

Ground-Based and Satellite Remote Sensing for Atmospheric Analysis

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Optimum Observation Strategies

- ***Goal: High-Resolution Climate/Weather Analysis***
 - ***Accurate***
 - ***Reliable***
 - ***Complete***
- ***System integration!***

Outline

1. *A Spatial Problem*: Characterizing the Atmosphere
2. *Looking for Truth*: Ground-Based RS as a Reference
3. *The Big Picture*: Multi-Perspective Remote Sensing

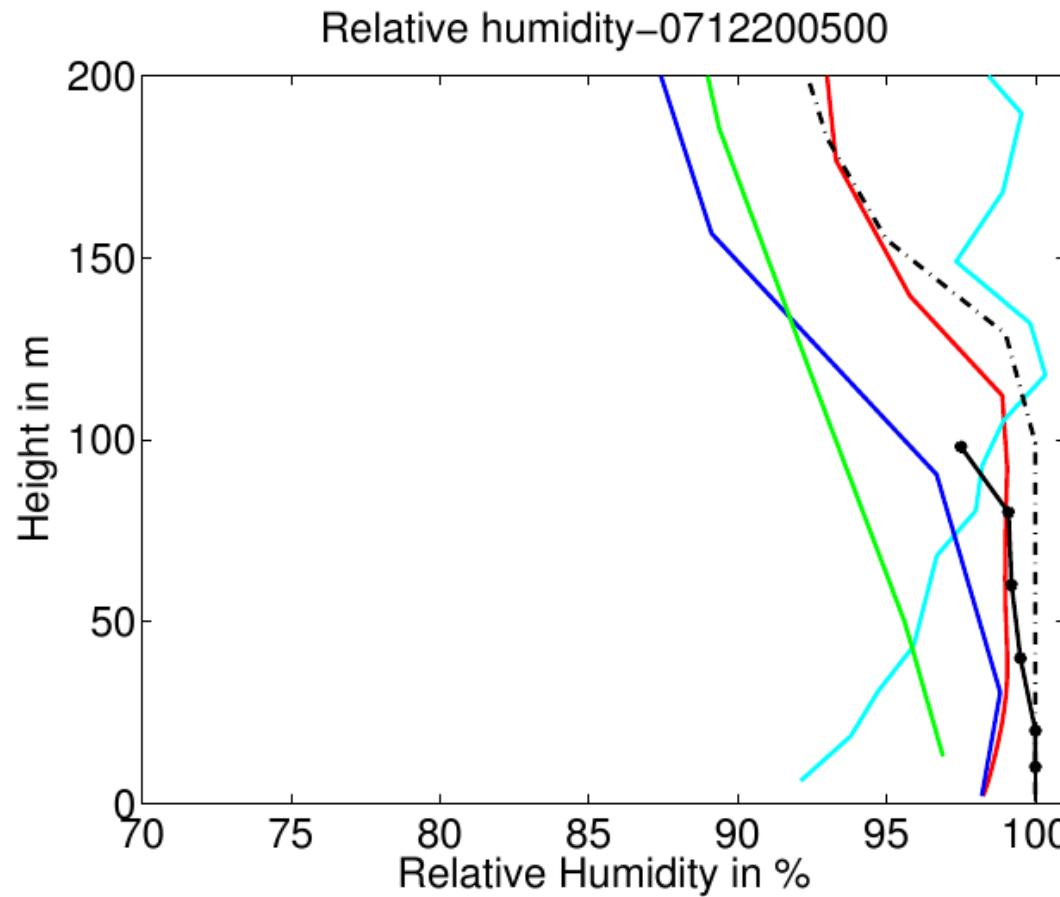
Outline

- 1. A Spatial Problem: Characterizing the Atmosphere**
- 2. Looking for Truth: Ground-Based RS as a Reference**
- 3. The Big Picture: Multi-Perspective Remote Sensing**

1. RS for Model Evaluation

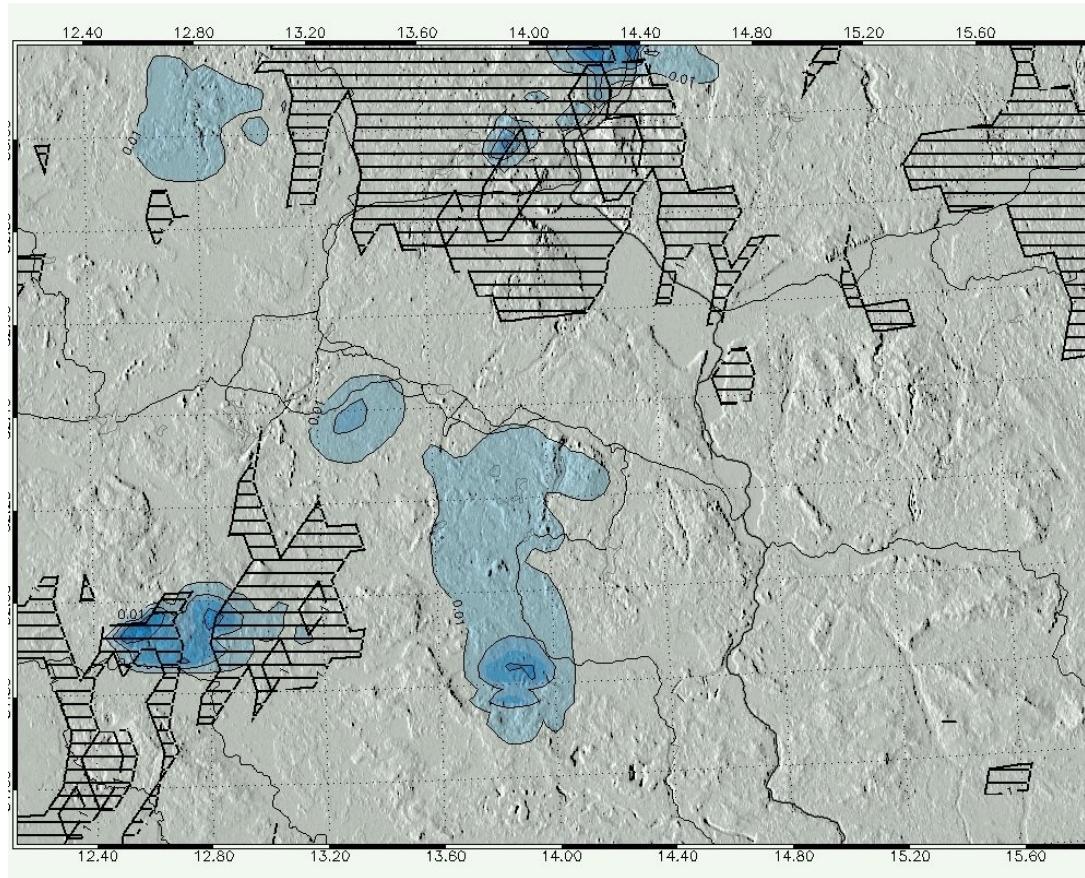
- COST 722 3D Fog Model Intercomparison
 - Lindenberg, Germany, September-December 2005
 - 4 European 3D models
- Evaluation
 - Correct detection of fog presence
 - Correct representation of atmospheric properties

