Mapping Drought and Evapotranspiration at High Resolution using Landsat/GOES Thermal Imagery

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OBJECTIVES

1) Develop multi-satellite thermal ET/drought product at 30m – 10km resolution

- **GOES:** Hourly continental coverage at 5-10km resolution
- **Landsat:** Periodic targeted disaggregation to 30-120m resolution

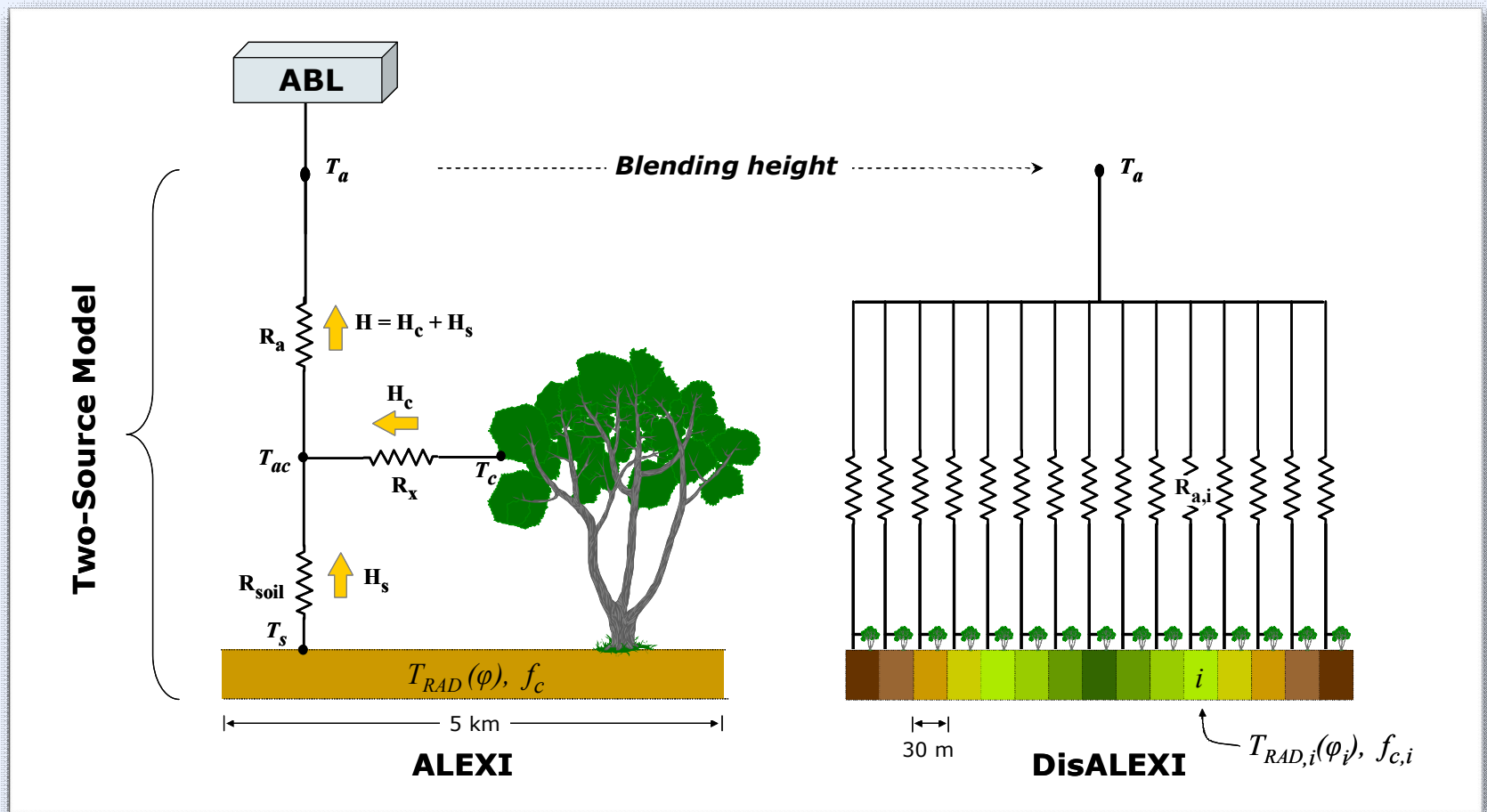
2) Develop technique for sharpening thermal band imagery to shortwave band resolution

- i.e., sharpen 60/120m (L7/L5) resolution thermal images to 30m

3) NEW: Identify modes of GOES-MODIS-Landsat synergy

- **MODIS-like instrument:** Daily assessments at 1km resolution

Atmosphere-Land Exchange Inverse Model (ALEXI)



