

University of Anbar

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2<sup>nd</sup> Stage

Remote Sensing

Lecture 11 : Thermal Imagery



# Thermal imagery

Thermal infrared energy is emitted from all objects that have a temperature greater than absolute zero. Therefore, all features in the nature on a typical day (Sun, vegetation, soil, rocks, water, people) emit thermal infrared electromagnetic radiation. reflective infrared (0.7 - 3.0  $\zeta$  m) or thermal infrared energy (3.0 - 14  $\zeta$  m). Engineers have developed detectors that are sensitive to thermal infrared radiation

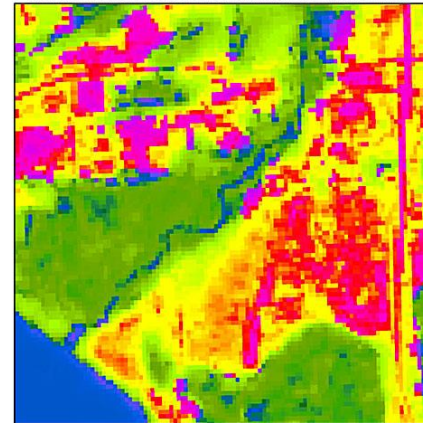
**Aerial RGB image**

Source: National Agricultural Imagery Program (NAIP).  
spatial resolution: 1m



**Coupled thermal-vegetation metric**

Source: Landsat satellite image  
spatial resolution: 30 m visible-near & mid infrared, 120 m thermal infrared



Cooler, greener than average    Hotter, greener    Hotter, less green    Cooler, less green

Normal

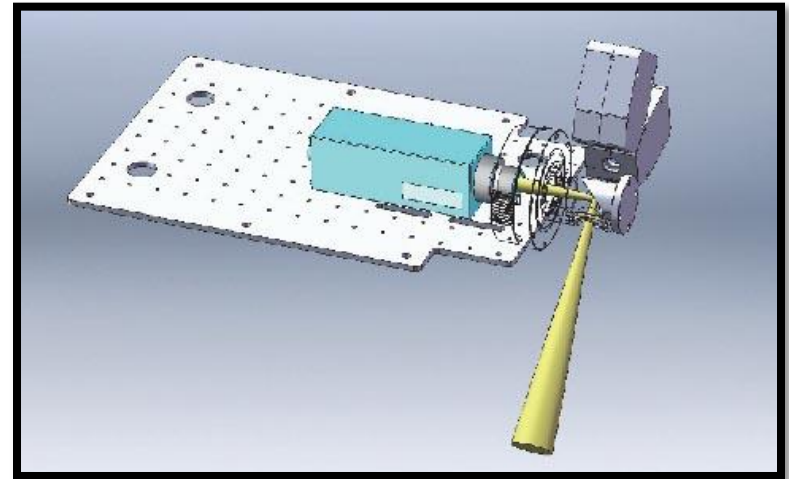
Thermal

## – Calibration of thermal recording

There are many procedures to test and calibrate the Thermal data , but this procedures may be useful in One area but failed in other area

