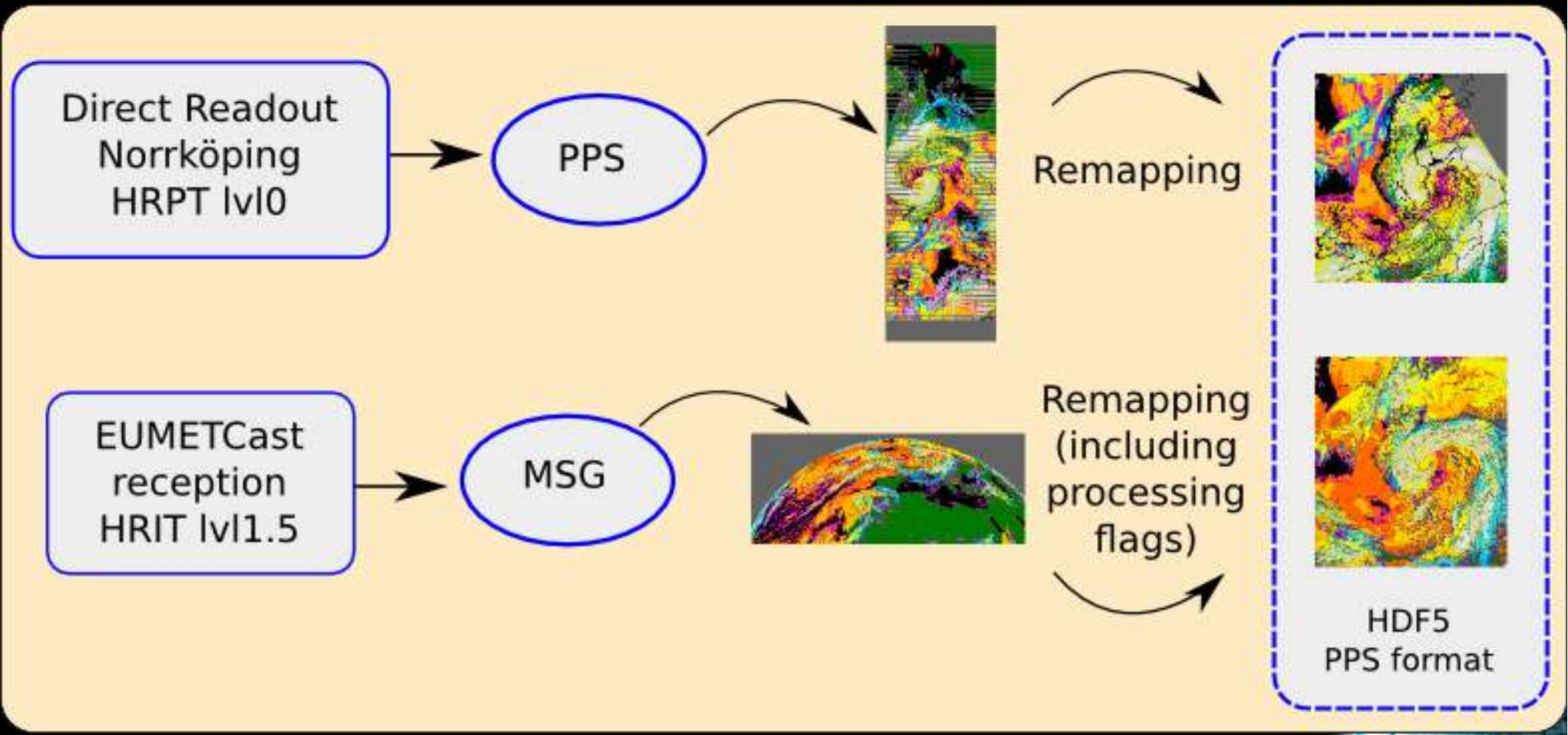
Met08 2005-10-16 11:30 UTC

AVHRR Cloud Type

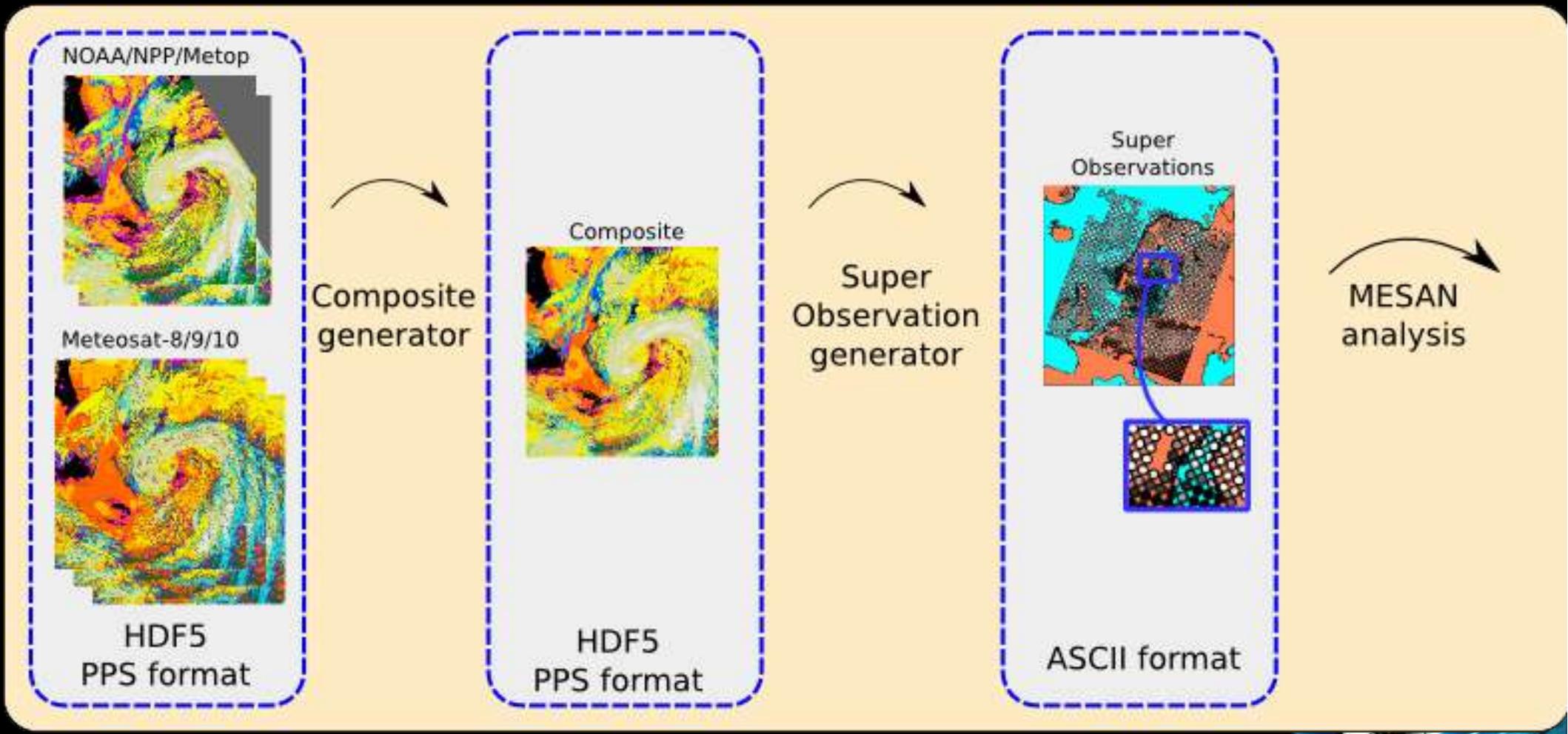


NOAA 18 #2102 2005-10-16 11:31 UTC

Current framework



Current framework (2)