1. RS for Model Evaluation



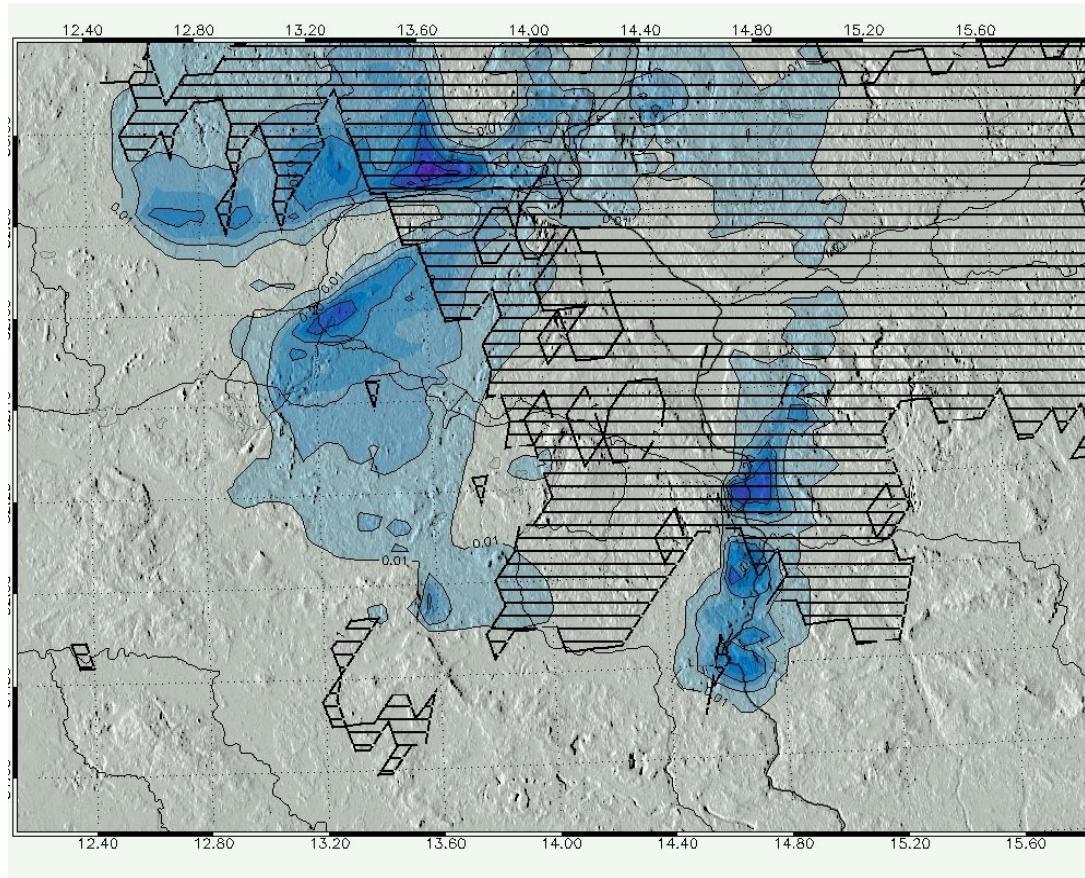
Radiosonde: dashed black, Lindenberg, Germany, 7 Dec 2005 (Masbou 2008)

1. RS for Model Evaluation



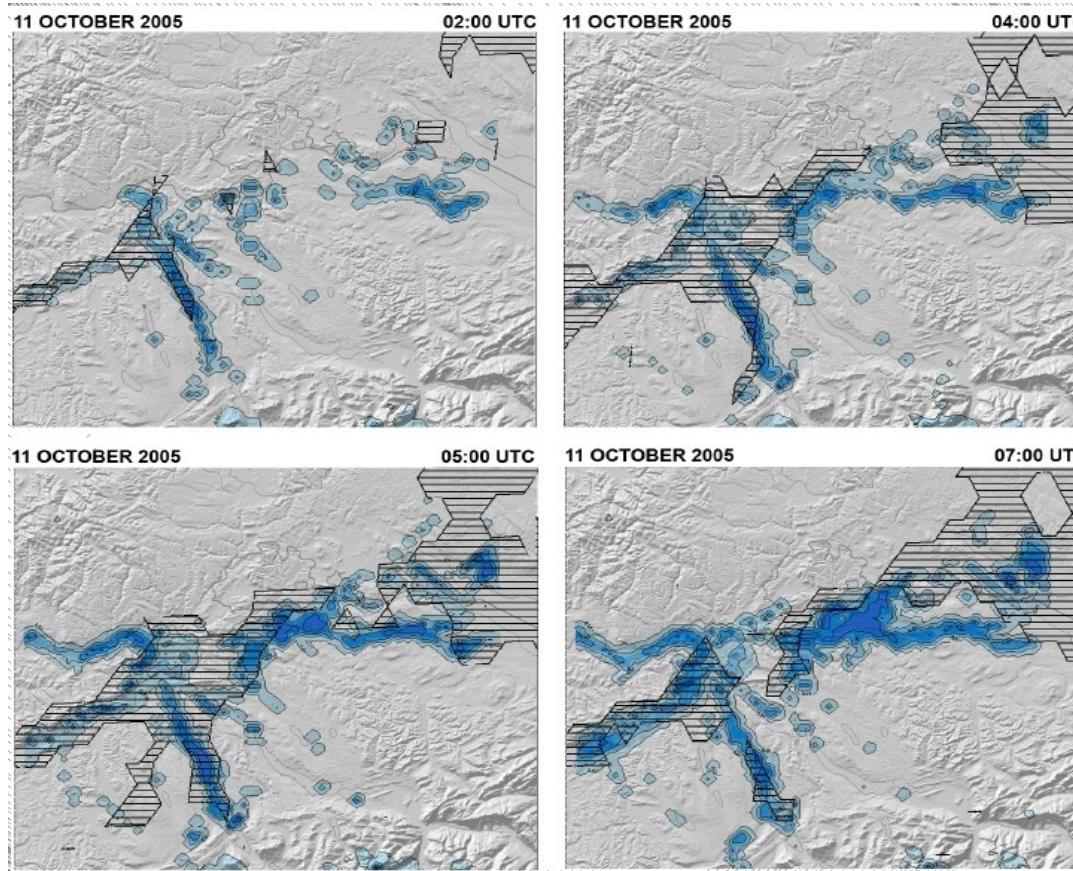
COSMO-FOG, Lindenberg, Germany, 26 Sep 2005 (Masbou 2008)

