



Supplement of

Recent intensification of extreme precipitation over East Antarctica driven by increases in greenhouse gases and stratospheric ozone

Sai Prabala Swetha Chittella et al.

Correspondence to: Sai Prabala Swetha Chittella (prabala.saiswetha@gmail.com)

The copyright of individual parts of the supplement might differ from the article licence.

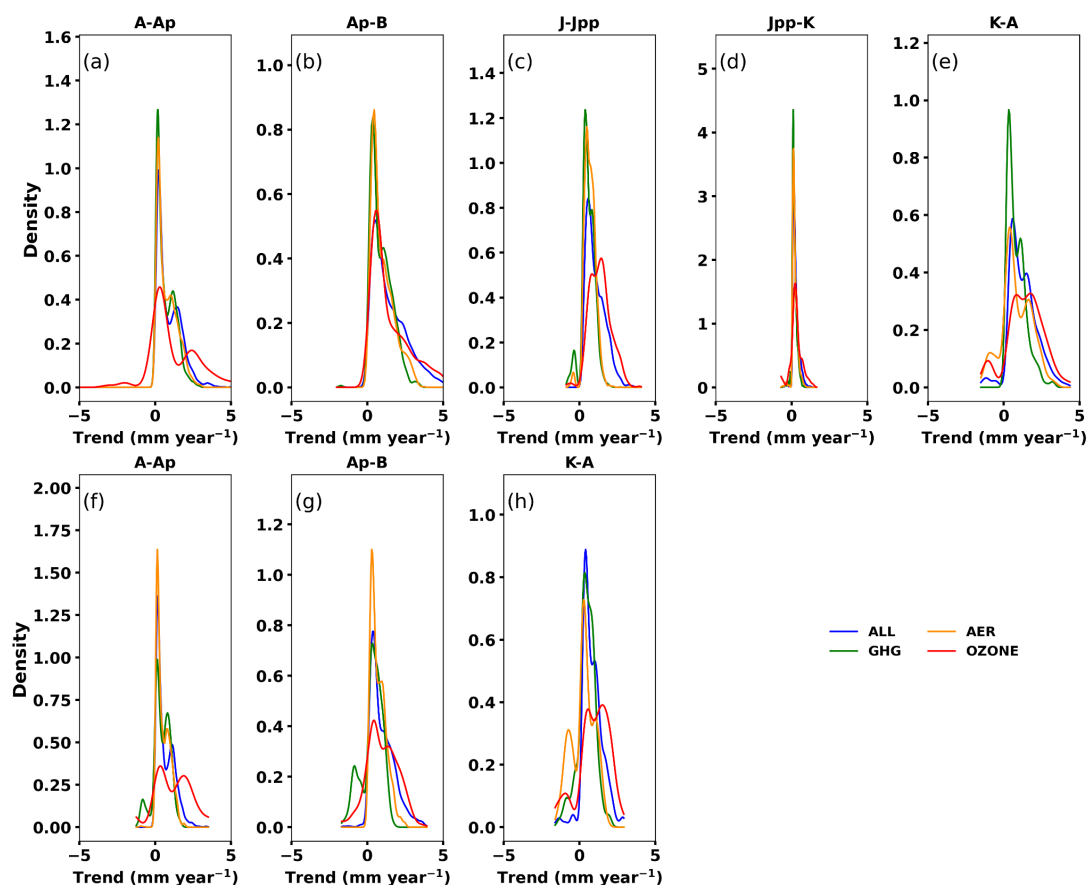


Figure S1: Probability density functions of annual trends in total precipitation (mm year^{-1}) for (a) A-Ap, (b) Ap-B, (c) J-Jpp, (d) Jpp-K and (e) K-A, and extreme precipitation (mm year^{-1}) for (f) A-Ap, (g) Ap-B, and (h) K-A from 1979 to 2023 for all of the CESM1 ensembles for ALL (blue), GHG (green), AER (orange) and O3 (red). The results are based only on annual trends from grid points in the basins that are statistically significant at the 90% confidence level. The A-Ap and K-A (Dronning Maud Land), Ap-B (Enderby Land), and J-Jpp (Filchner-Ronne) basins are in East Antarctica, and the Jpp-K (Filchner-Ronne) basin in West Antarctica.

