

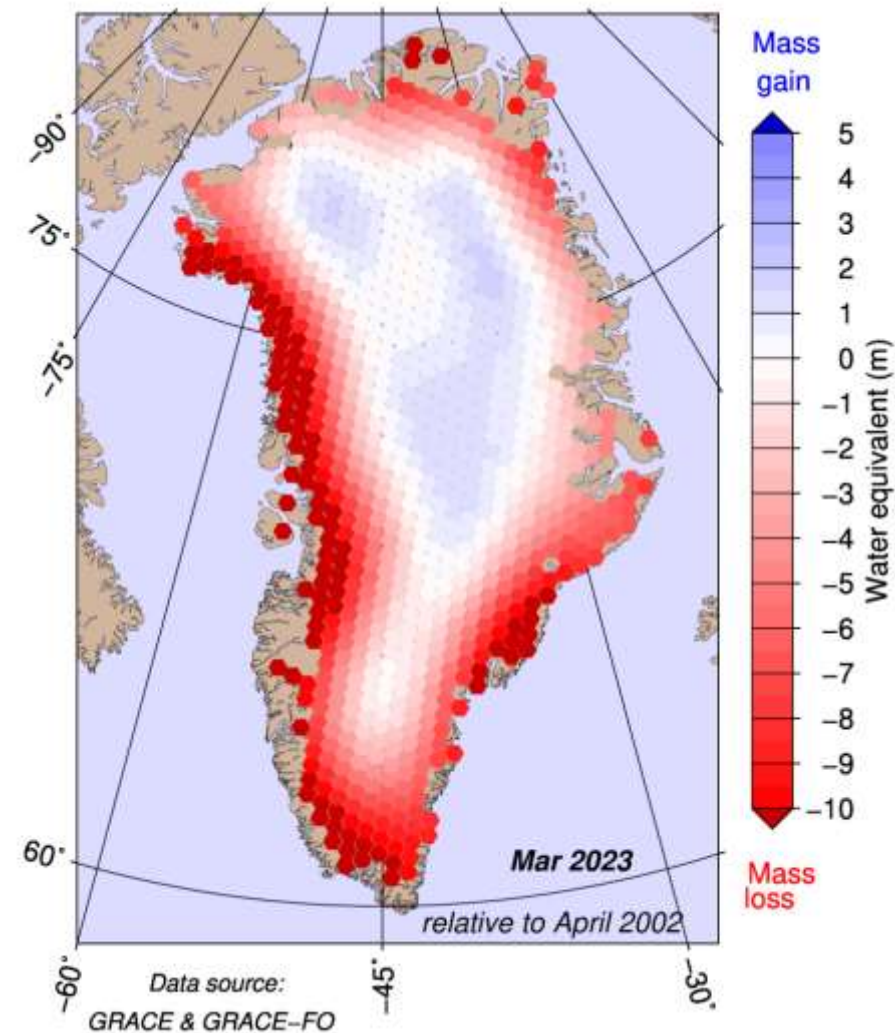
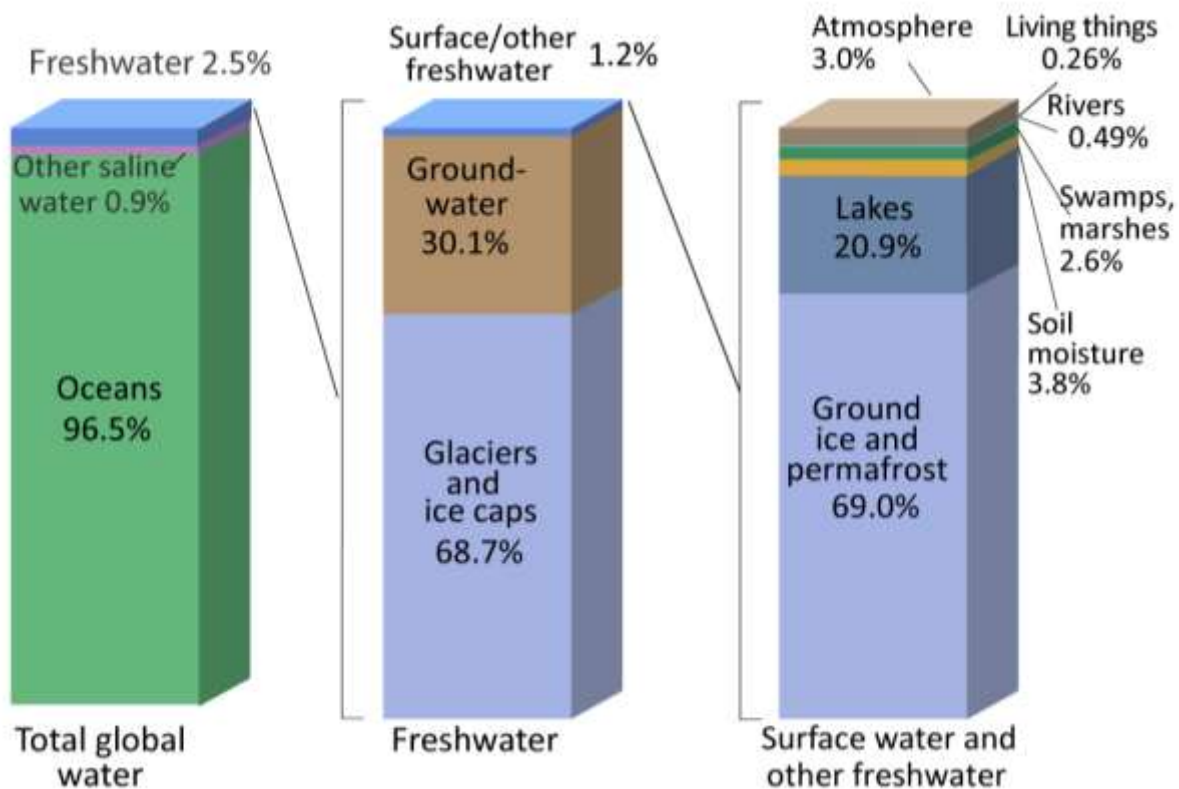
Uncovering the feasibility of double-glazed solar still