1. RS for Model Evaluation



COSMO-FOG, Lindenberg, Germany, 26 Sep 2005 (Masbou 2008)

1. RS for Model Evaluation



NMM-PAFOG, Zurich Airport, Switzerland, 11 Oct 2005 (Müller 2006)

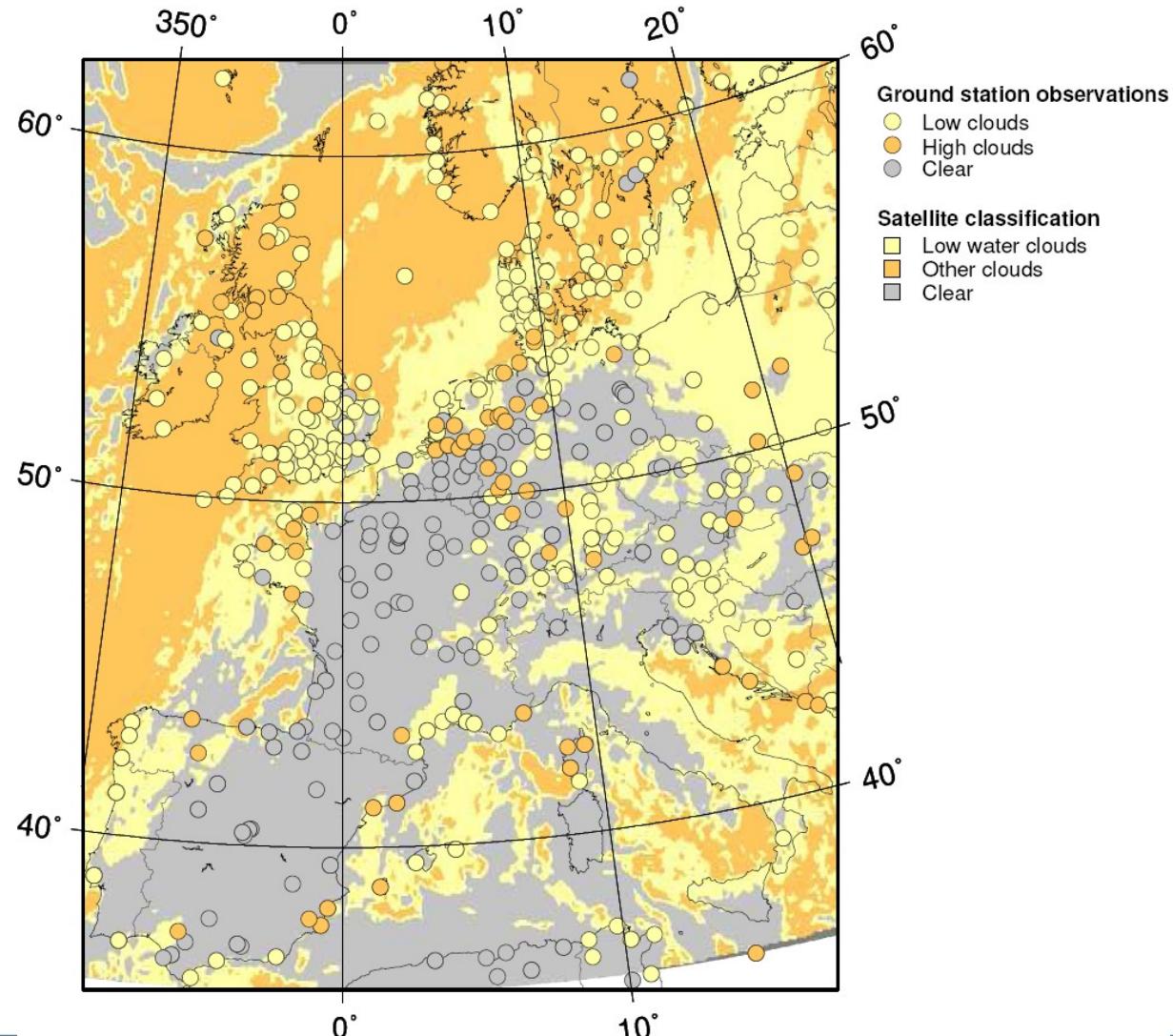
1. RS for Model Evaluation

- Conclusions Model Intercomparison
 - Detection of feature presence not enough
 - Spatial component is part of good forecast
 - *Reliable spatial observations essential*

