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Corrigendum: Projections for headwater catchments of the Tarim River reveal glacier retreat and decreasing surface water availability but uncertainties are large (2016 *Environ. Res. Lett.* **11** 054024)

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Updated results

Due to errors in the model code, changes in the glacier area extent have not been calculated correctly in the original version of this article. We have now corrected the code and rerun the simulations. The corrected results show that the glacier area change is slightly slower than previously estimated. This also has an impact on the projected changes in runoff and other water balance components. While there are changes in the numbers, the overall conclusions are not affected and the general statements of the paper remain. We have updated the text, figures, and tables, as detailed below.

Updated text

Abstract

Line 9ff.: The results show a decline in glacier area of −90% to −25% until 2099 (reference ~2008) (based on the 5–95 percentile range of the ensemble).

4. Results

4.2. Changes in glacier extent

Line 4ff.: By the end of the century, projections suggest a reduction in glacier area by −62(−88 to −21)% for the Sari-Djaz and −77(−98 to −40)% for the Kakshaal catchment (uncertainties refer to the 5–95 percentile range).

4.3. Peak glacier melt and evolution of annual runoff

Line 3ff.: After increases at the beginning of the 21st century, glacier melt decreases in the second half of the century. Peak glacier melt is projected to occur around the 2030s (median 2036; 5–95 percentile range 2023–2057) (figure 8(a)).

Line 10ff.: The changes in glacier melt have a significant impact on the evolution of total annual runoff of the Sari-Djaz River, resulting in the reduction of discharge by −15 (−47 to +12)% in the '2080s' compared to the control period (figure 9(a), table 1, supplementary figure S7).

5. Discussion

5.1. Projected changes in glaciers and discharge

Line 1ff.: Our results for glacier area reduction of −26 (−58 to −7)% by 2050 and −66(−90 to −25)% by 2099 compare well with other studies for Central Asia (supplementary table S1).

6. Conclusions

Line 5ff.: Glacier melt is projected to be high in the beginning of the 21st century and to decrease after peak melt around the 2030s.

Updated tables

The amendments affect table 1 and supplementary table S1. Lines 13–16 in table 1 accidently reported the mean and the 33 and 66 percentiles in the original paper. They have now been amended to correctly report the median and the 5 and 95 percentiles.

Table 1. Simulated annual rain, snowmelt, ice melt, AET, and discharge during the control period, and changes during the '2020s', '2050s', and '2080s' as compared to the control period for the Sari-Djaz and Kakshaal catchment and both Aksu headwater catchments together. Shown are the median values over all ensemble members and in parentheses the 5 and 95 percentiles.

	Rain	Snowmelt	Ice melt	AET	Discharge
Sari-Djaz					
Control (mm)	207 (192/225)	224 (201/264)	188 (151/202)	215 (208/227)	401 (382/440)
Δ 2020s (%)	18 (3/40)	7 (−5/17)	40 (−10/97)	10 (5/14)	30 (6/46)
Δ 2050s (%)	26 (−6/60)	6 (−11/21)	0 (−30/45)	15 (5/25)	15 (−22/38)
Δ 2080s (%)	33 (−7/87)	5 (−11/22)	−64 (−80/−35)	16 (4/39)	−15 (−47/12)
Kakshaal					
Control (mm)	202 (187/229)	178 (158/225)	30 (16/34)	271 (254/295)	150 (137/178)
Δ 2020s (%)	21 (−5/57)	1 (−18/12)	60 (19/123)	7 (−3/21)	24 (2/57)
Δ 2050s (%)	28 (−6/72)	−8 (−20/13)	−4 (−39/95)	10 (−6/31)	23 (−28/41)
Δ 2080s (%)	30 (−4/91)	−6 (−27/12)	−56 (−79/7)	12 (−7/39)	13 (−35/40)
Aksu headwater					
Control (mm)	204 (189/227)	197 (176/241)	95 (71/103)	248 (235/267)	253 (238/286)
Δ 2020s (%)	20 (−2/43)	4 (−13/13)	43 (−7/89)	8 (0/17)	29 (5/44)
Δ 2050s (%)	29 (−6/59)	−1 (−18/15)	−1 (−45/39)	12 (−3/26)	18 (−25/36)
Δ 2080s (%)	33 (−5/79)	−1 (−22/15)	−62 (−110/−21)	14 (−4/36)	−5 (−45/21)

Supplementary Table S1. Projected reductions in glacier area for studies in Central Asia.