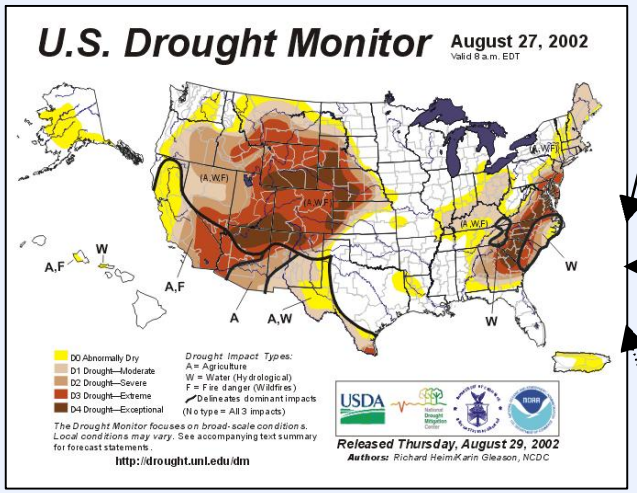
Regional scale

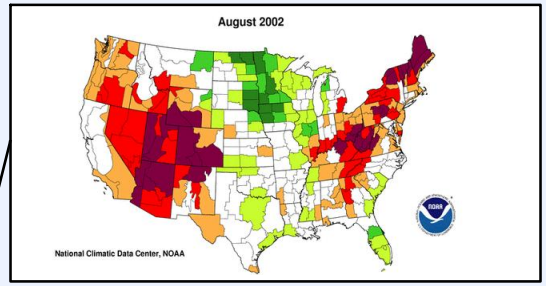
ΔT_{RAD} - GOES
f_c - AVHRR, MODIS

Landscape scale

T_{RAD} - TM, ASTER, MODIS
f_c - TM, ASTER, MODIS

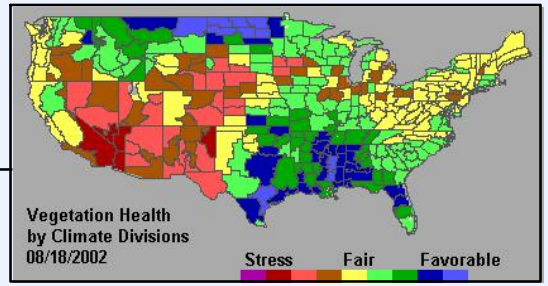
Evaporative Stress Index (ESI)