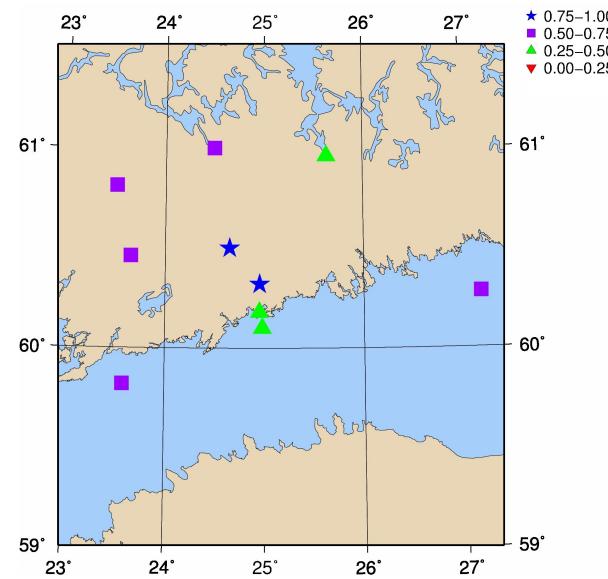
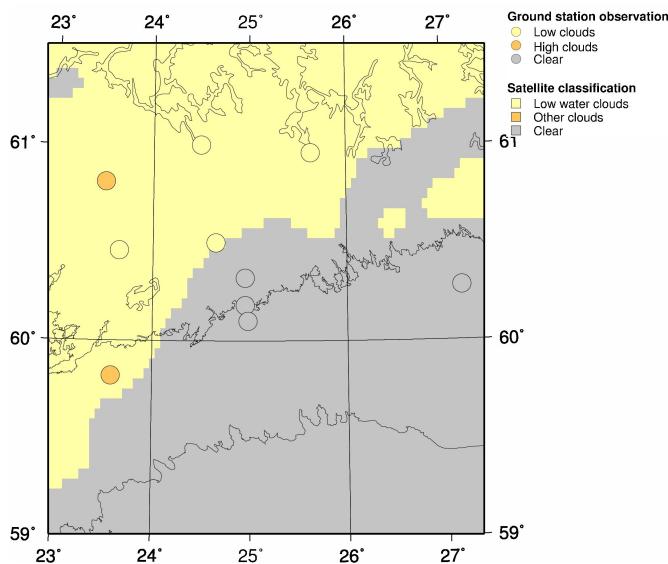
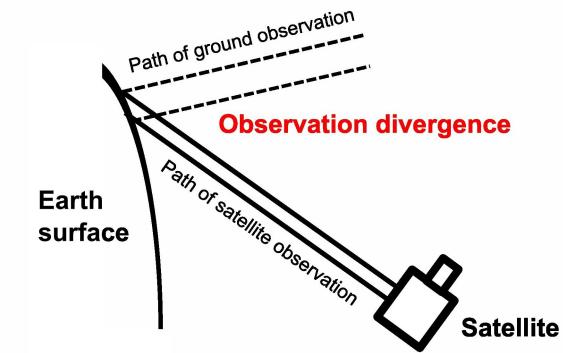
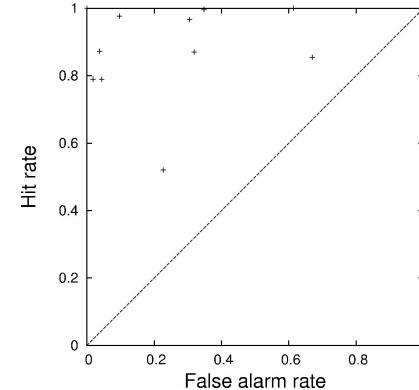
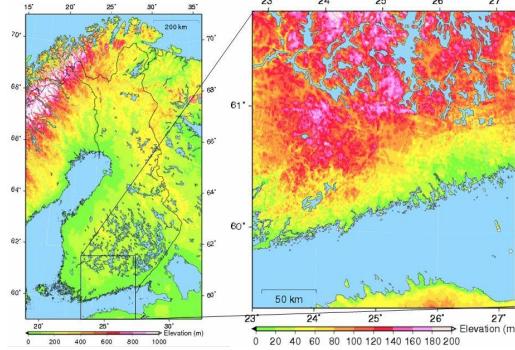
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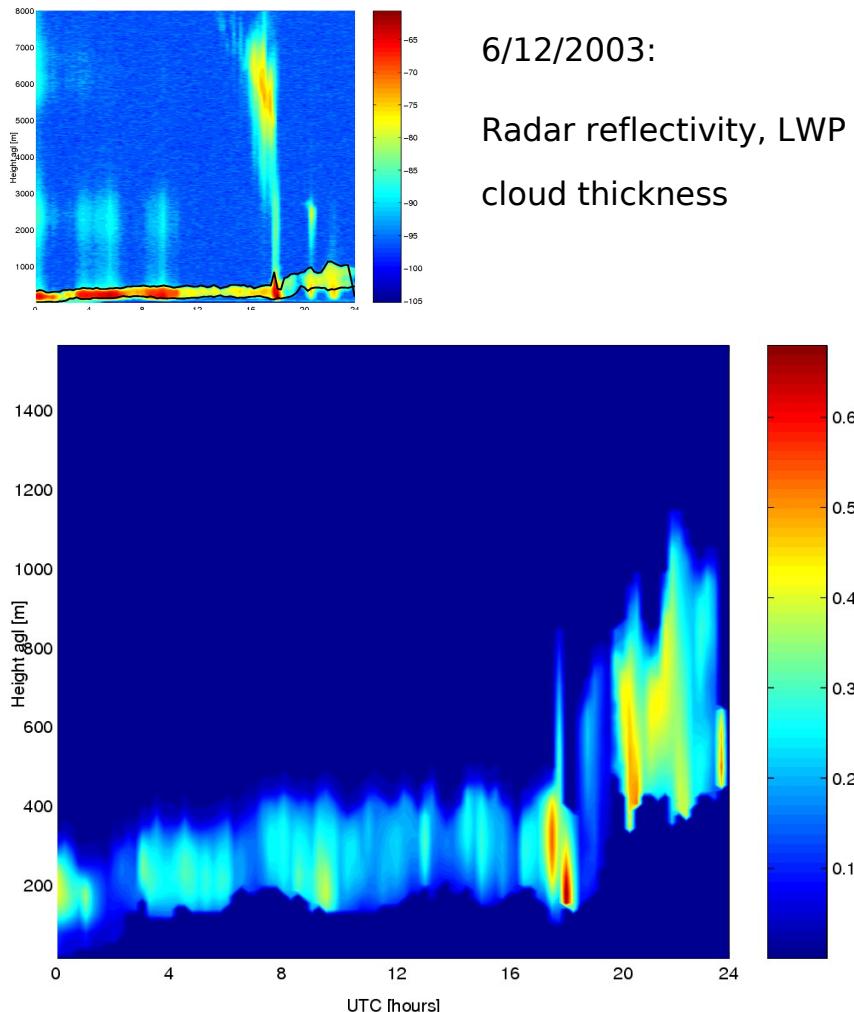
Feature Presence



