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Design, construction and analysis of a thermal energy storage system adapted to greenhouse cultivation in isolated northern communities



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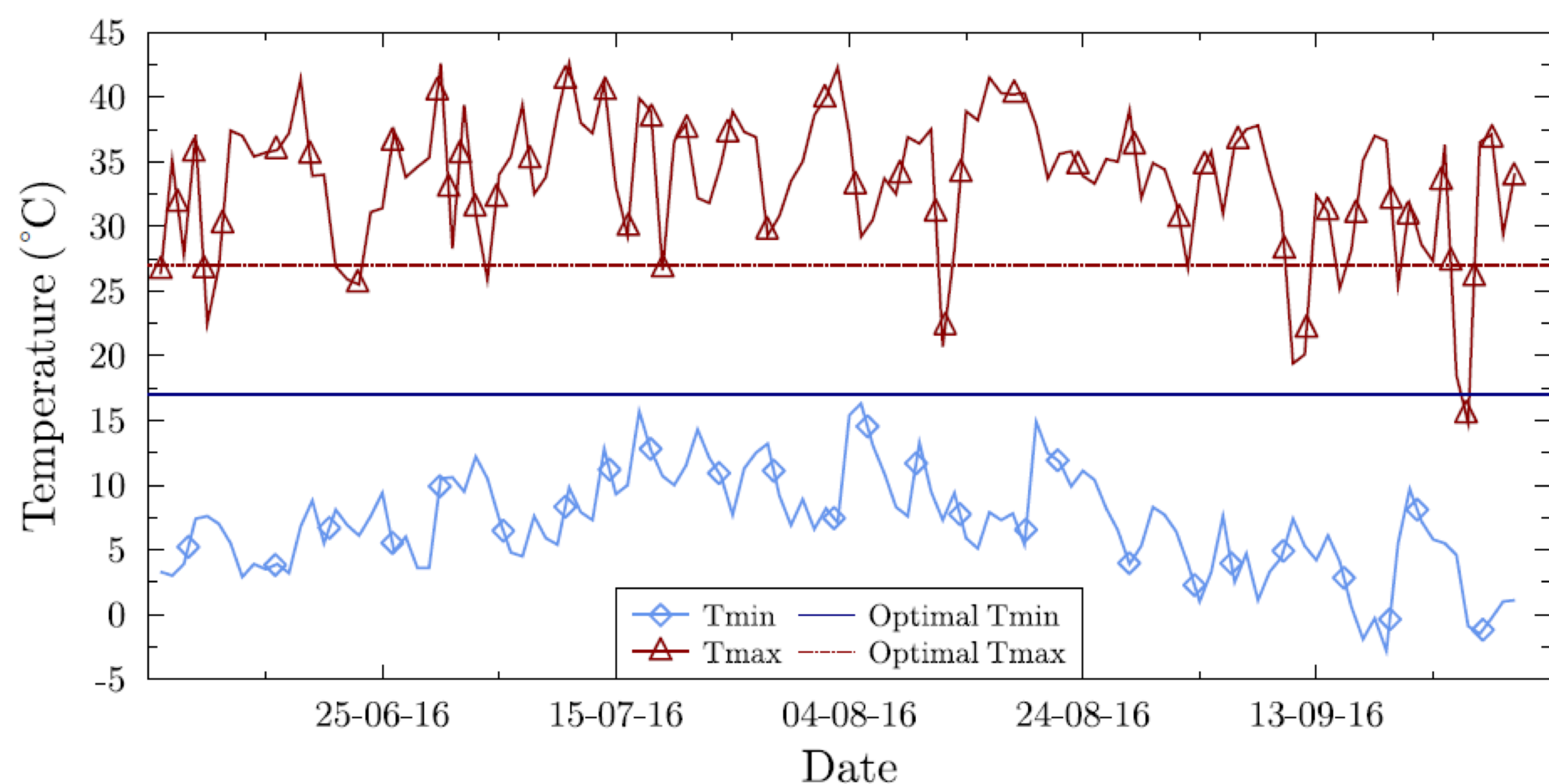
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The Greenhouse