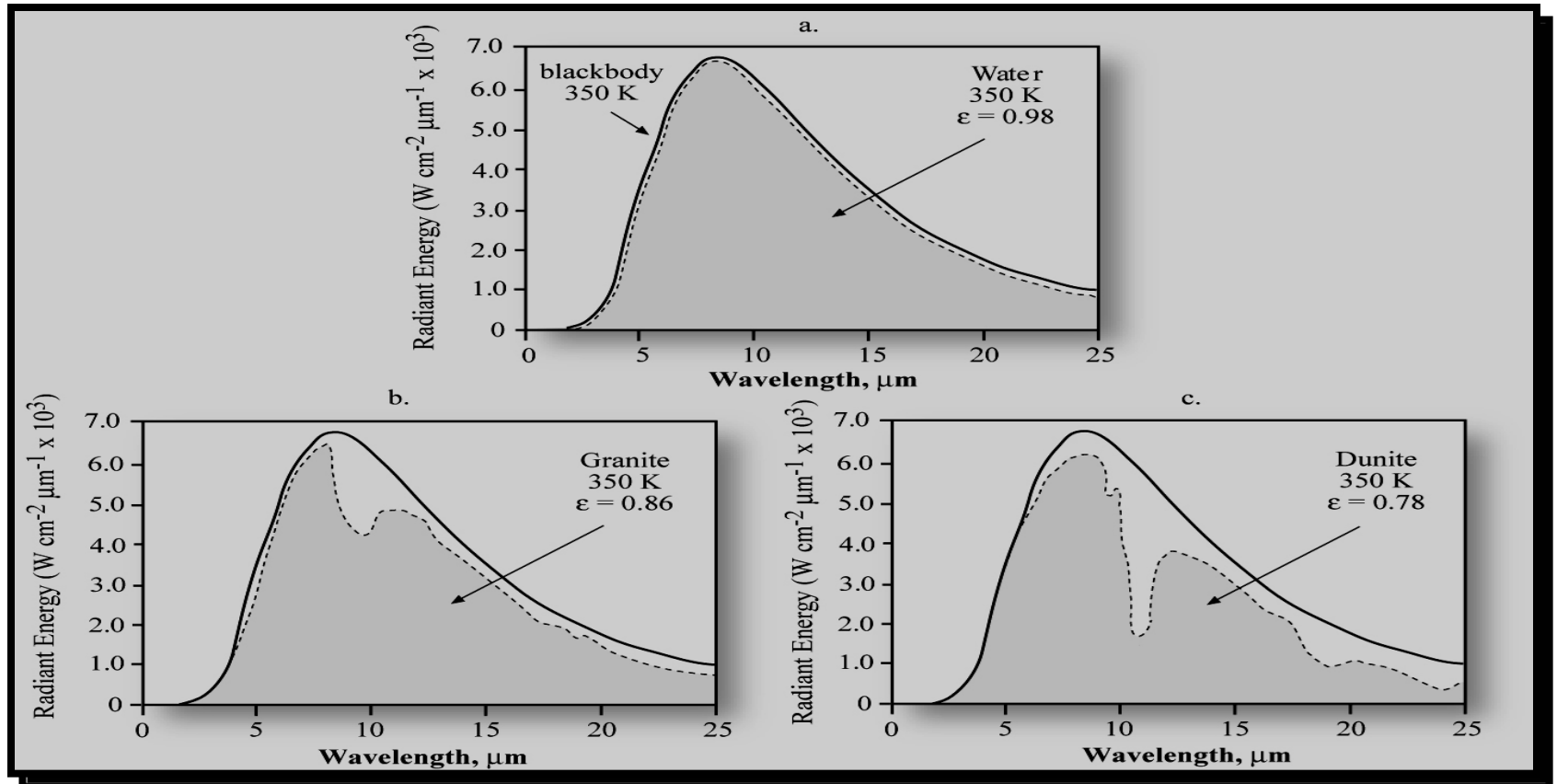
1 – comparing and calibration with Radiometer : the Radiometer can record as points not like the thermal which act as areal . So its more accurate for that before any flying we must do calibrate for both ( ground radiometer and satellite detector ) , but this procedure not very useful because we compare between ground one and satellite one

