

Remote Monitoring of Plant Drought Stress with the Apparent Heat Capacity

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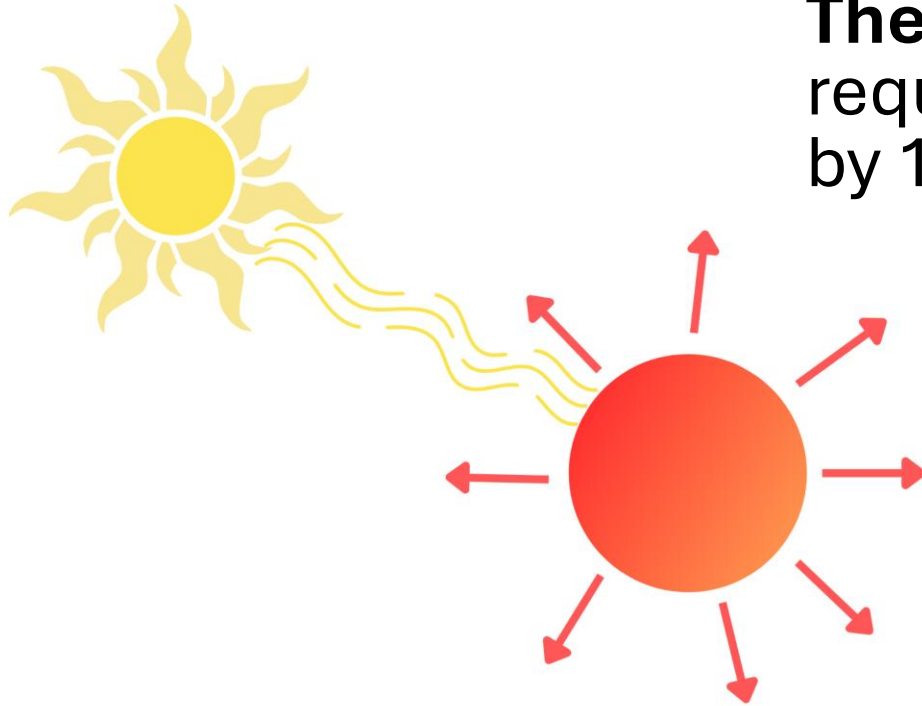
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BASIC IDEA OF THE NEW DROUGHT INDICATOR

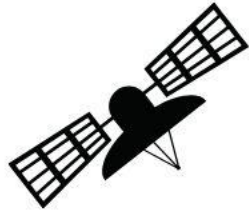


Thermal Heat Capacity \equiv amount of heat required to raise the temperature of a body by 1 degree

$$C = \frac{\int R_n}{\Delta T}$$

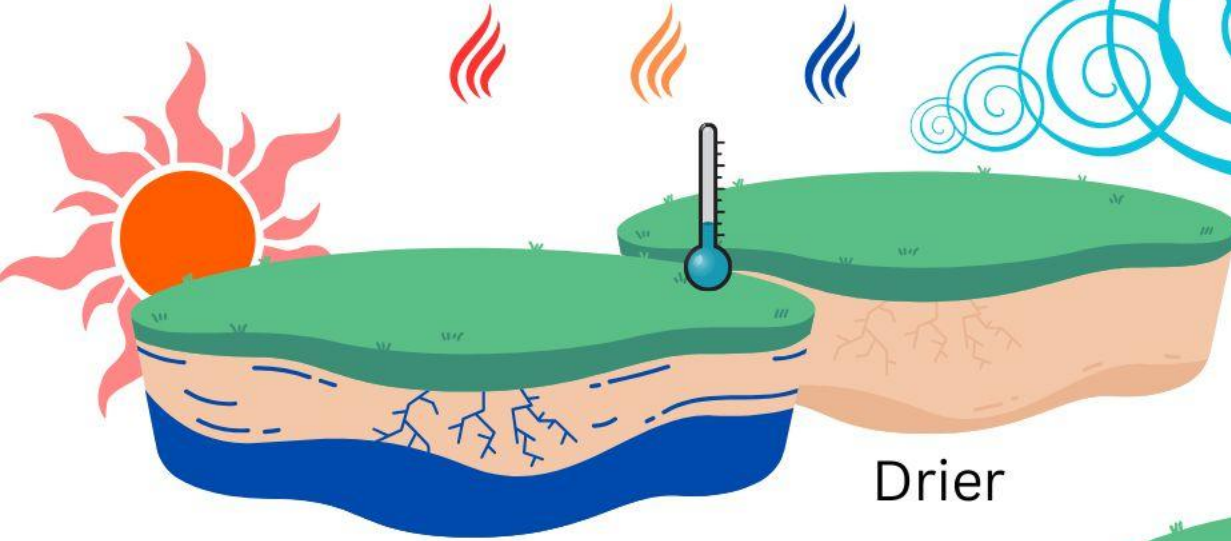
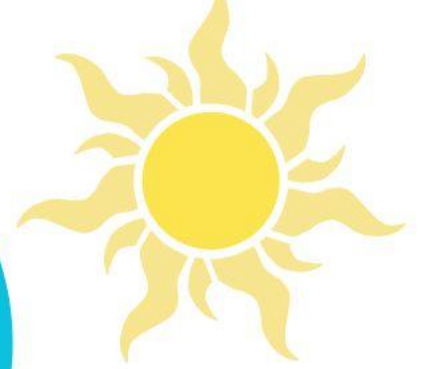
closed system
(only energy exchange, no matter exchange)

