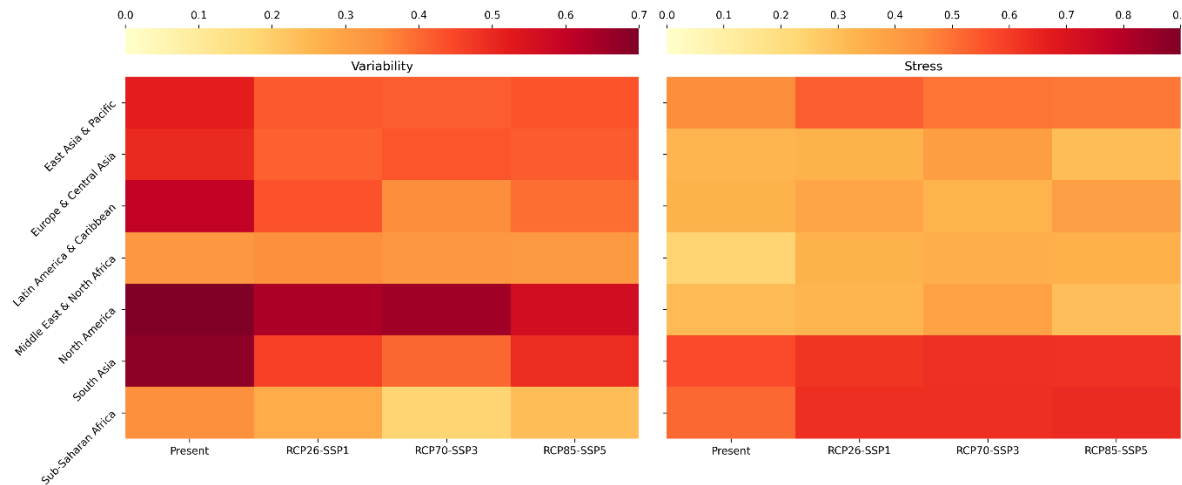


Closing the climate adaptation gap for water supply utilities

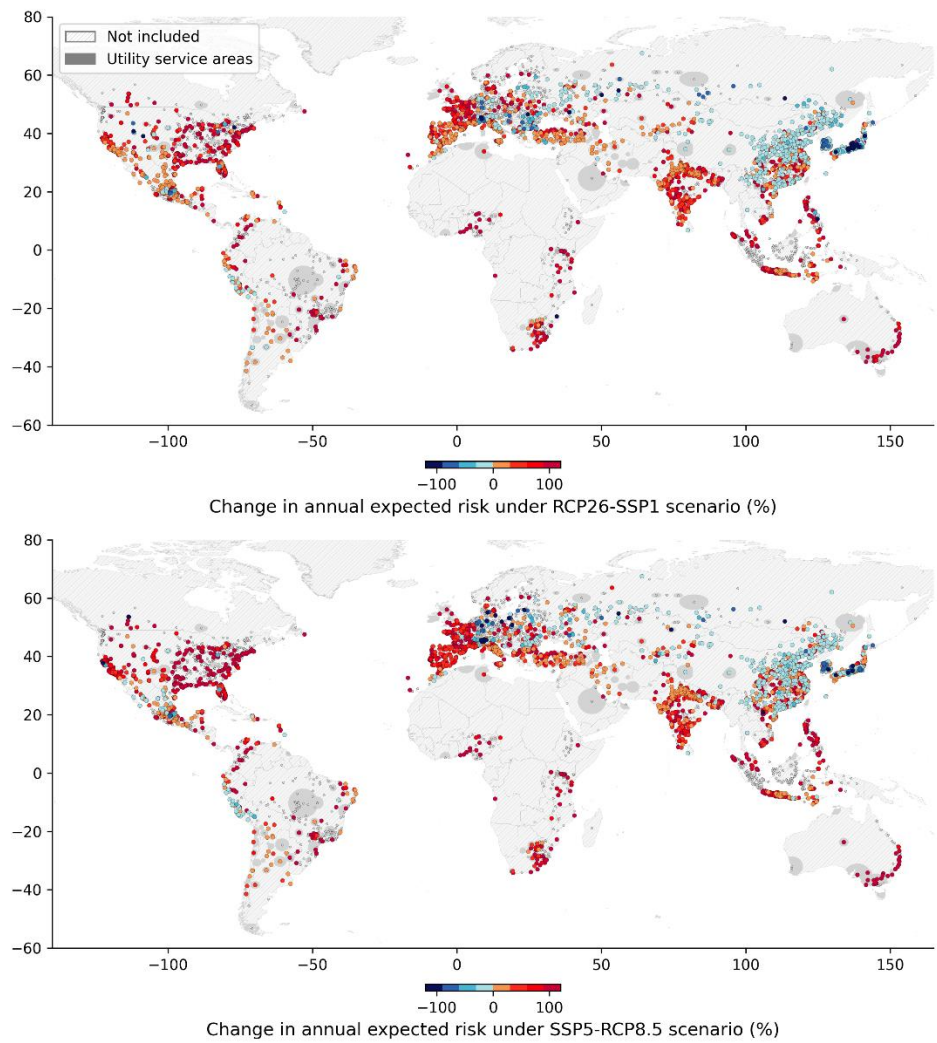
Supplementary Figures 1–9, Tables 1-2 and Text 1.

