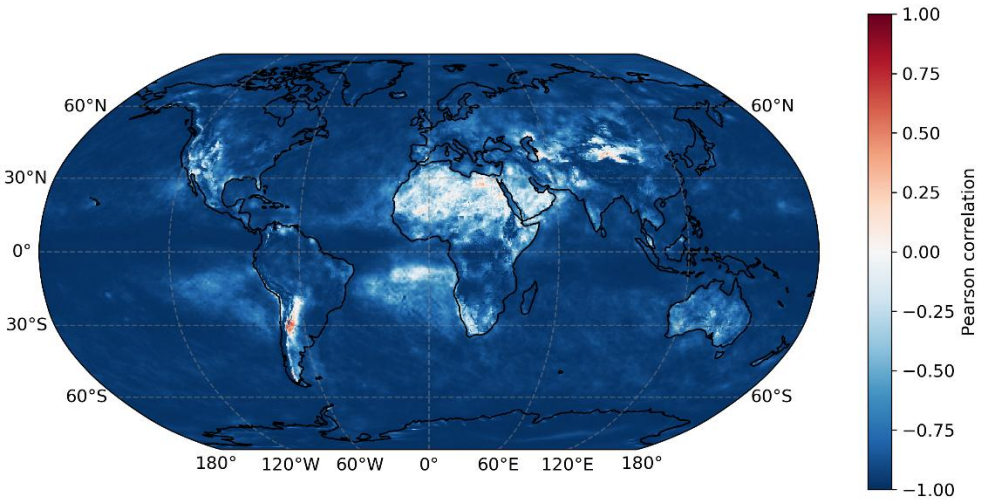
Supplementary Figures and Tables

Continents dry as declining precipitation efficiency redirects moisture pathways toward the ocean

