2nd COPS (Convective and Orographically-induced Precipitation Study) Workshop

A field experiment within the Priority Program 1167 PQP

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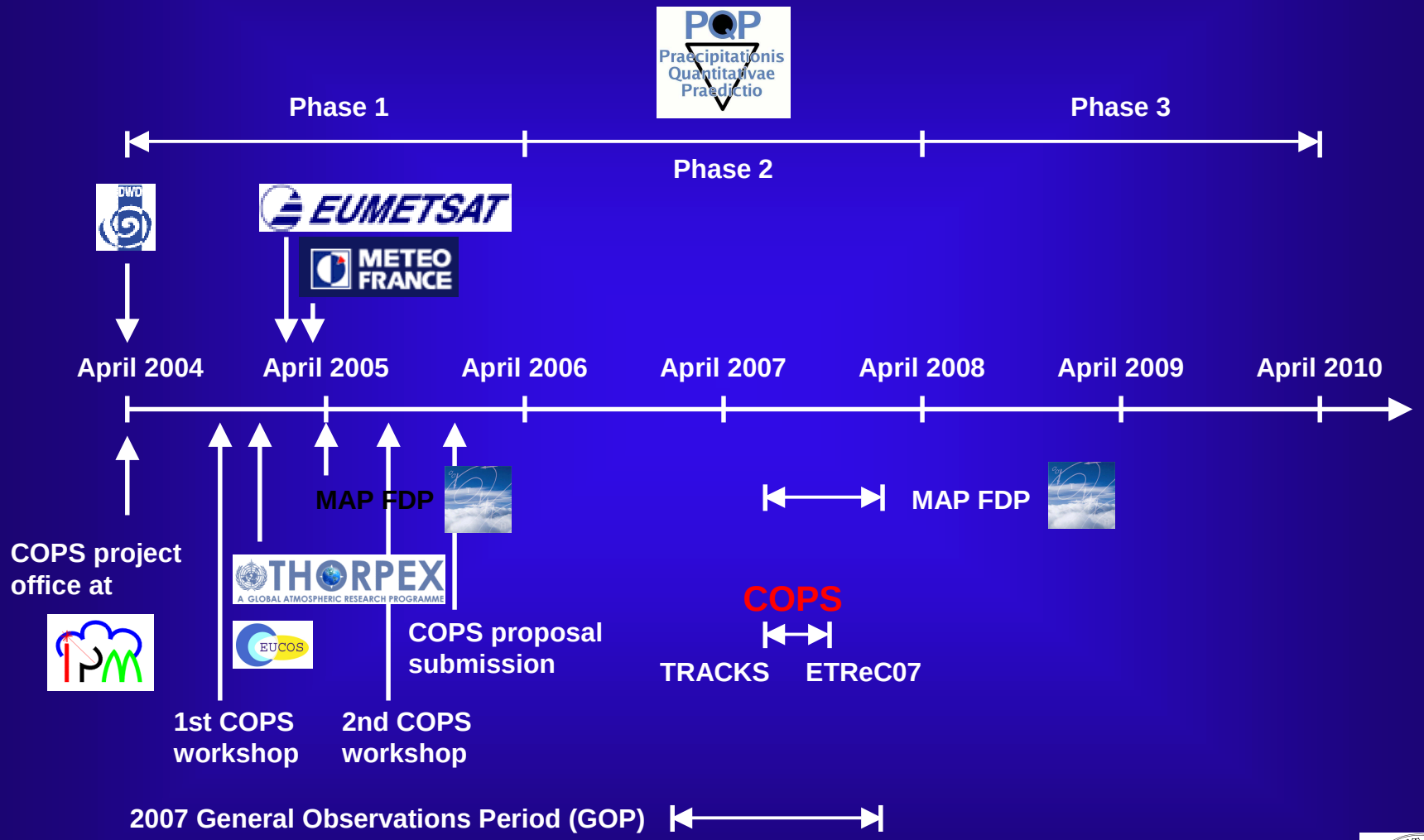
Goal of this workshop:

Preparation of the Science Overview Document and joint DFG proposals for submission in November 2005