Palmer Drought Index

Antecedent precipitation



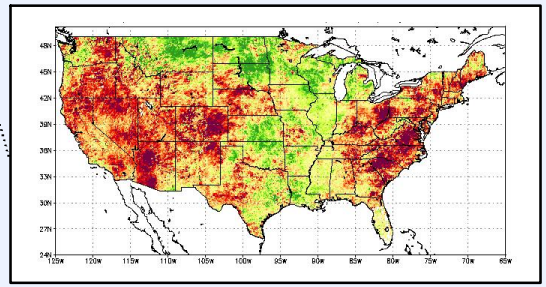
Vegetation Health Index

$$VCI = \frac{NDVI - NDVI_{min}}{NDVI_{max} - NDVI_{min}}$$

$$TCI = \frac{T_{max} - T}{T_{max} - T_{min}}$$

$$VHI = aVCI + (1-a)TCI$$

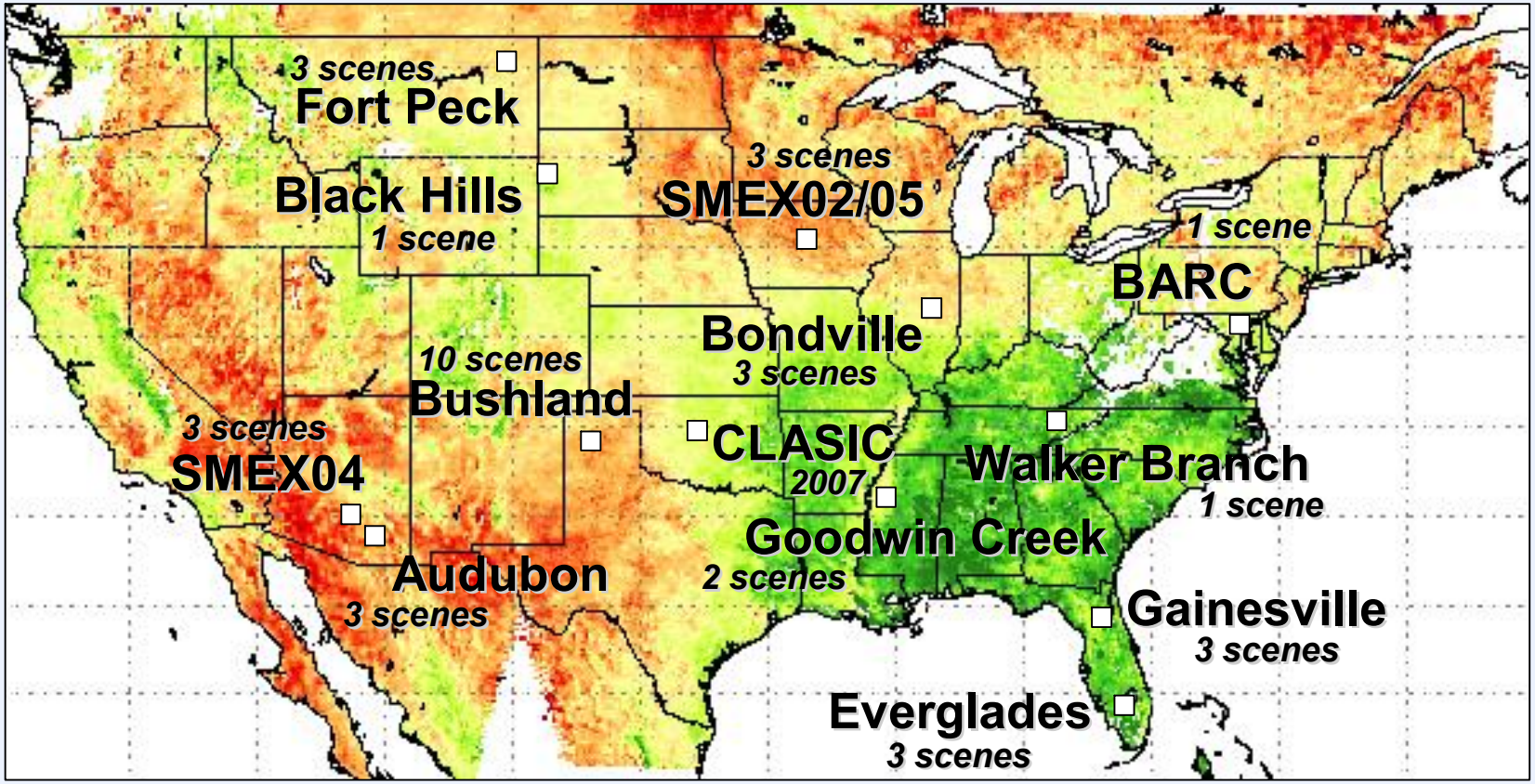
?



