

DFG Schwerpunktprogramm SPP 1167 Quantitative Niederschlagsvorhersage



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

3 Phases from 2004 to 2010

<http://www.meteo.uni-koeln.de/crewell/doku.php/quest>

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



KATHOLIEKE UNIVERSITEIT
LEUVEN

QUEST-Team



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Partnership

- **Universität zu Köln (IGMK, LMU)**
Susanne Crewell, Nicole van Lipzig, Felix Ament, Thorsten Reinhardt, [Christoph Selbach](#), [Veronika Breininger](#), Sonja Eikenberg, Mario Mech
- **Freie Universität Berlin**
Jürgen Fischer, Marc Schröder, Anja Hünerbein, Stefan Stapelberg
- **DLR Institut für Physik der Atmosphäre**
George Craig (jetzt LMU), Martin Hagen, Christian Keil (jetzt LMU), Monika Pfeifer, Lucas Fischer
- **Universität Hamburg (UHH)**
Felix Ament, Suraj Polade, [Nicole Feiertag](#), [Anja Ludwig](#)
- **Deutscher Wetterdienst (DWD)**
Axel Seifert, Michael Baldauf
- **Katholieke Universiteit Leuven (KUL)**
Nicole van Lipzig, Tim Böhme, Tom Akkermans, Kwinten van Weverberg



Jörg Schulz

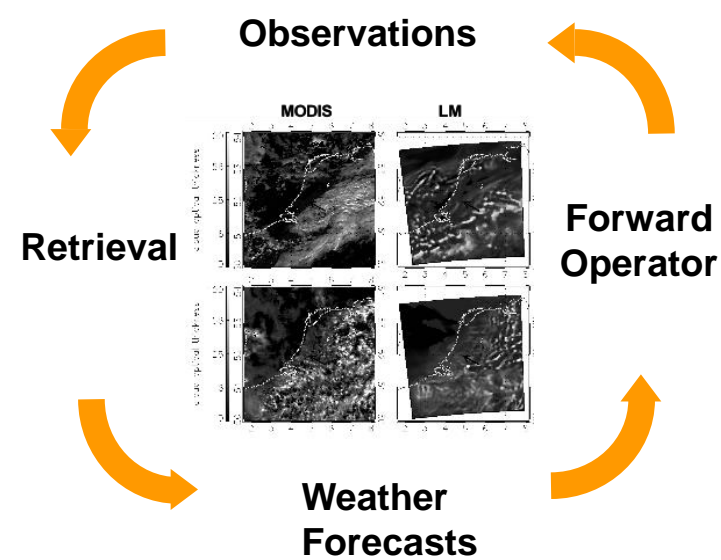
QUEST: Strategy

- Evaluating mesoscale model forecasts of water cycle variables
 - remote sensing data currently not used in routine model verification
 - radar/satellite observations with resolution comparable to high-resolution NWP models
 - polarimetric radar & millimetre wave radiometry for hydrometeors
 - life cycle of clouds and precipitating cells from model/reality

