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Global and regional evaluation of energy for water

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Energy for water (E4W)

E4W: energy consumption embedded in the processes of water withdrawal from the source, conveyance, treatment, distribution, and wastewater collection, treatment, and discharge



Global quantitative assessment of E4W is missing. Then we conduct the 1st analysis.

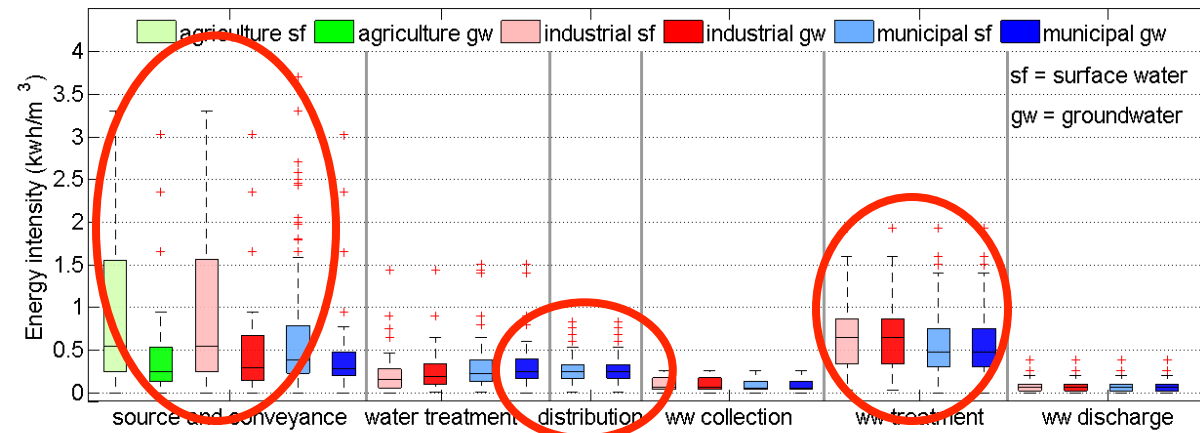
“Spinners” kick up water at Fulton, Missouri’s Wastewater Treatment Plant

Research questions

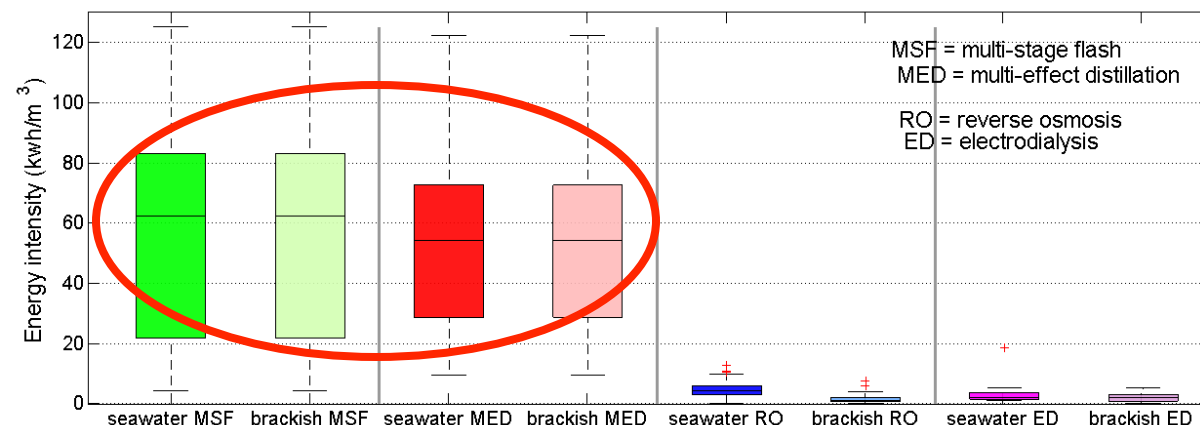
- How does E4W change across sectors, processes, water sources, and regions?
- What role does E4W play in global energy market?