Dr. Amr Omar



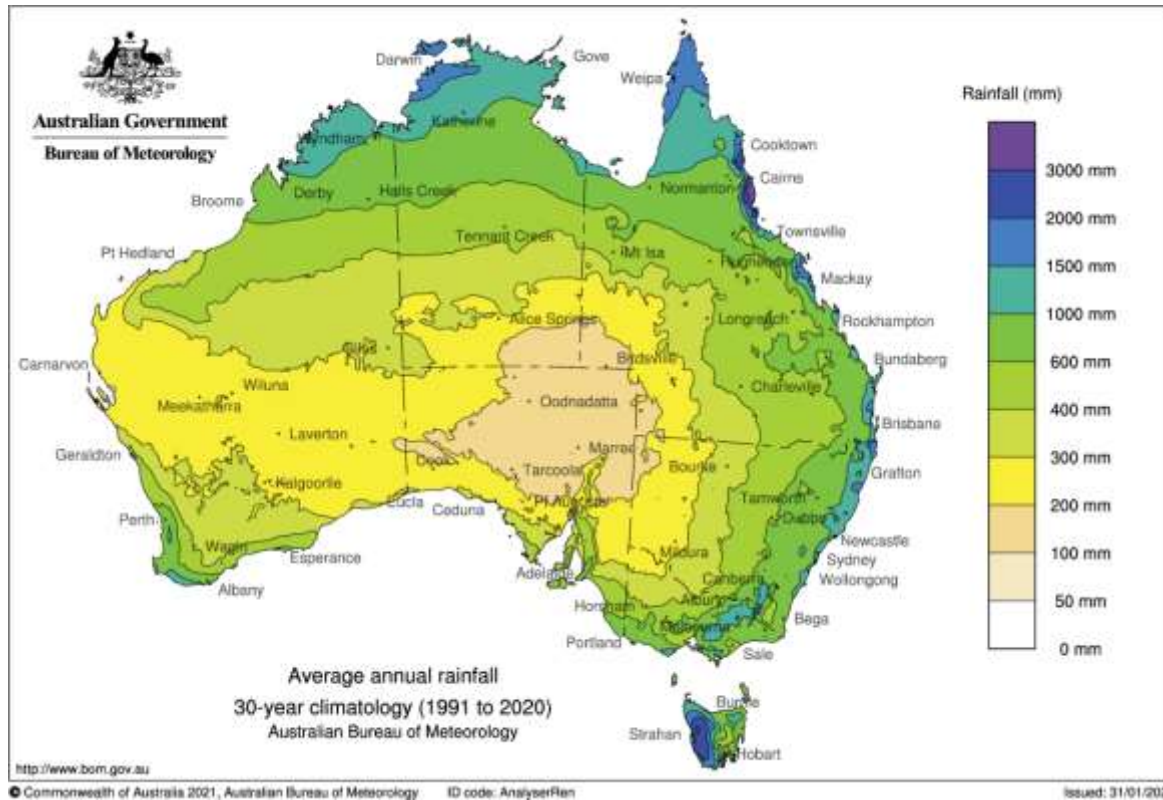
Where is Earth's Water?



[1] Igor Shiklomanov's chapter: "World Fresh Water Resources" 1993, Water in Crisis: A Guide to the World's Fresh Water Resources

