General Observation Period (GOP) 2007
Concepts and first results

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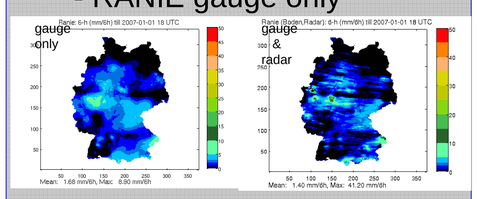
GOP Outline

The main goal of the General Observation Period (GOP) within the German Research Foundation's Priority Program on Quantitative Precipitation Forecasting (SPP-PQP) is to gather a comprehensive data set suitable for testing hypotheses and new modeling techniques developed within the SPP-PQP. The GOP encompasses the Convectively and Orographically induced Precipitation Study COPS performed in south-west Germany in summer 2007 both in time and space to provide information of all kinds of precipitation types and to relate the COPS results to a broader perspective (longer time series and larger spatial domain). The duration of one year will open up the possibility to statistically approach model problems and better pin down specific model weaknesses. The GOP collected as many data about the atmospheric state as possible within an area covering Germany and it neighboring states. Furthermore the GOP optimized the exploitation of existing instrumentation by gathering routine measurements normally not available to the scientific community. Focus has been put on continuous/coordinated observations using existing instrumentations which are suitable for statistical evaluation and on measurements, which are available in near real-time to enable a timely use within the PQP. The GOP group performed a rigorous quality control, cross-checking, and error estimation of the data and tailored the observations to model output (e.g., COSMO-DE, COSMO-EU forecasts. By launching a web site an easy access to data, quicklooks and first order analysis has been enabled. To make the data available to the scientific community the data were archived at the World Data Center for Climate in Hamburg. By developing techniques to bring together observations and model forecasts an optimal evaluation environment has been created.

Data Sets

Rain Gauges (GOP-1)

- DWD rain gauge network:
  - daily sums: ~3000
  - 1 h resolution: ~700
  - 1 min resolution: ~60
- DWD 6-h analyses:
  - RANIE gauge and radar
  - RANIE gauge only



- DWD 24-h analysis:
  - REGNIE
- Berlin high density rain gauge network

Weather Radar (GOP-2)

- DWD network: 16 C-Band
- Polarimetric research radars
  - POLDIRAD (DLR)
  - Hohenpeißenberg (DWD)
- X-Band radar (UBonn)
- C-Band radar (FZ Karlsruhe)
- RMI radar Wideumont
- DWD international composit
- DWD national composit
- DWD online calibrated radar precipitation (RADOLAN)

DSD (GOP-3)

- Micro rain radar
- Parsival
- Joss/Waldvogel
- Optical disdrometers

Lidar (GOP-4)

- Earlinet (Hamburg,Leipzig, Garmisch, München)
- DWD ceilometer network (> 100 stations in Germany)
- several ceilometer stations operated by universities/ research institutes

GPS (GOP-5)

GPS network for integrated water vapor measurements

Lightning (GOP-6)

Lightning for cloud-to-ground and in cloud discharges LINET and SAFIR

MetStat (GOP-8)

- Cloudnet stations
- Meteorological stations
- ARM mobile facility
- COPS stations

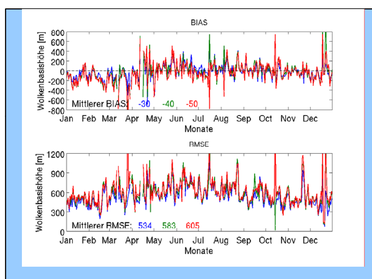
Satellite (GOP-7)

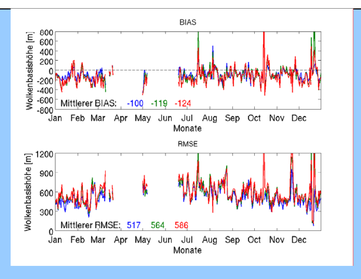
MSG:
- cloud mask
- cloud top pressure
- optical depth
- IR brightness temperature

MODIS:
- cloud mask
- cloud optical thickness **τ**
- liquid water path **LWP**
- effective radius $\mathbf{r_{eff}}$
- geometric cloud thickness **H**
- IWV

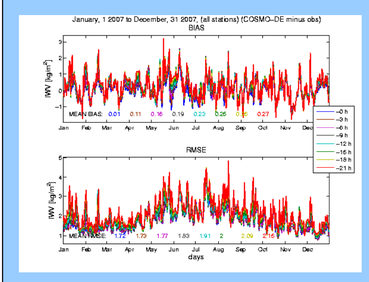
MERIS:
- cloud mask
- cloud optical thickness **τ**
- cloud top pressure

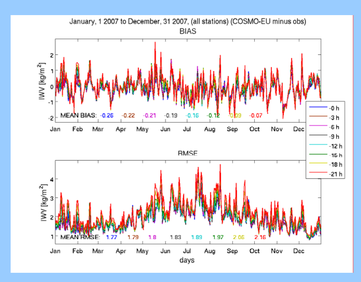
Evaluation



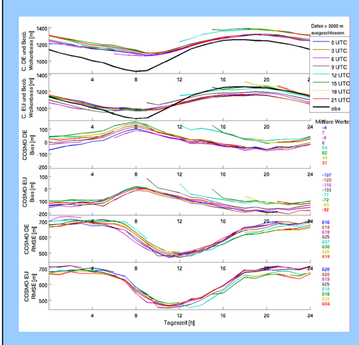


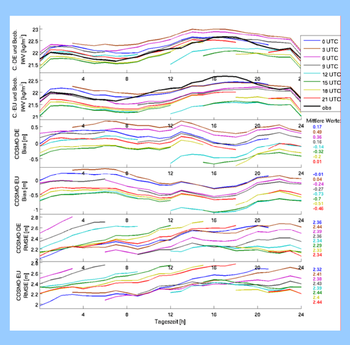
Bias and rmse in cloud base height for model forecasts (red - 21h, green -12h, blue -3h) (COSMO-DE left, COSMO-EU right) to ceilometer measurements for all stations within the model domains over the whole GOP year 2007.