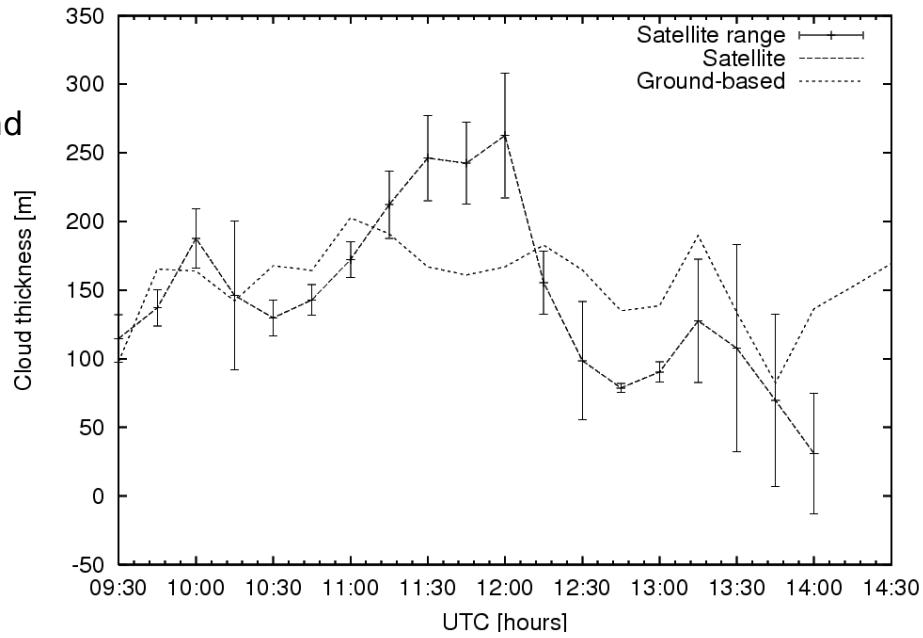
Feature Presence: Helsinki Test Bed



Vertical Information: TUC Campaign, 2003/2004

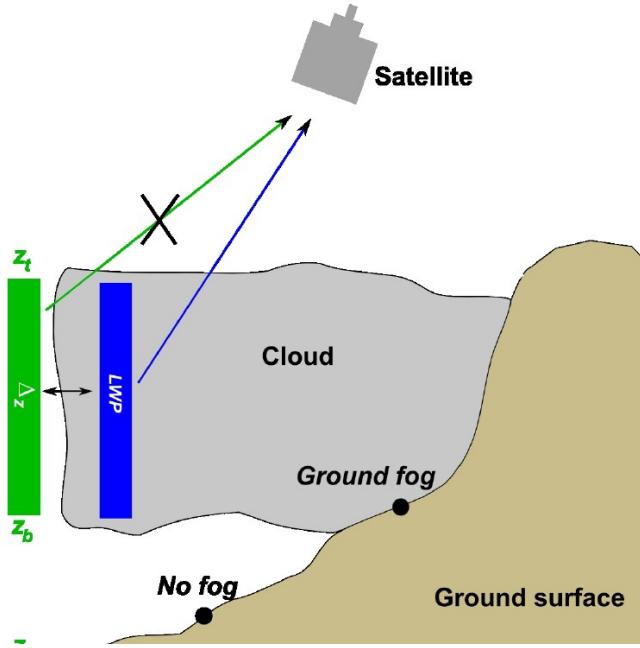


6/12/2003:
Radar reflectivity, LWP and
cloud thickness

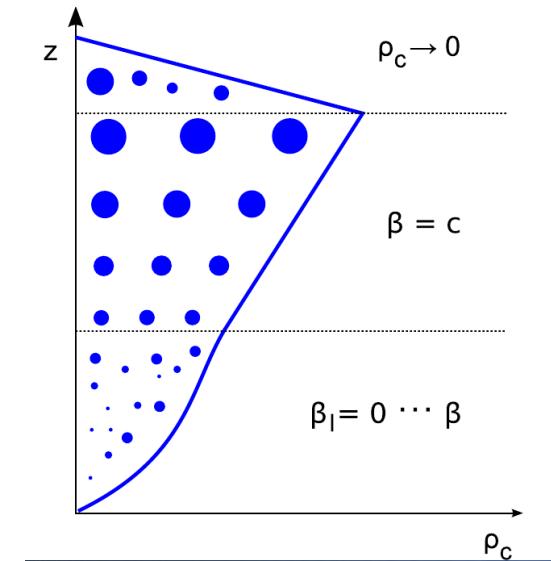
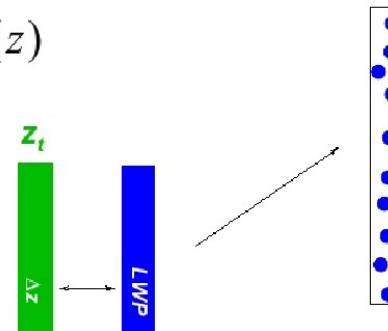


Cermak et al. 2006 (Met. Z.)

