1st COPS Workshop, Stuttgart-Hohenheim, 13 – 14 September 2004

Working group on "Precipitation processes and life cycle"

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Despite considerable improvement in the quality of numerical weather forecast in the recent years, no or only inadequate progress has been achieved in the quantitative precipitation forecast. Precipitation observed at the surface is the result of a long chain of complex processes. When considering precipitation processes it is obvious that also the history of the processes leading to the cloud formation have to be considered also.

The focus will be laid on the wide variety of convective precipitation systems. Initiation and life cycle will be different for the following list of convective precipitation systems:

- post-frontal rain showers,
- single cell thunderstorms,
- multi- and super cell thunderstorms,
- convection along cold fronts,
- squall lines, and other mesoscale convective systems.

Key scientific questions:

- Can we forecast what kind of convective organisation will develop?
- What time-scales are relevant for forecasts using radar-extrapolation and NWP?
- How important is orography if a cell has already formed? Does this depend on environment conditions?
- Is LM-K able to simulate the life cycle of a single cell?
- Will we be able to observe all kinds of convective organisation during COPS?
- How strong do cirrus clouds prevent or delay the development of deep convection?

Hypotheses:

- The Rhine valley modulates the development of deep convection by ascending (luv-side) and descending (lee-side) flow.
- The complete life cycle of single cells can be observed in the COPS area; whereas other deep convection systems like multi- or super cells are initiated in France and advected into the COPS area.
- Points or lines for the initiation of convection exist in the Rhine valley or along the Vosges Mountains or the Black Forest.
- Orographic forcing is not relevant for post-frontal showers.
- Super cells and other large mesoscale convective systems are not modified by the Black Forest.

Required instrumentation:

- High resolution 4-D radar observations with DWD radars (Frankfurt, Türkheim, Feldberg), MeteoFrance radar at Nancy, MeteoSwiss radar at Albis, IMK radar Karlsruhe and DLR radar POLDIRAD.
- Additional radar observations with mobile systems (DOW or airborne).
- Multiple-Doppler wind fields with operational radars and additional radar systems.
- Hydrometeor identification with polarimetric radar (POLDIRAD).
- Lightning detection system.
- Quantitative rain gauge network.

- Satellite observations: MSG, possible using the rapid-update cycle of the spare MSG satellite.
- Profiles of temperature, humidity and wind in the vicinity of the convective system, i.e. in the airmass which produces the convection.
- Measurements of vertical air velocity.
- Humidity budgets for cloud formation.
- In-situ verification of hydrometeors.

Operational issues:

- Extension of the observation area to the south to cover the inflow through the Belfort Gap (Burgundische Pforte) and to the east to cover the decay of systems developed over the Black Forest.
- DWD should be stronger involved in observations, e.g. RADOLAN radar-gauge adjustment.
- Enhanced observations with DWD, MeteoFrance and MeteoSwiss routine networks.
- What additional networks are available in Baden-Württemberg and France?
- Co-ordination with DFG proposal AQUAradar (S. Crewell).
- Contact to French and Swiss radar operators (M. Hagen).
- Lightning detection systems (T. Hauf).