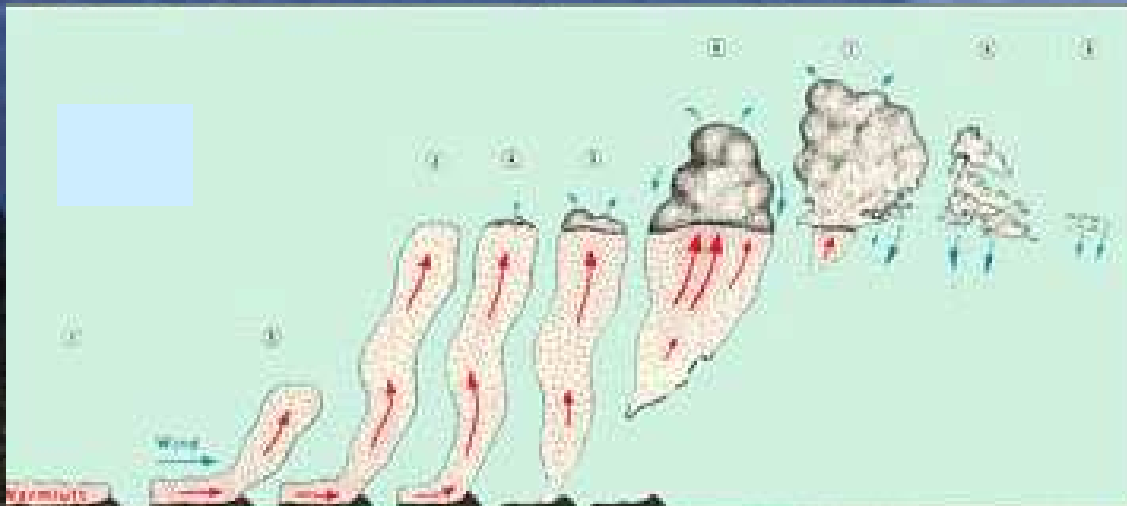




# COPS “Supersites”

Andreas Behrendt, Volker Wulfmeyer

Ulrich Corsmeier, Leonhard Gantner, Christian Barthlott



**Orographically induced convection**

- Goals
- Strategy
- Performance simulations of remote sensing instrumentation

# Goal of COPS:

Provide a 4-d set of key variables  
in a low-mountain region  
(and around)  
for testing hypotheses  
on the improvement of QPF

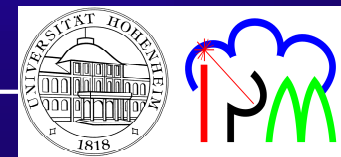
## Priorities? Optimum strategies?

### Responsibility of Hohenheim University

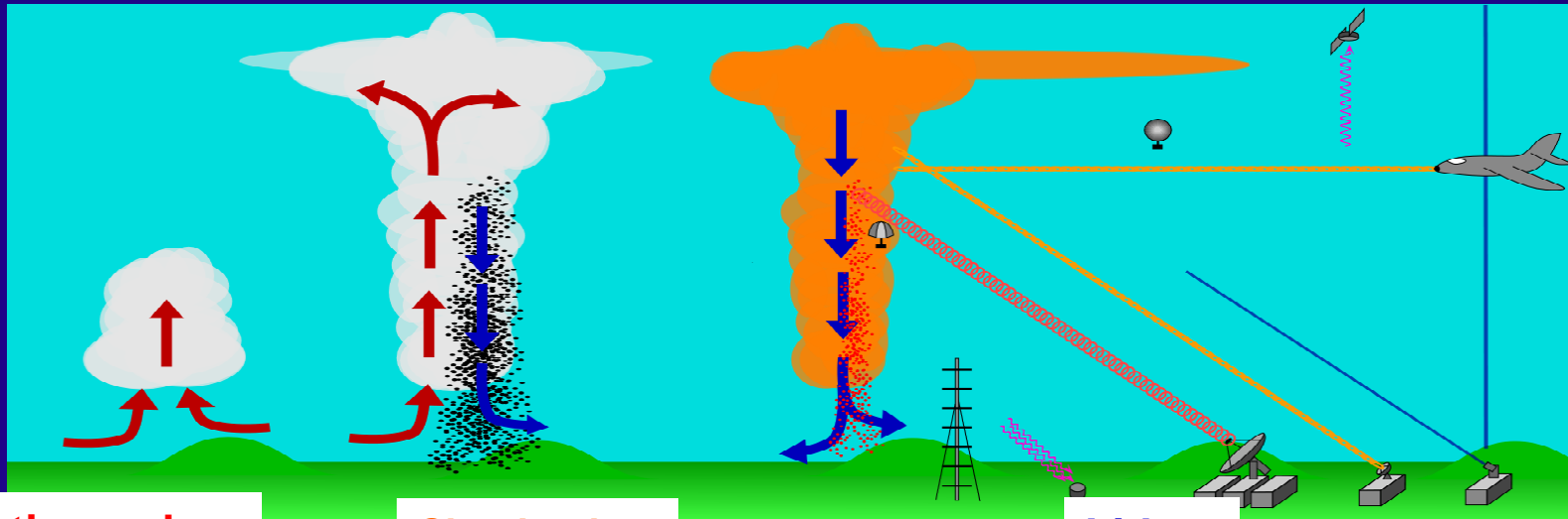
- 1) Set up of a **project office** and a **steering committee**
- 2) **Scientific performance analysis of advanced remote sensing systems**
- 3) Perform international workshops  
and prepare a **Scientific Overview Document** and an **Operations Plan**

