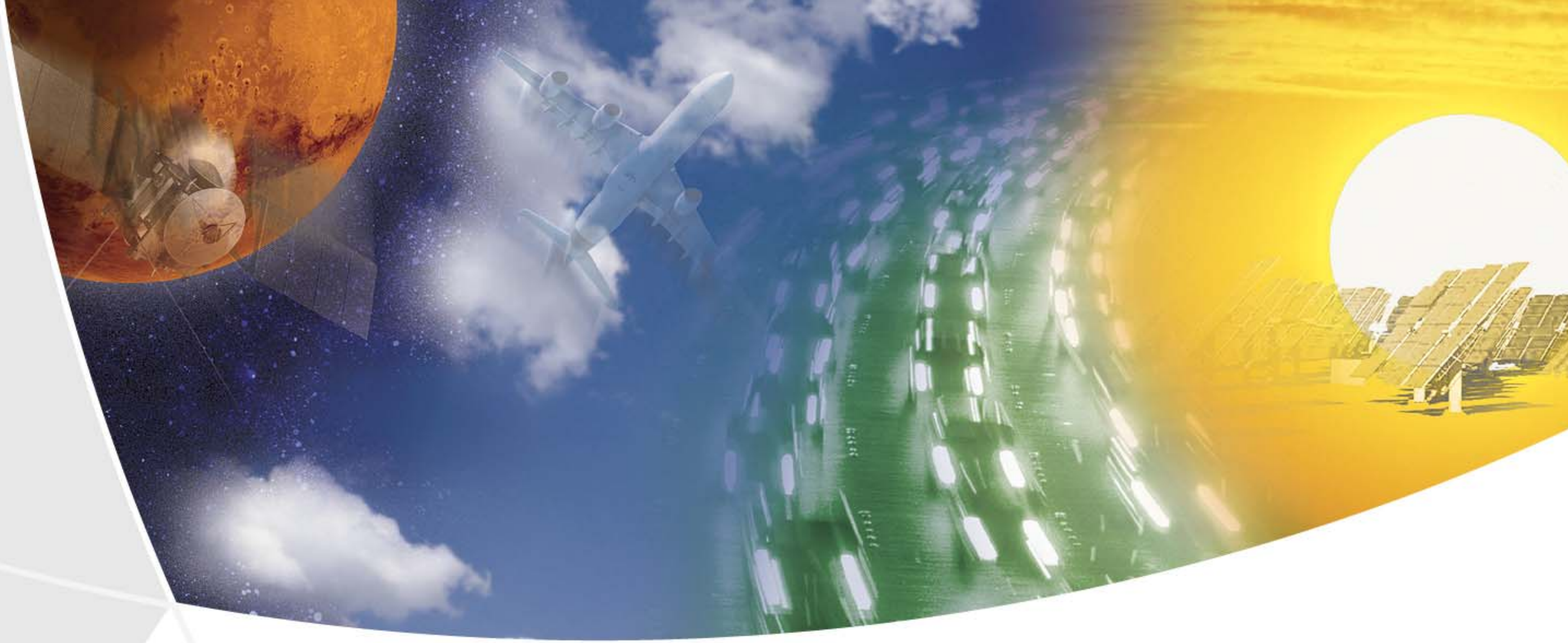


Evaluation of cloud microphysical parameterization schemes by polarimetric radar

Monika Pfeifer
G. Craig, C. Keil, W. Yen

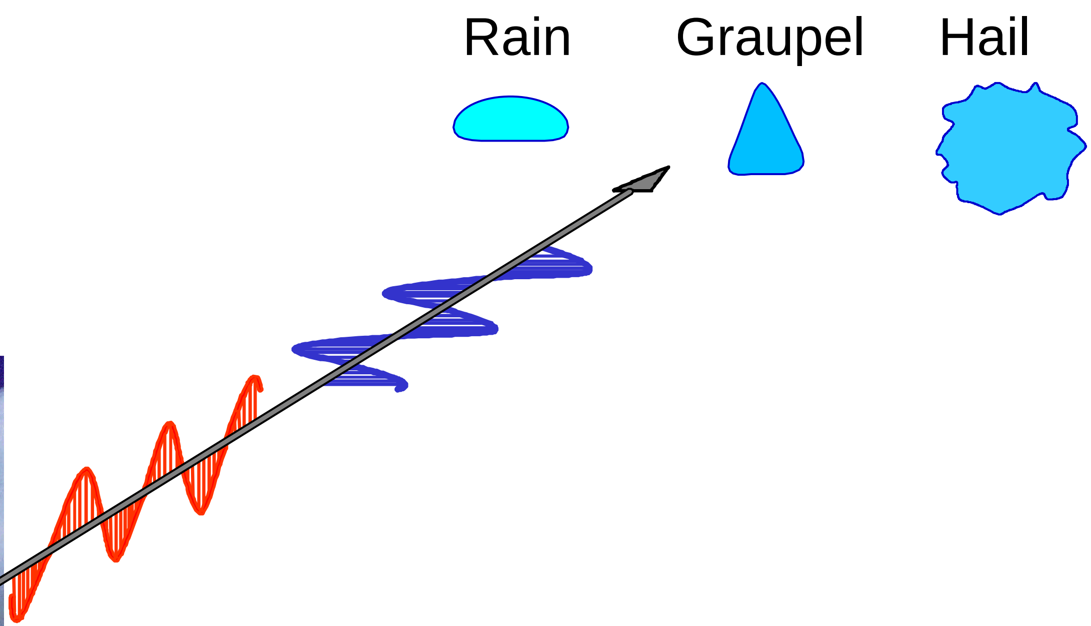
DLR Deutsches Zentrum für Luft- und Raumfahrt e.V. in der Helmholtz-Gemeinschaft

