Role of mean and variability change for changes in European annual and seasonal extreme precipitation events

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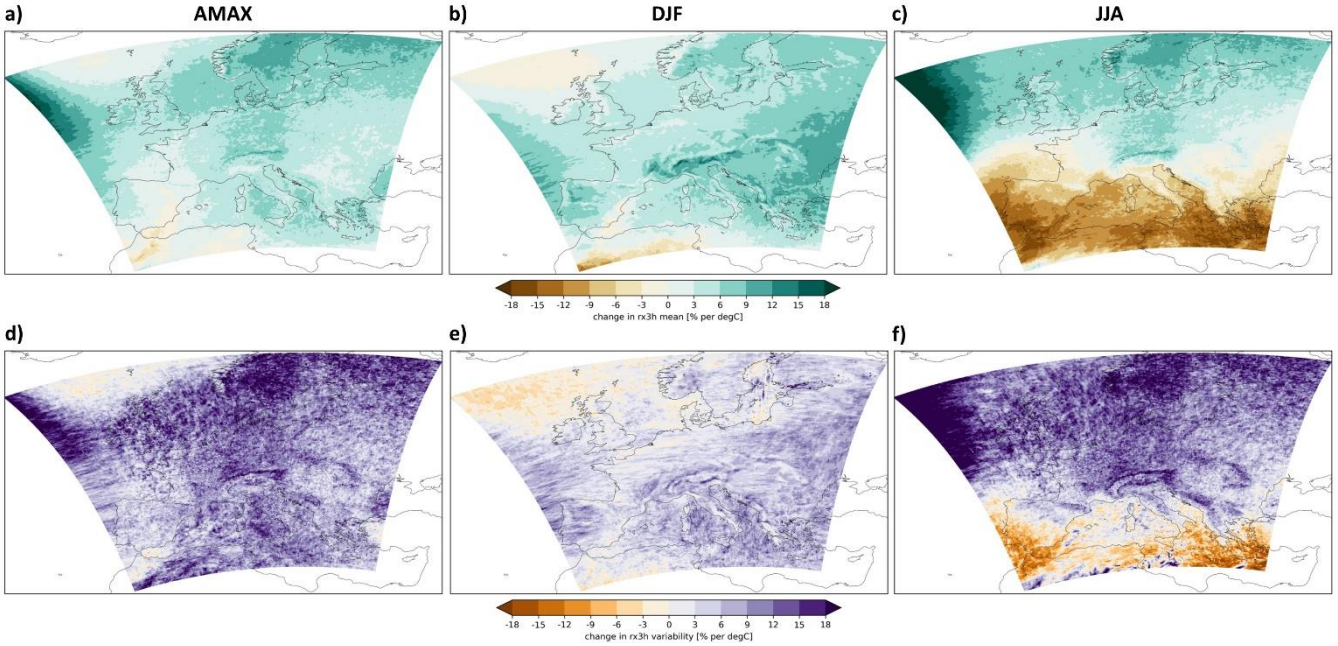


Figure S1: Forced response of annual and seasonal (DJF, JJA) mean and variability of rx3h at +4 °C warming compared to a pre-industrial climate. a) – c) Forced changes in the mean rx3h; d) – e) Changes in the variability of rx3h (i.e., standard-deviation); left column: Annual, centre column: Winter (DJF), and right column: Summer (JJA).

