Excursion to the Ahr valley, PrePEP-Conference 2025, Bonn, Wed. 19.3.2025

Altenahr gauge - Hydrological and meteorological data of the flood event in July 2021

Figure 1: Topographical map of the Ahr catchment area
https://upload.wikimedia.org/wikipedia/commons/thumb/2/27/Topografische_Karte_der_Ahr.PNG/1200px-Topografische_Karte_der_Ahr.PNG

Table 1: Gauges in the Ahr catchment area

Pegel	CA [km²]
Neuhof/Ahr (NRW)	124
Müsch/Ahr	353
Kirmutscheid/Trierbach	88
Niederadenau/Adenauer Bach	57
Denn/Kesselinger Bach	95
Kreuzberg/Sahrbach	46
Altenahr	**747**
Bad Bodendorf	861

Ahr catchment	897,5 km²

Altenahr Gauge

Start of operation:	01.11.1991
Current measurement systems:	Master sensor 10: Pressure probe in the shaft Redundancy sensor 18: Pneumatic bubble sensor in the shaft. The pneumatic bubble sensor is an indirect measuring method. It determines the water level very accurately from the difference between the air pressure and the prevailing line pressure.
Operator:	Struktur und Genehmigungsdirektion Nord Regionalstelle Wasserwirtschaft, Abfallwirtschaft, Bodenschutz Koblenz
Distance to the river mouth:	31,7 km
Catchment area:	747,97 km²
Gauge zero point:	160,522 m ASL
Predecessor gauge:	Reimerzhoven (catchment area: 754,5 km², Distance to the river mouth: 27,15 km)

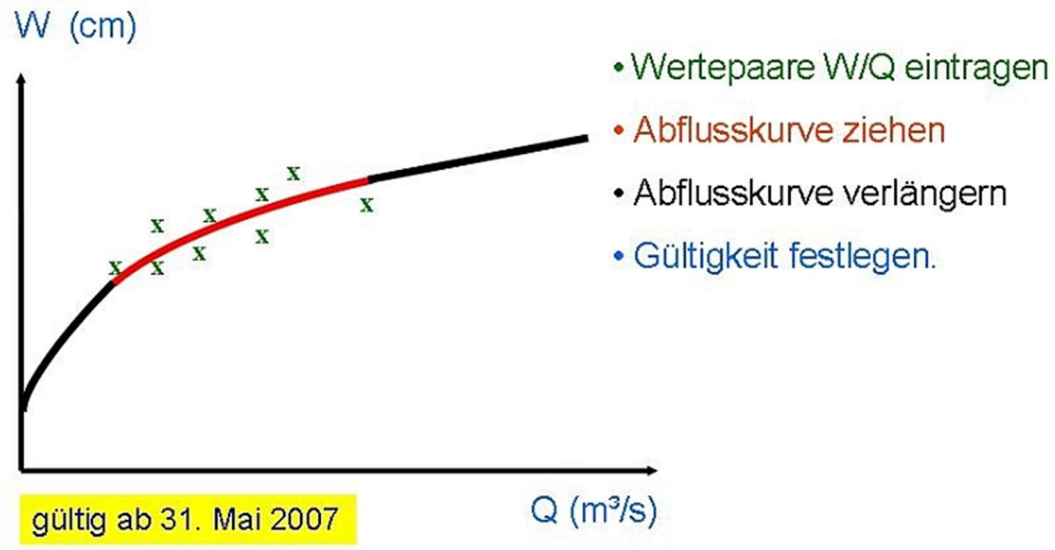

Figure 2: Development of a discharge curve

Source: https://www.lfu.bayern.de/wasser/wasserstand_abfluss/abflusskurve/index.htm

Figure 3: The Altenahr gauge before the flood in July 2021 (top) and a few days after the flood (middle and bottom) ©SGD Nord