Results

Figures

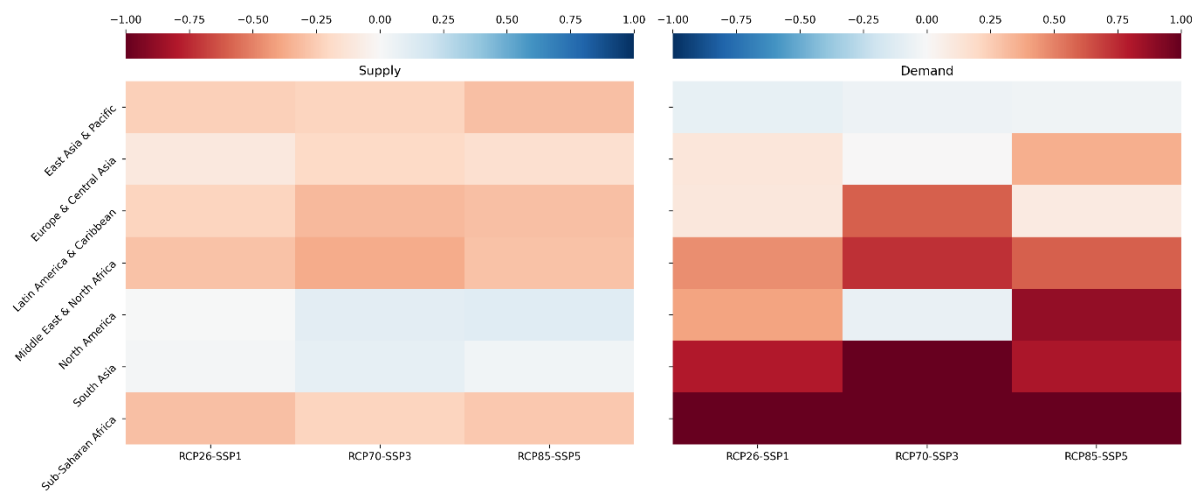


Supplementary Figure 1. Correlation coefficient between hydrological variability and stress on present-day risk per region, per climate scenario.



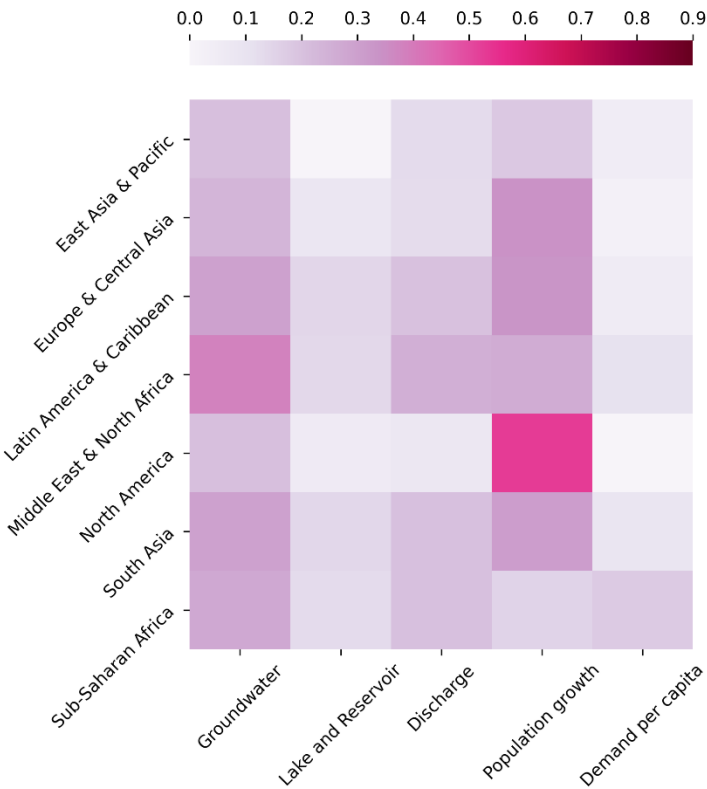
9

10 **Supplementary Figure 2. Change in future risk projected under optimistic and**
11 **pessimistic scenarios SSP1-2.6 and SSP5-8.5, respectively. Areas not covered by the**
12 **utility database used for our analysis are indicated with hatching.**

