Utility of Thermal Image Sharpening in Mapping ET over Irrigated Landscapes

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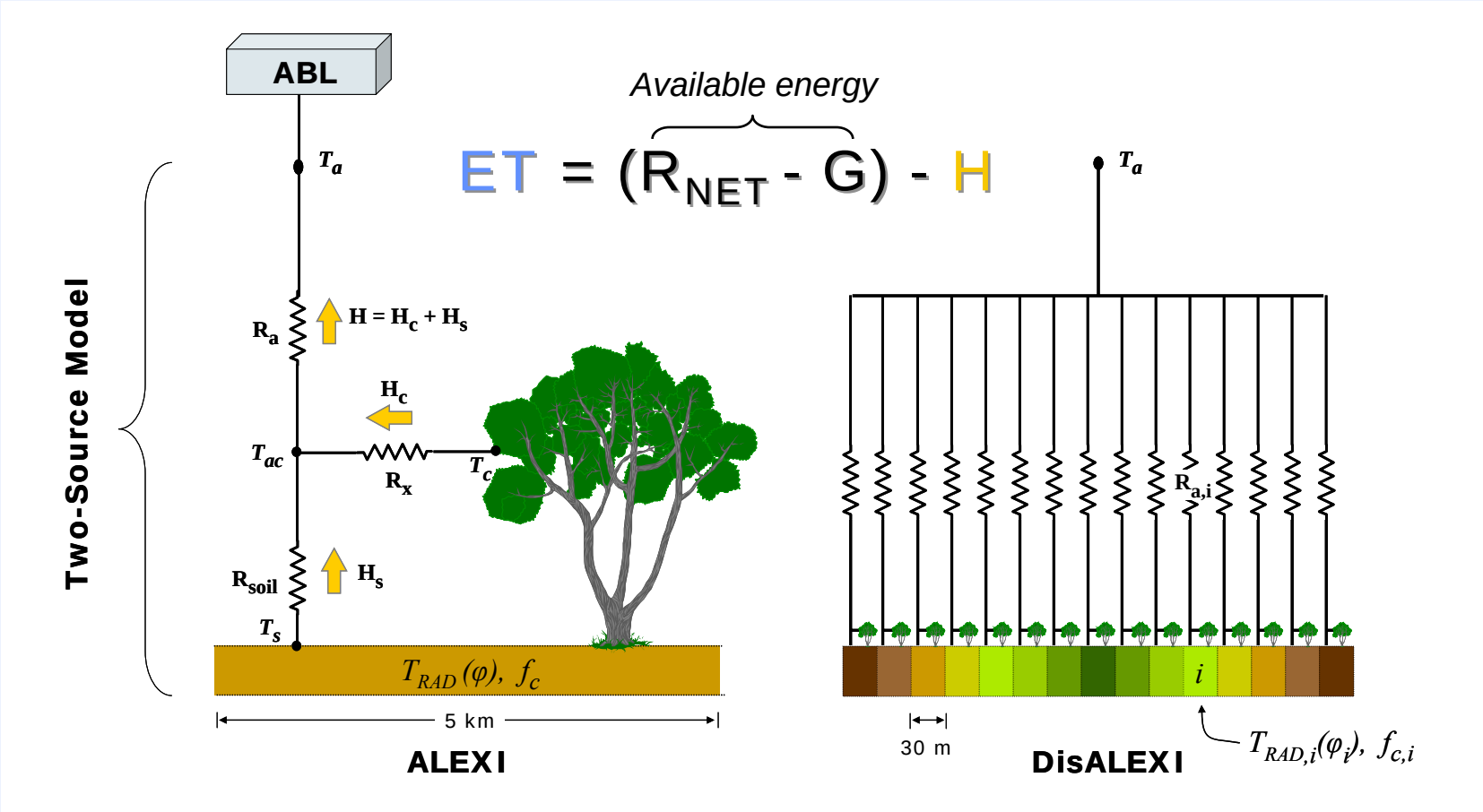
Atmosphere-Land Exchange Inverse (ALEXI)

