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Meteorologisch Instituut
Ministerie van Infrastructuur en Milieu

CM SAF
Climate Monitoring

Cloud microphysical property retrievals from MSG-SEVIRI

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Royal Netherlands Meteorological Institute

Outline

- Introduction
- Retrieval of cloud properties from passive imagers
- CM-SAF datasets
- Near-real time service
- Summary

- Introduction

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Where and who am I

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KNMI office with weather radar in De Bilt (The Netherlands)

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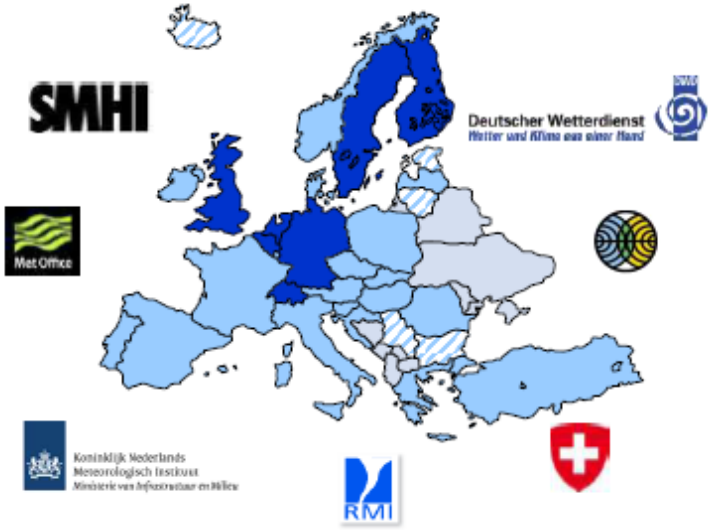
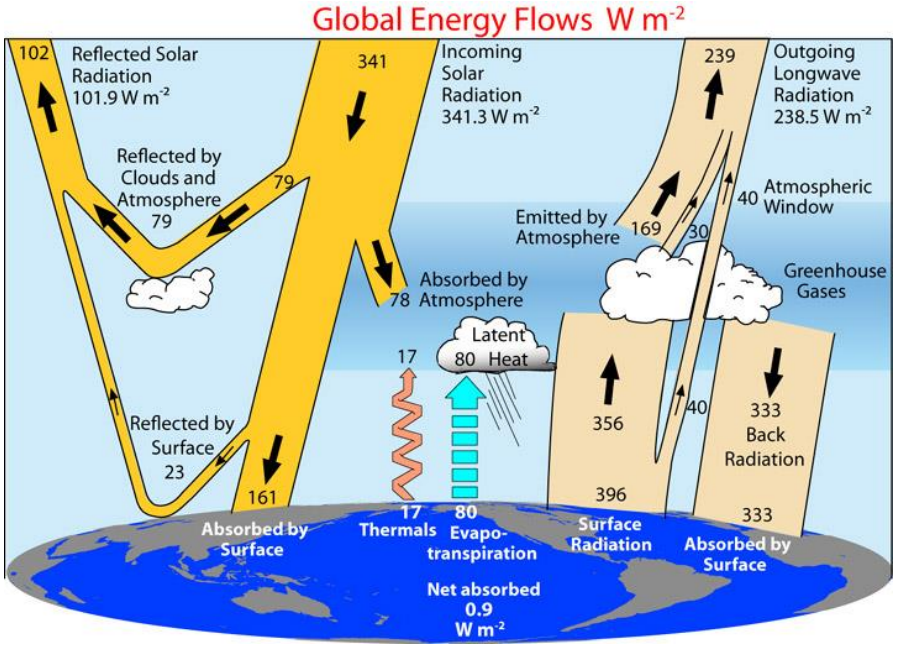


www.cmsaf.eu

Long-term satellite-based data records of the atmospheric energy and water cycle

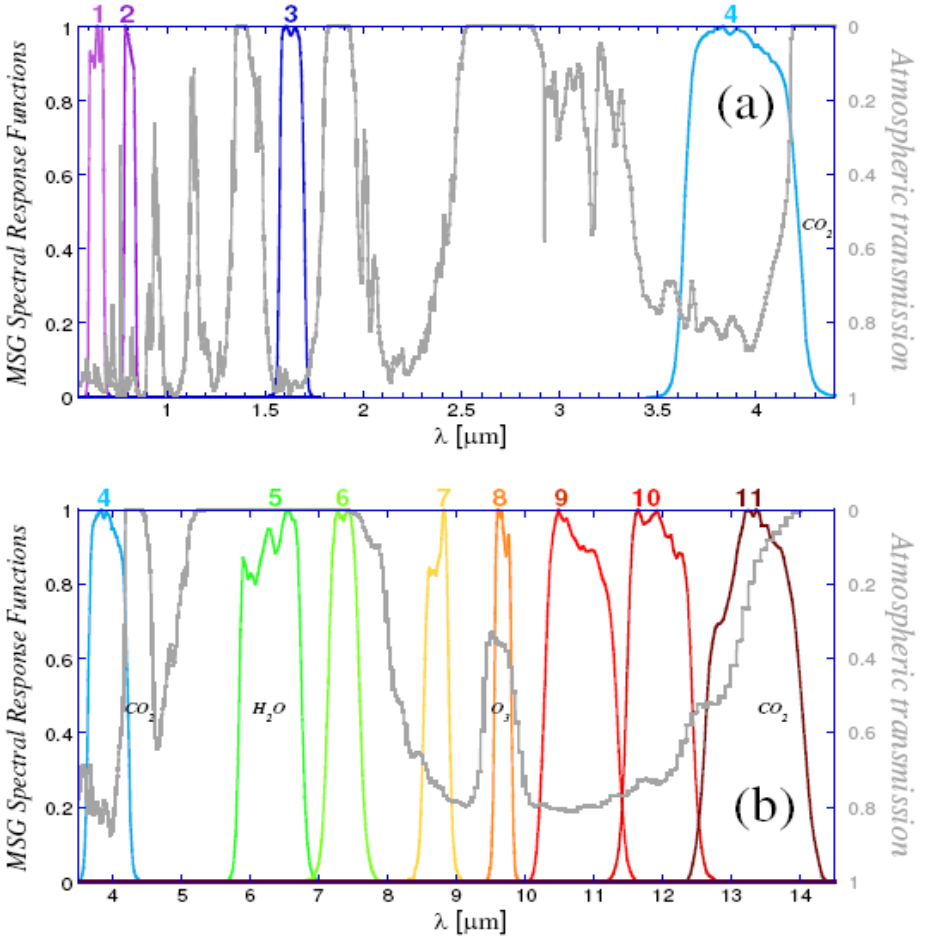


- Retrieval of cloud properties from passive imagers

Passive imagers

- Geostationary orbit
  - MSG-SEVIRI
  - GOES
  - Himawari
  - …
- Polar orbit
  - AVHRR
  - VIIRS
  - MODIS
  - …

SEVIRI spectral response



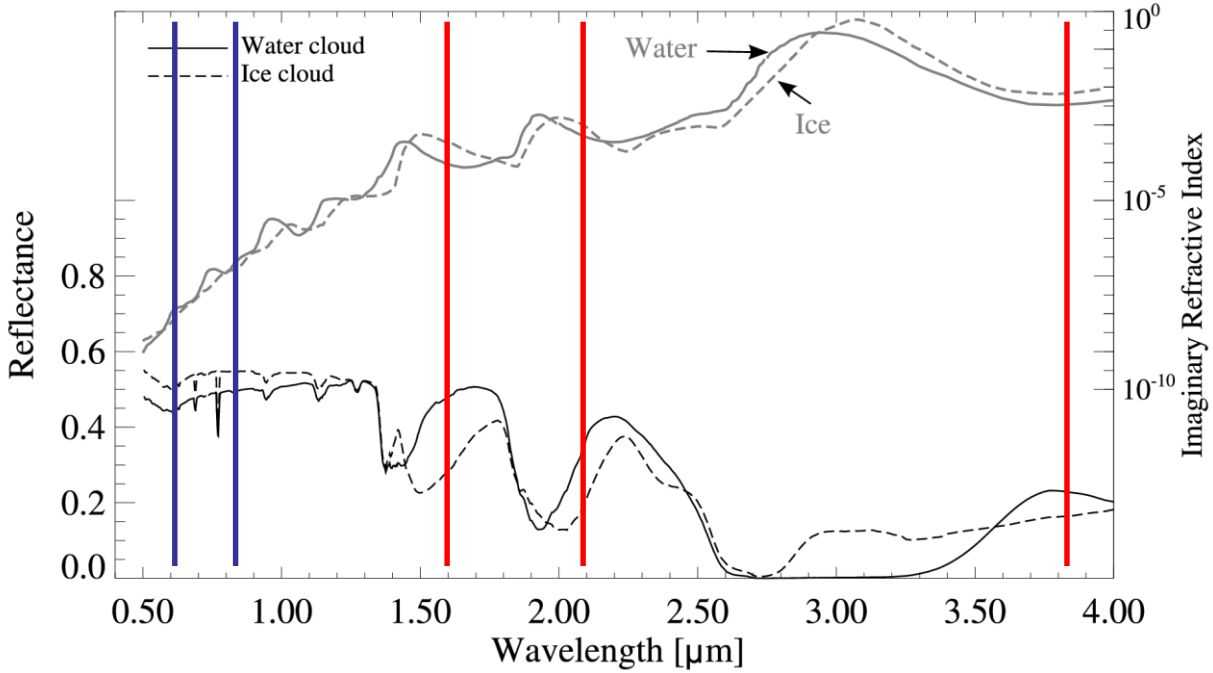
Cloud retrieval (1)