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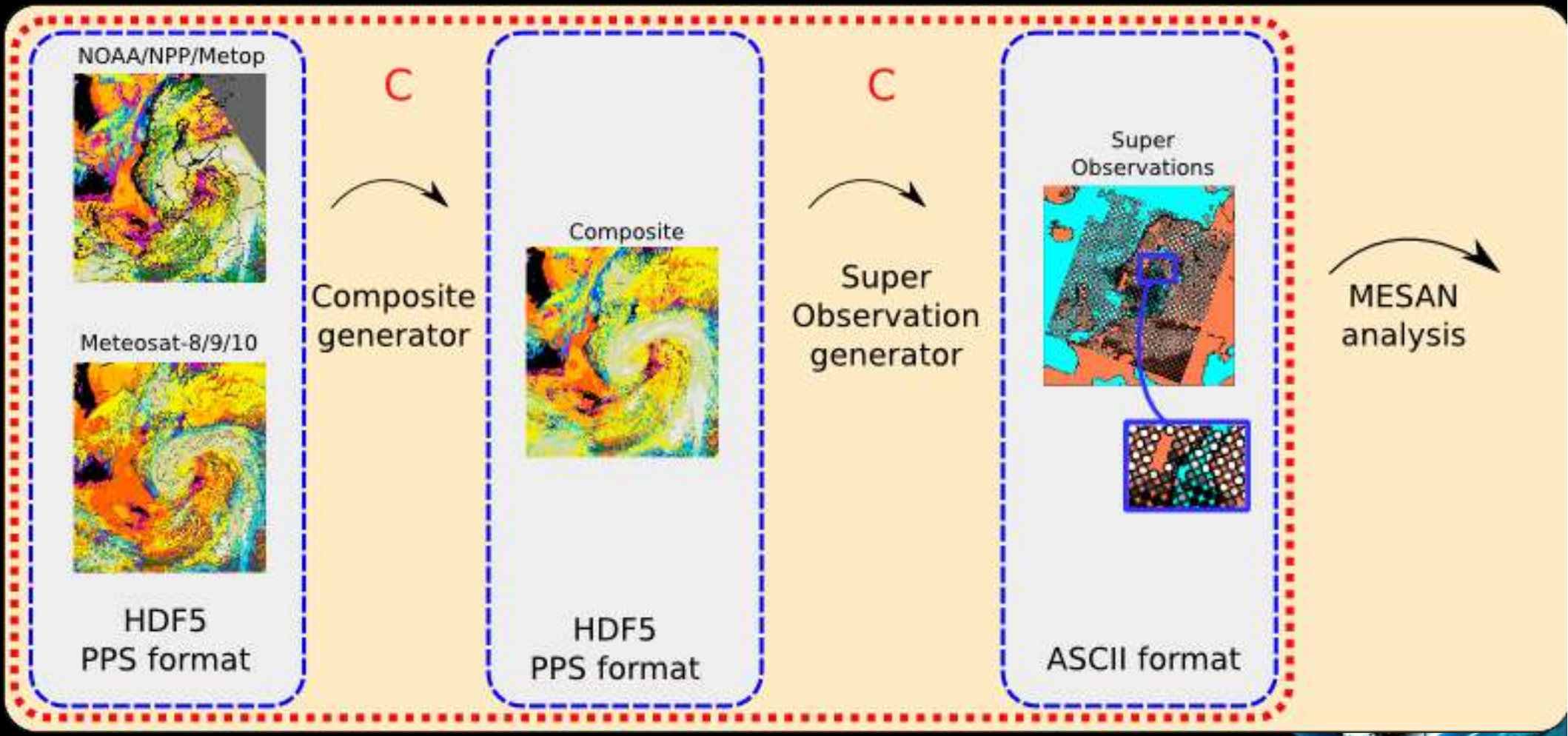
Current framework (3)



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Current framework (4)

- Several independent steps
- Use of file I/O
- C-code, needs to be compiled
- Difficult to update

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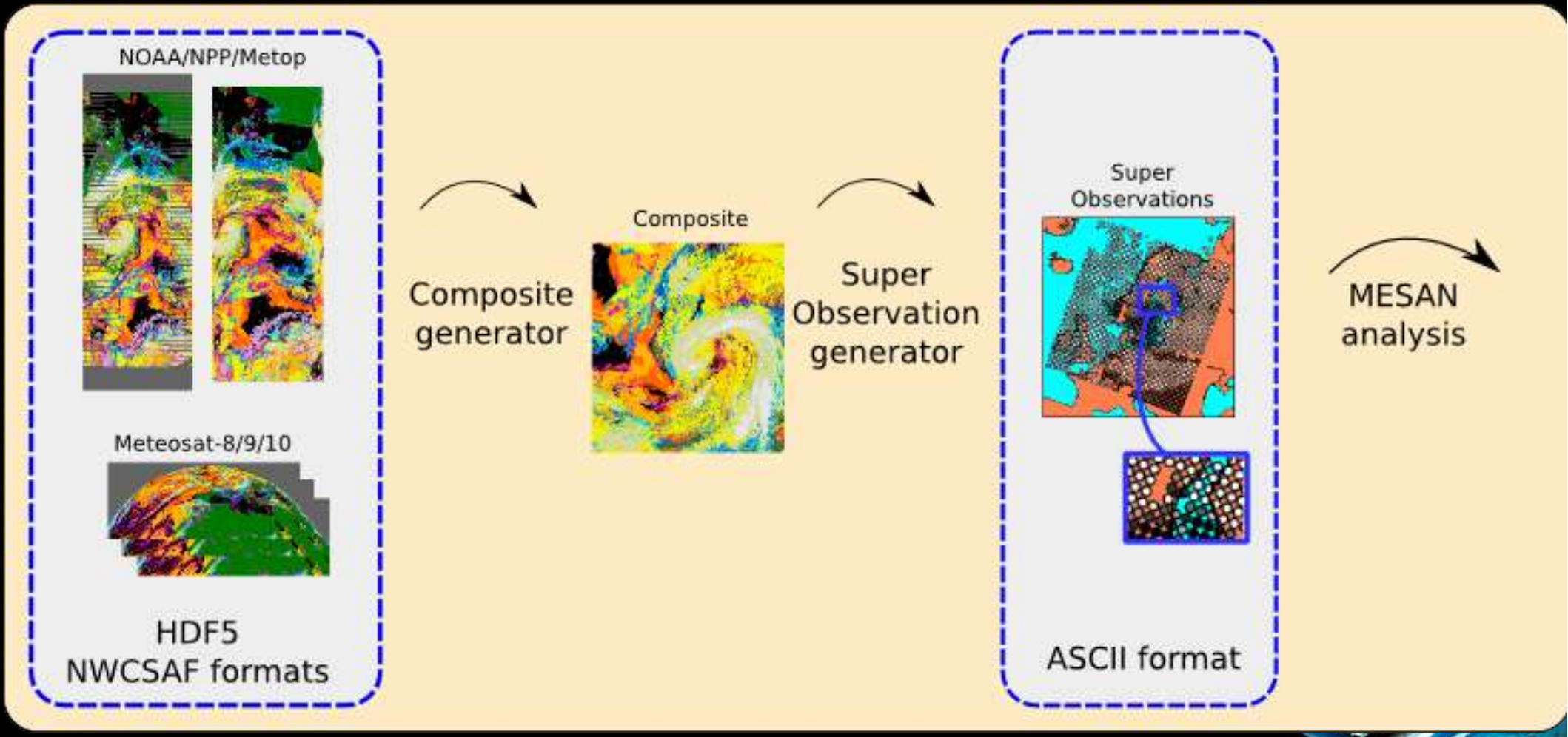
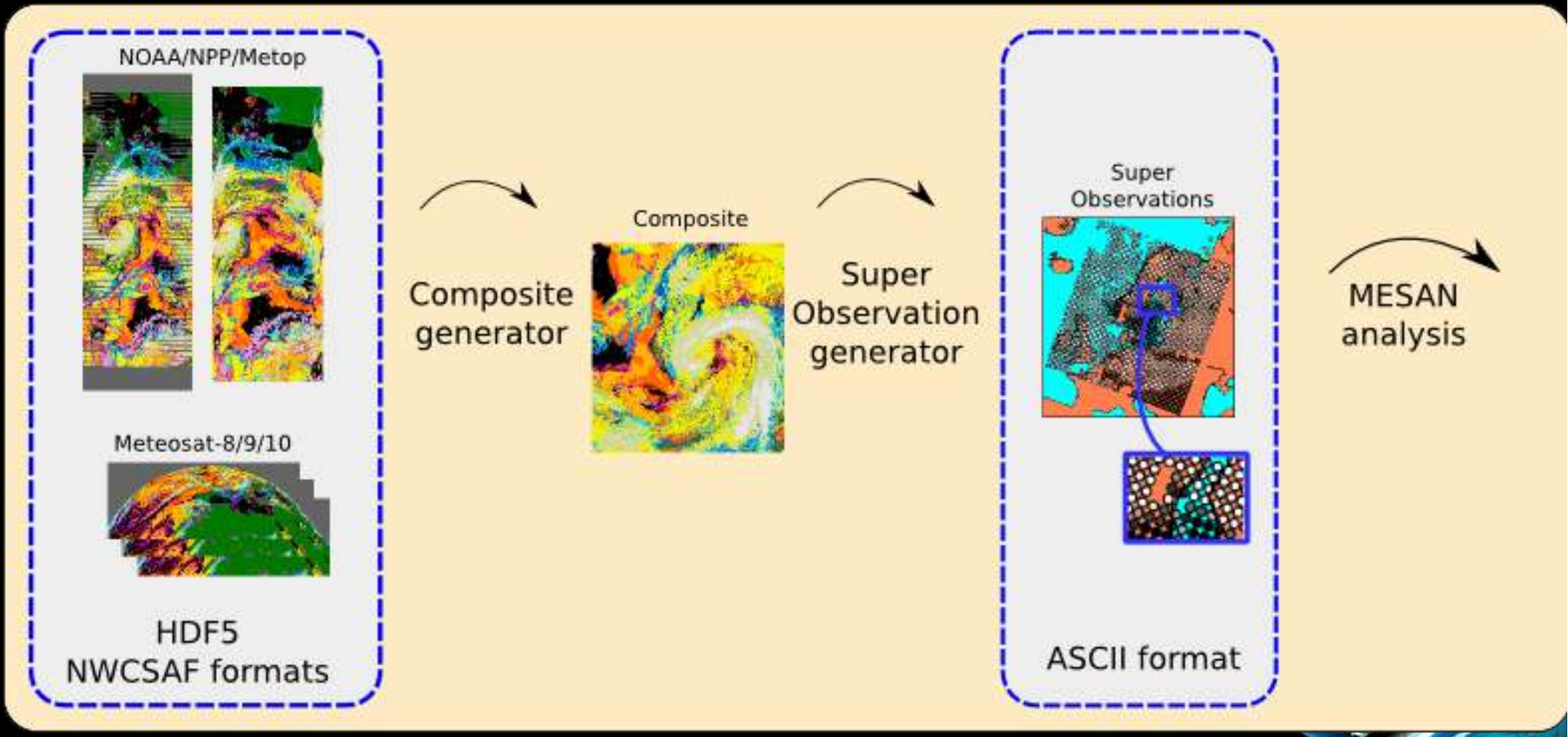
New framework