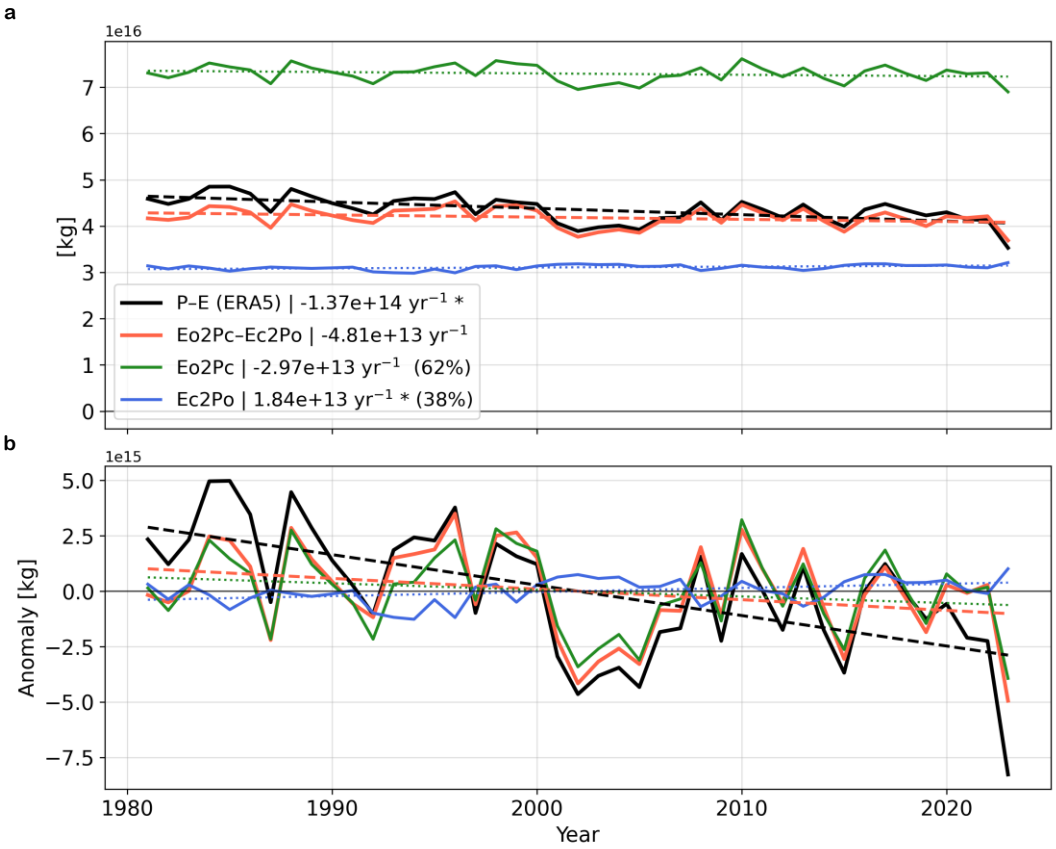
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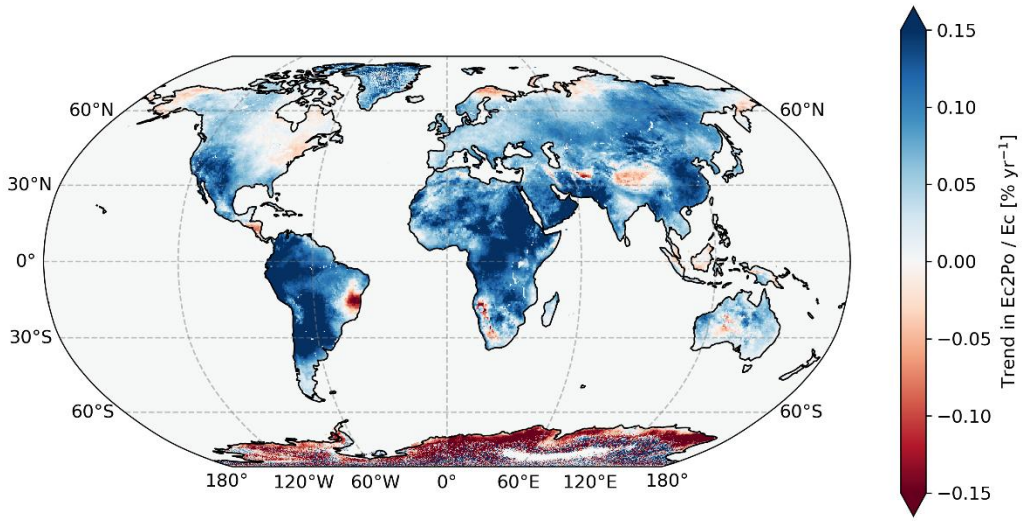
[2]Geophysical Fluid Dynamics Laboratory, National Oceanic and Atmospheric Administration, Princeton, NJ, USA.



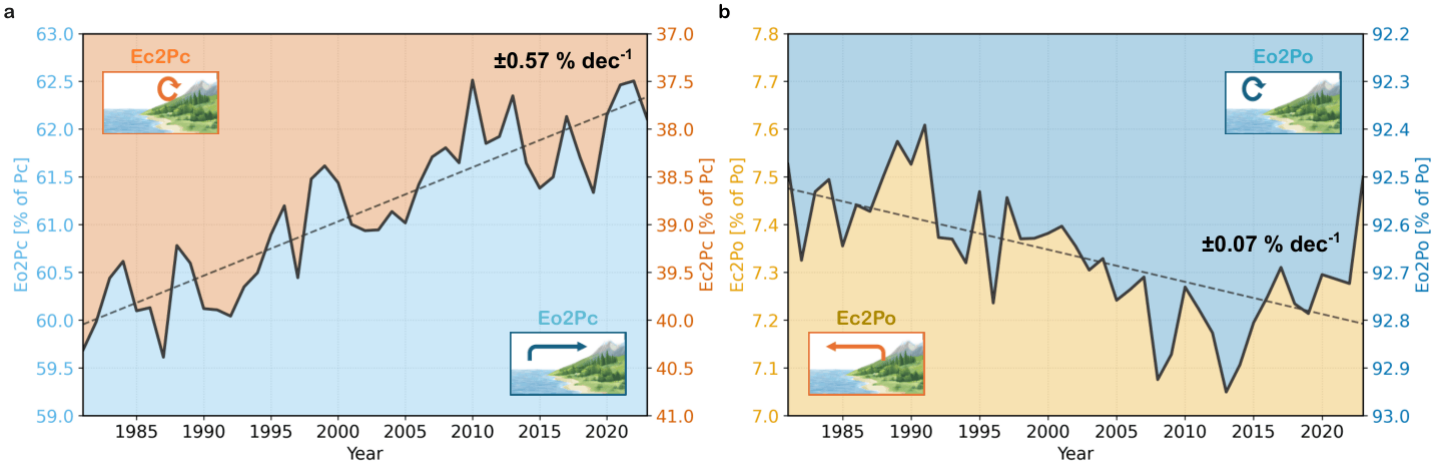
Supplementary Figure 1 | Pearson correlation of *P* − *E* and vertically integrated moisture convergence (1981–2023).