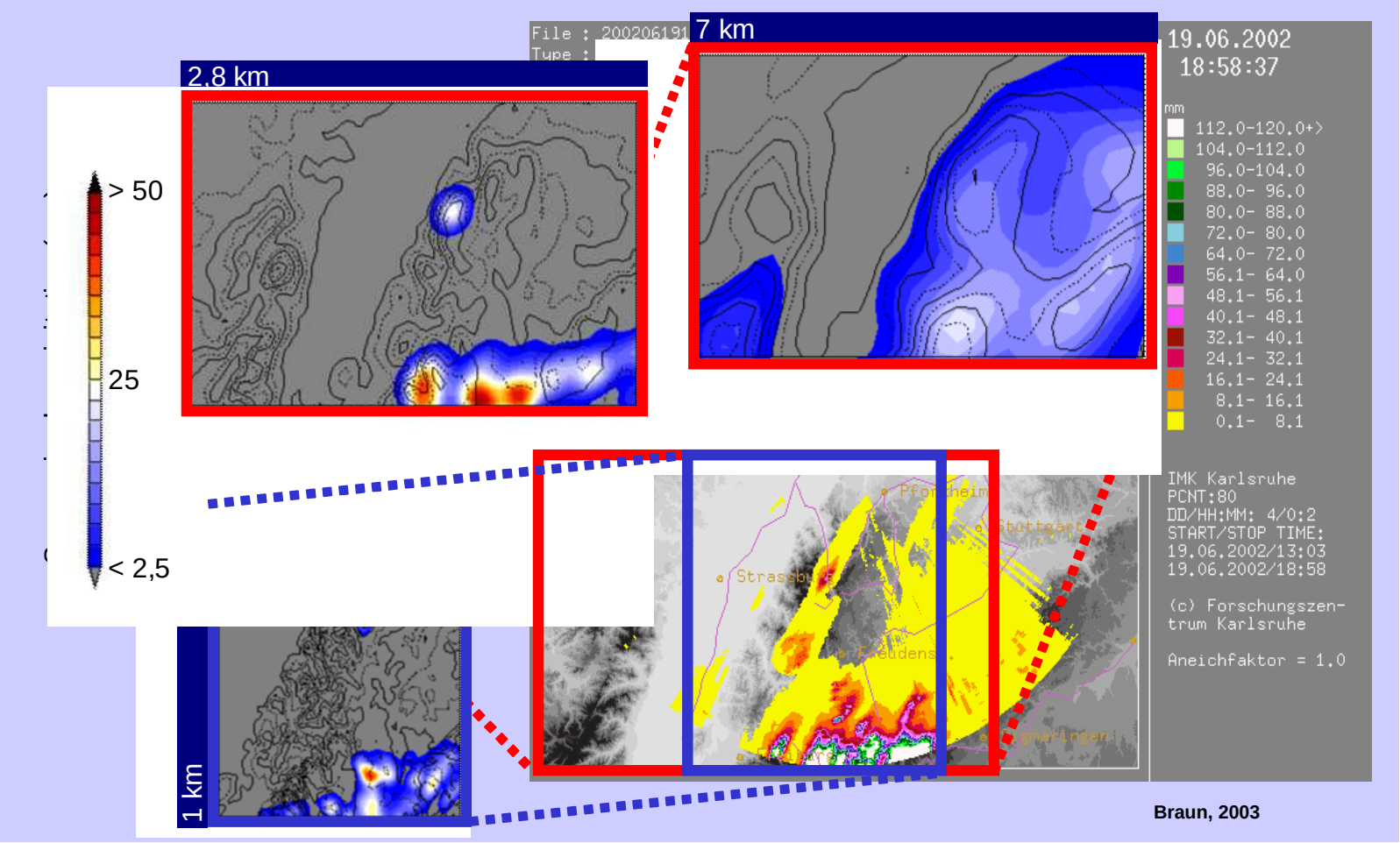
Advances and support of COPS



Devil‘s Advocate Statement #1:

D: QPF skill is continuously improving with the advance of model resolution. We should wait for the analysis of skill scores of upcoming high-resolution models.

L: QPF skill is mainly limited by inadequate representations of key processes in models. *The process understanding has to be improved.* Analysis of high-resolution models will show that significant systematic errors remain.



LM simulation, June 19, 2002, using different resolutions as well as with and without convection parameterization. Courtesy of Braun and Kottmeier, FZK.