DAYTIME SURFACE WARMING



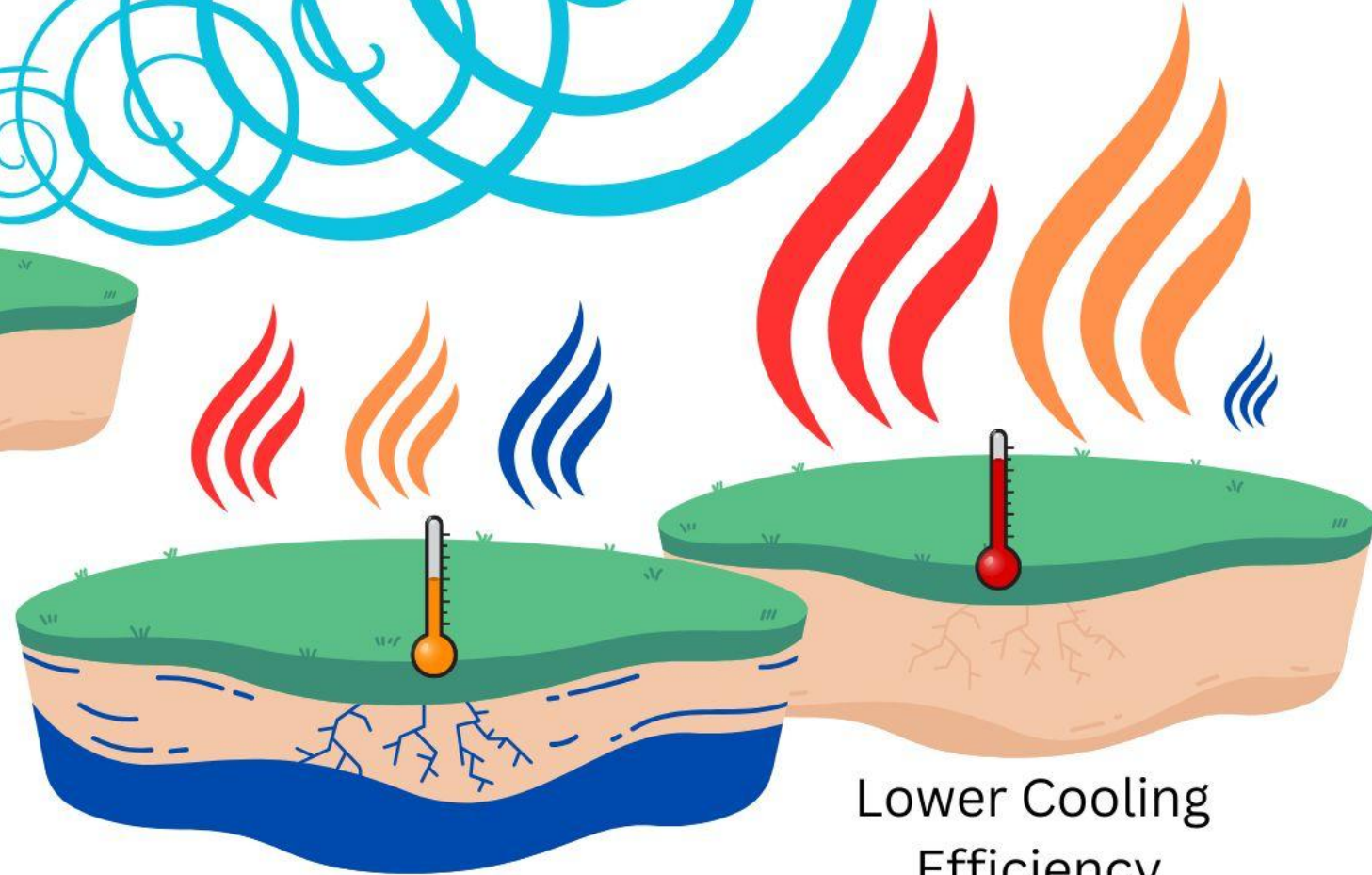
LONGWAVE
RADIATION SENSIBLE
HEAT LATENT
HEAT