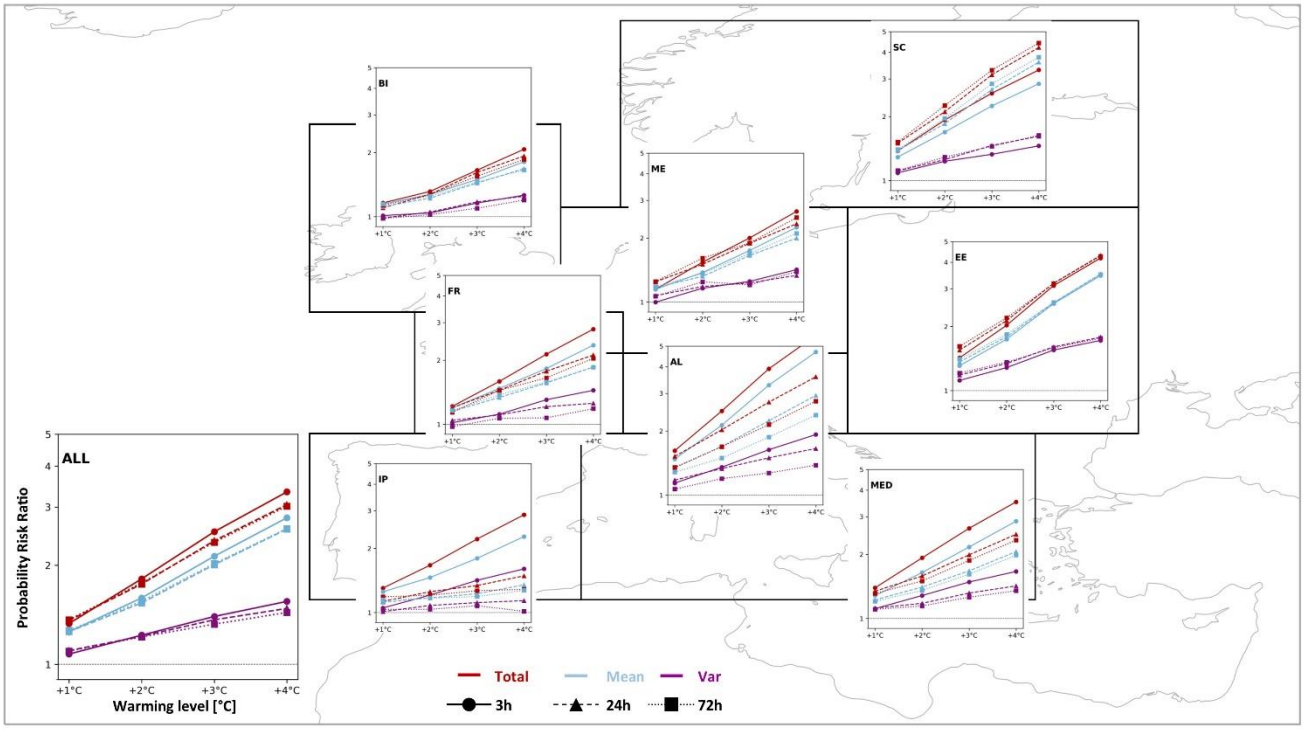


Figure S2: Regional probability risk ratios for different temporal aggregation levels (3h, 24h, 72h) in winter (DJF). The panels show PRtotal (red), PRmean (blue), and PRvar (purple) values (y-axis) at warming levels (+1, +2, +3, +4 °C) (x-axis). The solid lines with the circle marker represent PR-values for 3-hour temporal aggregation; the dashed lines with the triangle marker represent PR-values for 24-hours; the dotted lines with the square marker represent PR-values for 72-hours. The lower left panel shows the aggregation over all land grid cells and shows axis labels.