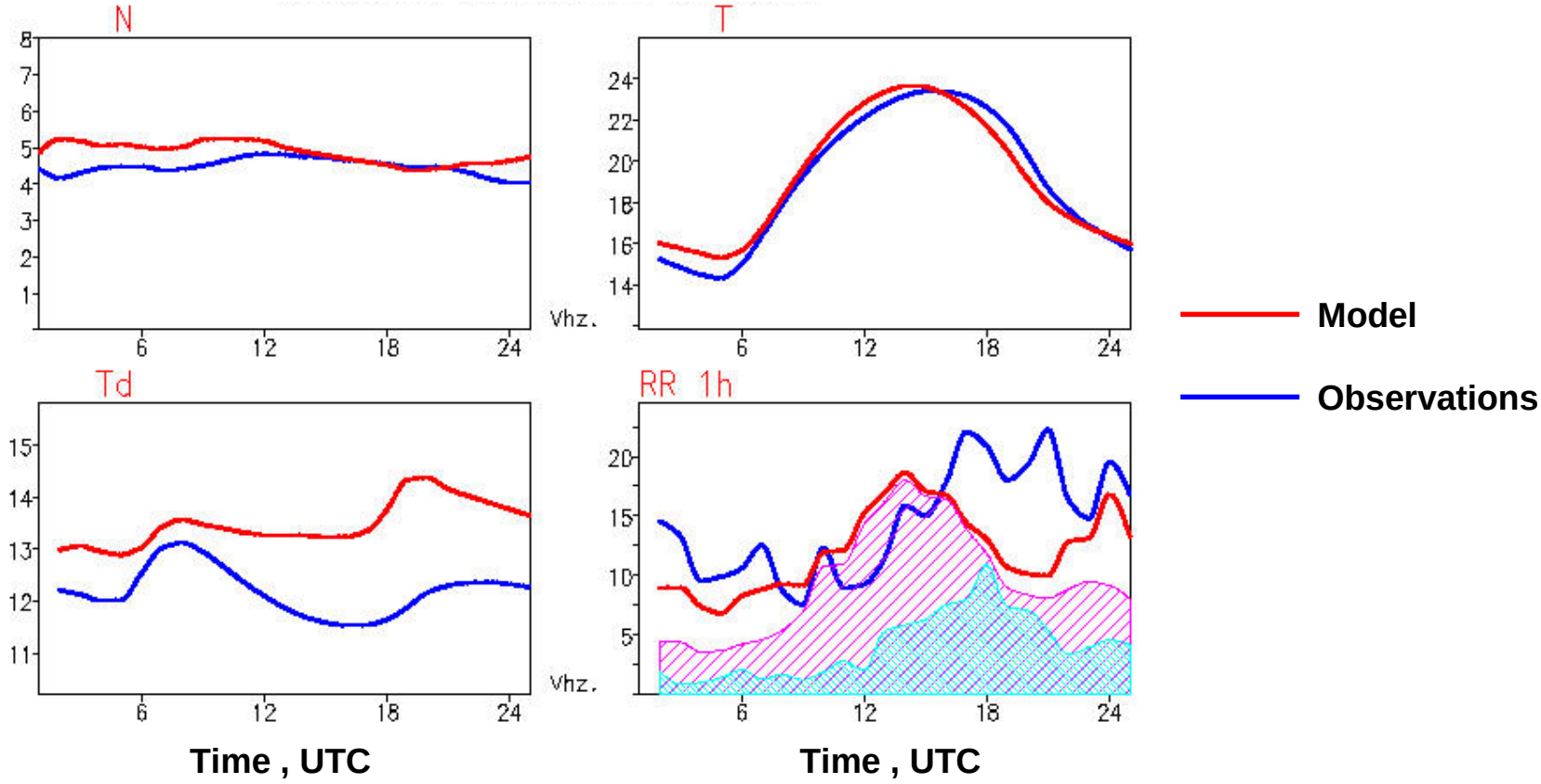
Increase of resolution and shutdown of convection parameterization do *not* necessarily improve model performance.

Devil‘s Advocate Statement #2:

D: Before setting out to improve QPF, we need an analysis of the specific failures of current models.

L: Several data sets have already been analyzed, problems have been identified (session 1 and talk of Andreas Behrendt). This work will be extended and summarized for the preparation of the proposal.