Evaporative Stress Index

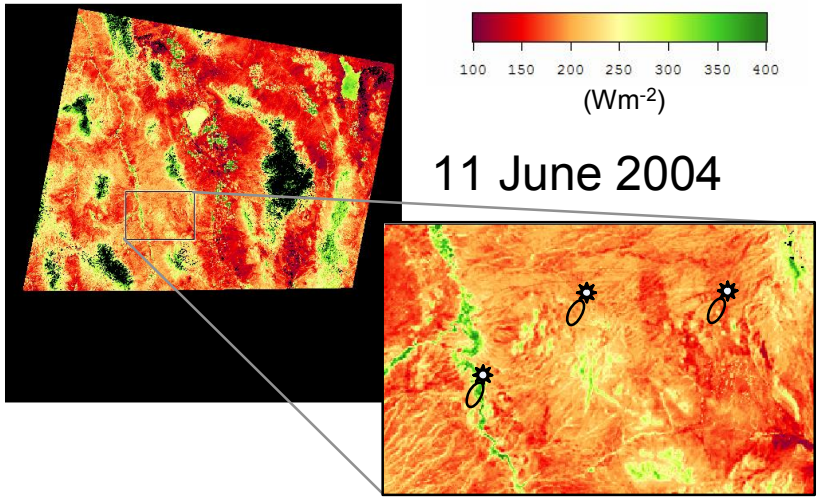
$$ESI = 1 - AET/PET$$

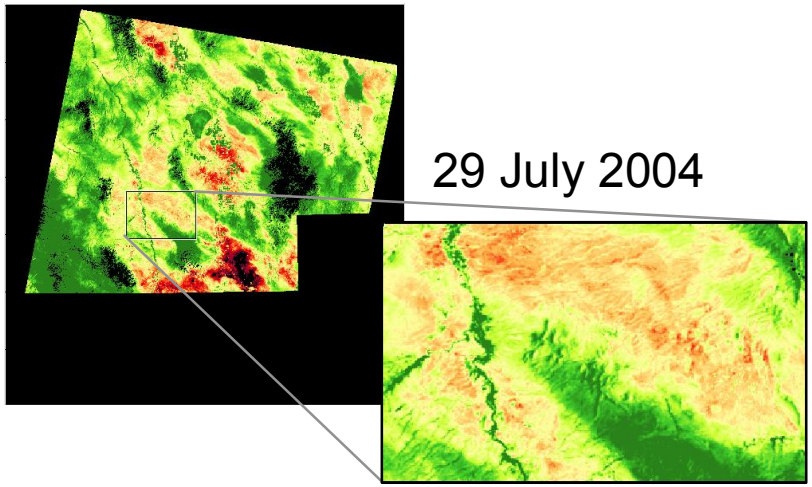
ALEXI/DisALEXI validation sites



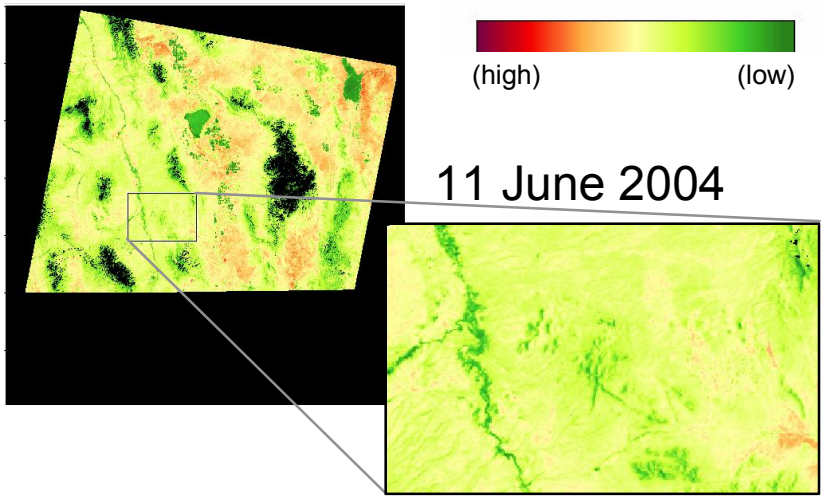
WALNUT GULCH, AZ

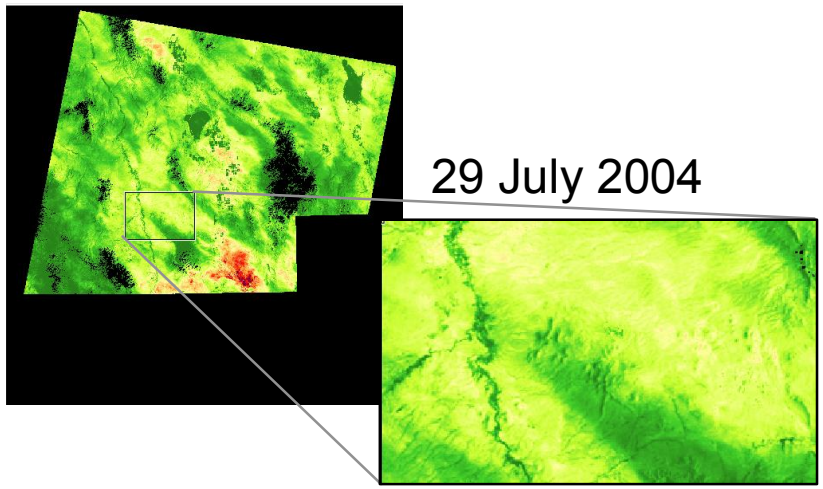