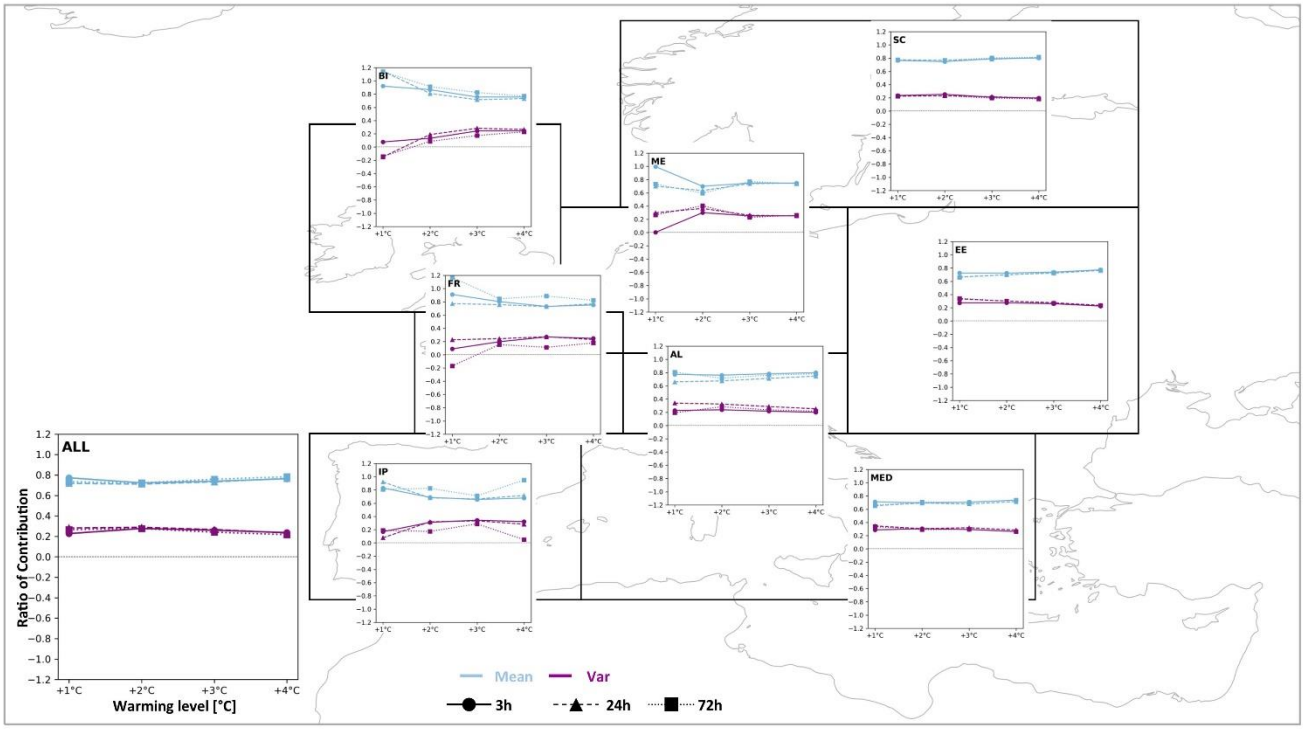


Figure S3: Regional ratios of contribution based on different levels of temporal aggregation (3h, 24h, and 72h) in winter (DJF). Ratio of contributions from PR-values in Figure S2. Contribution from the mean in blue and contributions from variability in purple. Ratio of contribution on the y-axis with different warming levels on the x-axis (+1, +2, +3, +4 °C). The solid lines with the circle marker represent individual contributions for 3-hour temporal aggregation; the dashed lines with the triangle marker represent contributions for 24-hours; the dotted lines with the square marker represent contributions for 72-hours. The lower left panel shows the aggregation over all land grid cells and shows axis labels.

