

# Dynamic analysis of the SunDial, the rotatory Fresnel collector

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## Main Idea

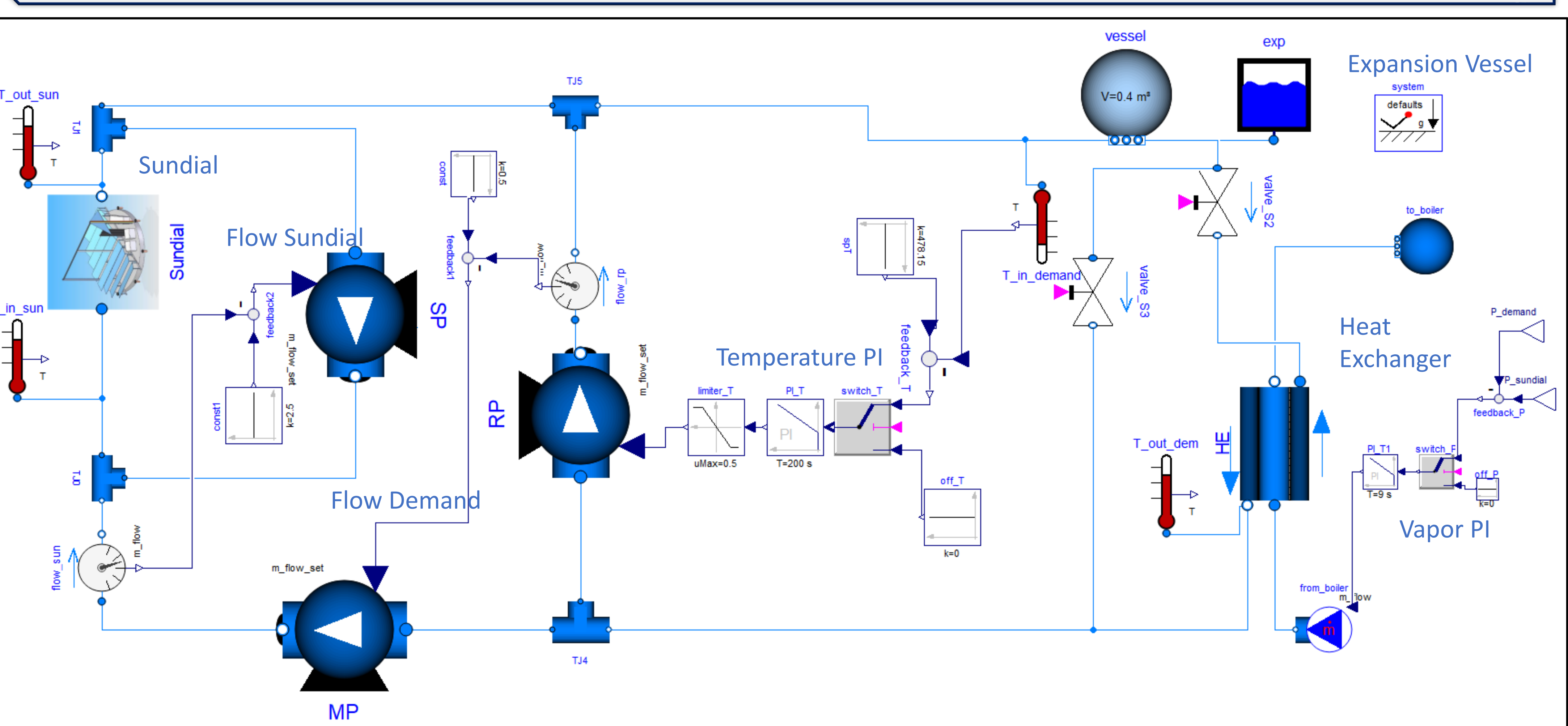
Dynamic simulation of SunDial (a novel rotatory Fresnel collector) shows the response of the collector for different transient such as cloud passages, defocus, start up; and its ability to maintain the temperature set point.