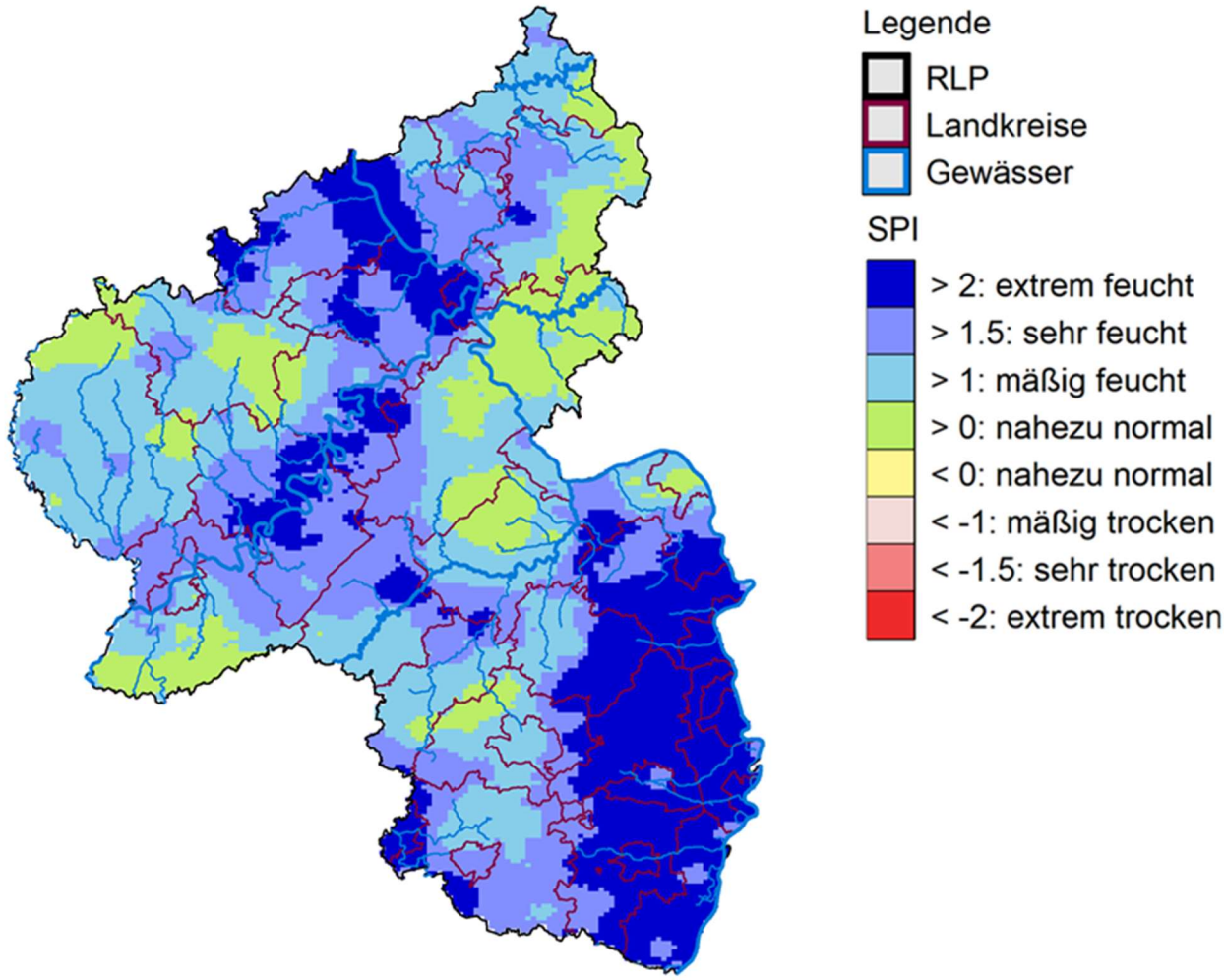

Figure 4: Standardized precipitation index SPI for the period 14.06. 07:00 to 14.07. 07:00 CET in Rhineland-Palatinate (database: REGNIE, DWD: reference period 1951 to 2020).