Satellite-Derived Parameters: Cloud Water



$$LWP = \int_{z=z_b}^{z_t} \rho_c(z) dz$$



Satellite-Derived Parameters

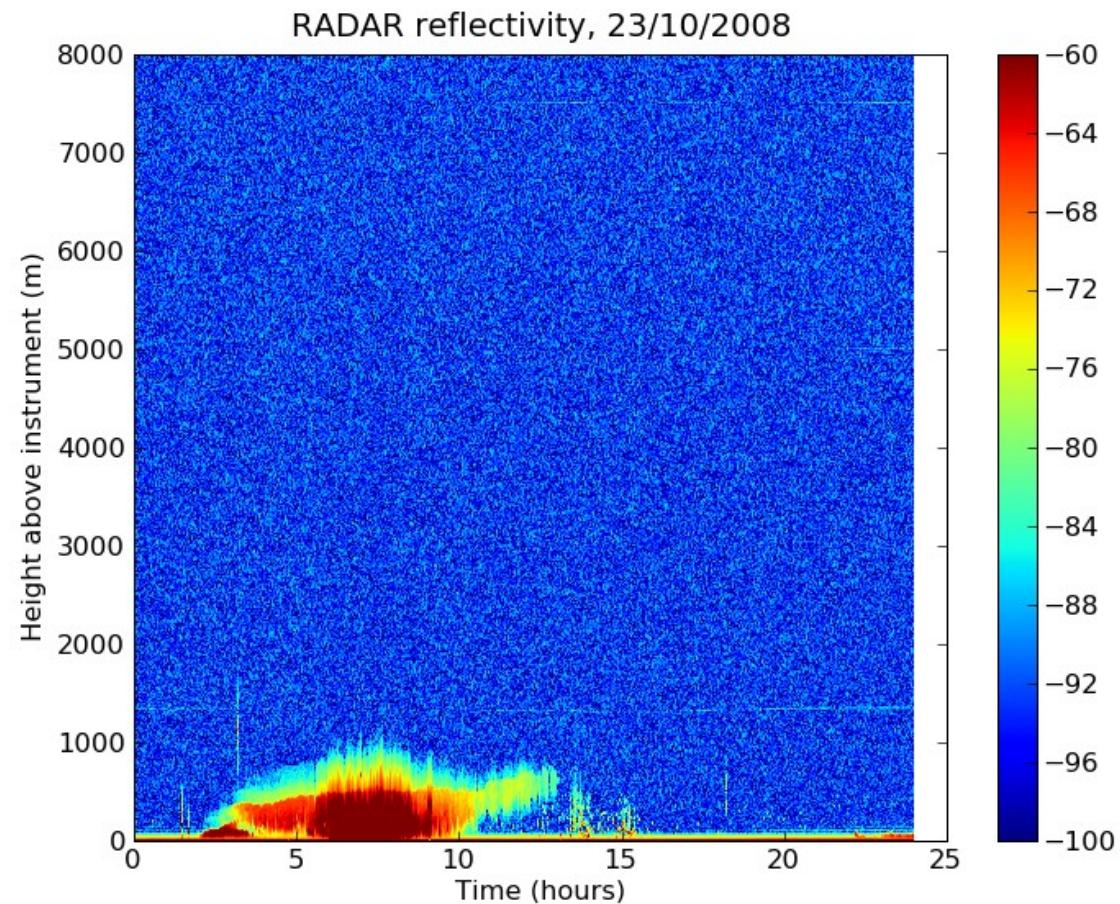
- Cloud properties
 - Radiance, temperature, reflectance
 - Geometry: height, thickness
 - Optics: optical thickness
 - Microphysics: liquid water path/content, effective droplet radius
- Aerosol properties
 - (parameters similar to clouds)
- Others
 - Water vapour (precipitable water)
 - ...

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Low stratus Europe, 10/2008

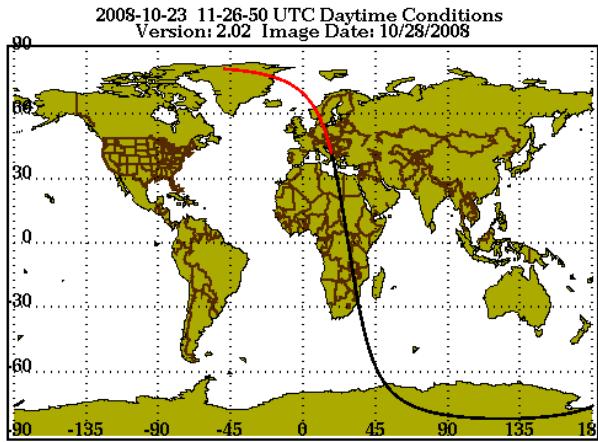
- *Step 1:*
Ground-based assessment



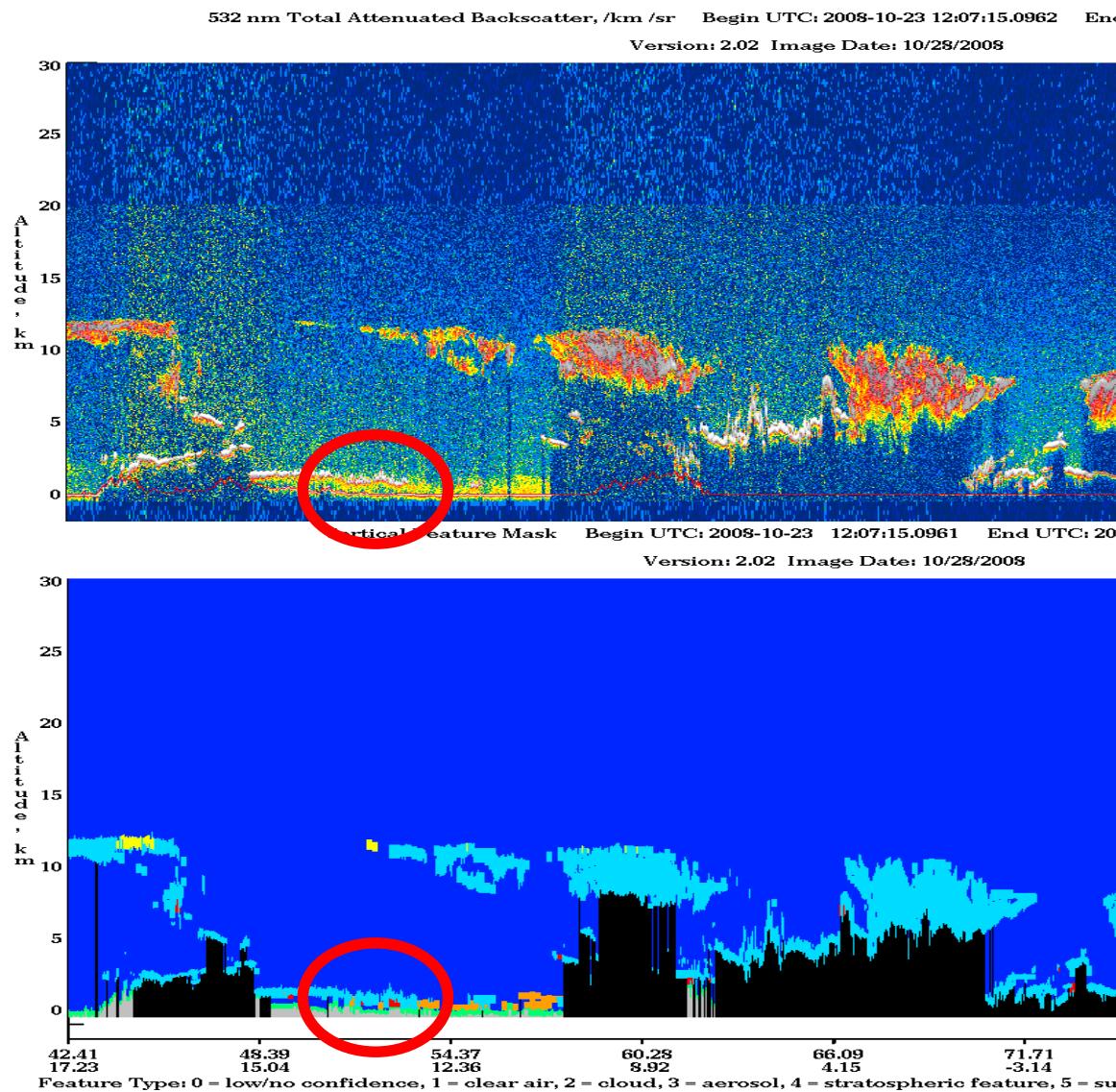
Data: Linden, Germany, courtesy U Marburg