- Cloud mask (-> cloud fraction)
  - Collection of VIS-NIR-IR spectral tests (e.g., visible reflectance exceeding particular threshold)
  - Weighting of these tests gives probabilistic cloud mask or clear/cloudy discrimination
- Cloud-top temperature / height / pressure
  - IR split-window technique
  - CO_2 slicing
- Cloud thermodynamic phase
  - Collection of NIR-IR spectral tests with reference to clear-sky and cloudy overcast radiances

Cloud retrieval (2)

- Cloud optical and microphysical properties
  - (Cloud-top thermodynamic phase)
  - Cloud optical thickness
  - Cloud particle effective radius
  - Liquid/Ice water path

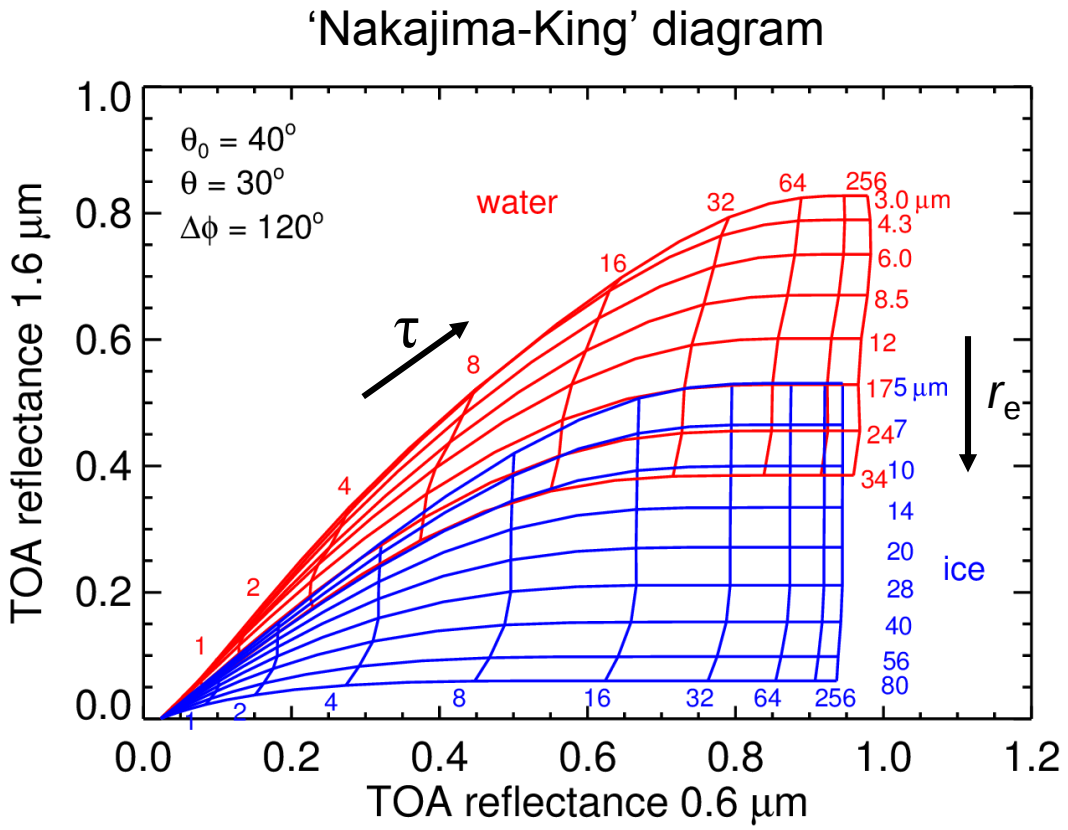
$$\mathrm{LWP} = \frac{2}{3}\rho_l \tau r_e; \quad \mathrm{IWP} = \frac{2}{3}\rho_i \tau r_e$$



Cloud retrieval (3)

- Cloud optical and microphysical properties

- 0.6 / 0.8 µm
  - Scattering
  - No absorption
  - $R_{0.6} = f_1(\tau)$
- 1.6 / 2.1 / 3.8 µm
  - Scattering
  - Absorption
  - $R_{1.6} = f_2(SSA) = f_3(phase, r_e)$



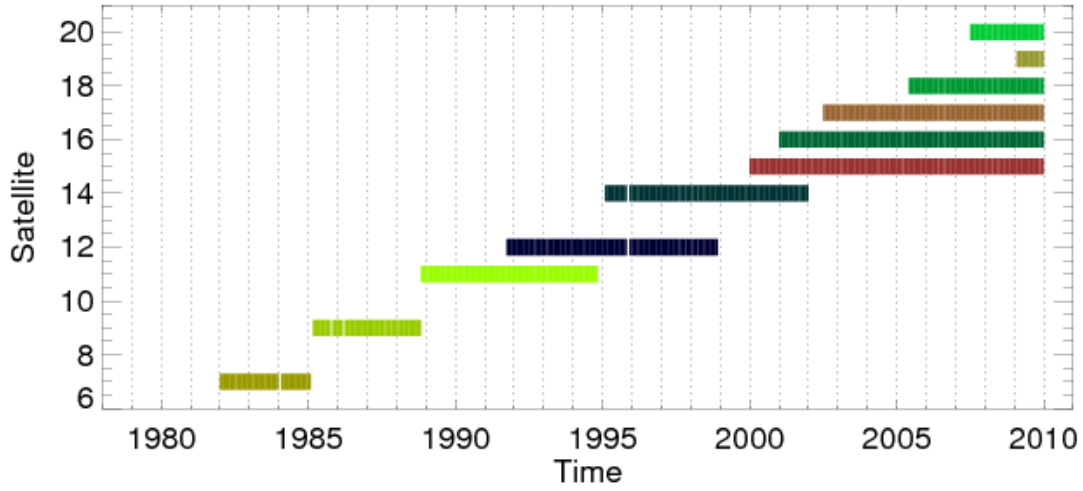
- Retrieval by matching observed and simulated refl. pairs

- CM SAF datasets

CLARA-A1

- CLARA-A: **C**M SAF c**l**oud, **a**lbedo and **ra**diation dataset from **A**VHRR
- NOAA and Metop satellites
- Time frame: 1982-2009
- Released: 2012