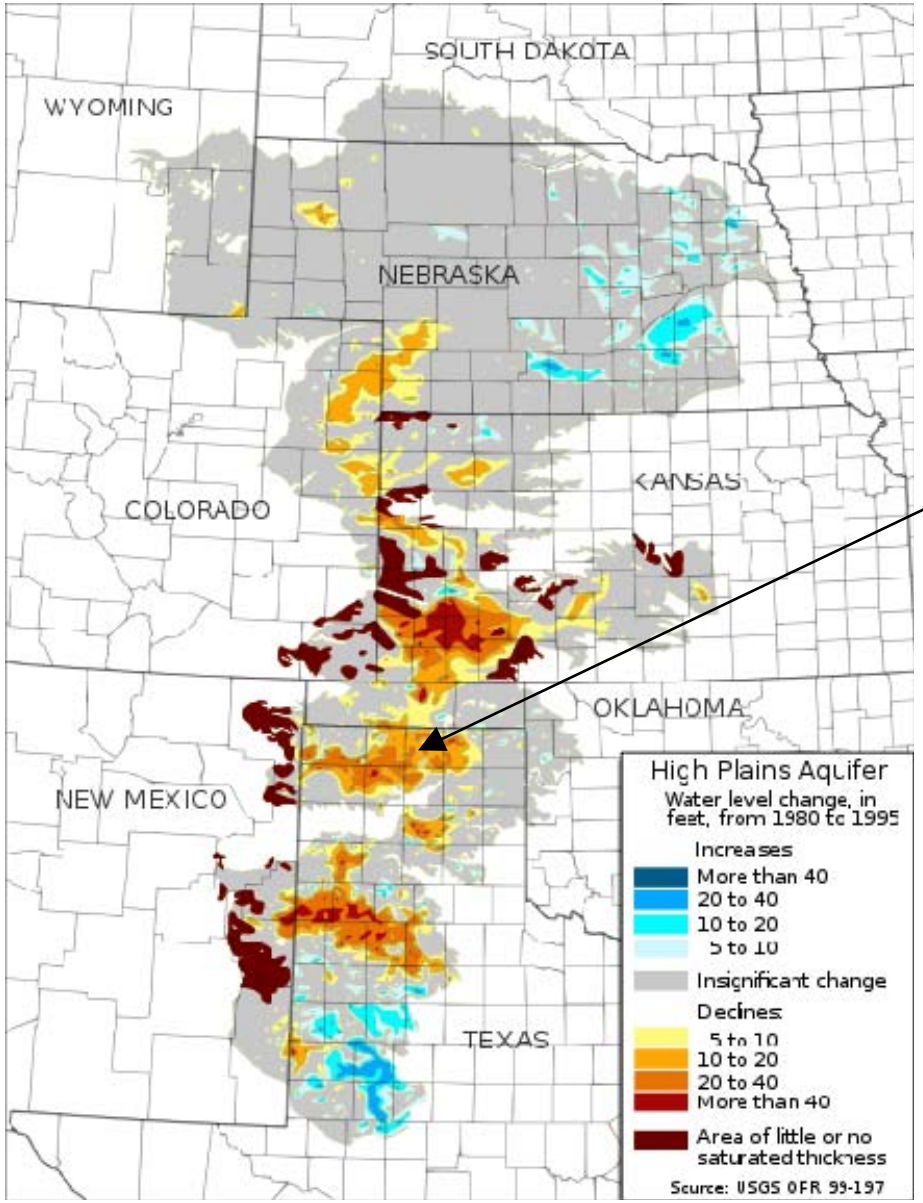


	Regional scale	Landscape scale
Surface temp:	ΔT_{RAD} - GOES	T_{RAD} - TM, ASTER, MODIS
Cover fraction:	f_c - MODIS	f_c - TM, ASTER, MODIS

BEAREX 08

Bushland Evapotranspiration and Agricultural Remote Sensing EXperiment

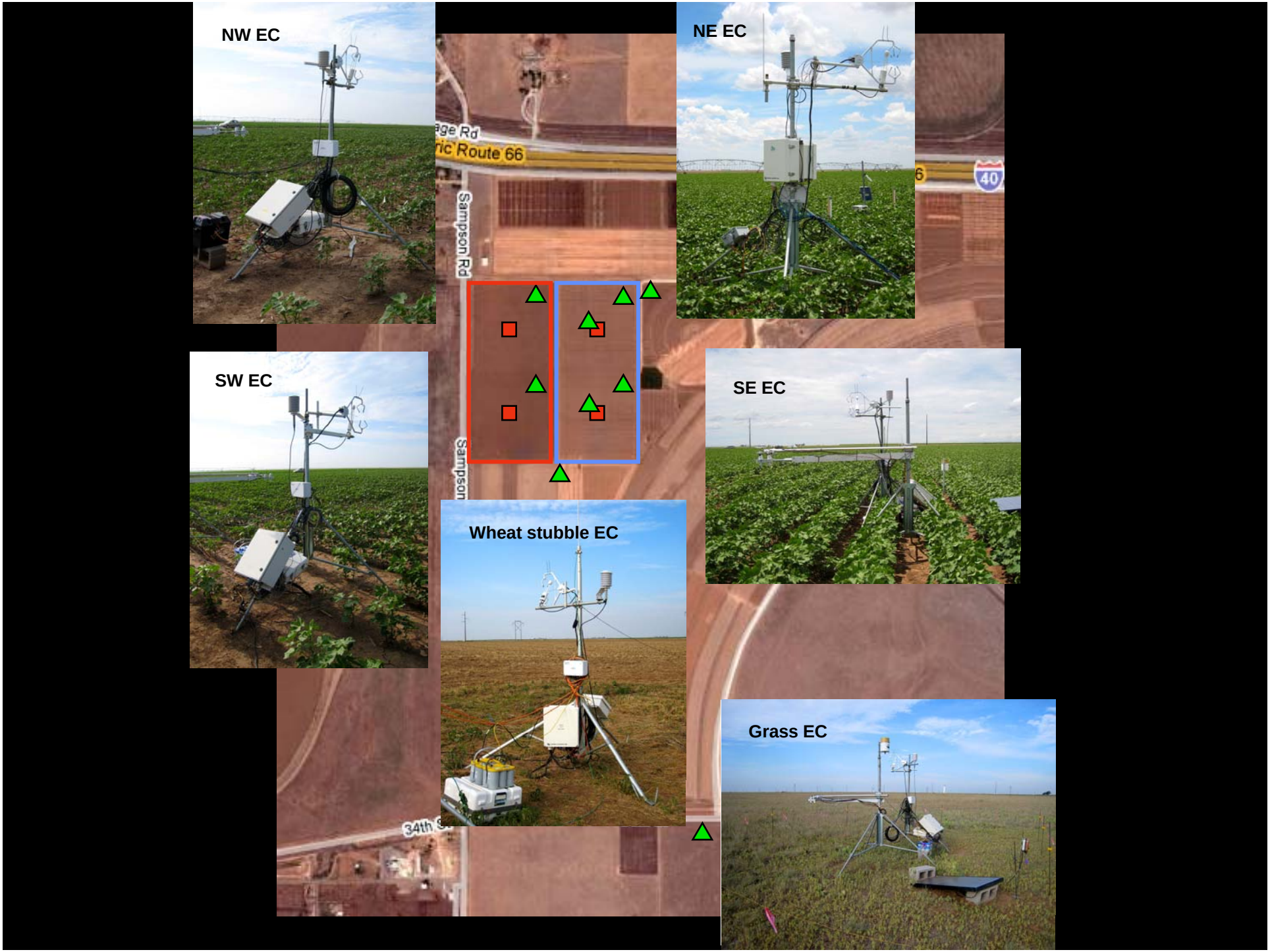
USDA-ARS Conservation & Production Lab
Bushland, TX



