Flood events in Austria August 3-7th and 27-29th 2023

Petra Lalk, Korbinian Breinl, Gabriele Müller, Peter Lorenz

Federal Ministry of Agriculture, Forestry, Regions and Water management, Directorate I - Water Management, Vienna, Austria

contact: petra.lalk@bml.gv.at

Introduction

In August 2023, Austria experienced two significant flood events. The first flood event occurred from the 3rd to the 7th of August and primarily affected the southern and southeastern regions of Austria, notably the states of Carinthia, southern Styria, and Burgenland. Additionally, Vorarlberg and the Salzkammergut also suffered from its impact. The second event, which took place from the 27th to the 29th of August, affected the western and southern parts of Austria.

Meteorology

European Flood Awareness System 18th EFAS annual meeting

28-29 September 2023 in Offenbach am Main, hosted at the Germany's National Meteorological Service (DWD)

Emergency

Copernicus Emergency Management Service



Bundesministerium Land- und Forstwirtschaft, Regionen und Wasserwirtschaft

August 3-7th 2023

August 27-28th 2023

An area of low pressure situated over upper Italy, known as a Genoa low, brought in moisture-laden air into Austria from the south. During the night spanning Thursday, August 3rd, to Friday, August 4th, weather patterns, leading to a southwesterly airflow. On Sunday, August 27, 2023, a cold front substantial precipitation occurred, ranging from 50 to well over 100 mm. Significant rainfall amounts followed, and on Monday, August 28, a low-pressure system moved along the southern side of the were particularly observed in Lower Carinthia and in the Karawanken region, as well as in both the western and eastern parts of Styria, along with southern Burgenland.

The Austrian weather service GeoSphere Austria reported precipitation amounts exceeding 130 mm in certain areas. In some parts of Carinthia and Styria, the rainfall within those five days surpassed the typical precipitation for an entire August. For instance, in Bad Eisenkappel, Carinthia, 250 mm of precipitation was recorded in August, considerably surpassing the average August precipitation of 144 mm and even surpassing the previous record for the highest amount of rain ever recorded in a single August.

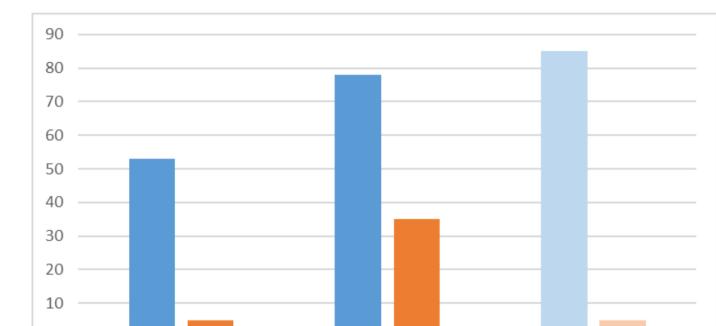
Due to a low-pressure system positioned over the British Isles, Central Europe experienced a shift in Alps, introducing a significant influx of moist air into Austria from the south. This atmospheric setup resulted in substantial precipitation, particularly affecting Vorarlberg, Tyrol, Salzburg, and Carinthia on August 28, accompanied by isolated thunderstorms in some areas.

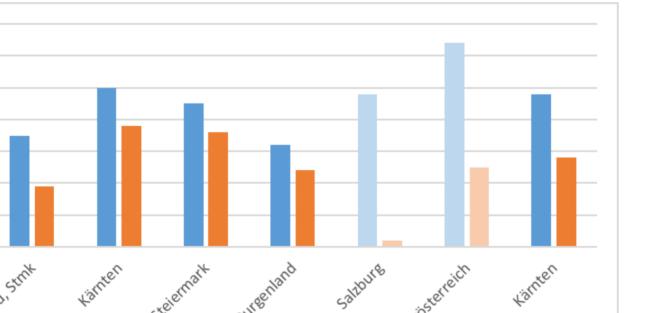
Initially, the heavy precipitation was concentrated in Vorarlberg, Tyrol, and Salzburg's Pinzgau region before gradually advancing eastward. Between August 26th and 29th, Vorarlberg and the province of Salzburg received approximately 60% of the typical long-term average precipitation for an entire August, while Upper Austria received nearly 70%. Notably, some areas experienced exceptionally high rainfall, with measurements of 160 mm in Bad Gastein, Salzburg, 110 mm in Schärding-Rossbach, Upper Austria, and 160 mm at the Dresdner Hütte in Tyrol. These amounts, recorded over four days, thus surpassed or equaled the average precipitation levels for an entire August.