Methods

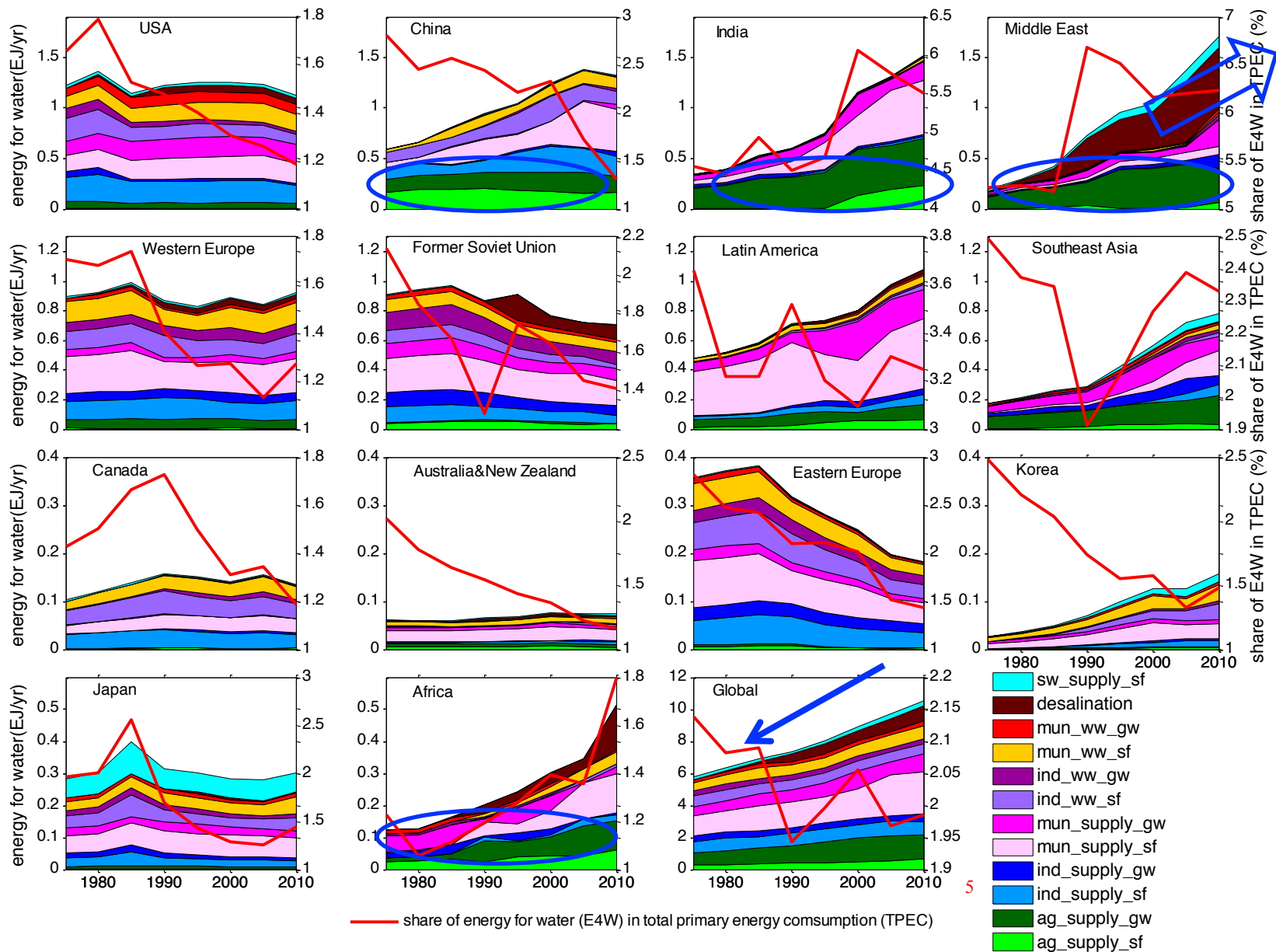
- Construct a country-level historical water use database.
- Evaluate energy intensities (EI) values and range.
- Estimate conversion ratios from primary energy to electricity.
- Estimate E4W at the country scale for 1973-2012.