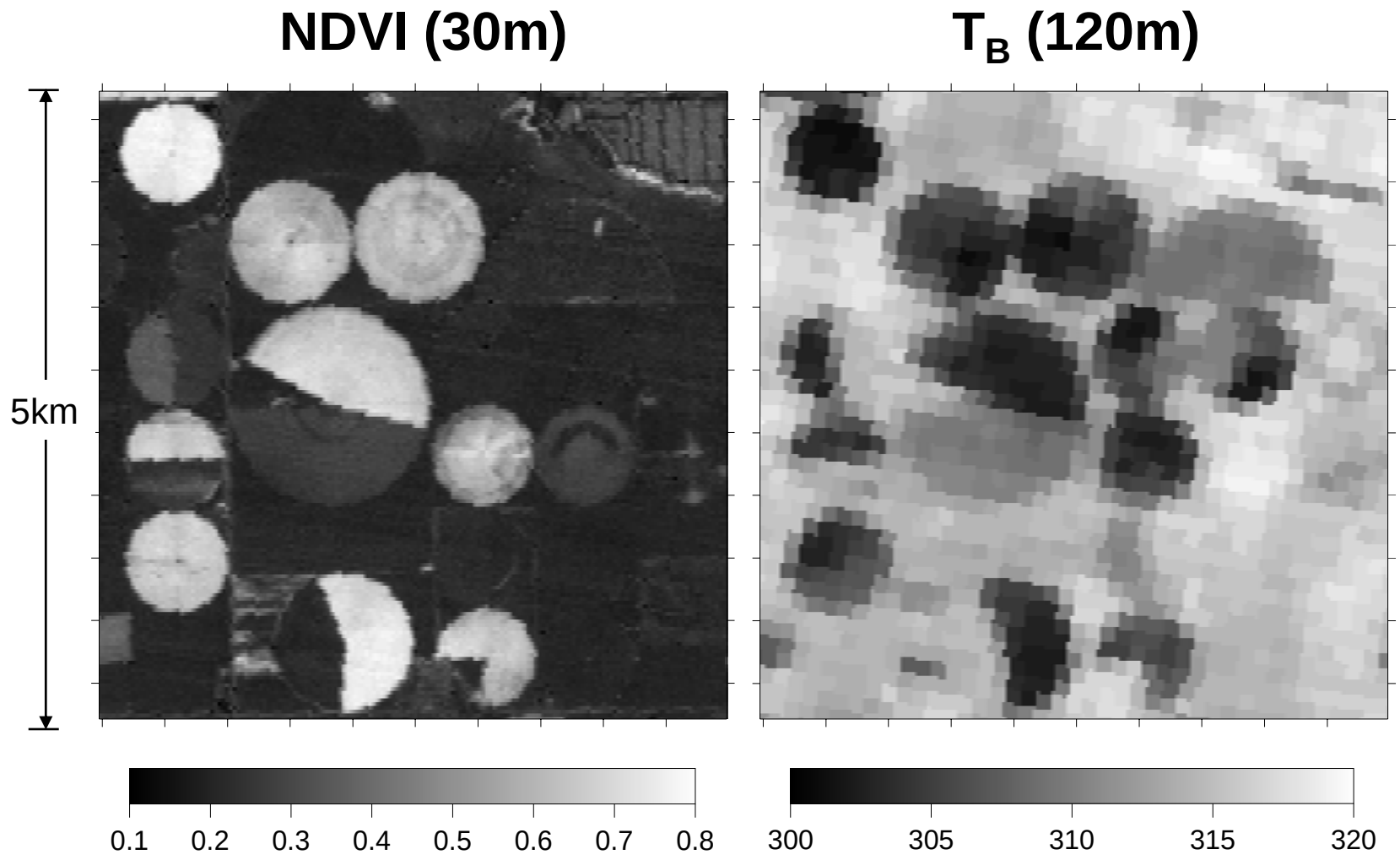
- Intense irrigation
- Declining aquifer
- Strong advective enhancement of ET

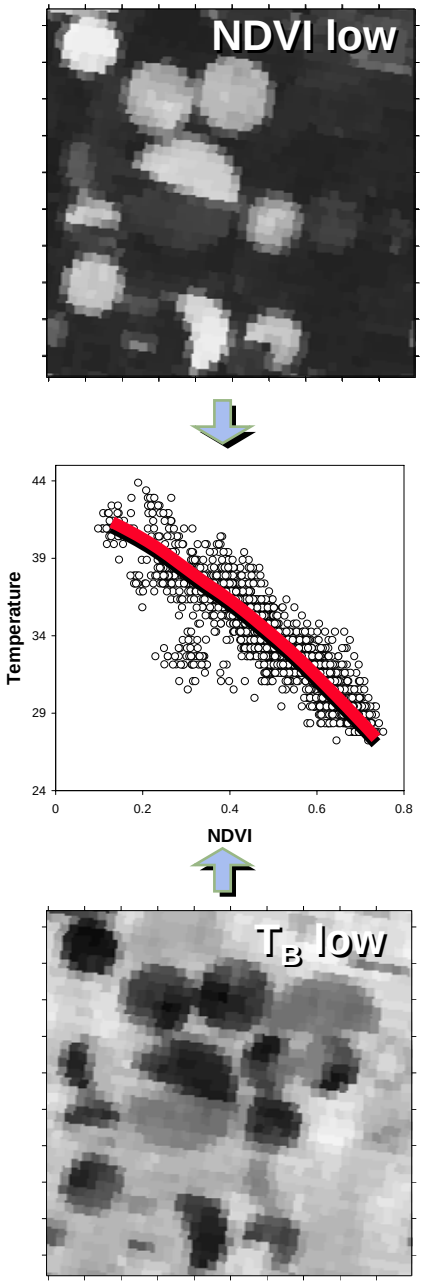
Frontage Rd
Historic Route 66
40
Historic Route 66
40
40
Sampson Rd
UNIRRIGATED
IRRIGATED
Sampson Rd
TM TIR pixel
Sampson Rd
34th St
34th St
34th St
1000 ft
200 m

NW
NE
SW
SE
Route 66
Sampson Rd
Sampson Rd
Sampson Rd
34th St
34th St
34th St
1000 ft
200 m


NW EC
NE EC
SW EC
SE EC
Wheat stubble EC
Grass EC
Route 66
Sampson Rd
Sampson
34th
40