### Responsibility of Karlsruhe University

- 1) **Extensive LM analyses of different precipitation events**
- 2) Develop preliminary hypotheses for improving QPF in NWP
- 3) Suggest **targeting** of key processes to be investigated



# Multi-wavelength remote sensing



## Precipitation radars

X-, C- or S-band,  
 $\nu = 2 - 10$  GHz,  $\lambda \approx 15 - 3$   
 cm,  
 ⇒ Reflectivity factor, LOS  
 velocity, refractivity  
 in precipitation

## Cloud radars

Ka- or W-band  
 $\nu = 35 - 95$  GHz,  $\lambda \approx 9 - 3$  mm  
 ⇒ Particle reflectivity factor,  
 depolarisation (→ liquid/ice),  
 LOS velocity  
 in clouds

## Lidars

$\lambda \approx 0.3 - 2$   $\mu\text{m}$ ,  $\nu = 10^{15} - 1.5 \times 10^{14}$   
 Hz  
 ⇒  $\alpha_{\text{par}}$ ,  $\beta_{\text{par}}$ ,  $\delta$  (→ liquid/ice),  
 $q$ ,  $T$ , LOS wind  
 in clear air, aerosol layers  
 and in thin clouds

## MW and FTIR radiometers

⇒ LWC,  $q$ ,  $T$ , ...

**Complementary and synergetic!**



# Lidar – Light detection and ranging

## „Clear-air“ component

-> characterization of pre-convective fields & LOS fields around clouds

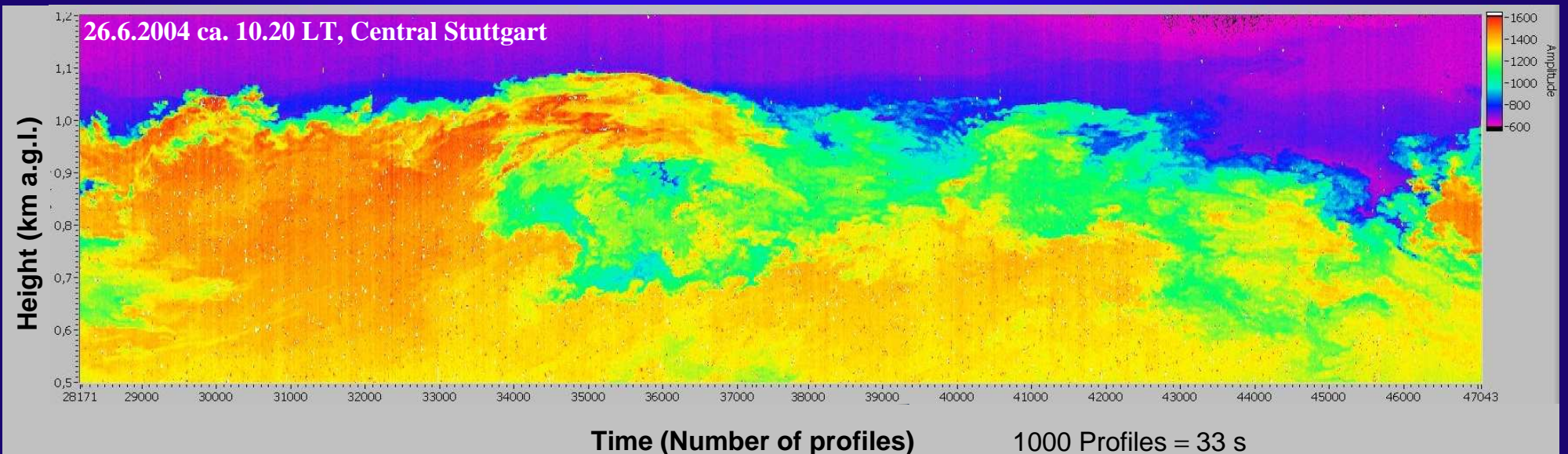
Measured parameters:

- Optical properties of **aerosols** and cloud particles: Backscatter, Raman, Depolarization
- **H<sub>2</sub>O** concentration/mixing ratio: H<sub>2</sub>O DIAL, Raman lidar
- **T**: Rotational Raman lidar
- LOS-vector **wind**: Doppler lidar

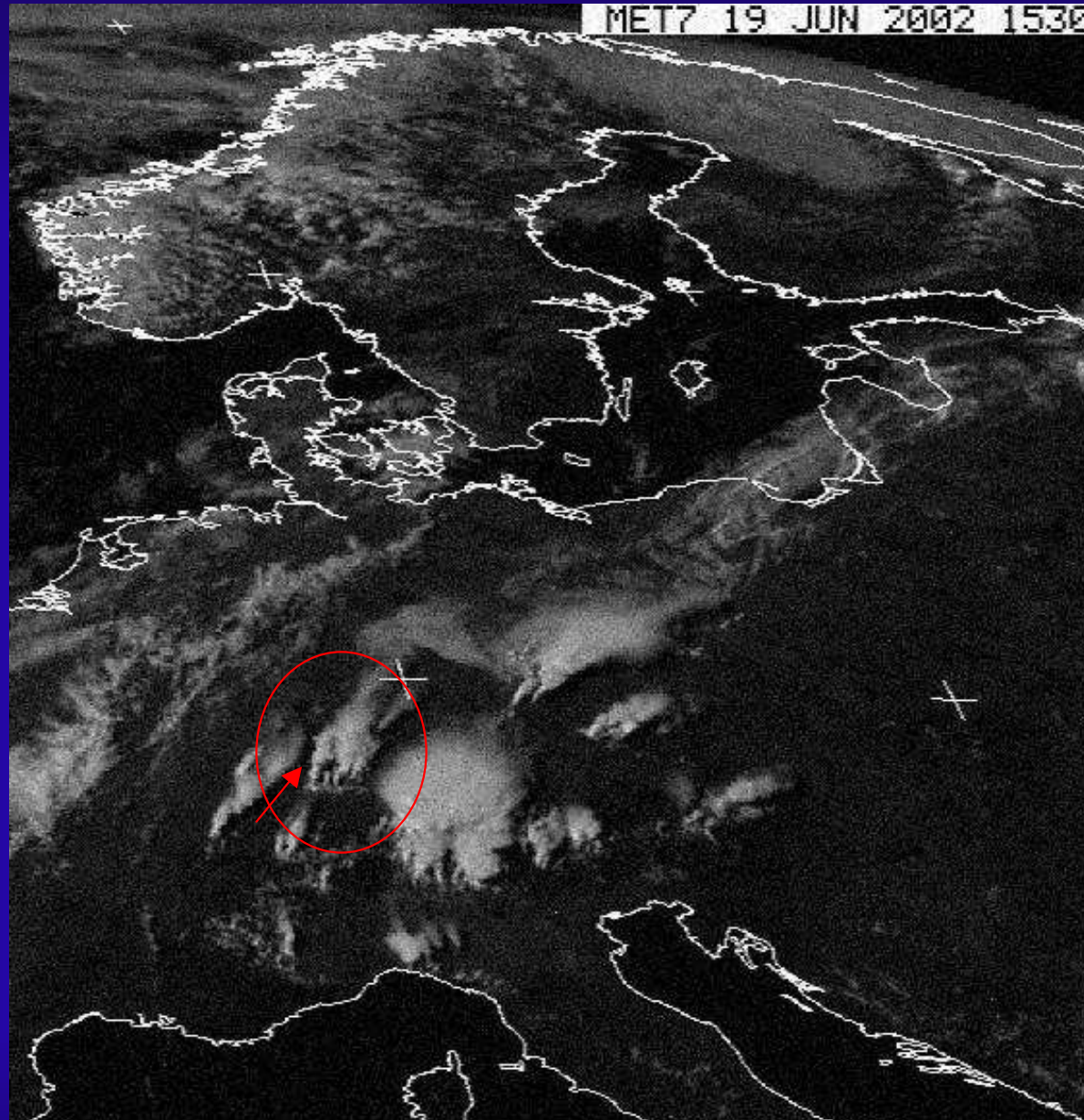
***RH, CAPE, CIN, fluxes***

Performance simulations: input LM 2.8 km data, no parameterization of convection

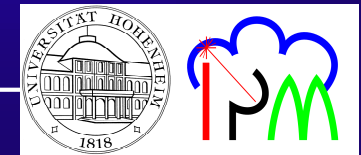
UHOH Lidar: range-corrected backscatter signal at 1064 nm,  $\Delta z = 3$  m,  $\Delta t = 1/30$  s