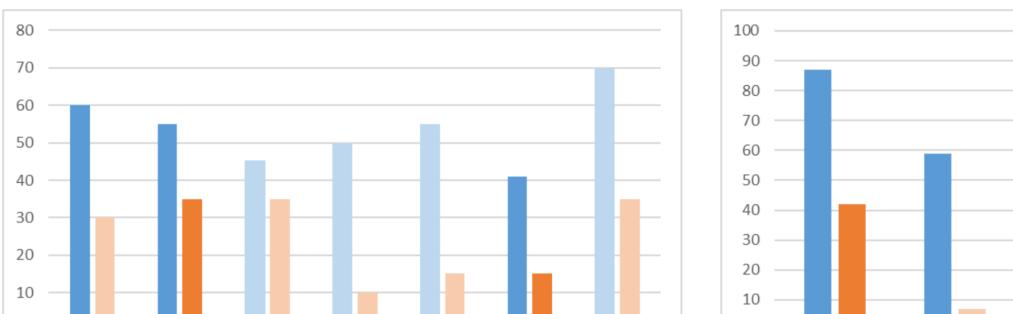
EFAS-Forecast

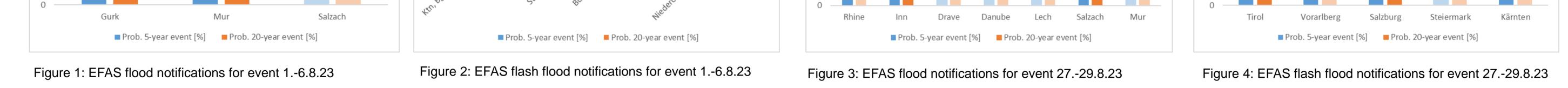
Before the first flood event EFAS provided three EFAS flood notifications (informal) for the rivers Gurk, Mur and Salzach. Also seven flash flood notifications were send out. Figure 1 and 2 show the probabilities [%] to exceed a 5-year return period threshold (blue column) and a 20-year return period Threshold (orange column). Events of a pale column didn't occur in this magnitude.

In advance the second flood event EFAS provided seven flood notifications (formal and informal) and five flash flood notifications. Figure 3 and 4 show the probabilities to exceed a 5-year return period threshold (blue column) and a 20-year return period Threshold (orange column). Events of a pale column didn't occur in this magnitude or at all...