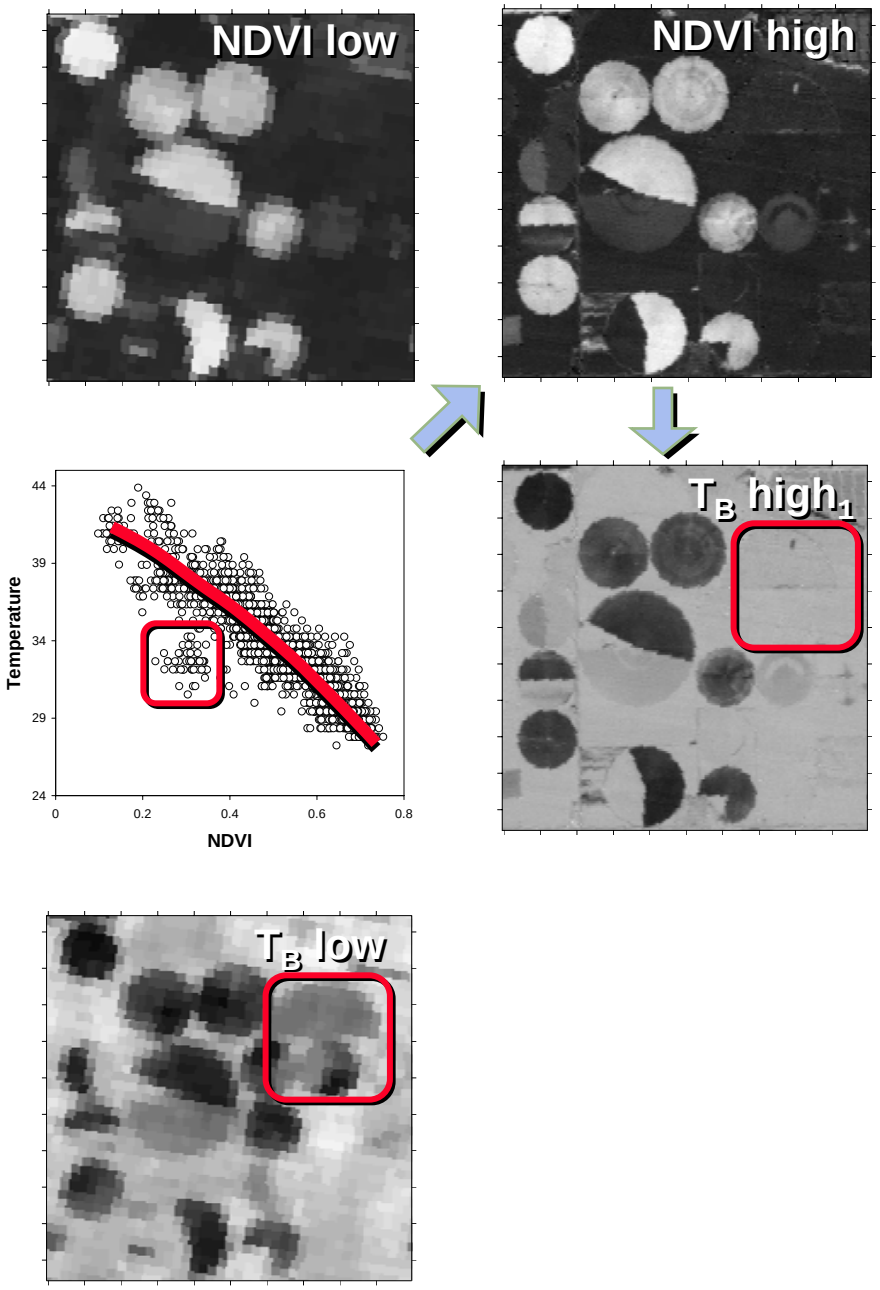
Landsat 5 thermal/shortwave imagery

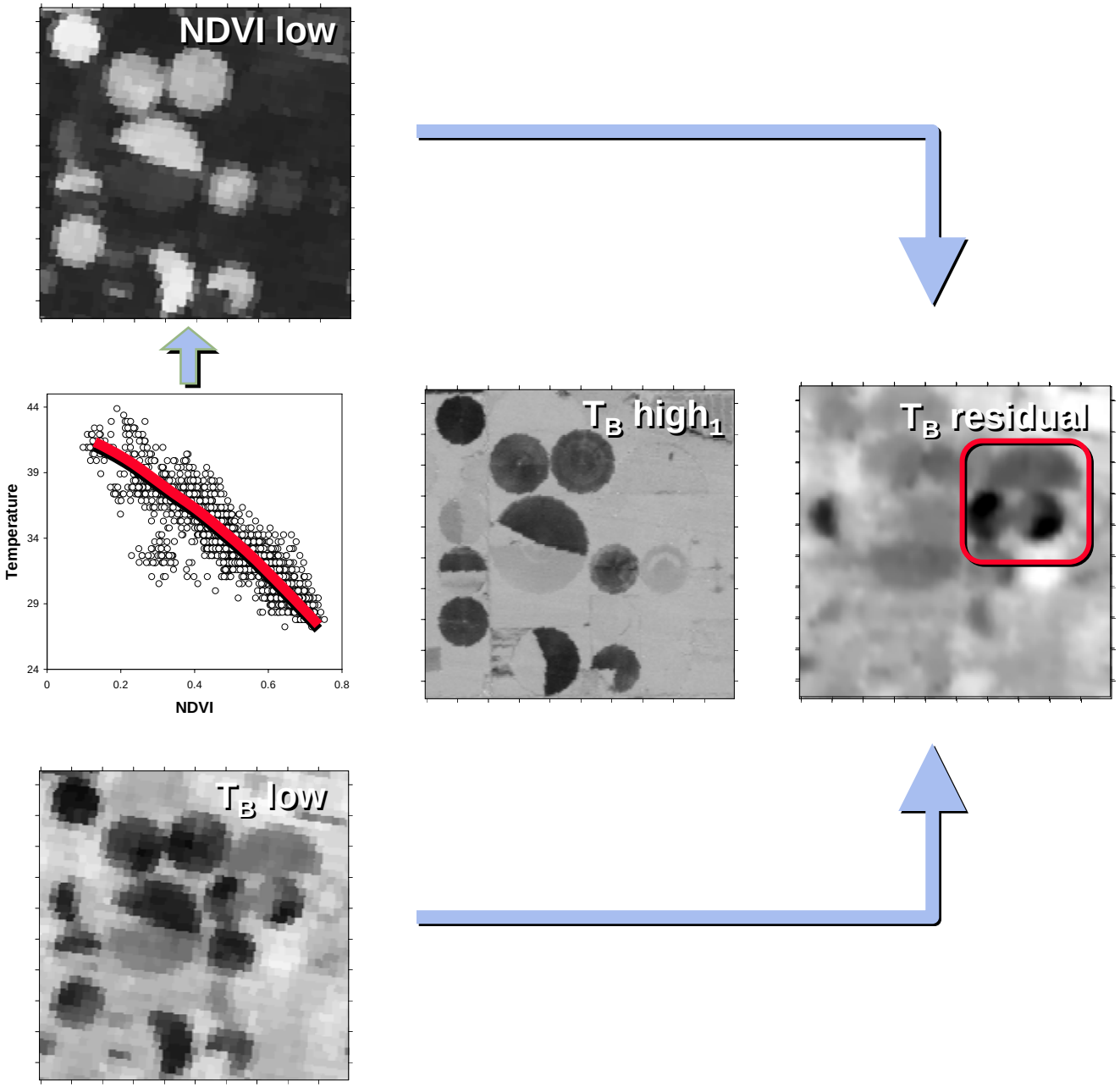


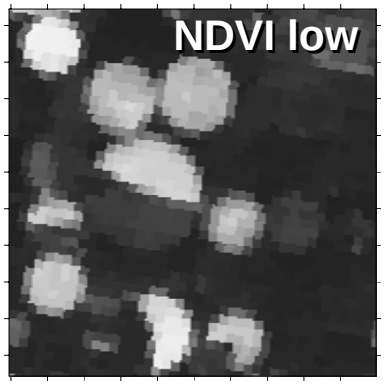


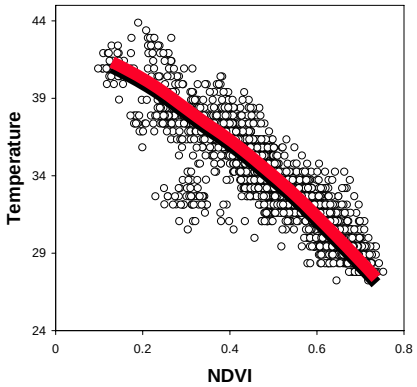
Thermal Sharpening

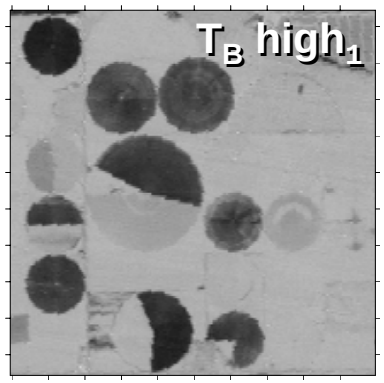
Kustas et al. (2003) Remote Sens. Environ., ***85****, 429.*


NDVI low
NDVI high
T_B high$_1$
Temperature
NDVI
44
39
34
29
24
0
0.2
0.4
0.6
0.8
T_B low


NDVI low
Temperature
44
39
34
29
24
0
0.2
0.4
0.6
0.8
NDVI
T_B high$_1$
T_B residual
T_B low







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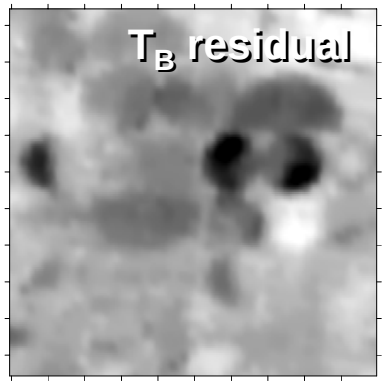