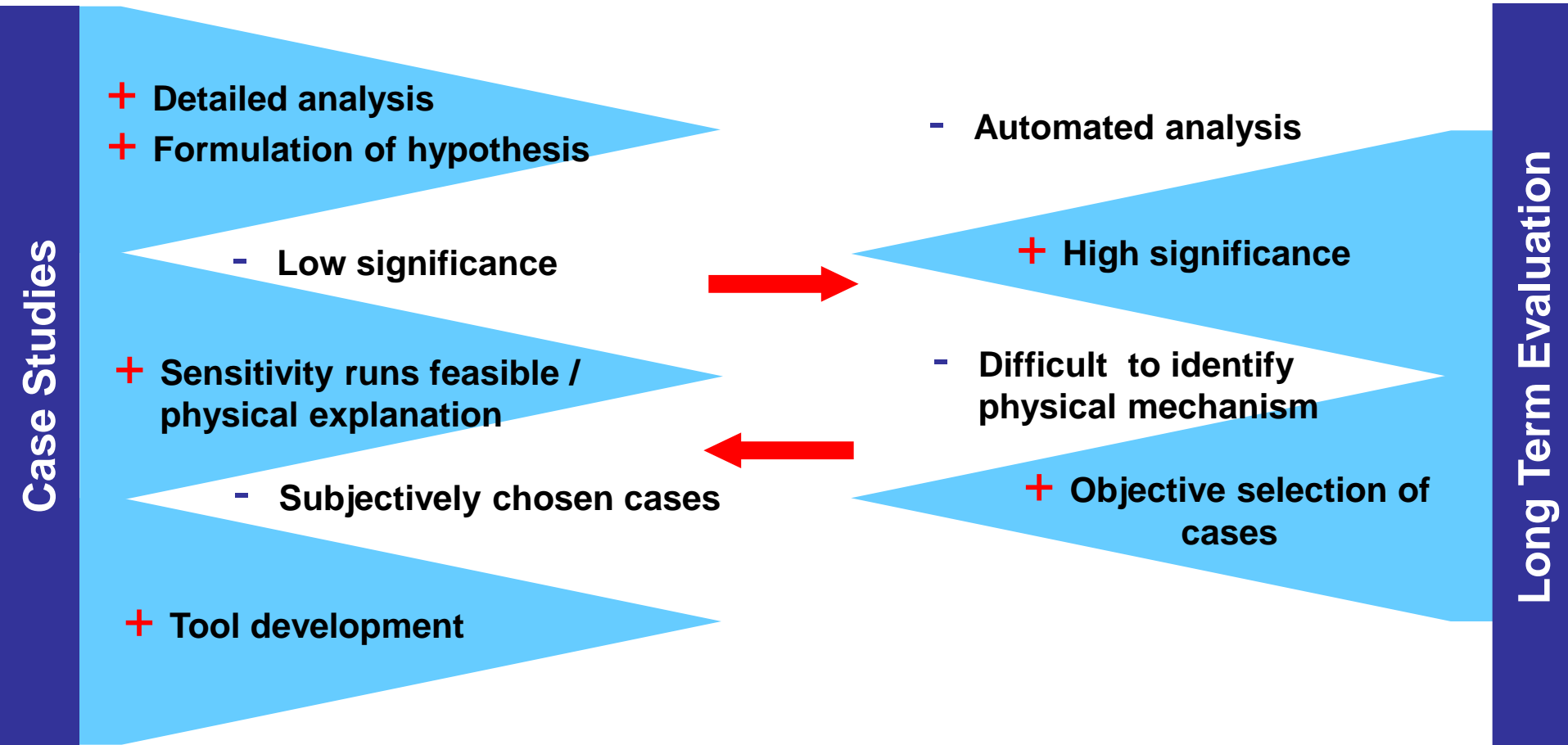
- Combining detailed case study investigations and long-term model evaluations

General Observation Period GOP

- Identifying systematic model deficits by averaging out stochastic errors
- Changing model physics in order to attribute the errors to the treatment of specific processes



Case studies versus long-term evaluation



COPS

3 months operation of state-of-the-art instrumentation in Black Forest region

Improvement of quantitative precipitation forecasting in low-mountain regions



GOP

1 year of continuous data in central Europe currently not used for standard verification

Statistical assessment of model forecasts and identification of regime related deficits.

