



Comparison of measurement and simulation of the temperature distribution on CUBI

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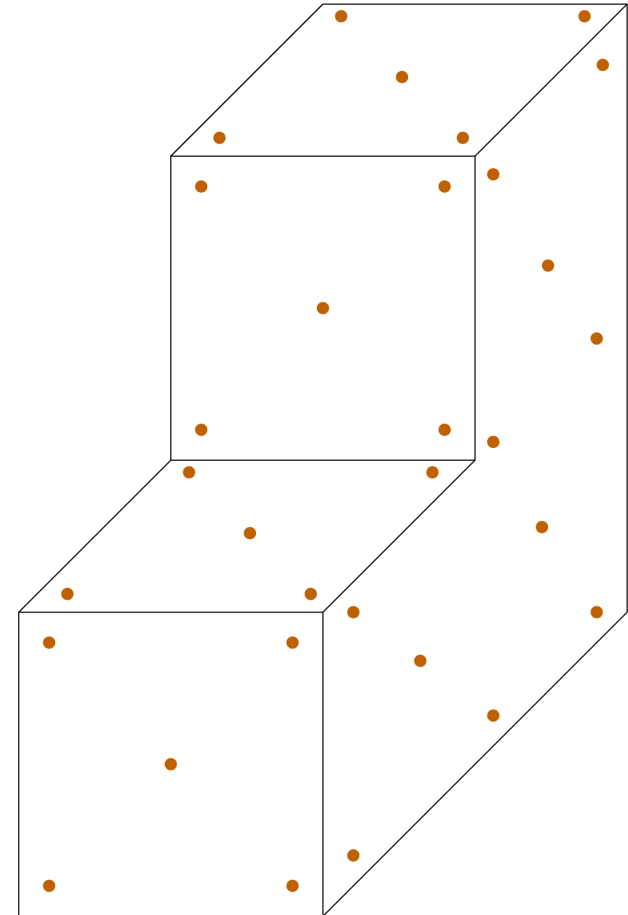
ITBM&S 2010, Ettlingen



Deutsches Zentrum
für Luft- und Raumfahrt e.V.
in der Helmholtz-Gemeinschaft

CUBI configuration of DLR

- **CUBI configuration of DLR**
 - *coating*: 4 mm steel plates
 - *isolation*: 60 mm layer of rock wool inside
 - 47 temperature sensors (Pt100) all over the object
 - stands on wooden pallet in order to be decoupled from the ground
 -



Location

- CUBI is placed at the area of DLR ground station near Weilheim, Germany





Weather station

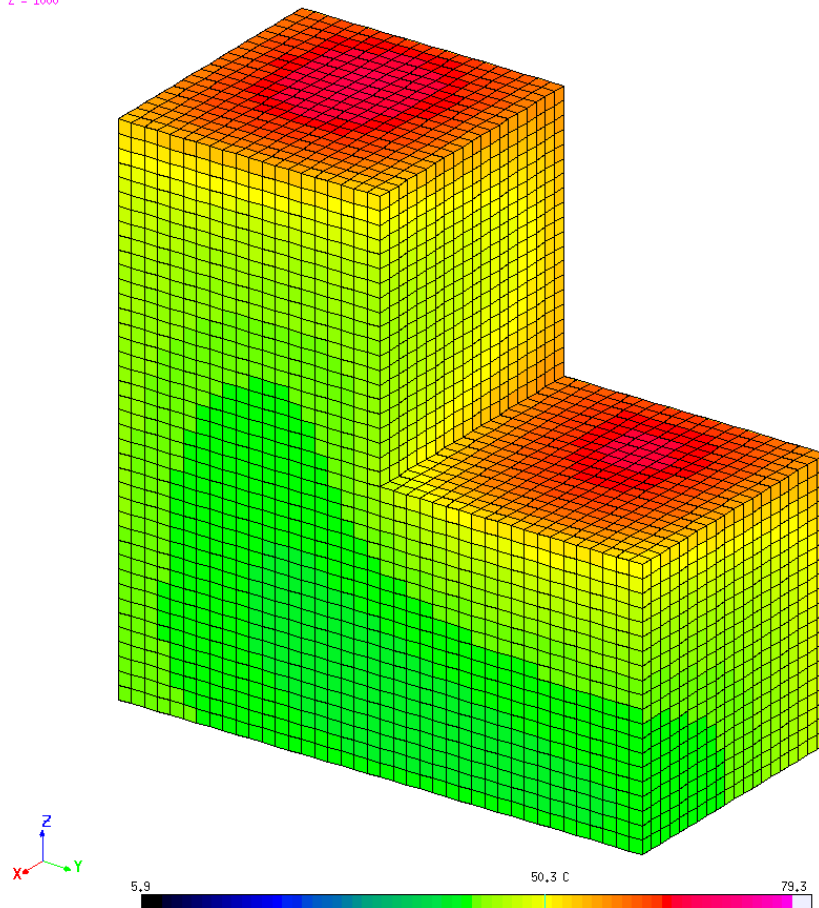
- Pluviometer
- Anemometer with vane
- Barometer
- Hygrometer/Thermometer
- Star pyranometer (solar irradiance, $0.3 - 3 \mu\text{m}$)
- Pyrgeometer (downwards LWIR, $4.5 - 44 \mu\text{m}$)
- Data logger