		Glacier area reduction (%, reference year ∼2000)	
	Study area	2050	2100
This study	Aksu headwaters	−58 to −7	−90 to −25
Sorg *et al* (2014)	Chon Kemin Basin	−88 to −14	−100 to −50
Gan *et al* (2015)	Naryn Basin		−65 to −36[a]
Lutz *et al* (2013)	Upper Amu Darya and Syr Darya	−65 to −55	
Hagg *et al* (2013)	Tanimas Basin	−45 and −35	
Zhang *et al* (2012)	Yarkand Basin	−17 to −13[a]	

[a] Reference year 1970s.

Updated figures

The amendments affect figures 3–10 and supplementary figures S5–S8.

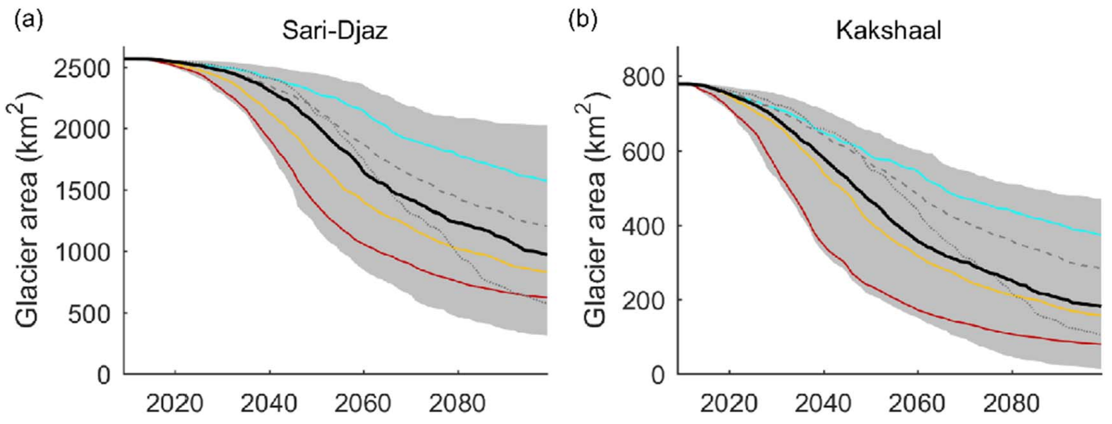


Figure 3. Simulated changes in glacier area for the Sari-Djaz (a) and the Kakshaal catchment (b). The black line and the grey area represent the median and the 5–95 percentile range of the ensemble (Sari-Djaz $N = 162$ and Kakshaal: $N = 756$). Coloured lines represent median values for three selected GCMs representing cold (light blue), warm-wet (yellow), and warm-dry (red) projections. The grey dashed and dotted lines show the median of the projections based on the RCMs CCLM and REMO.

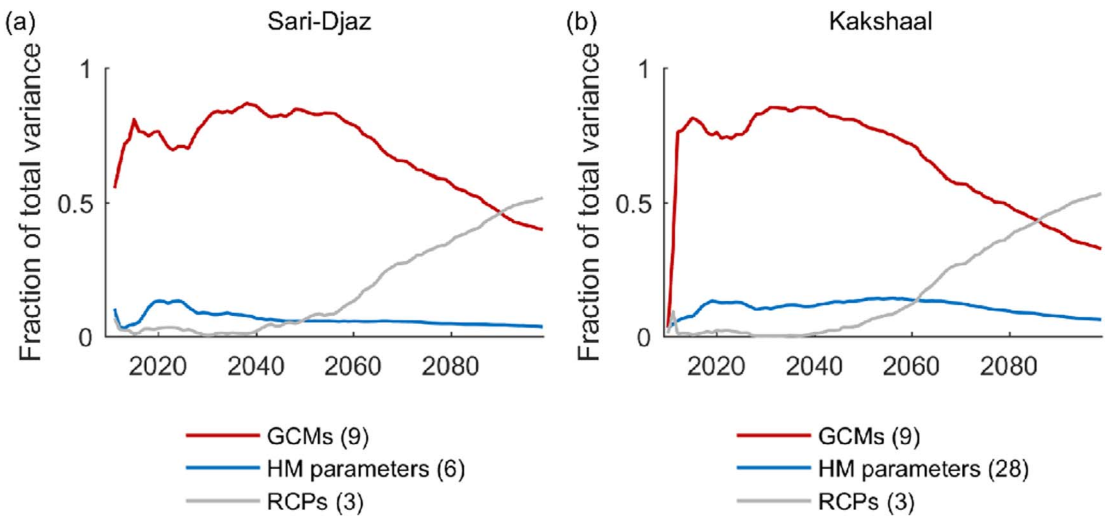


Figure 4. Relative contributions to the total ensemble uncertainty of the projected glacier area by GCMs, RCPs, and hydrological model parameters for the Sari-Djaz (a) and Kakshaal catchment (b), as analysed by their contribution to the total variance, see supplement. (The fractions do not add up to 1 due to interaction and error terms.)