Diurnal cycle of precipitation averaged between 03.07.-29.07.2003 and 6.5-15E, 47.3-54N



Courtesy of U. Damrath, DWD, Bechthold et al. QJRMS 2004, among others

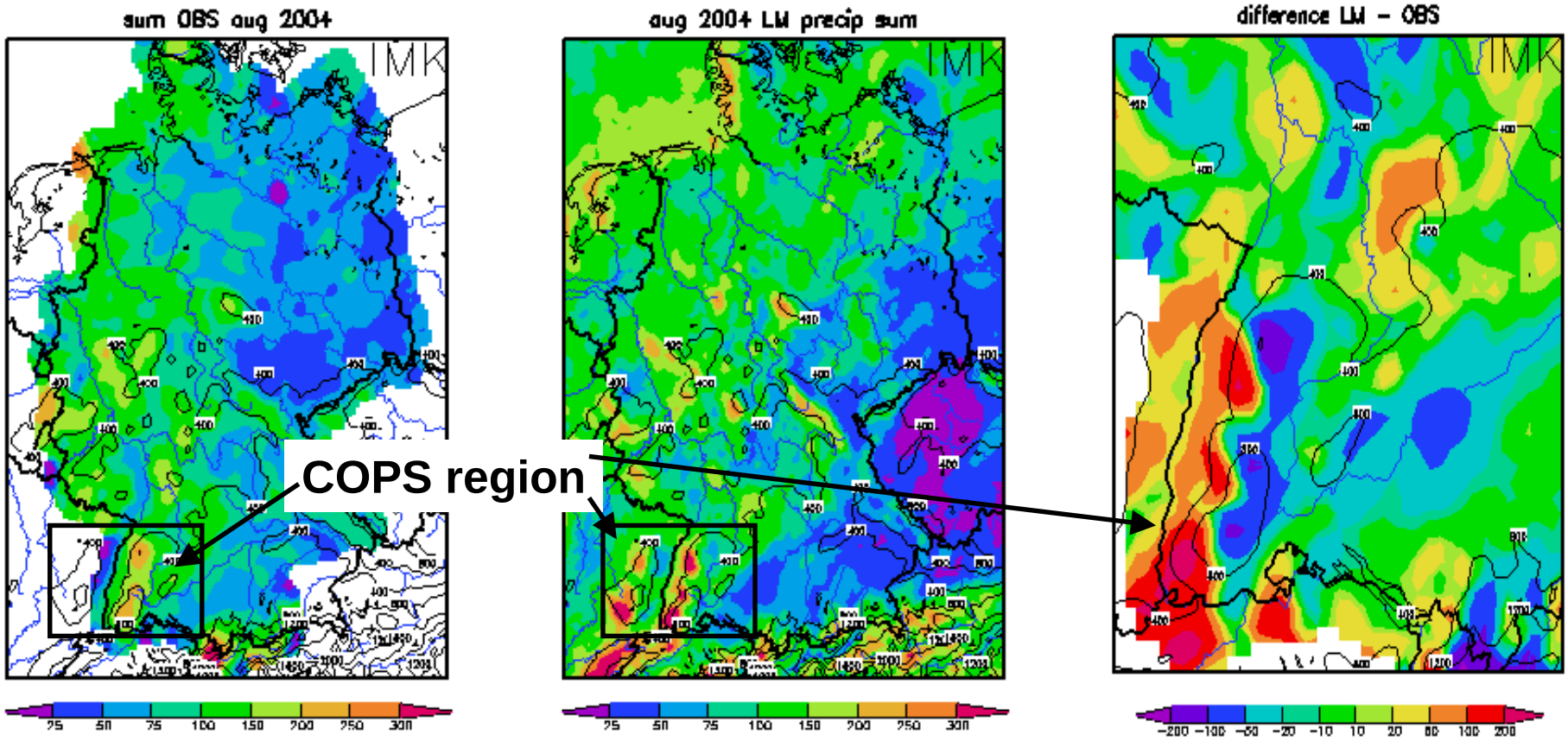
Systematic deviations in diurnal cycle of precipitation and of boundary layer variables are evident.

Devil's Advocate Statement #3:

D: You do not provide specific examples of which parameter-izations, e.g., cloud microphysics, are problematic and how the observing systems respond to the key challenges.

L: Many sensitivity analyses have been performed and published (session1). Priorities and instrumental design will be developed at this workshop (session 3).

