

COSMO-LEPS Forecasts for the August 2005 Floods in Switzerland

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1 Introduction

In August 2005, heavy precipitation for three days caused tremendous floods in Switzerland and in adjacent neighborhood countries. The precipitation started on 20 August and was most intense on the northern slopes of the Alpine ridge. The according weather type corresponded to the well known Vb situation with a low pressure system over Italy that transported warm and very moist air at the eastern edge of the Alps to the northern side where the air impinged in the northern Alpine slopes. Fig. 1 illustrates the synoptic situation for August 22 taken from the assimilation cycle of the Swiss Alpine Modell (aLMo; see COSMO Newsletter, No. 5, Section 4.5). This report documents the COSMO-LEPS forecasts for this extreme precipitation event and compares them with observations.

2 Observations

At MeteoSwiss, a high-resolution precipitation analysis has been derived for this event (Fig. 2). The analysis considers measurements of about 400 Swiss rain gauges and a high-resolution precipitation climatology. From 20 August 06 UTC until 23 August 06 UTC, more than 100 mm precipitation occurred in a large area from the western Alps to the north eastern Alpine foreland. In central Switzerland more than 150 mm were observed and at some locations even more than 300 mm during these 72 hours.

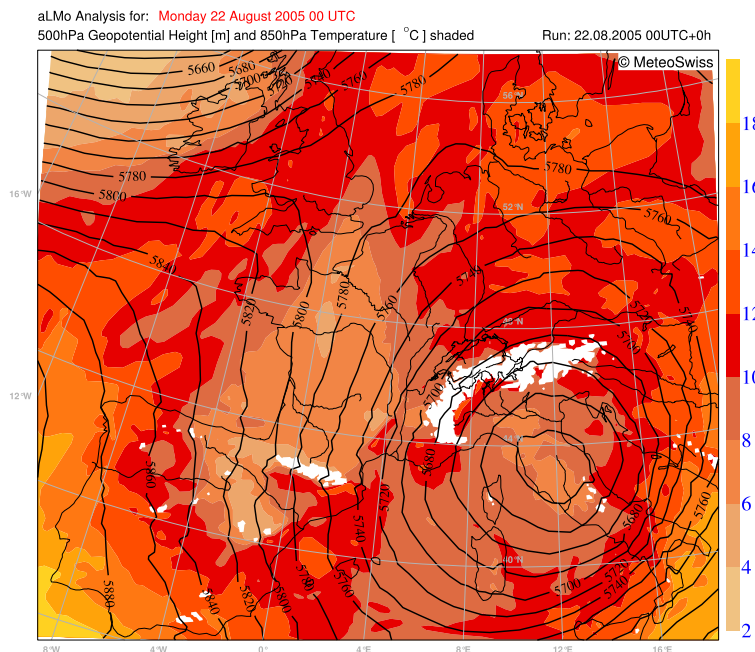


Figure 1: Overview of the synoptic situation for 22 August 2005 00 UTC from the aLMo analysis.

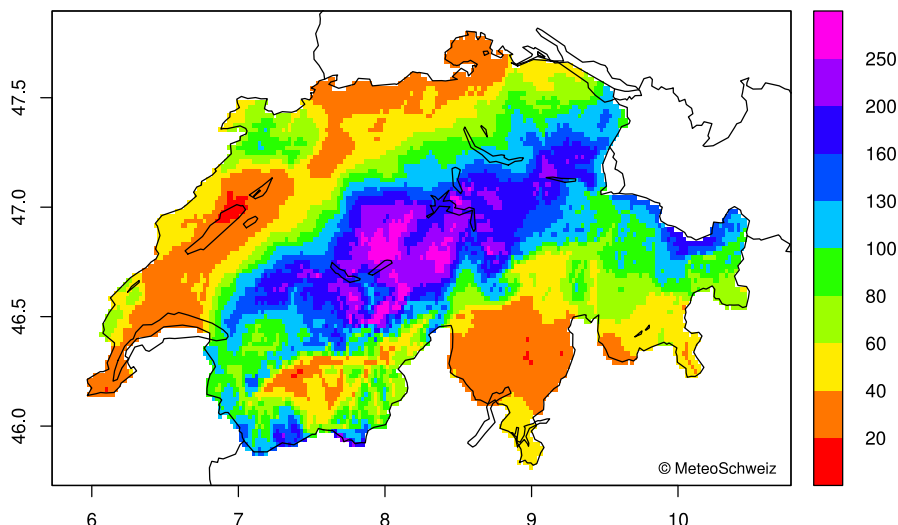


Figure 2: Analyzed accumulated precipitation from 20 Aug 2005 06 UTC to 23 Aug 2005 06 UTC (courtesy C. Frei, MeteoSwiss).