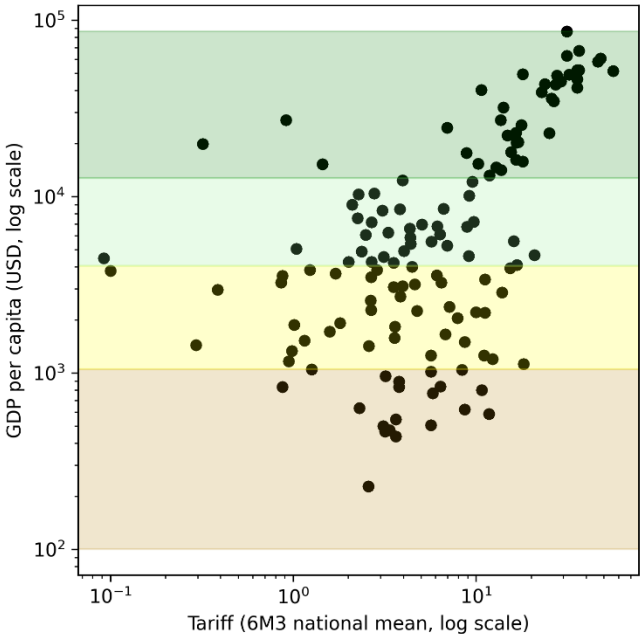


13

14 **Supplementary Figure 3. Change in supply and demand per considered future scenario**
15 **from the baseline scenario, per region.**



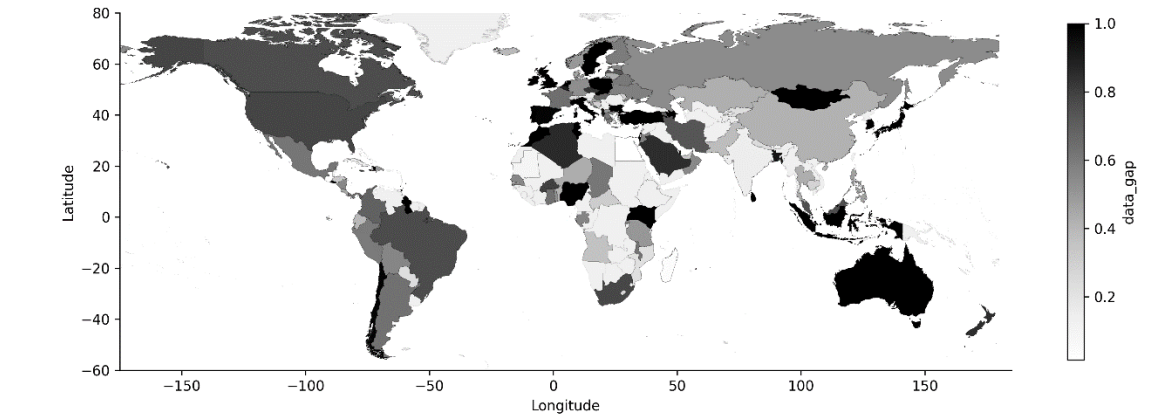
Supplementary Figure 4. Uncertainty range per input, per region. This is calculated as the maximum range across SSP and RCP scenarios considered in this study, divided by the mean.