NOAA-7



Karlsson et al., ACP, 2013

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CLARA-A1: global maps

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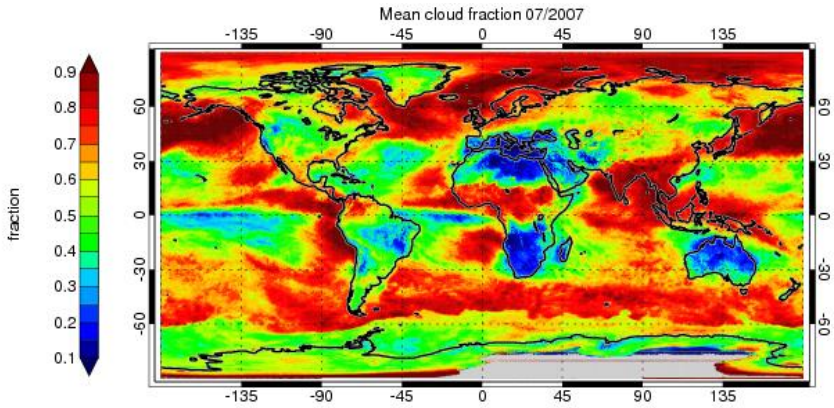
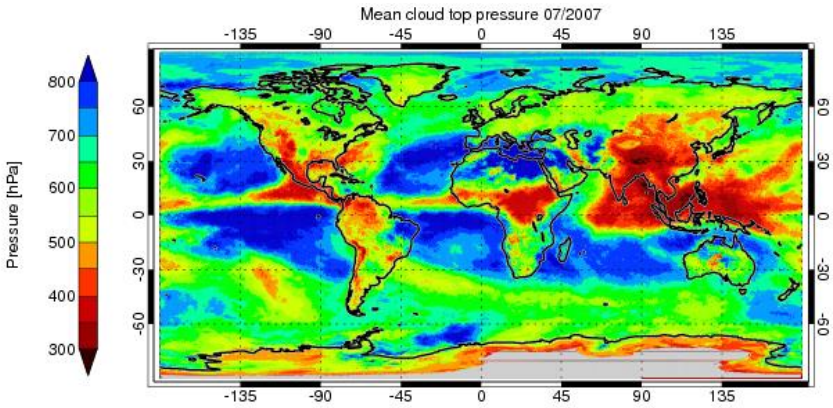
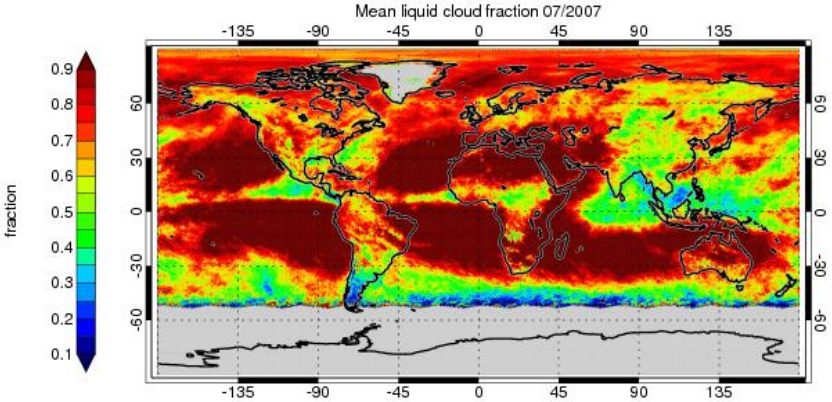