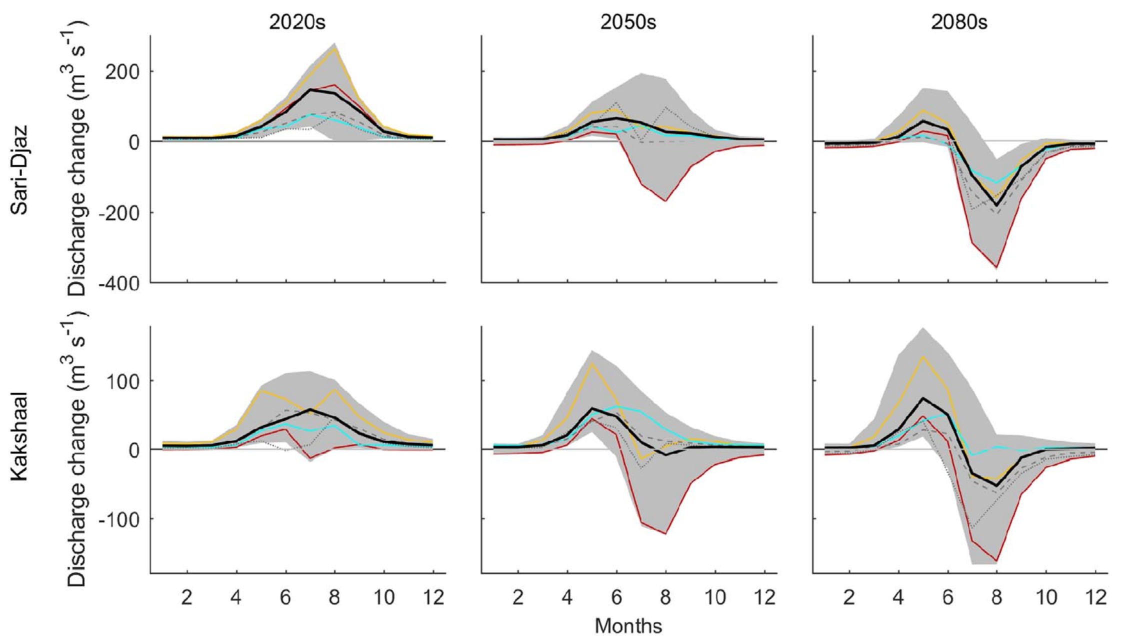


Figure 5. Projected changes in the discharge regime for the '2020s', '2050s', and '2080s' as compared to the control period 1971–2000 for the Sari-Djaz (top) and the Kakshaal catchment (bottom). The black line and the grey area represent the median and the 5–95 percentile range of the ensemble (Sari-Djaz $N = 162$ and Kakshaal: $N = 756$). Coloured lines represent median values for three selected GCMs representing cold (light blue), warm-wet (yellow), and warm-dry (red) projections. The grey dashed and dotted lines show the median of the projections based on the RCMs CCLM and REMO.