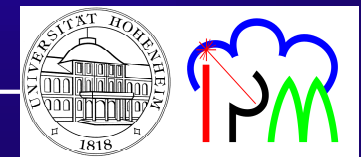
Andreas Behrendt, „Supersites“





Orography of the Northern Black Forrest

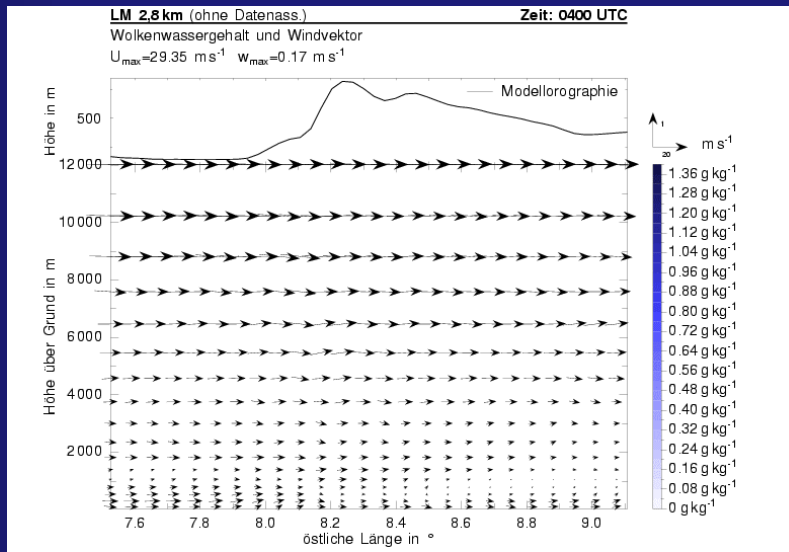
Typical region for initialization of convective cells



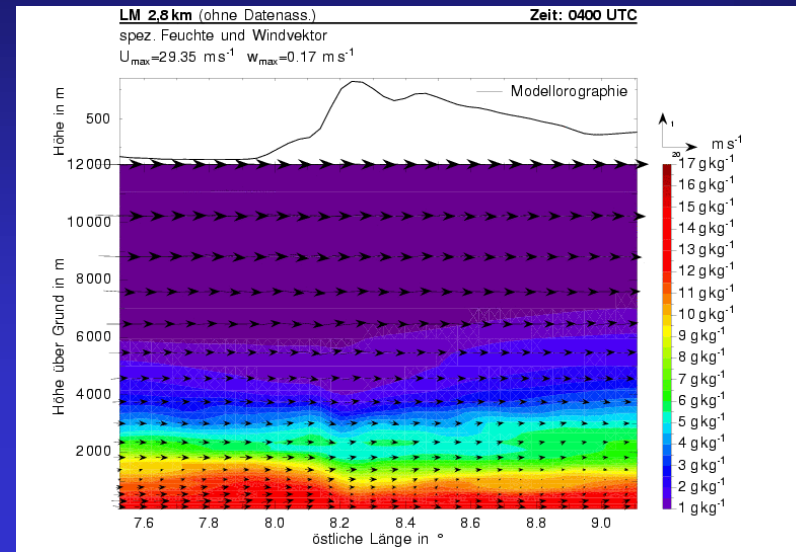


# Performance simulations: input LM 2.8 km data, no parameterization of convection

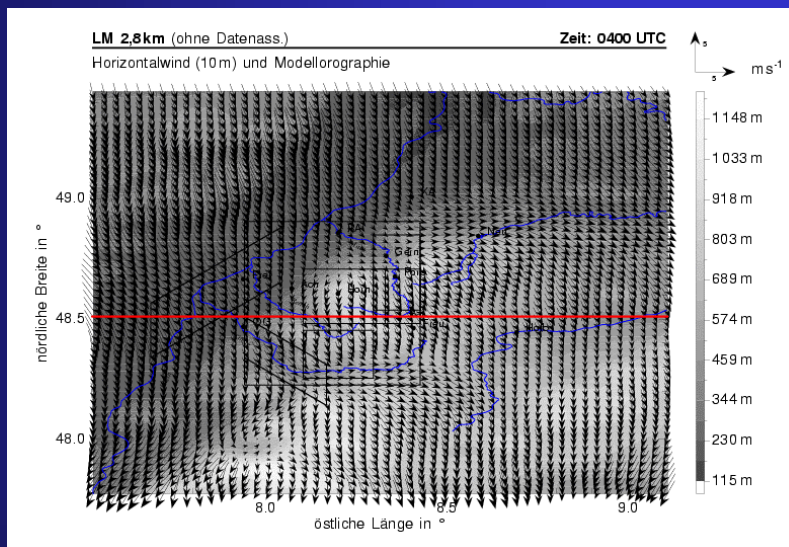
## Cloud liquid water content & vert. wind