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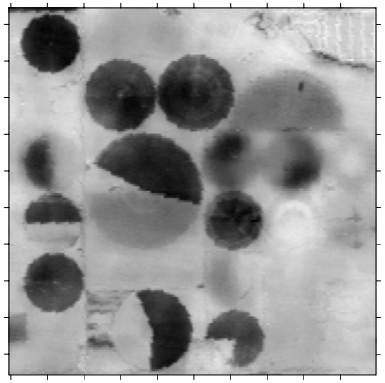
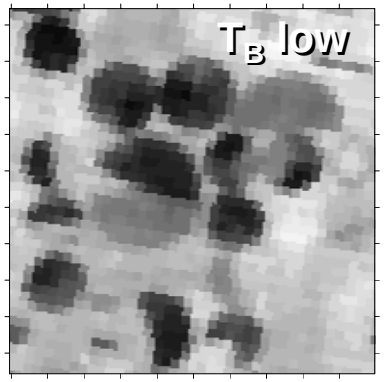
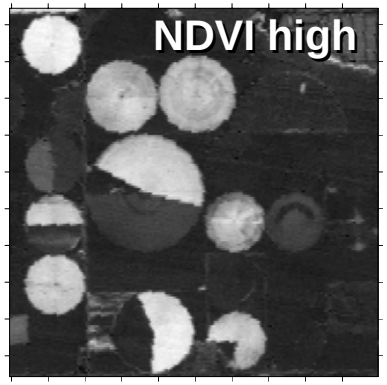
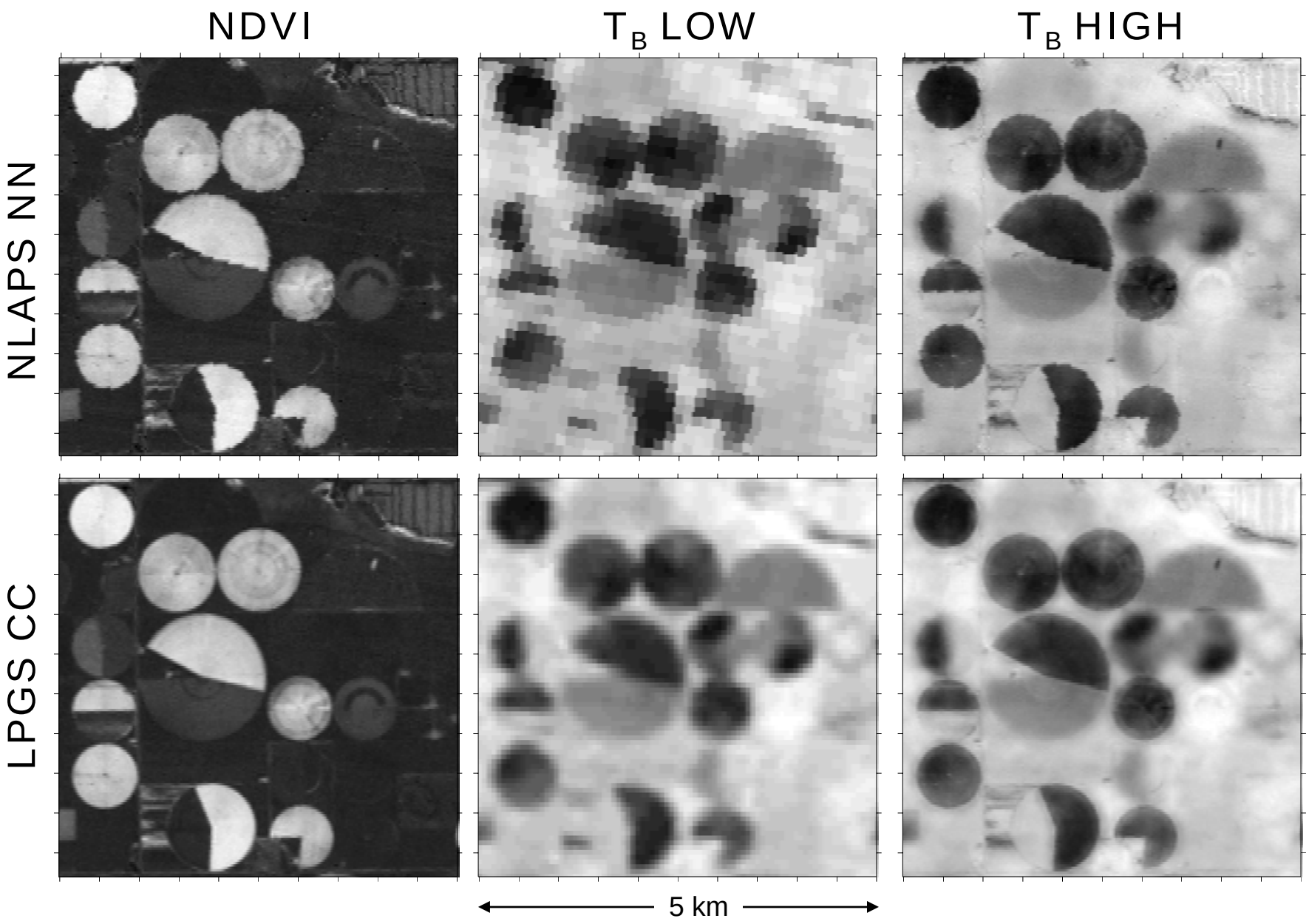
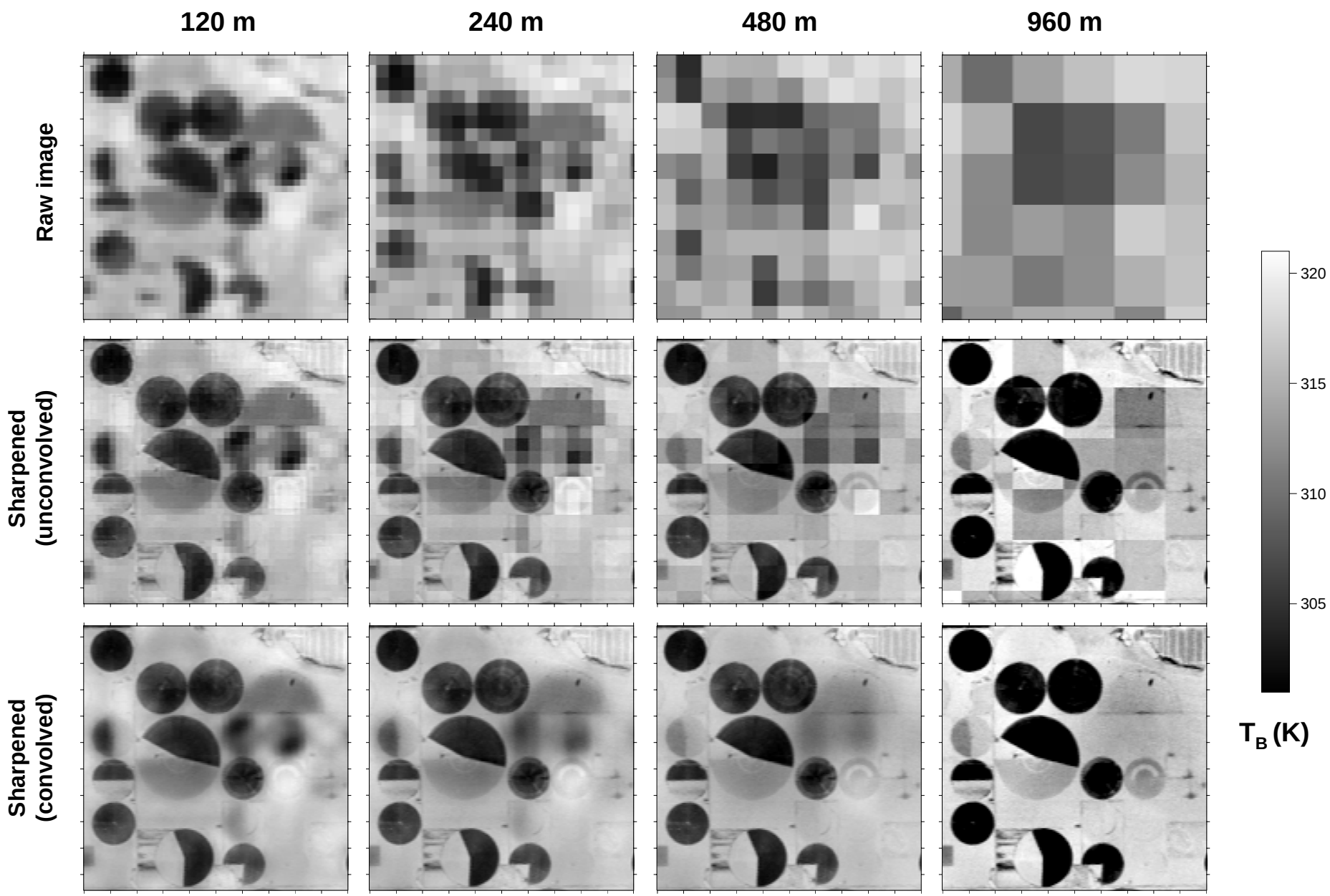
Sharpened T_B

