SUPPLEMENT

A seawater desalination scheme for global hydrological models

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Supplemental Text

Estimation of unit production cost

We used information regarding the engineering procurement and construction costs (hereafter EPC costs) for 186 Major Plants reported in DesalData. First, we confirmed that there were no clear tendencies pertaining to costs among countries, regions, user categories, and years of construction. However, we found distinct differences in cost between membrane processes (e.g., reverse osmosis and electrodialysis) and thermal technologies (e.g., multi-stage flash and multi-efficient distillation). In the future simulation, we assumed that new plants would use membrane processes because of their greater efficiency.

Lamei et al. (2008) estimated the unit production cost (0.86–3.21 USD m^{-3}) for membrane desalination plants in Egypt, Saudi Arabia, and several other countries. The unit production cost consists of the unit capital cost and operation and maintenance cost (O&M cost; including the costs for pretreatment and posttreatment chemicals, membrane replacement, energy, labor, brine disposal, and administration divided by annual plant production). The former is defined as annualized EPC cost divided by plant capacity. As the latter is seldom reported, O&M cost was assumed to be 150% of the unit capital cost based on a literature survey. Adopting this methodology, we estimated the unit production cost at 0.40–3.78 USD m^{-3} for the aforementioned 186 plants.

Supplemental Figures
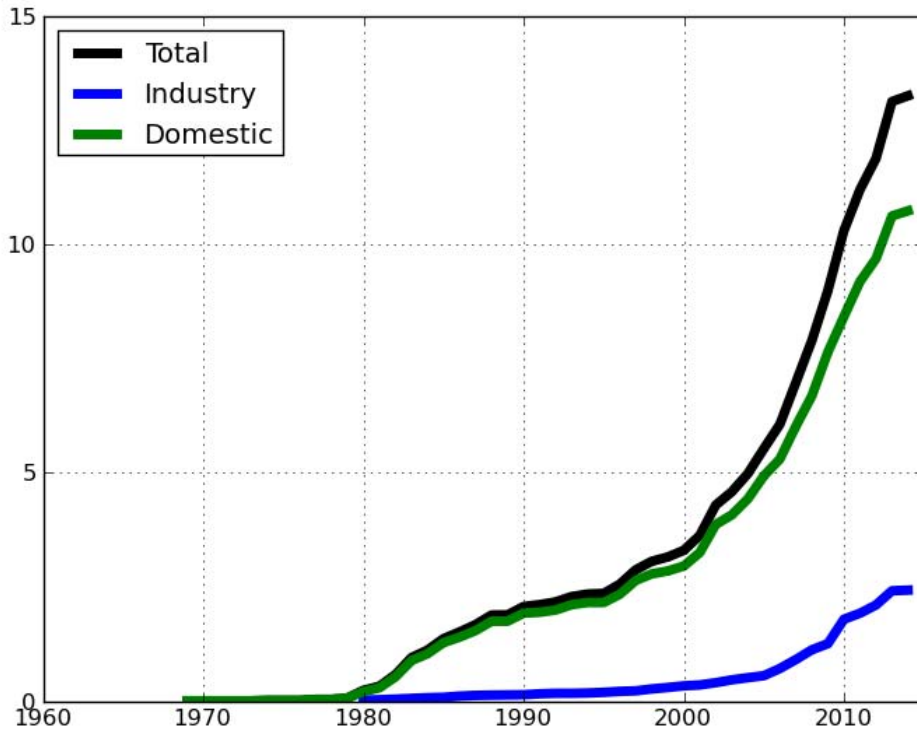
Figure S1. Historical change in global total desalination capacity (km^3 yr^{-1}).
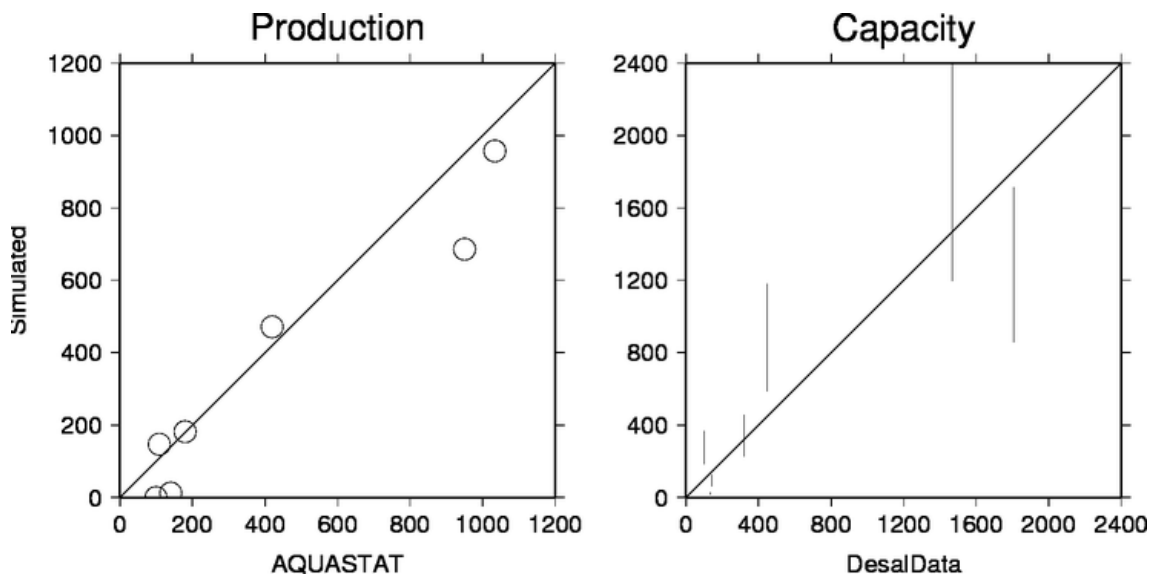
Figure S2. Production of seawater desalination and capacity for the Major Countries shown in Table 1 (10^{6}m^{3}yr^{-1}). The range of simulated capacity shows the uncertainty in production-to-capacity ratio which is assumed 40-80% in this study.
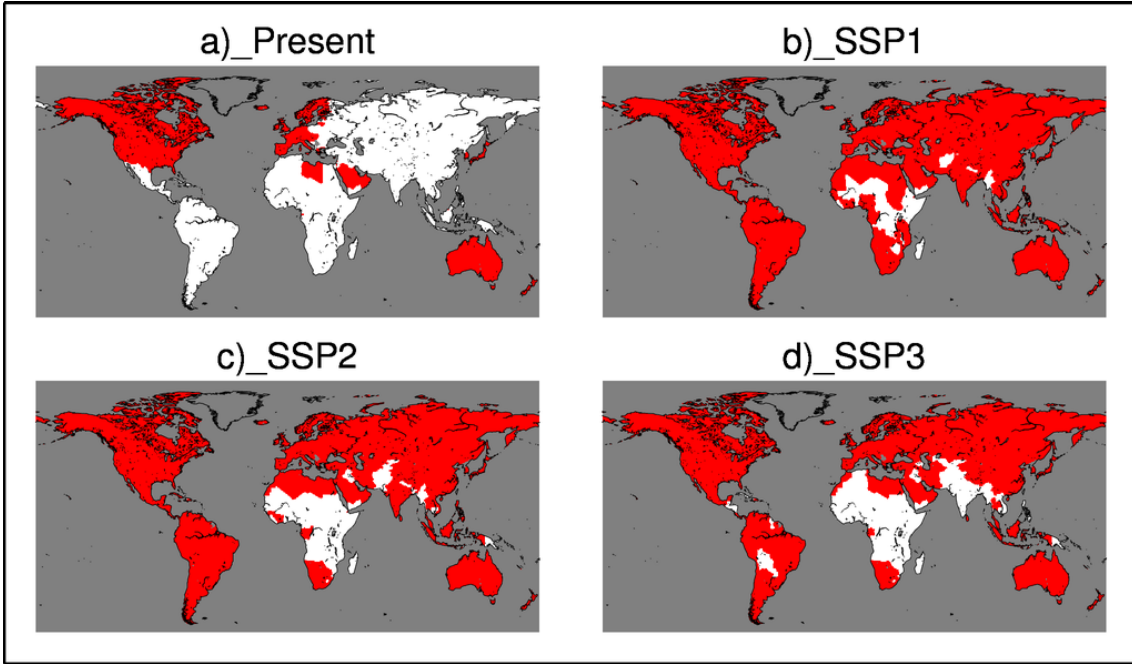
Figure S3. Countries per capita GDP exceed 14000 USD capita^{-1}.

