

# QUEST

## Quantitative evaluation of regional precipitation forecasts using multi-dimensional remote sensing observations

### Partnership

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### Contributes to PQP Goals

- Identification of physical and chemical processes responsible for the deficiencies in quantitative precipitation forecast
- Determination and use of the potentials of existing and new data and process descriptions to improve quantitative precipitation forecast

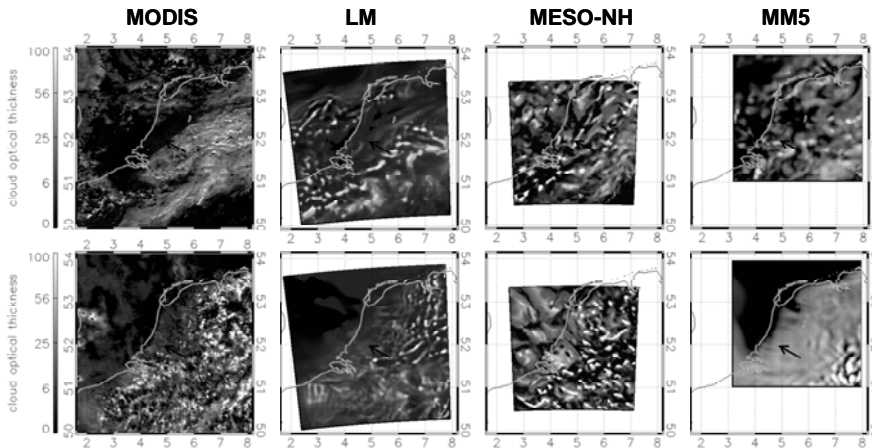
# QUEST: Strategy

## Observations

- multi-frequency radiances
- polarimetric radar quantities
- ground based and space borne observations

## Retrieval

- water vapour
- cloud properties
- precipitation



Schröder et al. [2006]

## Forward Operator

- SynPolRad (polari.radar)
- SynSat (MSG, MODIS)
- SynSatMic (AMSU, SSM/I)

## Weather Forecasts

- three-dimensional description of the forecasted atmospheric state
- focus on Lokal-Modell Kurzfrist (**LMK**)

# QUEST: Approach

## Case Studies (ongoing)

### Tool development

- SynPolRad
- SynSat (-Mic)
- MSG  $\mu$ -phys. retrievals
- verification measures
- ..

### Model Sensitivity Runs

### Hypothesis formulation

"What are the crucial variables/processes to observe and to improve?"

comparison tools  
test of hypotheses



## Model Improvement (new)

- cloud microphysics
- land surface
- turbulence



case study  
selection for  
process studies

## Long Term Evaluation

### Lokal-Modell Kürzfrist

- test suites
- GOP duration 2007
- benefits of high resolution modelling

### Identification of systematic model deficits

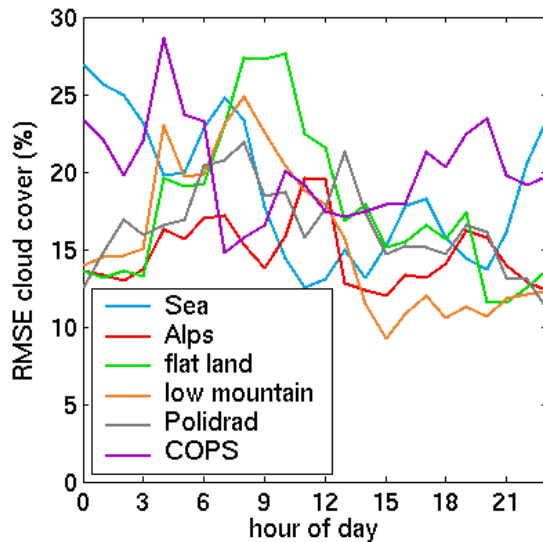
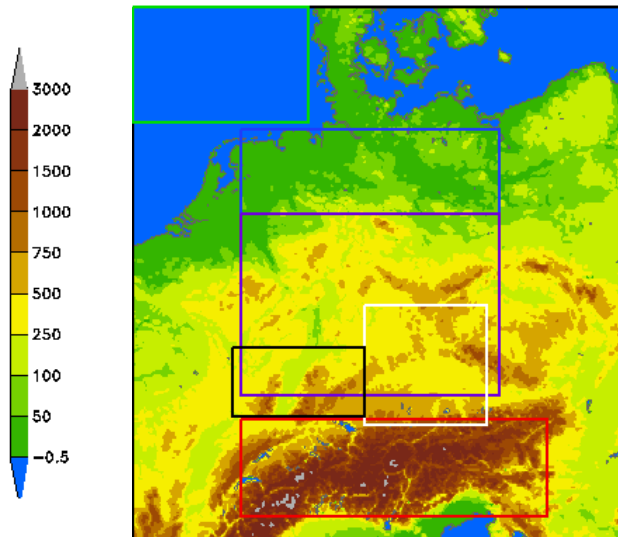
### Conditional verification