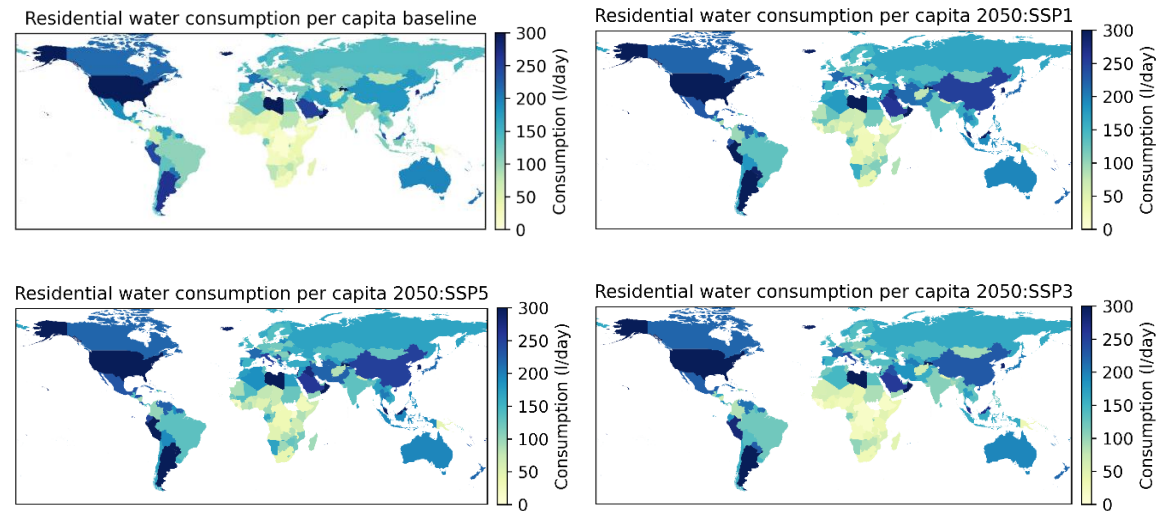
Supplementary Figure 5. Relationship between national mean tariff rate and GDP per capita.

Method

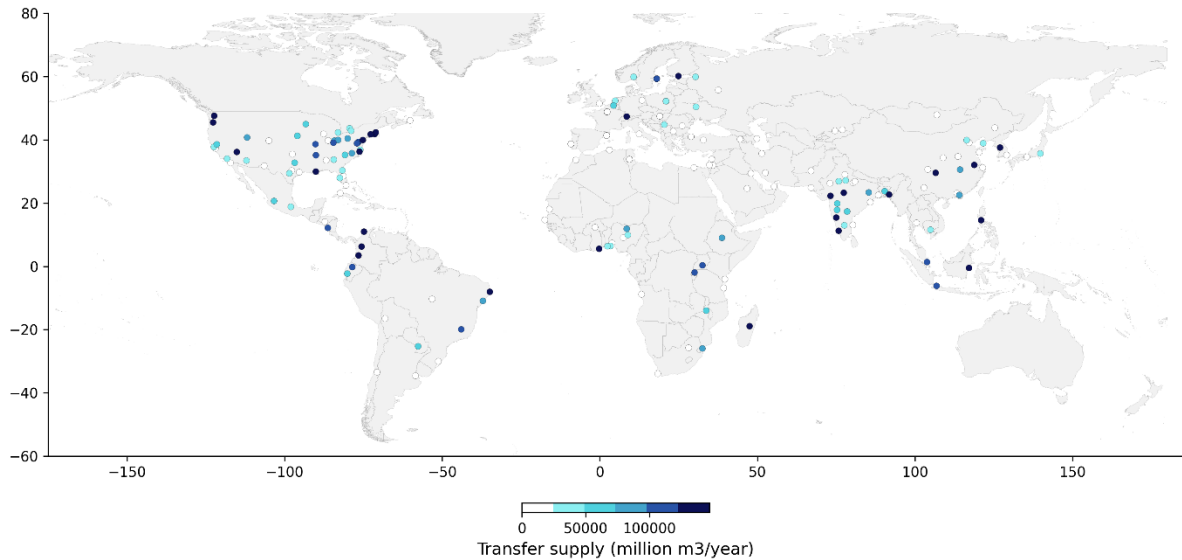
Figures



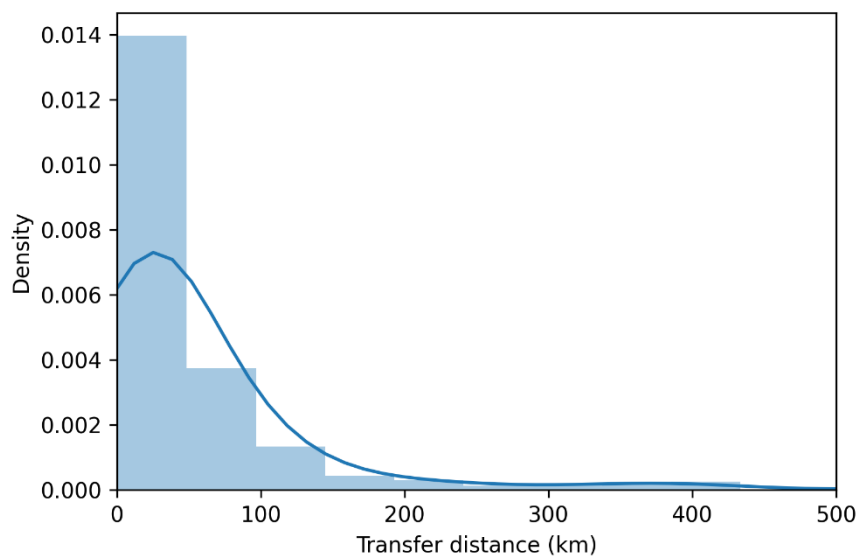
Supplementary Figure 6. Percentage difference between the total number of piped water customers (JMP, 2017) and those included in the utility database (GWI, 2022).