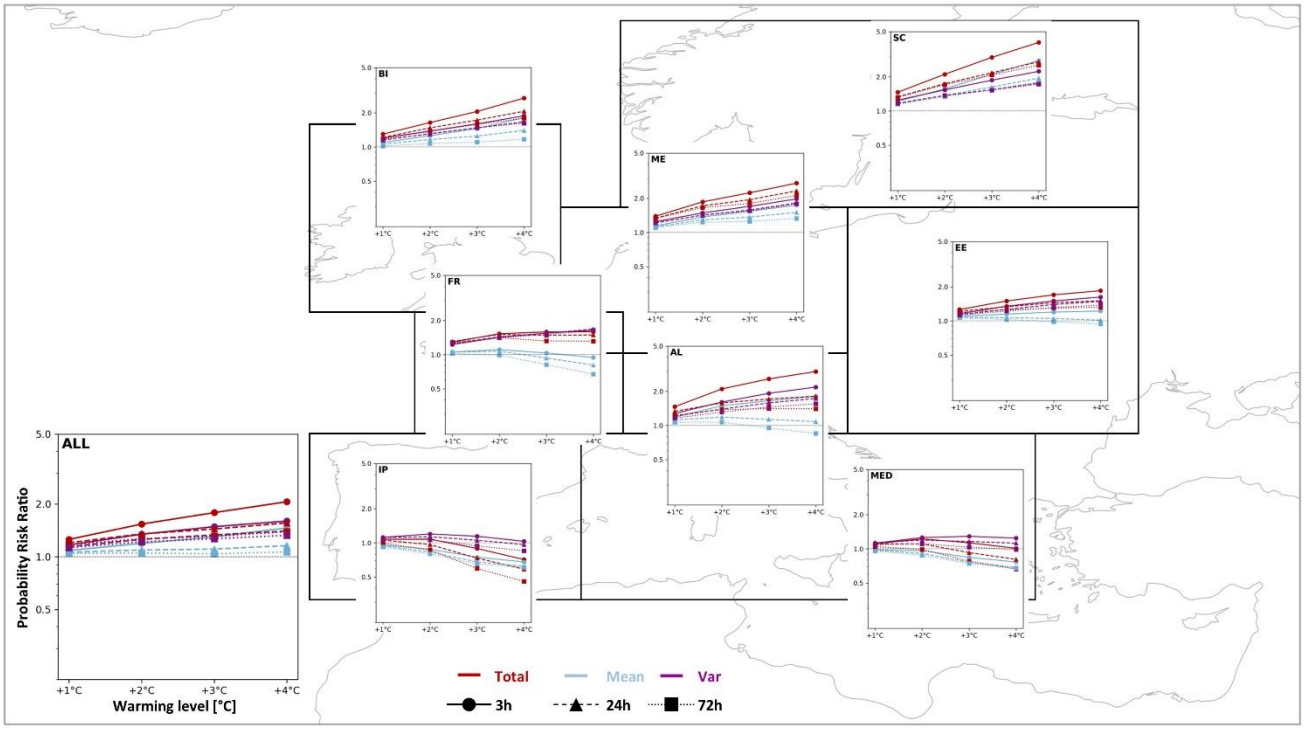


Figure S4: Regional probability risk ratios for different temporal aggregation levels (3h, 24h, 72h) in summer (JJA). The panels show PRtotal (red), PRmean (blue), and PRvar (purple) values (y-axis) at warming levels (+1, +2, +3, +4 °C) (x-axis). The solid lines with the circle marker represent PR-values for 3-hour temporal aggregation; the dashed lines with the triangle marker represent PR-values for 24-hours; the dotted lines with the square marker represent PR-values for 72-hours. The lower left panel shows the aggregation over all land grid cells and shows axis labels.

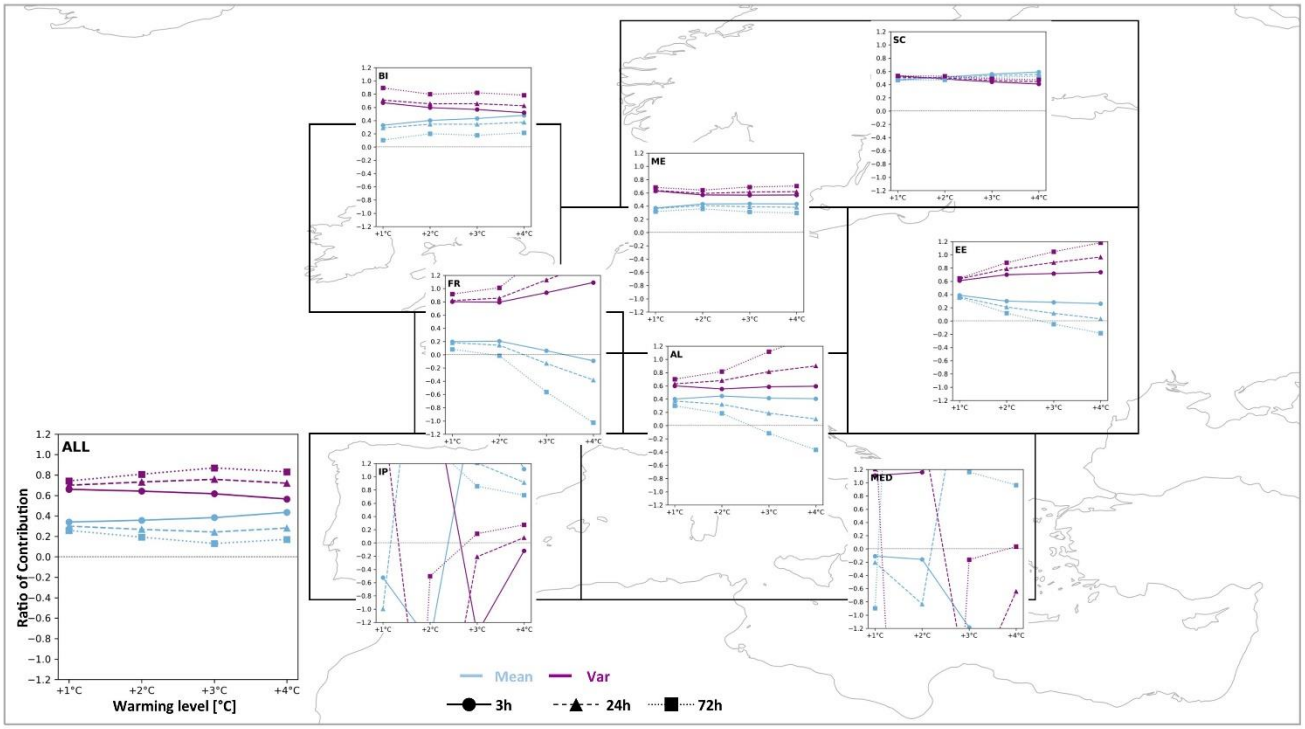


Figure S5: Regional ratios of contribution based on different levels of temporal aggregation (3h, 24h, and 72h) in summer (JJA). Ratio of contributions from PR-values in Figure S4. Contribution from the mean in blue and contributions from variability in purple. Ratio of contribution on the y-axis with different warming levels on the x-axis (+1, +2, +3, +4 °C). The solid lines with the circle marker represent individual contributions for 3-hour temporal aggregation; the dashed lines with the triangle marker represent contributions for 24-hours; the dotted lines with the square marker represent contributions for 72-hours. The lower left panel shows the aggregation over all land grid cells and shows axis labels.