Deutsche Forschungsgemeinschaft DFG

PQP Praecipitationis Quantitativae Praedictio

Institut für Physik der Atmosphäre

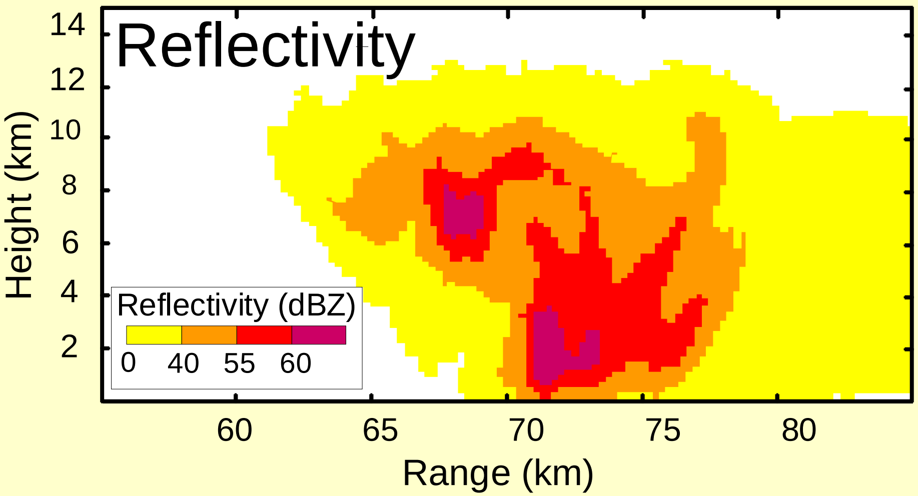
Polarimetric Radar Observations

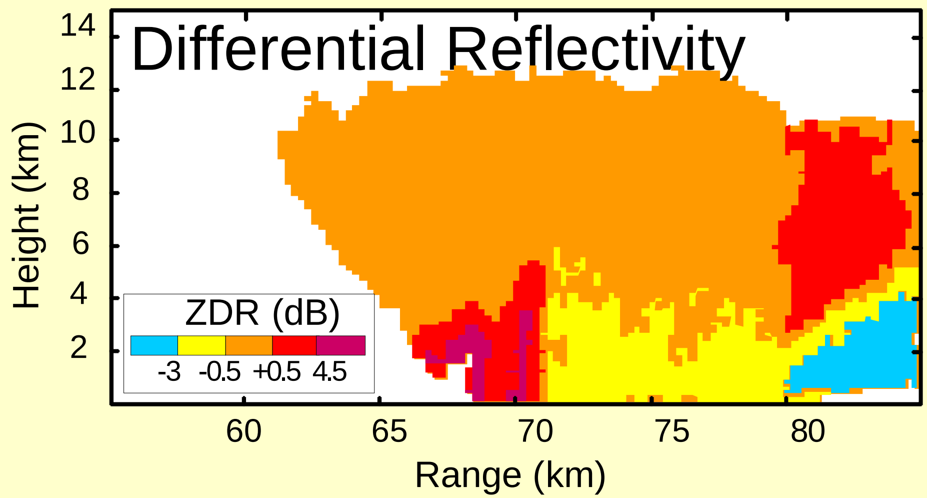


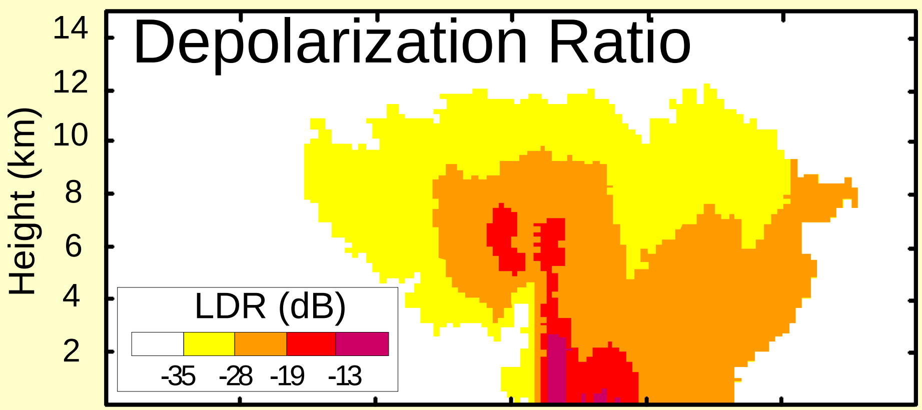
Polarization Diversity Radar POLDIRAD

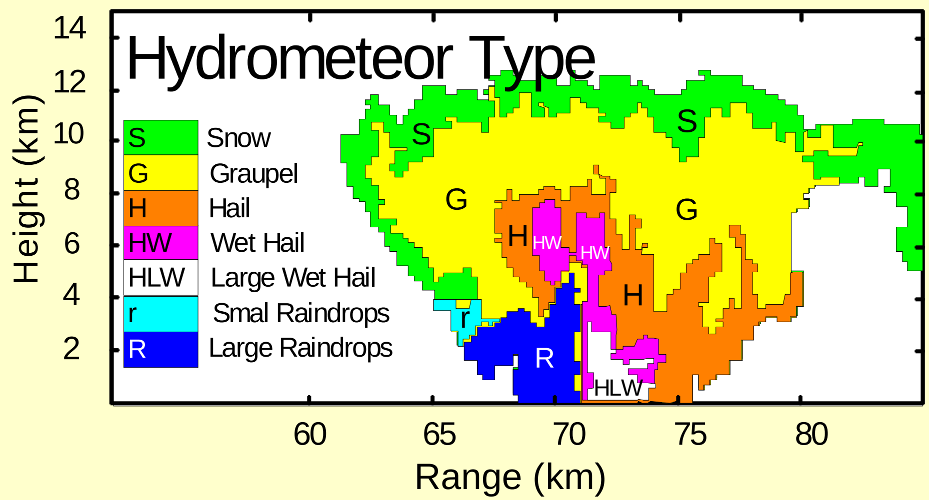
Frequency	5.503 GHz
Wavelength	5.45 cm
	C-Band

Horizontally aligned, not spherical Hydrometeors





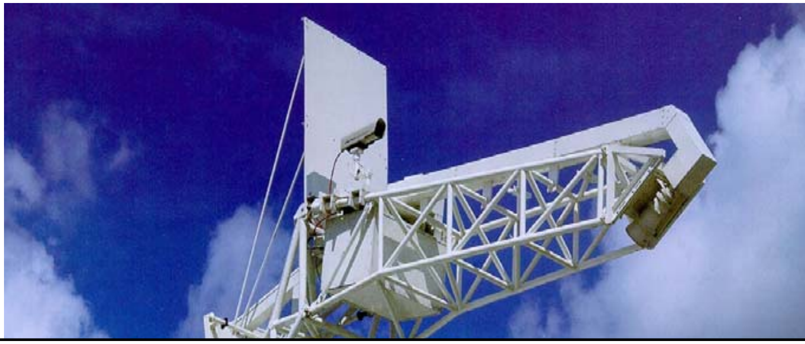




Tumbling, not spherical hydrometeors

(Graupel, Hail)

Advantages of polarimetry



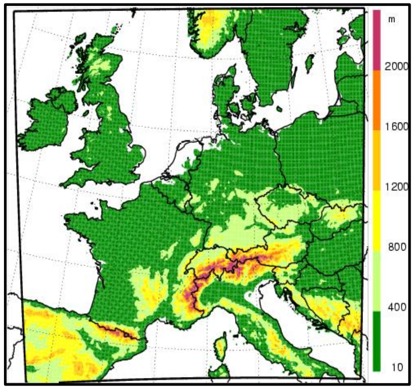
- Polarimetric variables depend on phase, shape, density, falling behaviour

Goal: Identification of critical model parameters and deficiencies in the microphysical parameterization schemes

- Classification of hydrometeors
- Insights in Microphysics of convective System

Synthetic Polarimetric Radar: SynPolRad

?



Reflectivity, LDR, ZDR	Specific water content of hydrometeors
Polar Coordinates	Model Grid

Synthetic Polarimetric Radar: SynPolRad

?

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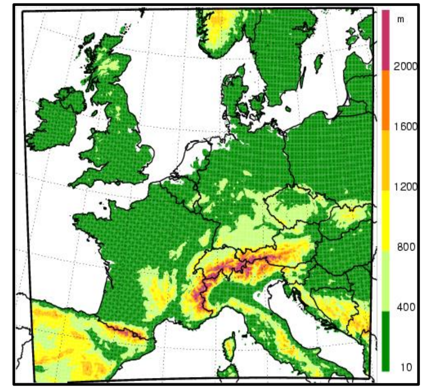


Reflectivity, LDR, ZDR Polar Coordinates	Specific water content of hydrometeors Model Grid