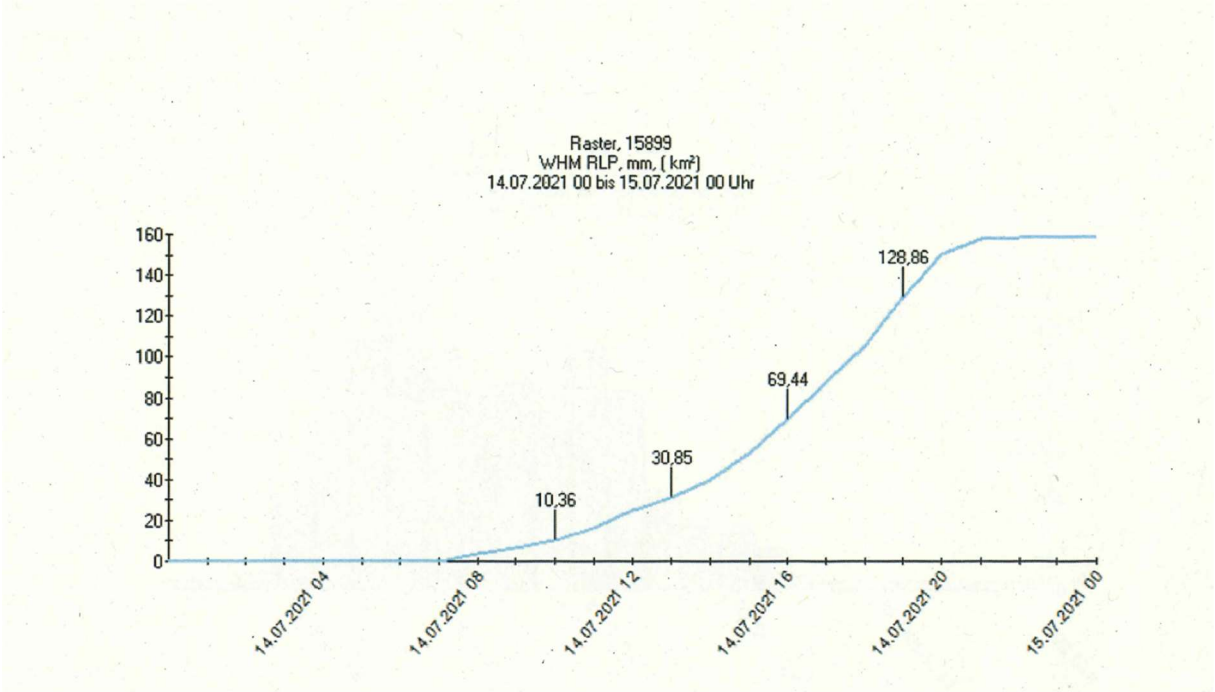

Figure 5: Precipitation total line (mm) at the Bad Münstereifel-Eicherscheid station (North Rhine-Westphalia) for the period 14.07. 00 h to 15.07.2021 00 h CET