RadThermIR model

- built from 14 multi-layer plates (20 x 20 facets)
- layers: 4mm steel (mild) + 60mm rockwool
- set in natural weather environment, data are imported from weather station

Model size (mm):
X = 500
Y = 1000
Z = 1000

May 17, 2008 12:35:00



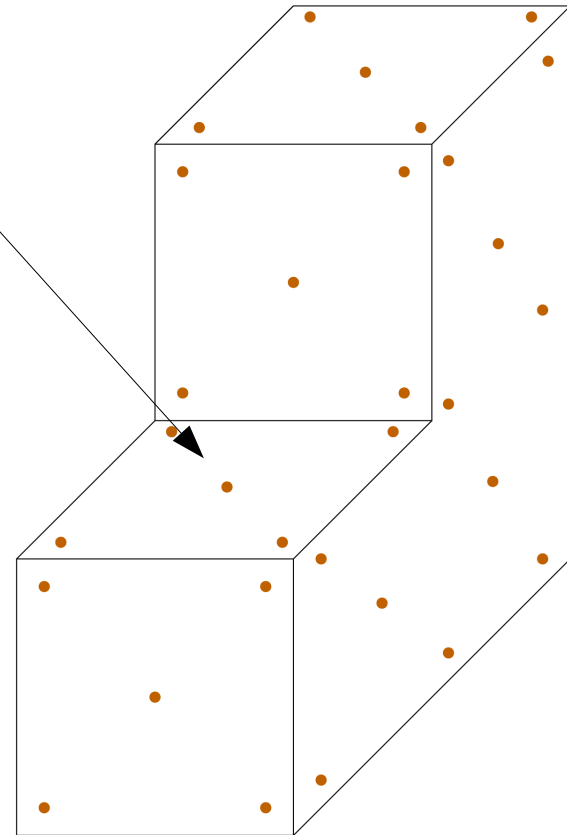


Weather file format (PRISM)

- Time
- Air temperature
- Solar irradiance
- Wind speed
- Humidity
- Cloud cover (unused)
- LWIR radiation
- Rate of rainfall