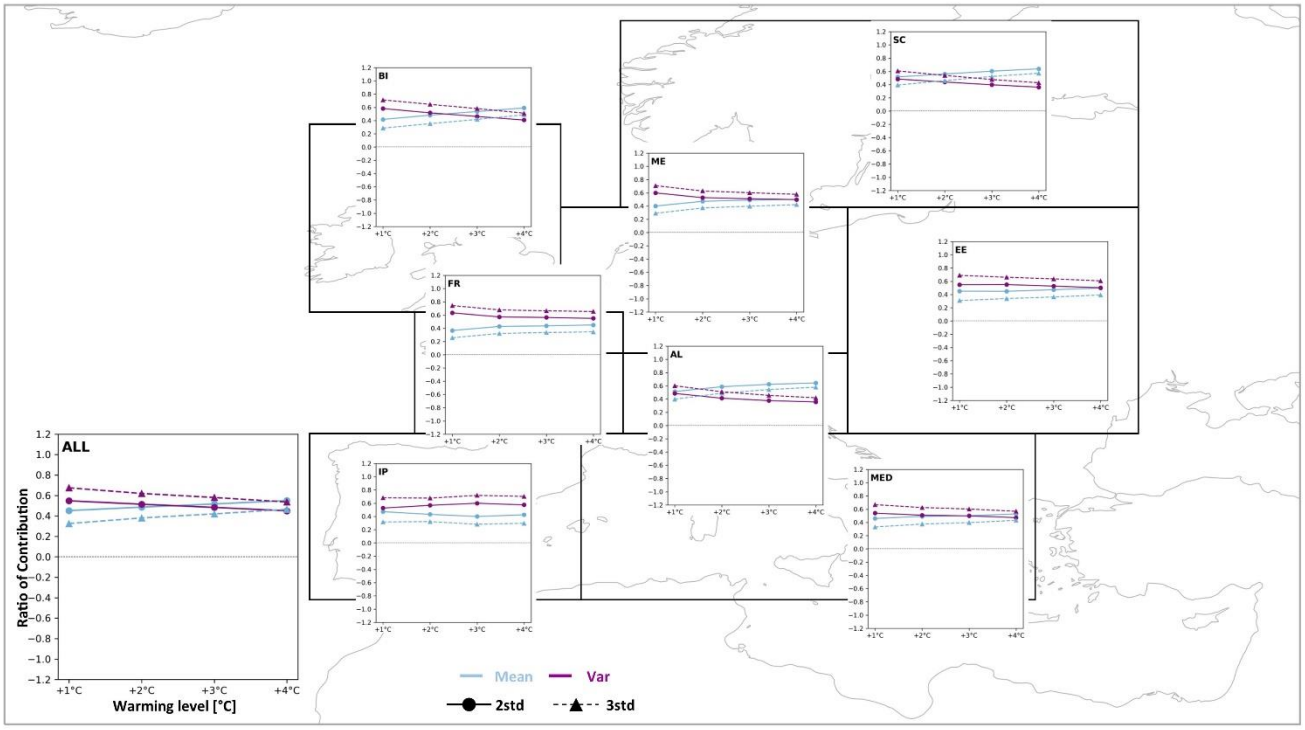


Figure S6: Regional ratios of contribution based on different levels of extremeness (2-sigma vs. 3-sigma) in annual rx3h extremes. Individual contributions from the mean in blue and contributions from variability in purple. Ratio of contribution on the y-axis with different warming levels on the x-axis (+1, +2, +3, +4 °C). The solid lines with the circle marker represent individual contributions for 2-sigma extremes; the dashed lines with the triangle marker represent contributions for 3-sigma extremes. The lower left panel shows the aggregation over all land grid cells and shows axis labels.