- Surface water “source and conveyance”.
- Industrial wastewater treatment.
- Water distribution.
- Thermal desalination.



- Agriculture E4W has large share in developing economies.
- Desalination induced E4W in the Middle East increases rapidly.
- Globally, E4W accounts for 1.7–2.7% of the global TPEC

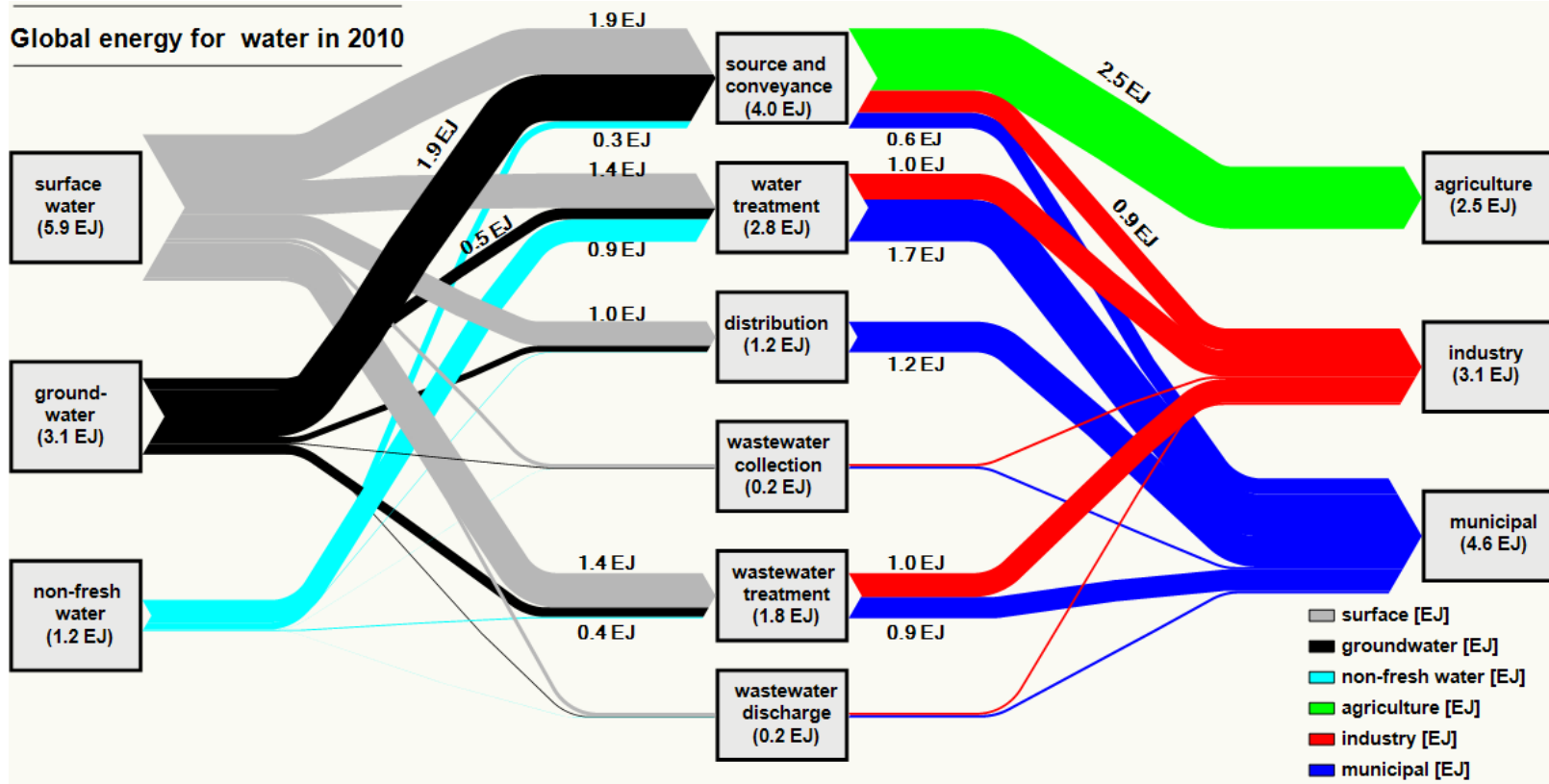


E4W by sources, processes and sectors (2010)