- regionalization
- diurnal cycle
- weather situation dep.

### Cross correlation of different variables

"How important is physical consistency?"

# Conditional Verification: LTE



## MSG Comparison

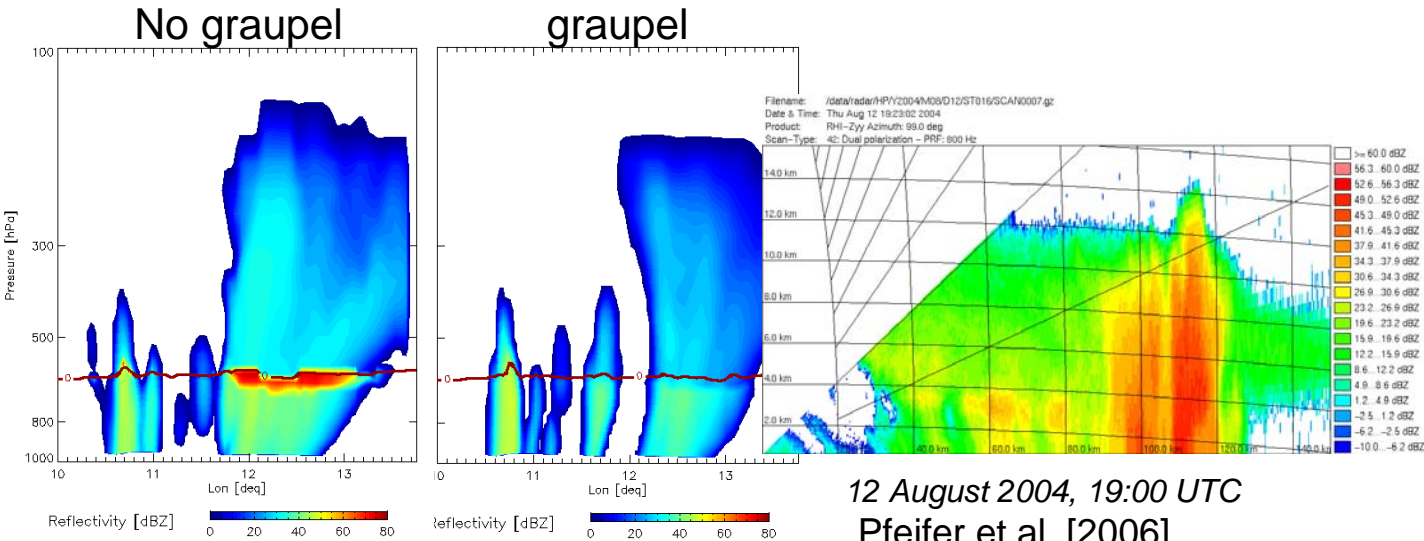
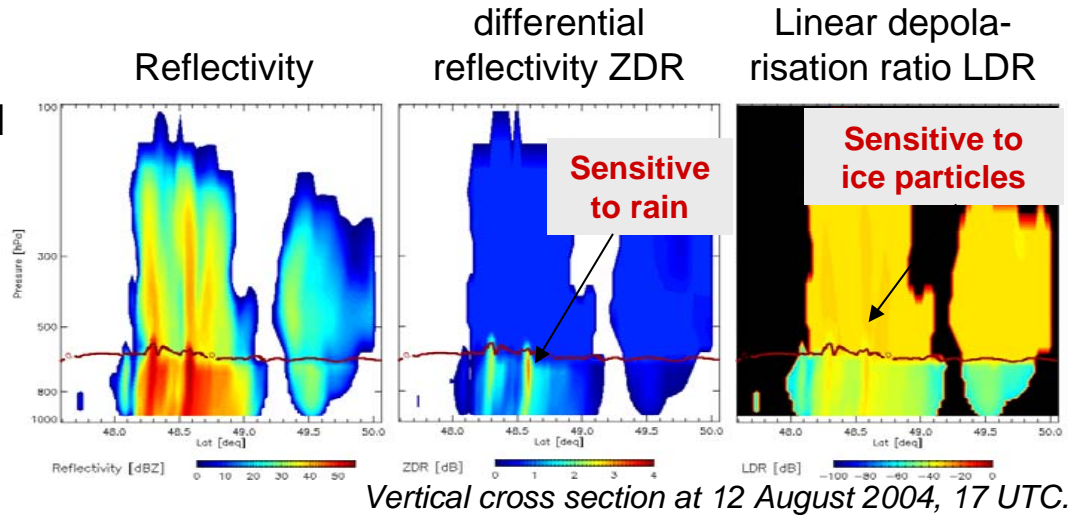
| Cloud cover (%)<br>LMK00 / LMK12 | BIAS (%) | STD (%) | Correlation |
|----------------------------------|----------|---------|-------------|
| <b>LMK total</b>                 | 8 / 5    | 9 / 9   | 0.80 / 0.80 |
| <b>Sea</b>                       | 9 / 8    | 17 / 17 | 0.72 / 0.70 |
| <b>Alps</b>                      | 6 / 2    | 14 / 15 | 0.78 / 0.81 |
| <b>Flat land</b>                 | 9 / 7    | 17 / 17 | 0.68 / 0.70 |
| <b>Low mountain</b>              | 7 / 5    | 15 / 16 | 0.68 / 0.67 |
| <b>Poldirad domain</b>           | 5 / 2    | 17 / 17 | 0.72 / 0.75 |
| <b>COPS domain</b>               | 4 / 0    | 22 / 20 | 0.49 / 0.61 |