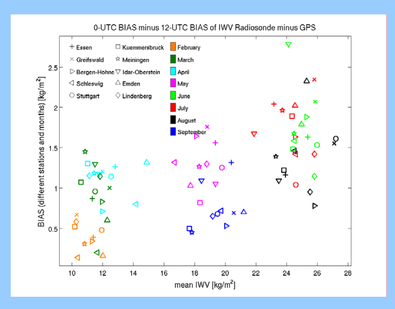


Bias and rmse in integrated water vapor for model forecasts (COSMO-DE left, COSMO-EU right) to gps measurements for all stations within the model domains over the whole GOP year 2007.

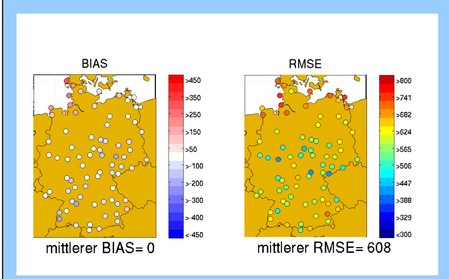




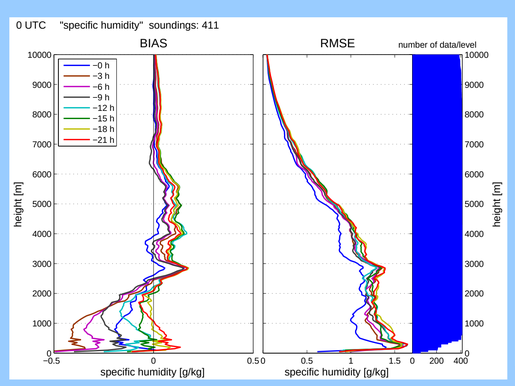
Forecasted and measured cloud base height (left) and intergrated water vapor (right) for the different forecast leas times indicated by the colors.



Mean difference between night-time and day-time IWV bias (radiosonde-gps).



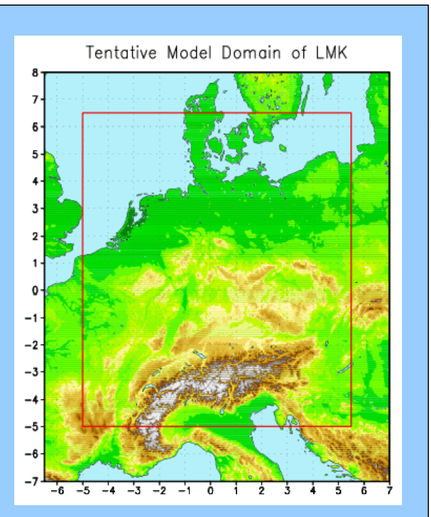
Bias and RMSE in cloud base height derived from ceilometer meauseuments and COSMO-DE model forecasts.

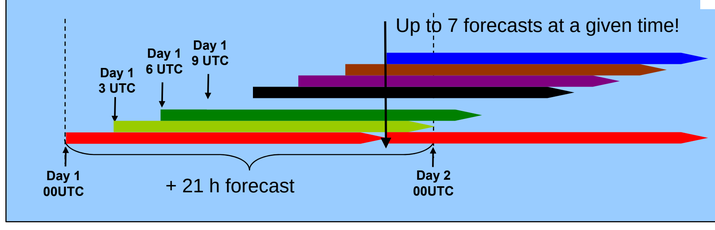


Bias and RMSE in mixing ratio at 00UTC for all radiosondes within the COSMO—DE domain für July 2007. Colors indicate different forecast lead times.

Models

Emphasis on DWD's COSMO-EU (boundary) and the convection-resolving COSMO-DE:
- Grid size: Δx = 2.8 km
  - Timestep: 25 s
- 421 x 461 x 50 gridpoints - Lowest level 10 m above surface
- Centre of model domain: 10 °E, 50 °N
- Forecast time: 21 h
- Started every 3 h





Lagged forecast ensemble

Conclusions

The GOP gathered a large data set of in-situ and remote sensing observations for Central Europe with focus on water cycle. A near realtime model evaluation for the COSMO-EU and COSMO-DE has been implemented. First analysis revealed:

- both models overestimate precipitation by 20% (not shown) during winter times
- integrated water vapor shows a significant diurnal cycle related to the daytime dry bias of radiosondes
- modeled cloud base height is significantly higher during day times due to assimilated dry biased radiosondes
- high Bias in cloud base at North Sea stations indicate problem with different boundary layer above
- data status and near-realtime evaluation results can be found at http://gop.meteo.uni-koeln.de

Outlook: The GOP is an ongoing project. Current investigation focus on evaluation of the models performance with satellite products like MSG or AMSU.

Crewell, S., M. Mech, T. Reinhardt, C. Selbach, H.-D. Betz, E. Brocard, G. Dick, E. O'Connor, J. Fischer, T. Hanisch, T. Hauf, A. Hünerbein, L. Delobbe, A. Mathes, G. Peters, H. Wernli, M. Wiegner and V. Wulfmeyer, 2008: General Observation Period 2007: Concept and first results. Met. Z. accepted