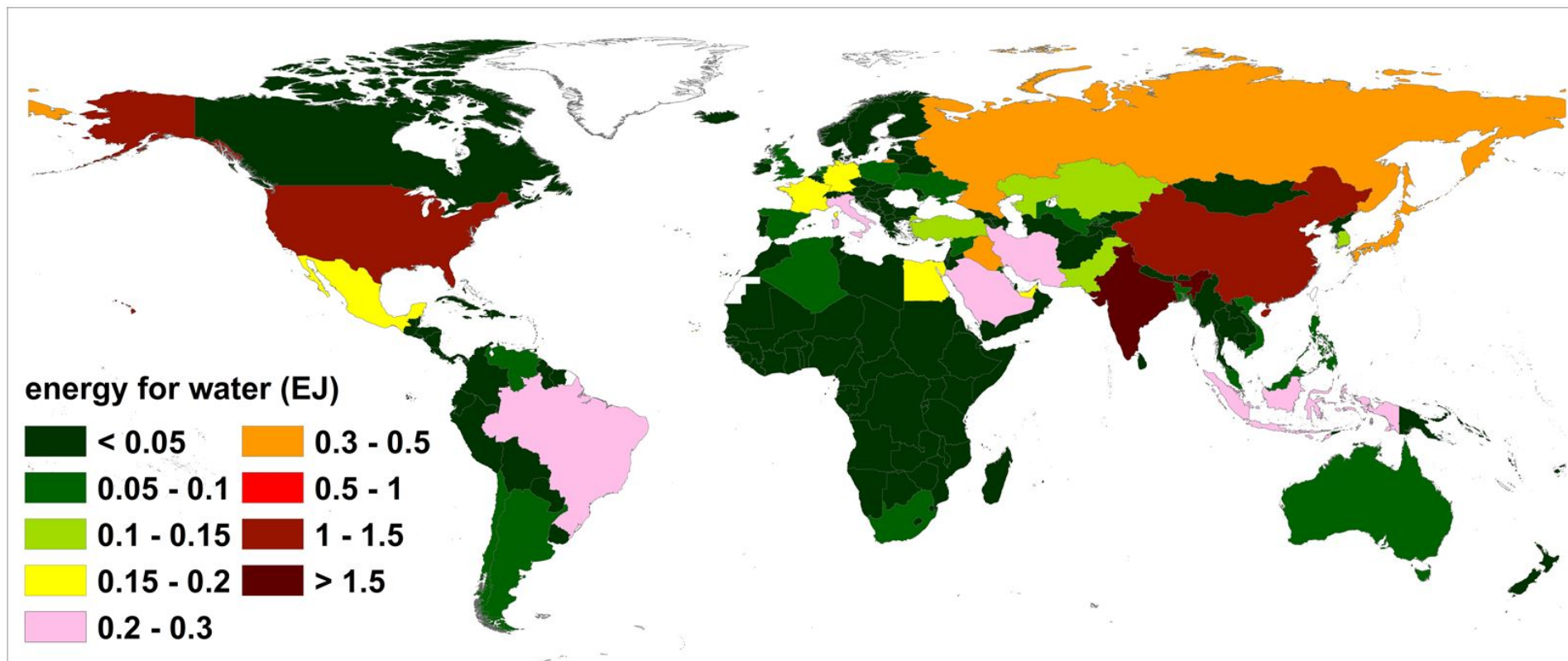
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- **Source and conveyance** is most energy-consuming process.
- Energy for **desalination** has a big portion in the total E4W (9.4%).
- **Municipal** sector consumes most E4W (45%).