- complete test suites analysis
- separate weather regimes
- prepare GOP exploitation

# Cloud microphysics: Case Study

## Polarimetric radar quantities

- Forward operator SynPolRad links LM predictions and observations.
- Polarimetric data provides information about hydrometeor types.
- inclusion of graupel in LMK improves representation of convective cells



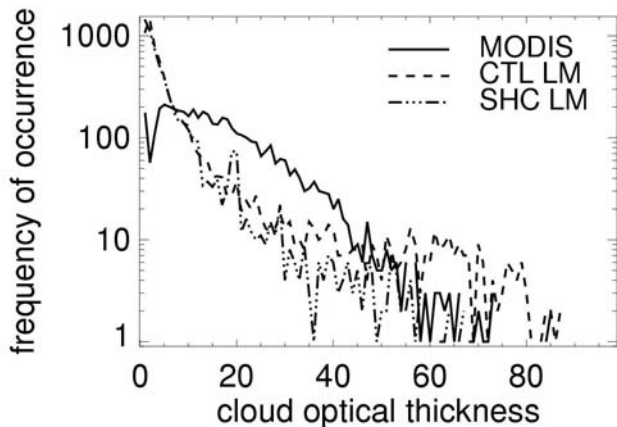
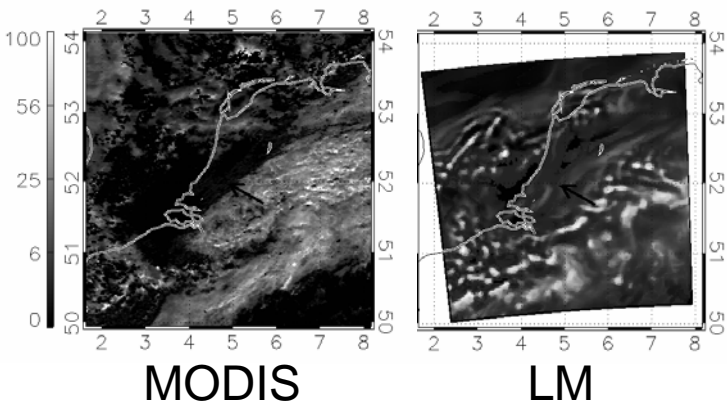
- add more observations for better constraints
- test more microphysical schemes