[2] Polar Portal – Monitoring Ice and Climate in the Arctic

Australia's Water

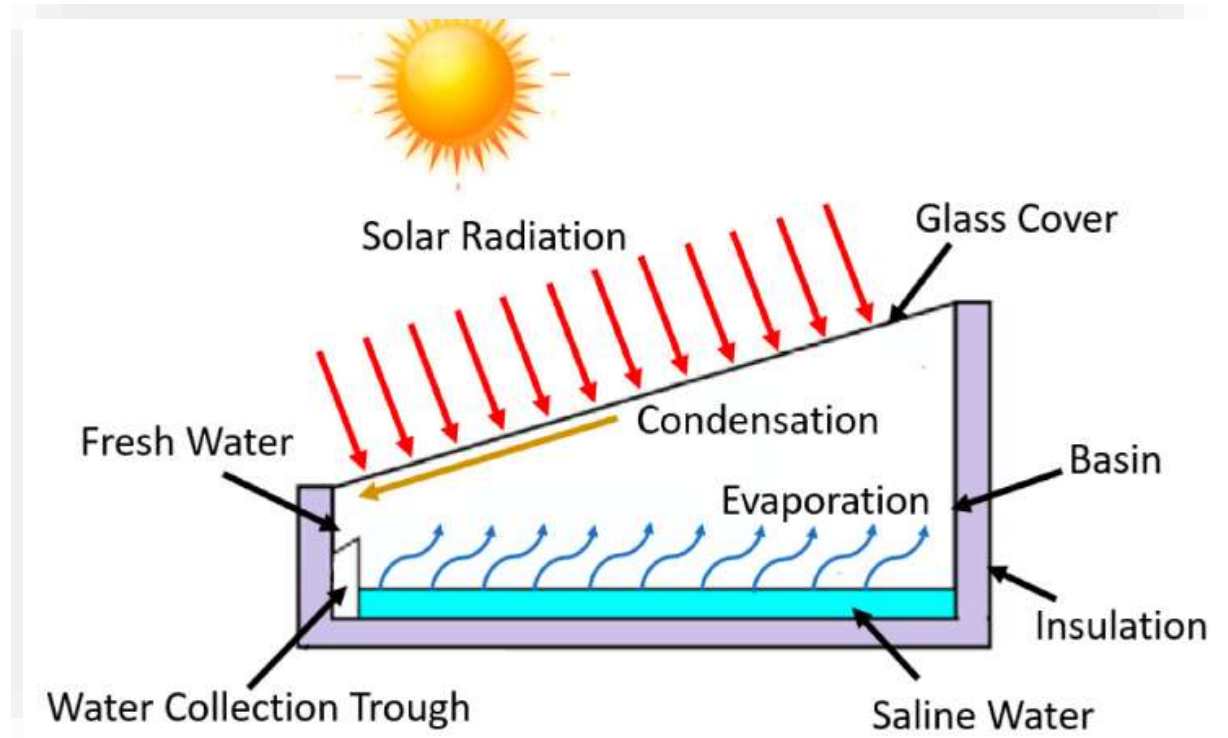
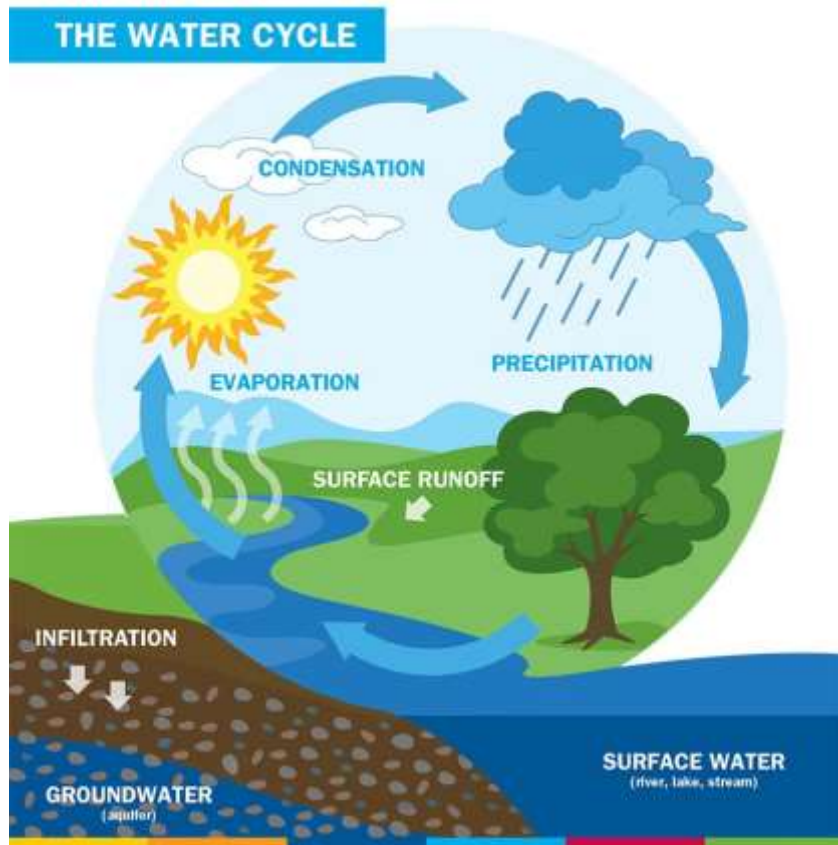


- Rainfall and Groundwater are unevenly distributed