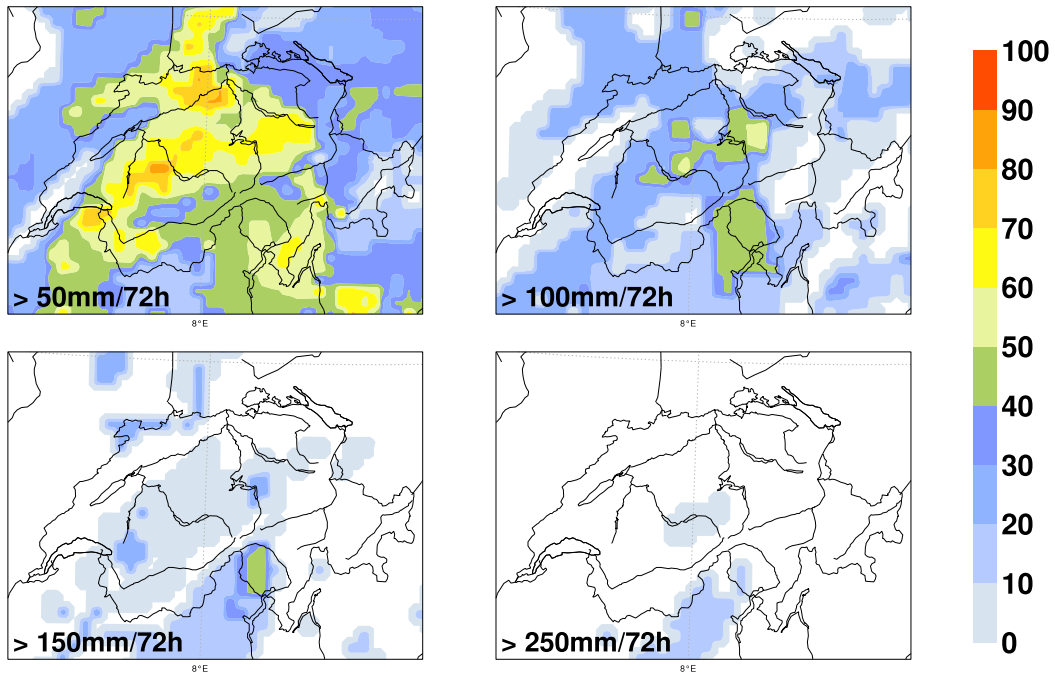
3 COSMO-LEPS forecasts

The limited-area ensemble prediction system COSMO-LEPS (Montani et al., 2003; Marsigli et al., 2005) computes daily probabilistic high-resolution weather forecasts for central and southern Europe for a lead-time of 132 hours.

Figure 3 shows the COSMO-LEPS forecast from 18 August 2005 12 UTC for the 72-h precipitation sum between 20 August 06 UTC and 23 August 06 UTC (lead-time 42h-114h). The four panels show the probabilities to exceed the corresponding thresholds 50, 100, 150 and 250 mm, respectively. This medium-range forecast reveals probabilities up to 60% for precipitation sums higher than 100 mm for the northern Alpine slopes and for the western part of Ticino as well as very low probabilities to exceed 150 mm for large parts of Switzerland, highest in the western part of Ticino. Overall, COSMO-LEPS predicted the event already with a lead-time of almost five days, but with higher probabilities rather for the southern Alpine region than for the northern Alpine area.

The forecast of the following day for the same forecast period is depicted in Fig. 4. The panels show for the entire northern Alpine slopes high probabilities (up to 80%) for accumulated precipitation over 100 mm and high probabilities (over 60%) for precipitation above 150 mm particularly in the Bernese and central Alps. In addition, a scenario with accumulated precipitation over 250 mm for some locations in these regions is predicted with probabilities of 20-30%. The two panels in Fig. 5 show the precipitation analysis with a contour corresponding to two of the precipitation thresholds used for the probability maps, namely for 100 mm and 250 mm, respectively. The panel for the former threshold demonstrates a high correlation of region with precipitation higher than 100 mm with those region showing high predicted probabilities (cf. Fig. 4). Further, the locations with observed precipitation above 250 mm are in those region where the predicted probabilities were highest for this threshold.