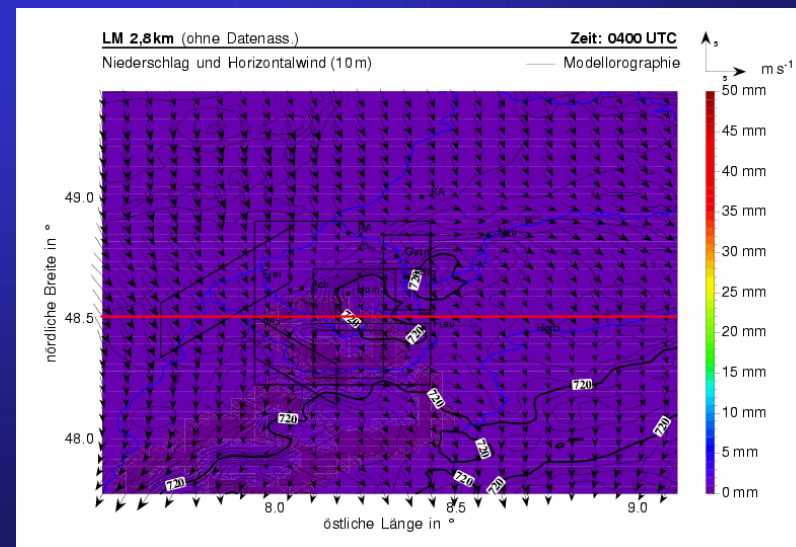
## Spec. humidity & vert. wind



## Orography & horiz. wind

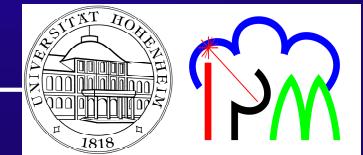
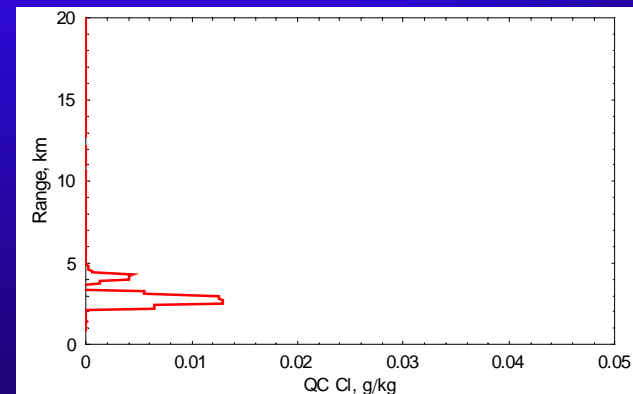
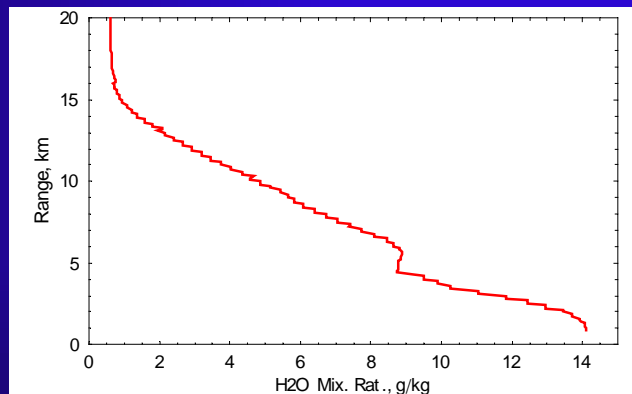
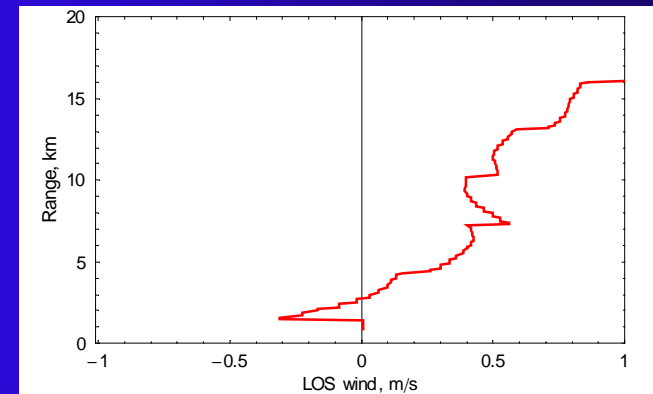