- There are over 400 remote or regional communities in Australia lack access to quality drinking water.

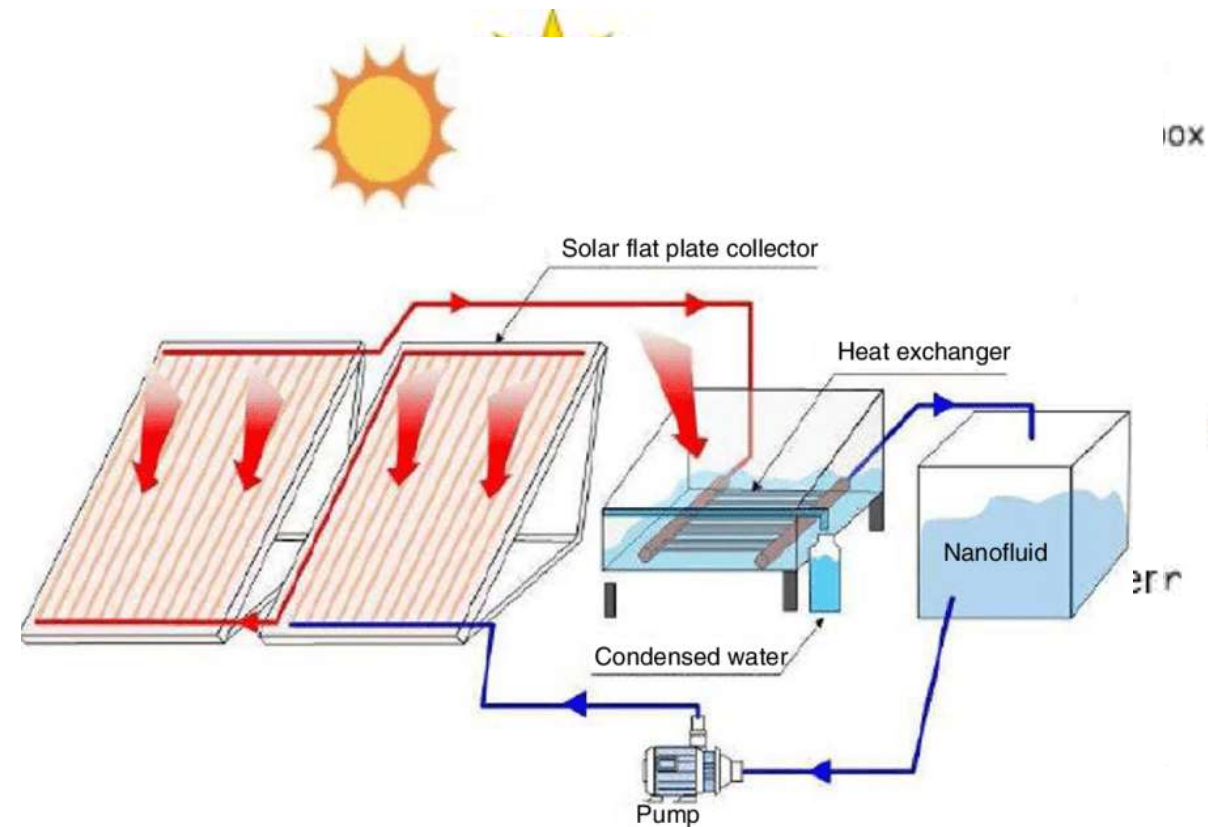
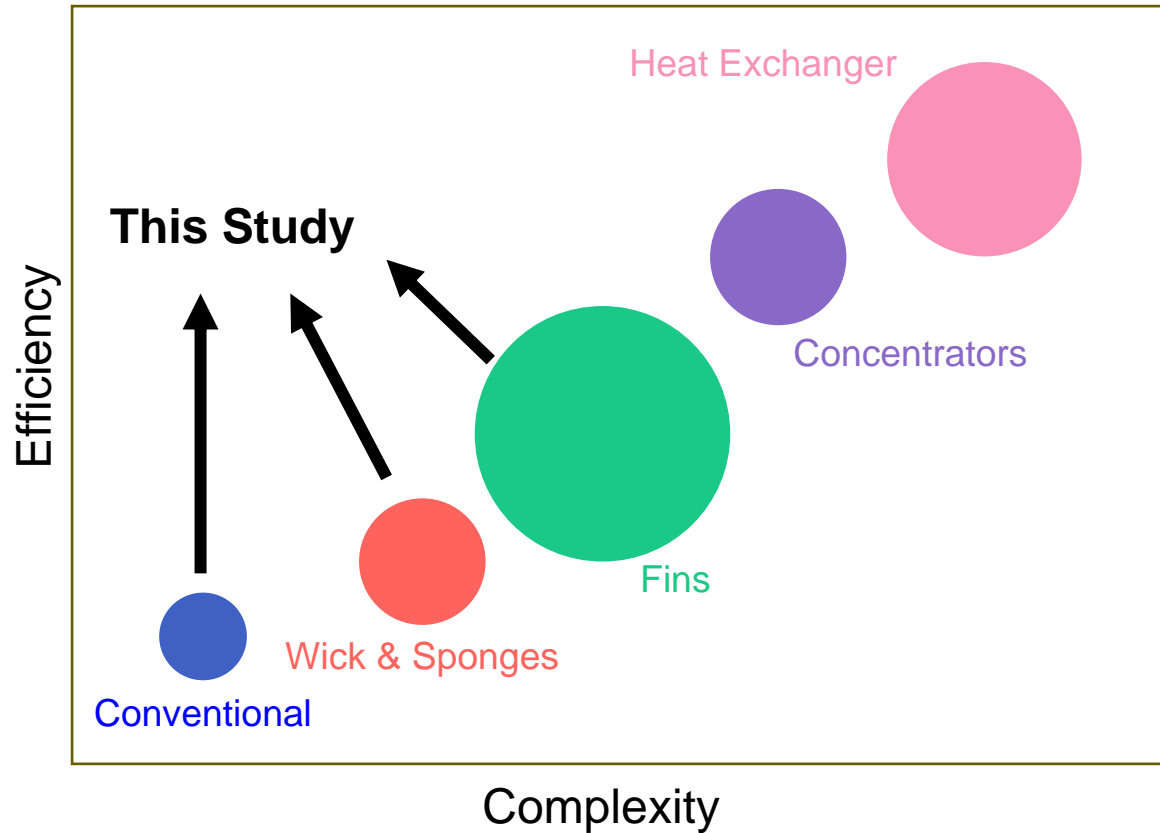


