SHORTCASTING OF ONE HOUR MICRO SCALE CLOUD FRACTION TREND THROUGH CLOUD INFRARED RADIOMETER DATA

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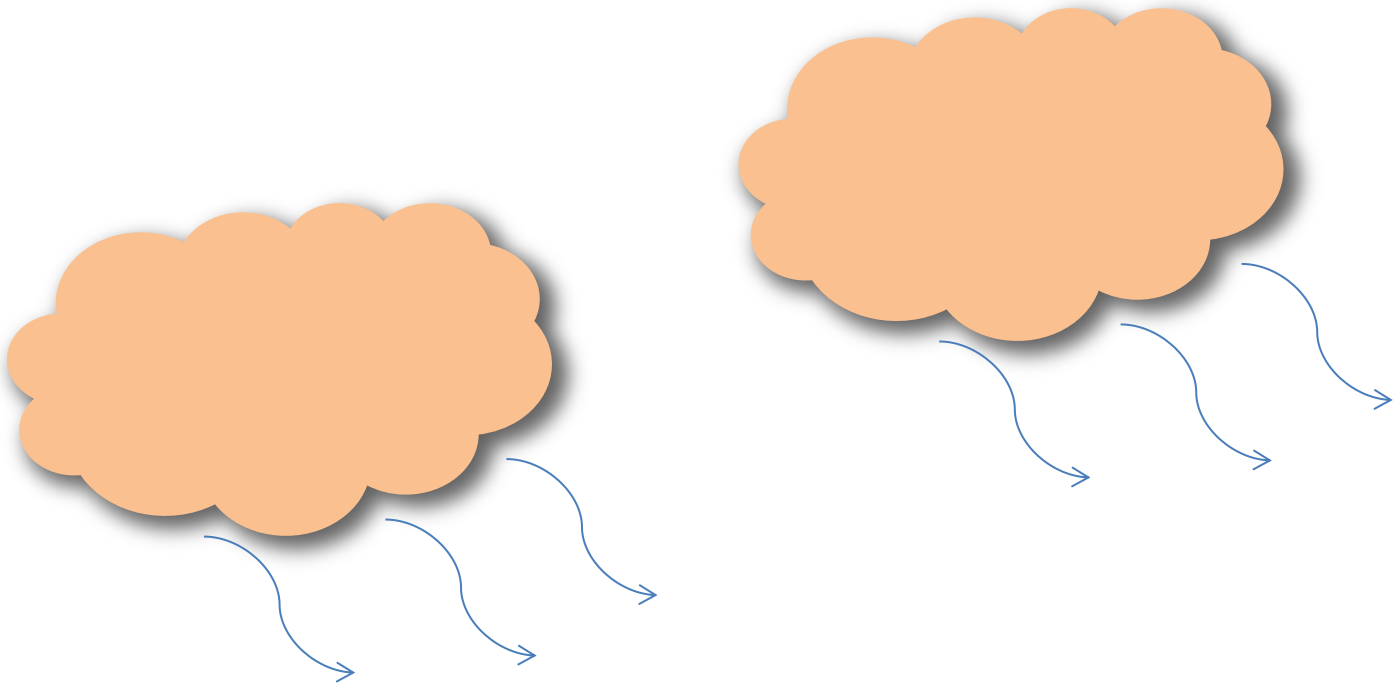
Research of the adequate physical phenomenon



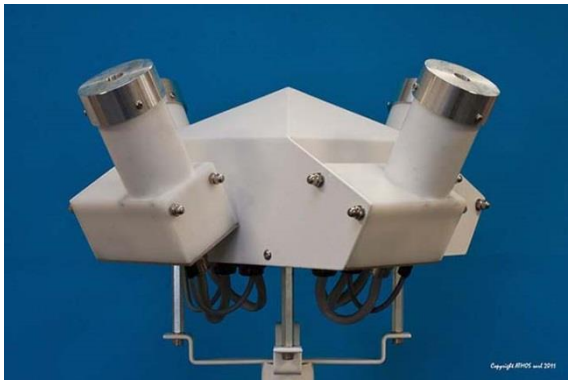
Thermal infrared
Emission 9-14 µm.