Ground Thermal Radiometer

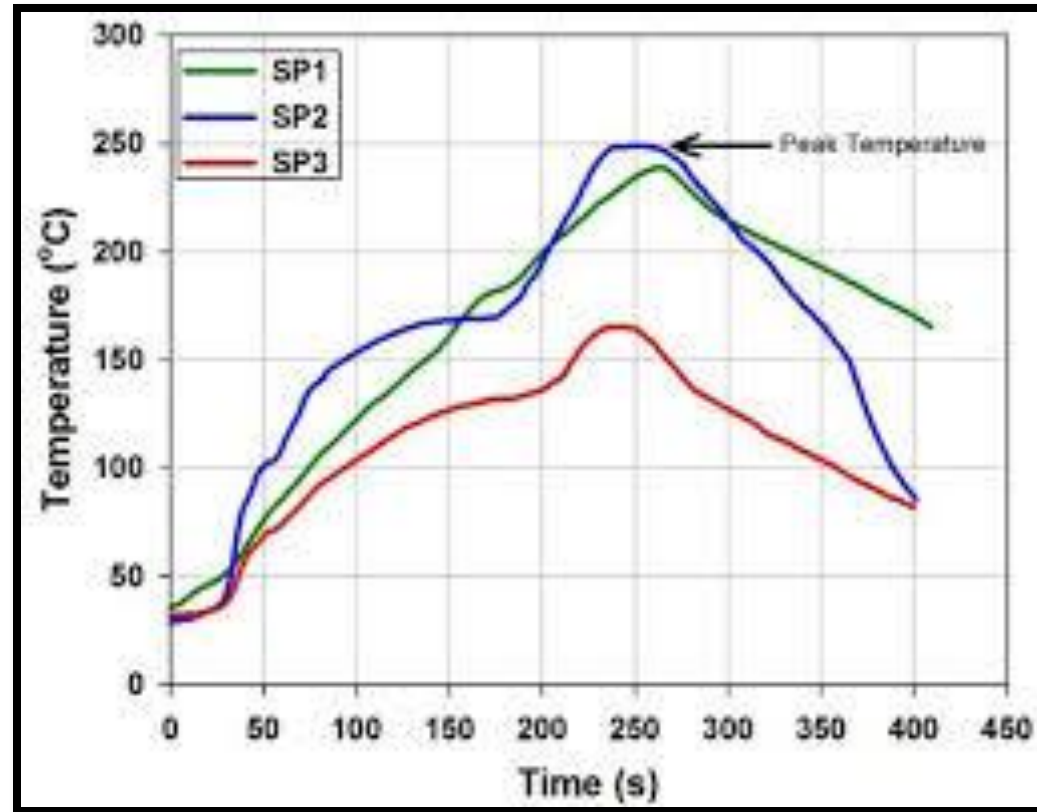


Satellite Thermal Radiometer

2 - comparing and calibration with Black body : The black body it's a theoretical body can absorbed all the wave length fall on its surface then he emitted them later with some wave length , we use two detectors one for cold degrees K and other for hot degress and the final one is the average between them . The accuracy We need its  $0.3\text{ C}^\circ$  with high 600 m but in areal recording its  $2\text{ C}^\circ$