Namoi River in Walgett

Solar Still – Natural Water Cycle in a Box



Solar Still(s)



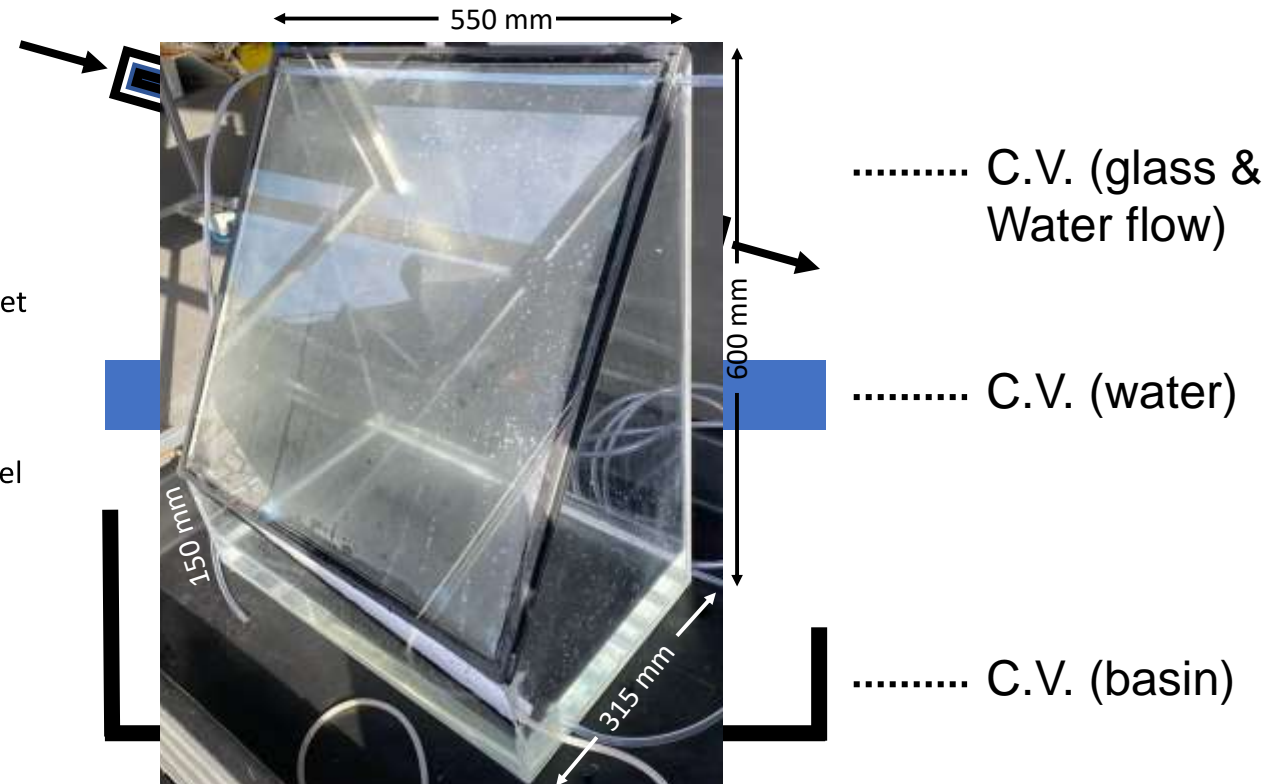
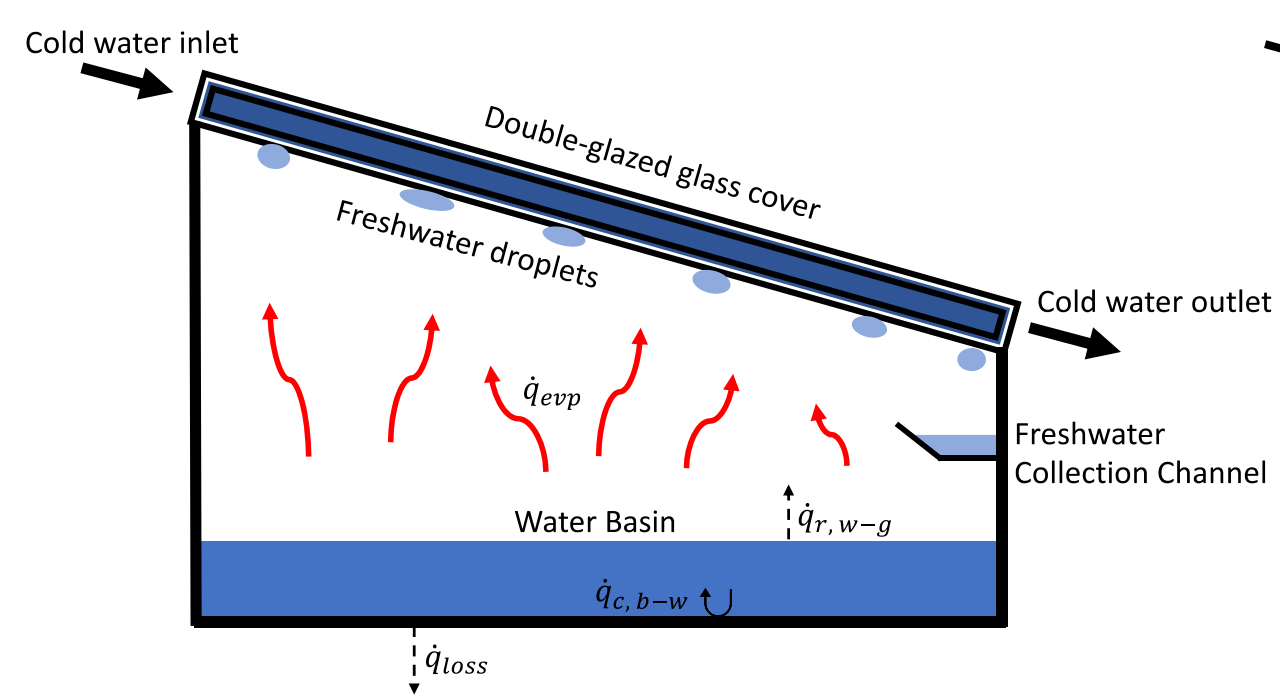
[5] Thakur et al. A study on heat and mass transfer analysis of solar distillation system, "Journal of Thermal Engineering", 2021

[6] Mevada et al. Effect of fin configuration parameters on performance of solar still: A review, "Groundwater for Sustainable Development", 2020