LM performance in August 2004 using prognostic precipitation



Left: observations, middle: LM forecast, right: difference. Courtesy of L. Gantner, FZK, see also v. Lipzip et al. 2005

Hypothesis: Luv/Lee problem due to inadequate convection parameterization

Devil‘s Advocate Statement #4:

D: It is unclear what was learned from recent field campaigns with similar topics and what COPS would do that goes beyond them.

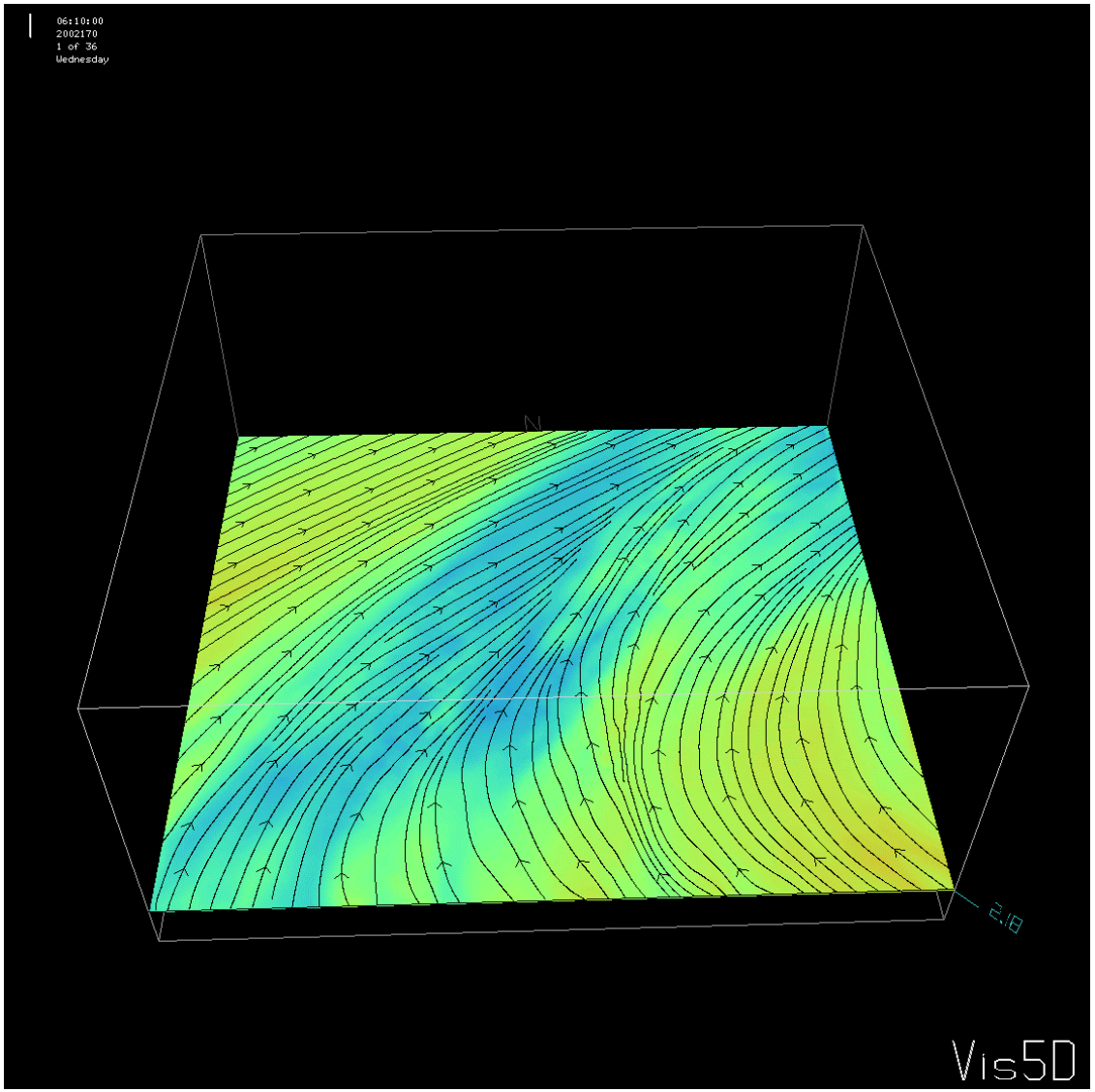
L: Previous field campaigns have been thoroughly studied (session 2). Conclusions and previous experience will be a major driver of our proposal.

Devil‘s Advocate Statement #5:

D: You are lacking a clear background on new dynamic and thermodynamic theories that can be verified using COPS data.