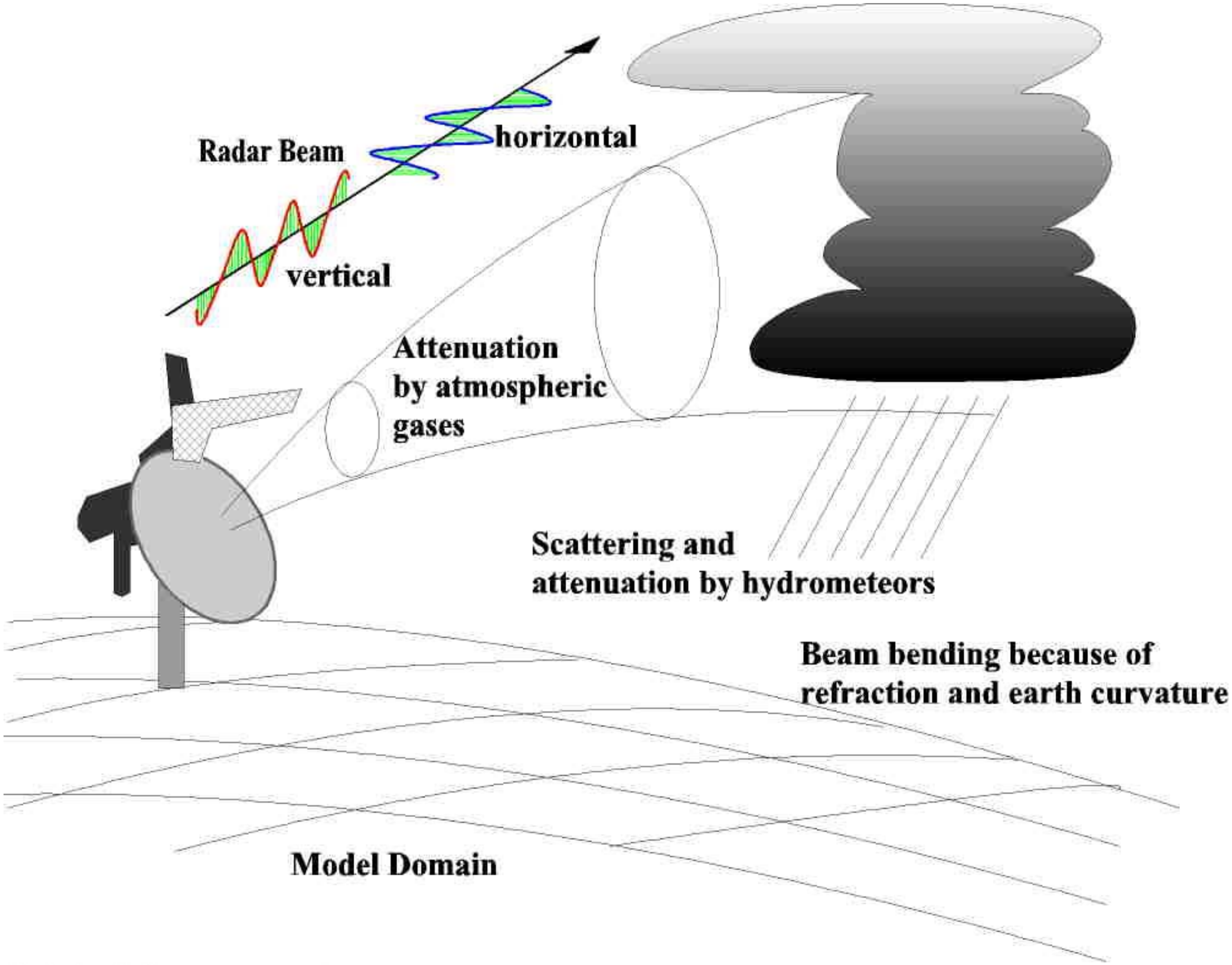
↓ ↓

Polarimetric Radar Forward Operator: SynPolRad

↓ ↓

Reflectivity, LDR, ZDR, Model Grid	Synthetic Reflectivity, LDR, ZDR, Model Grid

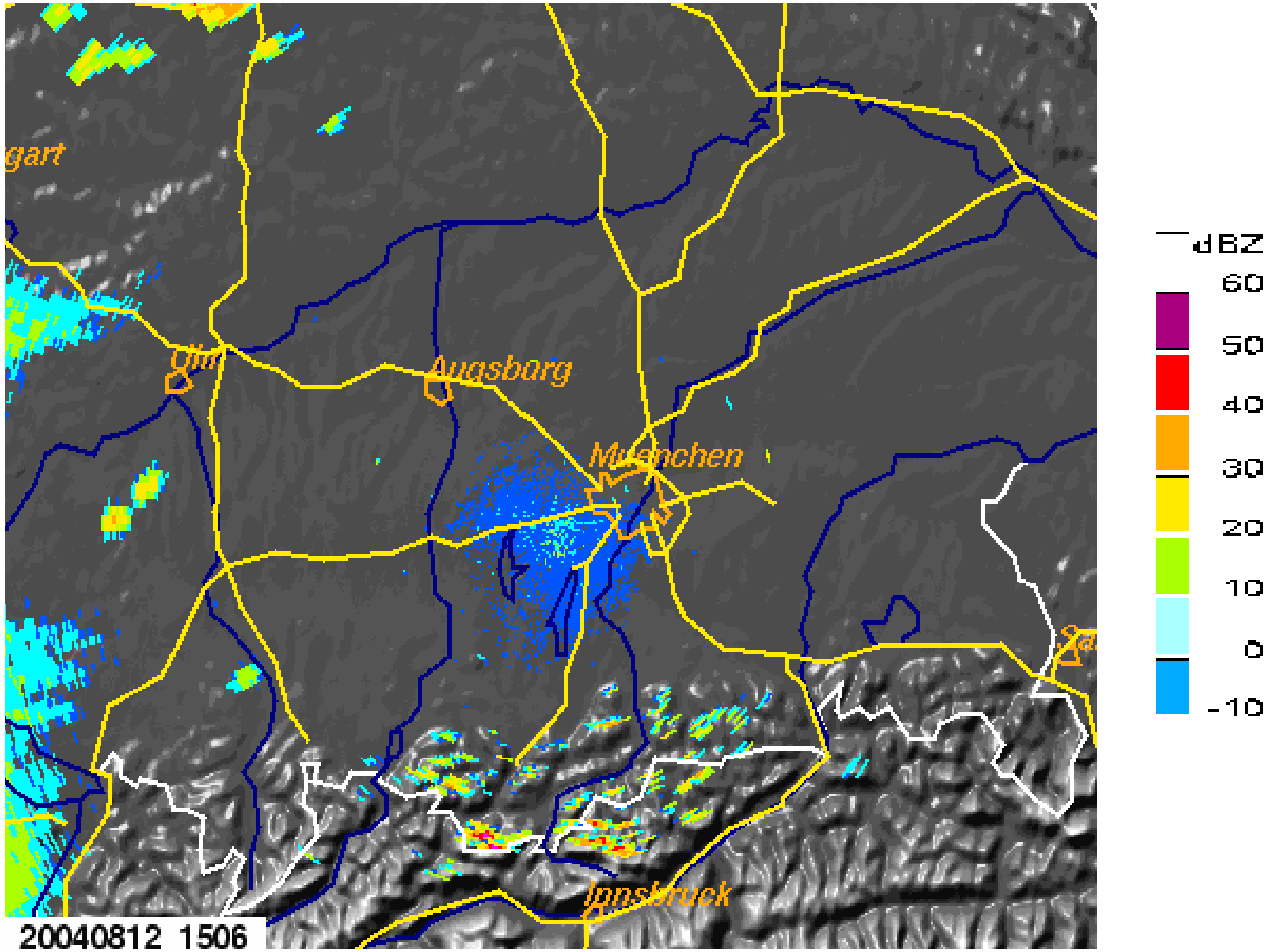
Synthetic Polarimetric Radar (SynPolRad)



Case Study: 12th August 2004, 15 to 20 UTC

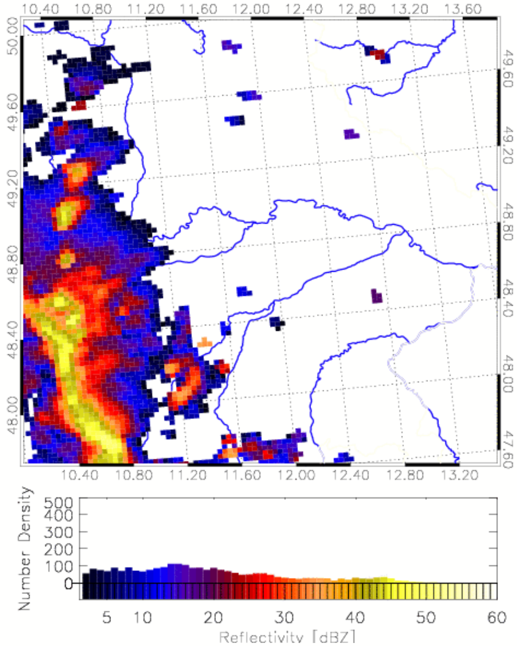
LMK 3.18:

- 2 component
- 3 component
- Thompson

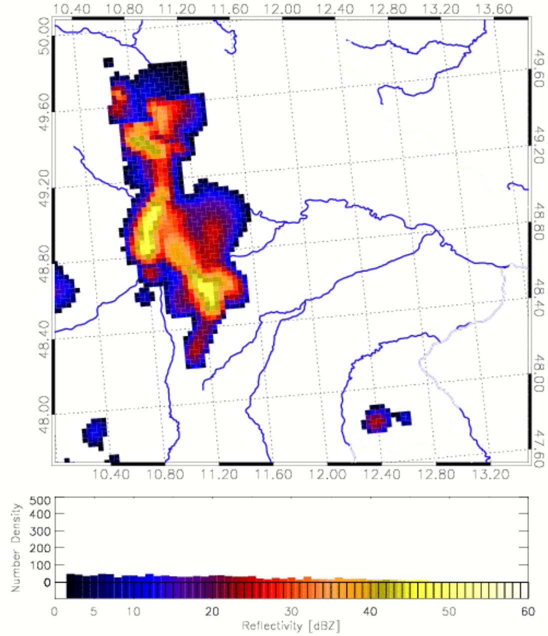


LMK 3.18: 17 UTC

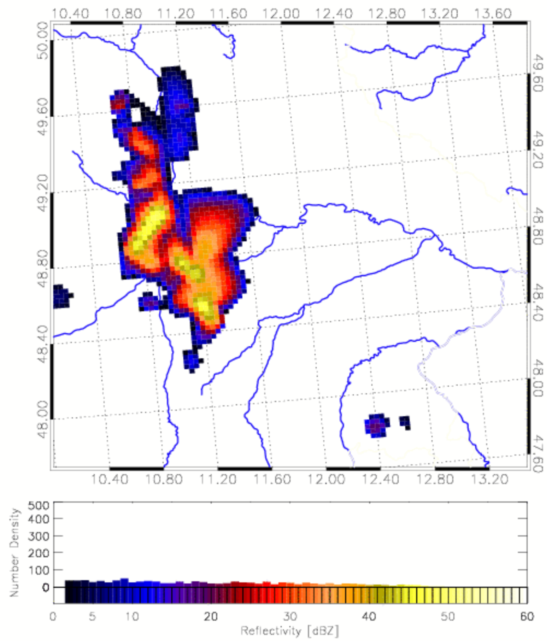
Poldirad



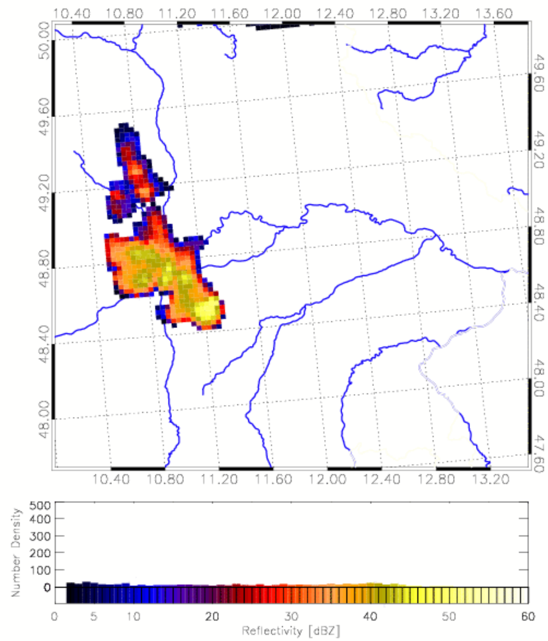
2 comp



3 comp

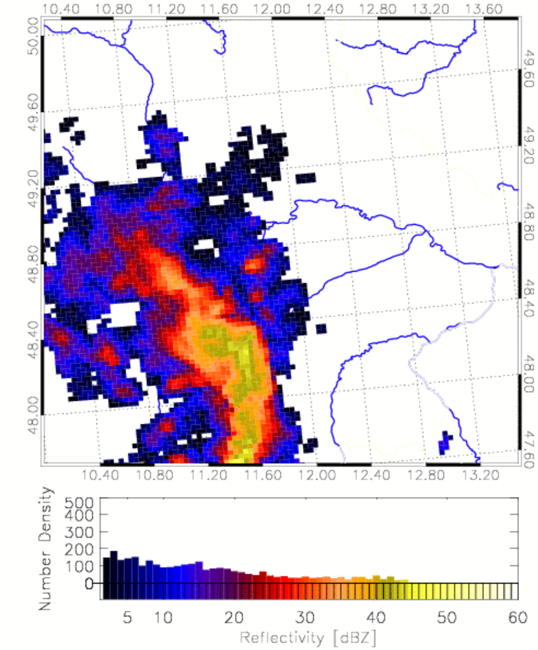


Thompson

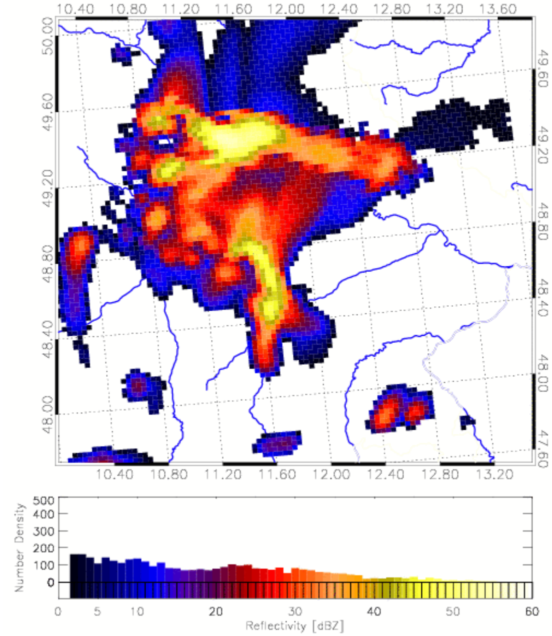


LMK 3.18: 18:00 UTC

Poldirad



2 comp



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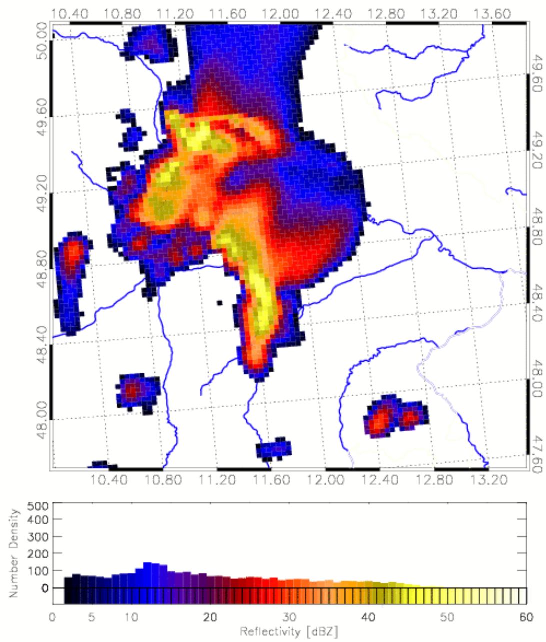
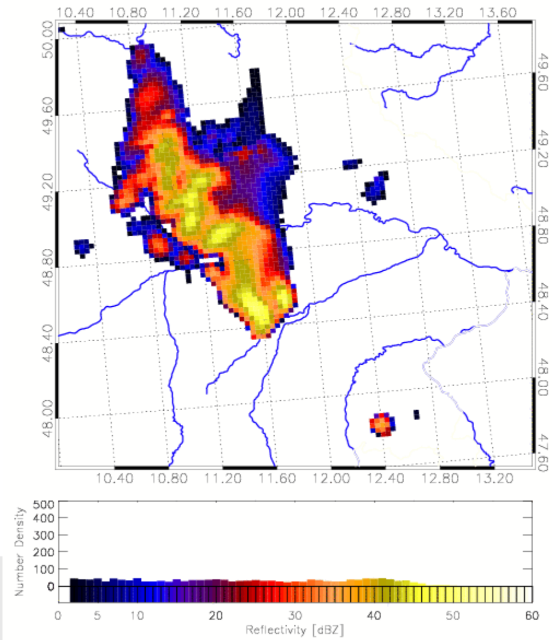
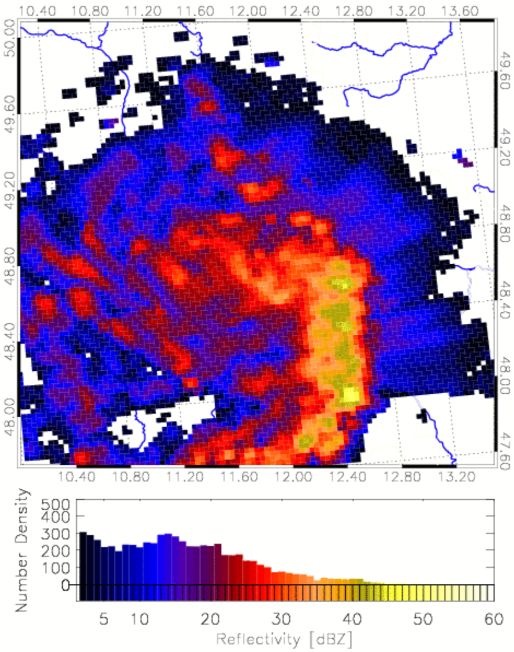