Ways of measurement

- ✓ Pyrometers
- ✓ Validated by previous authors
- ✓ Low cost
- ✓ Limited FOV
- ✓ Possibility considering the cost to gather several sensors on a common turret

Conclusion: SELECTED

Instrument designed using this principle



CIR-13 scanning instrument

CIR-4V Time serie instrument

Ground temperature measurement

$$T_{air} = Tm_{easured} \pm \Delta Tp_{robe} \pm \Delta Tra_{diative}$$

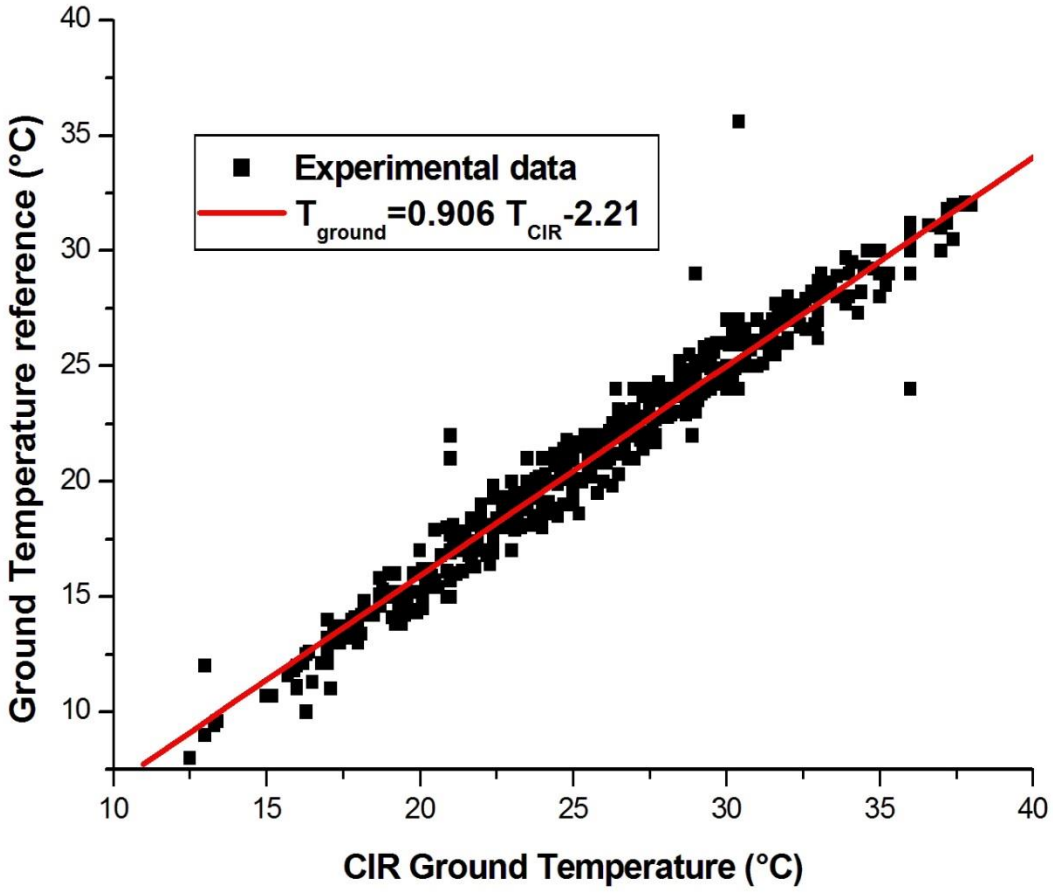
With naturally ventilated shields:

$$\Delta Tr_{adiative} = f\ (\text{wind speed}, \text{solar irradiance})$$

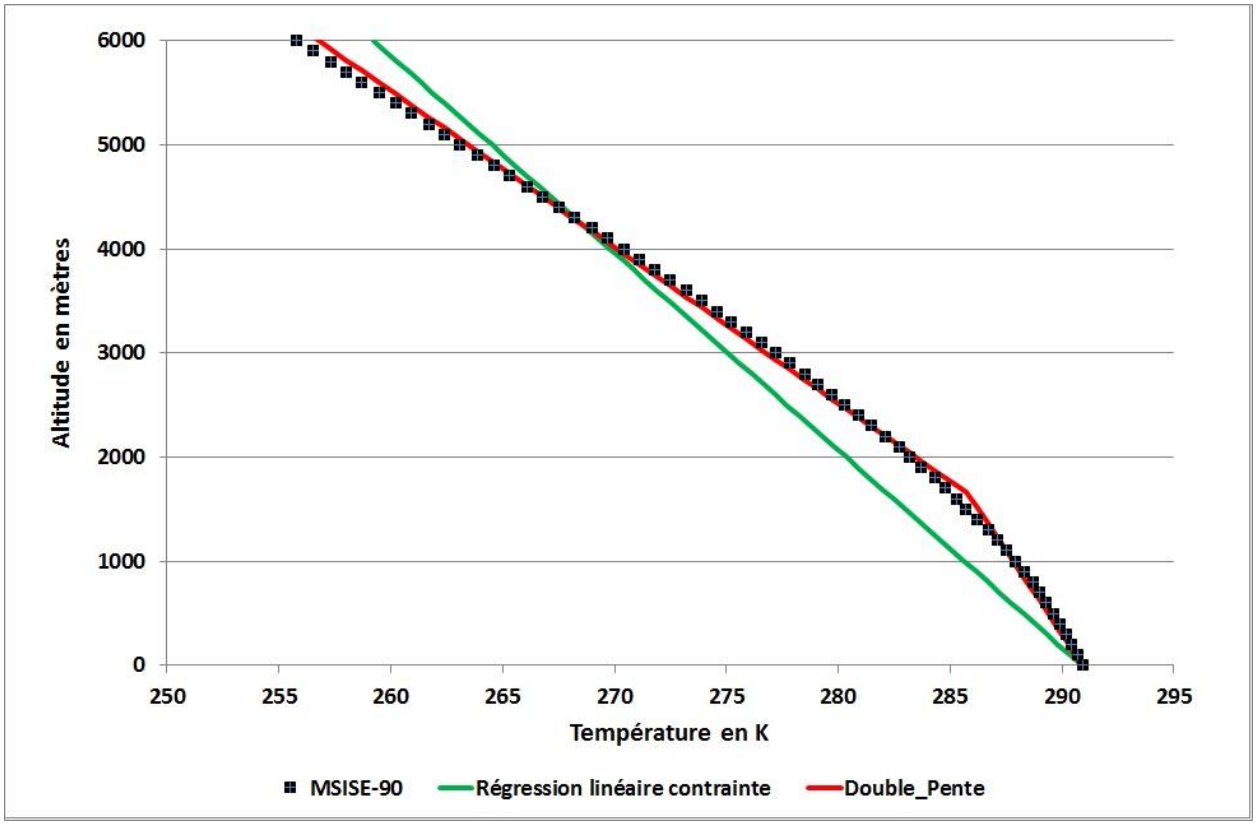
With motor aspirated shields:

$$\Delta Tr_{adiative} \approx \text{constant}$$

Transfer function T_{air} vs $T_{ground\ CIR}$

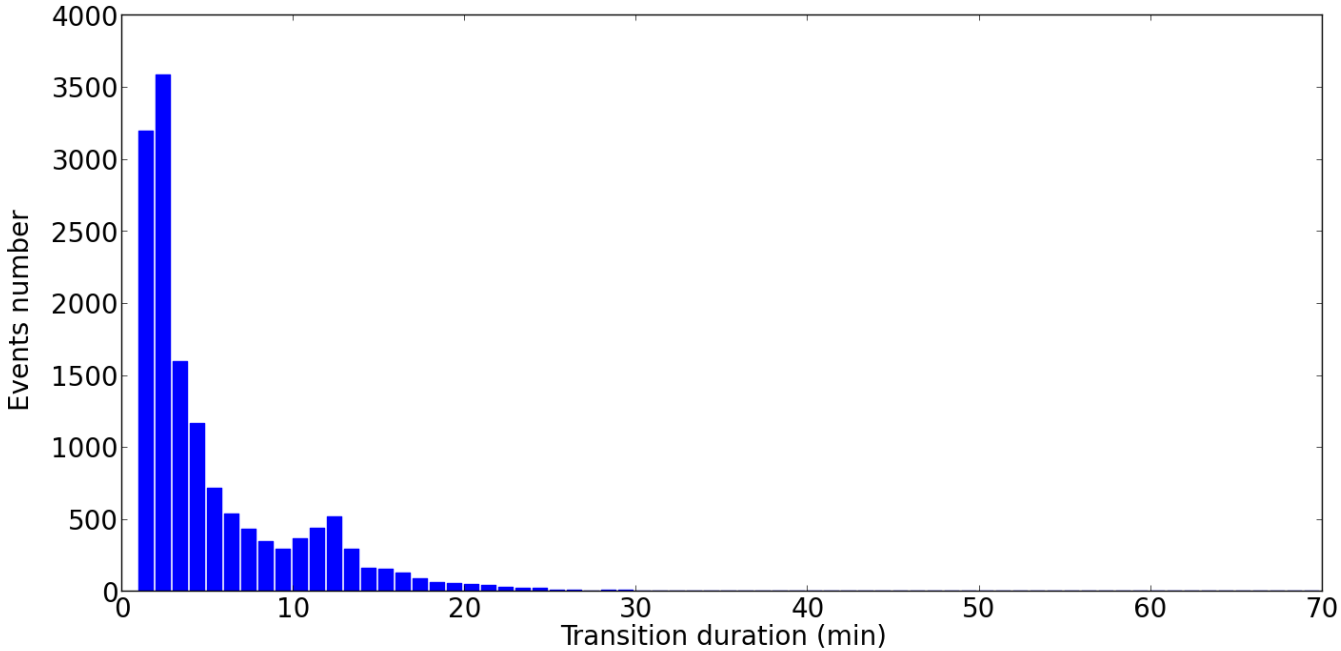


Cloud altitude versus T_{ground}-$T_{brightness}$



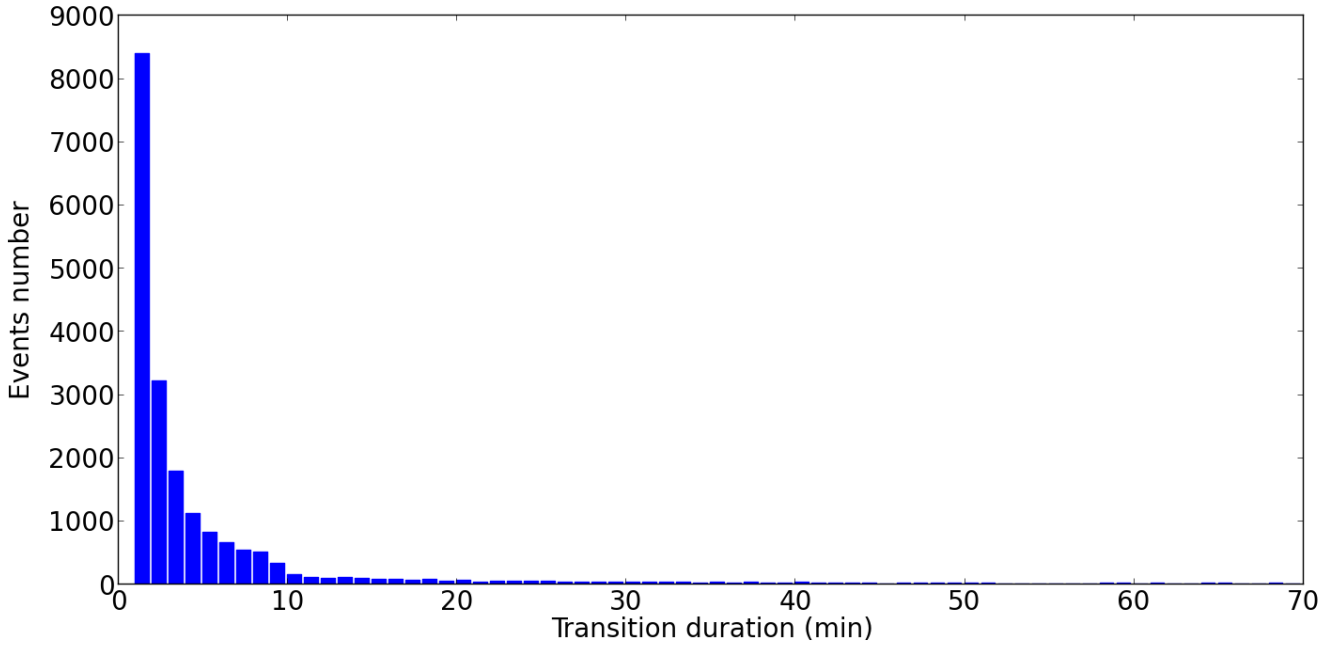
Kinetics of cloud cover variations

✓ Decrease durations



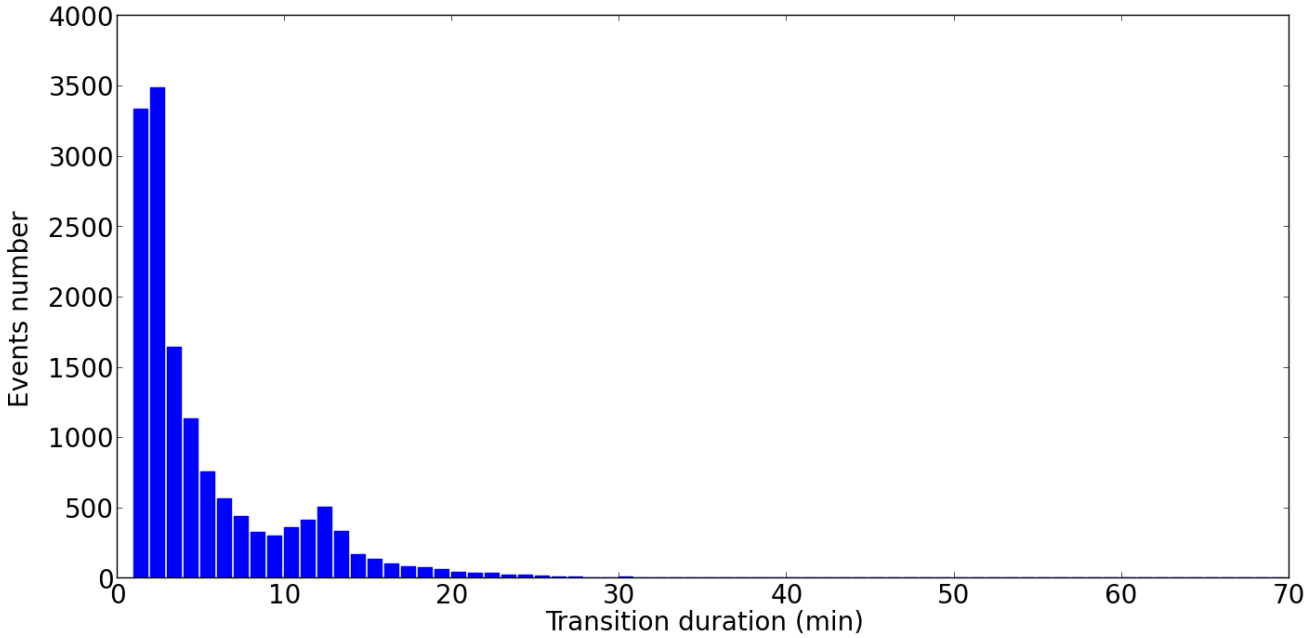
Kinetics of cloud cover variations

✓ Stability durations



Kinetics of cloud cover variations

✓ Growth durations



Impact of cloud cover on photovoltaic production

Photovoltaic farm field of view → micro scale measurement of cloud cover

Cloud cover status at t time	Cloud cover shortcasted at t+1 hour	Production trend
Clear sky	Clear sky	Growth according to growth of solar elevation
Overcast	Overcast	Steady production. No significant impact of solar elevation growth
Clear sky	Overcast	Decrease of photovoltaic production during the coming hour
Overcast	Clear sky	Growth of photovoltaic production during the coming hour

N.B. Difficulty to model broken clouds conditions considering solar spot position versus clouds

Shortcast rate of success

Station location	Period of data record	Rate of success (%)
Uccle	2010-2015	71,7
Virton	2008-2015	74,8
Redu	2007-2015	72,9
Mol	2010-2015	72,7
Ostende	2009-2015	73,1
Mont Riggi	2012-2015	71,9

Perspectives

- ✓ Test present algorithm under different lattitudes and longitudes
- ✓ Add basic pyranometer and/or sunshine duration meter to CIR-4V
- ✓ Approach other mathematical methods to improve shortcast

Thank you for your attention