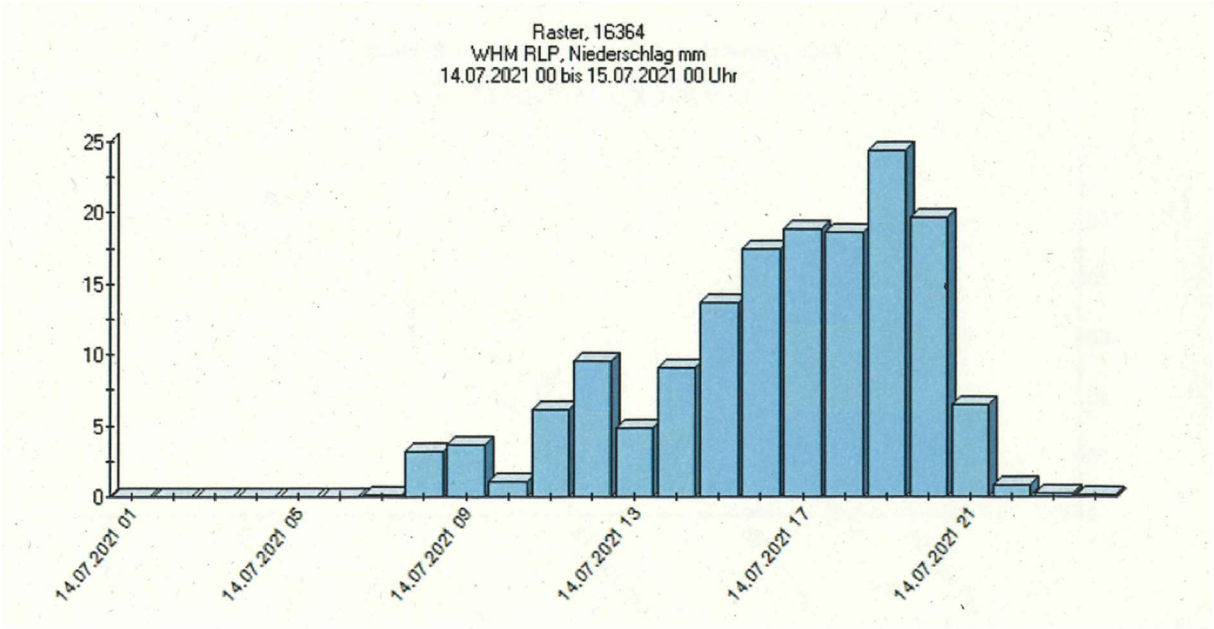

Figure 6: Hourly sums of the areal precipitation (mm) for the Ahr catchment area for the period 14.07. 00 h to 15.07.2021 00 h CET (data basis: InterMet)