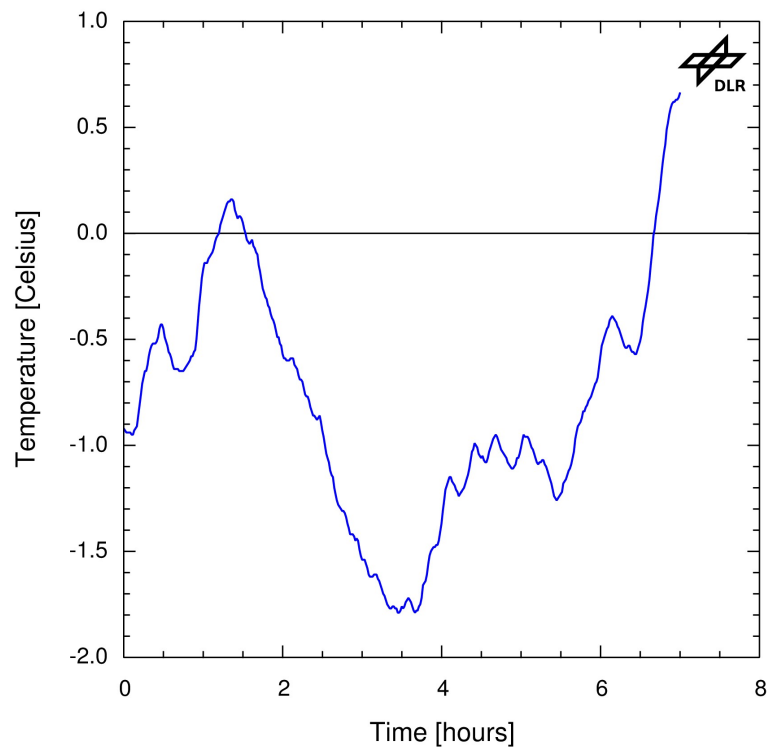
Measurement vs. simulation

- Measurement on the **middle** of the step at **night**
- plot temperature against time (every 5 minutes)
- start at March 19, 10 p.m.
- stop at March 20, 5 a.m.

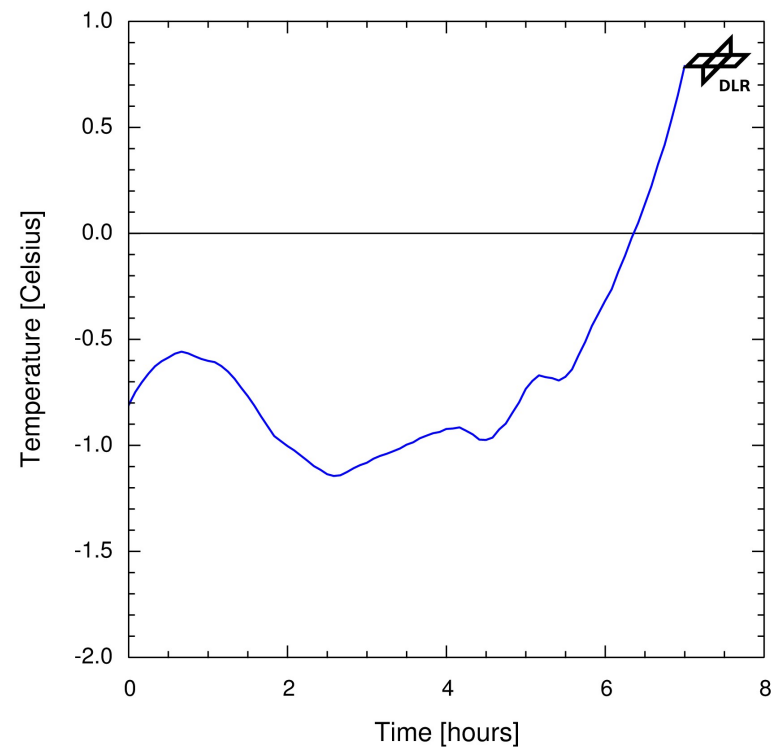


Measurement vs. simulation

CUBI temperature
(Pt100 No. 3)