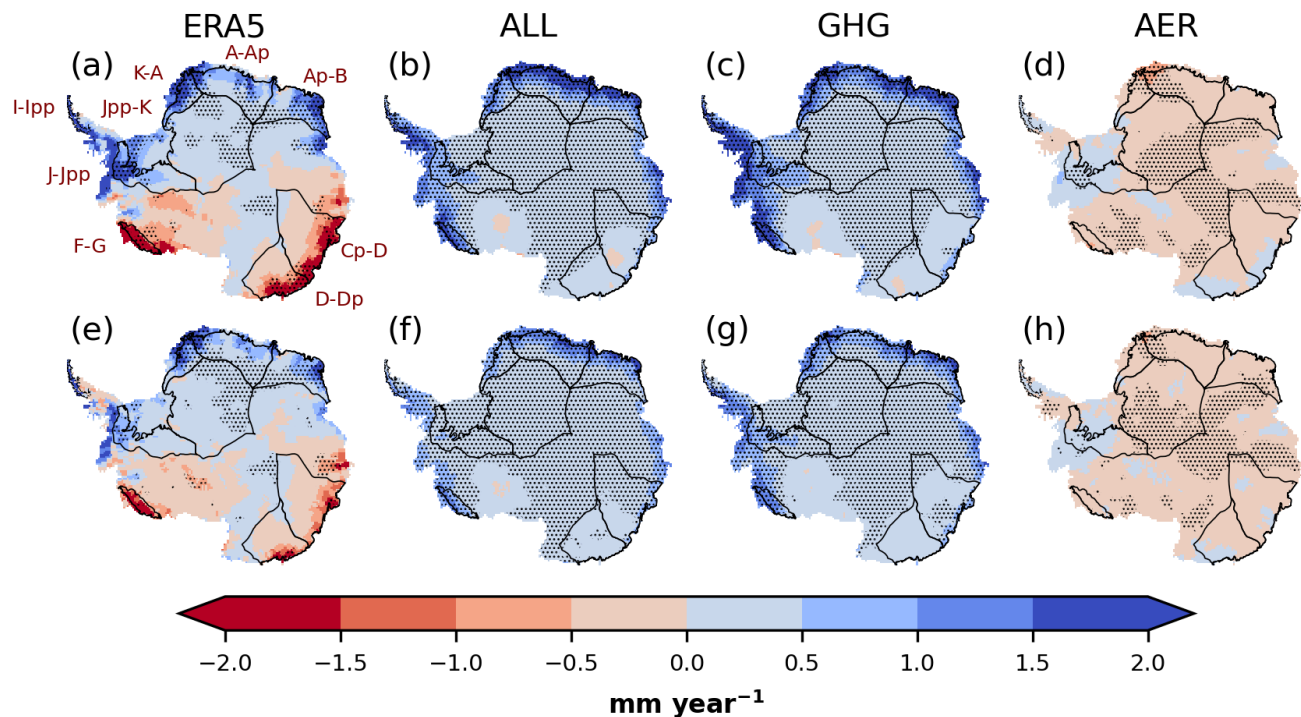


Figure S2: Annual linear trends in (a-d) total and (e-h) extreme precipitation over Antarctica from 1979 to 2023 (mm year^{-1}) from (a, e) ERA5 and the CESM2 ensemble mean for (b, f) ALL, (c, g) GHG, and (d, h) AER. Stippling indicates regions where trends are statistically significant at the 90% confidence level. Also shown in panel (a) are the locations of the A-Ap and K-A (Dronning Maud Land), Ap-B (Enderby Land), Cp-D (Wilkes Land), D-Dp (Victoria Land), and Jpp-K (Filchner-Ronne) basins in East Antarctica, the F-G (Marie Byrd Land) and J-Jpp (Filchner-Ronne) basins in West Antarctica, and the I-Ipp basin in the Antarctic Peninsula.

