SOLAR GREENHOUSE

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Abstract

A greenhouse is build based on calculations regarding the thermal processes. A configuration tool is used to define the dimensions. Temperature and irradiance data measured over a period of three weeks is compared to the calculated values. The resulting plots of measured vs. calculated temperatures show similar behaviour, but deviations in the greenhouse temperature peaks, e.g. due to constructive differences and simplified thermal processes. The interactive configurator is published as an open source tool and the greenhouse is built with sustainable components.

Motivation & Goal

- Extended growing period for vegetable plants in Germany
- Low budget components
- Low impact materials
- Solar energy driven
- Configurator tool for easy reconstruction based on a thermal model

Fig. 1: *Greenhouse*

Thermal Model

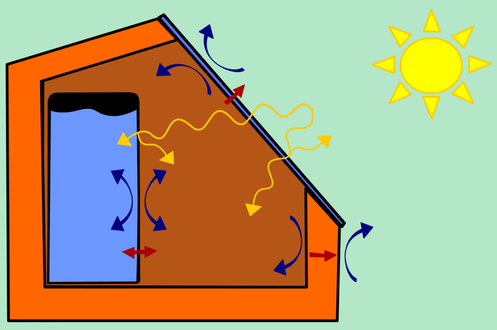

Fig. 2: *Heat transfer mechanisms*

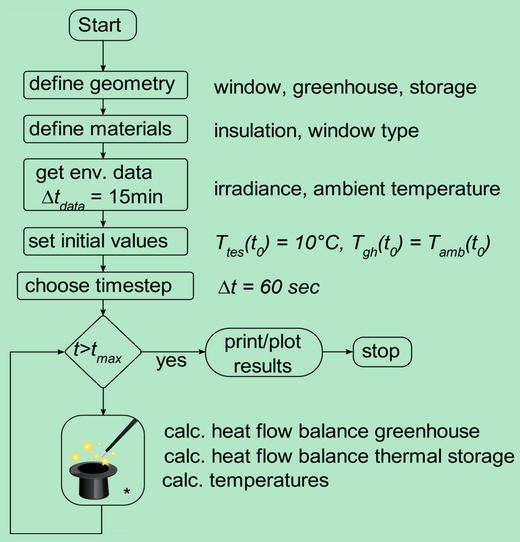

Fig. 3: *Program flow chart*

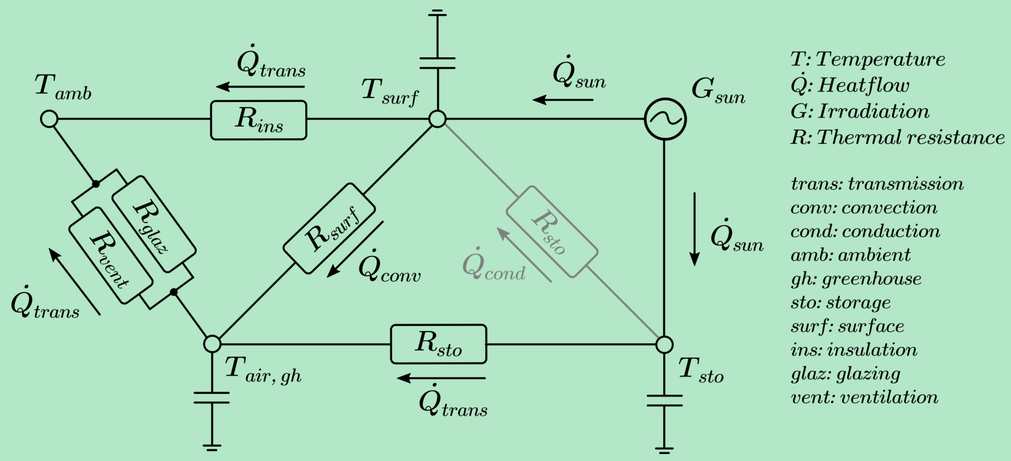

Fig. 4: *Thermal network*

Greenhouse Configurator

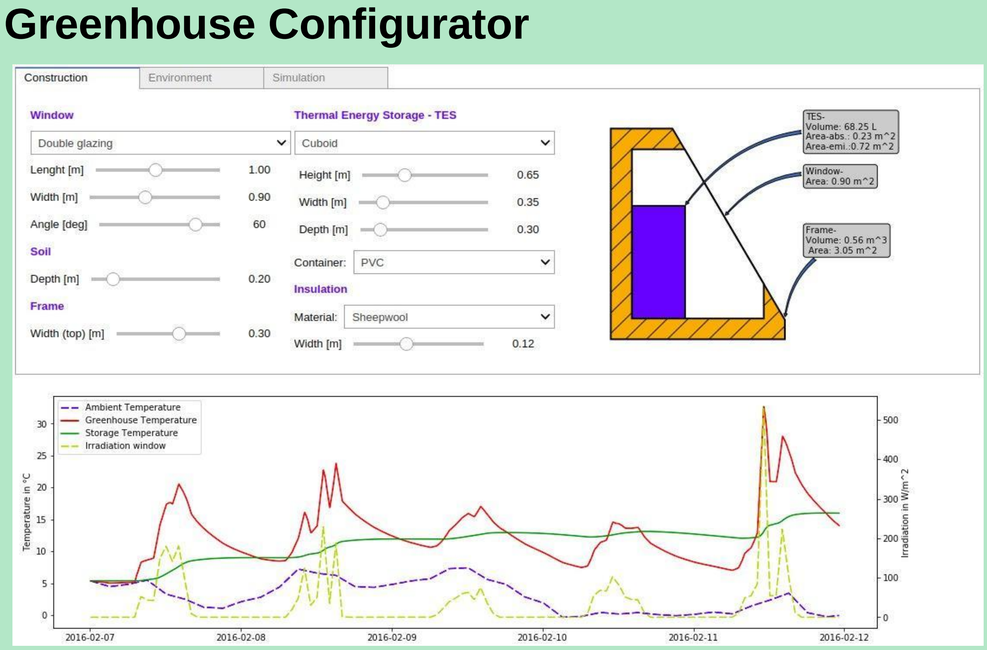

Fig. 5: *Jupyter Notebook – user interface of the greenhouse configurator*

Measurements

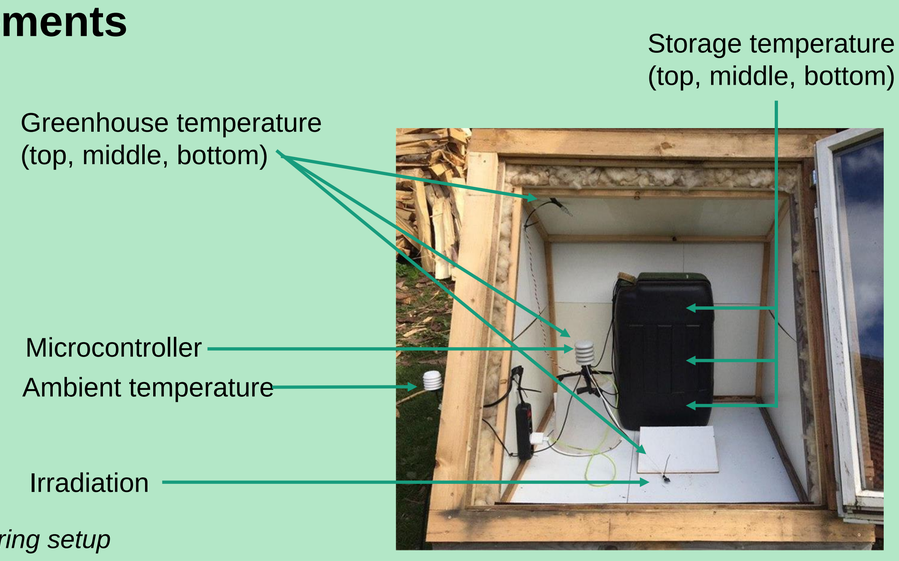

Fig. 6: *Measuring setup*