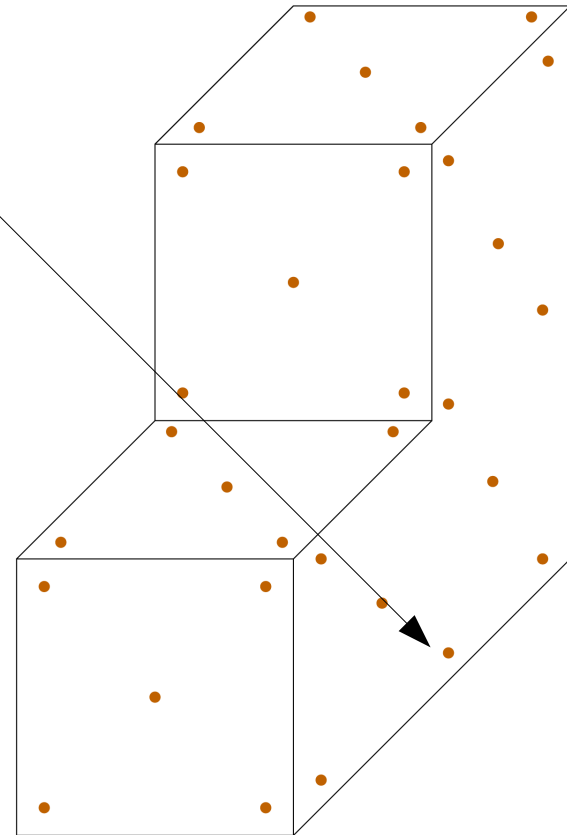


RadThermIR simulation



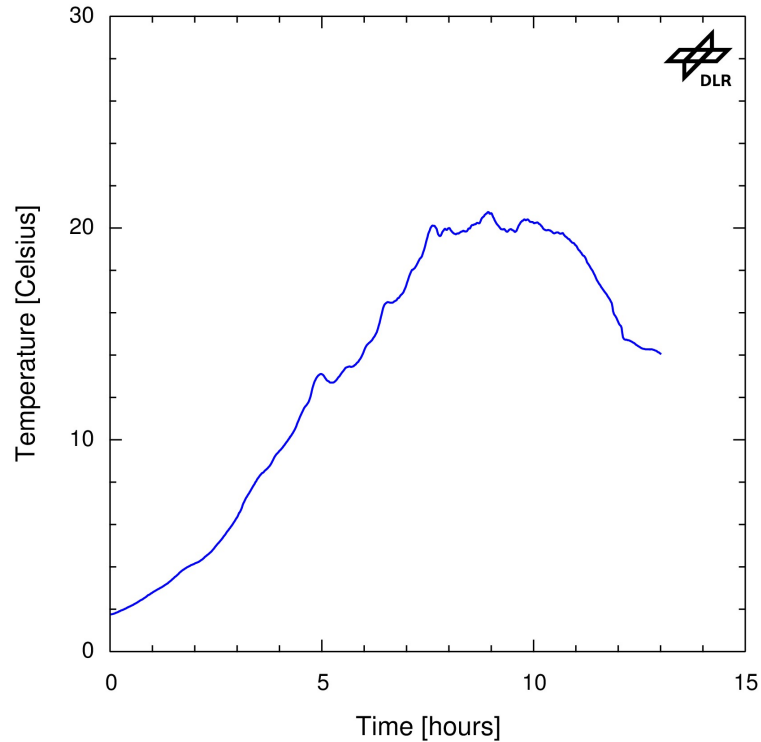
Measurement vs. simulation

- Measurement on the **base** on the **north side** during **daytime**
- start at March 20, 5 a.m.
- stop at March 20, 6 p.m.