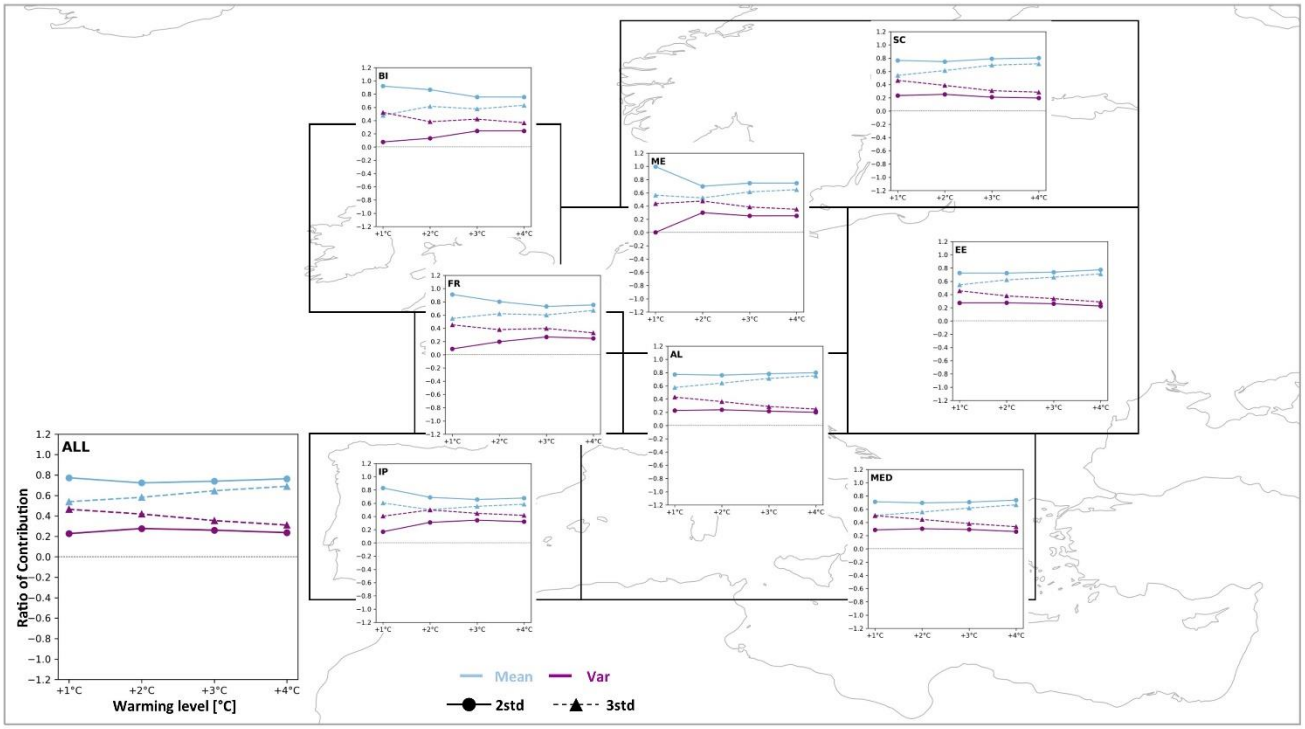
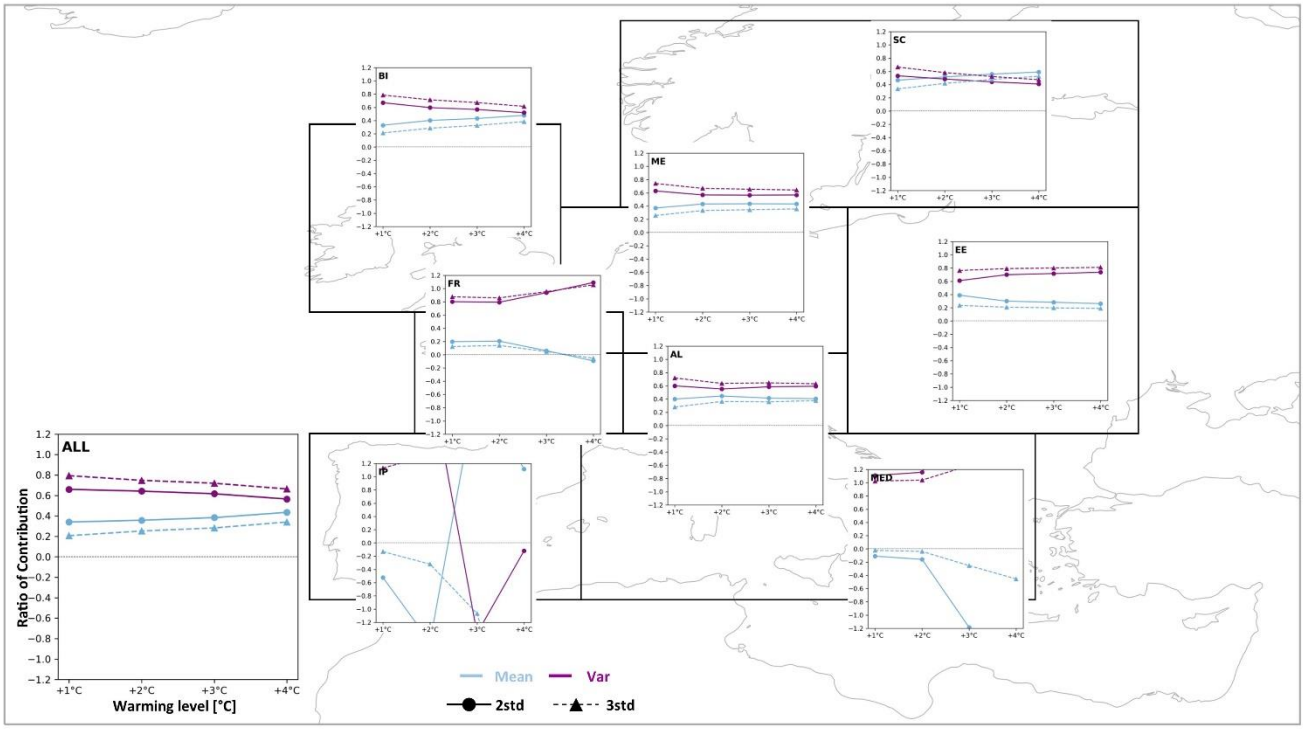