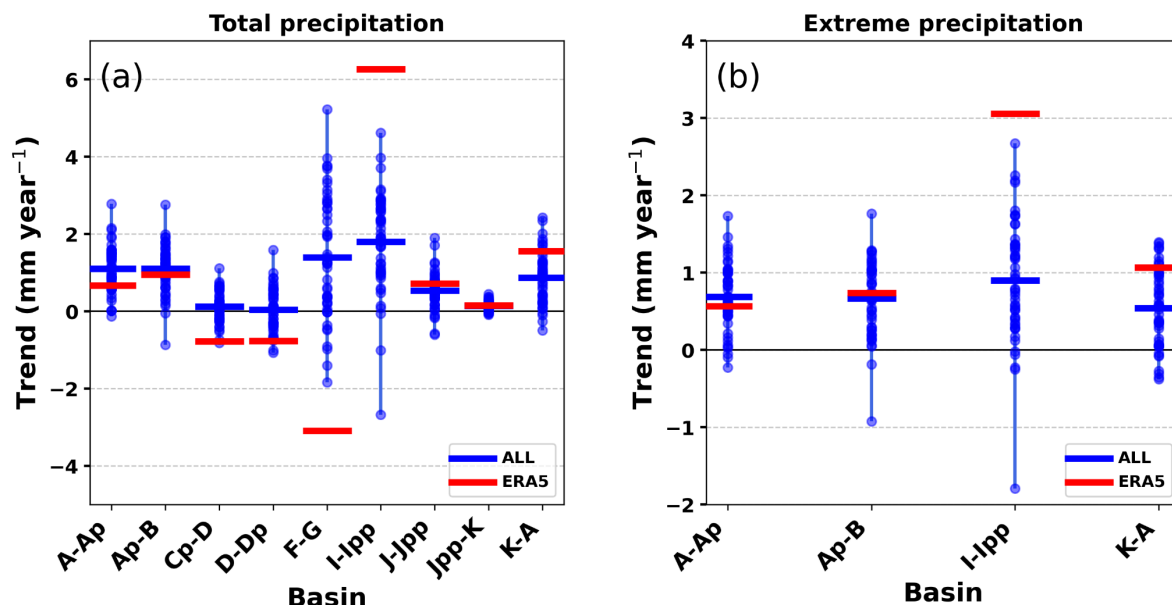


Figure S3: (a) Basin-averaged annual linear trends in total precipitation (mm year^{-1}) for drainage basins A-Ap, Ap-B, Cp-D, D-Dp, F-G, I-Ipp, J-Jpp, Jpp-K, and K-A for ERA5 (thick red line) and the CESM2 ensemble mean for ALL (thick blue line). (b) As (a) but for extreme precipitation for basins A-Ap, Ap-B, I-Ipp, and K-A. Also shown are the basin-averaged trends from the 50 different members of the ALL ensemble (filled blue circles). The trends are statistically significant with a 90% confidence level. The A-Ap and K-A (Dronning Maud Land), Ap-B (Enderby Land), Cp-D (Wilkes Land), D-Dp (Victoria Land), and Jpp-K (Filchner-Ronne) basins are in East Antarctica, the F-G (Marie Byrd Land) and J-Jpp (Filchner-Ronne) basins in West Antarctica, and the I-Ipp basin in the Antarctic Peninsula.