## Key findings

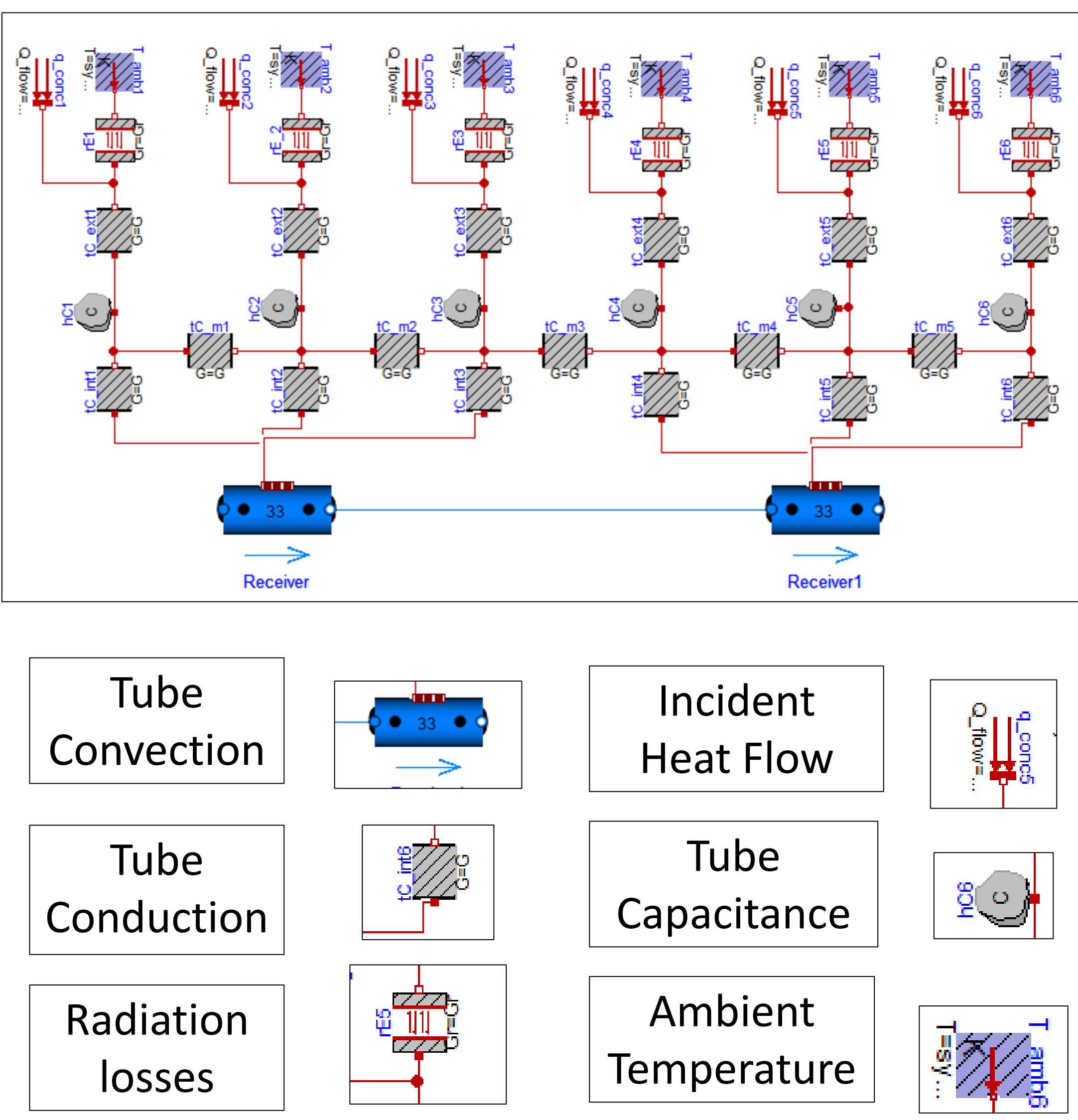
- The SunDial can supply a constant temperature operating at constant flow.
- The defocus control can limit the thermal oil temperature to the max. admitted.
- The thermal inertia of the system reduce the effect of short-term variations of the solar resource.
- The control system could manage de long-term variations.