atmospheric
turbulent mixing



Wetter

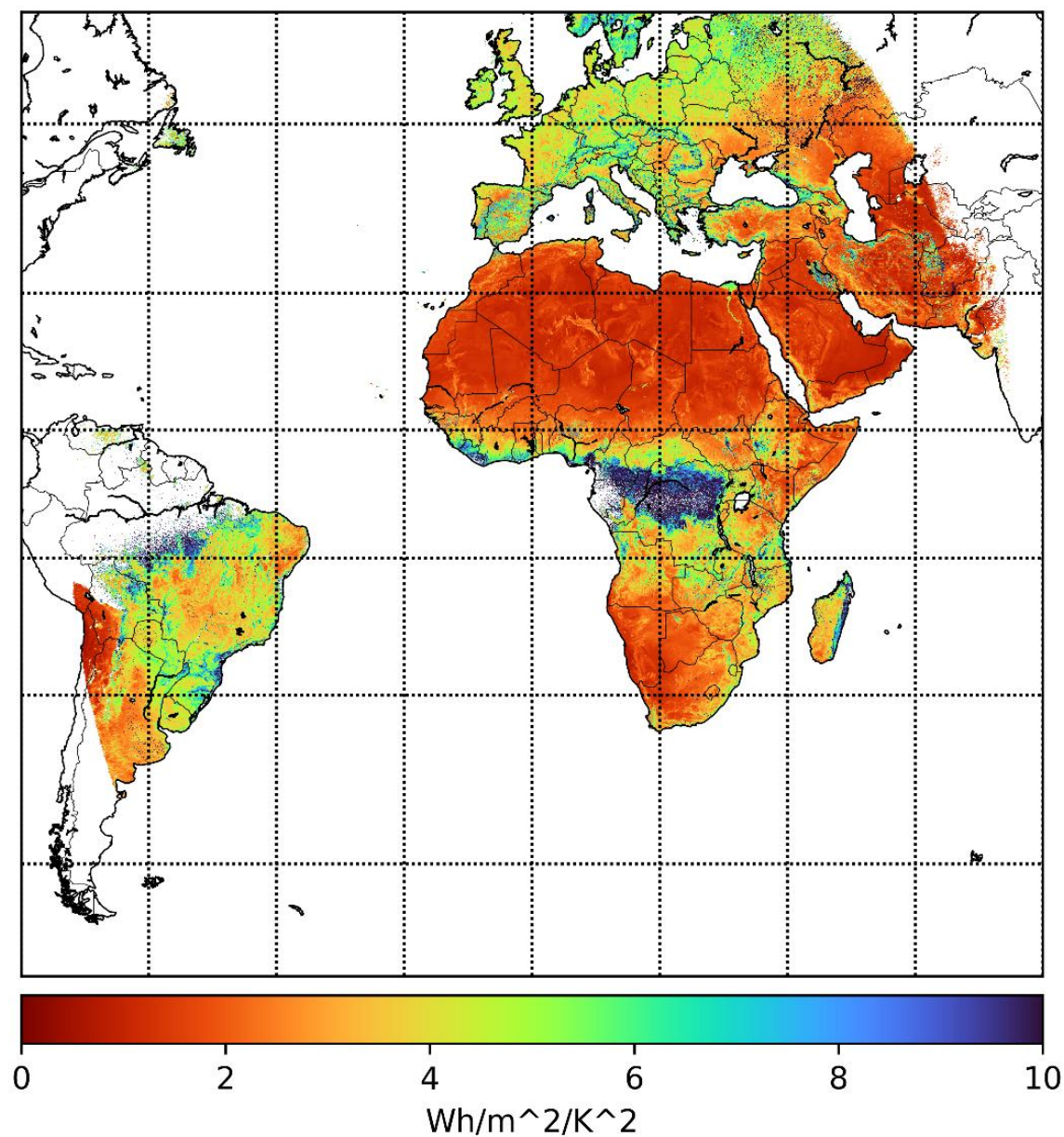
Drier



Higher Cooling Efficiency

Lower Cooling
Efficiency

*The apparent heat capacity
measured from satellite depends
on vegetation drought stress*