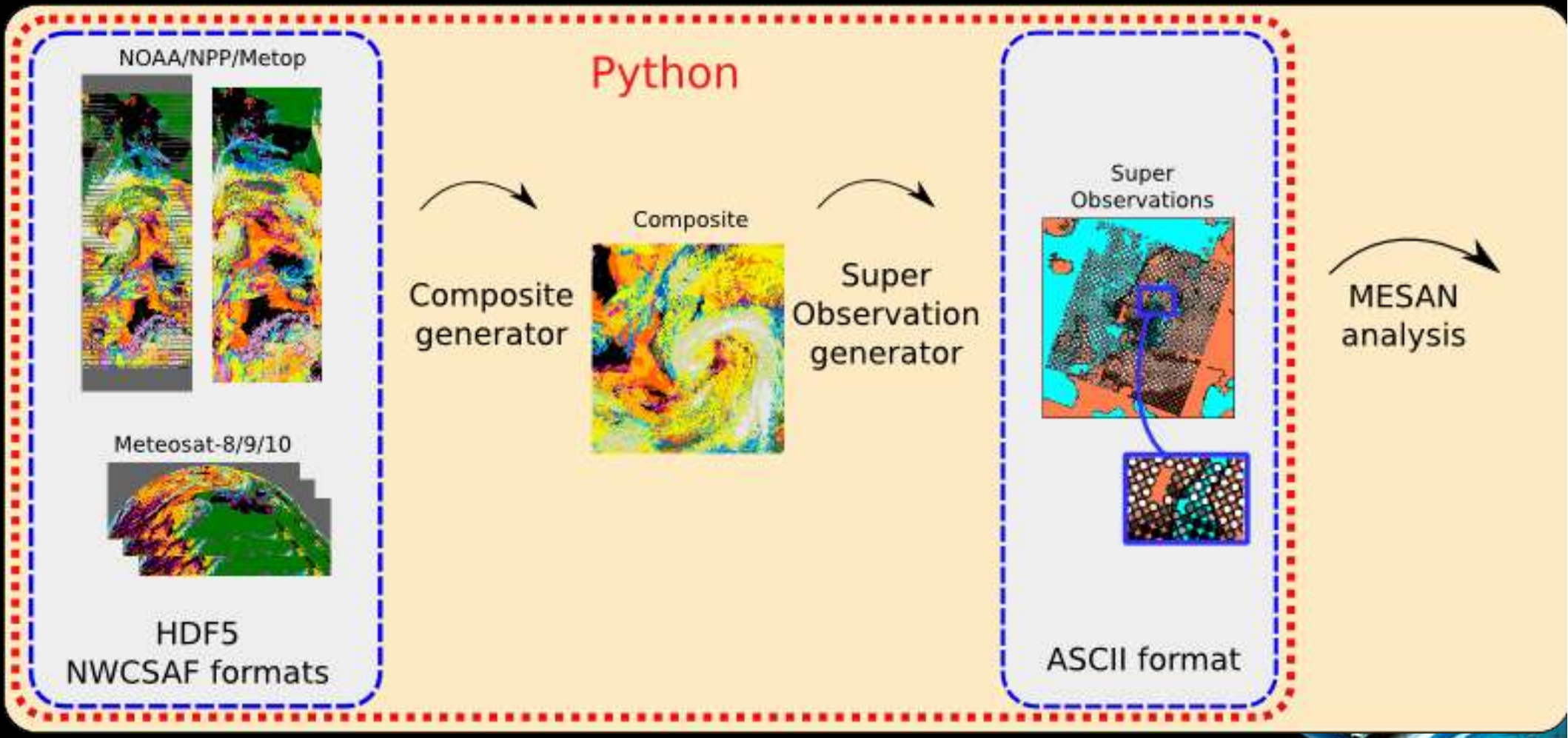


SMHI

New framework



New framework (2)



New framework (3)

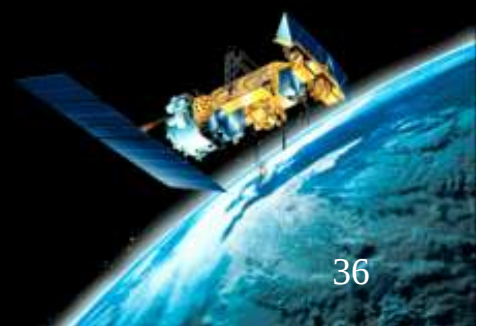
- One consistent framework
- Python – pytroll.org
- Flexible
  - Easy to add more services (e.g. EARS-NWC, Metop-GDS, RSS, etc)
  - Easy to change domain
  - Easy to add more ancillary information (like sun/satellite viewing geometry)

Instabilitetsindex i Mesan?

SMHI

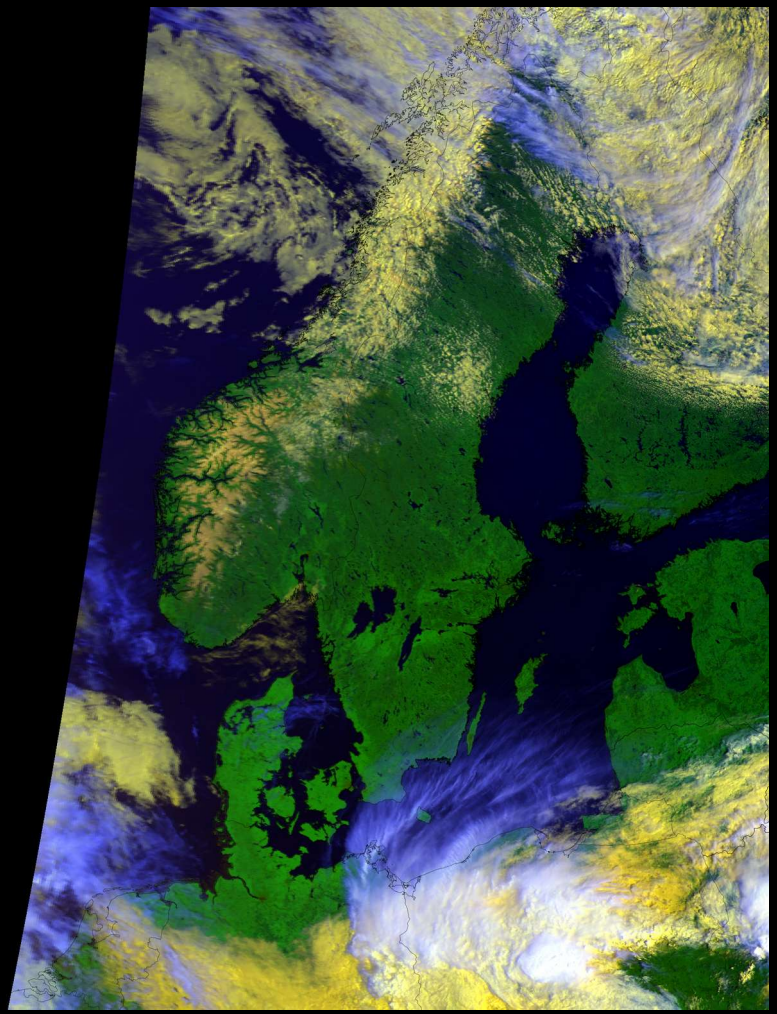
Objective

- Via a few case studies we want to see if and how instability indices derived from Hyperspectral sounding profiles can be used as predictor(s) for the onset of convection over Sweden
- If proven useful:
  - Such data could be included in the Mesan analysis today (using IASI, CrIS, AIRS) and provide a Nowcasting tool for the SMHI forecasting offices for the early warning for (strong) convective activity
  - There is scope for IRS data in Mesan!