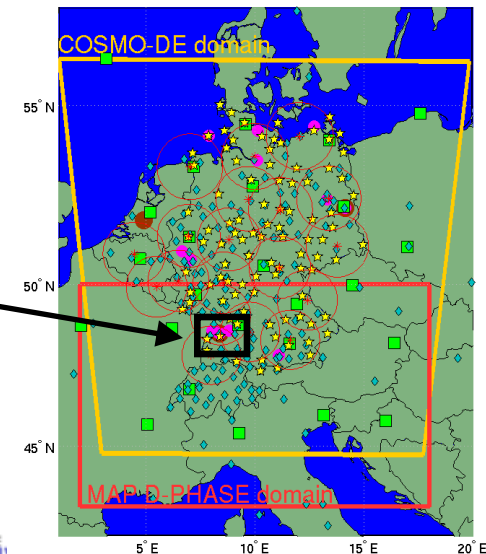
www.uni-hohenheim.de/spp-iop/cops/

Wulfmeyer et al., 2008
BAMS

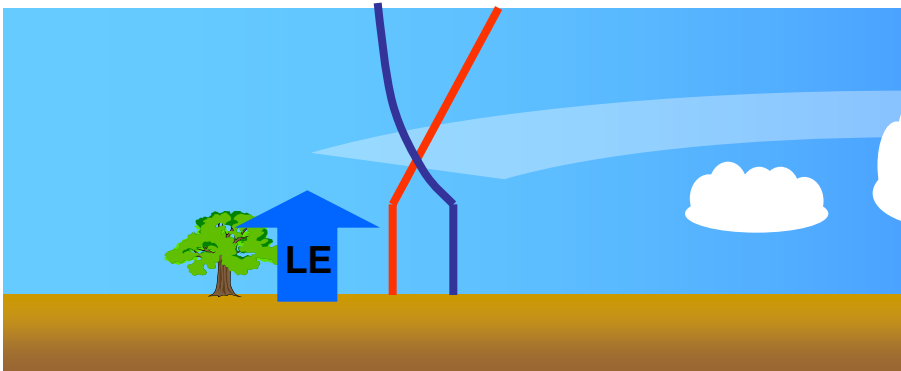


<http://gop.meteo.uni-koeln.de/>

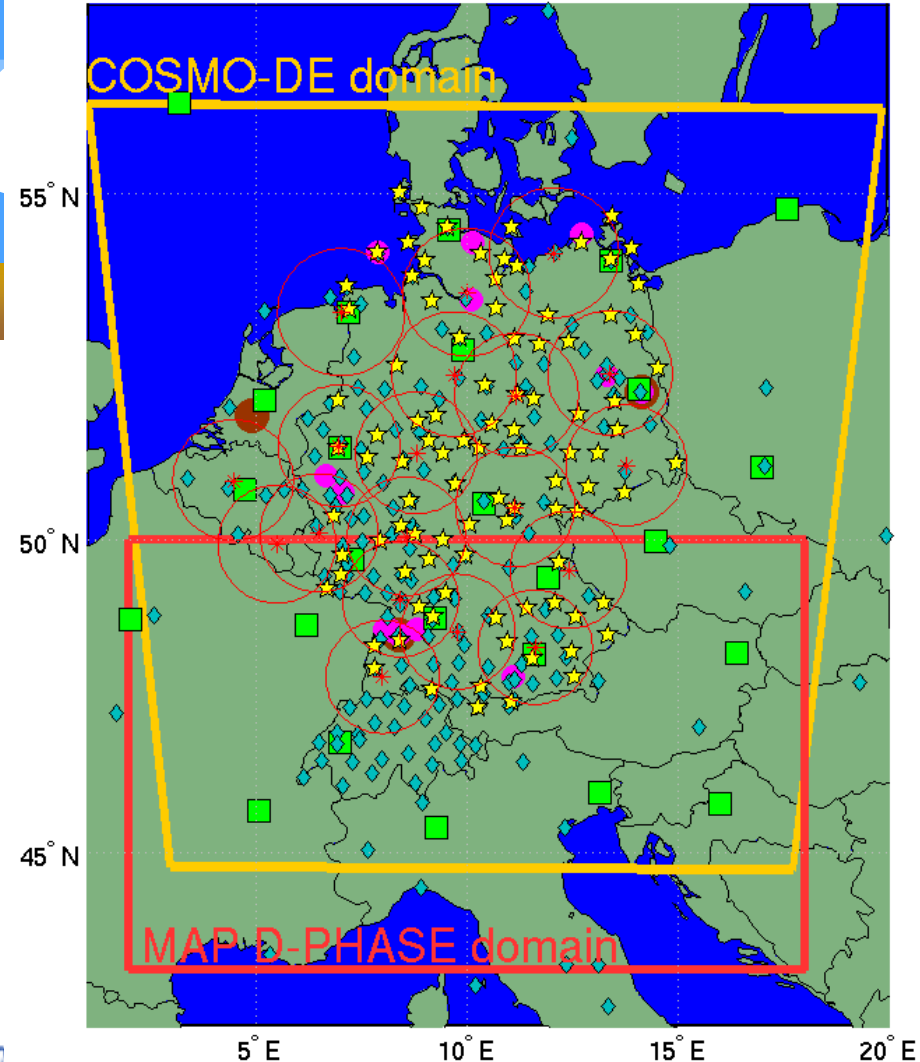
Crewell et al., 2008
Met. Z.



GOP Organisation



- **GOP-1** Rain gauges
- **GOP-2** Weather Radar ○
- **GOP-3** MRR Drop Size Distribution ●
- **GOP-4** Lidar (cloud base, mix layer) ★
- **GOP-5** GPS water vapour column ◆
- **GOP-6** Lightning networks
- **GOP-7** Satellite observations
- **GOP-8** Meteorological stations