fraction

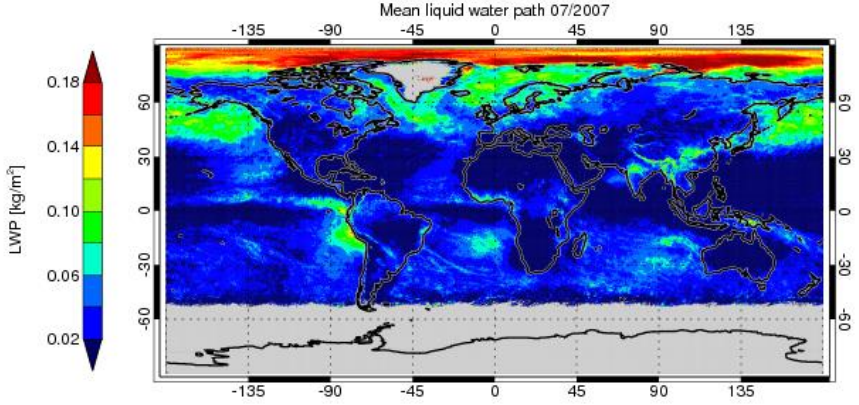


top pressure

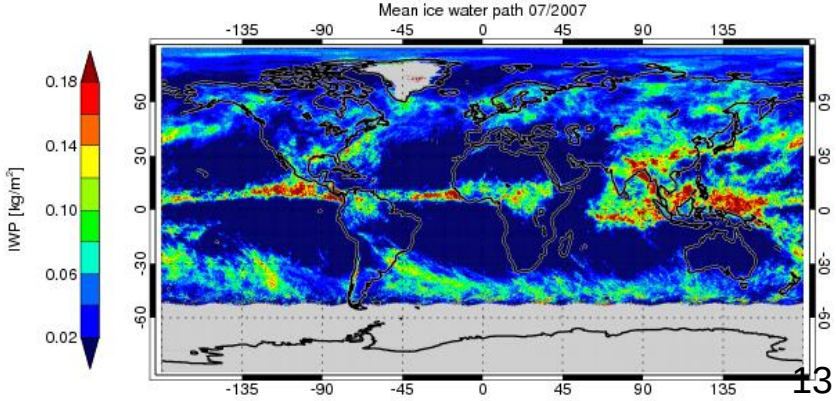
phase



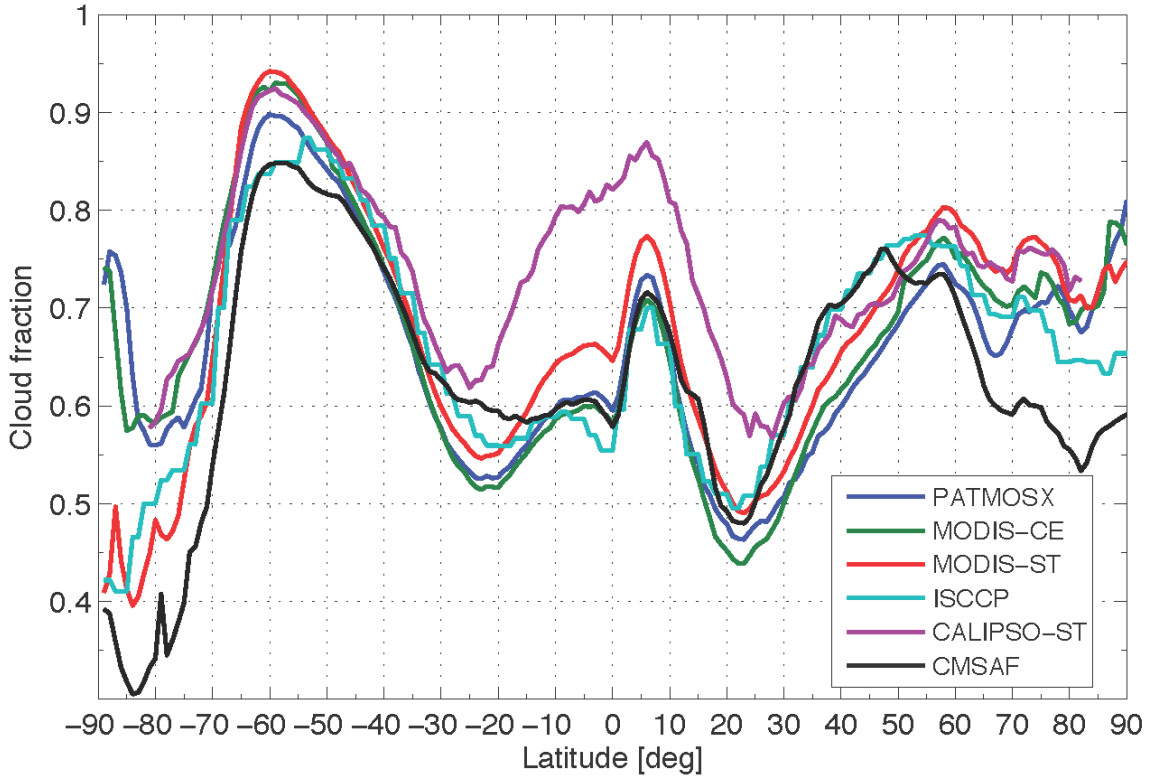
LWP



IWP

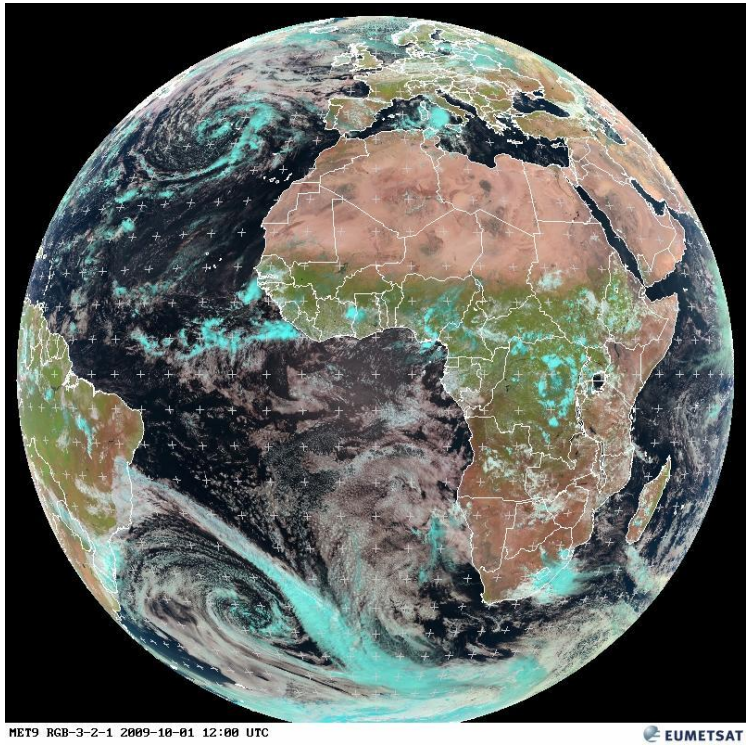


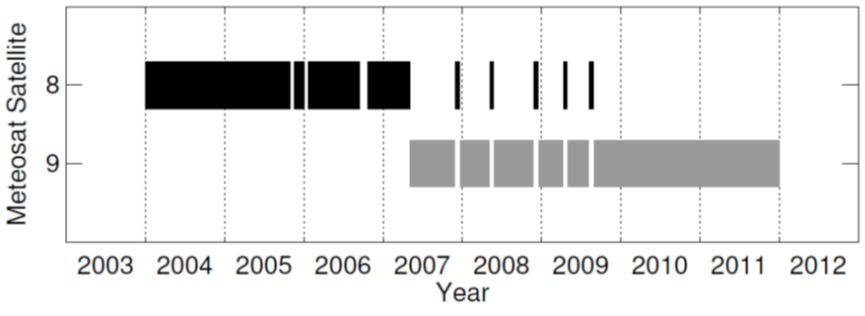
Cloud fraction zonal distribution

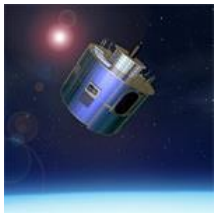


CLAAS-1

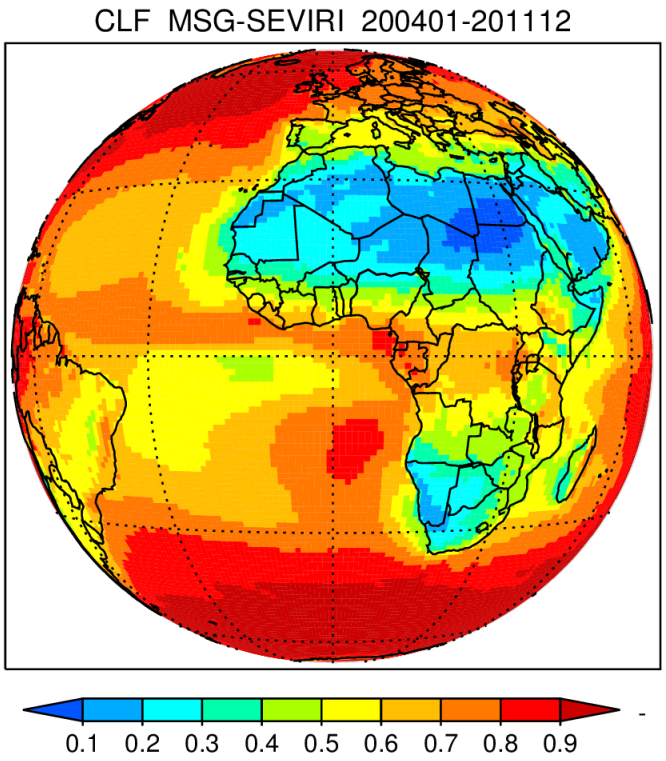
- CLAAS: **C**M SAF c**l**oud d**ata**set using **S**EVIRI
- Time frame: 2004-2011
- Release: 2013