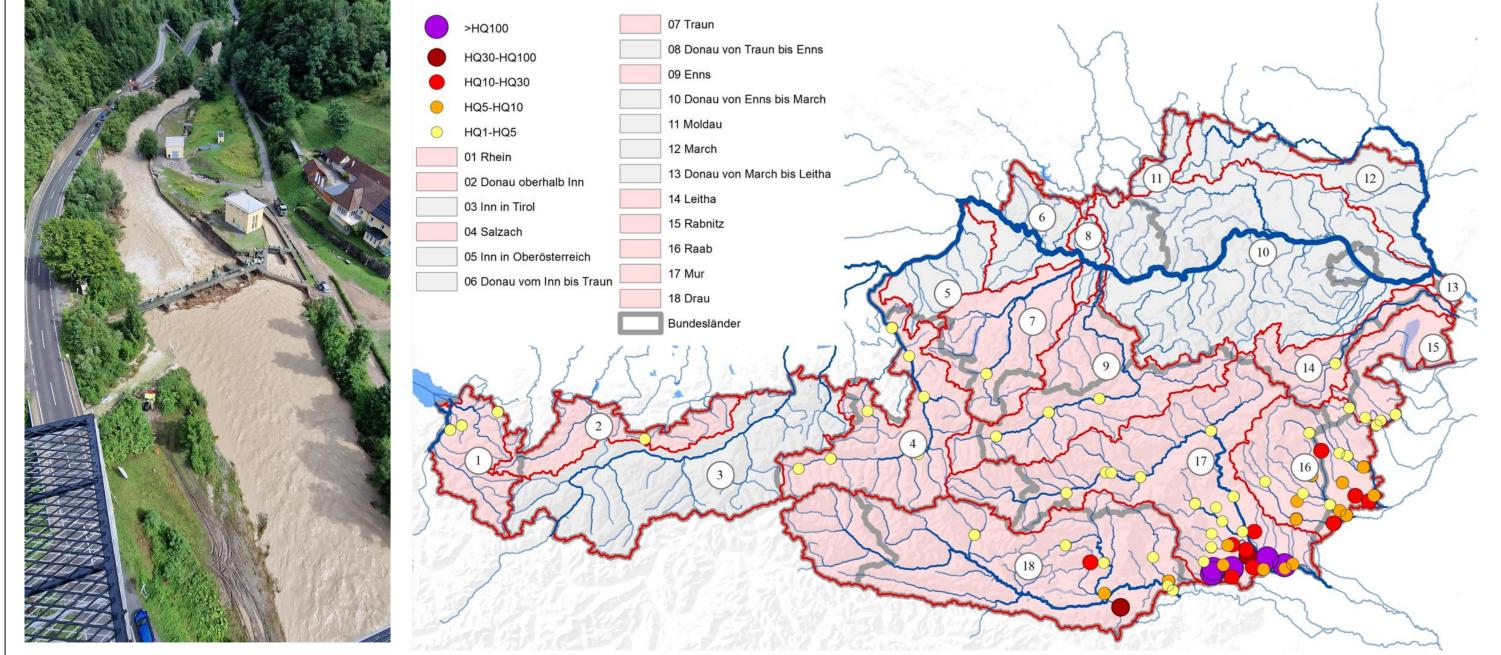


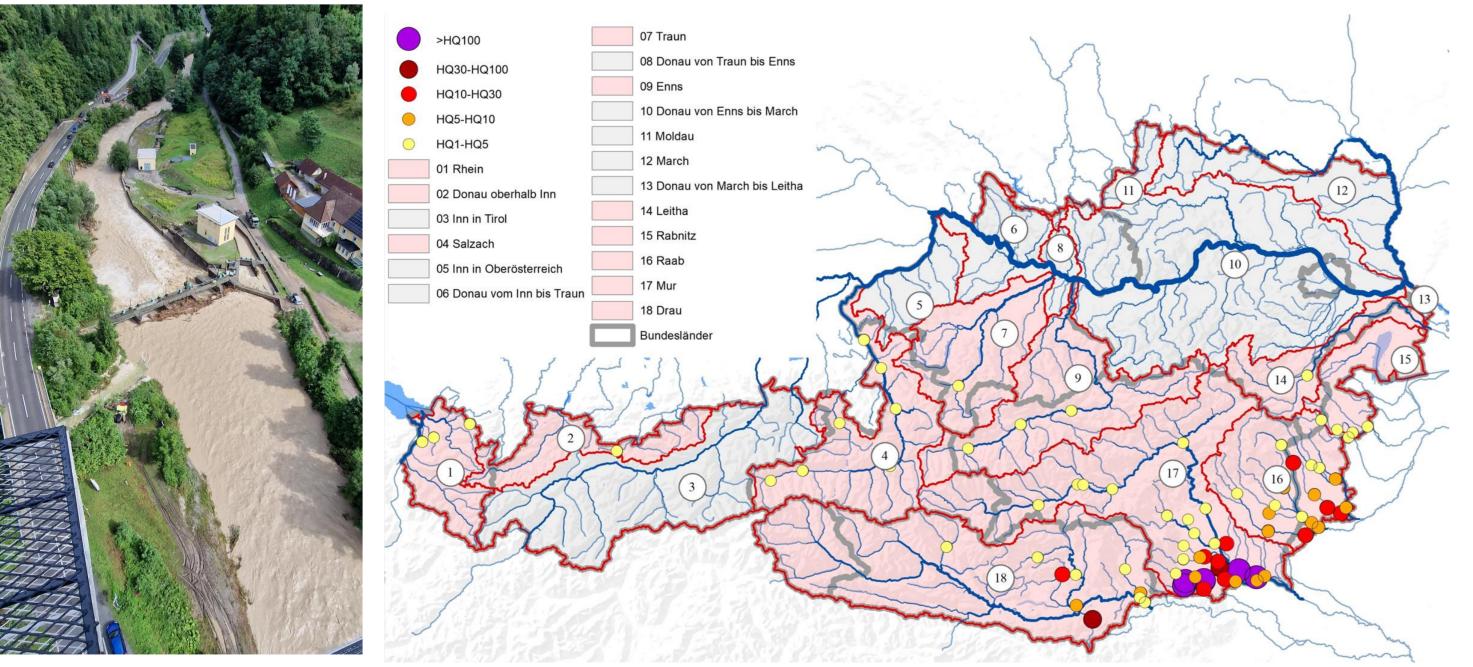
Hydrology

The substantial rainfall amounts at the beginning of August followed a similarly wet July in southern Austria. By the start of August, groundwater levels had already risen significantly, and many areas had saturated soils. Consequently, floods primarily affected Carinthia, southern Styria, and southern Burgenland, with numerous rivers bursting their banks.

In Carinthia, flood levels reached levels of Q 30 or even exceeded this flow at Drava tributaries within the Lower Drava river basin . The highest recorded values were in Miklauzhof/Vellach, where the flow was between that of a 30-year and a 100-year flood event (figure 5). This was followed by the Glan at the St. Veit gauge, which experienced a Q10-30 event. In Styria, certain gauges registered Q100 flows at Saggaubach, Weisse Sulm, and Schwarzaubach. In Burgenland, peak discharges ranged between a 10-year and a 30-year event on the Strem and Raab rivers. In the other provinces, the highest flows fell within the Q1 to Q5 range (figure 6).