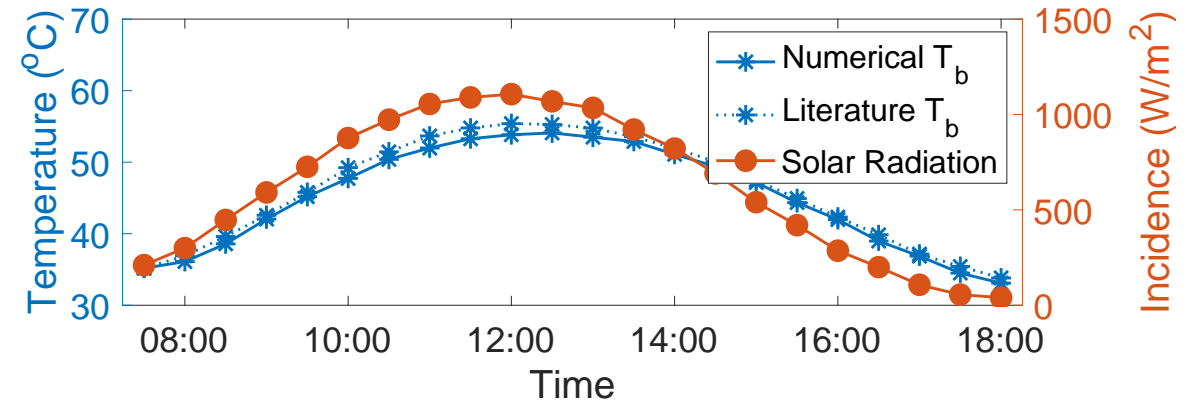
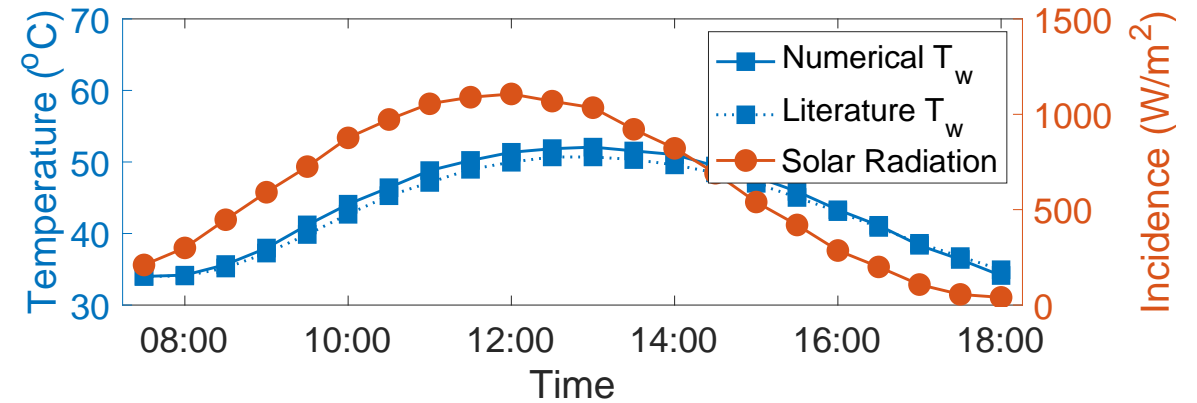
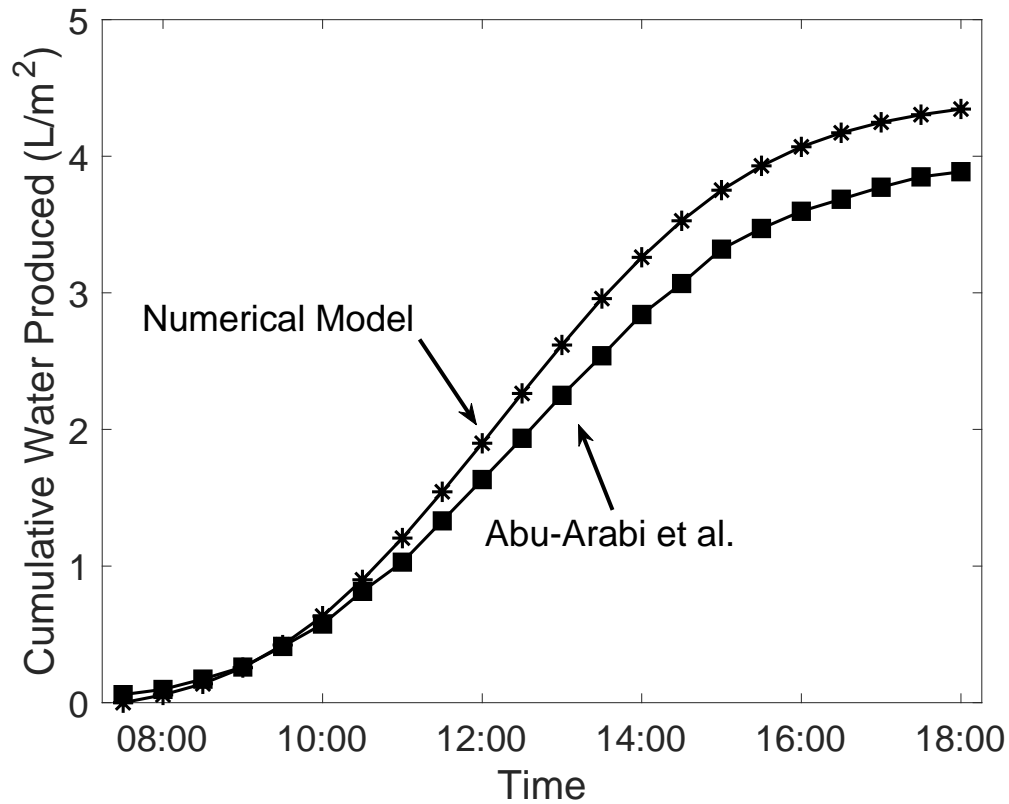
[7] Jathar et al. Effect of various factors and diverse approaches to enhance the performance of solar stills: a comprehensive review, "Journal of Thermal Analysis and Calorimetry", 2021

Double-Glazed Solar Still (DGSS)

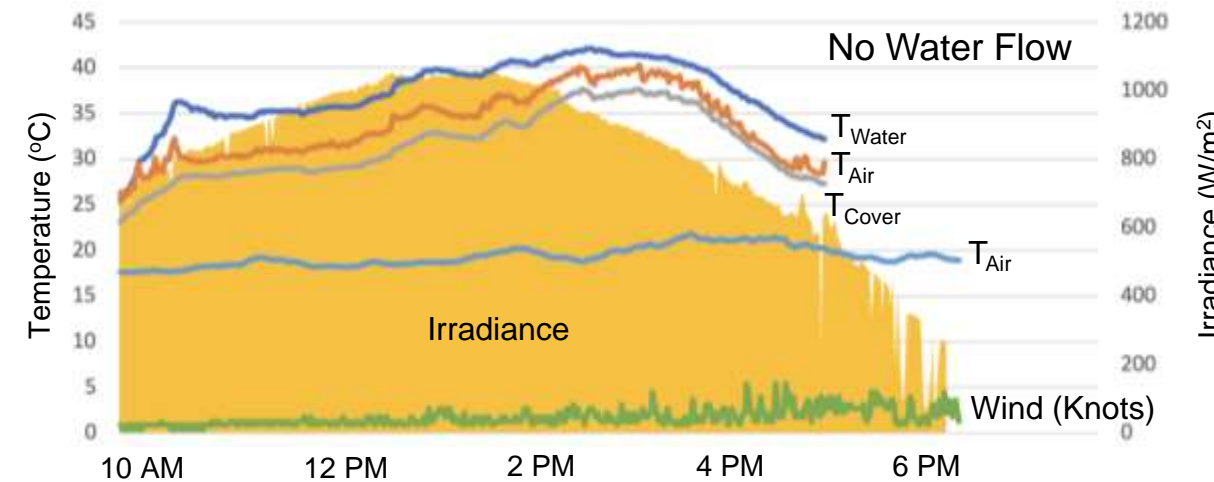
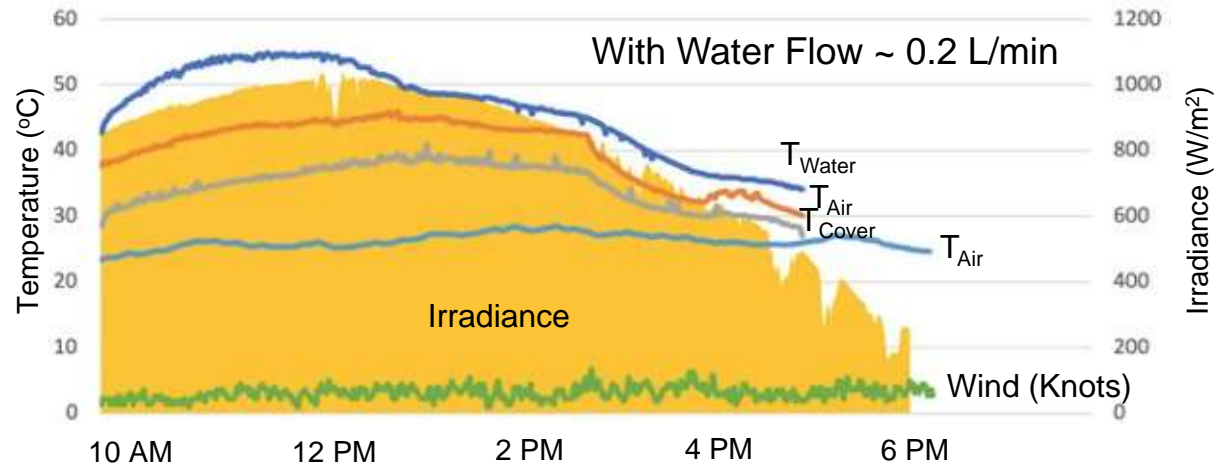
- Experimental Setup
- Heat Transfer Equations