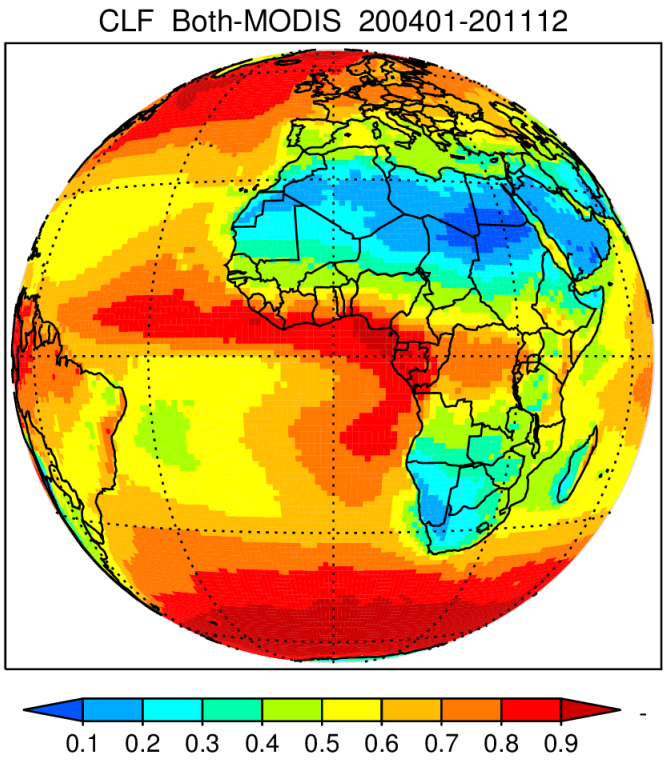




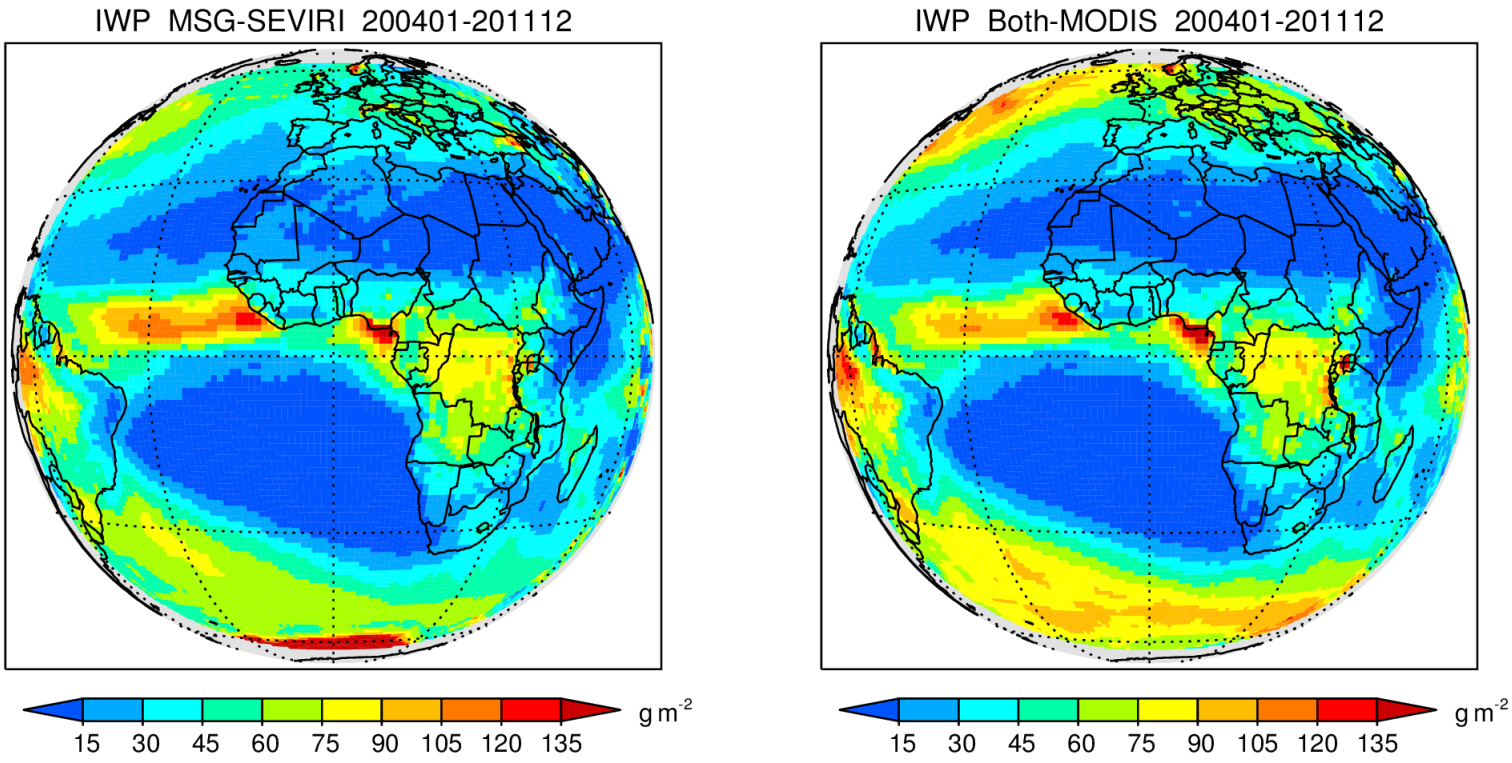


Comparison with MODIS cloud fraction

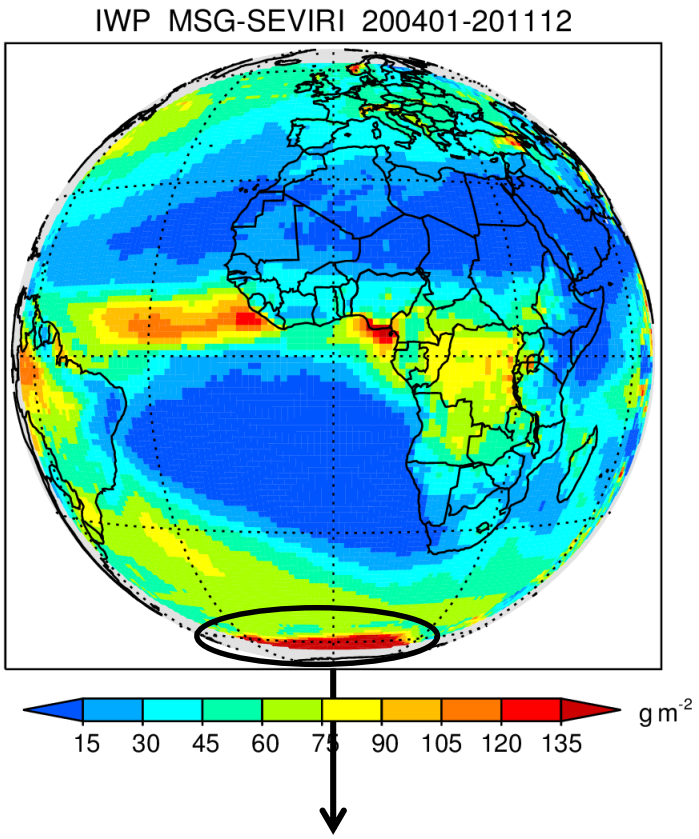


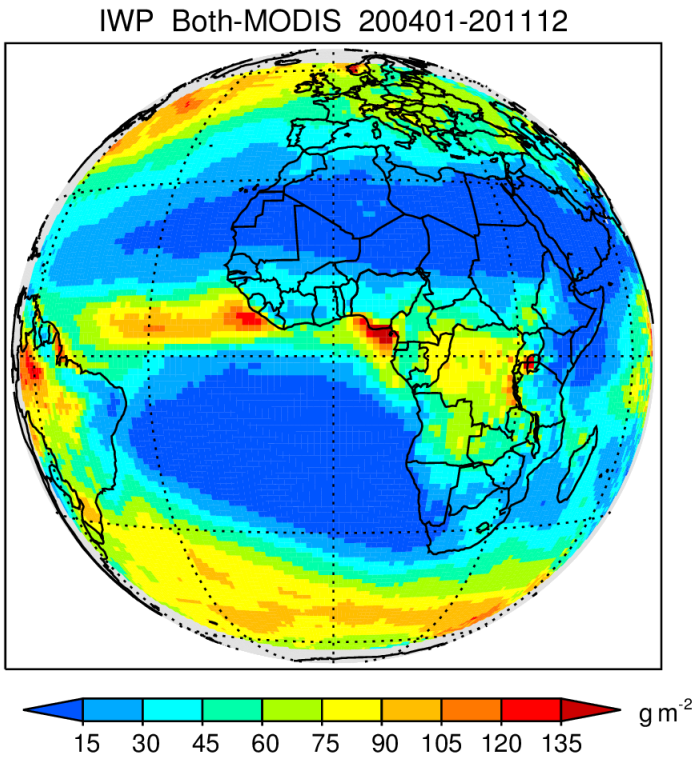


Comparison with MODIS ice water path

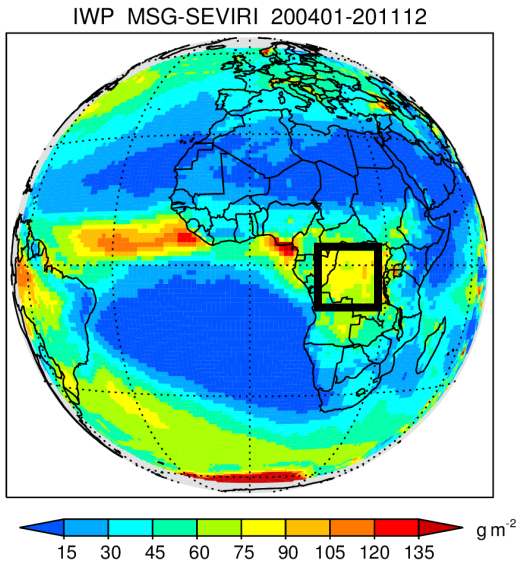


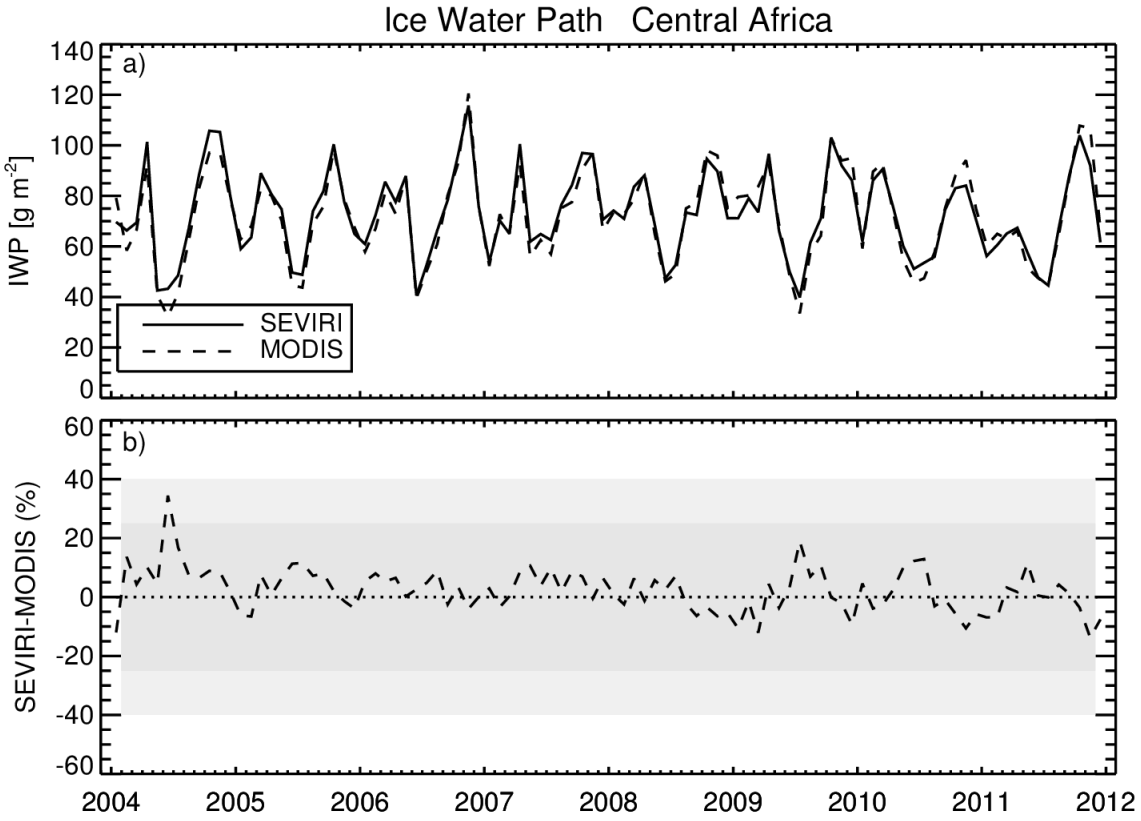
Comparison with MODIS ice water path





IWP Central Africa





Two peaks per year related to passing of ITCZ

- Near-real time service