Low stratus Europe, 10/2008

- Step 2:
Transect analysis (active sensor satellite)

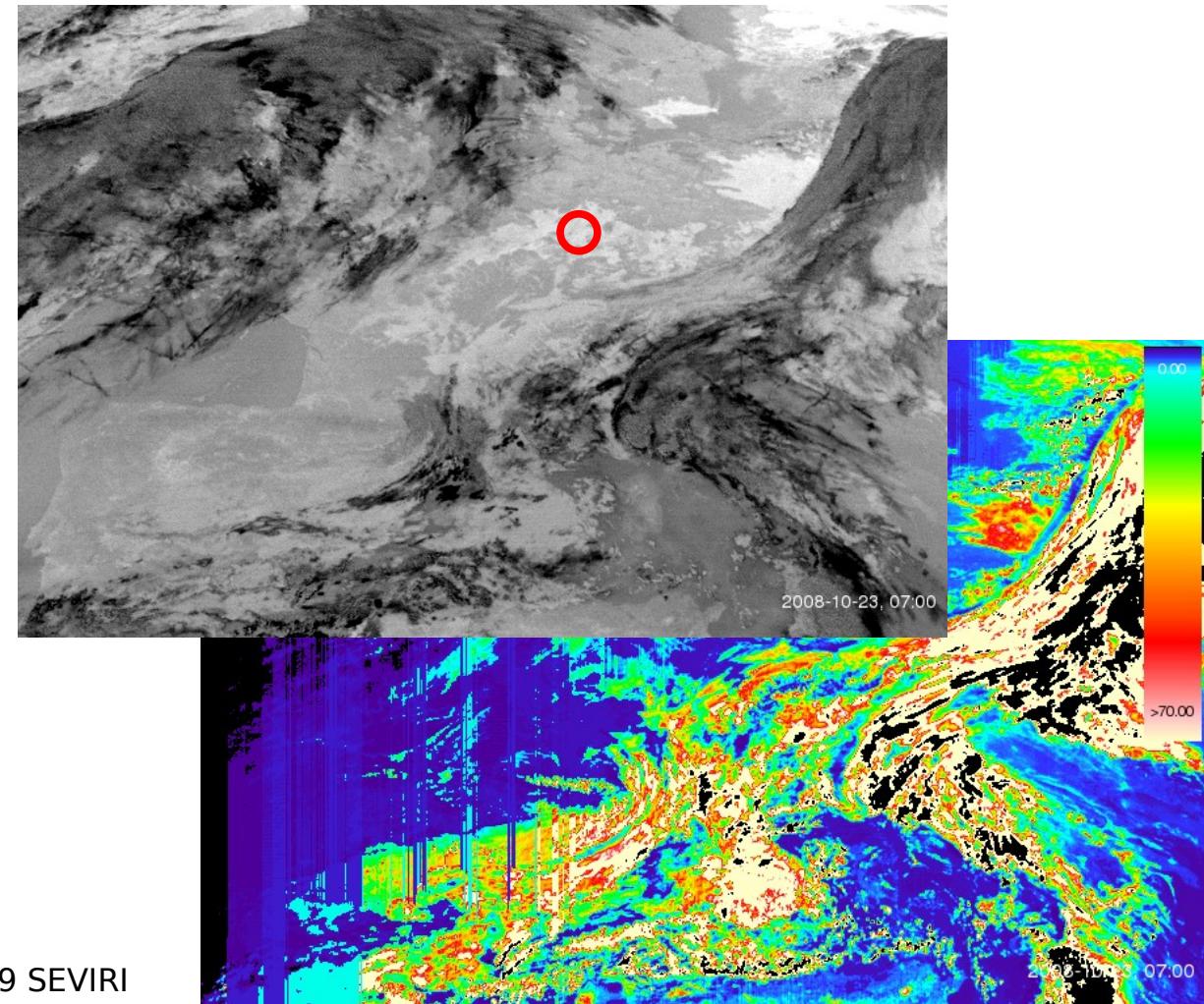


Figures: CALIPSO Science Team



Low stratus Europe, 10/2008

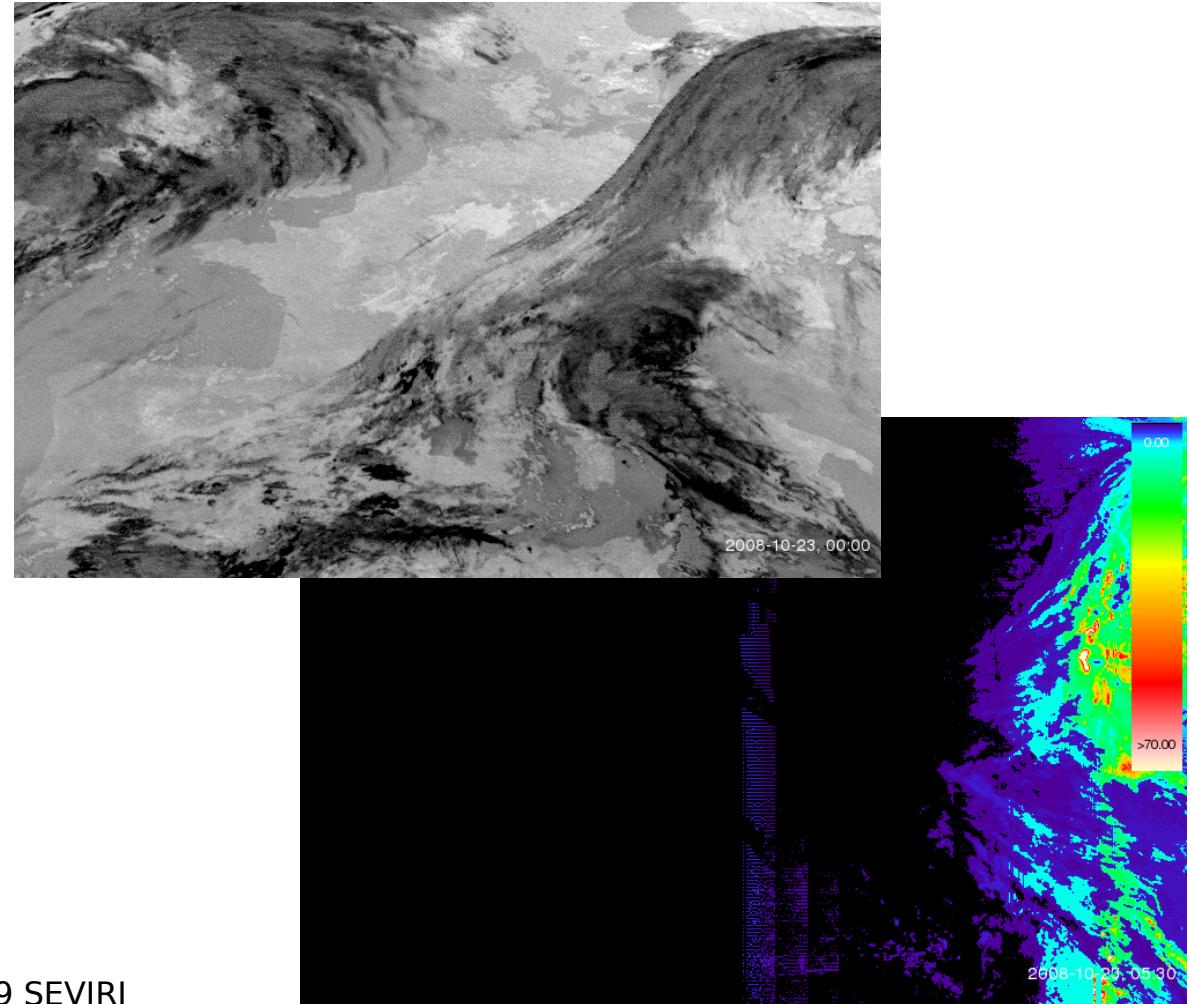
- Step 3:
Spatial
component
(passive sensor
satellite)



Figures: Products based on Meteosat 9 SEVIRI

Low stratus Europe, 10/2008