Thompson



LMK 3.18: 19:00 UTC

Poldirad



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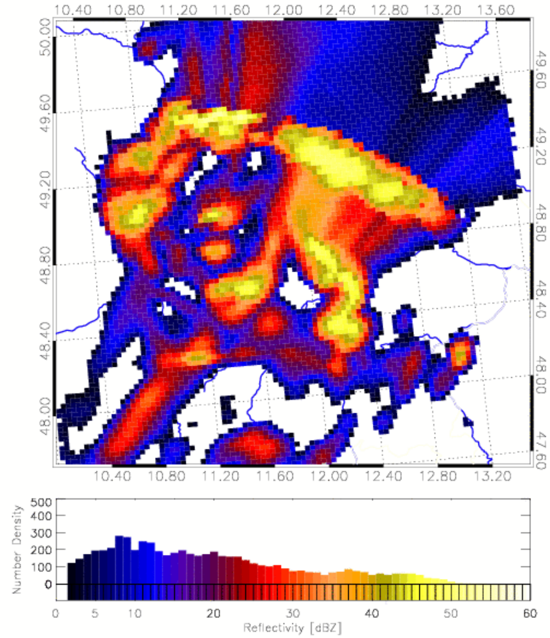

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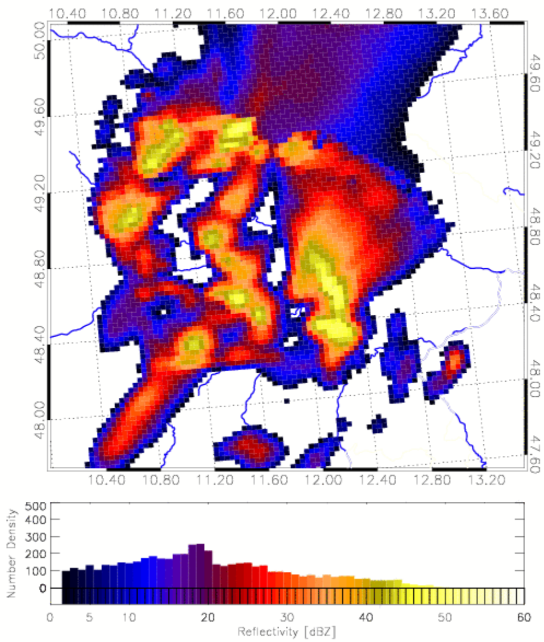
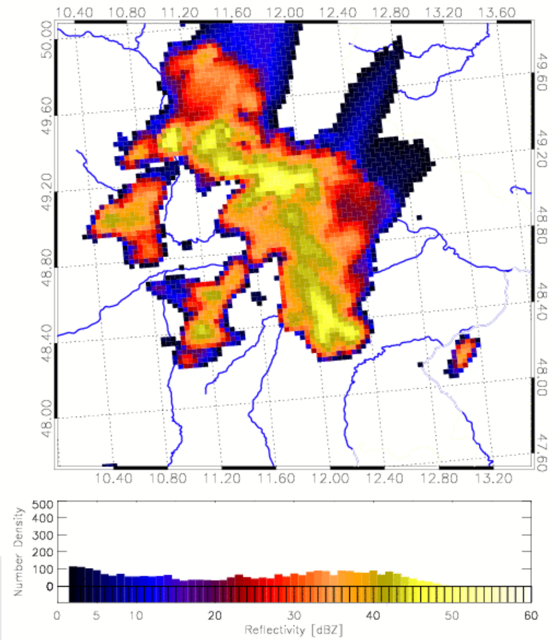
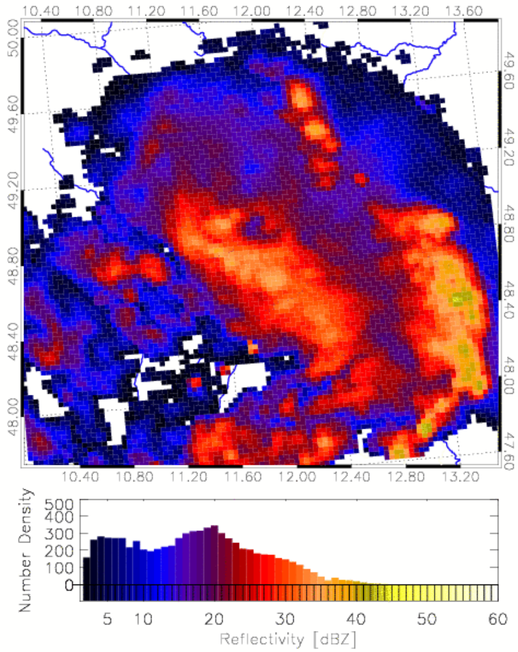