L: Key science hypotheses have been developed based on first high-resolution model runs in the COPS area, theoretical studies, and previous observations. They will be refined and specified at this workshop (session 3 and day 2).

Brand-new 1-km MM5 run of Vertikator case of June 19, 2002



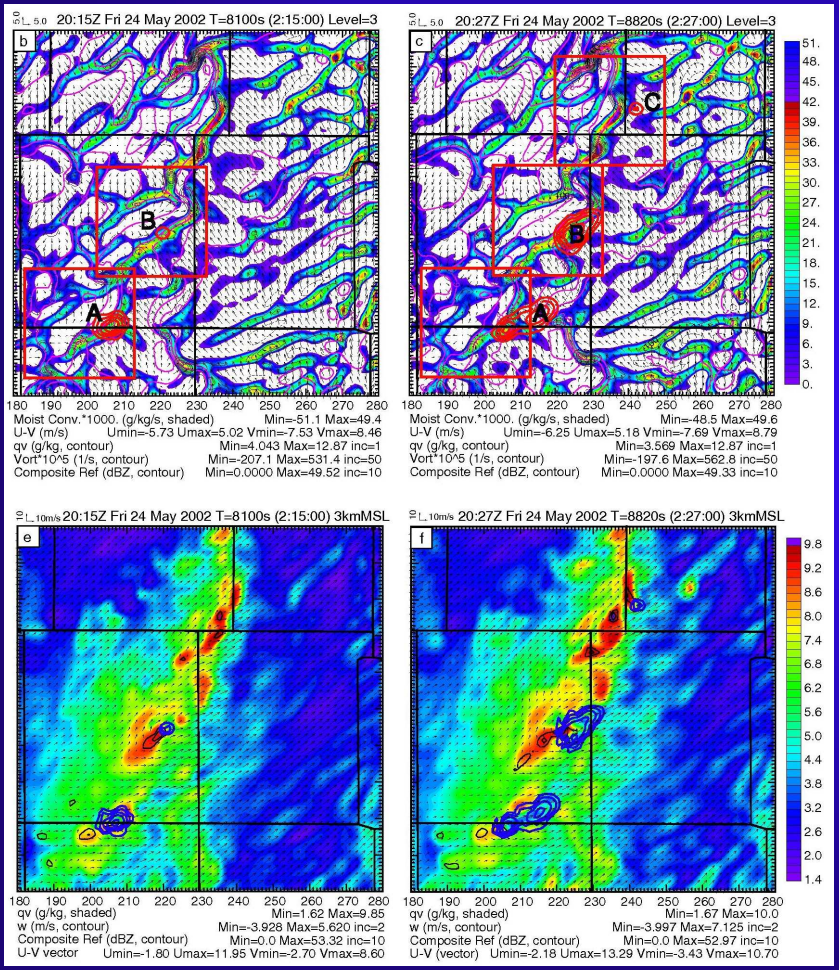
Hans-Stefan Bauer, IPM, 2005

Devil‘s Advocate Statement #6:

D: The strategies and the value of data assimilation for reaching the COPS goals are unclear.

L: Data assimilation is the key for using COPS data for process studies and studies on predictability.
Corresponding strategies will be a major subject of this workshop and of the proposals (session 3).