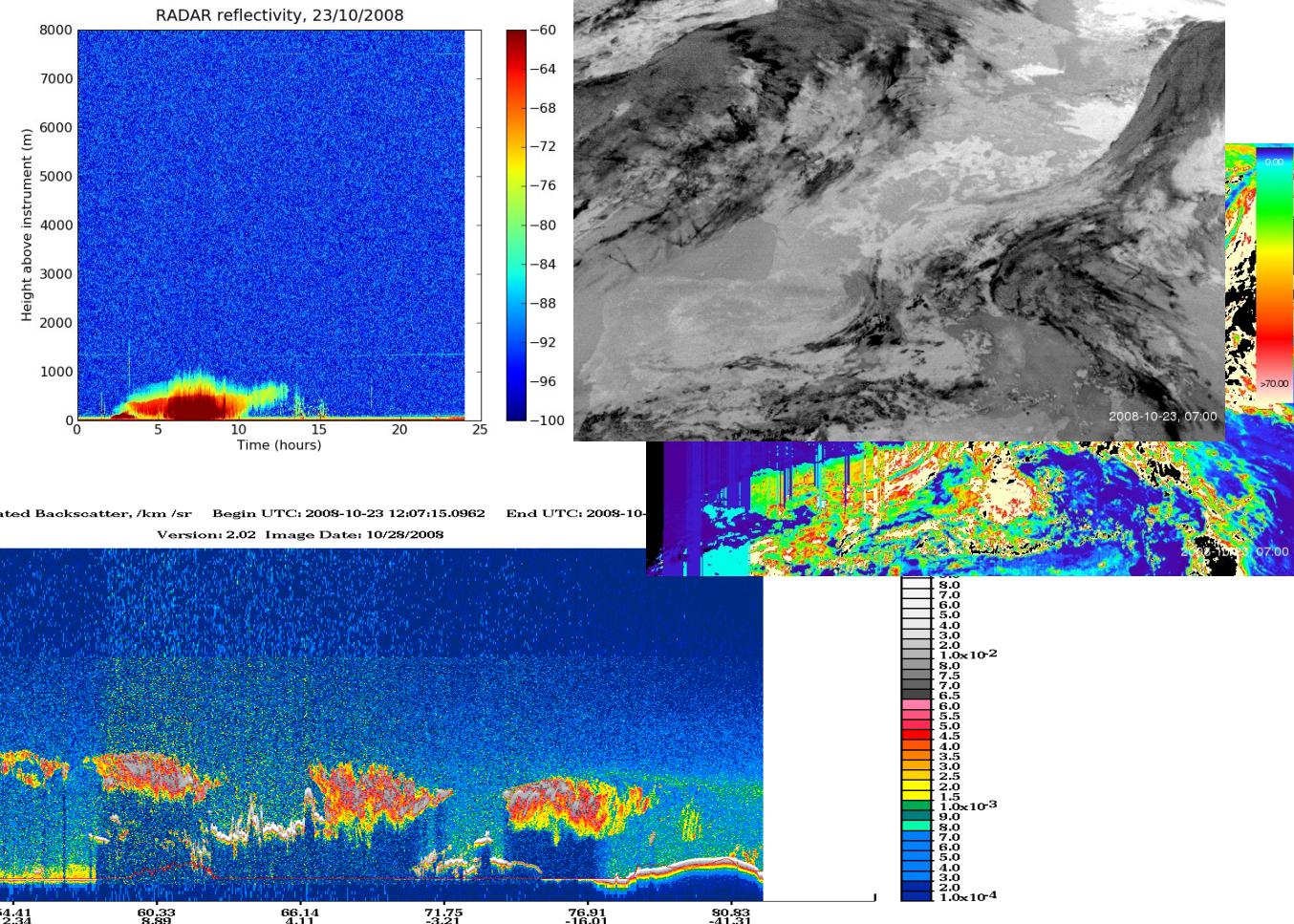
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Figures: Products based on Meteosat 9 SEVIRI

Low stratus Europe, 10/2008

- Step 4:
Validation/
Joint
analysis



Conclusions

- Ground-based and satellite systems are complementary
- Algorithm development profits from data comparison
- Joint interpretation/joint products
 - to be discussed in WG4