Energy for water by country in 2010



India, China and USA are the three largest E4W consumers.

Recap

- How does E4W change across sectors, processes, water sources and regions?

Highlight: Municipal, source/conveyance, desalination, India, the Middle East and China

- What role does E4W play in global energy market?

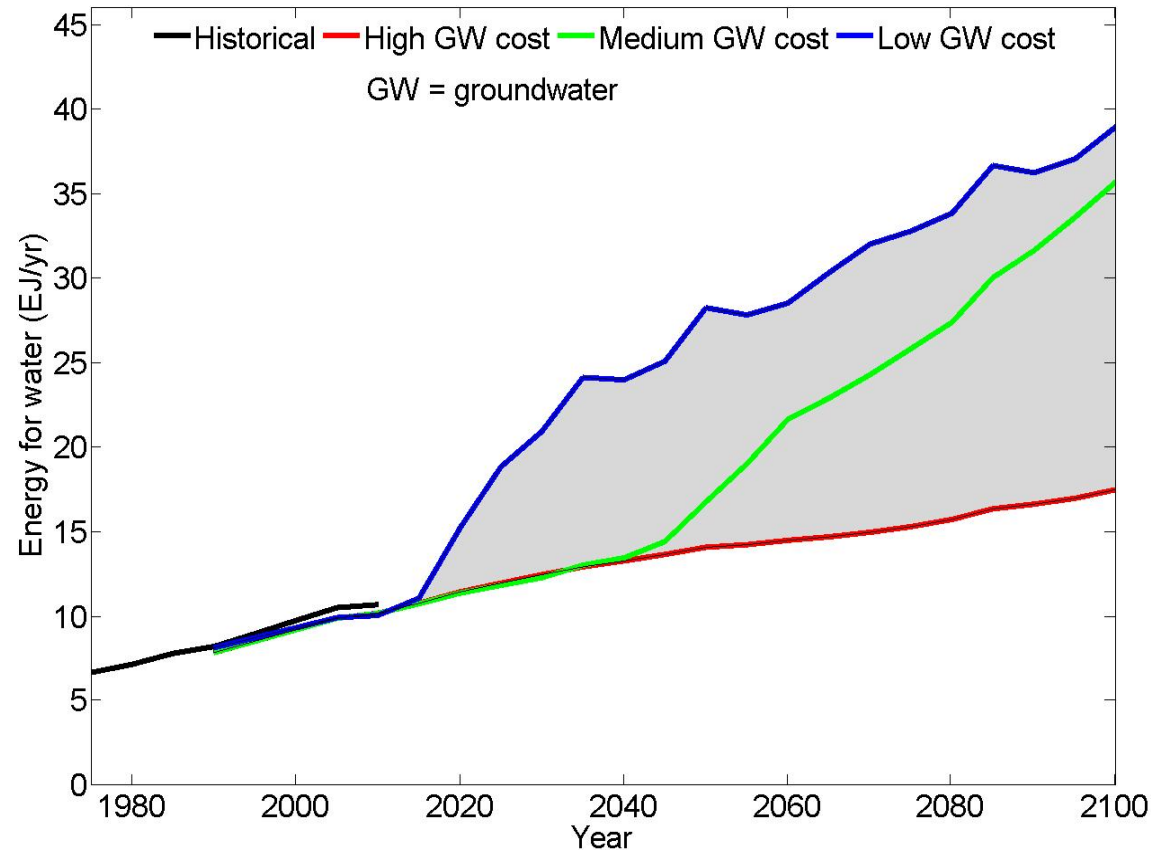
E4W accounts for 1.7–2.7% of the global total primary energy consumption, and is rapidly increasing.

Future work

- Incorporate E4W into Global Change Assessment Model.

- Assess the effects of E4W on future desalination and groundwater irrigation.

- Investigate the E4W induced greenhouse gas emissions.



(Preliminary results)

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