Supplemental Table

Table S1 Data items and selection.

Items	Options	Selection
Plant status	Online	Included
	Construction, Planned, Cancelled, On hold, Offline, Unknown	Excluded
Water type	Brine or concentrated seawater (TDS > 50000ppm),	Included
	Seawater (TDS 20000ppm – 50000ppm)	
	Brackish water or inland water (TDS 3000ppm - <20000ppm),	Excluded
	River water or low concentrated saline water (TDS 500ppm - <3000ppm),	
	Pure water or tap water (TDS <500ppm),	
	Waste water, Unknown	
User category	Municipalities as drinking water (TDS 10ppm - <1000ppm),	Included
	Tourist facilities as drinking water (TDS 10ppm - <1000ppm),	
	Industry (TDS <10ppm),	
	Military purposes (TSD 10ppm- <1000ppm),	
	Power stations (TDS <10ppm),	
	Irrigation (TDS <1000ppm)	
	Demonstration, Discharge, Process, Water injection, Unknown	Excluded
Plant size	XL (Capacity$\geq$ 50,000 m^3 d^{-1}),	Included
	L (50,000 > Capacity $\geq$ 10,000 m^3 d^{-1})	
	M (10,000 > Capacity $\geq$ 1,000 m^3 d^{-1}),	Excluded
	S (1,000 m^3 d^{-1} > Capacity)	