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Near-real time processing

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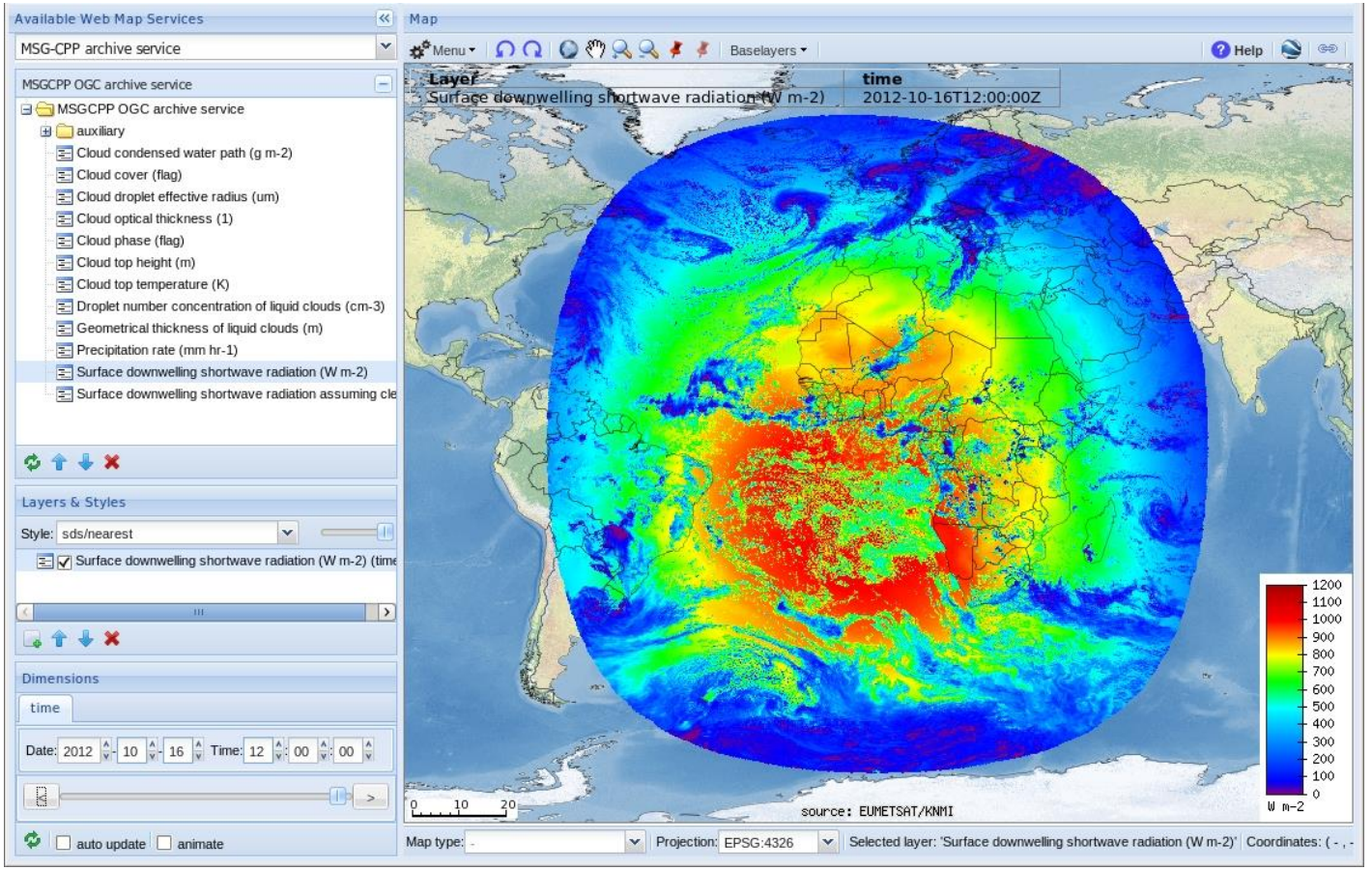
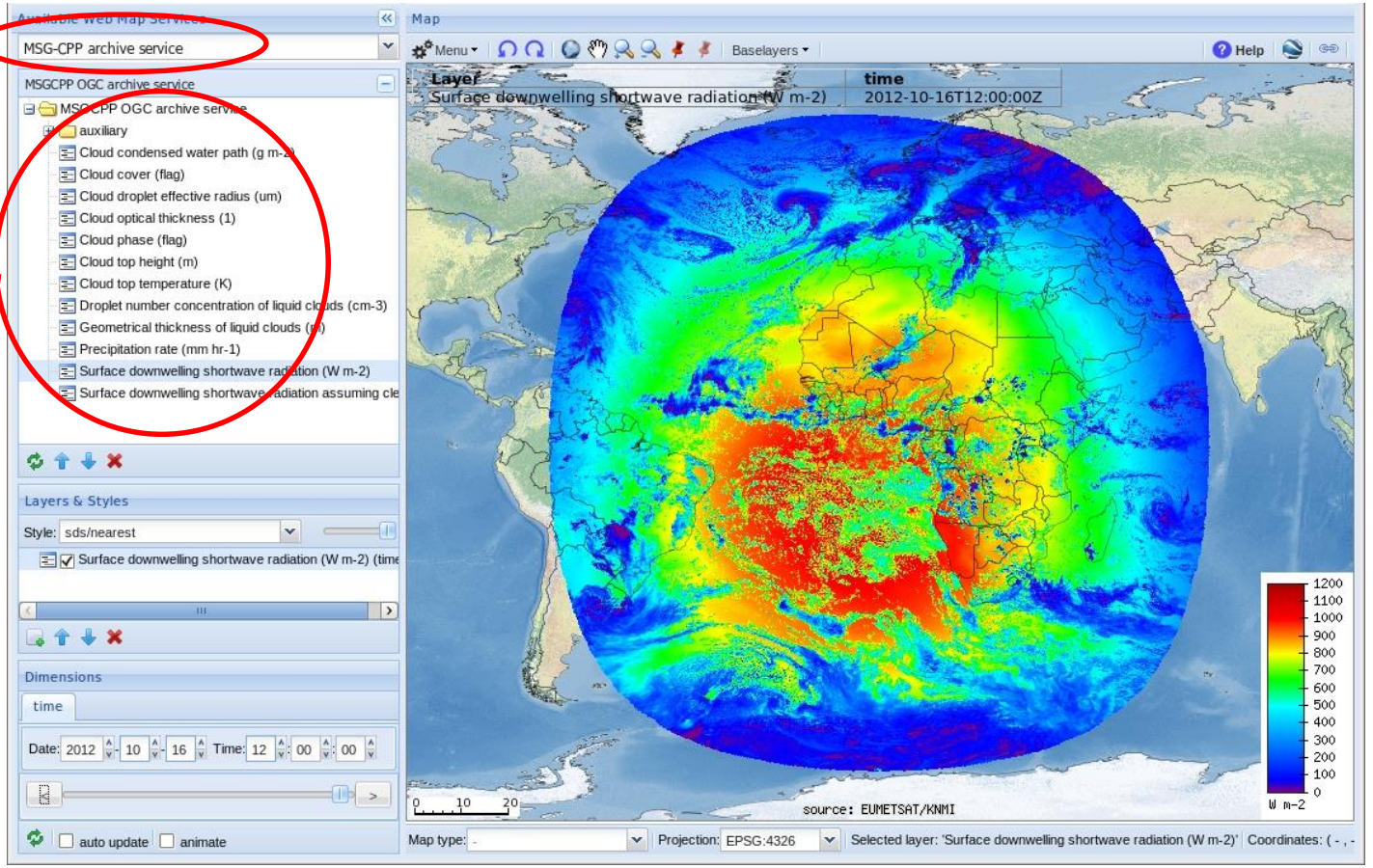


http://msgcpp.knmi.nl

Near-real time processing

Apart from NRT also ~2-yr archive service

Parameters: include also precipitation and surface radiation



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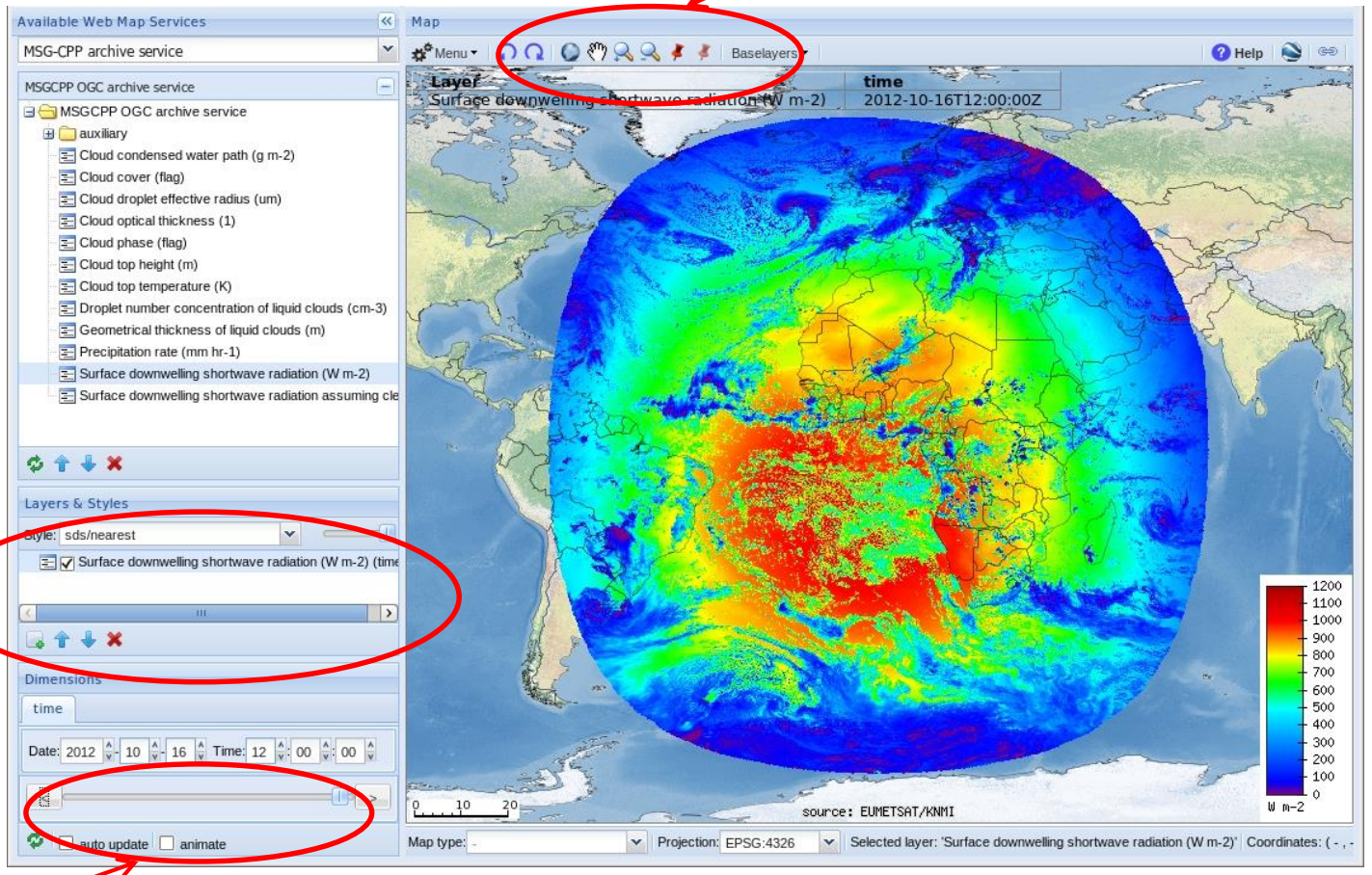
Near-real time processing