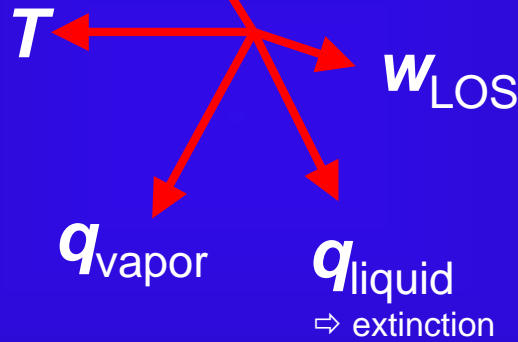
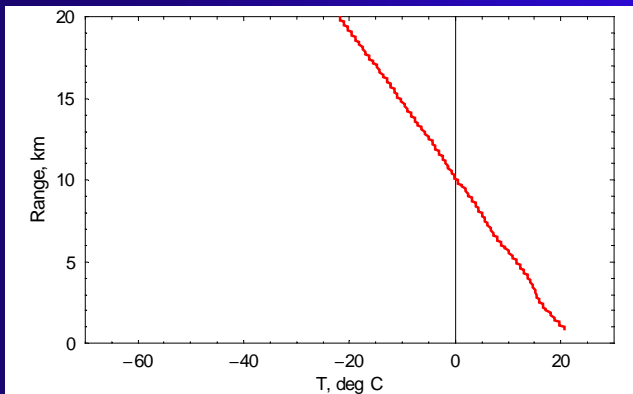
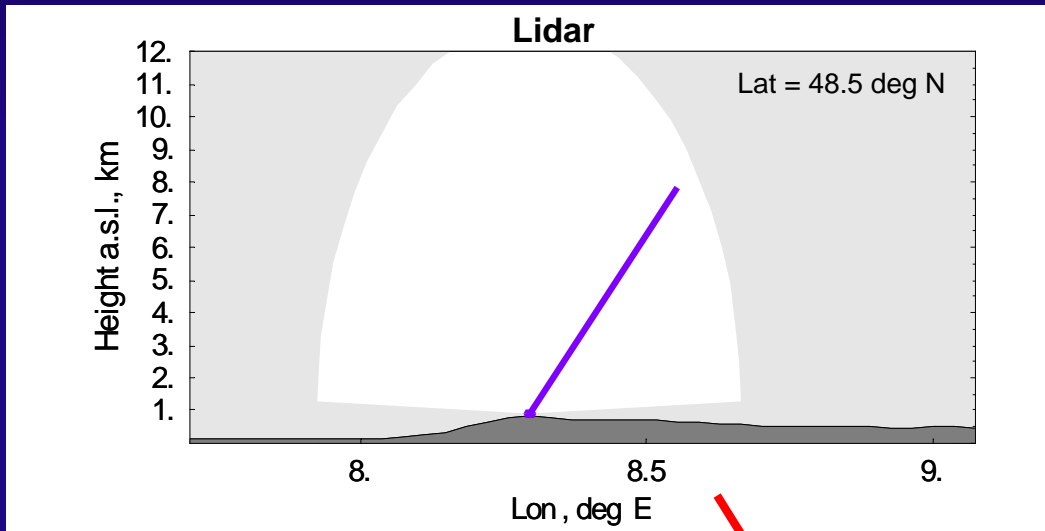


## Precip



# Performance simulation

Example:  
 Ground-based lidars at „supersite“  
 Location: near Hornisgrinde  
 RHI scans  
 19 June 2002

