

Why **0.5°C** matter for the future evolution of Alpine glaciers

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Time for a read?

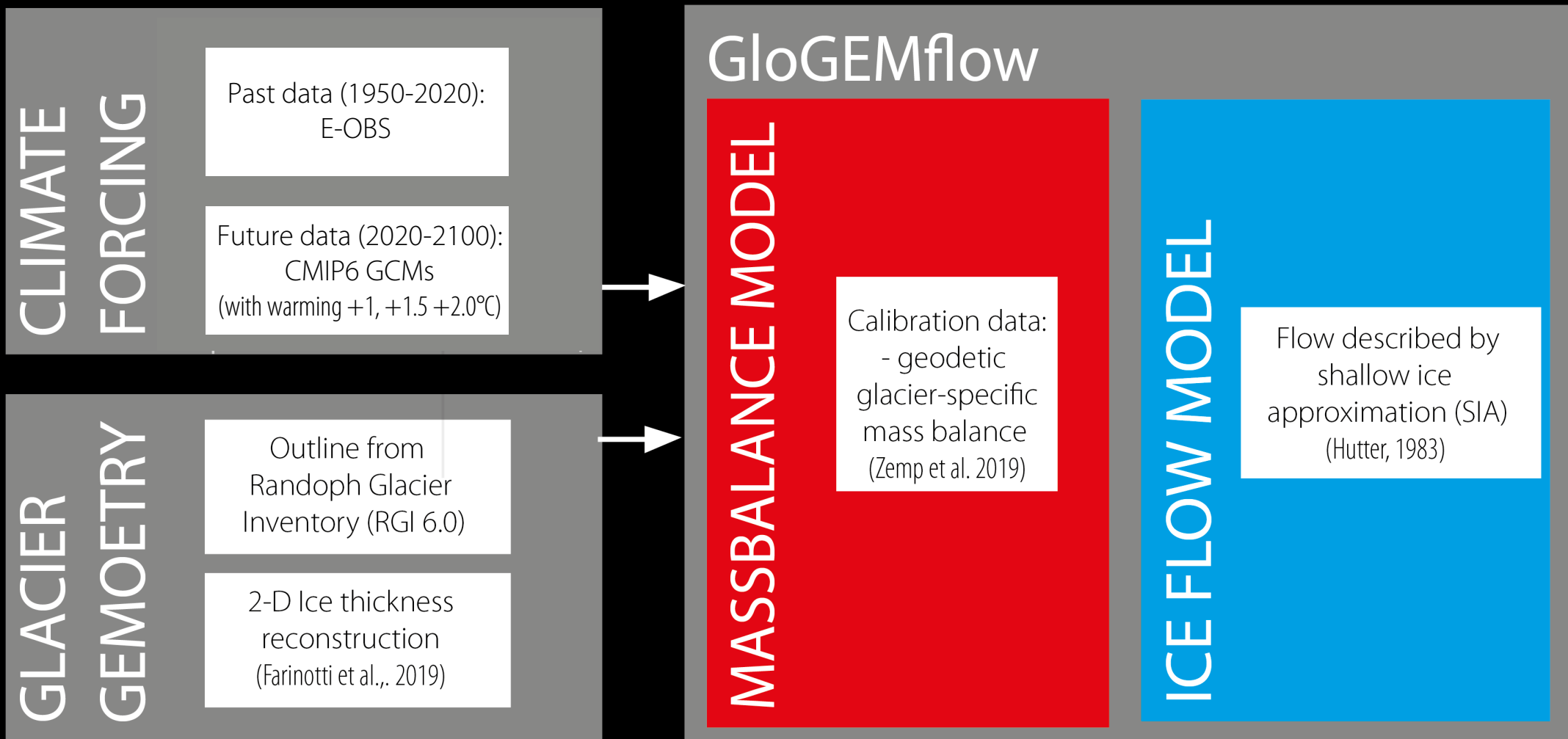


Introduction

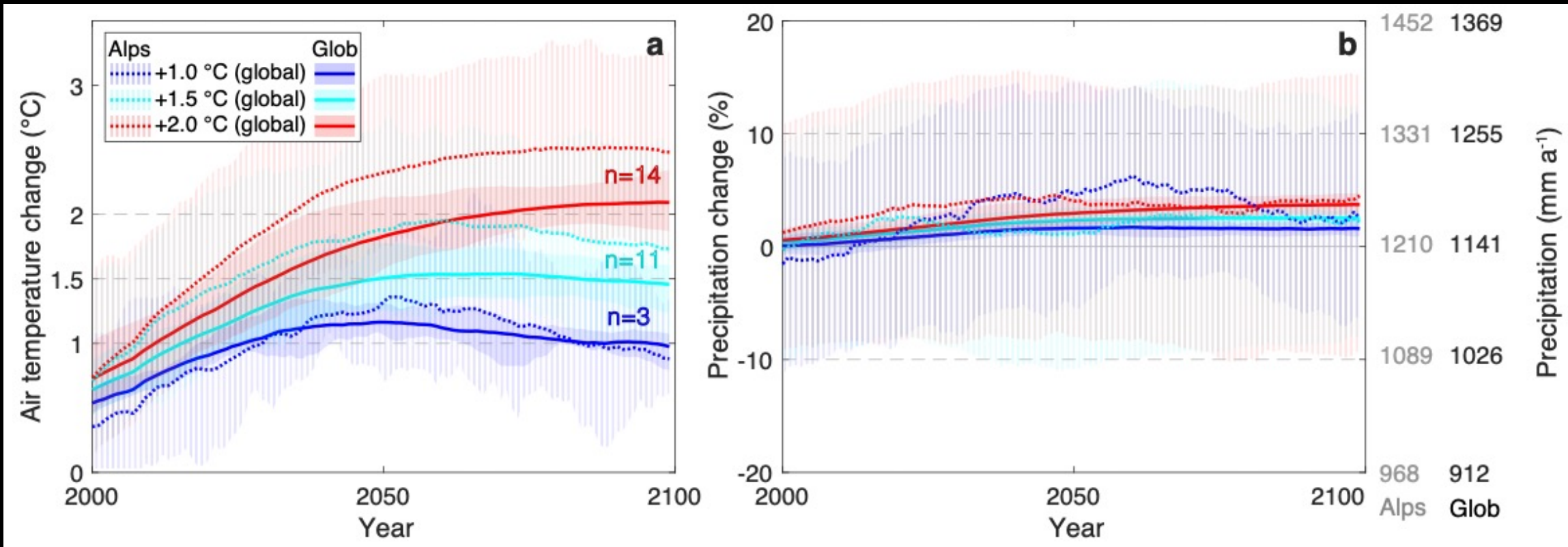
With the Paris Agreement, the urgency of limiting ongoing anthropogenic climate change has been recognized. More recent discussions have focused on the difference of limiting the increase in global average temperatures below 1.0, 1.5, or 2.0 °C compared to pre-industrial levels. Here, we assess the impacts that such different scenarios would have on both the future evolution of glaciers in the European Alps and the water resources they provide. Our results show that the different temperature targets have important implications for the changes predicted until 2100, and that glaciers might start recovering after the end of the 21st century.