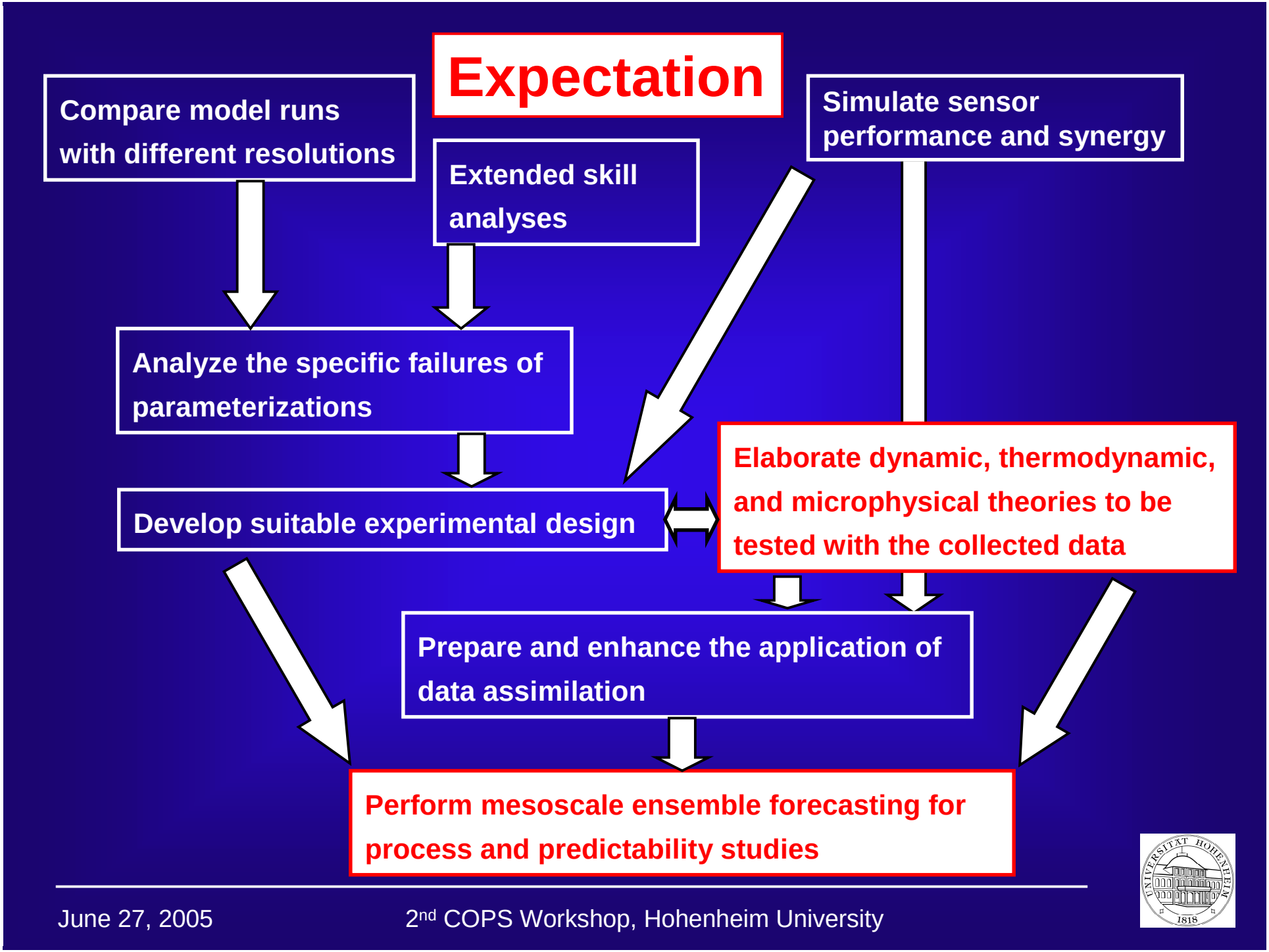
High-resolution data assimilation and process study (Xue and Martin MWR 2005, accepted)



- Initiation of convection study
- Nudging using extended IHOP_2002 data set (surface and in-situ observations)
- Nested ARPS model (1 km / 3 km) driven by ETA analysis
- Validation using high-resolution radar data
- Investigation of moisture convergence and stability

COPS Science Hypotheses

- Detailed knowledge of the large-scale conditions is a prerequisite for improving QPF in orographic terrain ⇒ THORPEX
- Better understanding and high-resolution modeling of the orographic controls of convection is essential ⇒ MAP FDP
- Initiation of convection depends mainly on the structure of the humidity field in the planetary boundary layer.
- Continental and maritime aerosol type clouds develop differently over mountainous terrain, but ice formation and precipitation from convective clouds do not depend on measurable aerosol properties ⇒ TRACKS, SFB 641
- Novel instrumentation during COPS can be designed so that parameterizations of sub-grid processes in complex terrain can be improved.
- Real-time data assimilation of key prognostic variables such as water vapor and dynamics is routinely possible and leads to a significant better short-range QPF ⇒ MAP FDP


Expectation
Compare model runs with different resolutions
Extended skill analyses
Simulate sensor performance and synergy
Analyze the specific failures of parameterizations
Develop suitable experimental design
Elaborate dynamic, thermodynamic, and microphysical theories to be tested with the collected data
Prepare and enhance the application of data assimilation
Perform mesoscale ensemble forecasting for process and predictability studies