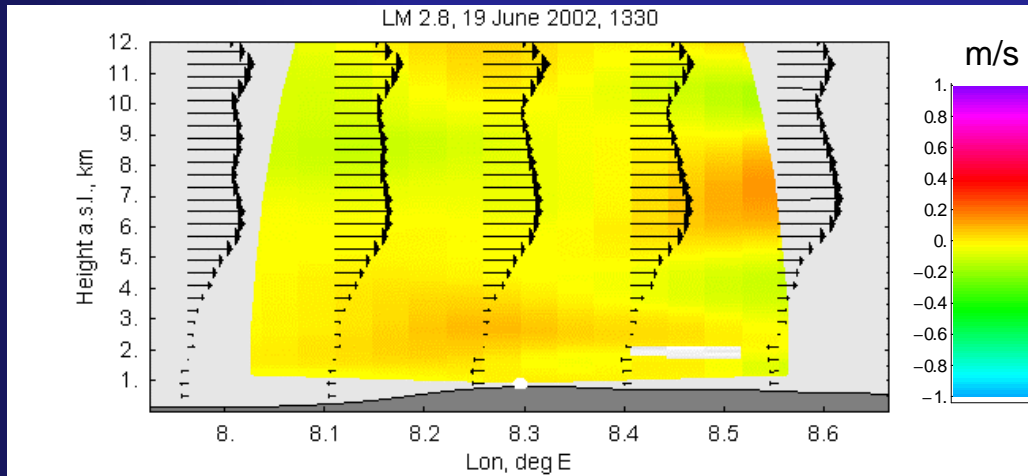




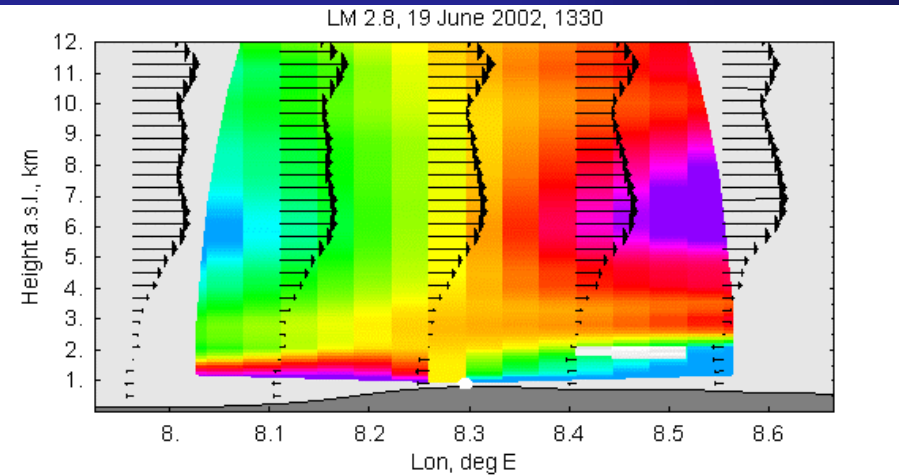
# Performance simulations

Ground-based lidars at „supersite“; Location: near Hornisgrinde  
RHI scans; 19 June 2002 13:30 – 17:30 UTC

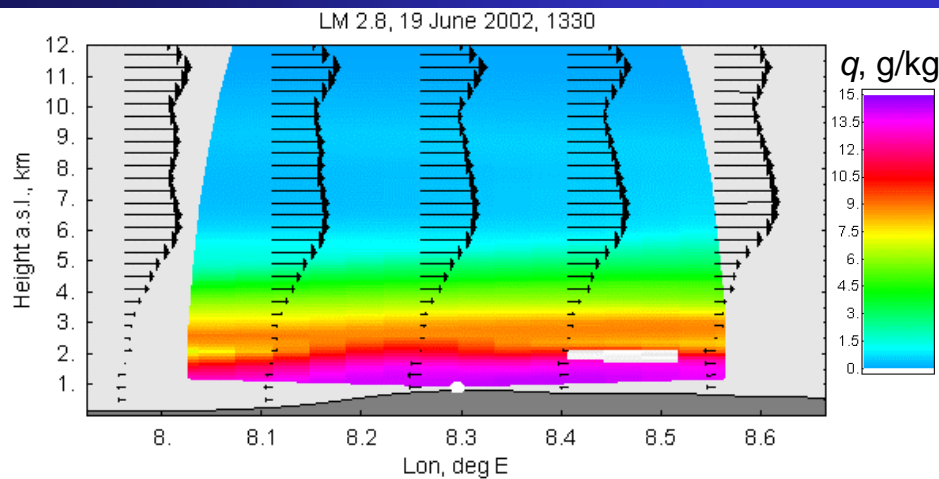
## Vertical wind (colors)



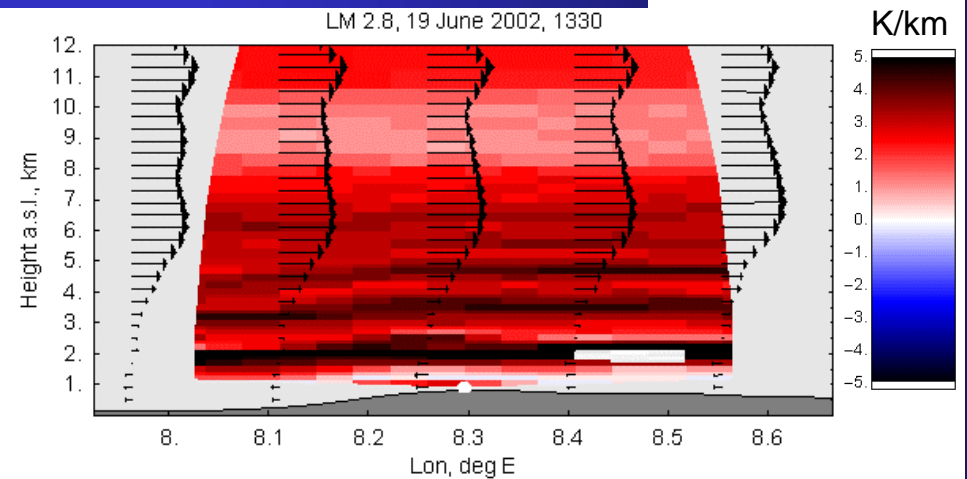
## Line-of-sight wind (colors)