# Land Surface: Case Study or LTE

Felix? Your Vorarbeiten!

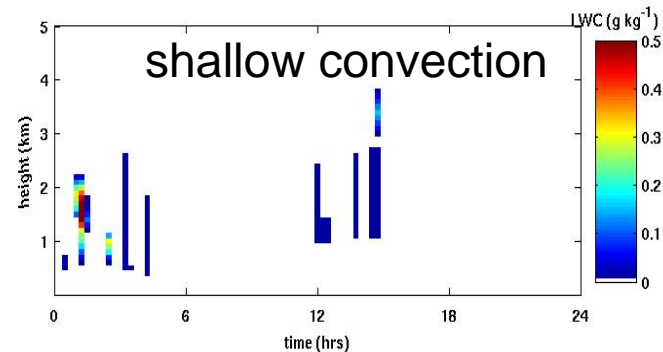
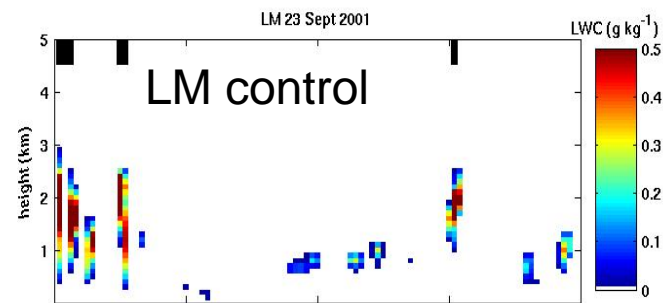
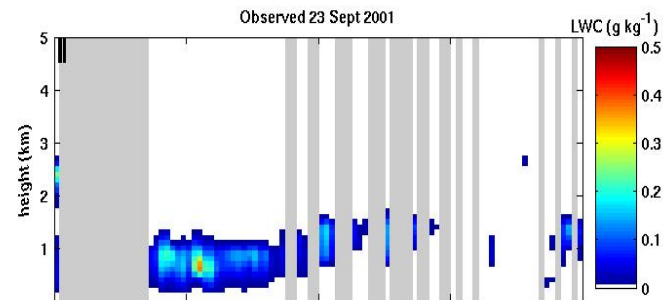
# Turbulence: Case Study

## Horizontal structure



- refine cloud pattern descriptors
- cross correlate different variables (precip/cloud/vapor)
- test 3D-turbulence & new shallow convection param.

## Vertical structure



van Lipzig et al. [2006]

# PQP Collaborations

## COPS & GOP Preparation

### Improvement of Model Physics

- **Beheng and Blahak, Karlsruhe**  
Test of the newly developed cloud microphysics parametrization
- **Bott and Gassmann, Bonn**  
Evaluation of the newly developed convection scheme, case study selection
- **Schlünzen, Hamburg**  
Support in verification activities, satellite observations, process studies

### Data assimilation

- **Simmer et al., Bonn (DAQUA)**  
Identification of test cases, satellite data, verification of assimilation runs

### Verification

- **Cubasch, Nevir and Reimer, Berlin (STAMPF)**  
Verification measures, precipitation analysis, satellite data, connection to clouds and vertical velocity
- **Wernli, Hagen and Frei, Mainz (VERIBREG)**  
Verification measures, aggregated radar products, cross correlation of variables