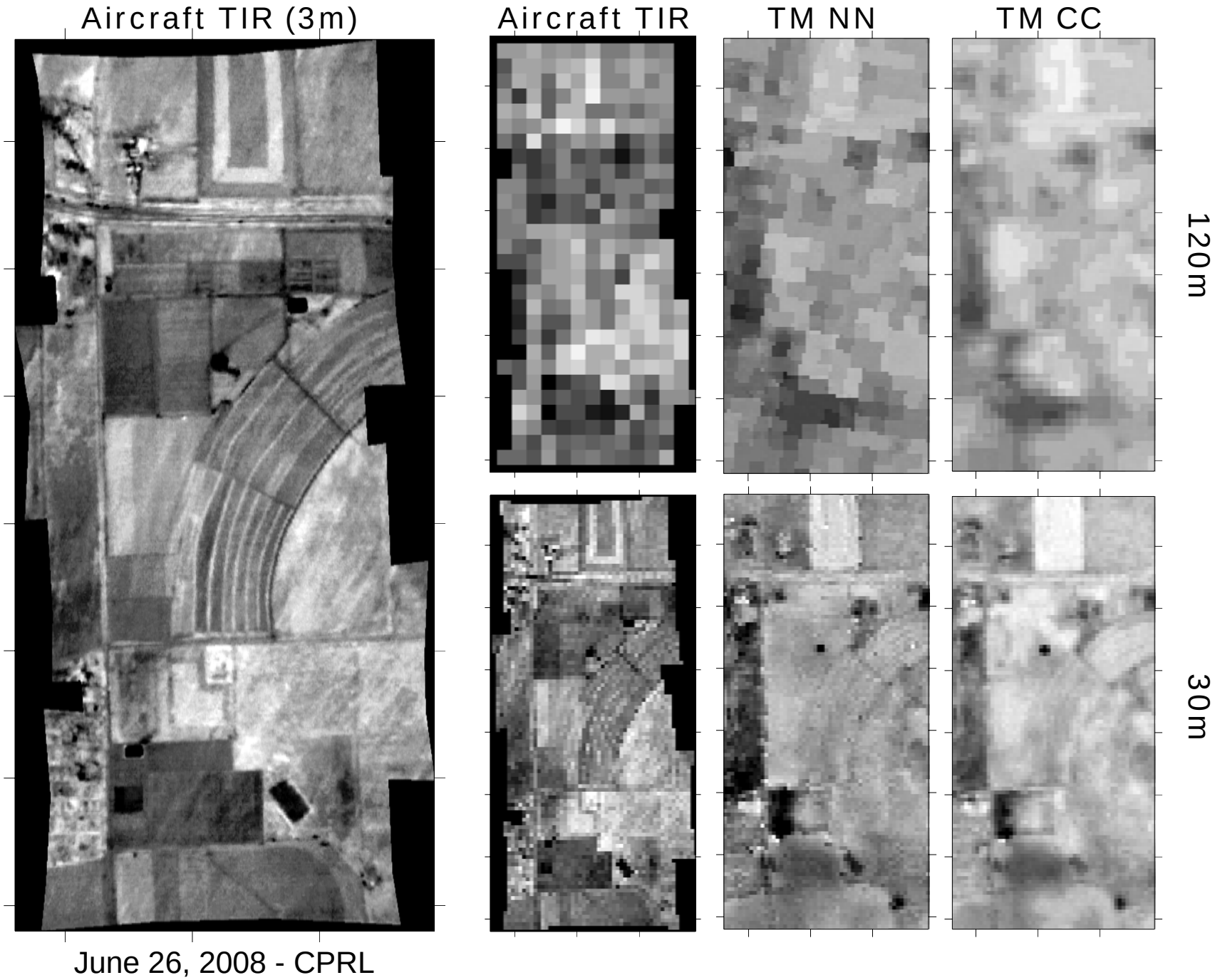


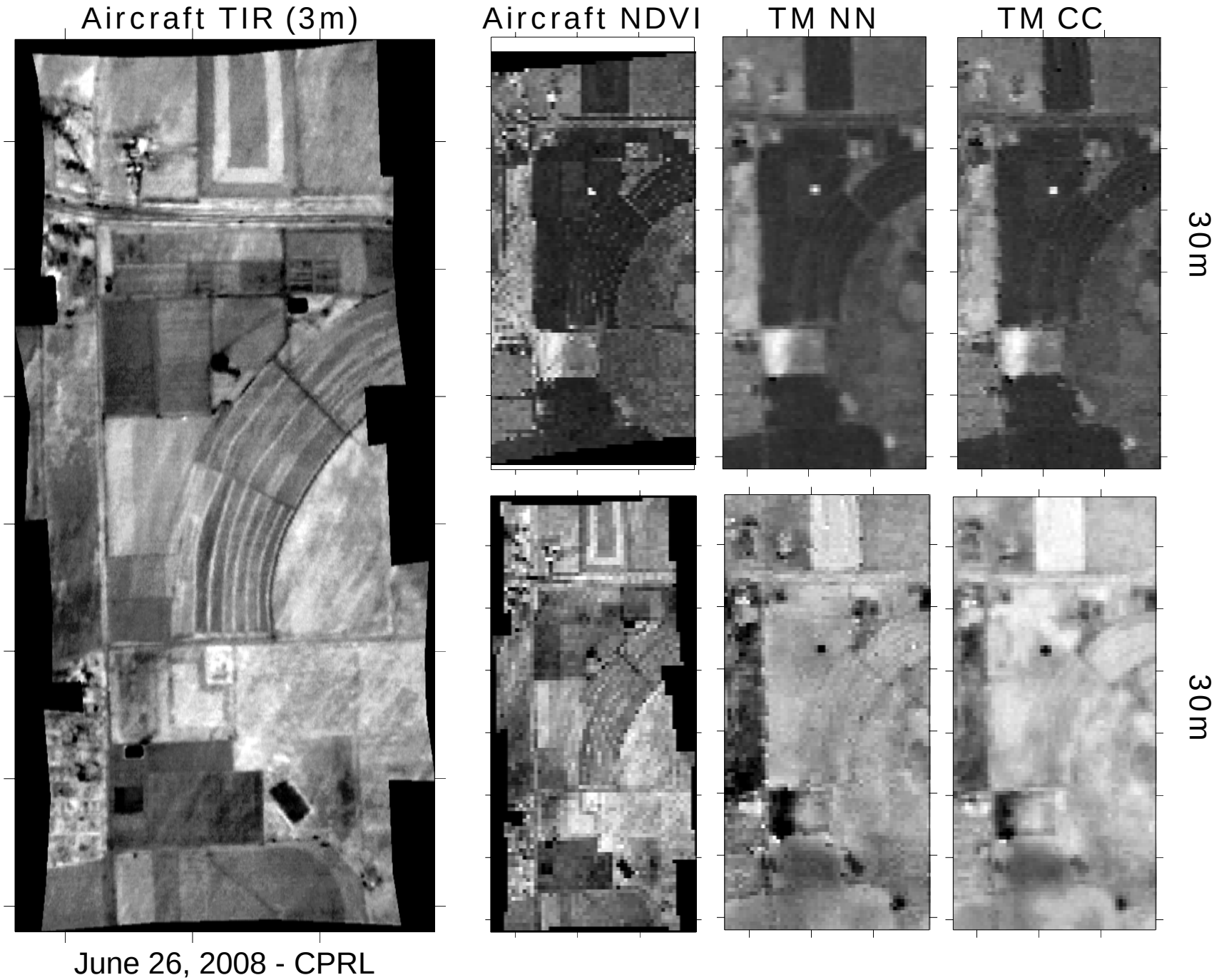


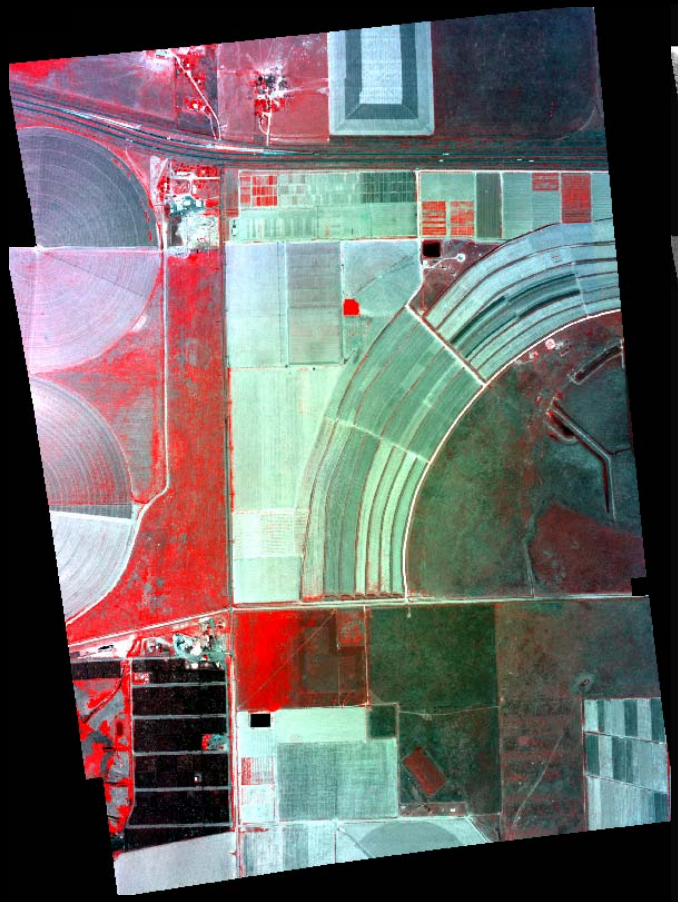



NDVI
T_B LOW
T_B HIGH
NLAPS NN
LPGS CC
5 km


120 m
240 m
480 m
960 m
Raw image
Sharpened (unconvolved)
Sharpened (convolved)
320