Additionally, the high precipitation significantly influenced groundwater levels. At numerous groundwater gauges in Carinthia, southern Styria, and southern Burgenland, new all-time highs for August were recorded. These elevated groundwater levels receded slowly, leading to problems such as flooding in basements. Furthermore, high lake water levels in Carinthia posed additional challenges.





Because of the preceding weeks of persistent heavy rainfall, the substantial downpour towards the end of August 2023 led to a rapid surge in water levels, particularly pronounced in Vorarlberg, Tyrol, and Salzburg. Nonetheless, high flood discharges were also observed in Upper Austria, Carinthia, and Styria. In various regions, peak discharges of notably high magnitudes were recorded, with preliminary assessments of return periods depicted in figure 9.

Notably, in Tyrol, a flood event with a return period of 100 years (Q100) was observed along the Ötztaler Ache (figure 6), while in Salzburg, a Q100 event occurred at the Hüttwinklache in Bucheben (figure 7). In Tyrol, discharges ranging between Q30 and Q100, or even exceeding Q30, were recorded along the Inn River (figure 8) and some of its southern tributaries, as well as in the upper Salzach and certain southern tributaries. Numerous other rivers also experienced flood peaks of lower magnitudes.



Figure 7: left: Bucheben (Hüttwinklache) in Salzburg, Foto: A. Schlemmer Figure 8: right: Innsbruck (Inn) in Tirol Foto: HD Tirol)

Figure 5: Vellach at Eisenkappel-Vellach Foto Helmut Malle, AFK Jauntal

Figure 6: preliminary assessments of return periods of peak discharges, 3.-7th of August 2023

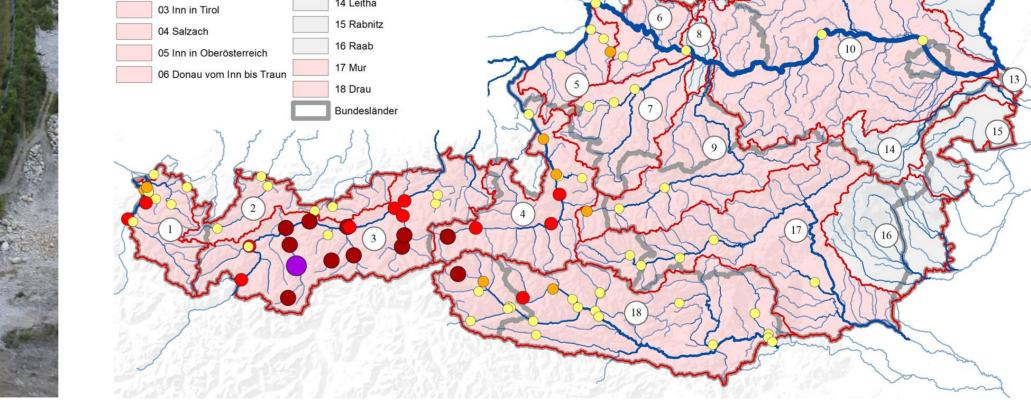


Figure 6: Ötztaler Ache, 28th of August 2023, Foto: M. Sturm (Land Tirol)

Figure 9: preliminary assessments of return periods of peak discharges, 27.-29th of August 2023

Conclusions

Concerning the affected regions, EFAS was able to predict the two flood events reasonably well. For individual rivers, the performance of EFAS was less robust: in some cases, floods predicted by EFAS actually occurred in neighboring rivers (e.g. river Vellach instead of river Gurk) or in tributaries instead of the main river channel (e.g. Saggaubach instead of Mur). In other cases, predicted flood peaks were too low (< 5year event). Performance of EFAS for flash flooding was good (only one of twelve flash flood notifications failed – in Lower Austria) and two predicted flood peaks were too low.

References: https://info.bml.gv.at/themen/wasser-oesterreich/hydrographie/chronik-besonderer-ereignisse/hochwasser-oesterreich/hydrographie/chronik-besonderer-ereignisse/hochwasser-oesterreich/hydrographie/chronik-besonderer-ereignisse/hochwasser-oesterreich/hydrographie/chronik-besonderer-ereignisse/hochwasser-august-2023.html, https://info.bml.gv.at/themen/wasser-oesterreich/hydrographie/chronik-besonderer-ereignisse/hochwasser-august-2023.html, https://info.bml.gv.at/themen/wasser-oesterreich/hydrographie/chronik-besonderer-ereignisse/hochwasser-august-2023.html, https://info.bml.gv.at/themen/wasser-august-2023.html, https://info.bml.gv.at/themen/wasser-august

Contact: Federal Ministry of Agriculture, Forestry, Regions and Water management, Directorate I - Water Management, Vienna, Austria e-mail: petra.lalk@bml.gv.at