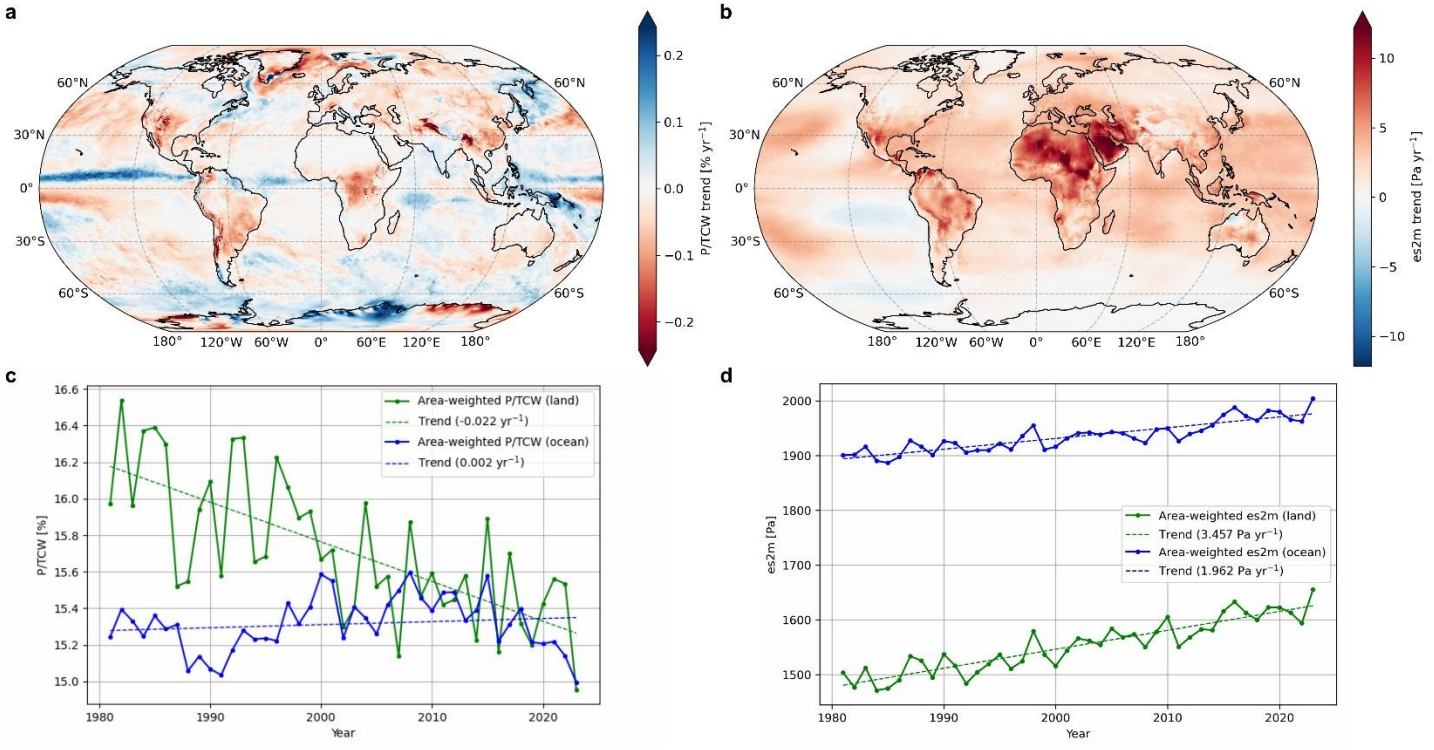
Supplementary Figure 2 | Comparison of the terrestrial water balance and Lagrangian moisture fluxes. a, Absolute time series and b, anomalies of *P* − *E* from ERA5 (black), the Lagrangian moisture balance Eo2Pc−Ec2Po (red), oceanic moisture import Eo2Pc (green) and continental moisture export Ec2Po (blue). Asterisks indicate trends significant at $p < 0.05$; percentages indicate the contributions of Eo2Pc and Ec2Po to the *P* − *E* trend.