Supplementary Figure 7. Water demand per capita per scenario, with SSP scenarios projected to the year 2050.



Supplementary Figure 8. Spatial distribution utilities with long-distance transfer and their supply volume.



Supplementary Figure 9. Distribution of transfer distance in km (McDonald et al., 2014).

Text

Supplementary Text 1. Community Water Model.

The Community Water Model (CWatM) is a process-based distributed hydrological model¹. This paper uses model results at 30 arcminutes at a daily timestep. Lakes and reservoirs include location, shape, area, and volume derived from the HydroLAKES². Live storage, inflow, evaporation, abstraction, and outflow are simulated waterbody specific. Reservoir outflow is determined based on three storage limits and three outflow functions (minimum, normal, and non-damaging). Lake outflow is simulated with a weir function from Poleni for rectangular weirs. Groundwater is simulated as a

linear reservoir, recharged through soil percolation and preferential flow (renewable), and outflows through capillary rise, baseflow, and pumping. Groundwater demand exceeding availability is facilitated through fossil water (non-renewable).

Tables

Supplementary Table 1. Modelling assumptions.

Adaptation option type	Min limits (% of demand)	Max limits (% of demand)
Leakage reduction	10%	Existing rate
Desalination capacity increase	0%	90%
Reservoir storage volume increase	0%	90%

Supplementary Table 2. Option cost inputs³.

Option	Sub-component	Cost category	Value	Units	Source
Non-revenue water reduction	Pipe renovation	Capital cost	94-628	Euros/m	4
Storage	Surface water reservoir	Capital cost	450 (150-2500)	1000\$/Mm ³	5,6
		O&M cost	0.05 (0.01 – 0.3)	\$/m ³	
Desalination	Plant	Capital cost	1700 (900–2500)	\$/m ³ /day	7
		O&M cost	0.25 (0.15-0.35)	\$/m ³	
	Transfer	Capital cost	57 (34–135)	\$/m ³ /day	8,9
		O&M cost	0.01 (0-0.05)	\$/m ³	

Supplementary References

1. Burek, P. *et al.* Development of the Community Water Model (CWatM v1.04) - A high-resolution hydrological model for global and regional assessment of integrated water resources management. *Geosci. Model Dev.* (2020). doi:10.5194/gmd-13-3267-2020
2. Messenger, M. L., Lehner, B., Grill, G., Nedeva, I. & Schmitt, O. Estimating the volume and age of water stored in global lakes using a geo-statistical approach. *Nat. Commun.* (2016).

doi:10.1038/ncomms13603

3. Kahil, T. *et al.* A Continental-Scale Hydroeconomic Model for Integrating Water-Energy-Land Nexus Solutions. *Water Resour. Res.* (2018). doi:10.1029/2017WR022478
4. Ahopelto, S. & Vahala, R. Cost-benefit analysis of leakage reduction methods in water supply networks. *Water (Switzerland)* (2020). doi:10.3390/w12010195
5. Keller, A., Sakthivadivel, R. & Seckler, D. Water scarcity and the role of storage in development. *Water Manag.* (2000).
6. Wiberg, D. & Strzepek, K. *Development of regional economic supply curves for surface water resources and climate change assessments: A case study of China.* (2005).
7. Ghaffour, N., Missimer, T. M. & Amy, G. L. Technical review and evaluation of the economics of water desalination: Current and future challenges for better water supply sustainability. *Desalination* (2013). doi:10.1016/j.desal.2012.10.015
8. Albiac, J. *et al.* The economic unsustainability of the Spanish National Hydrological Plan. *Int. J. Water Resour. Dev.* (2003). doi:10.1080/0790062032000122961
9. Stillwell, A. S., King, C. W. & Webber, M. E. Desalination and Long-Haul Water Transfer as a Water Supply for Dallas, Texas: A Case Study of the Energy-Water Nexus in Texas. *Texas Water J.* (2010).