Figure S7: Regional ratios of contribution based on different levels of extremeness (2-sigma vs. 3-sigma) in winter (DJF) rx3h extremes. Individual contributions from the mean in blue and contributions from variability in purple. Ratio of contribution on the y-axis with different warming levels on the x-axis (+1, +2, +3, +4 °C). The solid lines with the circle marker represent individual contributions for 2-sigma extremes; the dashed lines with the triangle marker represent contributions for 3-sigma extremes. The lower left panel shows the aggregation over all land grid cells and shows axis labels.



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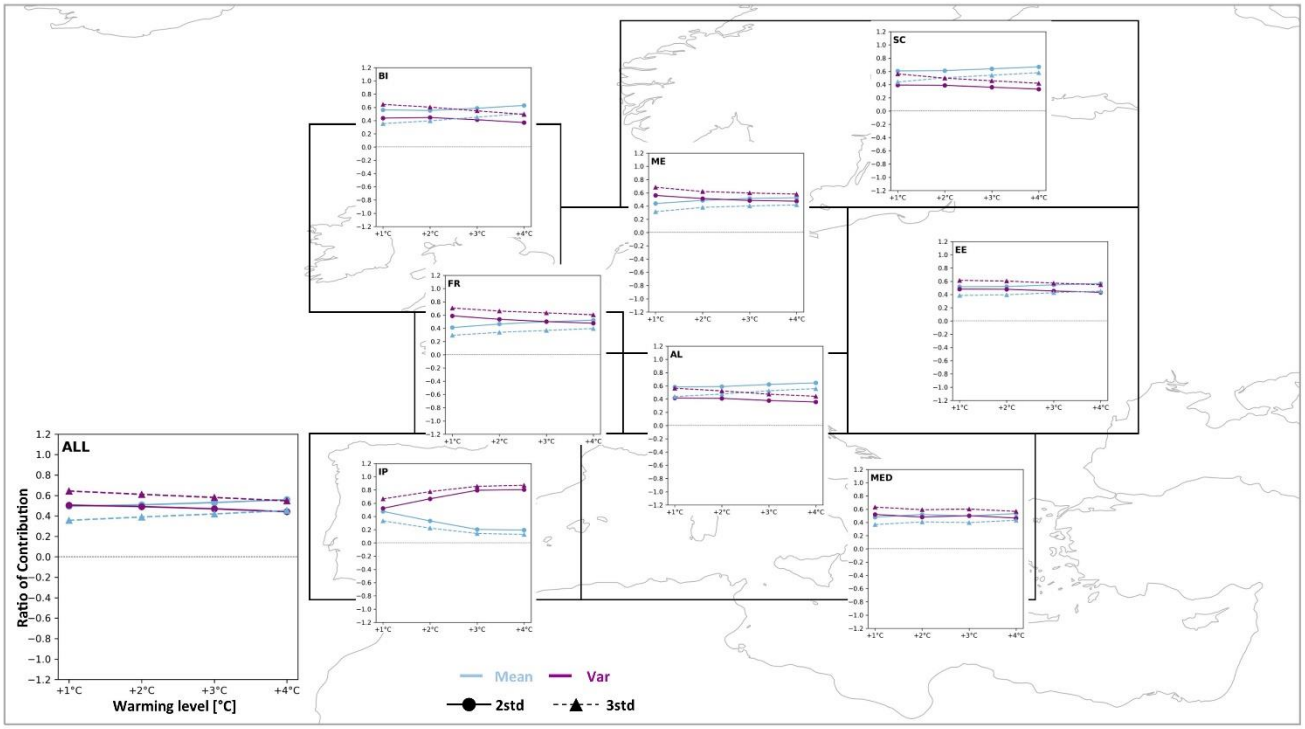
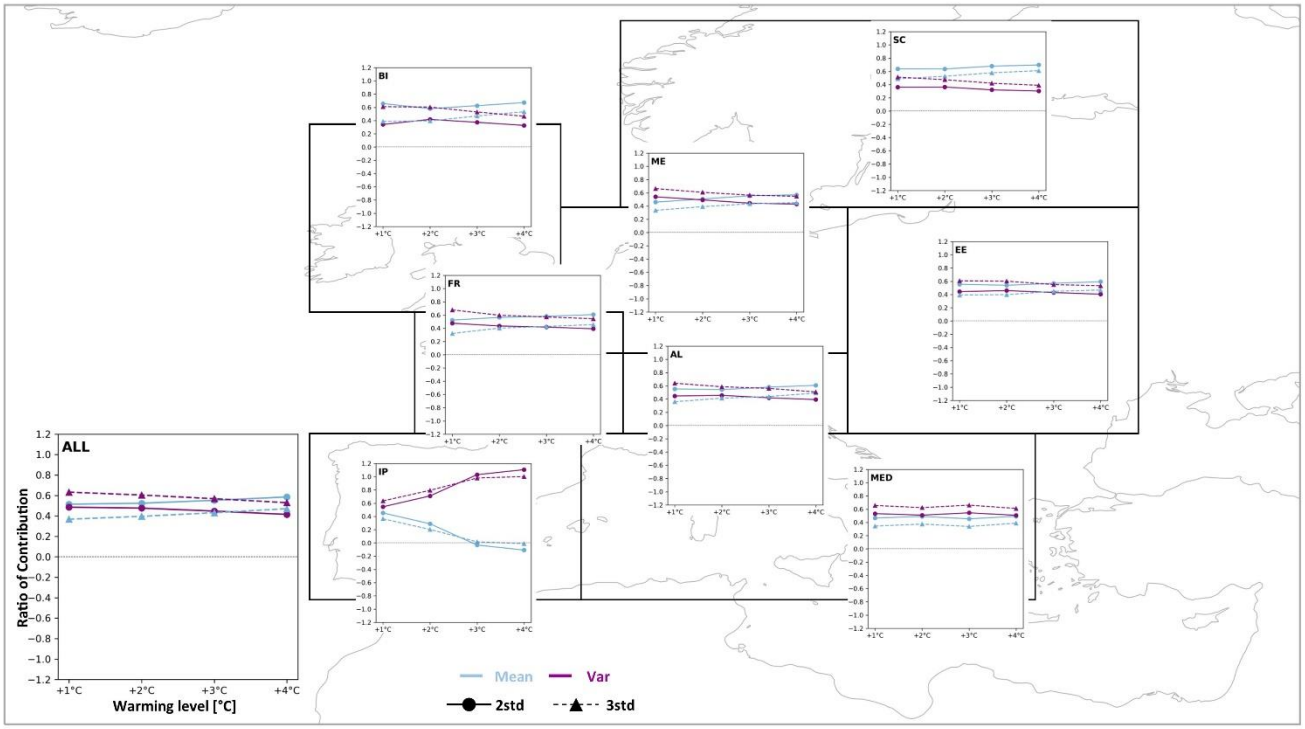


Figure S9: Regional ratios of contribution based on different levels of extremeness (2-sigma vs. 3-sigma) in annual rx24h extremes. Individual contributions from the mean in blue and contributions from variability in purple. Ratio of contribution on the y-axis with different warming levels on the x-axis (+1, +2, +3, +4 °C). The solid lines with the circle marker represent individual contributions for 2-sigma extremes; the dashed lines with the triangle marker represent contributions for 3-sigma extremes. The lower left panel shows the aggregation over all land grid cells and shows axis labels.



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