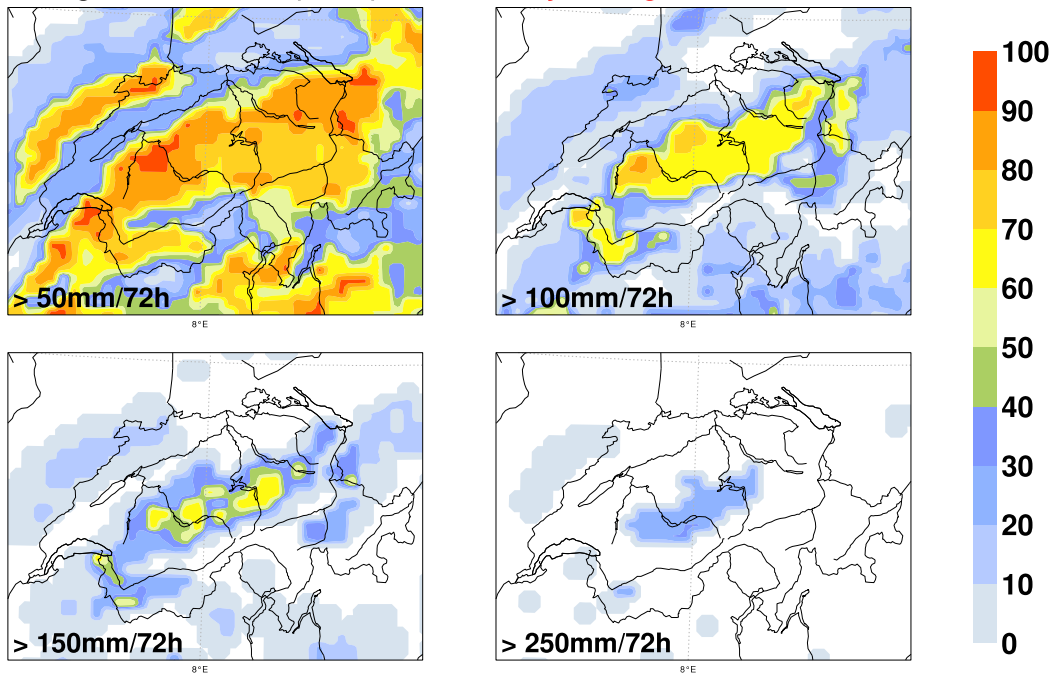
COSMO-LEPS probability forecast: 72h sum of total precipitation
18 Aug 2005 12UTC, t+(42-114), VT: Tuesday 23 Aug 2005 06UTC



Wed Nov 16 18:04:23 2005 / © MeteoSwiss; e

Figure 3: COSMO-LEPS forecast from 18 Aug 2005 12 UTC for 72-h precipitation sum. The panels show the probabilities to exceed the given thresholds 50, 100, 150 and 250 mm/72h, respectively, for the period 20 Aug 06 UTC to 23 Aug 06 UTC.

COSMO-LEPS probability forecast: 72h sum of total precipitation
19 Aug 2005 12UTC, t+(18-90), VT: Tuesday 23 Aug 2005 06UTC



Thu Nov 17 08:29:11 2005 / © MeteoSwiss; e

Figure 4: Same as Fig. 3, but for COSMO-LEPS forecast from 19 August 2005 12 UTC.

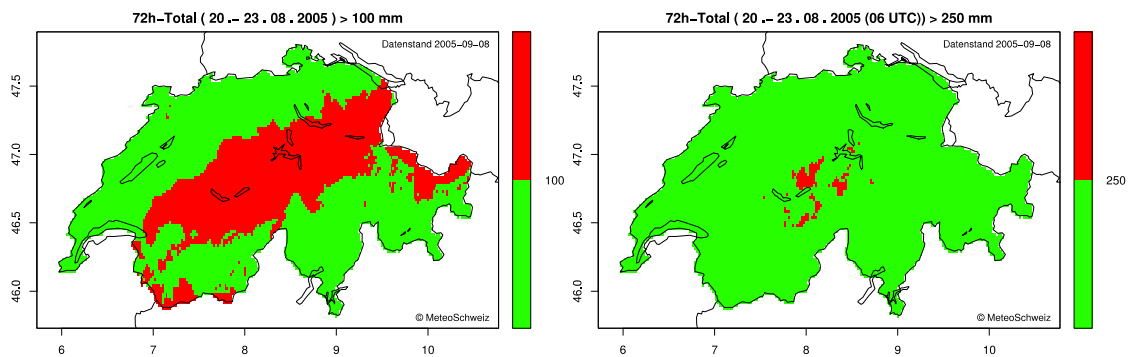


Figure 5: Same as Fig. 2, but (left) with a 100 mm and (right) with a 250 mm contour, respectively.

4 Conclusion

In summary, COSMO-LEPS forecasts provided very appropriate warnings for the extreme precipitation event in August 2005. In particular the forecast initialized at 19 August 2005 12 UTC predicted high probabilities for large precipitation amounts for most of the regions hit by the event without giving obvious false alerts for other regions.

References

- Marsigli, C., F. Boccanera, A. Montani, and T. Paccagnella, 2005: The COSMO-LEPS mesoscale ensemble system: validation of the methodology and verification. *Nonlinear Processes in Geophysics.*, 12, pp. 527–536.
- Montani, A., M. Capaldo, D. Cesari, C. Marsigli, U. Modigliani, F. Nerozzi, T. Paccagnella, P. Patrino, and S. Tibaldi., 2003: Operational limited-area ensemble forecasts based on the Lokal Modell, ECMWF Newsletter No. 98.