Evapotranspiration



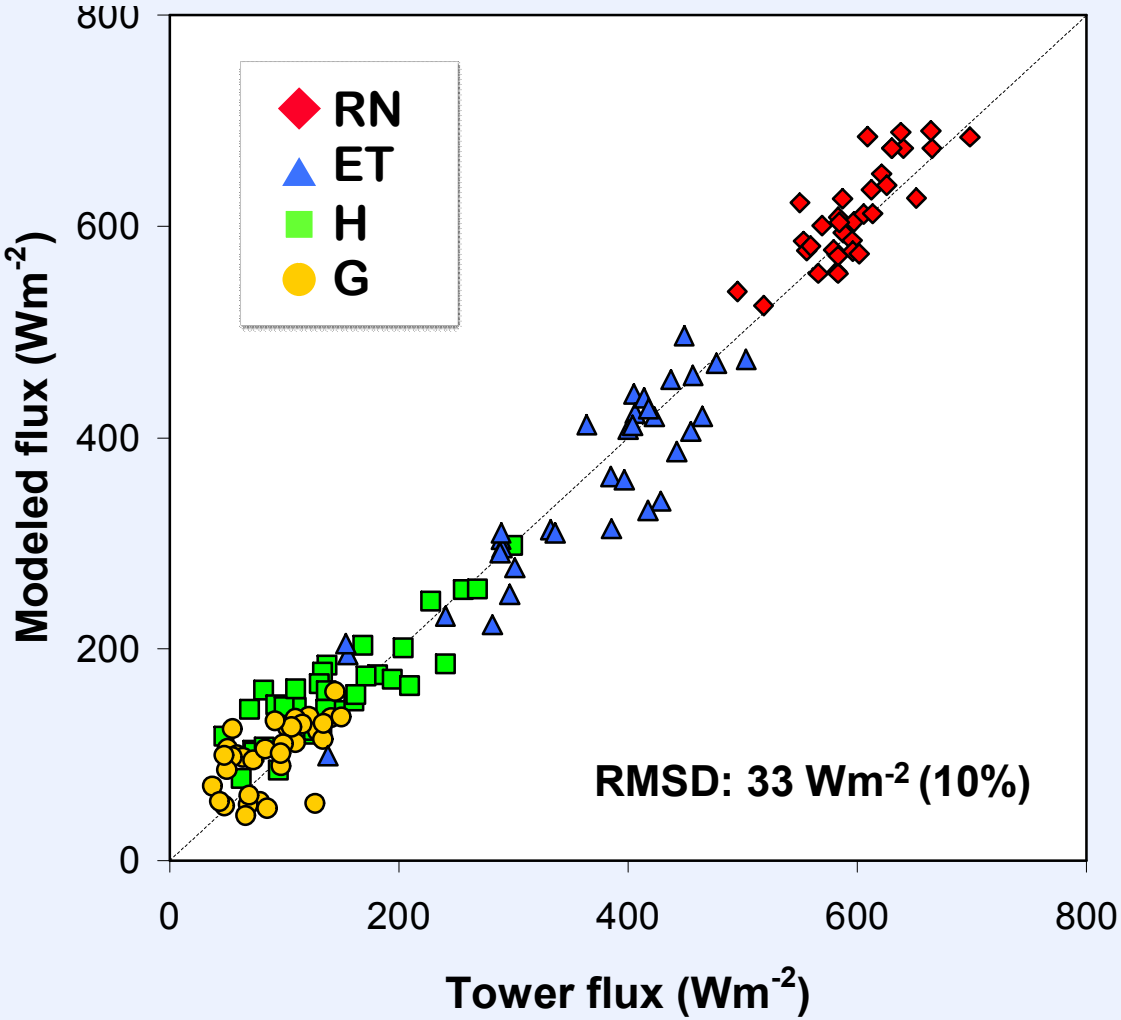


Evaporative stress





Clear-sky fluxes using Landsat thermal (60m)



- rangeland
- pasture
- corn
- soybean

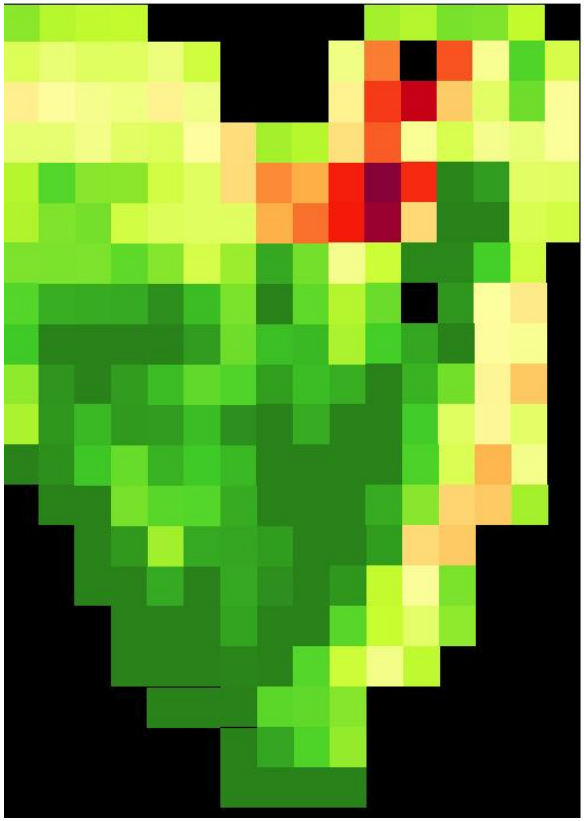
…

(Anderson et al, 2007)