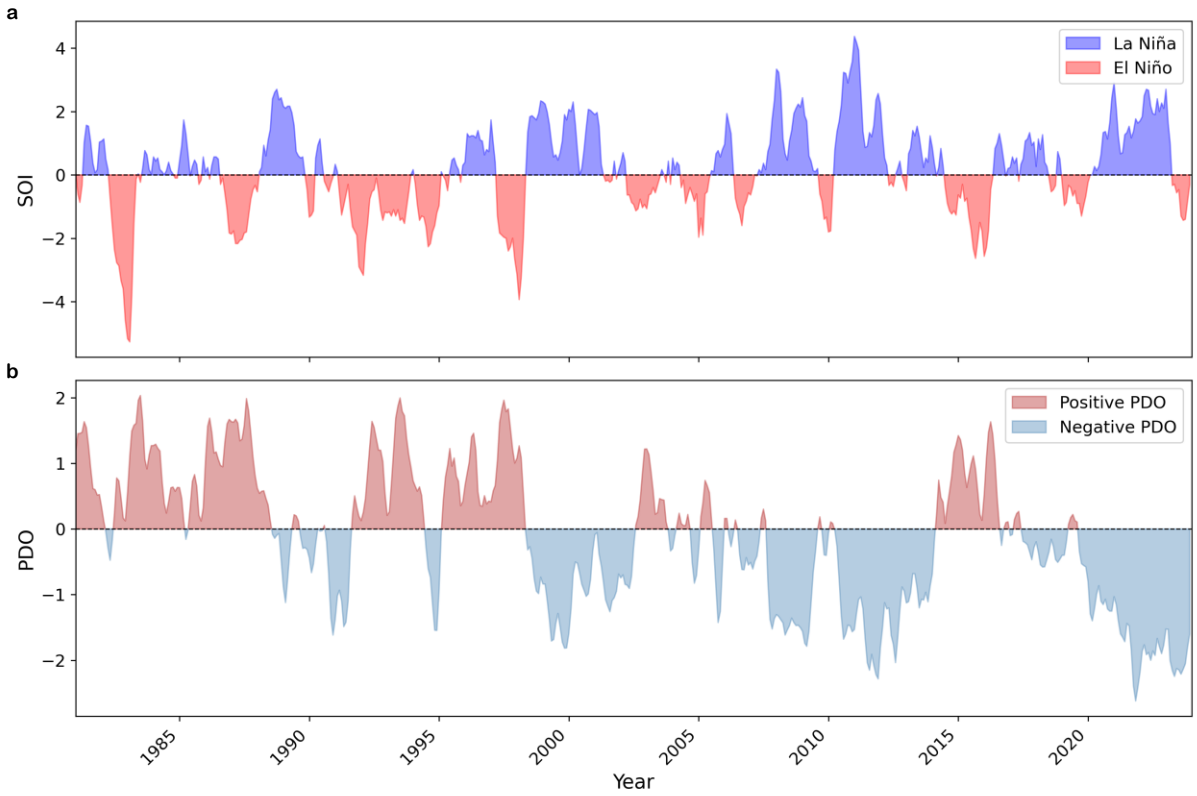
Supplementary Figure 3 | Trend of the fraction of continental evaporation going to ocean precipitation (Ec2Po/Ec) over 1981–2023.