- Located at Kuujjuaq (Quebec, 58°N latitude)
- Built in 2012
- Surface area of 140 m²
- Polycarbonate casing
- Growing season from June to September (without heating system)
- In 2016, about one ton of vegetables were harvested

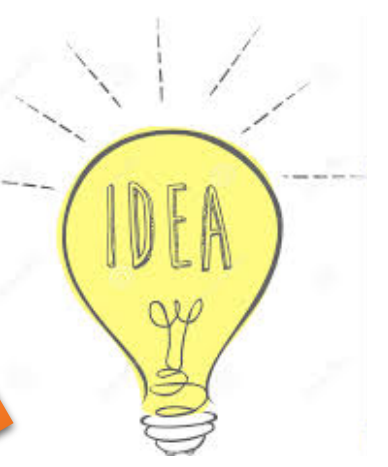


The Problem...



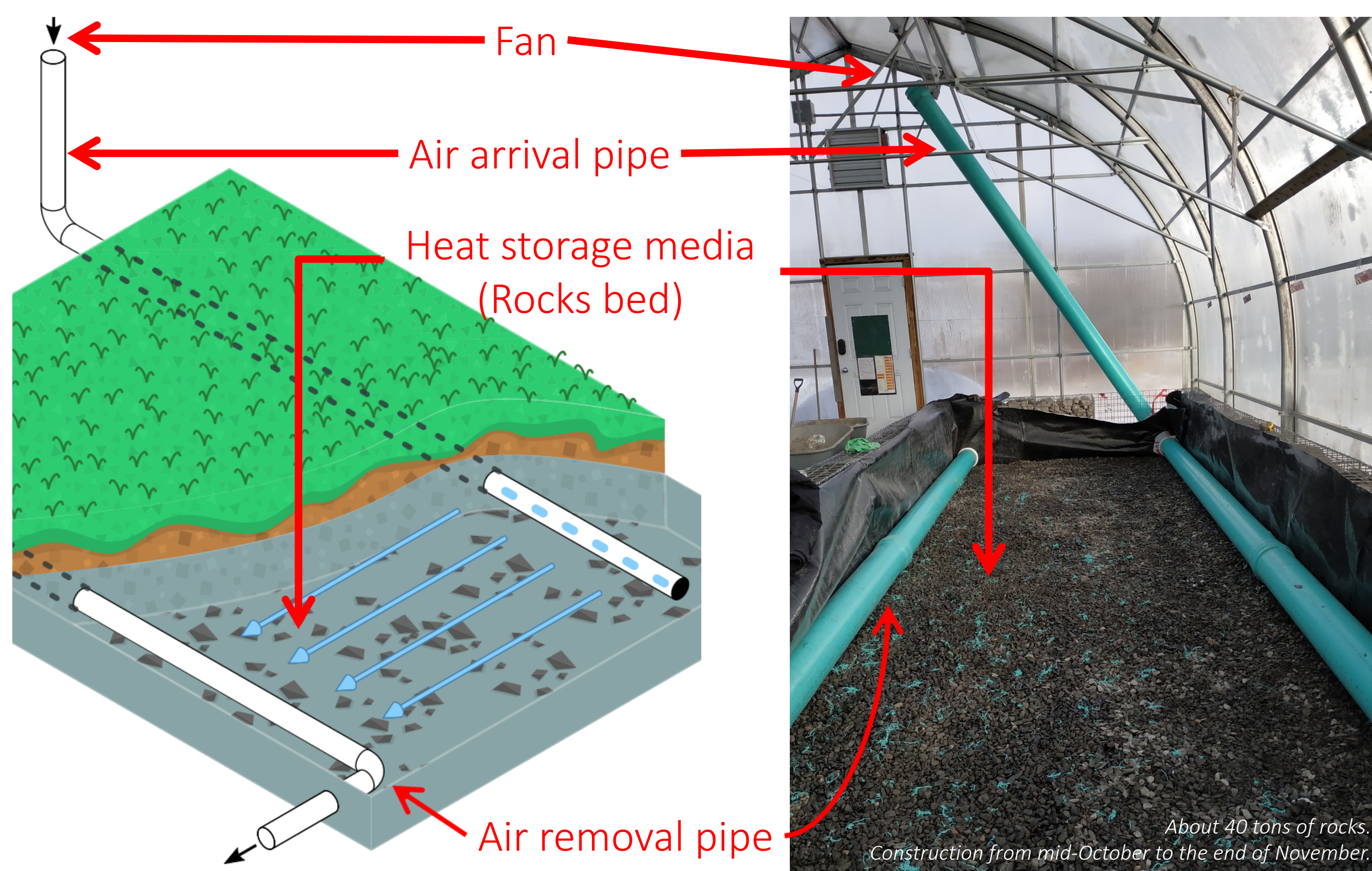
During the growing season, the day-night temperature difference is unfavorable to plant growth:

- the temperature rises too high during the day → Need to **extract heat** from the greenhouse to the outside
- and drops too low at night → It would be necessary to **provide heat**

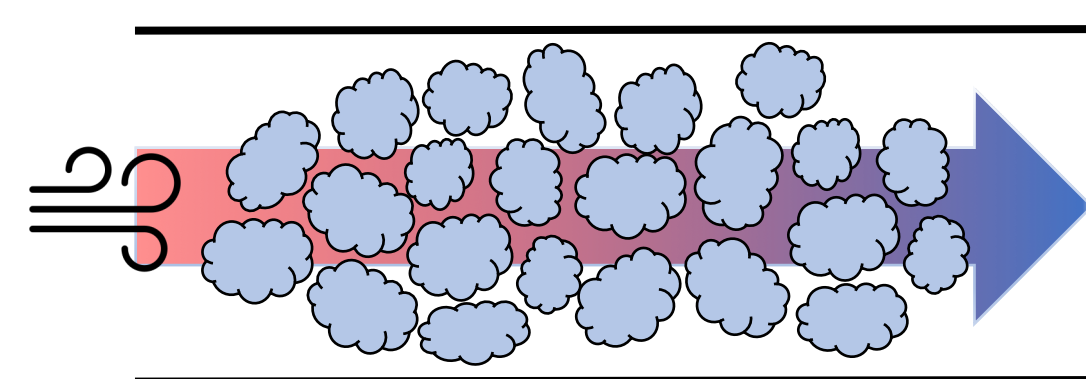


Store excess heat and release it when useful!

A solution...