Numerical Model Validation



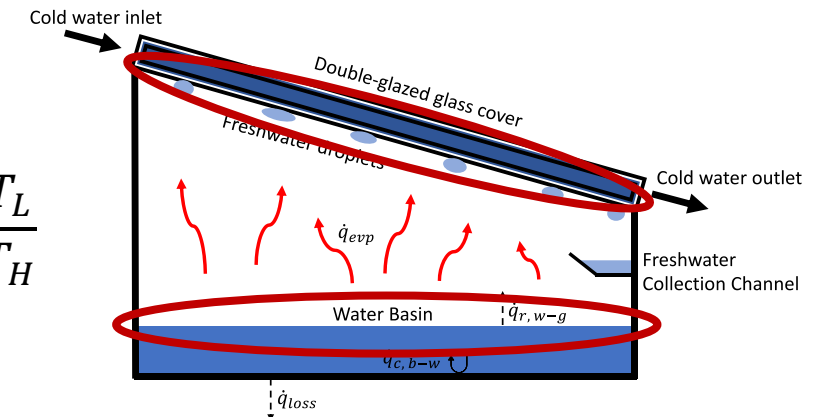
Experimental Results



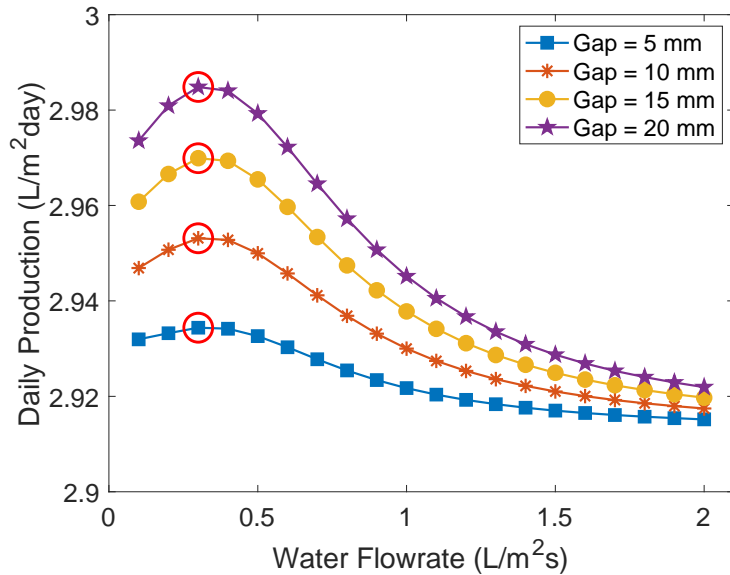
Parameter	With Water Flow	No Water Flow	% Difference
Production Rate (L/m ² /day)	0.78	0.18	333%
Average ΔT (°C)	10.93	5.25	108%