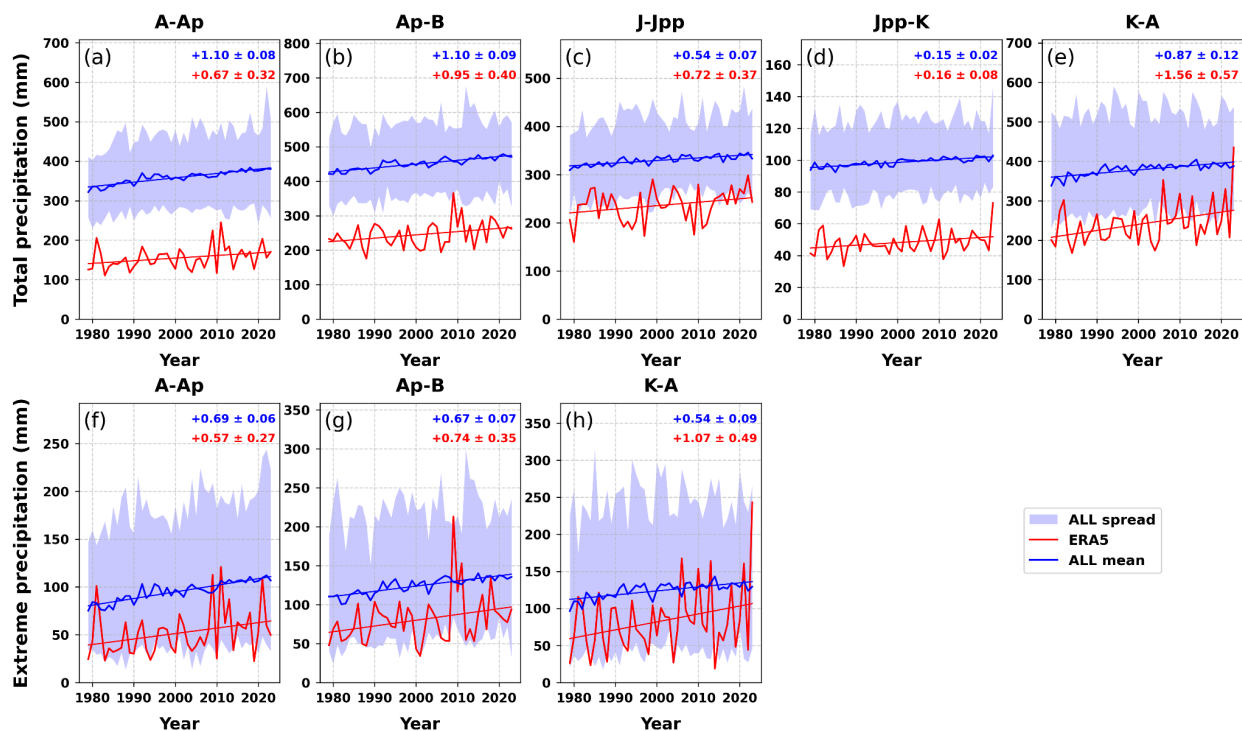


Figure S4: Times series of basin-averaged annual total precipitation (mm) for (a) A-Ap, (b) Ap-B, (c) J-Jpp, (d) Jpp-K and (e) K-A, and annual extreme precipitation (mm) for (f) A-Ap, (g) Ap-B, and (h) K-A, from 1979 to 2023 from ERA5 (red) and the CESM2 ensemble mean for ALL (blue). Linear trends (statistically significant at 90% confidence level) for ERA5 and ALL are represented by the red and blue lines, respectively. Blue shading represents the maximum and minimum ensemble spread of ALL. Each panel also shows the linear trend and the standard error (mm year⁻¹). The A-Ap and K-A (Dronning Maud Land), Ap-B (Enderby Land), and J-Jpp (Filchner-Ronne) basins are in East Antarctica, and the Jpp-K (Filchner-Ronne) basin in West Antarctica.