CEFI

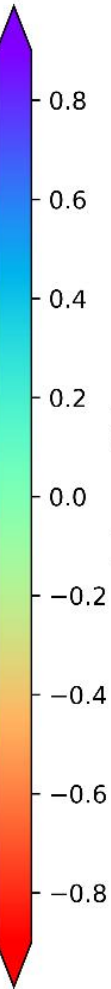
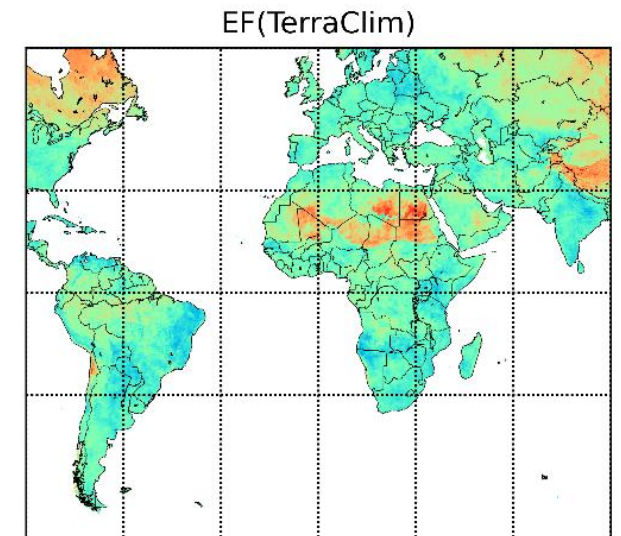
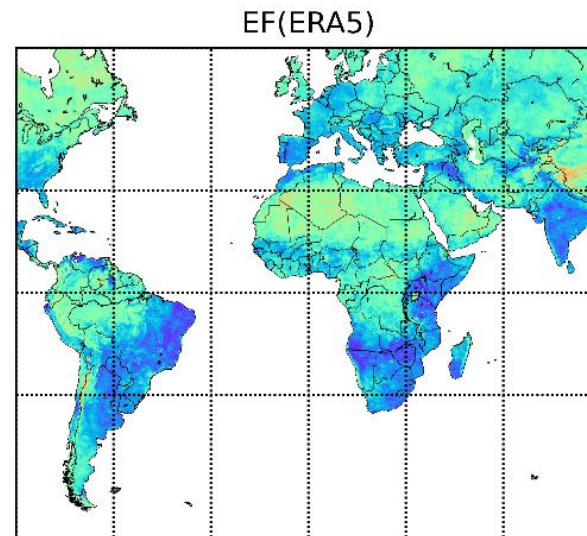
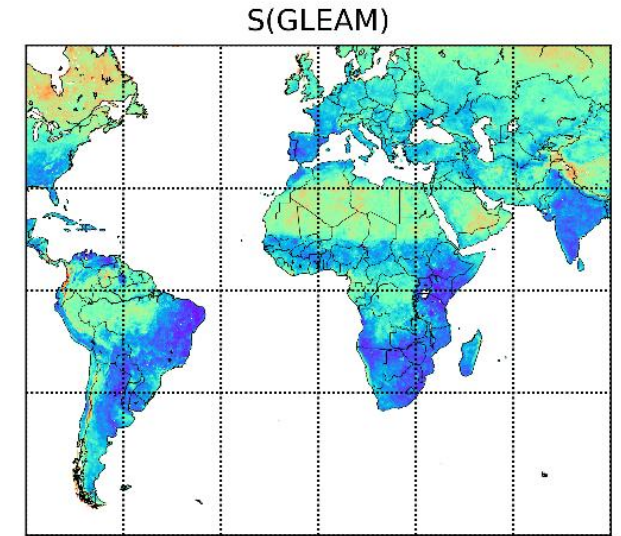
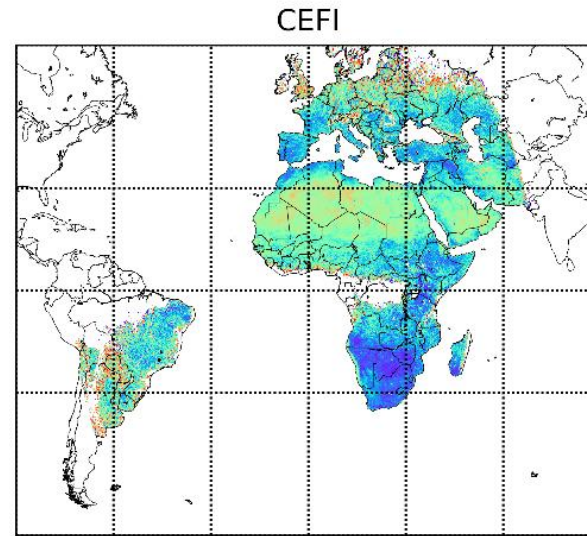
Cooling Efficiency Factor Index