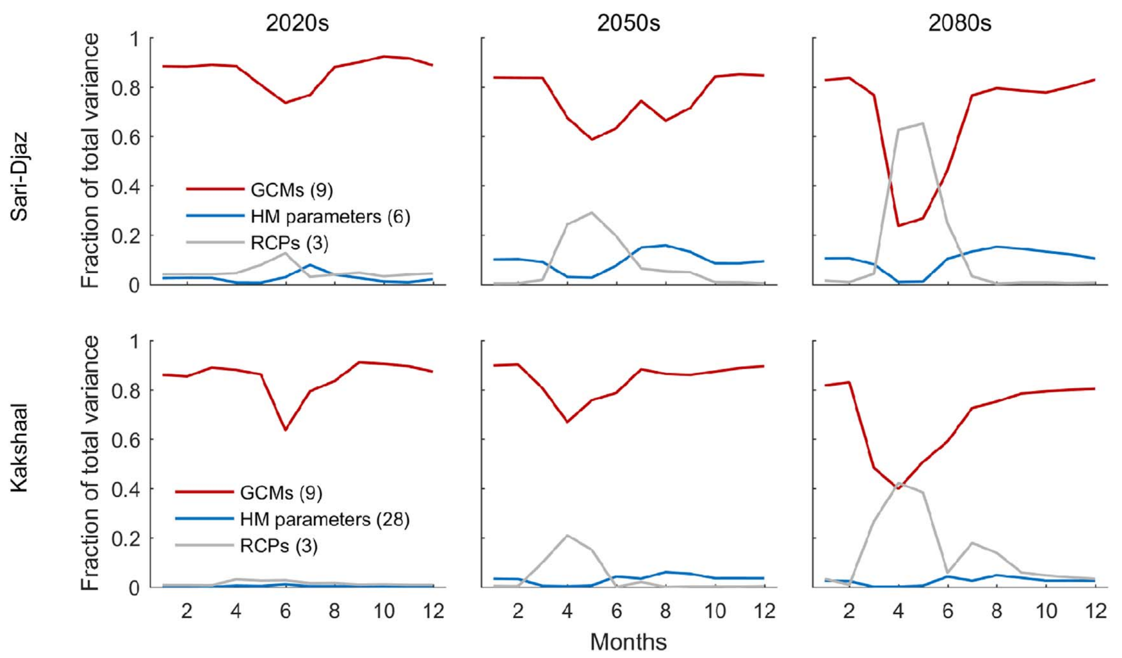


Figure 6. Relative contributions by the GCMs, RCPs, and hydrological model parameters to the total ensemble uncertainty of the projected changes in the runoff regime for the Sari-Djaz (top row) and Kakshaal catchment (bottom row), as analysed by their contribution to the total variance, see supplement. (The fractions do not add up to 1 due to interaction and error terms.)

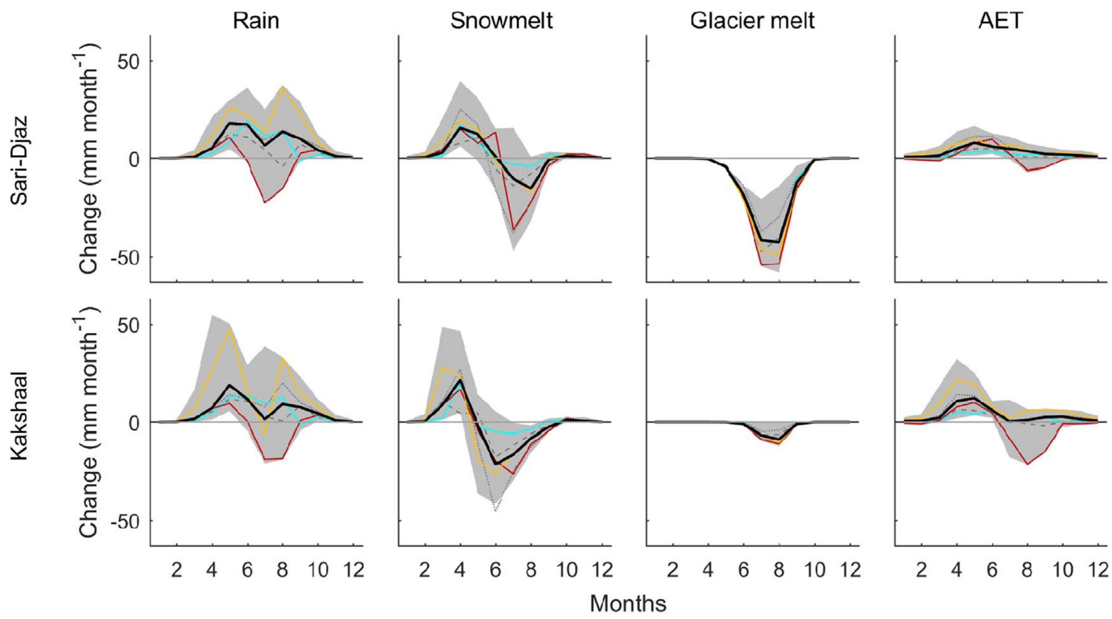


Figure 7. Projected changes in monthly rain, snowmelt, ice melt, and actual evapotranspiration for the Sari-Djaz (top) and the Kakshaal catchment (bottom) for the '2080s' as compared to 1971–2000. The black line and the grey area represent the median and the 5–95 percentile range of the ensemble (Sari-Djaz $N = 162$ and Kakshaal: $N = 756$). Coloured lines represent median values for three selected GCMs representing cold (light blue), warm-wet (yellow), and warm-dry (red) projections. The grey dashed and dotted lines show the median of the projections based on the RCMs CCLM and REMO.