zoom etc.



overlay

animate

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Example: tropical convection

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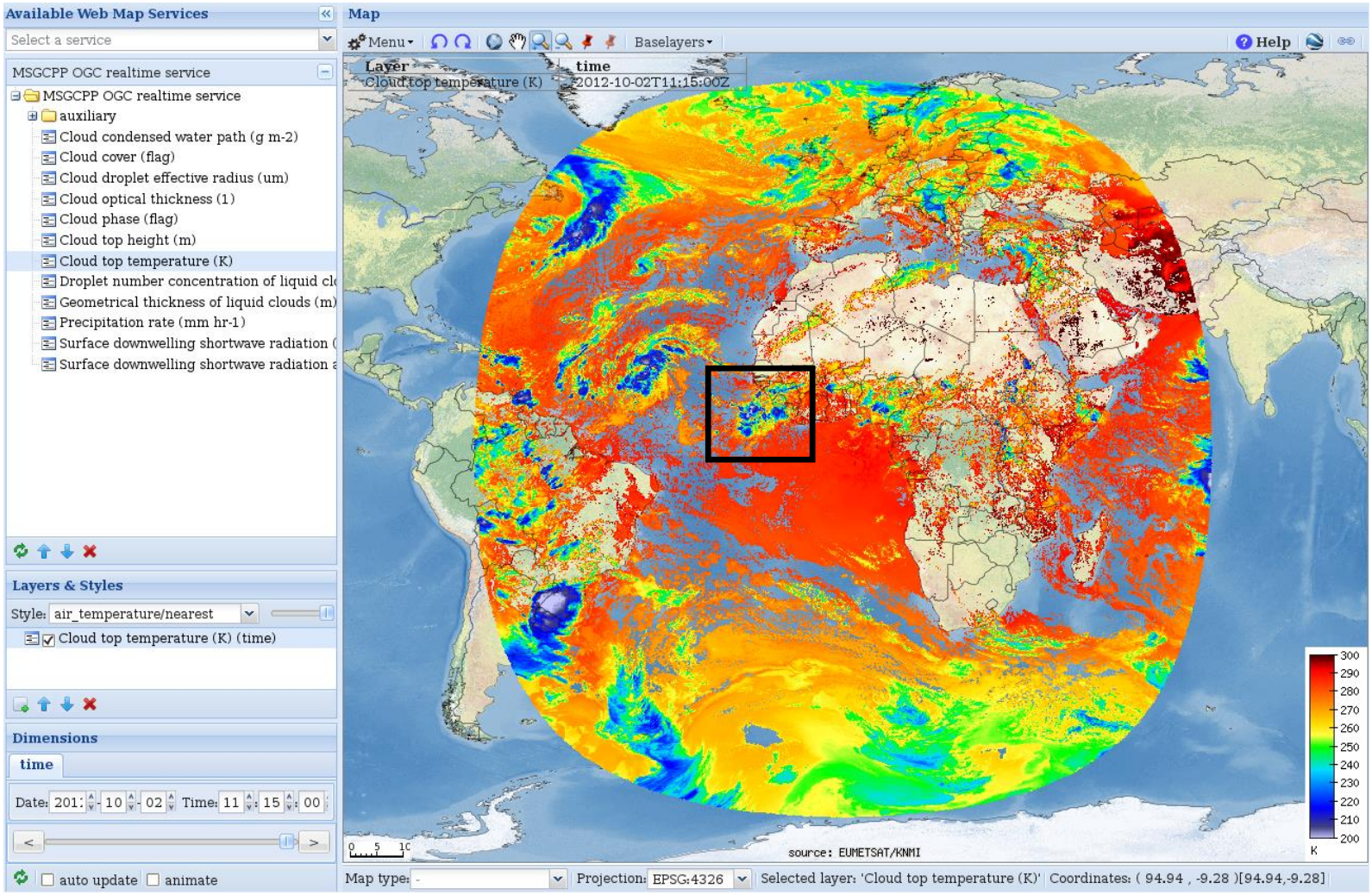
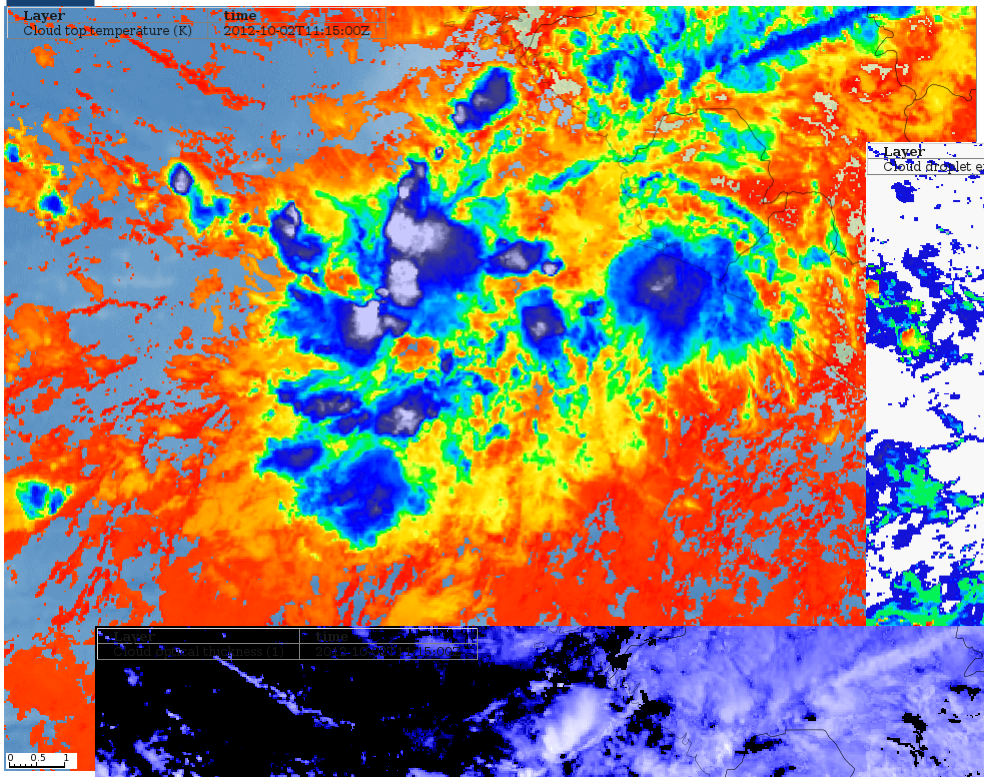
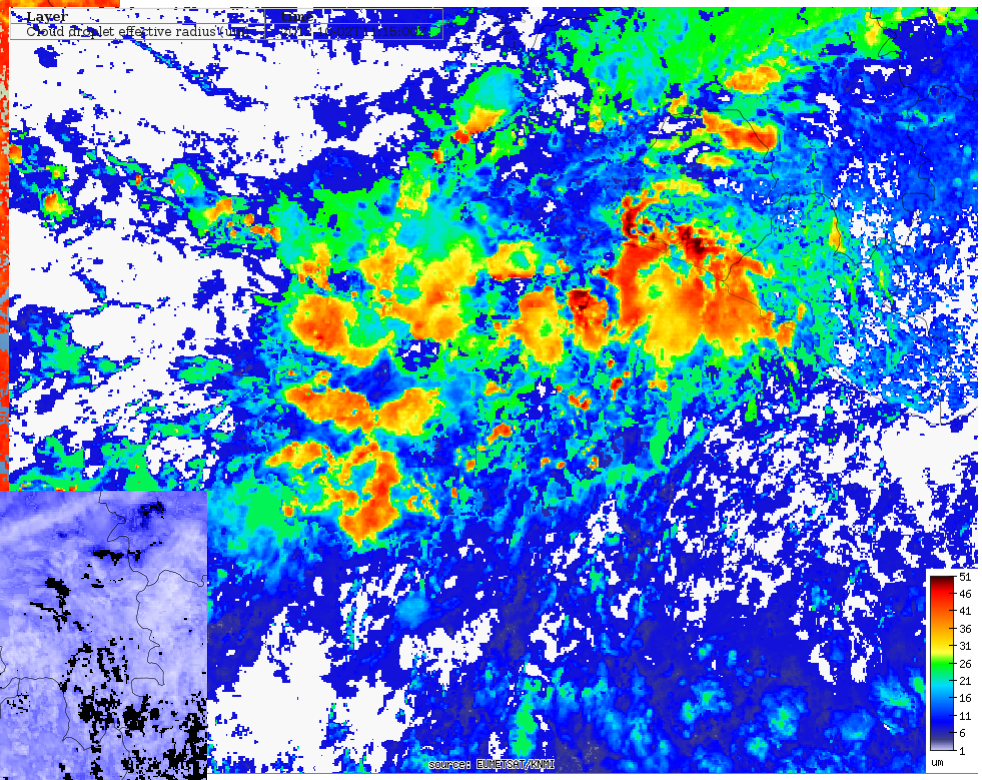
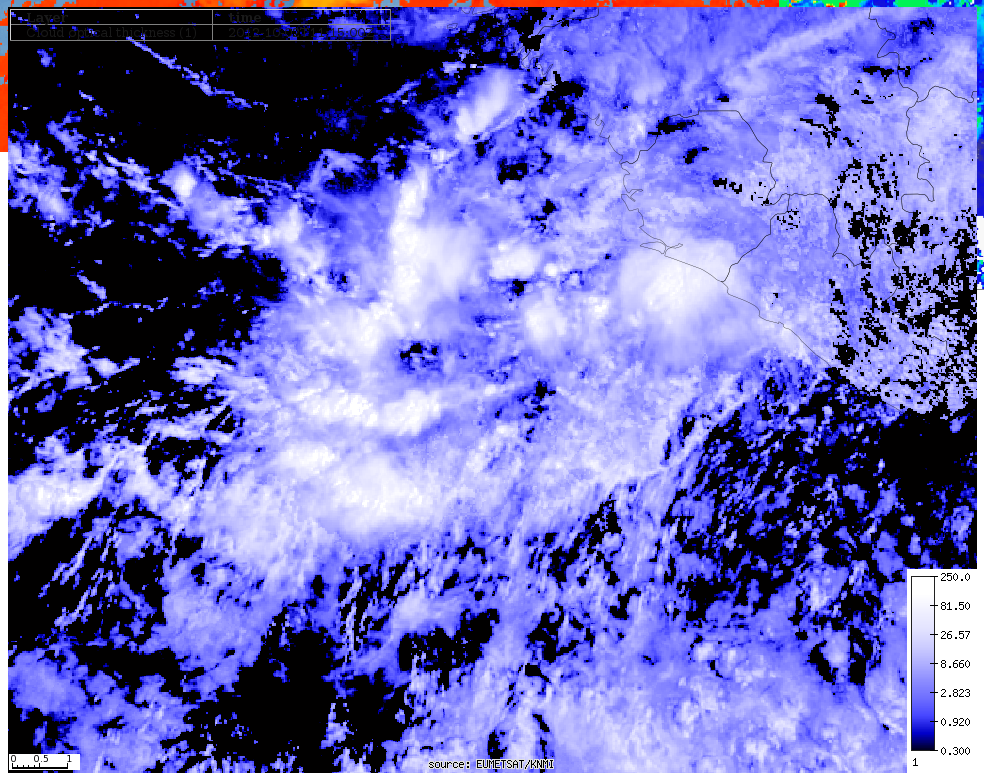