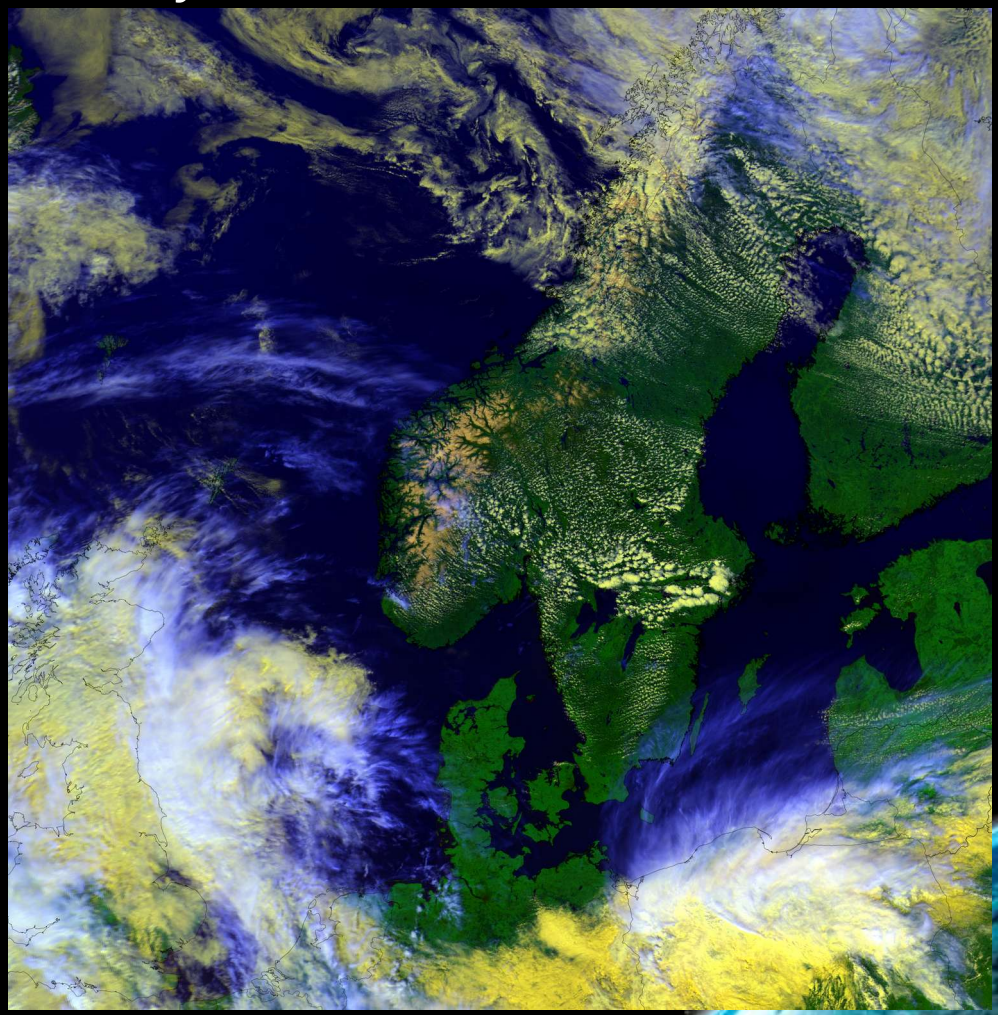


June 21, 2012 Case

Morning: NOAA-16 07:19 UTC

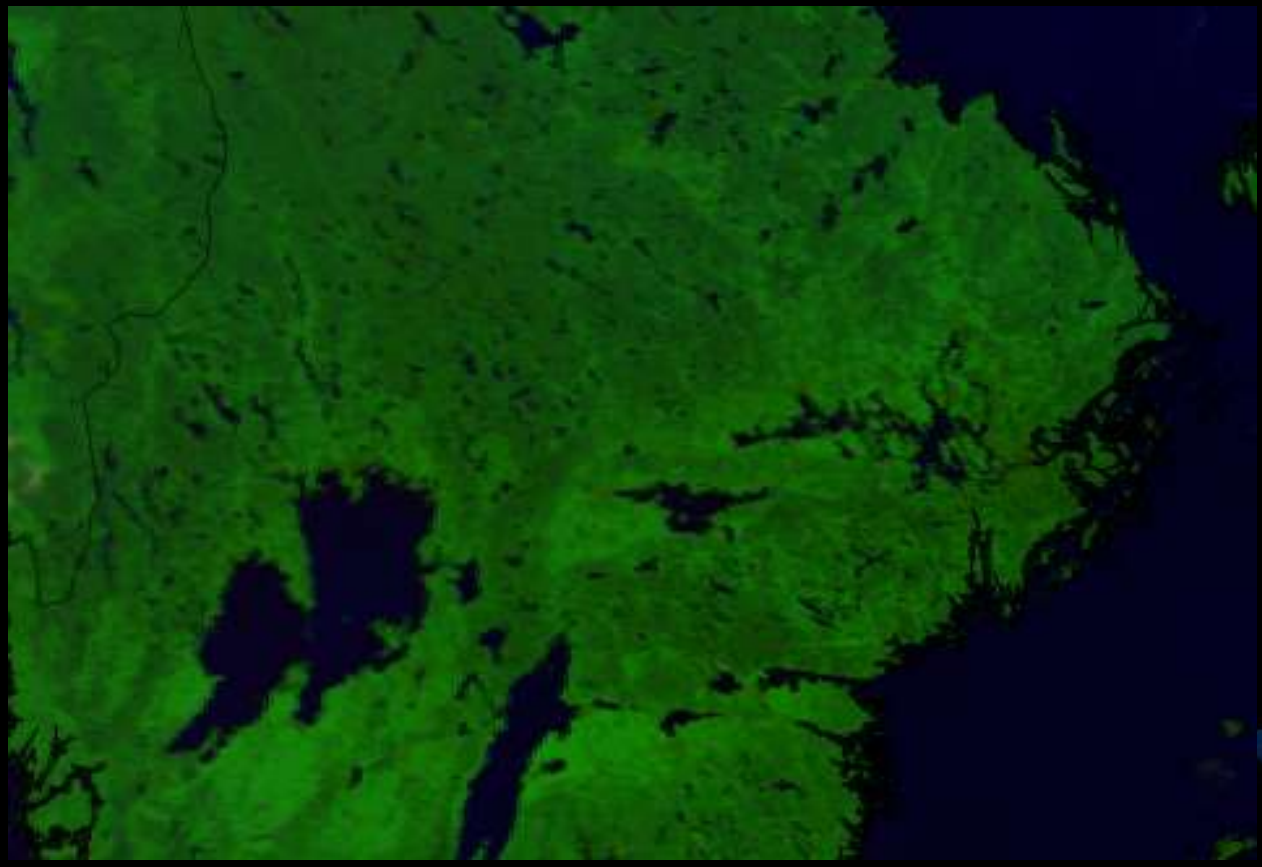


Midday: NOAA-19 11:24 UTC



June 21, 2012 Case

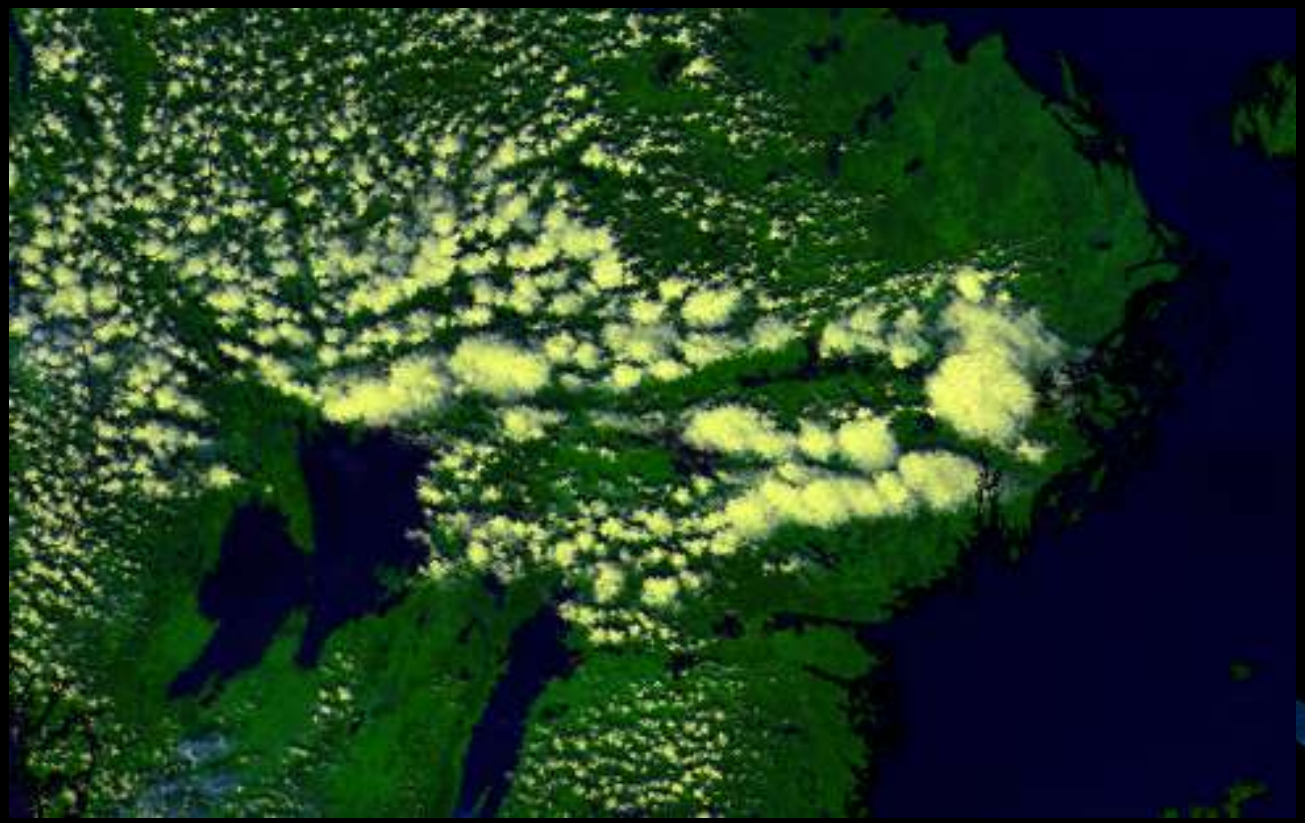
Convection (mainly shallow) over mid-southern Sweden – Close to Stockholm