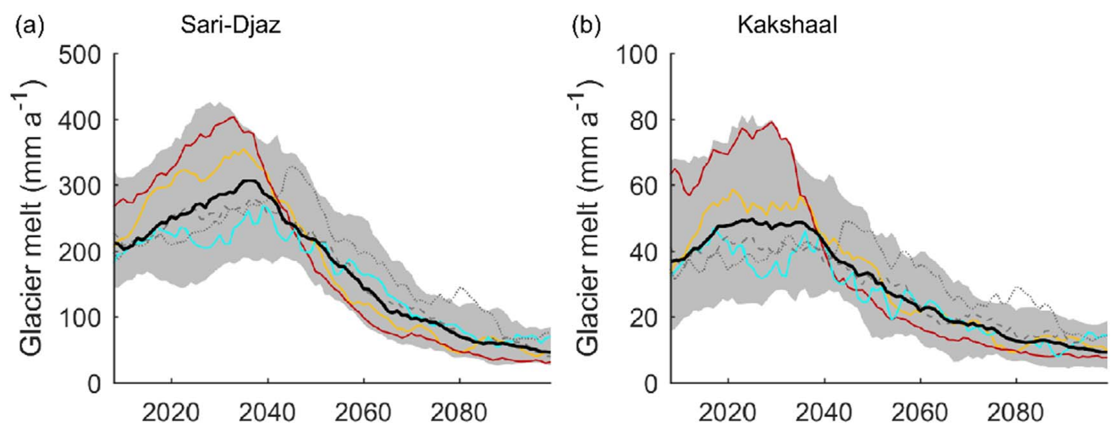


Figure 8. Projection for the evolution of glacier melt over the 21st century for the Sari-Djaz (a) and the Kakshaal catchment (b) (smoothed curves using a 10 year moving average). The black line and the grey area represent the median and the 5–95 percentile range of the ensemble (Sari-Djaz $N = 162$ and Kakshaal: $N = 756$). Coloured lines represent median values for three selected GCMs representing cold (light blue), warm-wet (yellow), and warm-dry (red) projections. The grey dashed and dotted lines show the median of the projections based on the RCMs CCLM and REMO.

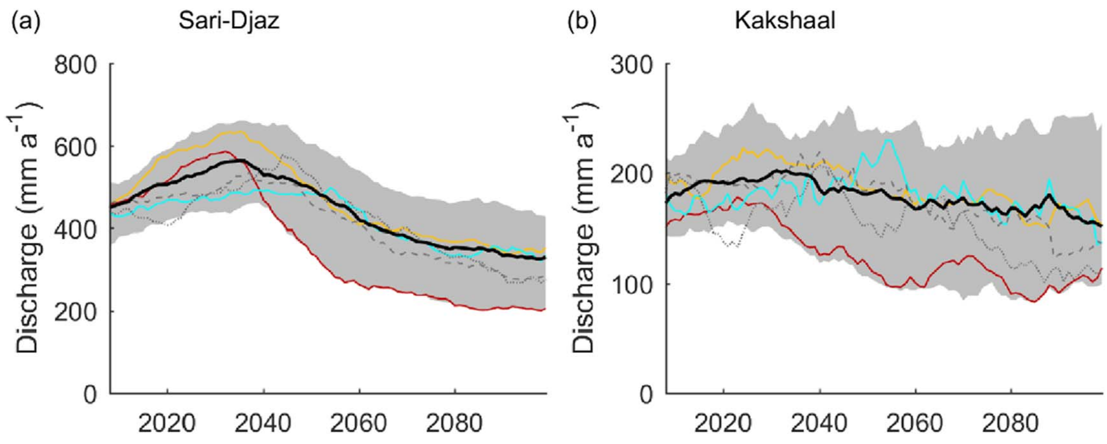


Figure 9. Projection for the evolution of discharge over the 21st century for the Sari-Djaz (a) and the Kakshaal catchment (b) (smoothed curves using a 10 year moving average). The black line and the grey area represent the median and the 5–95 percentile range of the ensemble (Sari-Djaz $N = 162$ and Kakshaal: $N = 756$). Coloured lines represent median values for three selected GCMs representing cold (light blue), warm-wet (yellow), and warm-dry (red) projections. The grey dashed and dotted lines show the median of the projections based on the RCMs CCLM and REMO.