■ Radiosonde Cloudnet



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QUEST: Publications

- Akkermans, T., Tim Böhme, M. Demuzere, S. Crewell, C. Selbach, T. Reinhardt, A. Seifert, F. Ament, and N.P.M. Van Lipzig, 2010: Regime-dependent evaluation of accumulated precipitation in the COSMO model, *Meteorol. Z.*, submitted.
- Böhme, T., S. Stapelberg, T. Akkermans, S. Crewell, J. Fischer, T. Reinhardt, A. Seifert, C. Selbach, N. van Lipzig, 2010: Long-term evaluation of COSMO forecasting using combined observational data of the GOP period, *Meteorol. Z.*, submitted.
- Crewell, S., V. Breininger, M. Mech, T. Reinhardt, C. Selbach, E. O'Connor, H.-D. Betz, G. Dick, J. Fischer, T. Hanisch, T. Hauf, A. Mathes, G. Peters, and H. Wernli, 2008: General Observation Period 2007: Concept and first results, *Meteorol. Z.*, 17(6), 849-866.
- Pfeifer, M., W. Yen, M. Hagen, G. Craig, T. Reinhardt, M. Mech, S. Crewell, A. Hünenbein, J. Fischer, M. Schröder, and M. Baldauf, 2008: Validating precipitation forecasts using sensor synergy: The case study approach, *Meteorol. Z.*, 19(6).
- Pfeifer, M.; G. Craig, M. Hagen, and C. Keil, 2008: A polarimetric radar forward operator for model evaluation. *Journal of Applied Meteorology and Climatology*, 47, 3202-3220.
- Schröder, M., N. P. M. van Lipzig, F. Ament., J.-P. Chaboureau, S. Crewell, J. Fischer, V. Matthias, E. van Meijgaard., A. Walther, and U. Willén, 2006: The representation of low-level clouds in atmospheric models: Part II: Spatial distribution from satellite remote sensing during the BALTEX Bridge Campaigns. *Atmos. Res.* 82(1-2), 83-101.
- Van Lipzig, N.P.M., M. Schröder, S. Crewell, F. Ament, J.-P. Chaboureau, U. Löhnert, V. Matthias, E. van Meijgaard, M. Quante, U. Willén, Marc Schröder, et al W. Yen, 2006: Model predicted low-level cloud parameters. Part I: Comparison with observations from the BALTEX Bridge Campaigns. *Atmos. Res.* 82(1-2), 55-82.

QUEST: Agenda

- 11:15 Tim Böhme (KU)
Long-term evaluation of COSMO forecasting using combined observational data of the GOP period
- 12:00 Tom Akkermans (KU)
Regime-dependent evaluation of accumulated precip in the COSMO model
- 12:30 Mittagspause
- 13:15 Suraj Polade (UHH)
Evaluation of the atmospheric water cycle predicted by MAP D-PHASE models using GOP observation
- 14:00 Stefan Stapelberg (FUB)
Long-term evaluation of the diurnal cycle of COSMO-DE/EU with Meteosat-Second-Generation (MSG) data
- 14:45 Nicole Feiertag (UHH)
Lagrangian verification of COSMO-DE precipitation forecasts
- 15:15 Kaffeepause
- 15:45 George Craig (LMU)
Model evaluation with polarimetric Radar and with Lidar
- 16:30 Sonja Eikenberg & Mario Mech (IGMK)
Validation of ice and snow content in GME with Cloudsat data



Discussion points

- Publications

- Pfeifer
- Eikenberg (splinter meeting)
- Tim?
- Stefan
- Felix-Ceilometer

- Sustainability

- Data
- Infrastructure -> relation to data project of Andreas Hense

- Future work

- Lucas Fischer
- Sonja Eikenberg



Work package

- WP1: Coordination (web site, other SPP projects)
- WP2: Model evaluation
 - WP2.1 Representation of water vapour (FUB, IGMK) Modis, Merissubgrid
 - WP2.2 Development of clouds (FUB, IGMK) – tracking base/top
 - WP2.3 Identification of regime related model deficits using GOP data (IGMK, FUB, UHH)
 - WP2.4 GOP generalization towards D-PHASE models (UHH)
 - WP2.5 Detecting error structures in the hydrological cycle
- WP 3: Model improvement
 - WP3.1 Boundary layer evolution and the daily cycle (IGMK, DWD)
 - WP3.2 Cloud microphysics (DLR, IGMK)
 - WP3.3 Cloud radiation interaction
 - WP3.4 Evaluation of ensembles (UHH)



Work Items 3rd Phase

- **Water vapour and its impact on clouds and precipitation**
 - COSMO-DE vs COSMO-EU, advection or evaporation
 - RS dry bias
 - spatial variability (MODIS, MERIS, MSG)
- **Cloud development**
 - spatial and intensity development (tracking of MSG and radar data + AMSU)
 - vertical development (combined MSG and ceilometer data)
- **Regime related deficits**
- **GOP generalization using MAP D-Phase**
- **Error structures in the hydrological cycle**
 - multivariate analysis, lagged correlation, ensemble members
- **Boundary layer evolution and diurnal cycle**
 - DWD testsuite analysis concerning different turbulent length scales
- **Cloud Microphysics**
 - frozen hydrometeor representation, 2-moment scheme
- **WP3.3 radiation interaction**
- **WP3.4 Evaluation of ensembles**
 - spread equals skill? - in a multivariate perspective!

Bott

VERIPREG

DAQUA

Kottmeier et al.



Discussion items

- **Assimilation of boundary layer temperature profiles using swiss microwave radiometers**
- **Water vapour and its impact on clouds and precipitation**
 - COSMO-DE vs COSMO-EU, advection or evaporation
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