Overview RGB (AVHRR 1;2;4) NOAA-16 07:19 UTC

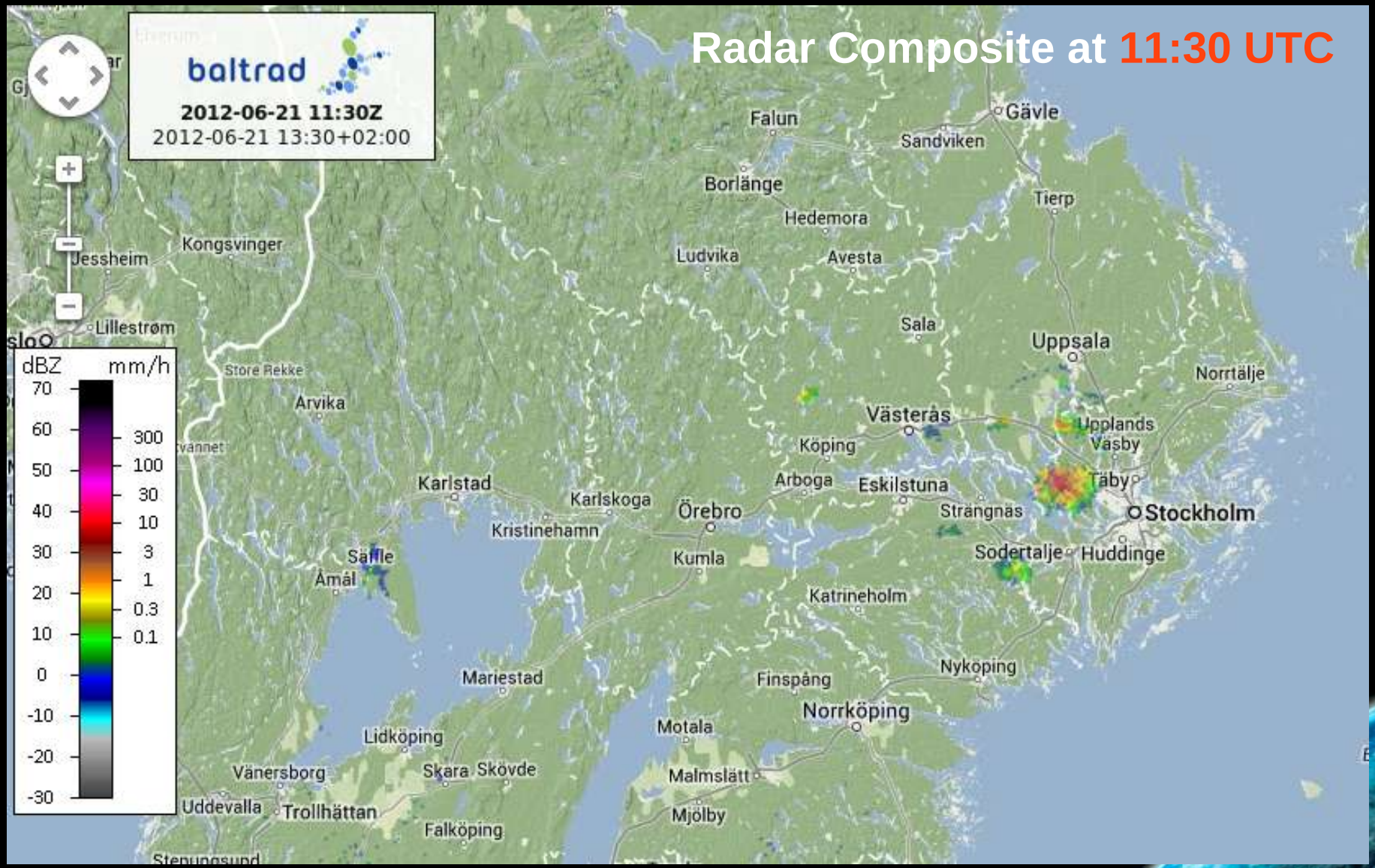
June 21, 2012 Case

Convection (mainly shallow) over mid-southern Sweden – Close to Stockholm



Overview RGB (AVHRR 1;2;4) NOAA-19 11:24 UTC

June 21, 2012 Case



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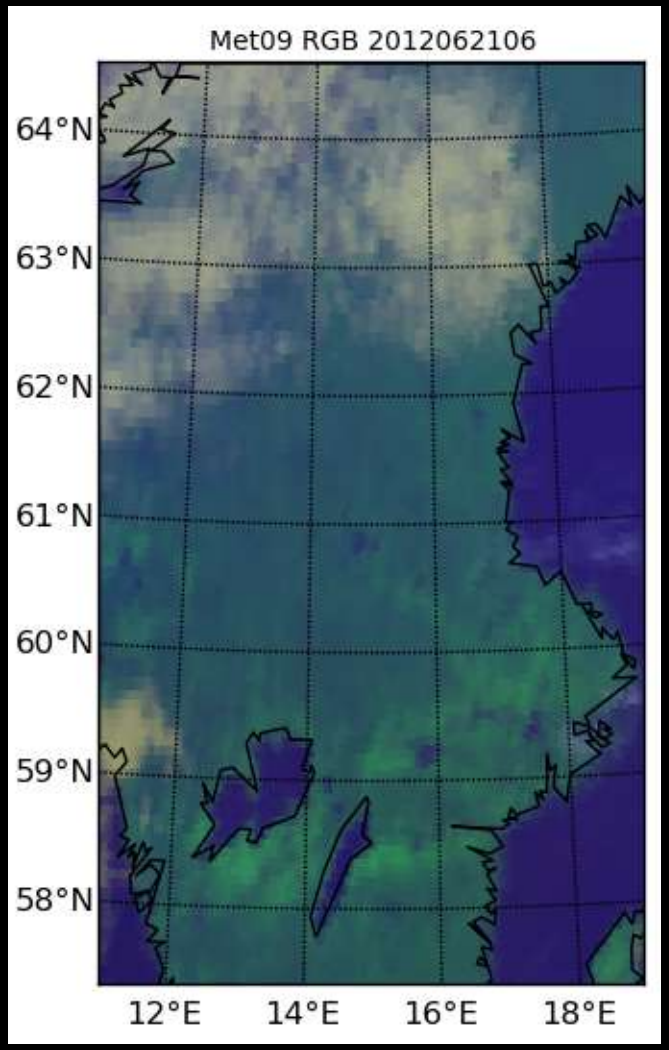
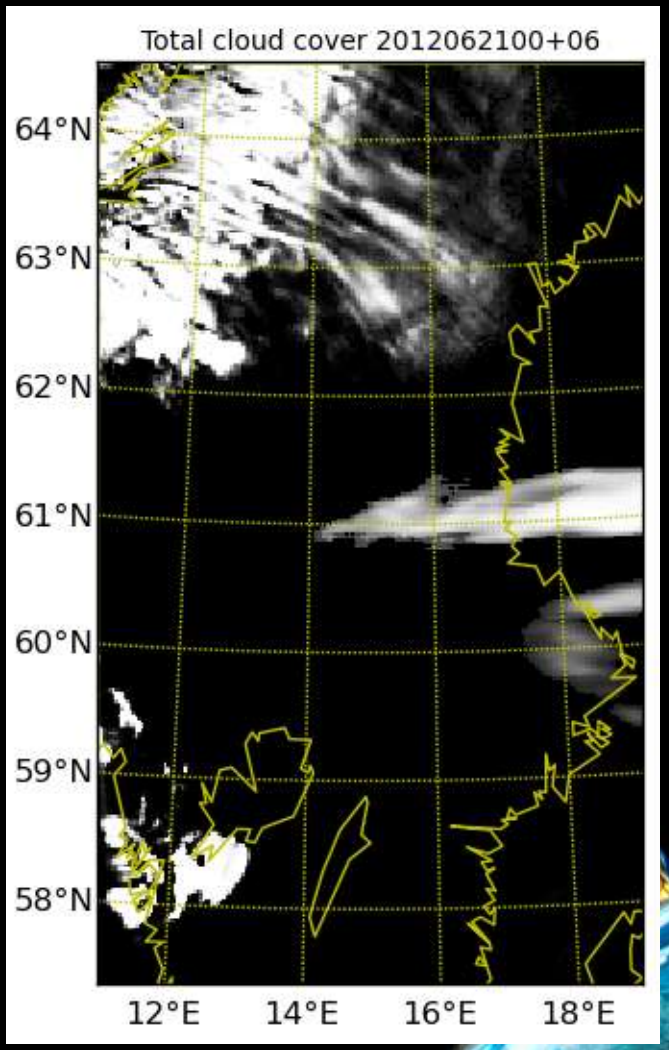
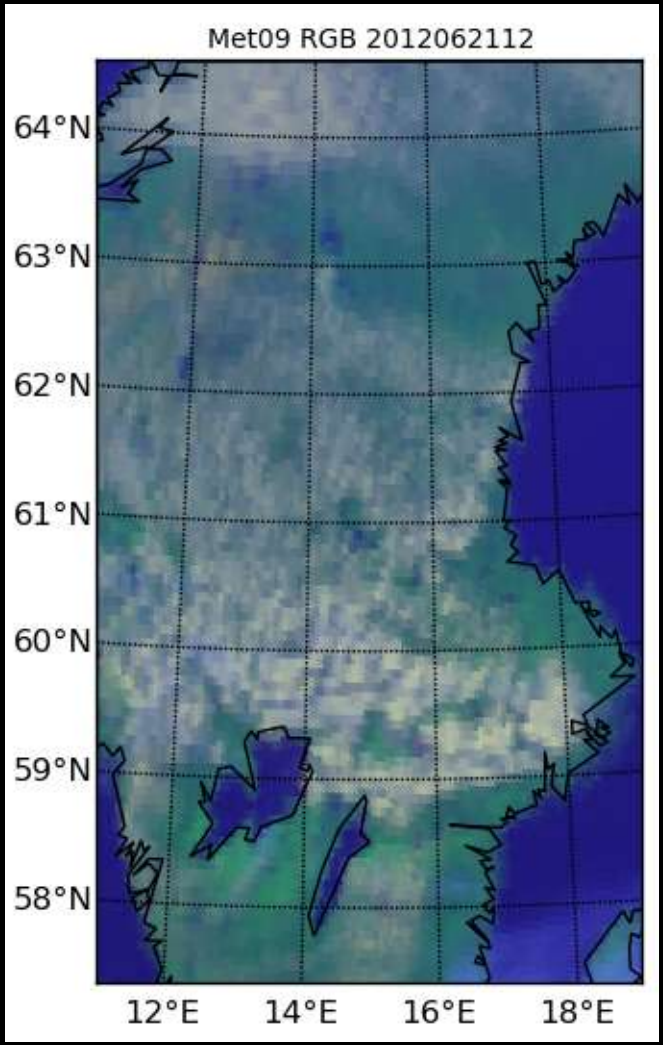
Met-9 versus Harmonie NWP at 06 UTC