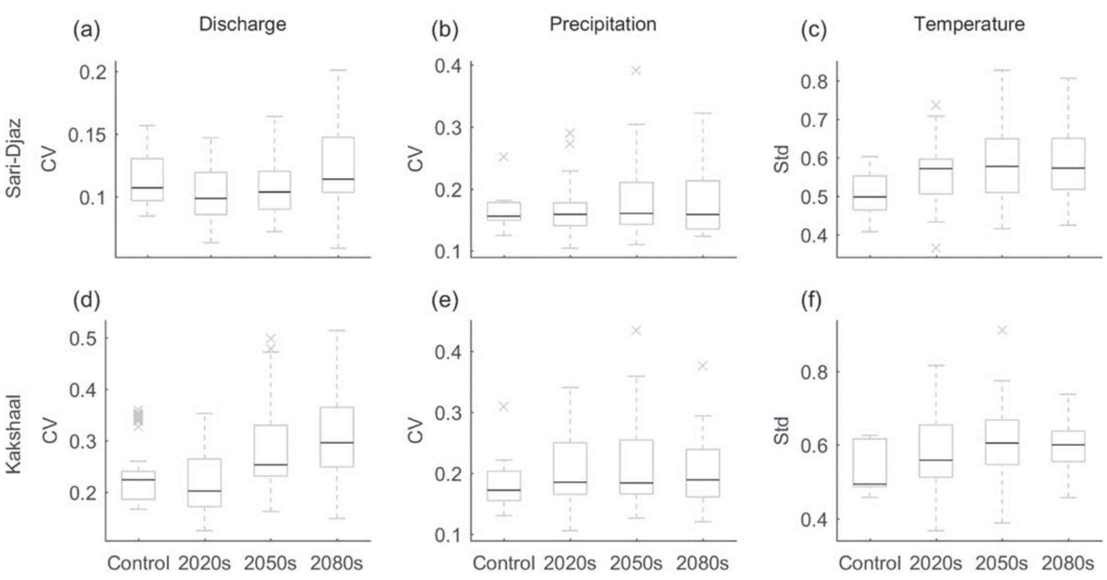
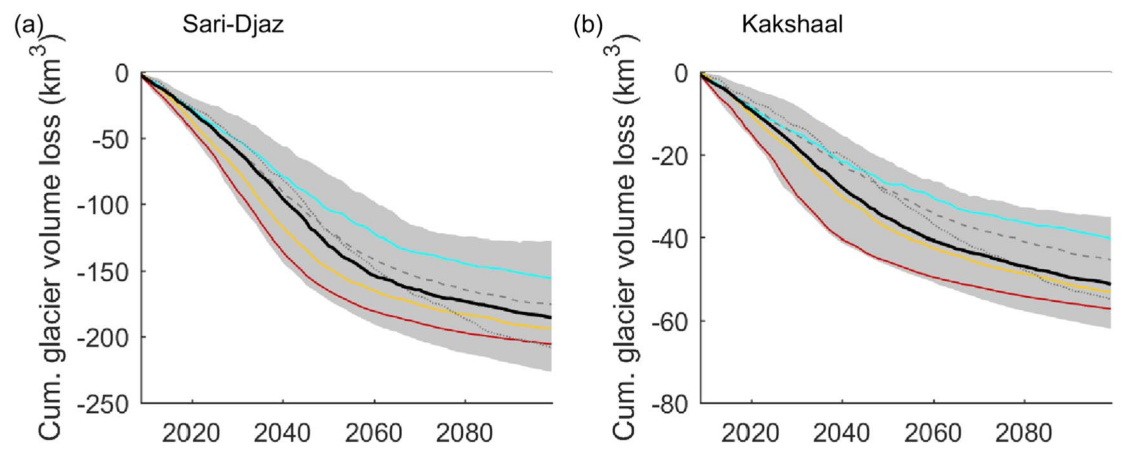
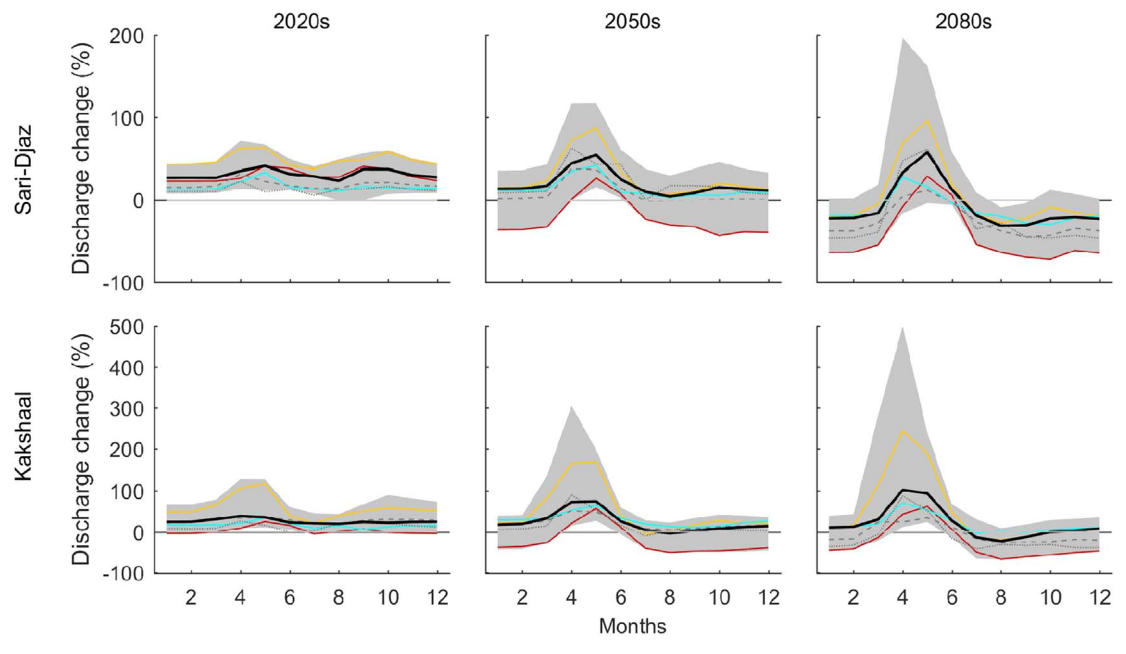