Data & Method

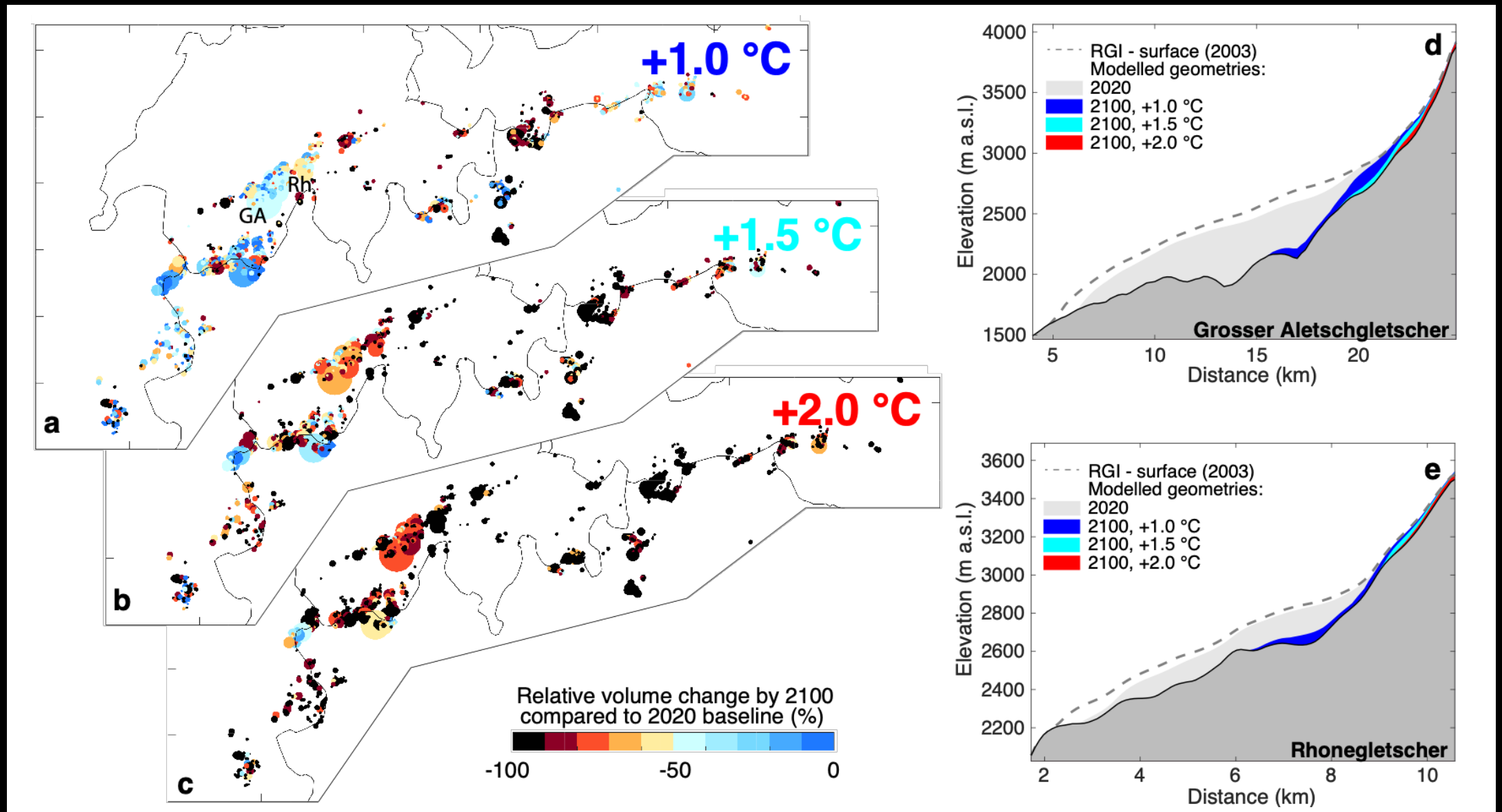


Results - climate



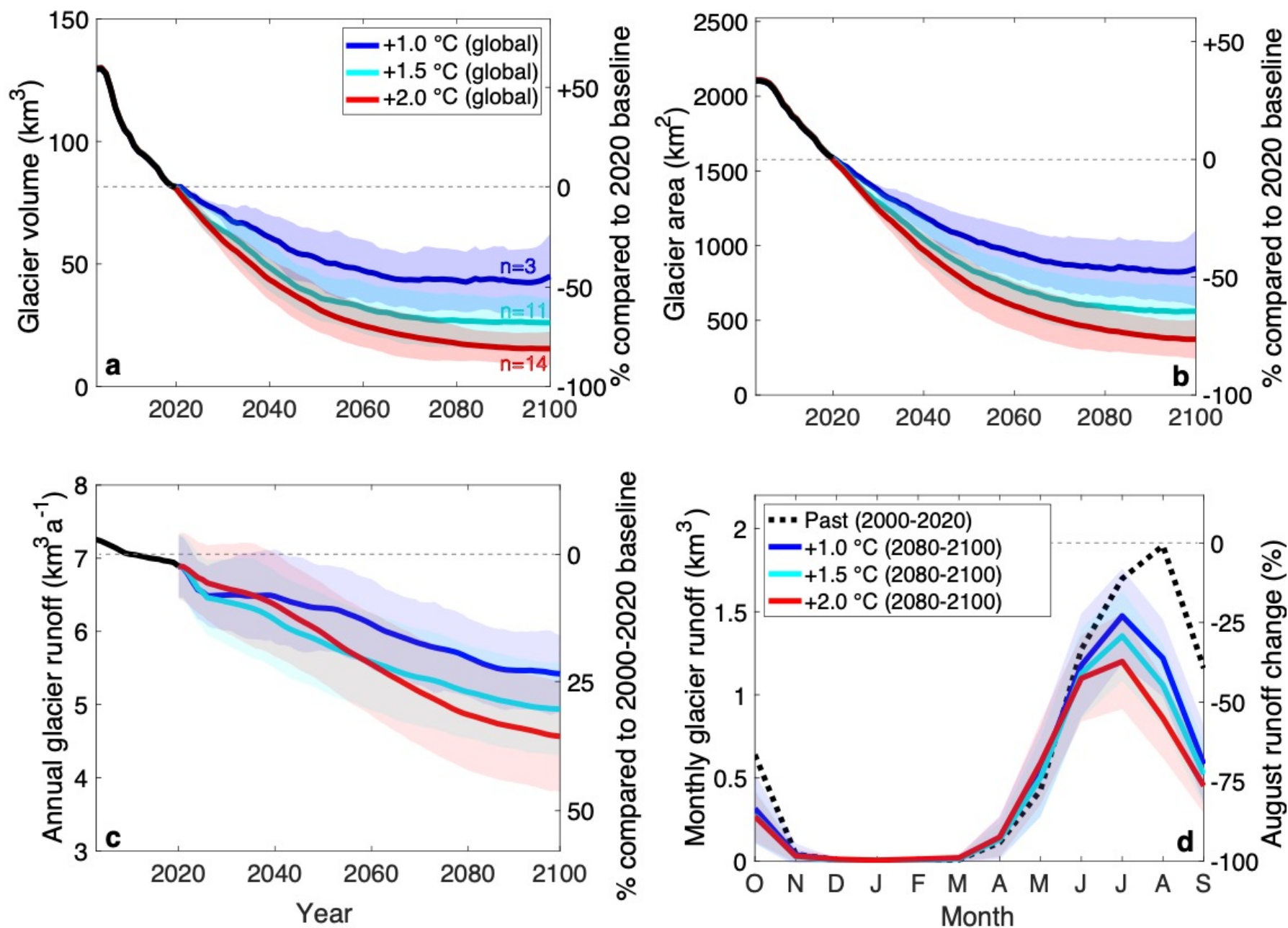
Evolution of annual global and Alpine (a) average air temperature and (b) precipitation total compared to the pre-industrial (1850- 1900) baseline. Series are smoothed with a 30-year running mean. The coloured bands show the standard deviation of the projection given by individual GCM members. n is the considered numbers of GCM members.

Results - glaciers



Relative change in glacier volume between 2020 and 2100 for scenarios of (a) +1.0 °C, (b) +1.5 °C and (c) +2.0 °C of global temperature increase. Each dot represents one glacier, the dot's size being proportional to the glacier area as given by the Randolph Glacier Inventory. The labels "GA" and "Rh" identify "Grosser Aletschgletscher" and "Rhonegletscher", respectively. The modelled geometries of these two glaciers are shown in panels (d and e) at inventory date (dashed), for the year 2020 (grey), and for the year 2100 under the three selected scenarios (colours).