Cloud-top temperature





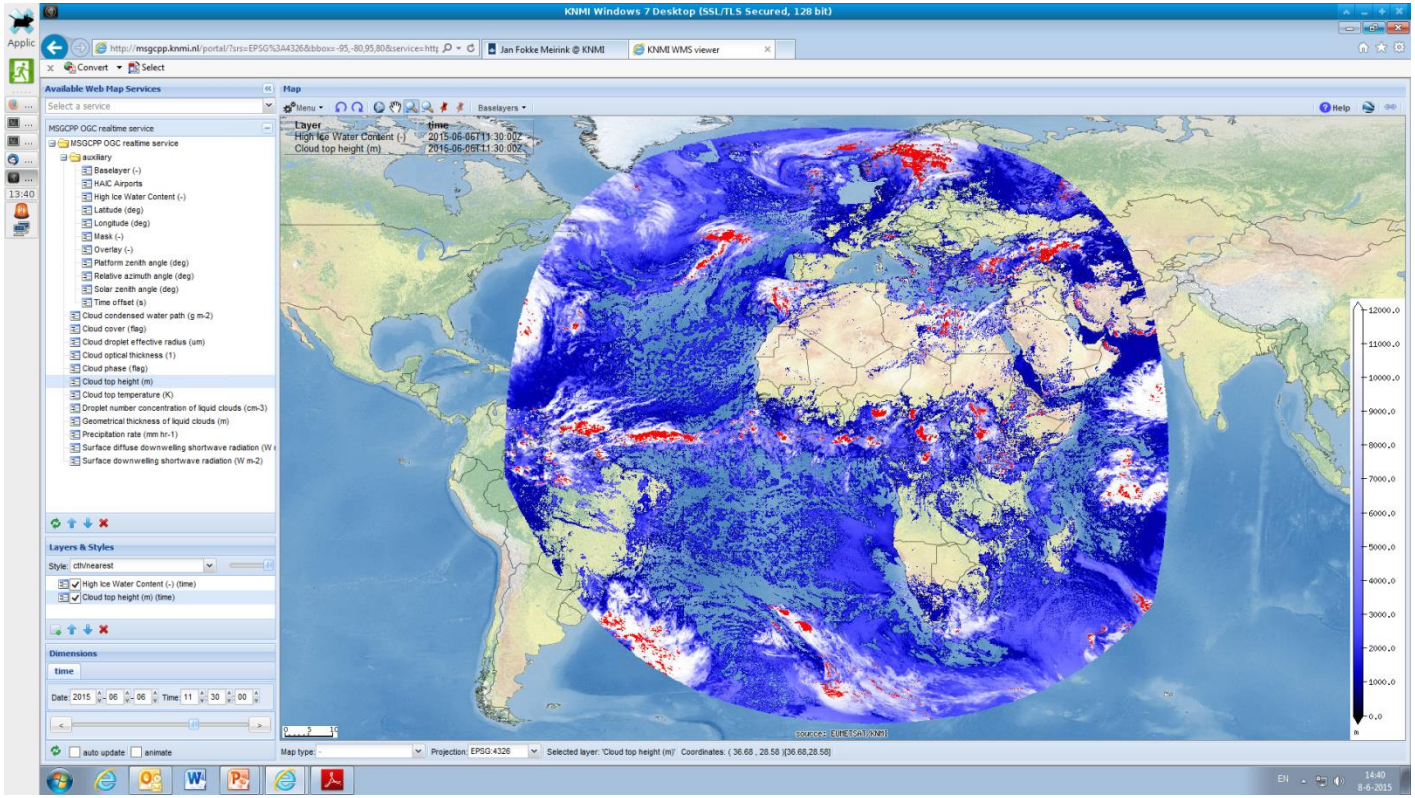
Cloud Particle Effective Radius



Cloud Optical Thickness

New product

- Development of ‘High Ice Water Content’ index
  - Based on collection of retrieved cloud properties
  - Warning aviation for high-altitude icing conditions



Cloud-top height overlayed with high IWC index

Summary

- CM SAF release of two cloud **climate** datasets
  - CLARA-A1: AVHRR (global; 1982-2009)
    - Cloud properties, surface radiation, surface albedo
  - CLAAS-1: SEVIRI (Eur., Atlantic, Africa; 2004-2011)
    - Cloud properties

  New releases expected in 2016
- KNMI **NRT** processing and visualization
  - SEVIRI
    - Cloud properties, precipitation, surface radiation
- These datasets are **openly available** for studies of convective clouds!