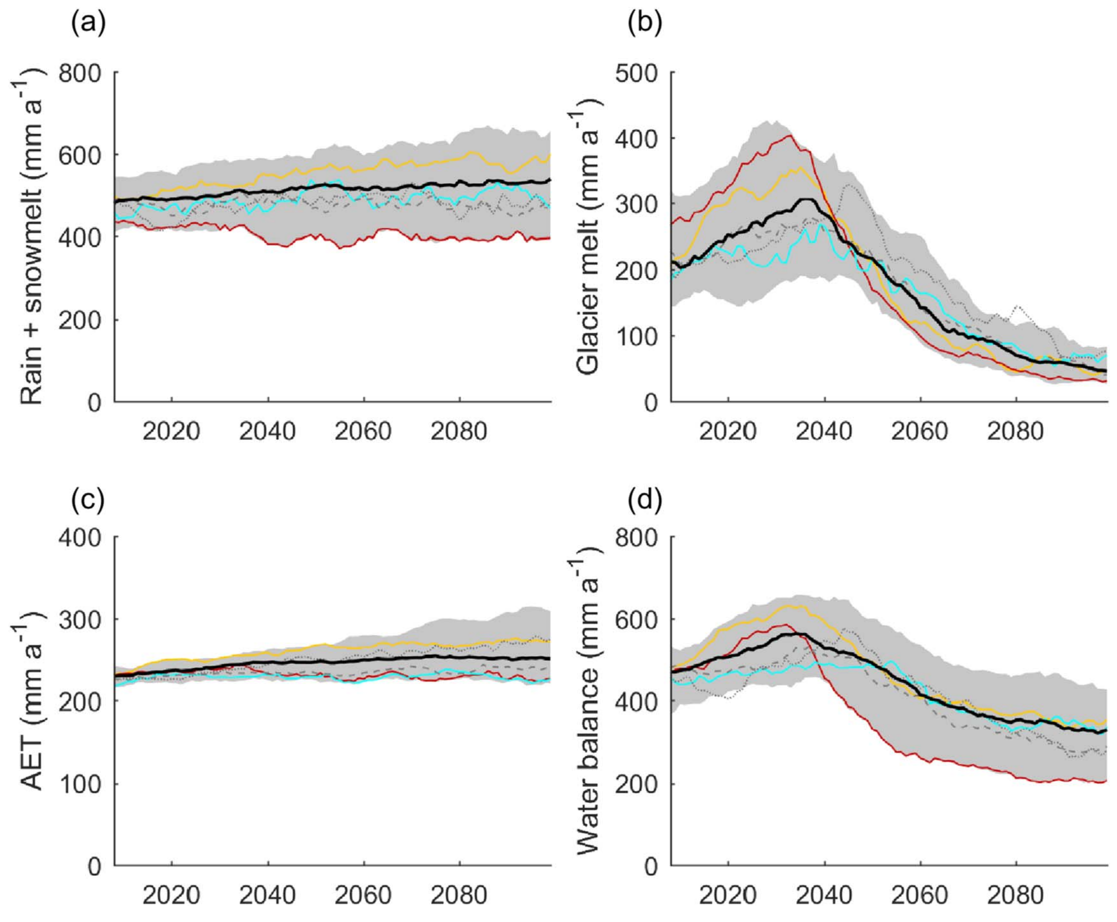
Figure 10. Interannual variability of discharge (a), (d), precipitation (b), (c), and temperature (c), (f), shown as coefficient of variation (CV) for discharge and precipitation, and as standard deviation (std) for temperature. To exclude influences of systematic discharge changes, a 20 year moving average filter was applied before calculating the CV or standard deviation (see text).