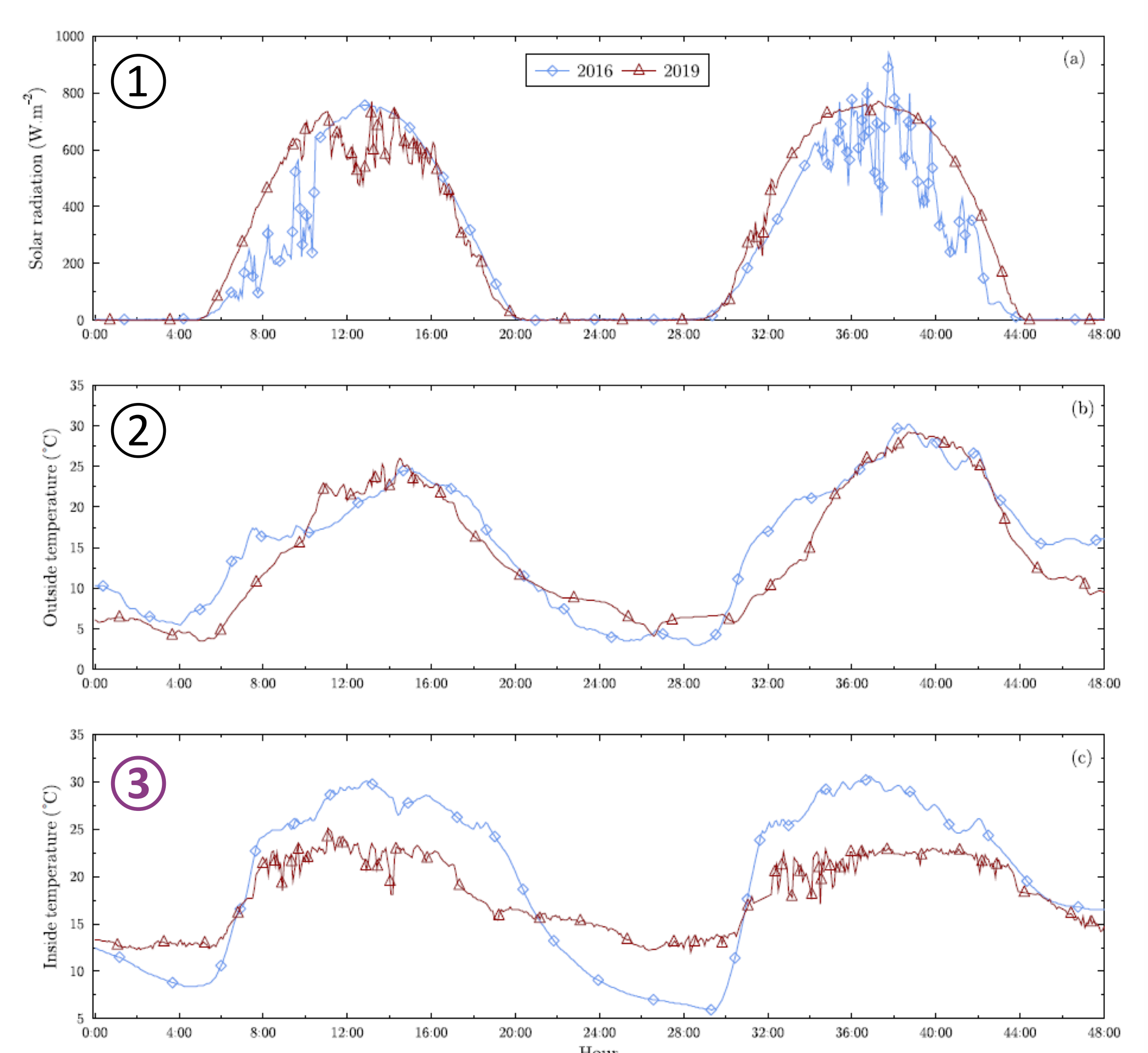
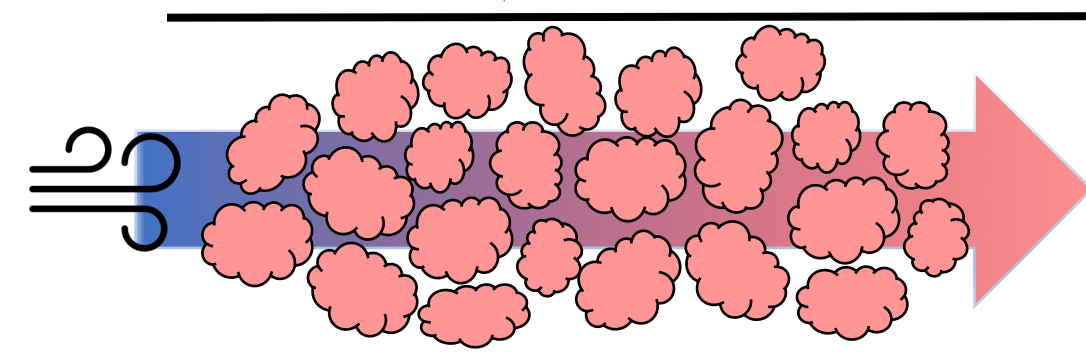


During overheating, the hot air extracted passes through the storage system, gives up part of its heat → **Charge Phase**



Charge Phase: The temperature of the rock increases
Discharge Phase: The temperature of the rock decreases

During the night, the cold air passes through the stock to be heated → **Discharge phase**



Comparison of two periods with the same outside temperature ① and solar irradiation ②:

- **Blue:** without storage system
- **Red:** with storage system

➤ Inside temperature ③ variations are reduced, reducing the negative impact of extreme temperatures on growth!

Preliminary results

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