Thompson

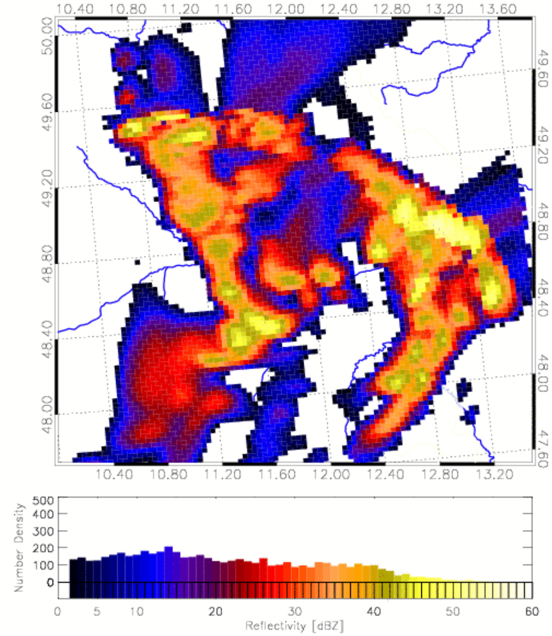


LMK 3.18: 20 UTC

Poldirad



2 comp



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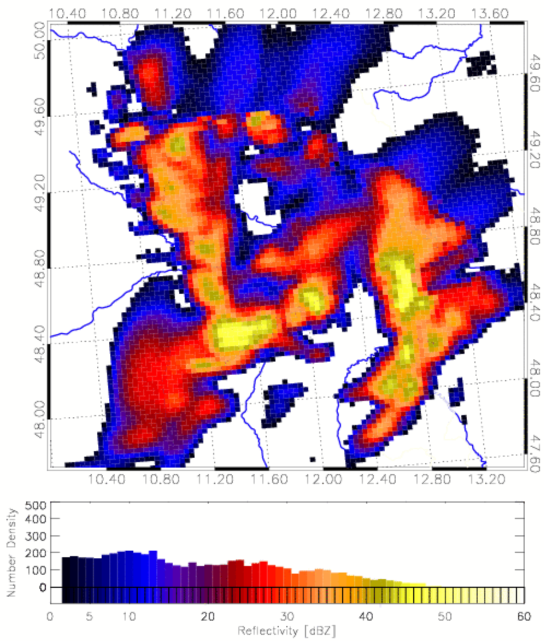
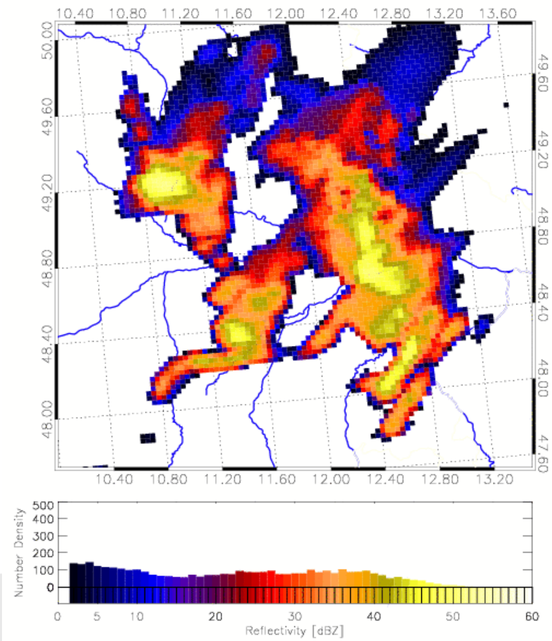
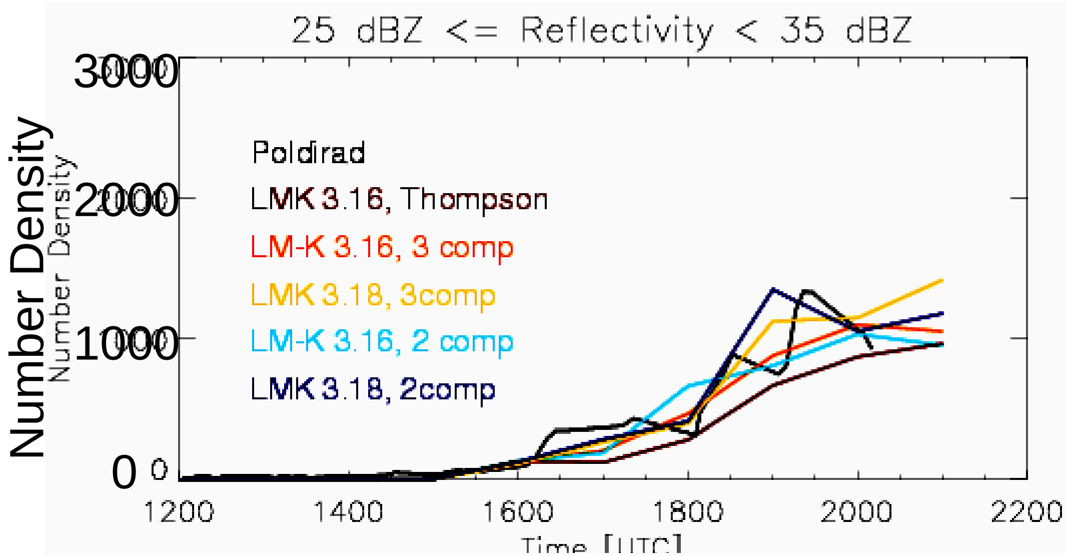
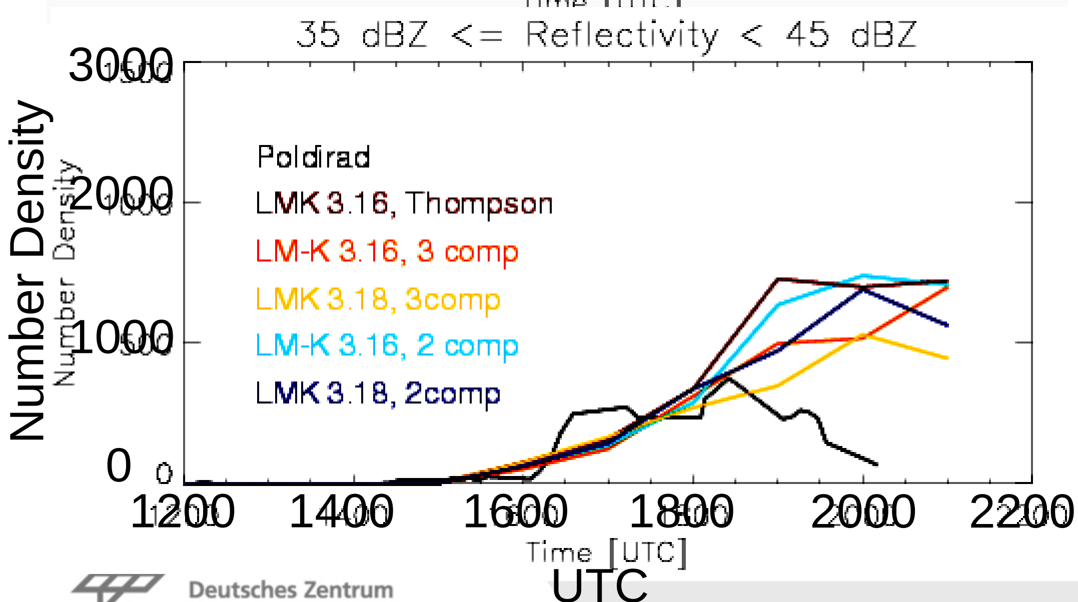