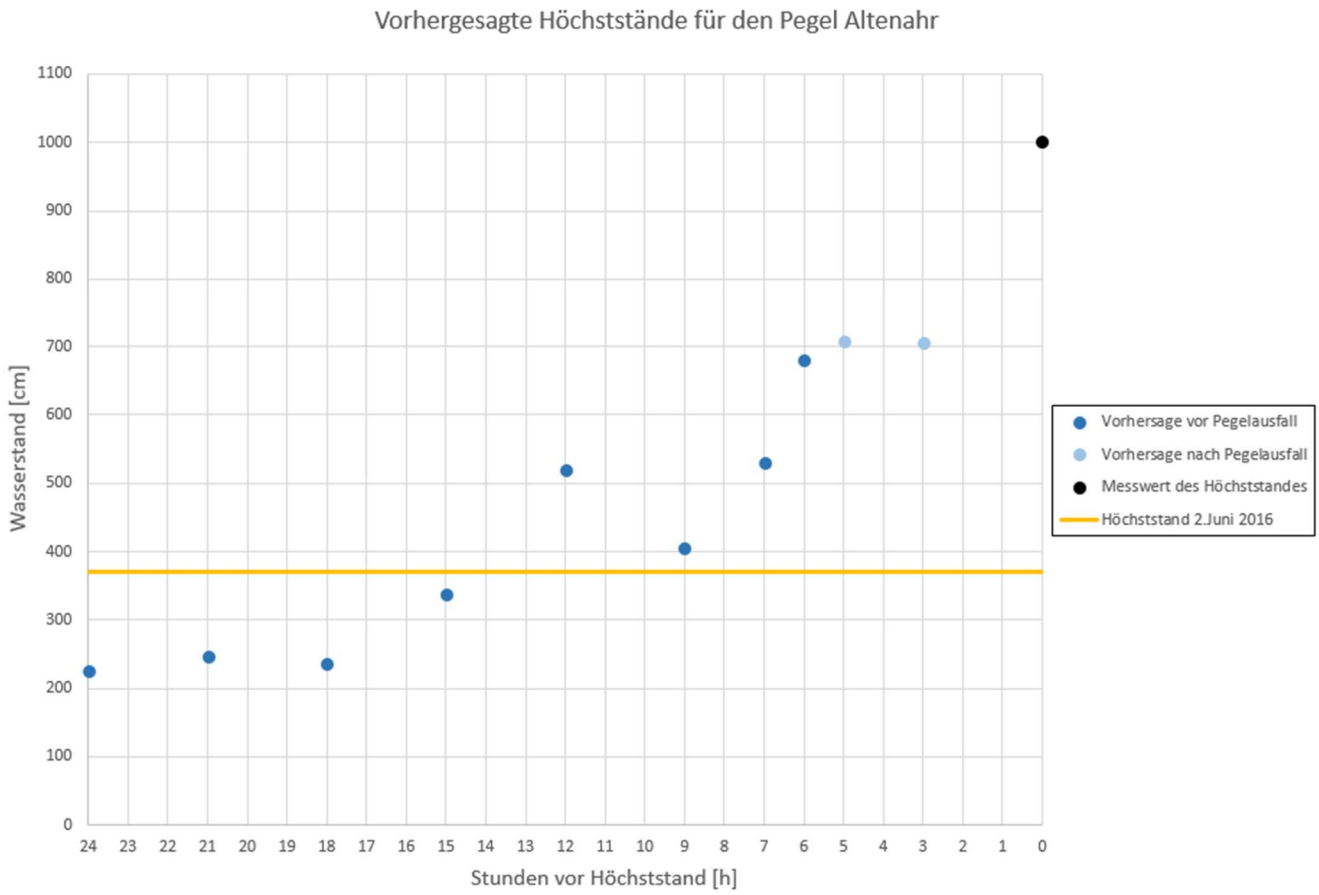

Figure 7: Predicted maximum water levels for the Altenahr gauge for forecast times before the measured maximum water level ("measured" maximum water level reconstructed).
Source: https://www.hochwasser.rlp.de/static/shared/documents/Hochwasser_im_Juli2021.pdf

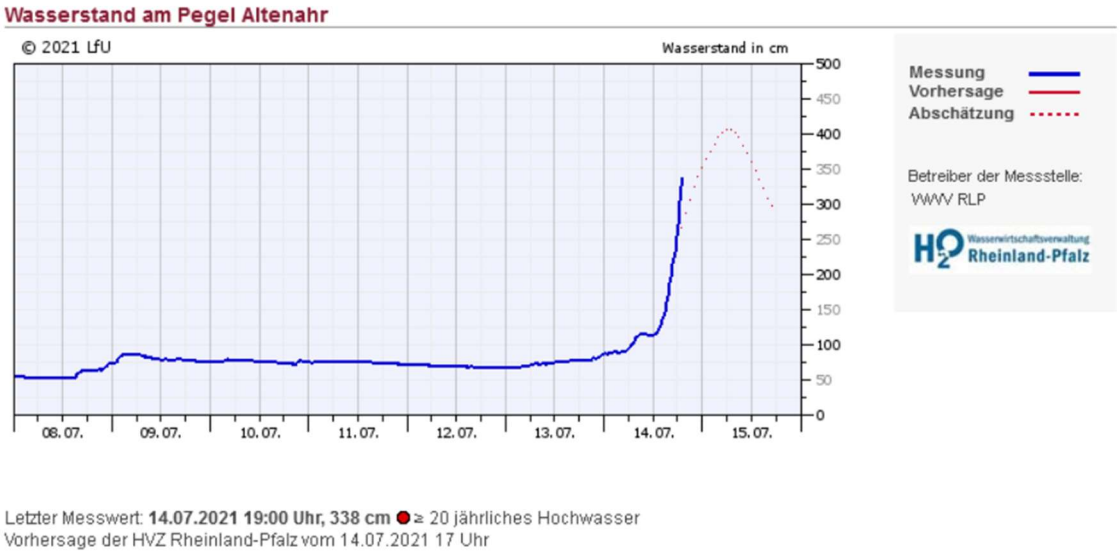

Figure 8: Illustration of the water level measurements and forecasts on www.hochwasser-rlp.de; forecast time 17:00 CEST; publication time 18:25 CEST.
Source: https://www.hochwasser.rlp.de/static/shared/documents/Hochwasser_im_Juli2021.pdf