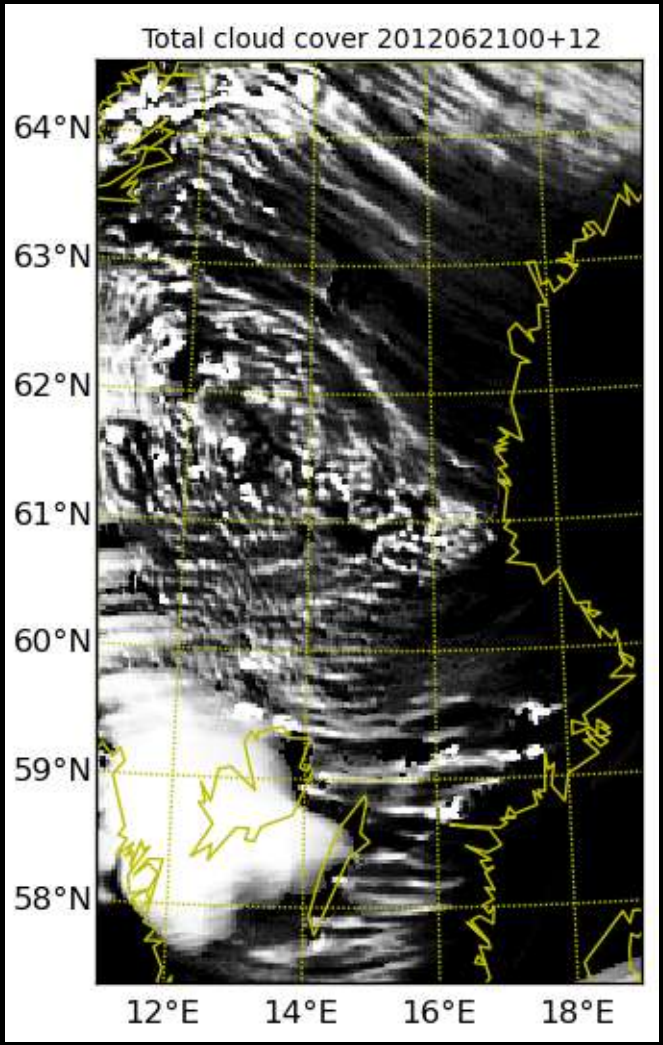


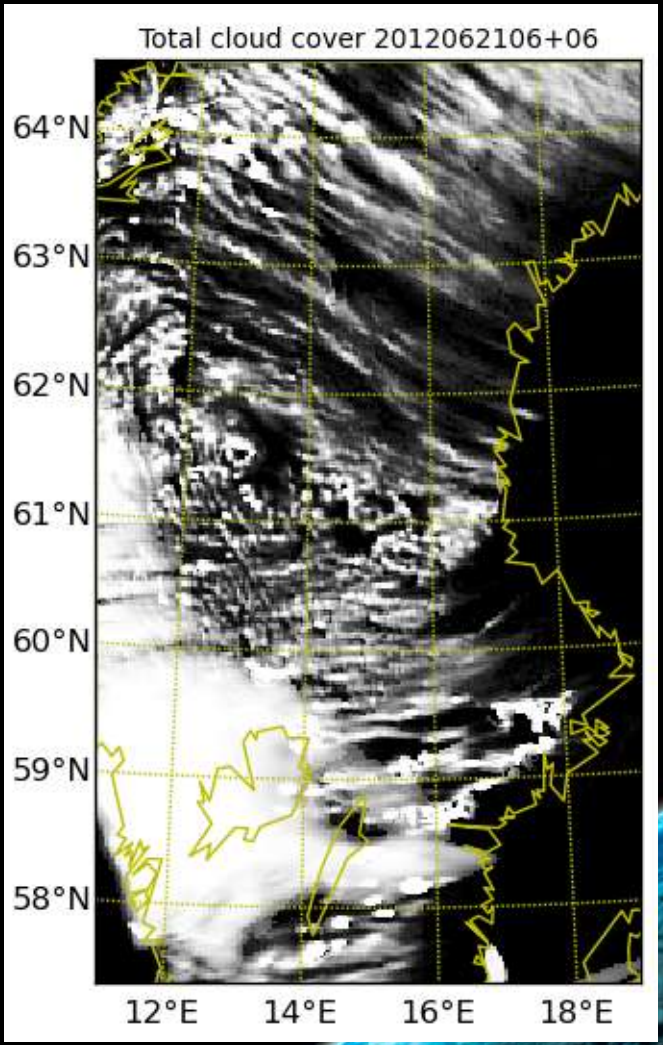


SMHI

Met-9 versus Harmonie NWP at 12 UTC

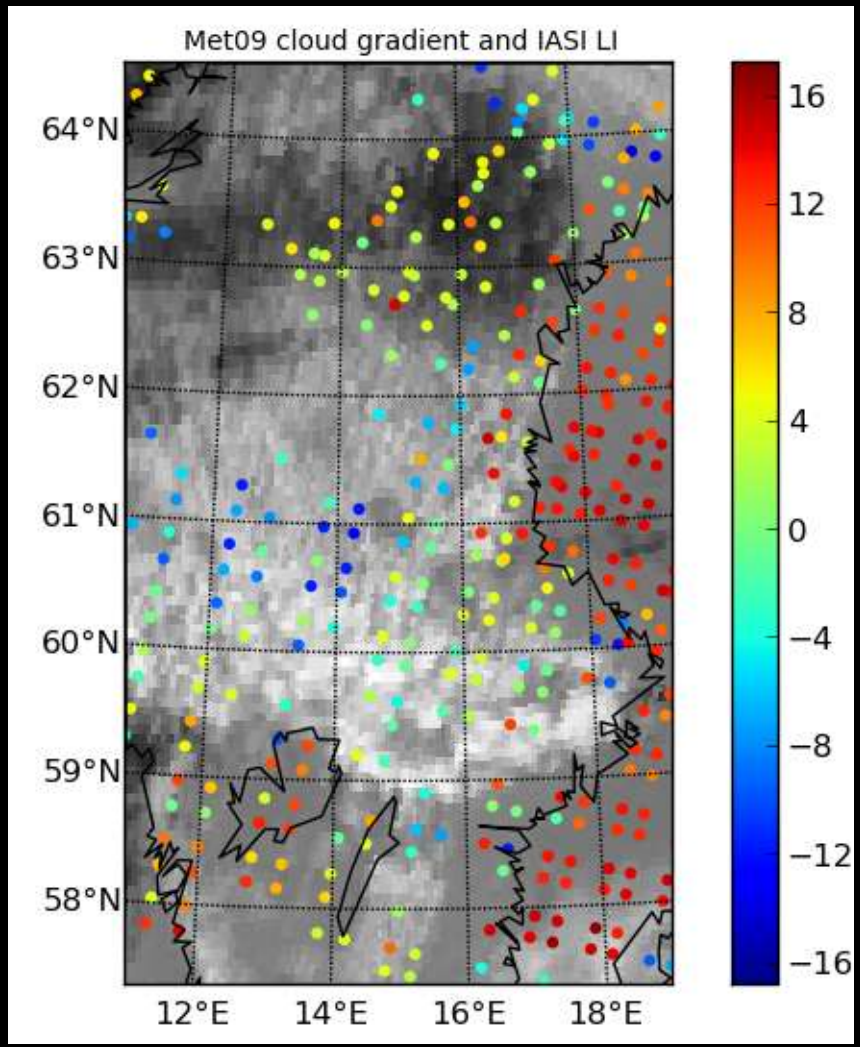




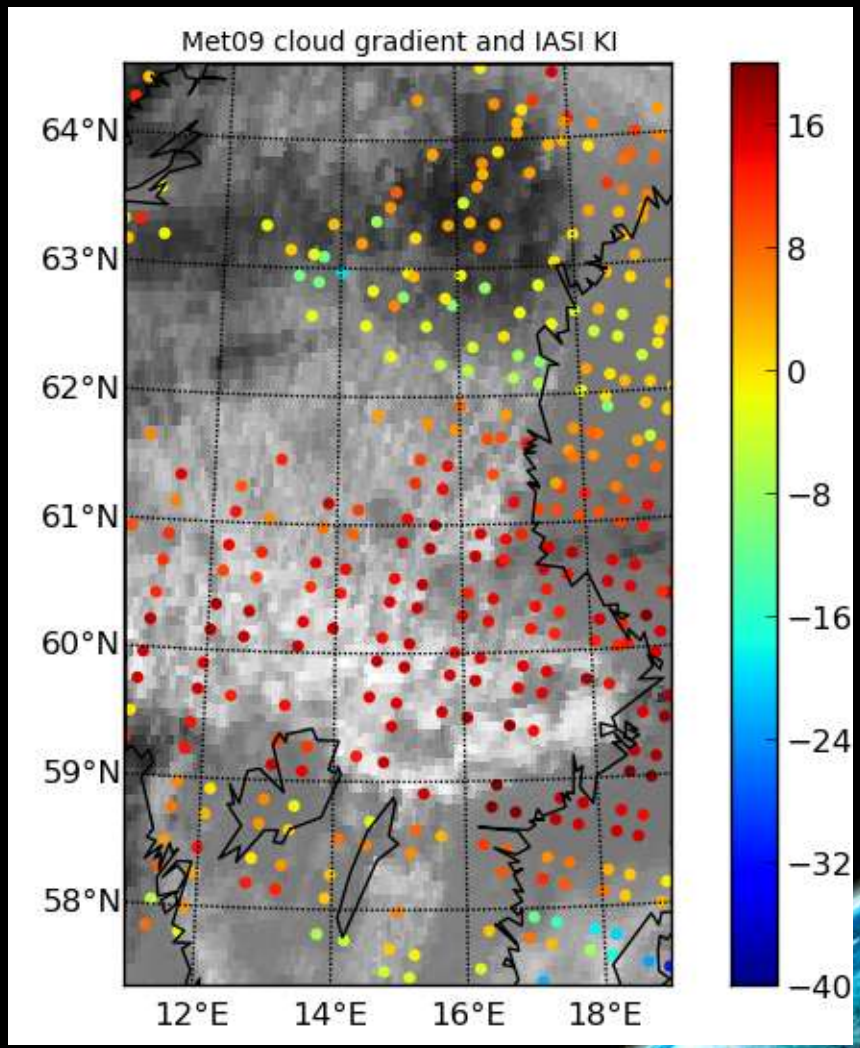


Lifted Index and K index at ~09 UTC

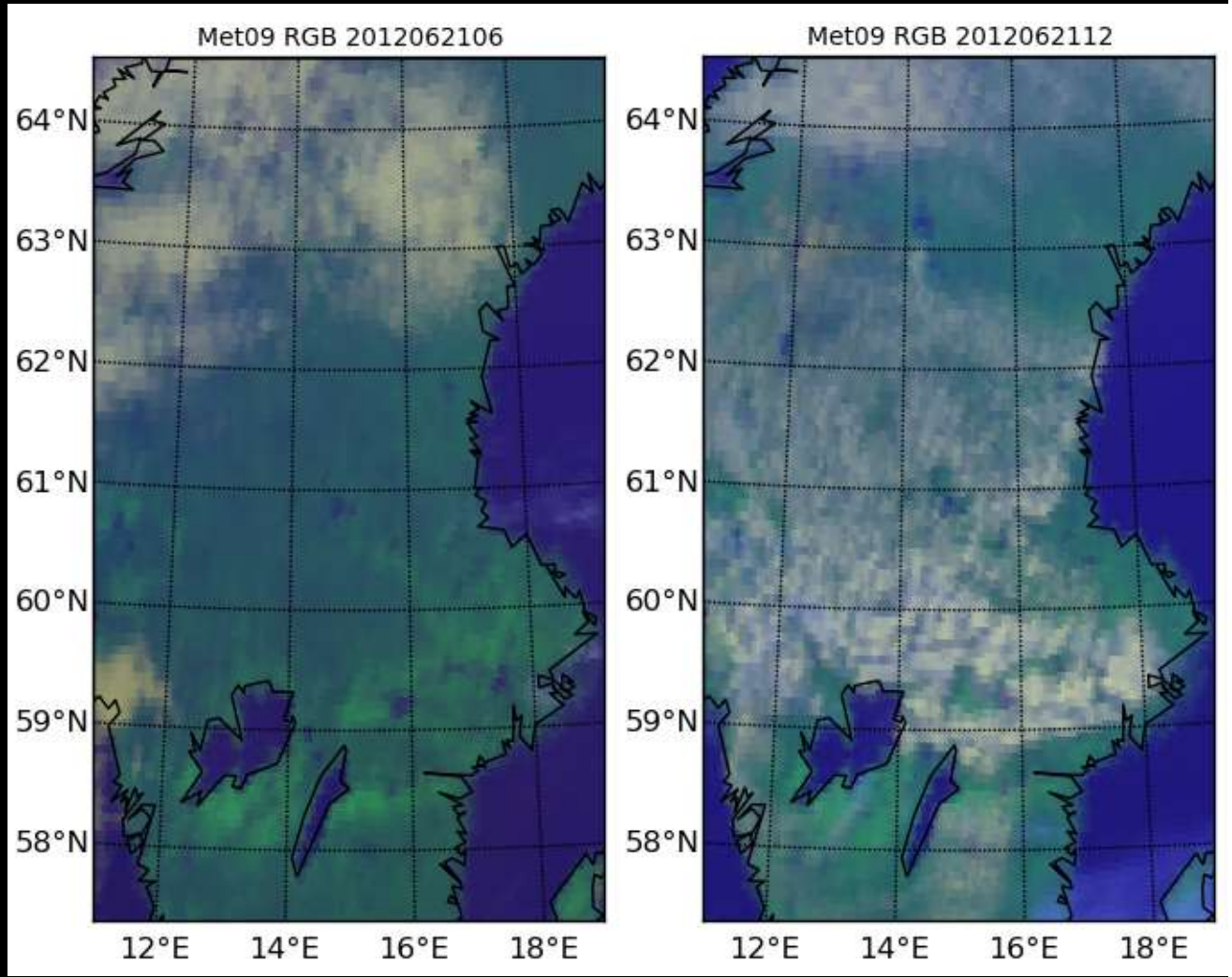
Lifted Index

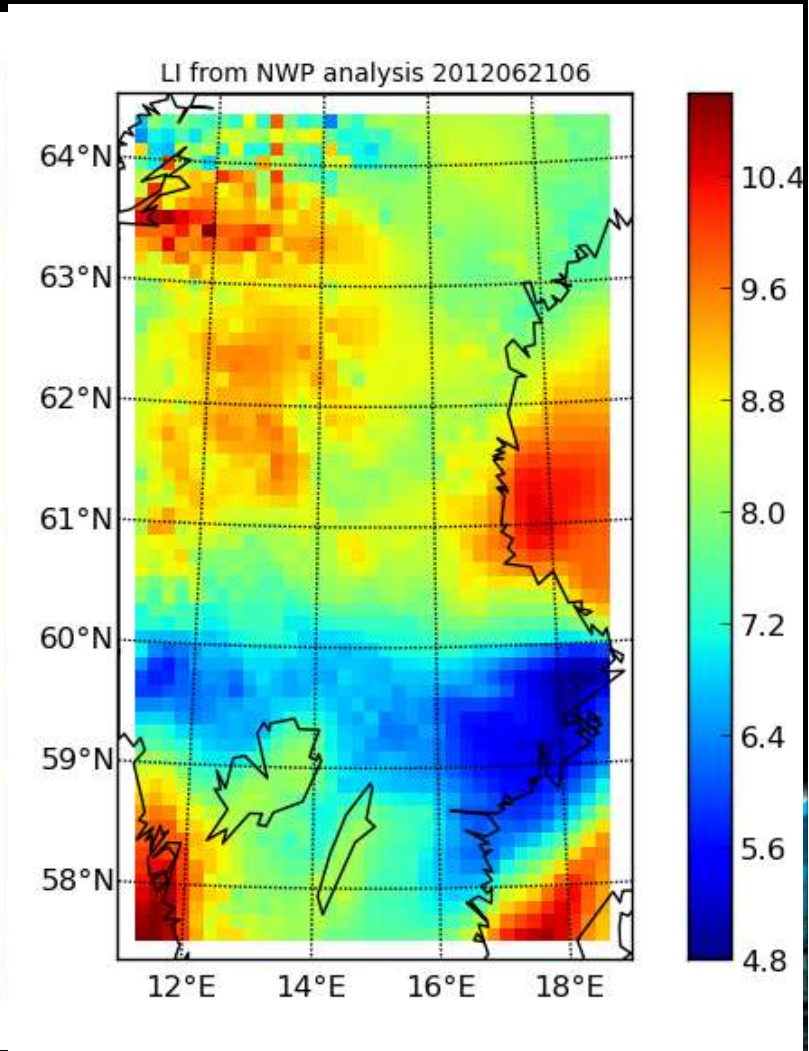


K Index

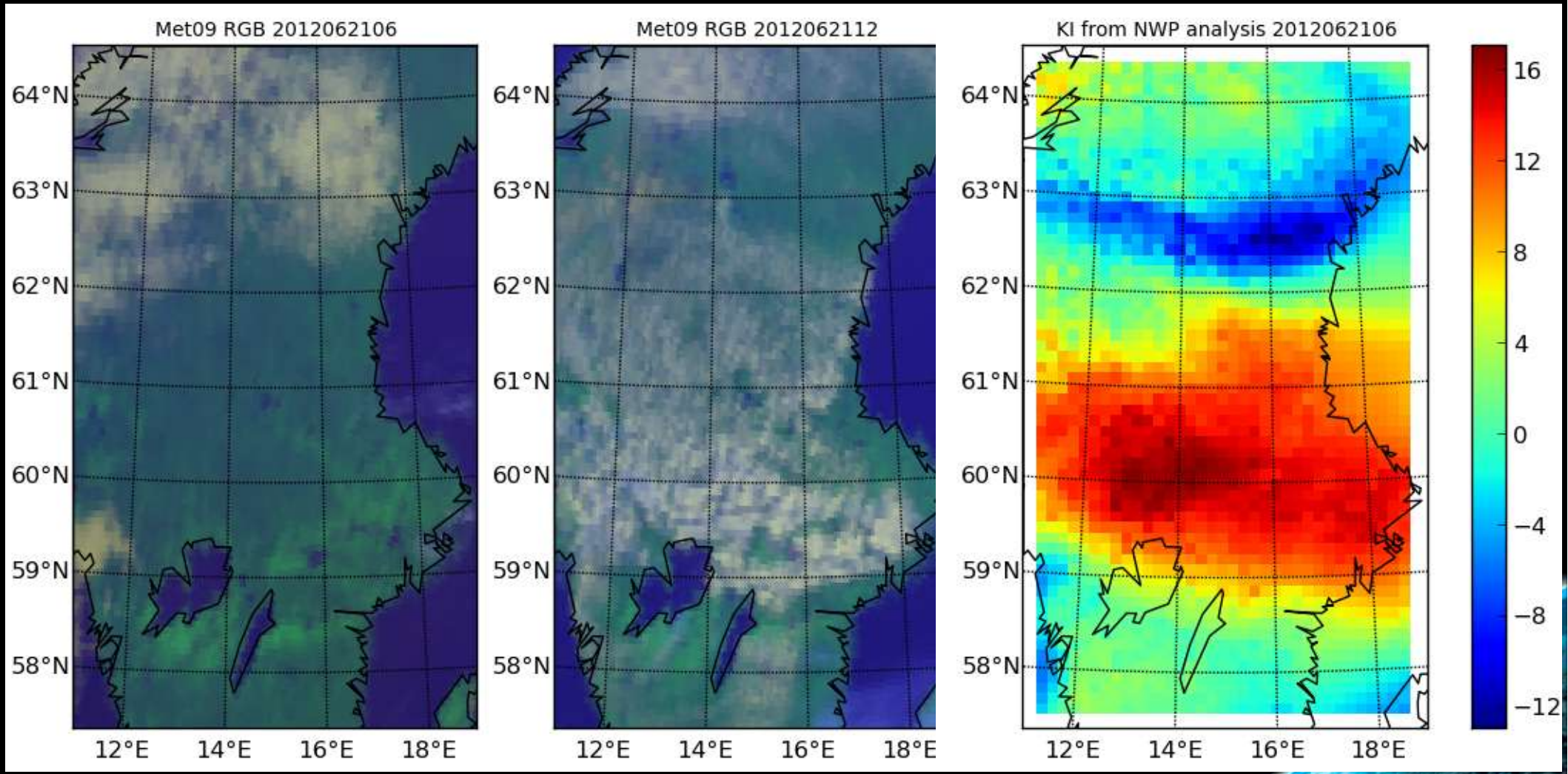


LI from Harmonie NWP at 06 UTC



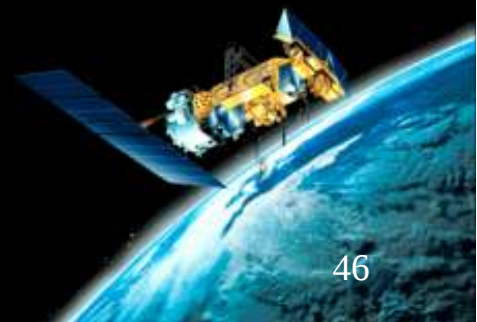


KI from Harmonie NWP at 06 UTC



Summary

- A rather gentle (weak) convective summer case over mid/southern Sweden was studied
- Two indices were derived from both NWP and IASI data



Summary