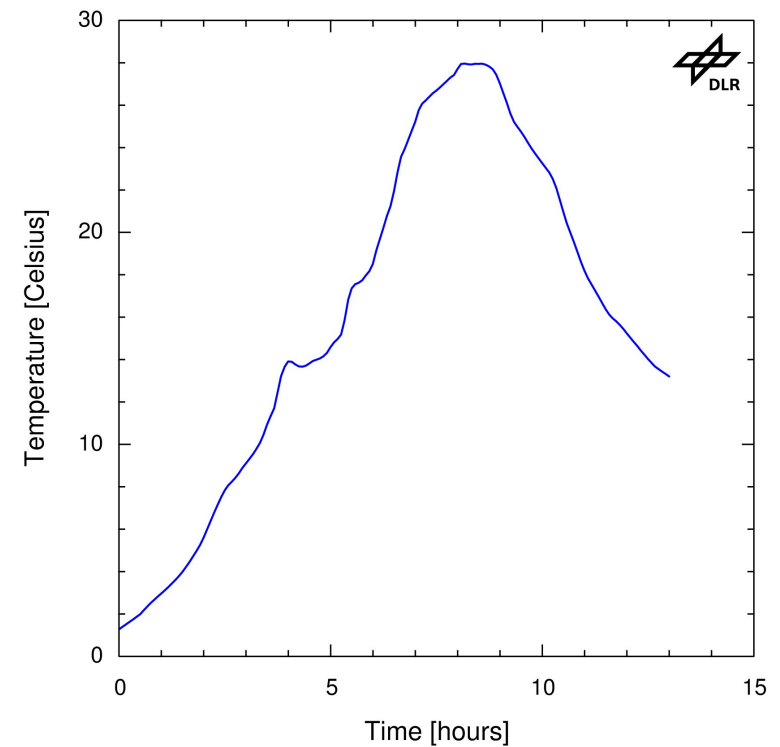


Measurement vs. simulation

CUBI temperature
(Pt100 No. 39)