Difference between the basin temperature and the glass cover temperature

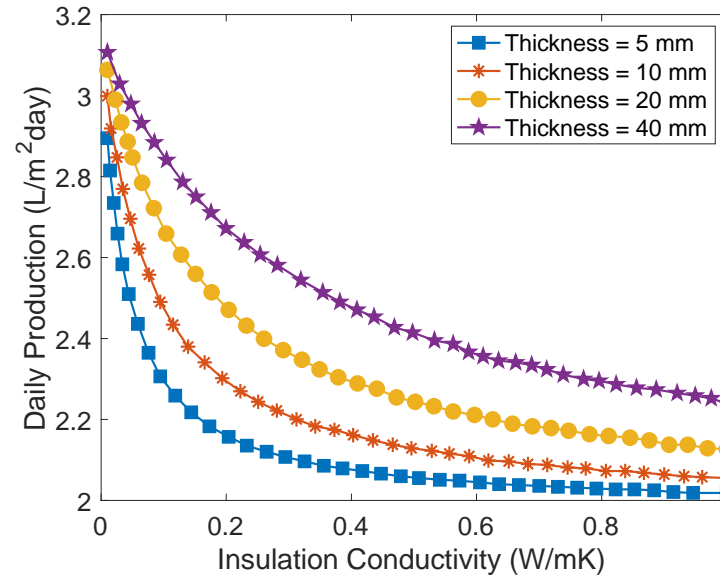
$$\eta_{Carnot} = 1 - \frac{T_L}{T_H}$$



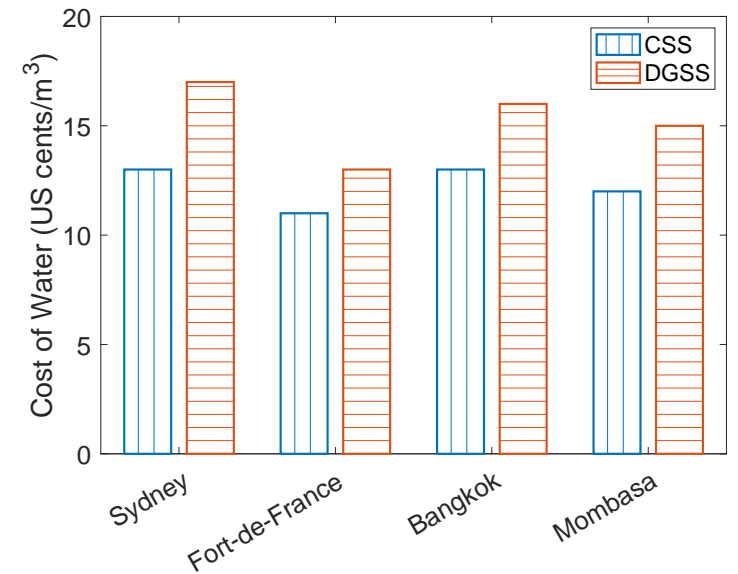
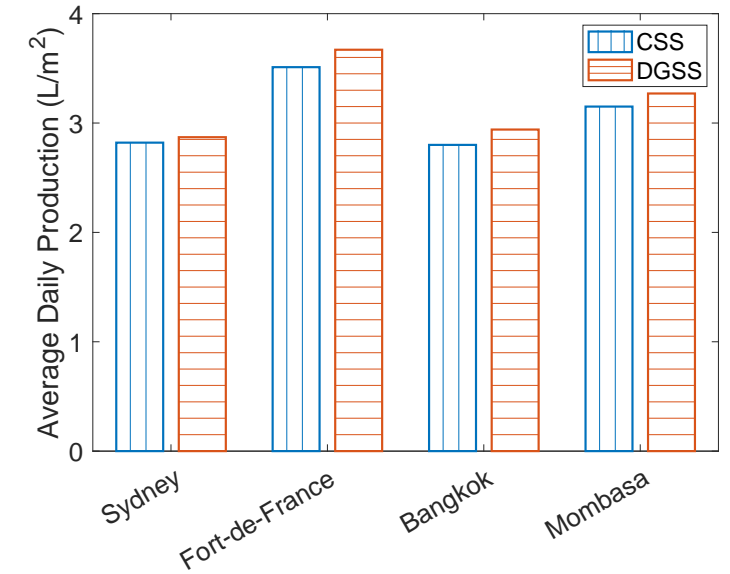
Numerical Results



Optimizing both variables is shown to be insignificant as the daily production only varies by less than 2% between 2.92 L/m² and 2.985 L/m².

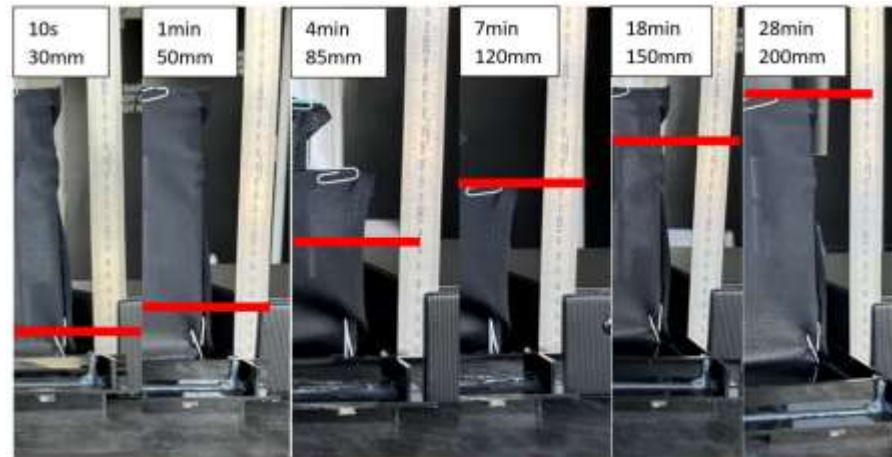


Investing in a better-quality insulation material with a conductivity lower than 0.1 W/mK is more critical than using thicker insulation material.



Fiber Wick Solar Still

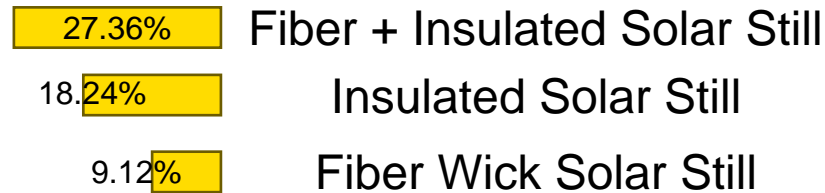
Fiber cloth – 80% Polyester and 20% Nylon
Styrofoam Insulation



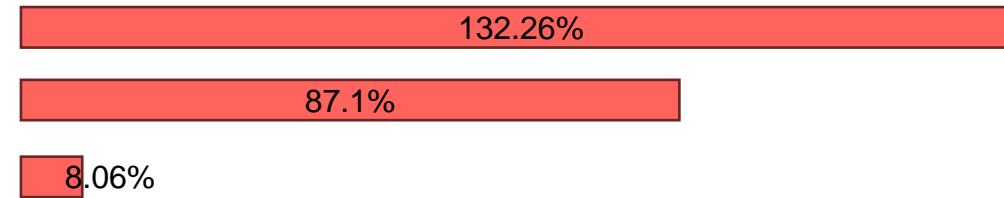
Parameter	Production Rate (L/m ² /day)	Average ΔT (°C)
Basic	1.24	8.16
Fiber Wick	1.81	8.59
Insulation	3.28	11.61
Fiber Wick + Insulation	4.08	6.23

Summary

Complexity



Efficiency



- The double-glazed cover leads to a slight improvement in the solar still's production rate, but design optimization is critical to decreasing its cost of water.
- Adding insulation to the side walls is the best value for money.