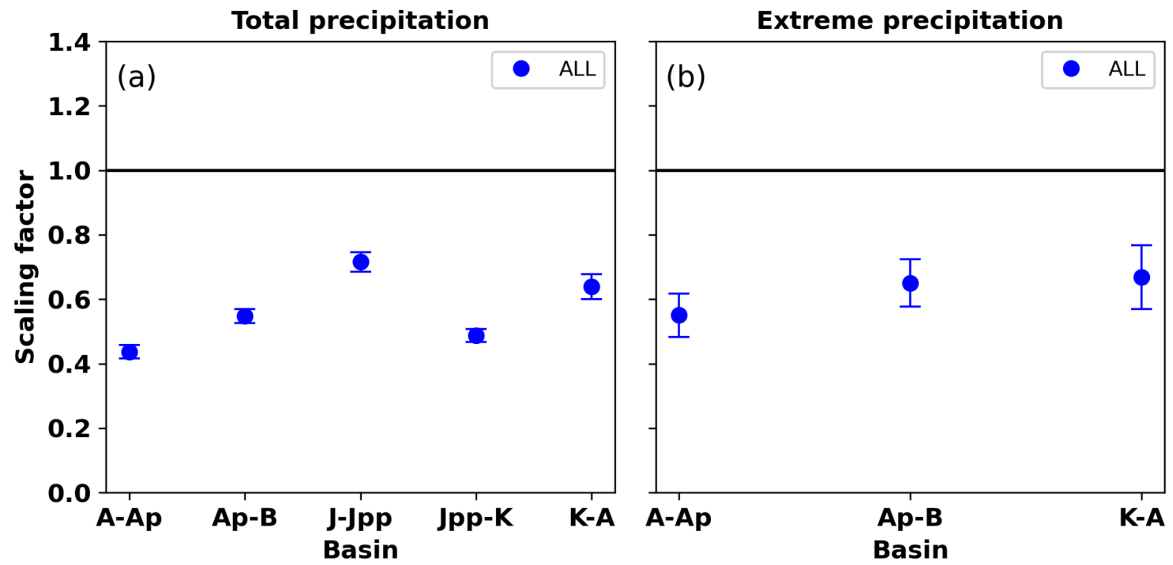


Figure S5: (a) One-signal estimates of basin-averaged scaling factors (solid blue circles) for annual total precipitation for drainage basins A-Ap, Ap-B, J-Jpp, Jpp-K and K-A from 1979 to 2023 based on regressing the CESM2 ALL ensemble against ERA5. (b) As (a) but for annual extreme precipitation for basins A-Ap, Ap-B and K-A. The error bars denote the 90% confidence intervals and the horizontal line indicates a scaling factor of one. The A-Ap and K-A (Dronning Maud Land), Ap-B (Enderby Land), and J-Jpp (Filchner-Ronne) basins are in East Antarctica, and the Jpp-K (Filchner-Ronne) basin in West Antarctica.