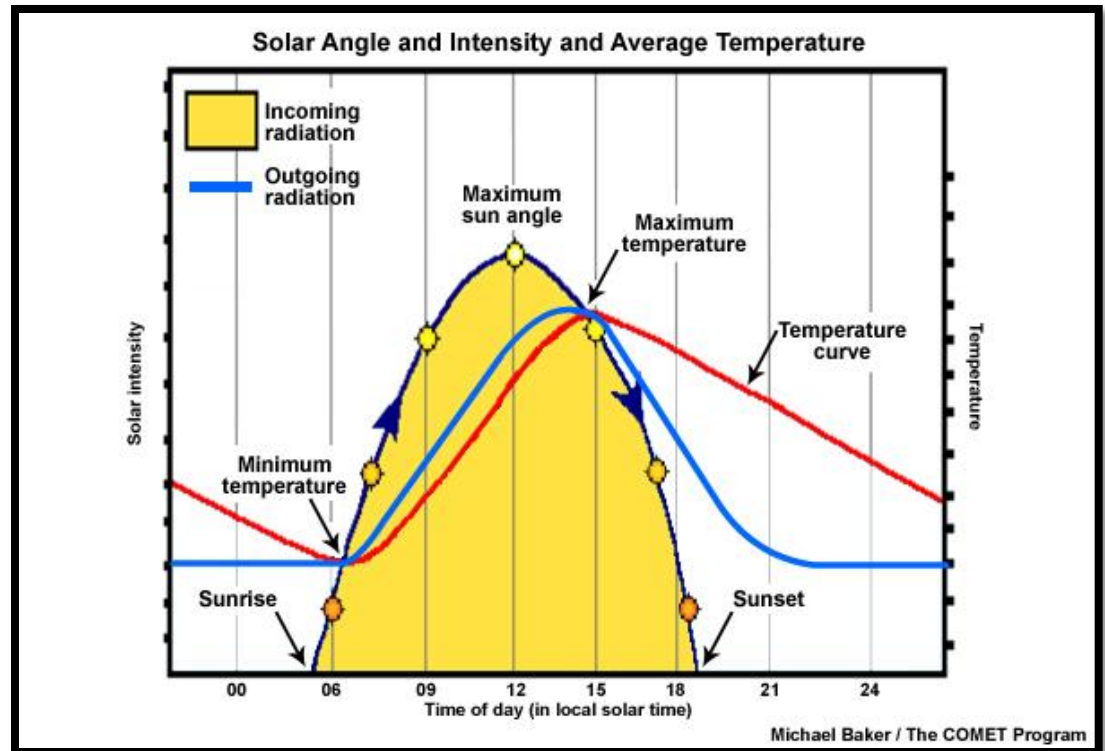


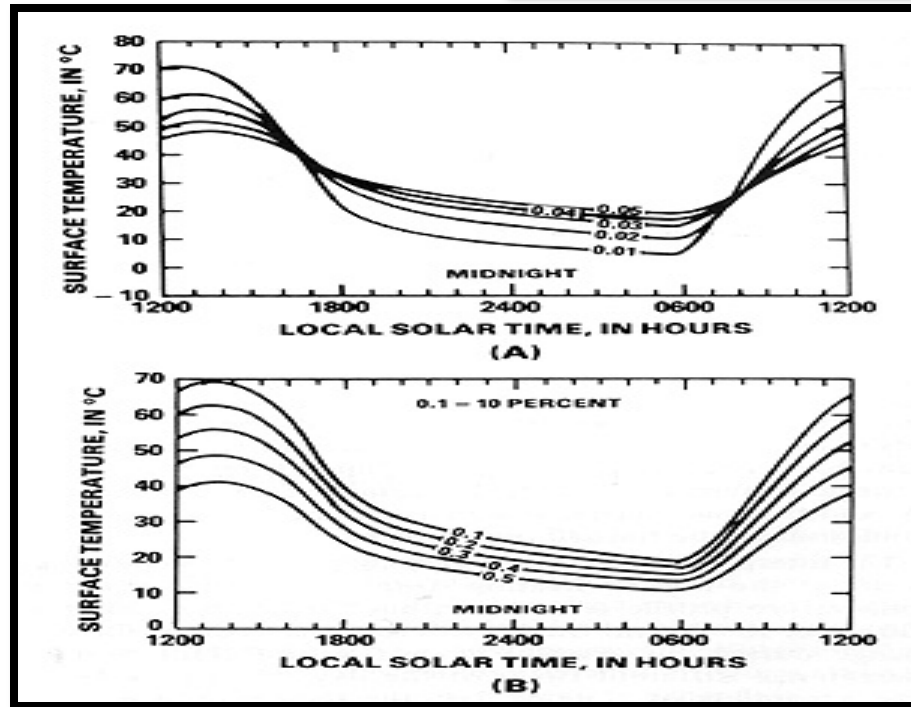
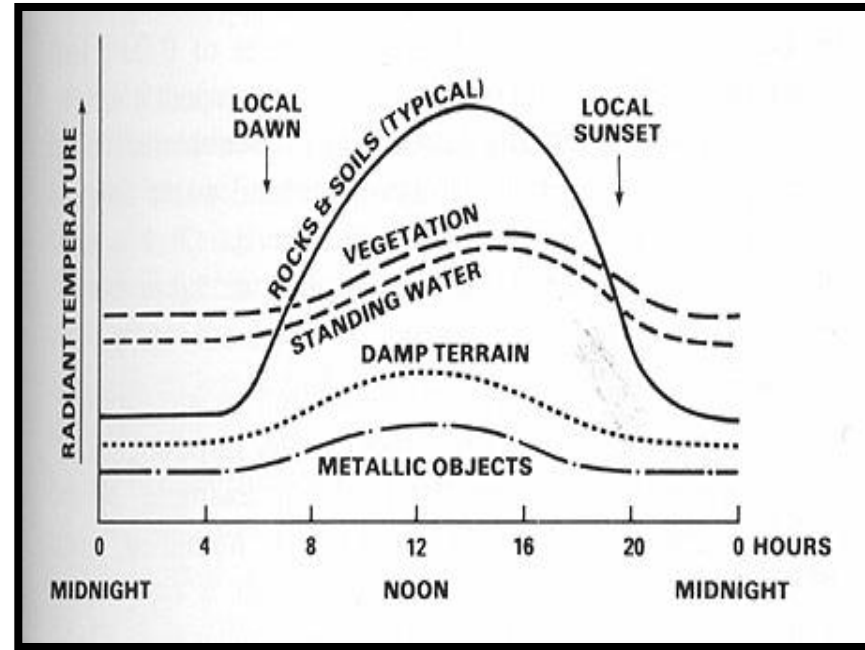
3 – Repeated recording for the area : we can record continually for same area to show how can atmosphere effect on satellite or plane recording , this can happen when we record above same area to 4 different levels and about four times , this can give as the diagram for effect of high to thermal records .



# Diurnal thermal changes :

Along one day the thermal can change for any body because of the sun and its path over the sky , when the sun rise and the beam fall over the bodies its begin to absorb the heat and become more wormer , this operation continuous all the day - light and when the sun set its become opposite and the heat absorbed by bodies begin to emit and give another Degree of heat , so at dawn and sunset all the bodies can be more similar together .





# References

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# Earth Science Satellite Remote Sensing Vol. 1: Science and Instruments , Qu J. J., Gao W. , Kafatos M. , Murphy R. E, Salomonson V. V., Tsinghua University Press, Beijing and Springer-Verlag GmbH Berlin Heidelberg . 2006

# Internet Remote Sensing Lectures sites