Table 2: Areal precipitation in the control areas of gauging stations in the Ahr basin during the period 14/07/2021 06:00 to 23:00 CEST based on different products of precipitation record. Long-period monthly mean for July: 69 mm (*processed online)

Gauging station control area	**InterMet LfU-RLP* [mm]**	**RADOLAN-RL-DWD [mm]**	**Radar-ITWH-Ahr [mm]**	**Uni Stuttgart-PWS [mm]**	**Radar-Uni-Bonn [mm]**
Müsch	114*	121	115	127	134
Kirmutscheid	101*	100	94	105	116
Niederadenau	92*	94	87	115	105
Denn	84*	82	84	104	93
Kreuzberg	137*	144	149	159	169
Altenahr	121*	131	131	153	149
Bad-Bodendorf	72*	70	80	77	92
Ahr basin total (08 to 22 CEST)	102*	93*/106	106	119	123
Simulated peak at gauging station Altenahr	509 m³/s	563 m³/s	568 m³/s	801 m³/s	871 m³/s

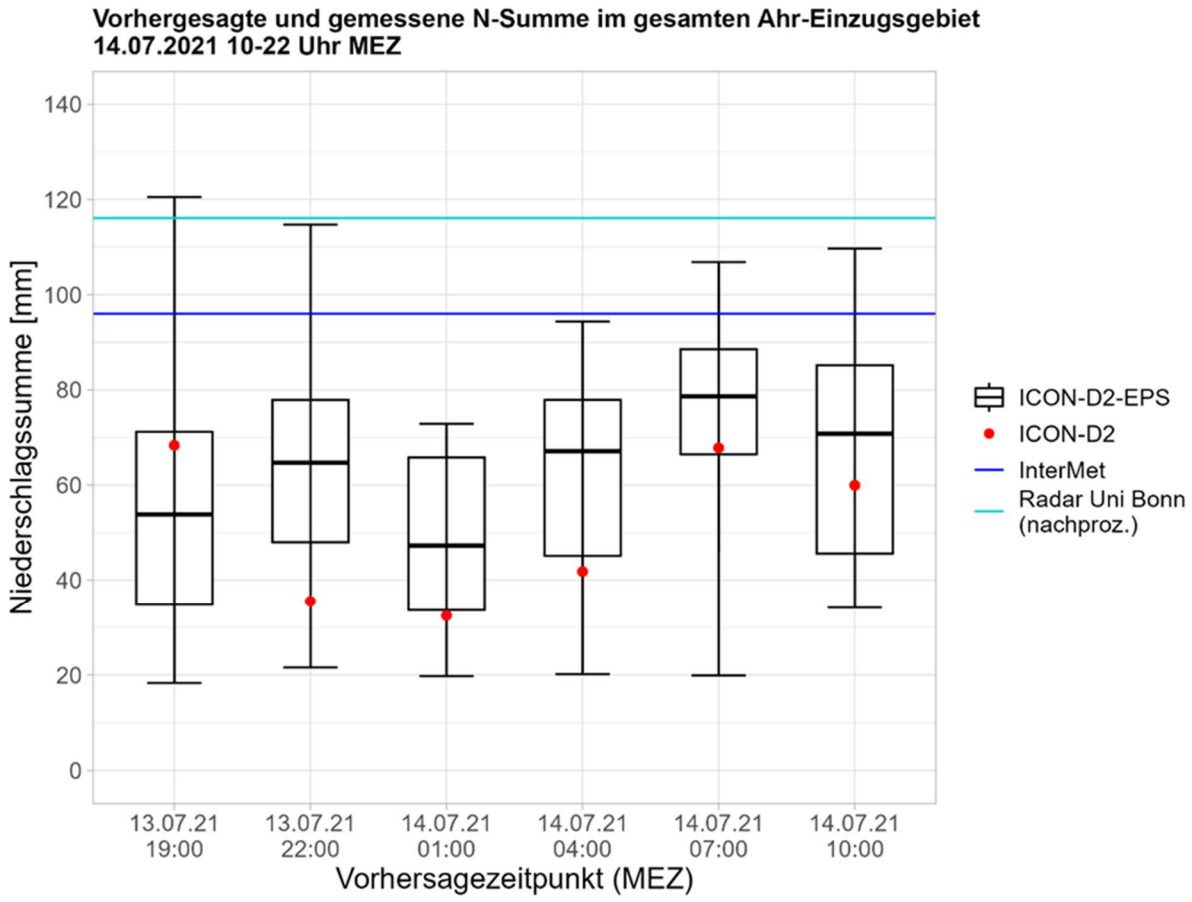

Figure 9: Ranges of the predicted 12h precipitation totals for 14.07. 