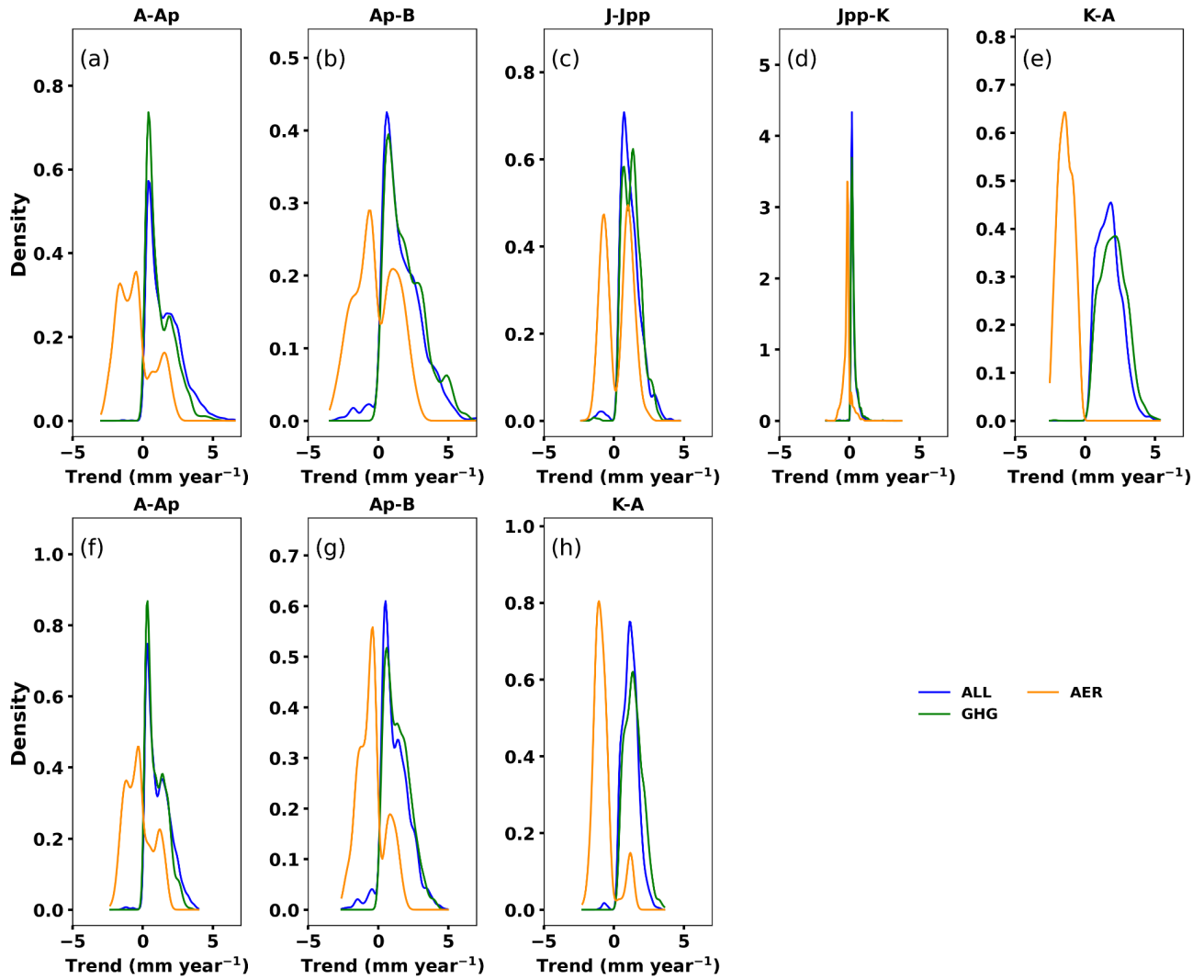


Figure S6: Probability density functions of annual trends in total precipitation (mm year⁻¹) for (a) A-Ap, (b) Ap-B, (c) J-Jpp, (d) Jpp-K and (e) K-A, and extreme precipitation (mm year⁻¹) for (f) A-Ap, (g) Ap-B, and (h) K-A from 1979 to 2023 for all of the CESM2 ensembles for ALL (blue), GHG (green) and AER (orange). The results are based only on annual trends from grid points in the basins that are statistically significant at the 90% confidence level. The A-Ap and K-A (Dronning Maud Land), Ap-B (Enderby Land), and J-Jpp (Filchner-Ronne) basins are in East Antarctica, and the Jpp-K (Filchner-Ronne) basin in West Antarctica.

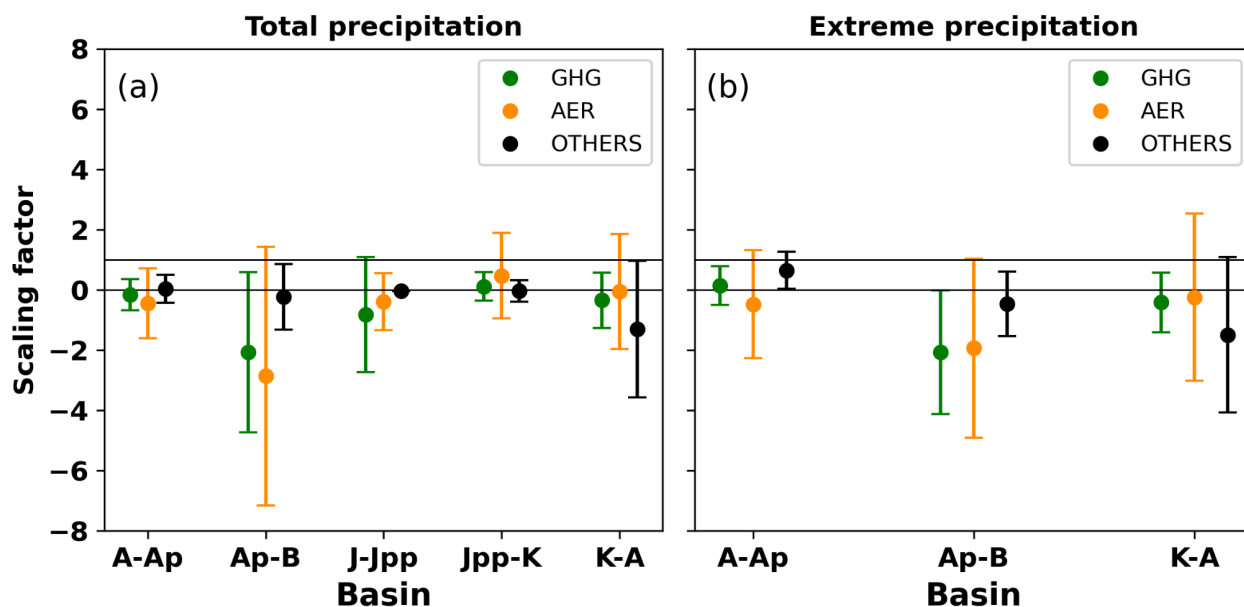


Figure S7: As Fig. S5, but showing three-signal estimates of basin-averaged scaling factors for (a) annual total precipitation for drainage basins A-Ap, Ap-B, J-Jpp, Jpp-K and K-A from 1979 to 2023 for the CESM2 ensembles for GHG (solid green circles), AER (solid orange circles), and O3 (solid red circles). The GHG, AER and OTHERS scaling factors are based on regressing ALL, GHG and AER against ERA5. (b) As (a) but for annual extreme precipitation for basins A-Ap, Ap-B and K-A. The error bars denote the 90% confidence intervals and the horizontal line indicates a scaling factor of one. The A-Ap and K-A (Dronning Maud Land), Ap-B (Enderby Land), and J-Jpp (Filchner-Ronne) basins are in East Antarctica, and the Jpp-K (Filchner-Ronne) basin in West Antarctica.