## Water vapor mixing ratio

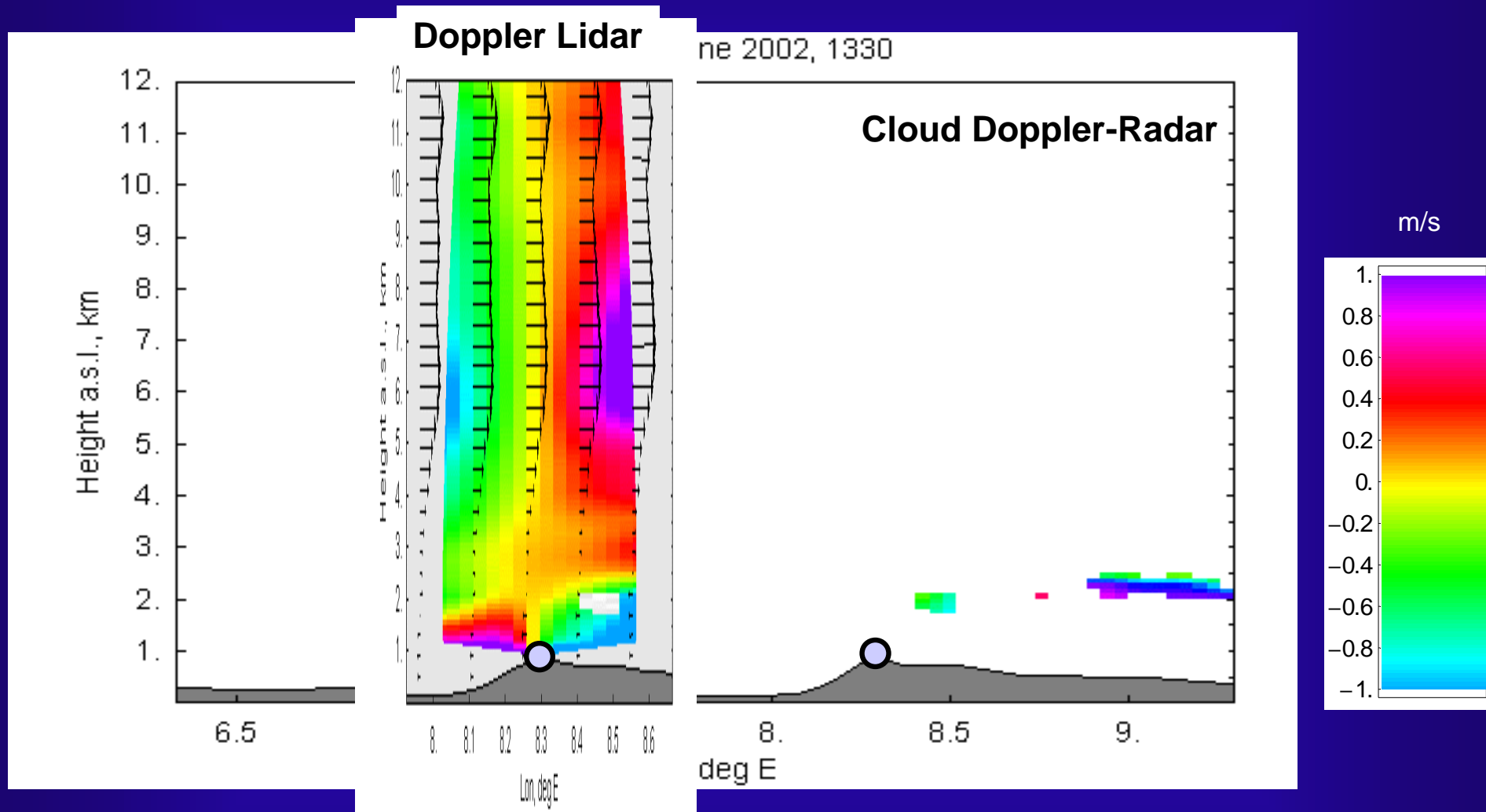


## Temperature gradient

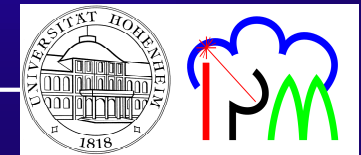


# Performance simulations

Location: near Hornisgrinde  
RHI scans; 19 June 2002 13:30 – 17:30 UTC



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Andreas Behrendt, „Supersites“





**COPS „Supersites“**

**...also „scenic sites“**