Thompson



Temporal evolution of the storm



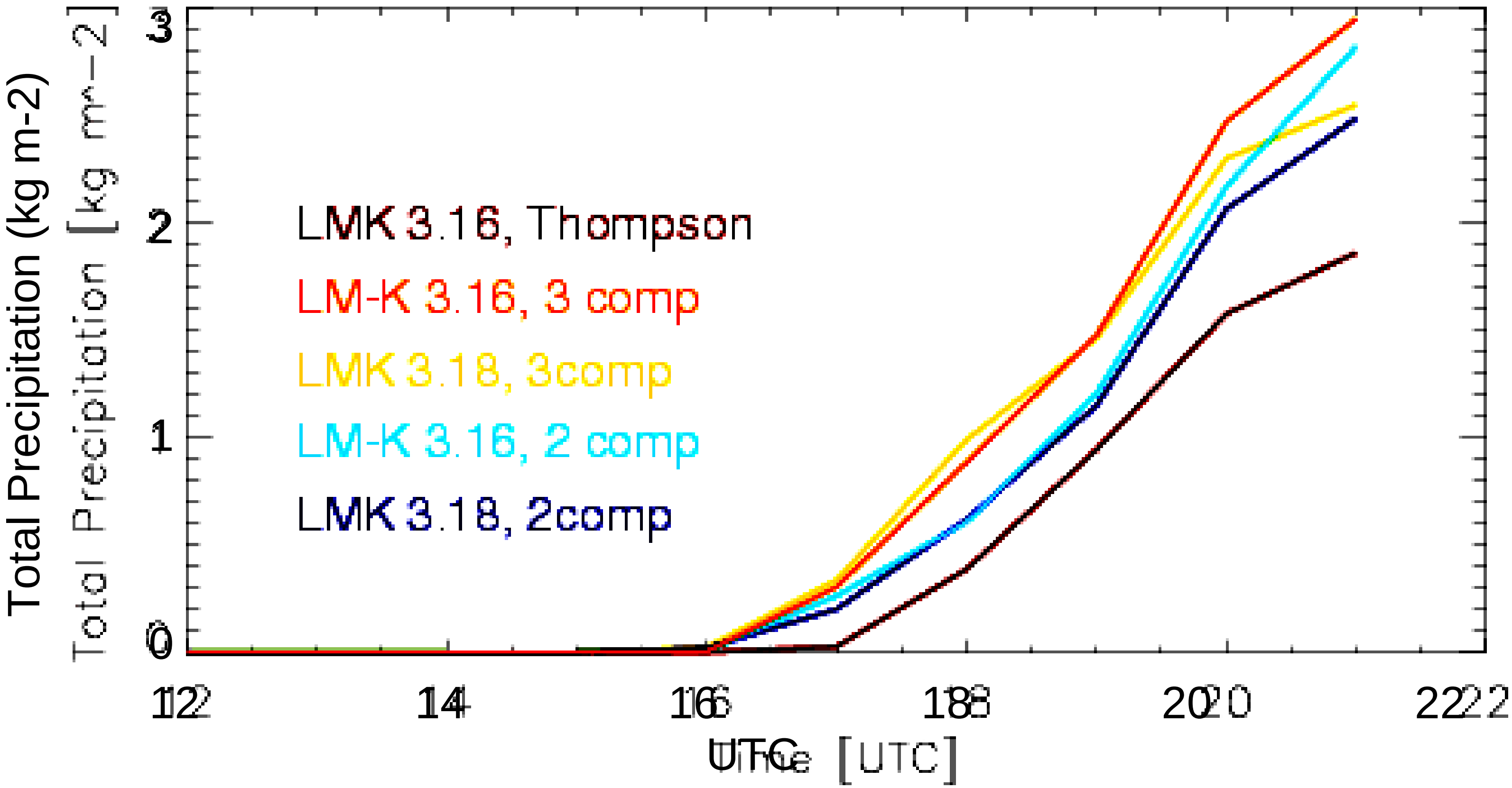


25 dBZ < Zhh < 35 dBZ

Time series of histograms of classes of reflectivity

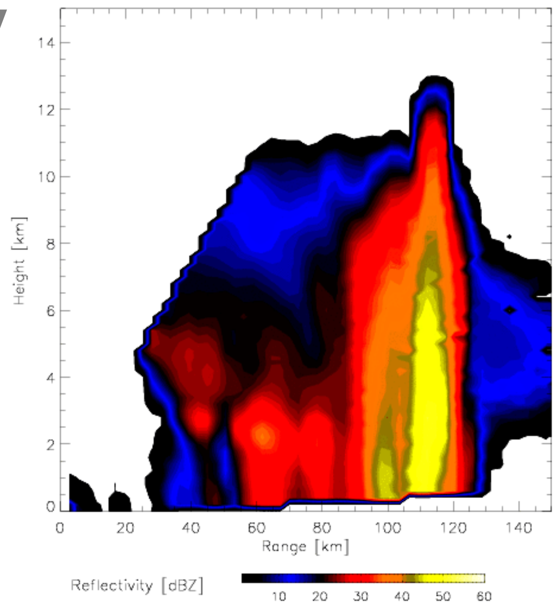
35 dBZ < Zhh < 45 dBZ

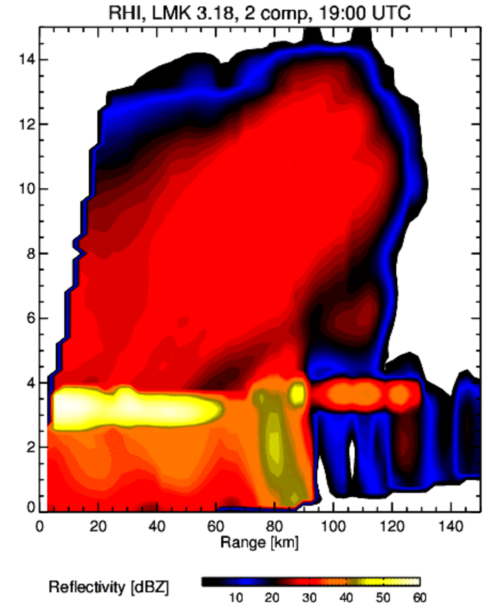
Total precipitation at the ground (hourly accumulated)



RHI Reflectivity

Poldirad





LMK,

2 comp.

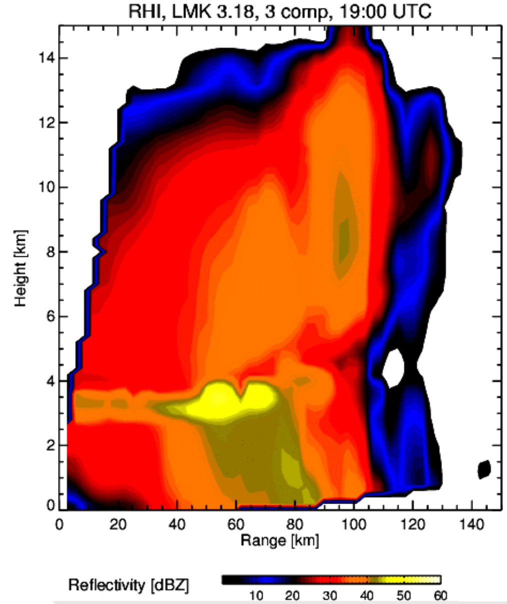
Rain,

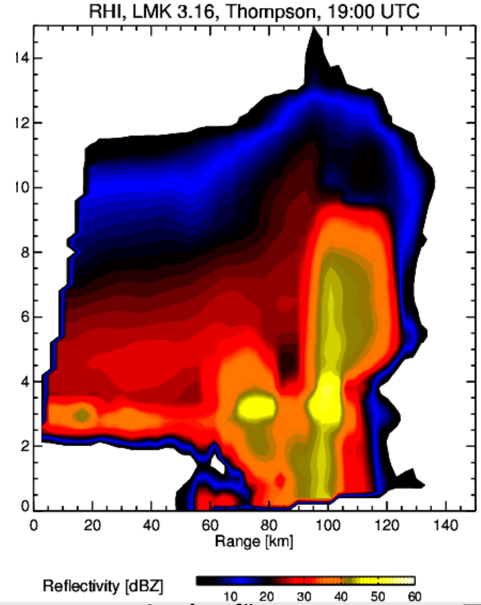
Snow

LMK,

3 comp.