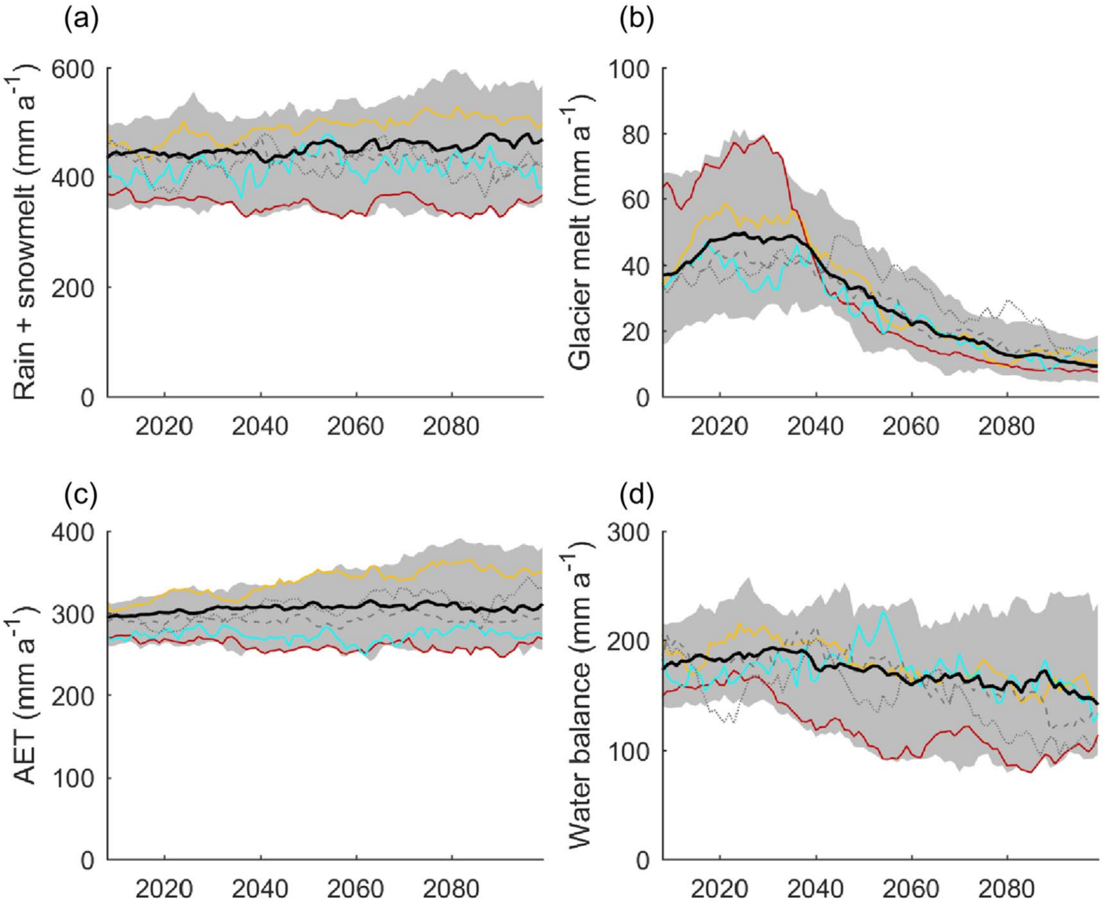
Supplementary Figure S5. Projections of the cumulative glacier volume loss for the Sari-Djaz (a) and Kakshaal catchment (b).The black line and the grey area represent the median and the 5–95 percentile range of the ensemble (Sari-Djaz $N = 162$ and Kakshaal: $N = 756$). Coloured lines represent median values for three selected GCMs representing cold (light blue), warm-wet (yellow), and warm-dry (red) projections. The grey dashed and dotted lines show the median of the projections based on the RCMs CCLM and REMO.



Supplementary Figure S6. Projected changes in the discharge regime in percentage for the '2020s', '2050s', and '2080s' as compared to the control period 1971–2000 for the Sari-Djaz (top) and the Kakshaal catchment (bottom). The black line and the grey area represent the median and the 5–95 percentile range of the ensemble (Sari-Djaz $N = 162$ and Kakshaal: $N = 756$). Coloured lines represent median values for three selected GCMs representing cold (light blue), warm-wet (yellow), and warm-dry (red) projections. The grey dashed and dotted lines show the median of the projections based on the RCMs CCLM and REMO.



Supplementary Figure S7. Projection for the evolution of (a) rain and snowmelt, (b) glacier melt, (c) AET, and (d) the water balance (calculated as the sum of rain, snowmelt, and glacier melt minus AET) over the 21st century for the Sari-Djaz catchment (smoothed curves using a 10 year moving average). The black line and the grey area represent the median and the 5–95 percentile range of the ensemble (Sari-Djaz $N = 162$ and Kakshaal: $N = 756$). Coloured lines represent median values for three selected GCMs representing cold (light blue), warm-wet (yellow), and warm-dry (red) projections. The grey dashed and dotted lines show the median of the projections based on the RCMs CCLM and REMO.



Supplementary Figure S8. As supplementary figure S7 but for the Kakshaal catchment.