2005-2022 average

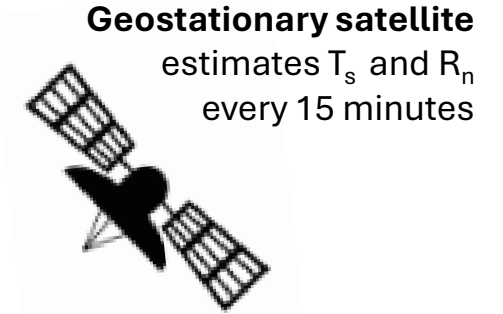
Correlations with monthly NDVI anomalies

S = *Stress Factor*

EF = *Evaporative
Fraction (ET/ET_0)*



FORMALIZATION



DAILY SURFACE WARMING AFTER SUNRISE

Surface Temperature Equation

$$\Delta T_s = \frac{1}{c_s} \int (R_n - SH - LH - GH) dt$$

Surface Heat Capacity

$$c_s = c_a - e_c,$$

Apparent Heat Capacity

$$c_a = \frac{\int R_n dt}{\Delta T_s},$$

Cooling Efficiency

$$e_c = \frac{\int (SH + LH + GH) dt}{\Delta T_s}$$

Hypothesis

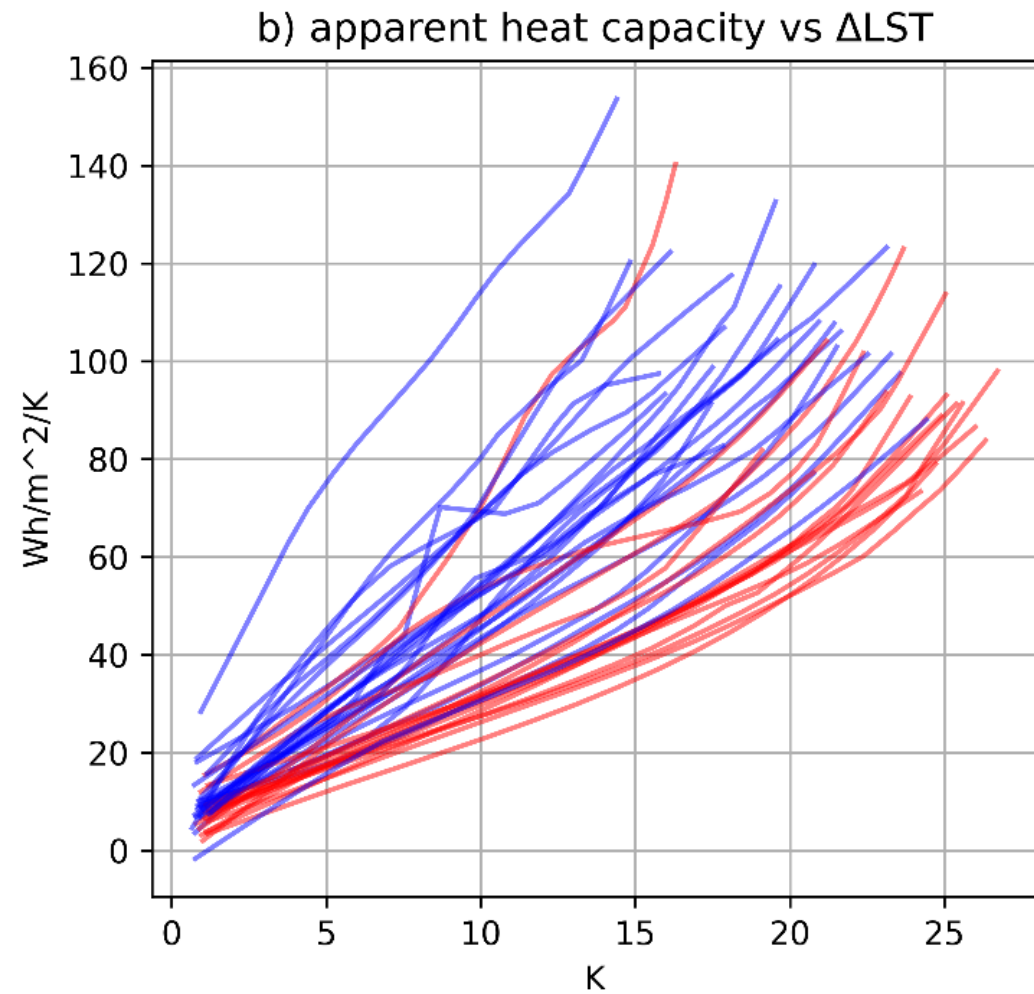
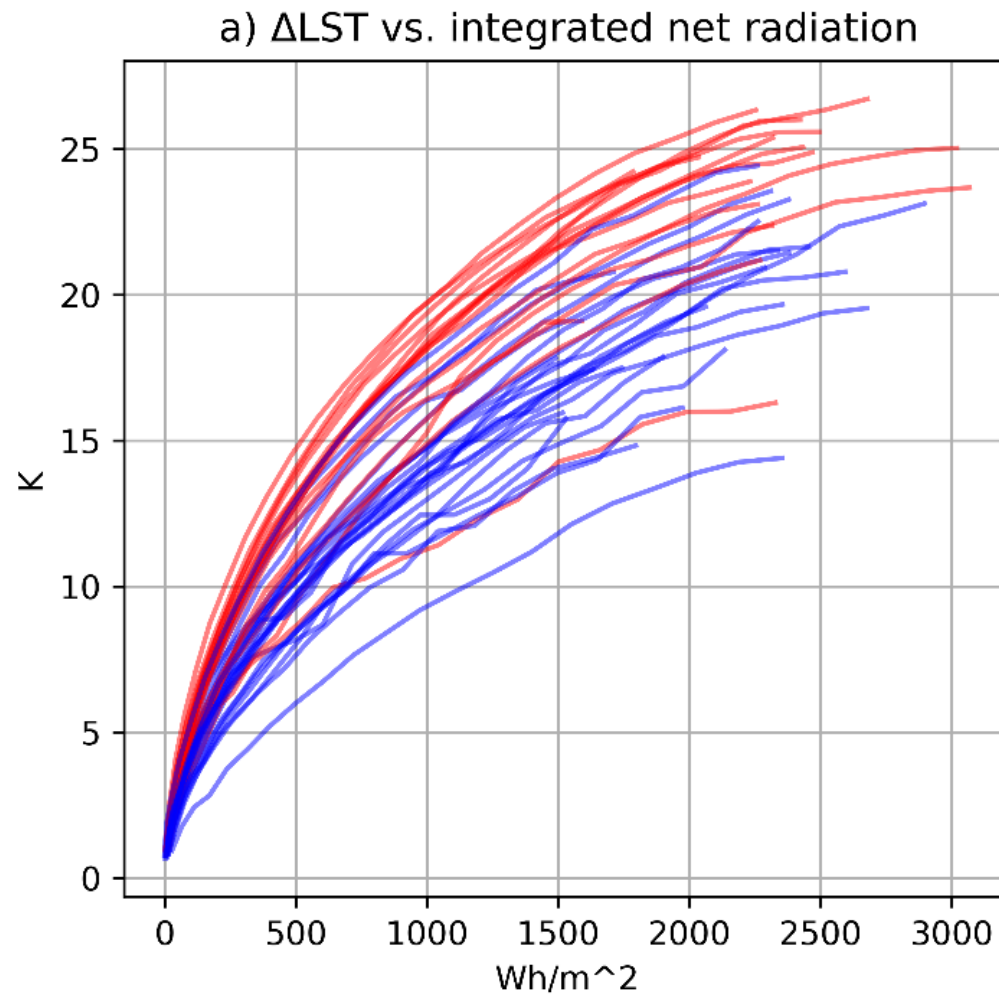
$$e_c \sim e_{c0} + e_{c1} \cdot \Delta T_s,$$

Definition

$$e_{c1} \equiv \mathbf{CEF}(\mathbf{Cooling\ Efficiency\ Factor})$$

CEFI (Cooling Efficiency Factor Index) \equiv CEF monthly median

EXAMPLE: Spain forest - April 2017



Check out the song:

Stop the CO₂



<http://stoptheCO2.com>