## Methods

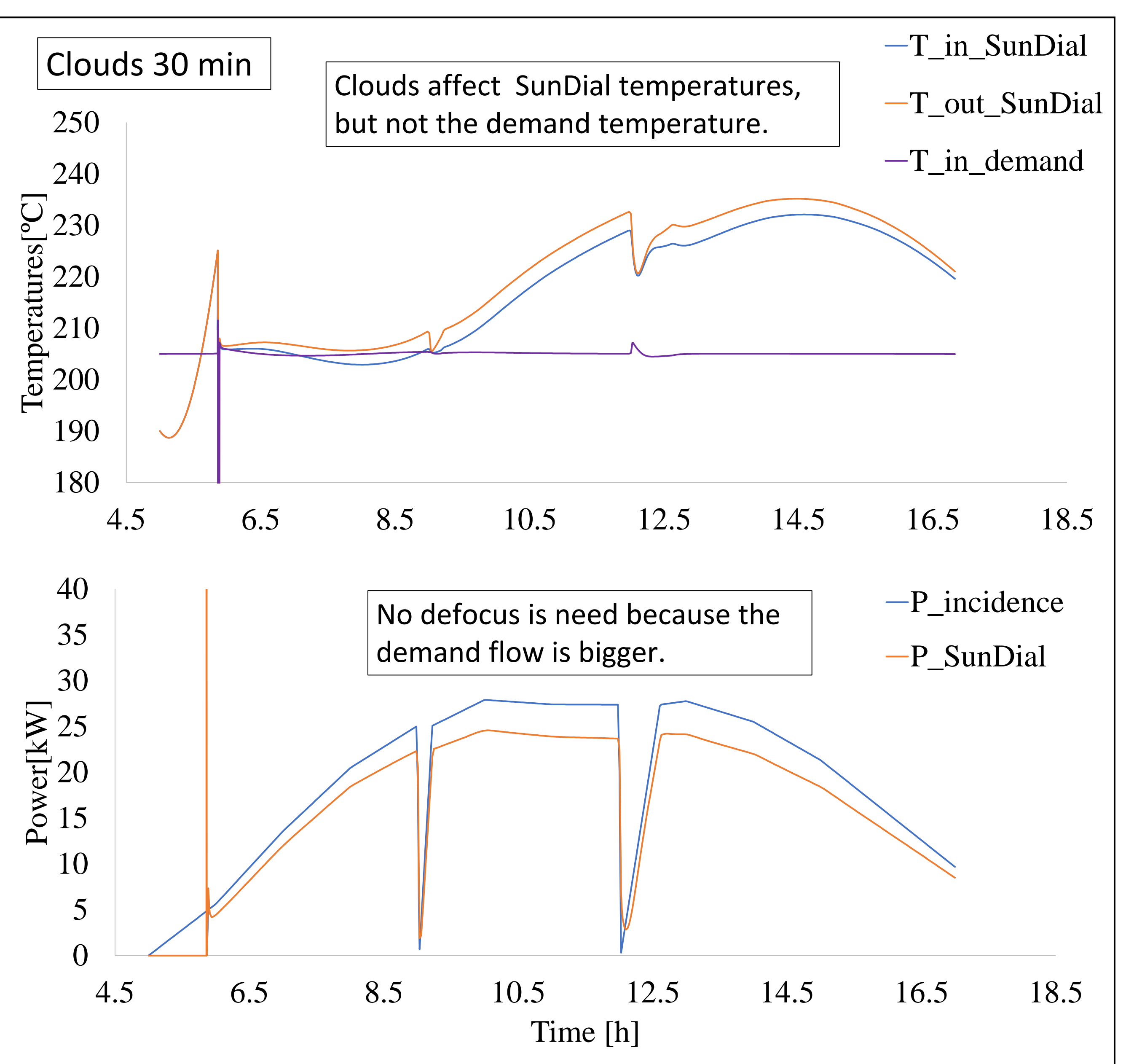
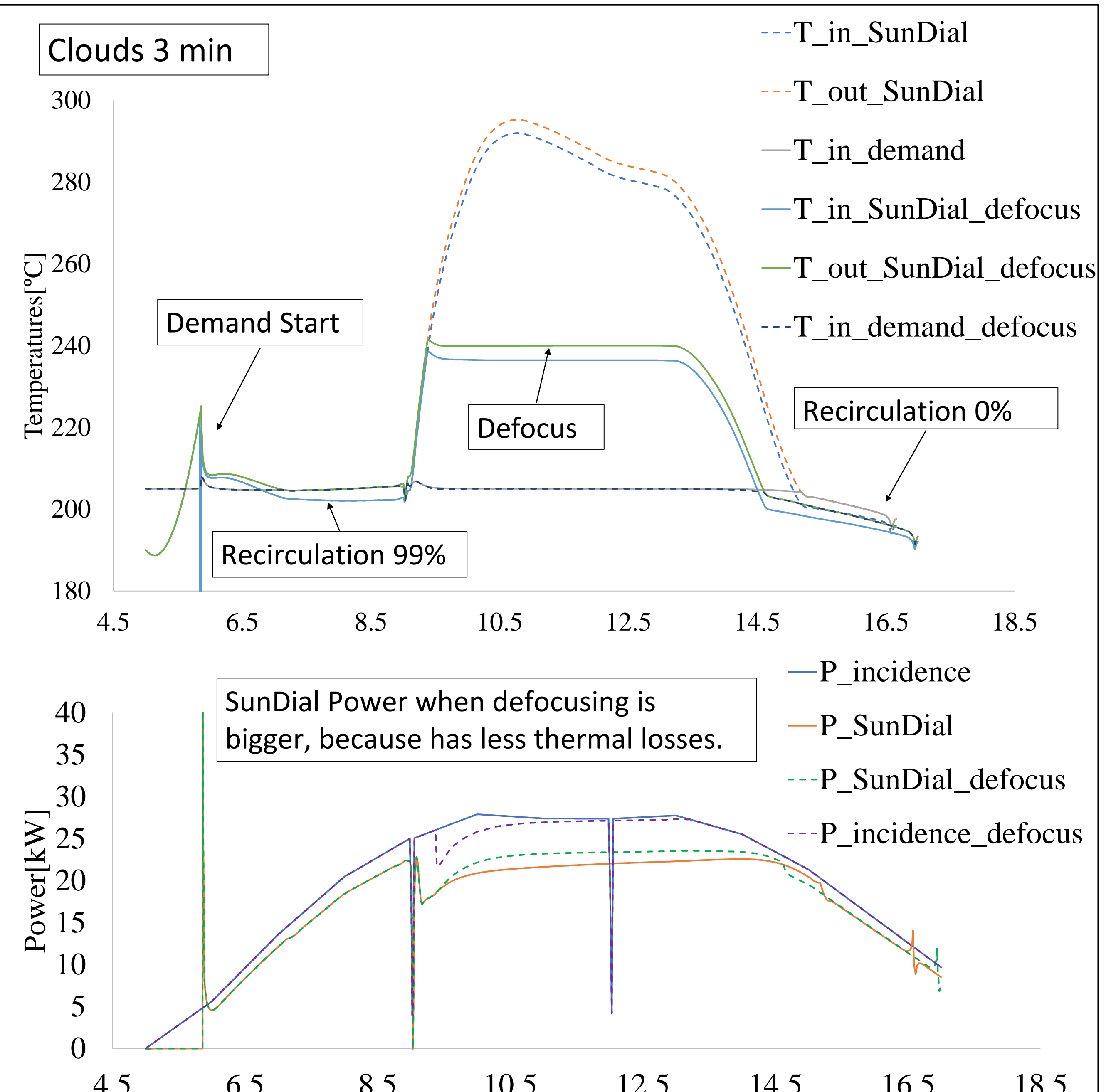
- A model for the Sundial was developed in Dymola to simulate the following simulations:
1. Clouds of 3 min, demand flow 0.5 kg/s and defocus PI activated (Plot 1, 2 dashed line)
  2. Clouds of 3 min, demand flow 0.5 kg/s and defocus PI deactivated (Plot 1, 2 continues line)
  3. Clouds of 30 min, demand flow 1 kg/s, defocus is not need (Plot 3, 4)



## SunDial Model



## Results



## Conclusions

This study showed that, although the Sun was a variable source of energy, the SunDial can be a constant source of temperature with an adequate control system. An improvement to the system could be adding a storage system, which would be able to provide 24 hours of constant heat supply without wasting energy.

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## References

- J. Muñoz-Antón et al. "Experimental facility for a new thermal-solar field configuration: The rotatory Fresnel collector or sundial," AIP conference proceedings, vol. 2126, no. 1, Jul 25.
- R. Abbas et al. "Enhancement of SunDial optical performance handling cosine and end losses.". SolarPaces 2020.
- S. Rodat et al. "Dynamic Simulations of Fresnel Solar Power Plants", Energy procedia.