Multi-scale Ecosystem Health Monitoring

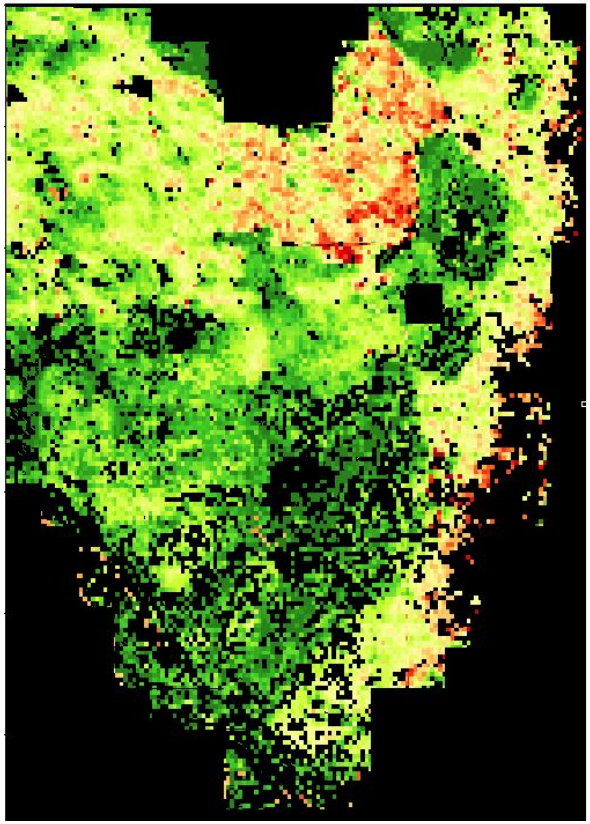
FLORIDA EVERGLADES

GOES (5km)



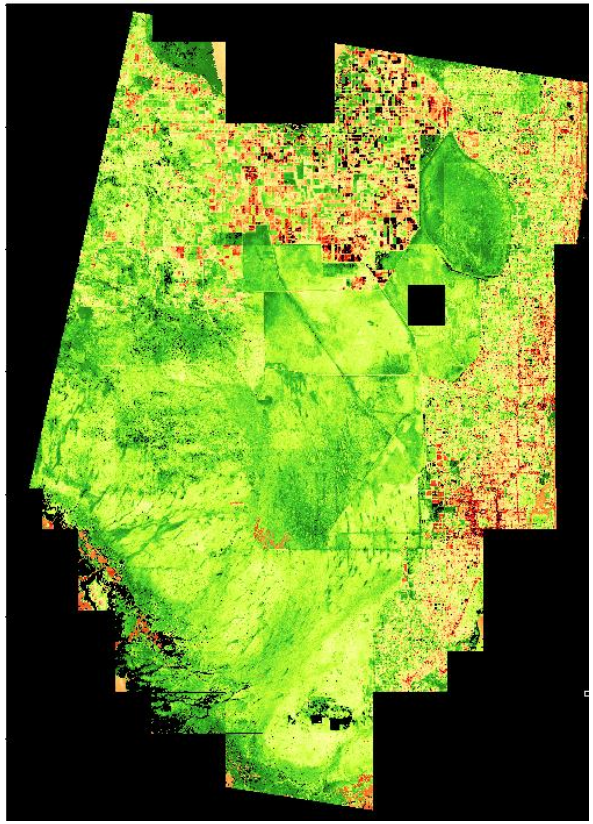
(hourly)

MODIS (1km)



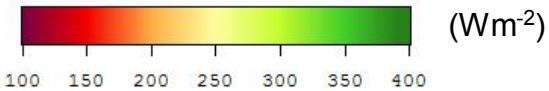
(daily)

L7 (60m)



(monthly)