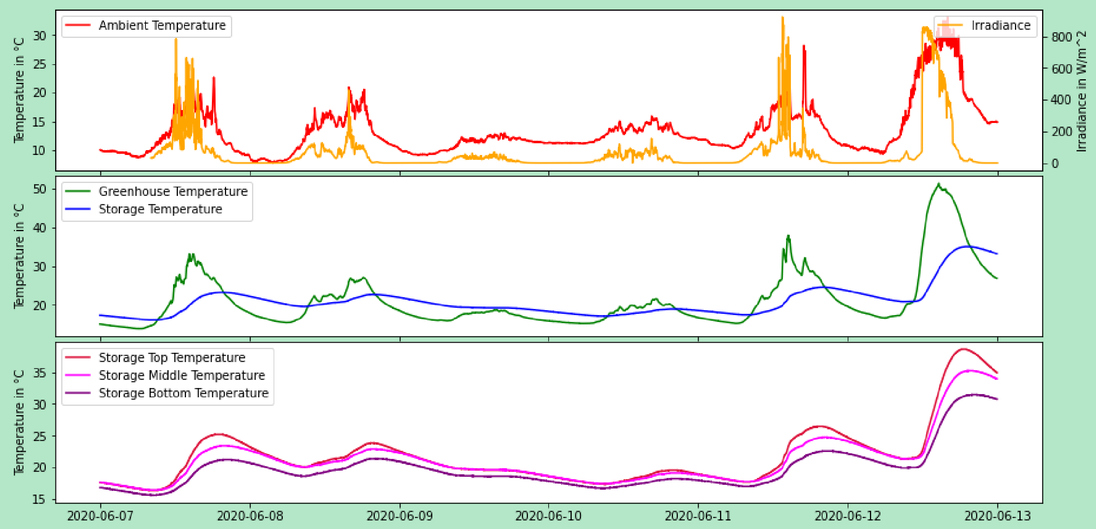

Fig. 7: *Example for measured data*

Evaluation

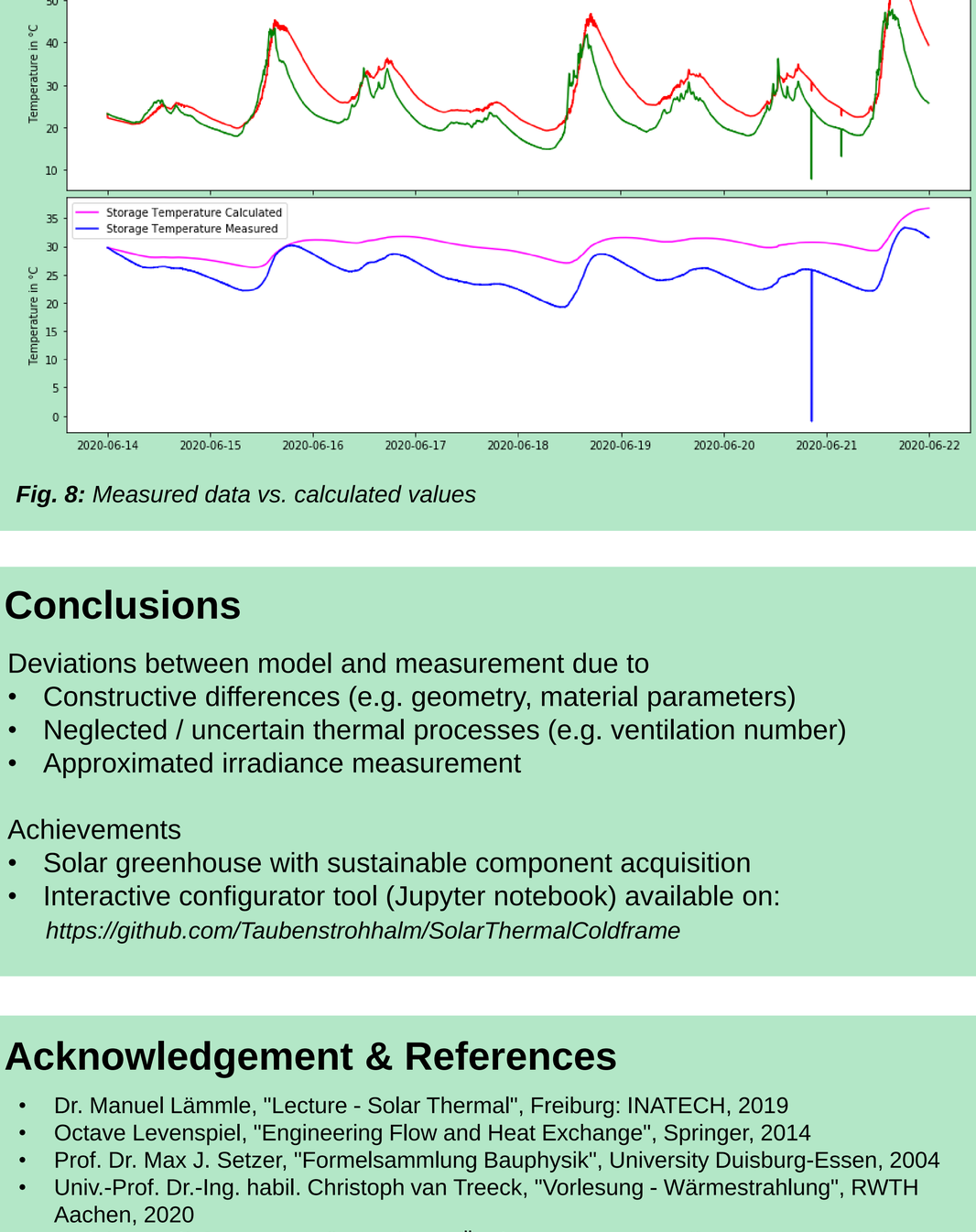

Fig. 8: *Measured data vs. calculated values*

Conclusions

Deviations between model and measurement due to

- Constructive differences (e.g. geometry, material parameters)
- Neglected / uncertain thermal processes (e.g. ventilation number)
- Approximated irradiance measurement

Achievements

- Solar greenhouse with sustainable component acquisition
- Interactive configurator tool (Jupyter notebook) available on:
  https://github.com/Taubenstrohhalm/SolarThermalColdframe

Acknowledgement & References

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