- In this particular case the Harmonie model did a fairly decent job in predicting the convective cloudiness (leaving less motive for using satellite derived instability indicators)

Summary

- Both the LI and KI derived from IASI data showed atmospheric instability consistent with the later development (convective activity peaking around 2-3 hours later)
- But none of the indices really pointed specifically to the main area of strongest activity (near the Stockholm city area)

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Conclusions

- The case studied indicated potential for Hyperspectral sounding derived instability indices in Mesan
- Even though the Harmonie model did a quite good job in this case both predicting the convective cloudiness and providing atmospheric instability indices consistent with the development

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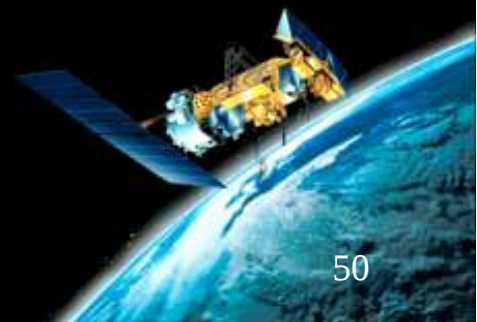
Conclusions

- More case studies are needed
- It has yet to be decided which indices are most useful over Scandinavia and northern Europe
- Desirable to look at cases with more satellite soundings from several platforms (Metop-B and Suomi NPP foremost)



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Conclusions

- In light of this rather positive though very preliminary and limited study we would recommend EUMETSAT to consider IRS level 2 data also over the Scandinavian area!