Evapotranspiration

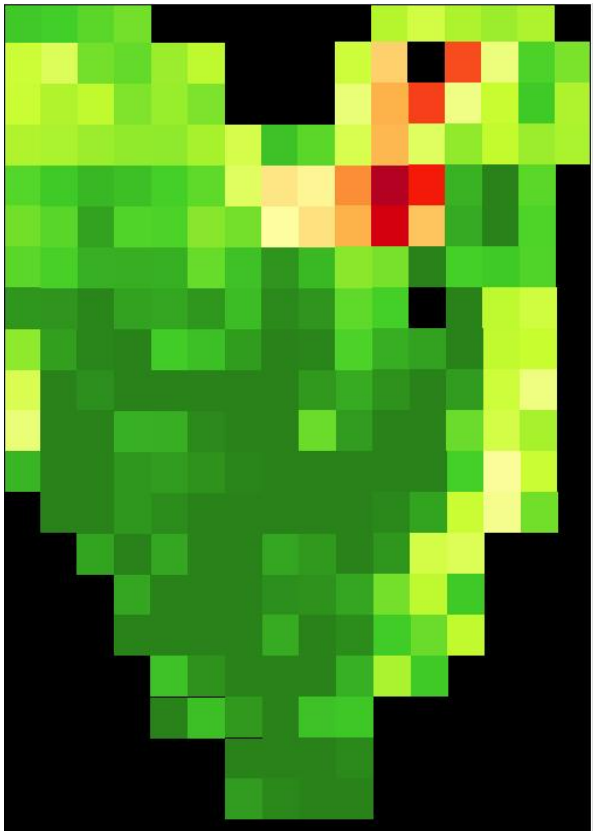


(Wm^{-2})

Multi-scale Ecosystem Health Monitoring

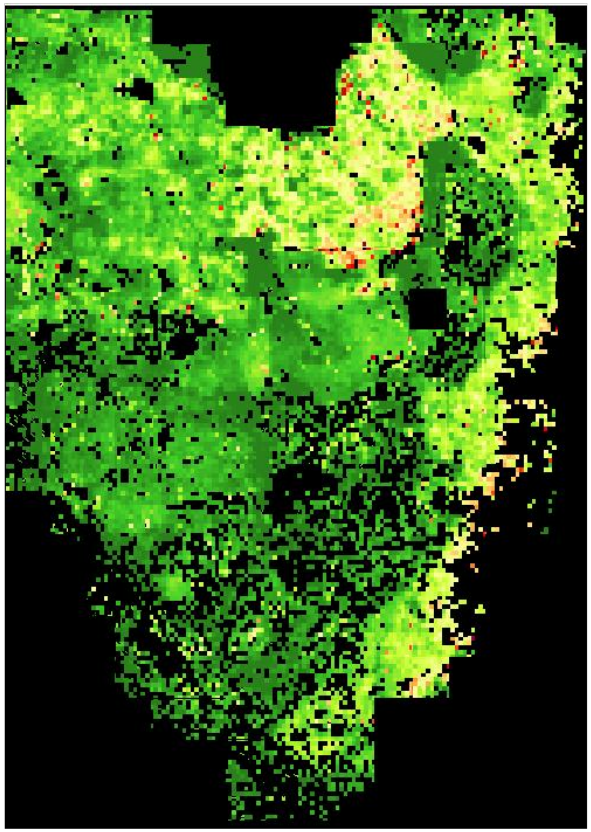
FLORIDA EVERGLADES

GOES (5km)



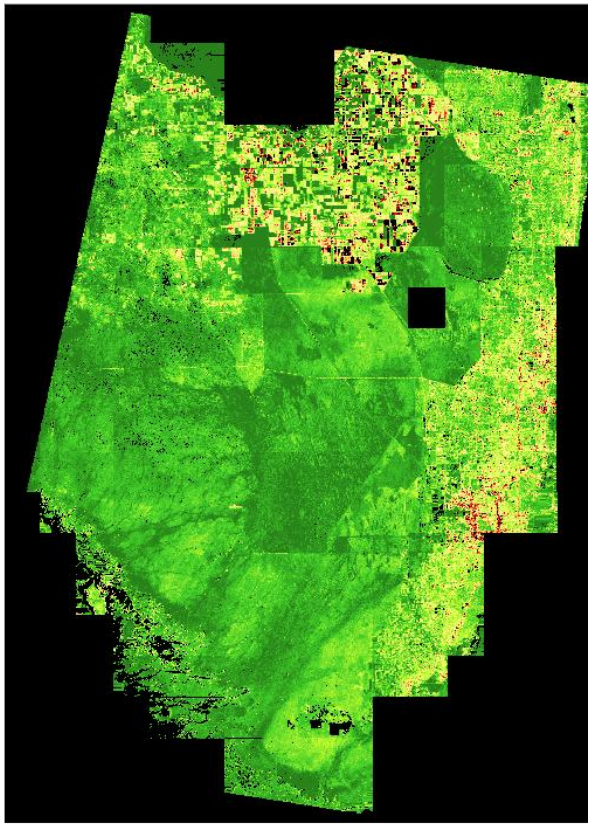
(hourly)