10:00 to 22:00 CET (area mean) for the Ahr catchment area in the 20 ensemble precipitation forecasts of the DWD (ICON-D2-EPS) at different forecast times; comparison with the ICON-D2 forecast and with measured values (InterMet, Radar Uni. Bonn); (boxplots: minimum, 25% percentile, median, 75% percentile, maximum).

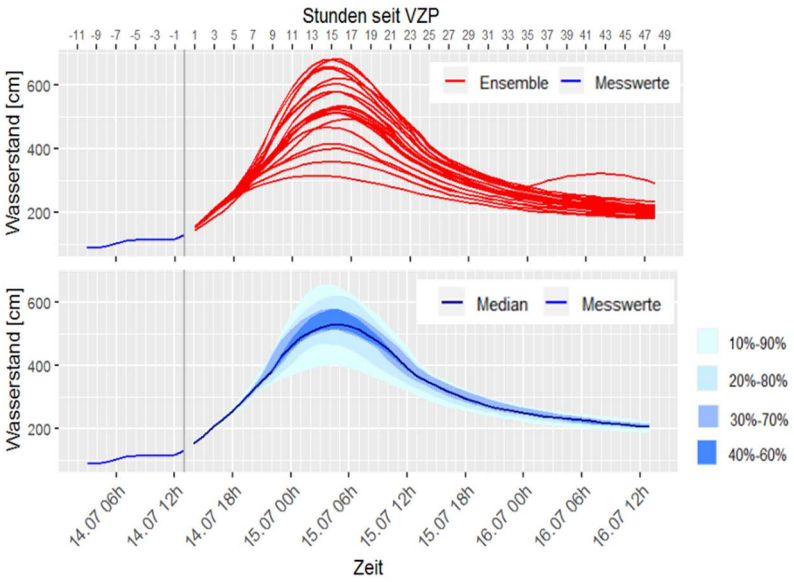

Figure 10: Range of water level forecasts for the Altenahr gauge at the forecast time 14.07. 14:00 CEST using 20 ensemble weather forecasts (ICON-D2-EPS); 20 individual forecasts (top) and quantile representation (bottom).
Source: https://www.hochwasser.rlp.de/static/shared/documents/Hochwasser_im_Juli2021.pdf

Figure 11: Displacement of forest litter in coniferous forest with low slope inclination in the upper reaches of the Bröhlinger Bach © Demuth

Figure 12: Massive depth erosion at the upper reaches of the Bröhlinger Bach © Demuth

Figure 13: At the lower reaches of the Armutsbach creek © Casper

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