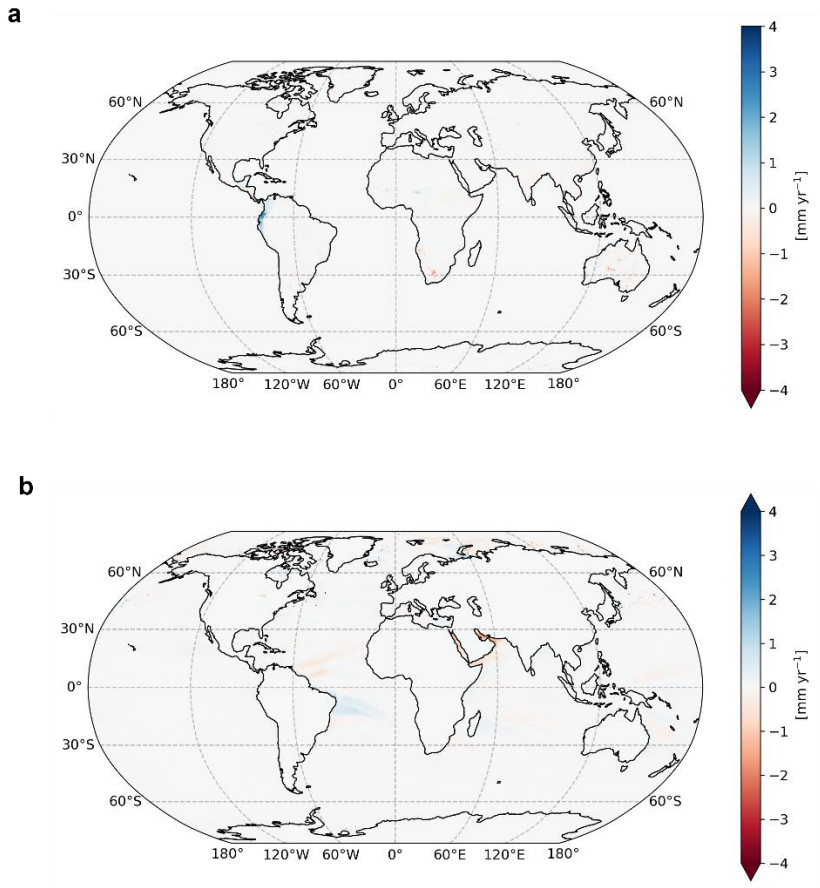
Supplementary Figure 4 | Changes in the moisture sources of land and ocean precipitation. Time series of the fraction of a, land precipitation originating from continental (Ec2Pc/Pc) and oceanic (Eo2Pc/Pc) evaporation and b, ocean precipitation originating from continental (Ec2Po/Po) and oceanic (Eo2Po/Po) evaporation.



Supplementary Figure 5 | Changes in precipitation relative to total column water and saturation vapour pressure.. a, Spatial trend and c, time series of the ratio of precipitation to total column water. b, Spatial trend and d, time series of 2-m saturation vapour pressure (es2m). Trends are calculated over 1981–2023.



Supplementary Figure 6 | Variability in the Southern Oscillation and Pacific Decadal Oscillation. Time series of a, the Southern Oscillation Index (SOI) and b, the Pacific Decadal Oscillation (PDO) over 1981–2023. Blue and red shading denote cold and warm phases, respectively.



Supplementary Figure 7 | Residuals of the moisture-pathway decomposition. Residual trends for the decomposition of a, continental moisture export (Ec2Po) and b, oceanic moisture import (Eo2Pc).

Supplementary Table 1 | Contributions to trends in continental moisture export and oceanic moisture import. Global-mean contributions of evaporation, moisture pathway connectivity (α), *en route* survival (β) and sink precipitation efficiency (γ) to trends in Ec2Po and Eo2Pc over 1981–2023. Contributions are reported in mm per decade and as a percentage of the total trend; residuals represent the unexplained fraction of the decomposition.

	Ec2Po		Eo2Pc	
	mm/decade	% of trend	mm/decade	% of trend
Moisture pathway connectivity (α)	0.01	0.7	0.17	2.3
En route survival (β)	0.84	**61.8**	0.58	7.7
Sink precipitation efficiency (γ)	-0.29	21.3	-4.05	**53.8**
Evaporation	-0.21	15.4	2.67	35.5
Residual	0.01	0.7	0.06	0.8