IMG Wien

Reliability of precipitation measurements

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Introduction

One of the major interests when investigating convective events is the amount of precipitation reaching the ground. For this purpose, a couple of independent precipitation measurement systems have been operated during COPS. Several of these data sources are compared to gain insight into the uncertainties of the "true" rainfall field.
In Figure 1, the area of investigation in the surroundings of Supersite S (near Deckenpfronn, at point 1/-1) is displayed. The black line indicates the "supersite S catchment area" with an extension of 77km², the red numbers are indicating grid points used for investigations.

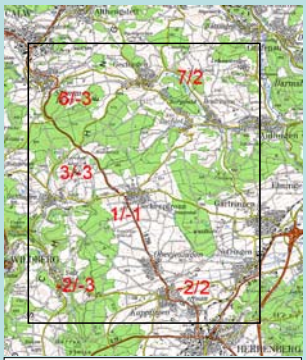


Fig. 1: supersite S and the area of investigation

Data sources

Ground measurements:
- ✓ GTS-data for Central Europe
- ✓ nonGTS-data for Europe, collected within the project MAP D-Phase - talk of T. Gorgas (Session 7, 9.15-9.30)
- ✓ pluviograph (PLUVIO) data from COPS, provided by Bodo Ahrens (University of Frankfurt)
- ✓ HOBO–meso-network from COPS (University of Vienna)

For comparing the different data sources, all data have been interpolated to a regular 1km grid with the VERA interpolation method.

Radar data:
- ✓ Karlsruhe: data from data archive in Hamburg (cops_radk_cband_sripic_p)
- ✓ DOW data from DLR, provided by Martin Hagen

Precipitation during IOP 10 (23 07 2007) 12-18 UTC

The precipitation distribution due to a cold front, approaching from the west during this IOP, was analysed using several ground measurement networks, displayed in Figures 2 - 5. From these analyses, a mean areal precipitation for the supersite S catchment area has been calculated.

GTS nonGTS

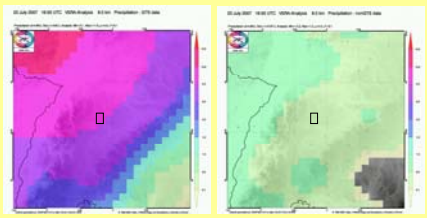


Fig. 2 + 3: 6 hourly precipitation sum for July, 2007 12-18 UTC using GTS-data/ nonGTS-data. Supersite S catchment is marked by the black rectangle.

HOBO PLUVIO

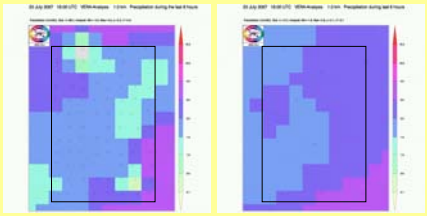


Fig. 4 + 5: Same as in Fig.2, but with mesonet data (HOBO/PLUVIO) for the supersite S catchment area.

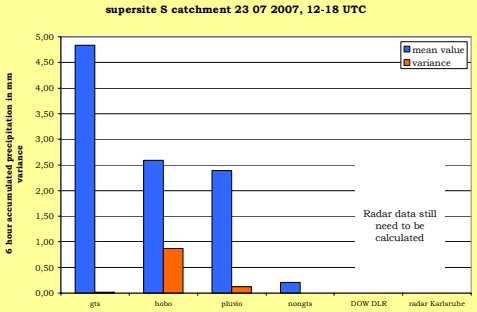
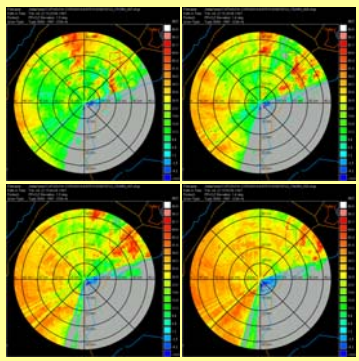
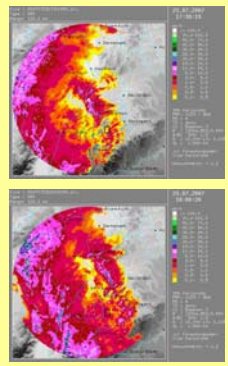


Fig. 6: Mean areal precipitation for July 23, 2007 12-18 UTC for the supersite S catchment area. Due to the low station density in the GTS analysis, large scale gradients (see Fig. 2) lead to the high amount of areal precipitation. The two meso-networks agree quite well. The denser HOBO-network results in a higher analysis variance.





Data from the mobile radar (DOW – left side) as well as radar data from Karlsruhe (right) show the passage of a convective cell at ~15.30 UTC over the south-eastern part of the catchment area. This can be detected in the meso-network analyses, too. Further investigations will deal with the quantitative comparison of the remote sensing and in situ data sources.

Total amount of precipitation

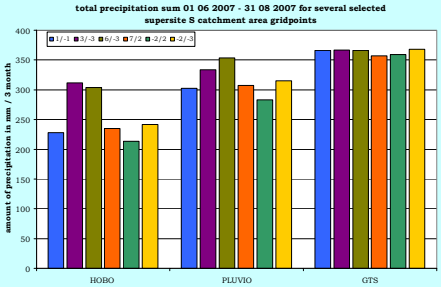


Fig. 6: Explanation see text.

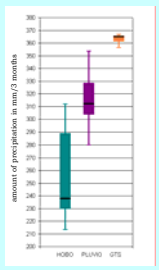


Fig. 7: Boxplot for the grid points of Figure 6.

For each grid point within the catchment area, the total amount of precipitation during COPS (01 06 2007 – 31 08 2007) has been calculated for HOBO data, PLUVIO data and GTS data.
Figure 6 (leftmost) shows the accumulated precipitation for arbitrarily selected grid points (see Fig. 1) out of the 96 catchments grid points. Comparing the two meso-networks, pattern are quite similar, but the PLUVIO amounts are ~20% higher on average. Of course, the small scale features detected by the meso-networks cannot be resolved by the analyses using the much coarser GTS data set. GTS amounts are higher, but there is rather no variance in the data at all (see Figure 7).
Furthermore it is interesting to see that even on these small distances (only several kilometres), there are large differences in the amount of precipitation. This leads to the conclusion that with just one measurement available within the catchment to estimate the catchments mean areal precipitation, one has to take into account a standard deviation of 20% of the mean value for this single value.

Outlook: The main goal of this investigation is a statement about the accuracy of precipitation measurements in a small catchment. For this purpose, radar data will be implemented, in order to gain additional information. Afterwards, model results will be investigated, taking into account the new defined analysis uncertainty when making statements about the model performance. A second field of interest is the combination of GTS ground measurements and radar data for downscaling precipitation (Schneider and Steinacker (2008), MAP, accepted), using the mesonetwork data for verification.

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