Results - glaciers

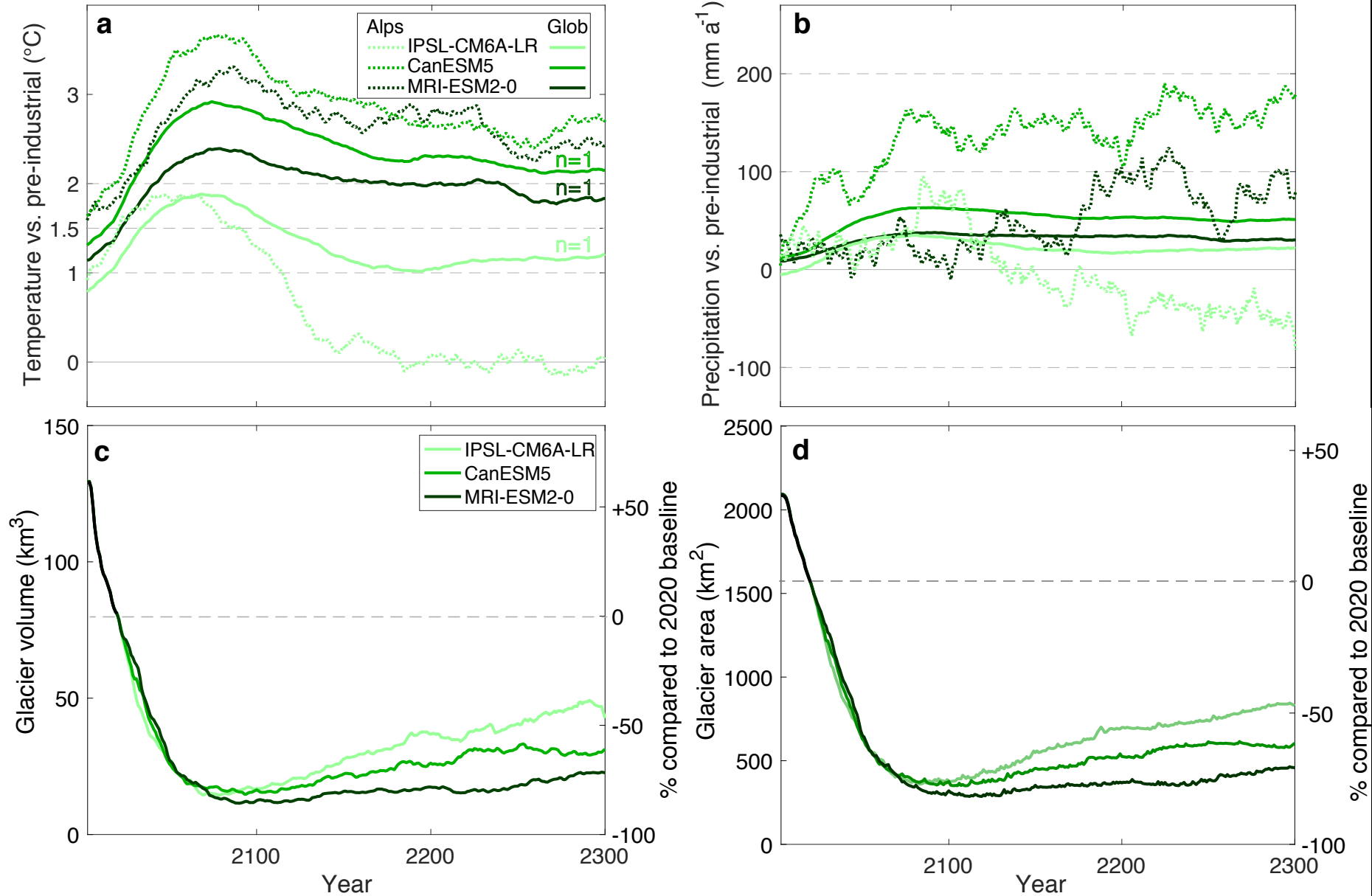


Modelled evolution of total glacier (a) volume, (b) area, (c) annual glacier runoff, and (d) monthly glacier runoff of the European Alps. Time series in (c) are smoothed with a 20-year running mean. In all panels, the thick line represents the mean and the transparent band corresponds to one standard deviation of the results obtained by forcing GloGEMflow with the selected GCM members. The numbers of GCM members is given (n).

Conclusions

2100 Vs. 2020	+1.0°C	+1.5°C	+2.0°C
Volume loss	- 44 ± 21 %	- 68 ± 12 %	- 81 ± 8 %
Annual runoff	- 25 ± 6 %	- 32 ± 8 %,	- 36 ± 10 %
August runoff	- 36 ± 15 %	- 44 ± 14 %	- 55 ± 15 %,

EVERY
HALF
DEGREE
COUNTS



Modelled glacier evolution until 2300. Changes in global ("Glob", solid) and Alpine ("Alps", dotted) (a) average air temperatures and (b) precipitation totals, compared to the pre-industrial (1851-1900) baseline. Series are smoothed with a 30-year running mean. Modelled evolution of total glacier (c) volume, and (d) area based on three individual GCM members.