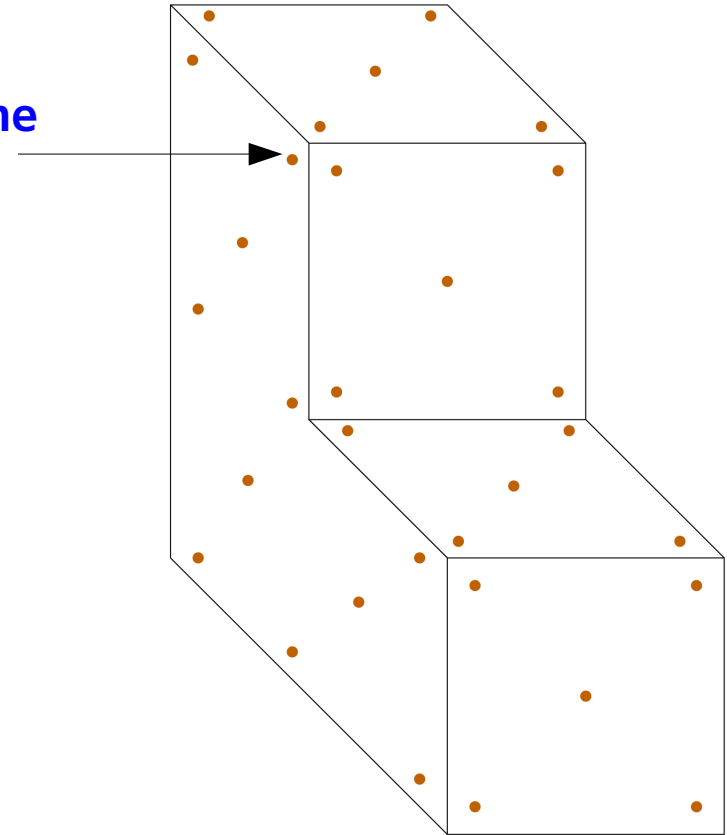
RadThermIR simulation



Measurement vs. simulation

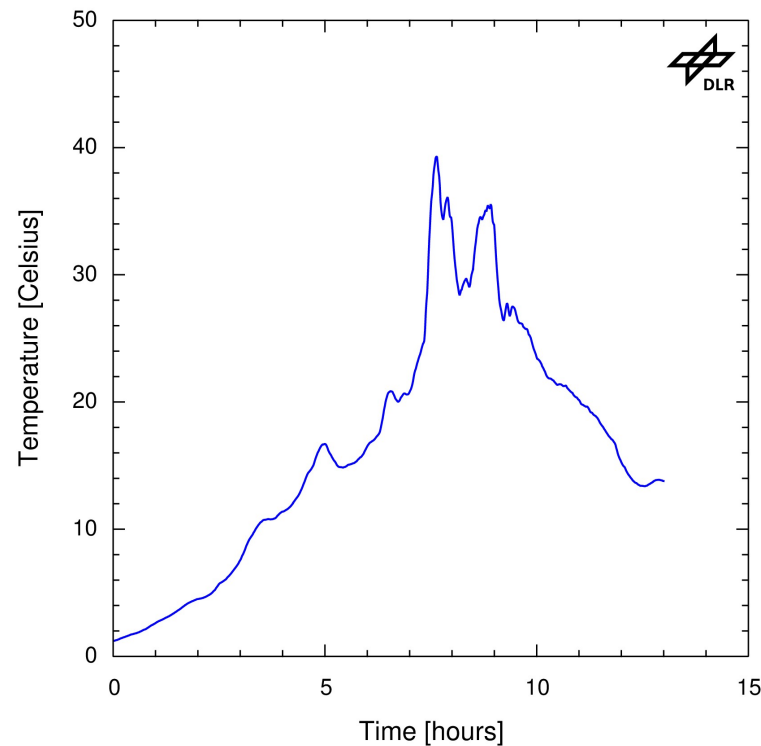
- Measurement on the **upper step** on the **southern side** during **daytime**

- start at March 20, 5 a.m.
- stop at March 20, 6 p.m.

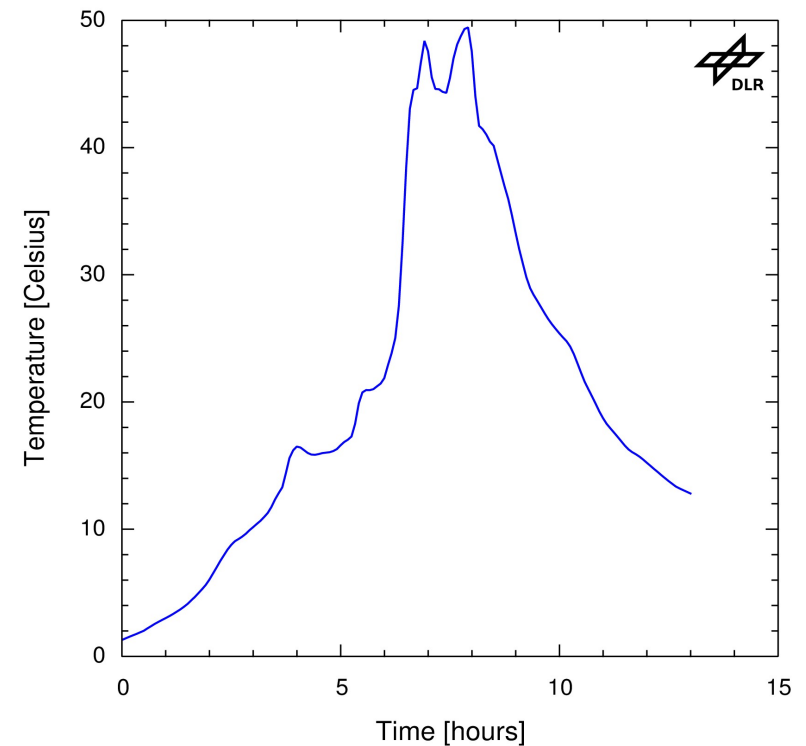


Measurement vs. simulation

CUBI temperature
(Pt100 No. 30)



RadThermIR simulation





Summary and Conclusion

- CUBI and weather station are now in service
- simple RadThermIR model of CUBI available
- first simulations have been run
- temperature can be coarsely reproduced in their run
- but simulation setup is still not sufficient for giving the right values esp. at extrema

Outlook:

- Ground effects have to be taken into account
- Effects of rain and water on the ground have to be built in

*Thanks to
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