MODIS (1km)



(daily)

L7 (60m)



(monthly)

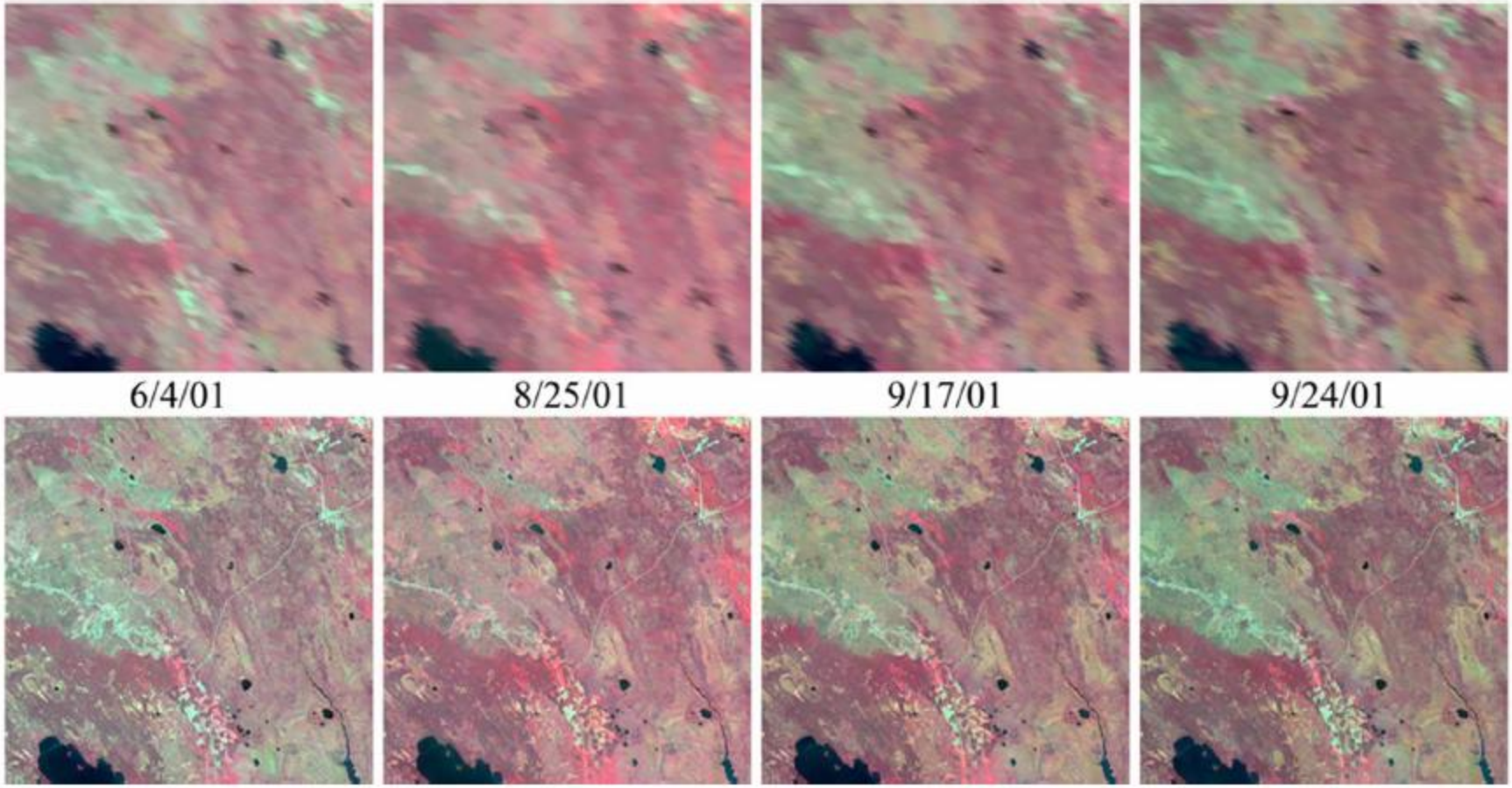
Evaporative stress

(high) (low)

With Feng Gao: MODIS/Landsat Thermal Data Fusion

MODIS (RGB=NIR,R,G)

Shortwave application



Fused MODIS-Landsat (RGB=NIR,R,G)

Gao, et al. 2006

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