Rain, Snow,
Graupel





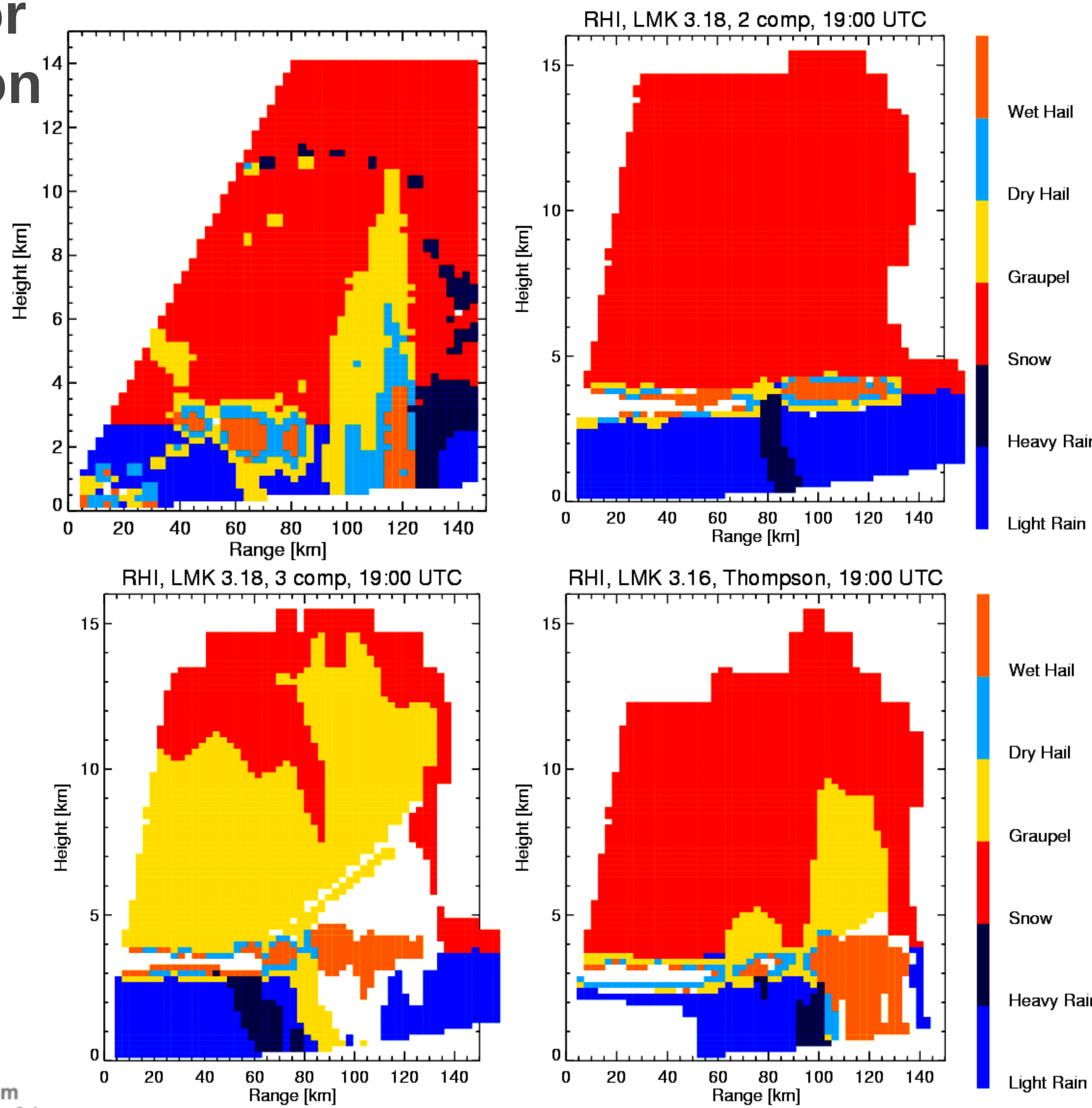
LMK,

Thompson,

Rain, Snow,
Graupel

Hydrometeor Classification

Poldirad



LMK,

2 comp.

Rain,

Snow

LMK,

3 comp.

Rain, Snow,
Graupel

LMK,

Thompson,

Rain,

Snow,

Graupel

Conclusions and Outlook

The representation of microphysical processes in NWP models has a major effect on QPF.

How to improve the description of microphysical processes?

- **Systematic evaluation of current microphysical parameterization schemes**

  Identification of major and systematic problems.

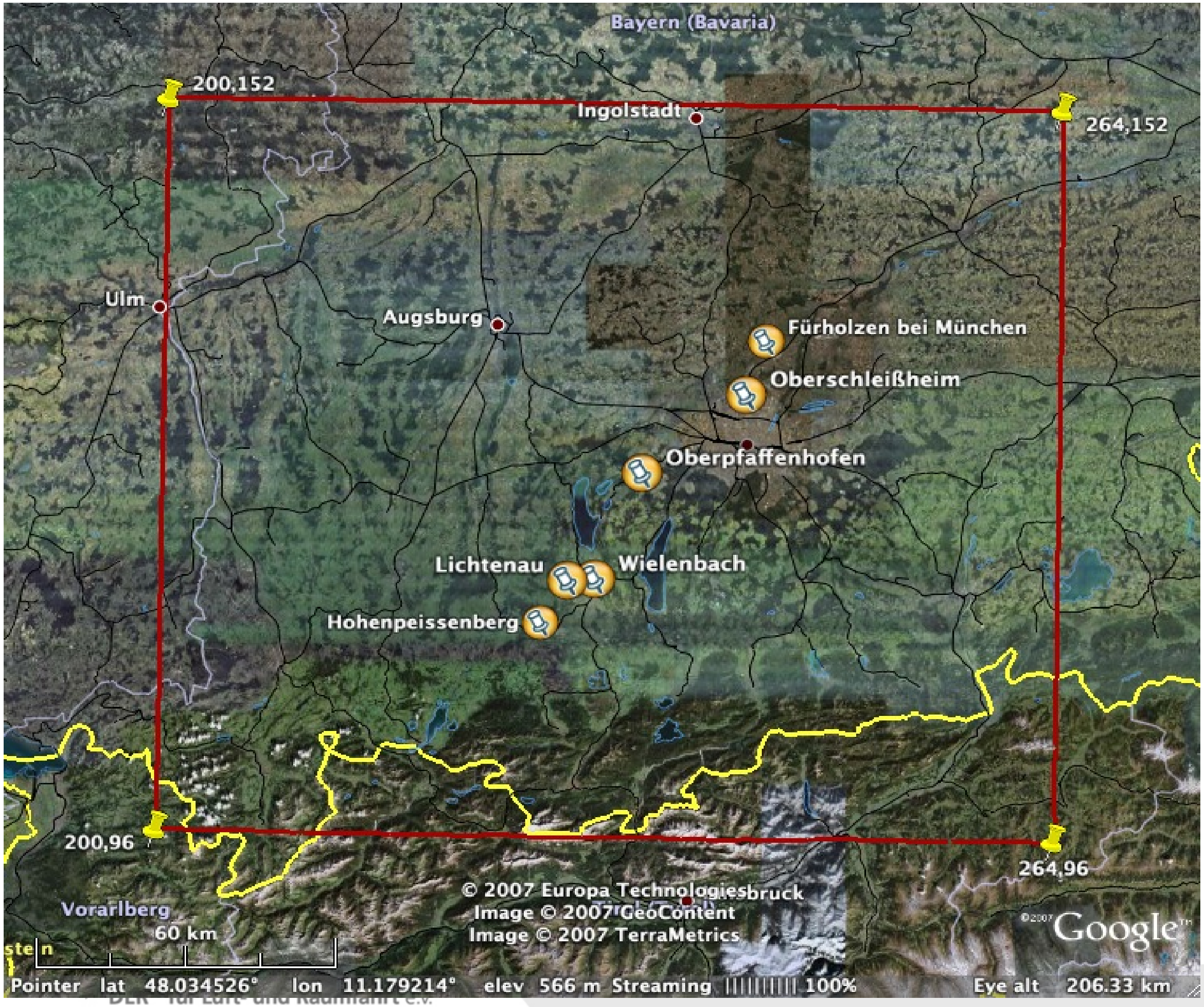
- **Development of new microphysical parameterization schemes closely linked to observations**
- **Assimilation of observations of precipitation and especially polarimetric radar data**

Systematic Long-Term Model Evaluation

1. **Mesoscale Models have major problems in the vertical distribution of intensities and hydrometeor types.**
2. **Regarding precipitation, polarimetric radar is a key instrument for providing information about microphysical processes.**
3. **The polarimetric radar forward operator SynPolRad provides the means for a systematic model evaluation.**
4. **The precipitation at the ground is the final product of a number of processes taking place in the atmosphere. For a complete evaluation of model physics, it has to be combined with other remote sensors.**
5. **Life Cycle, Feed back onto dynamics and redistribution of latent heat???**
6. **LAF ensemble???**

AQUARadar: Special Observation Period

Advances in Quantitative Areal Precipitation Estimation



- Weather Radars
- MRRs
- Disdrometers
- Rain Gauges