315
310
305
T_B (K)


Aircraft TIR (3m)
Aircraft TIR
TM NN
TM CC
120m
30m
June 26, 2008 - CPRL

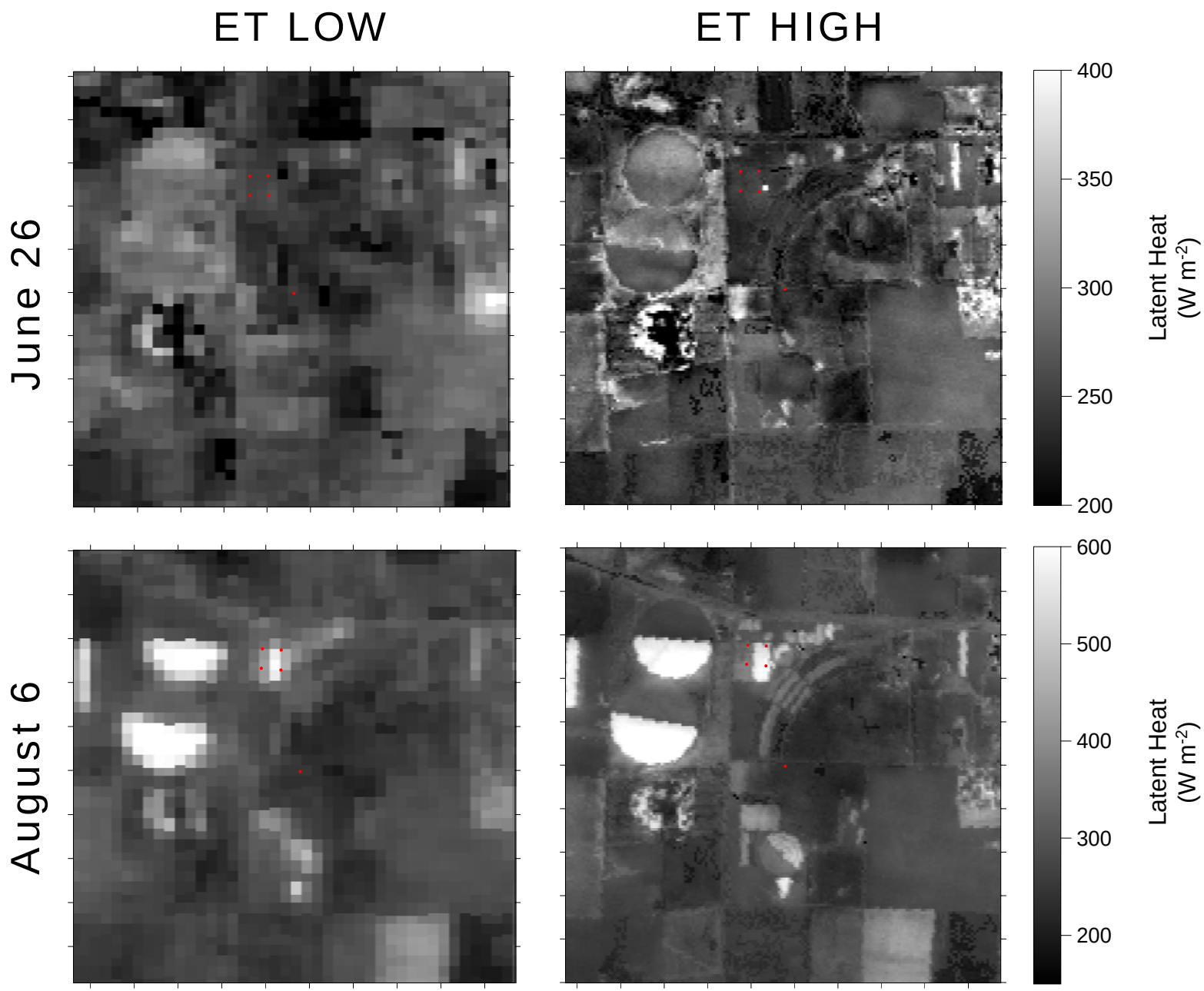

Aircraft TIR (3m)
Aircraft NDVI
TM NN
TM CC
30m
30m
June 26, 2008 - CPRL



Aircraft RGB (1m)
(R=NIR, G=Red, B=Green)

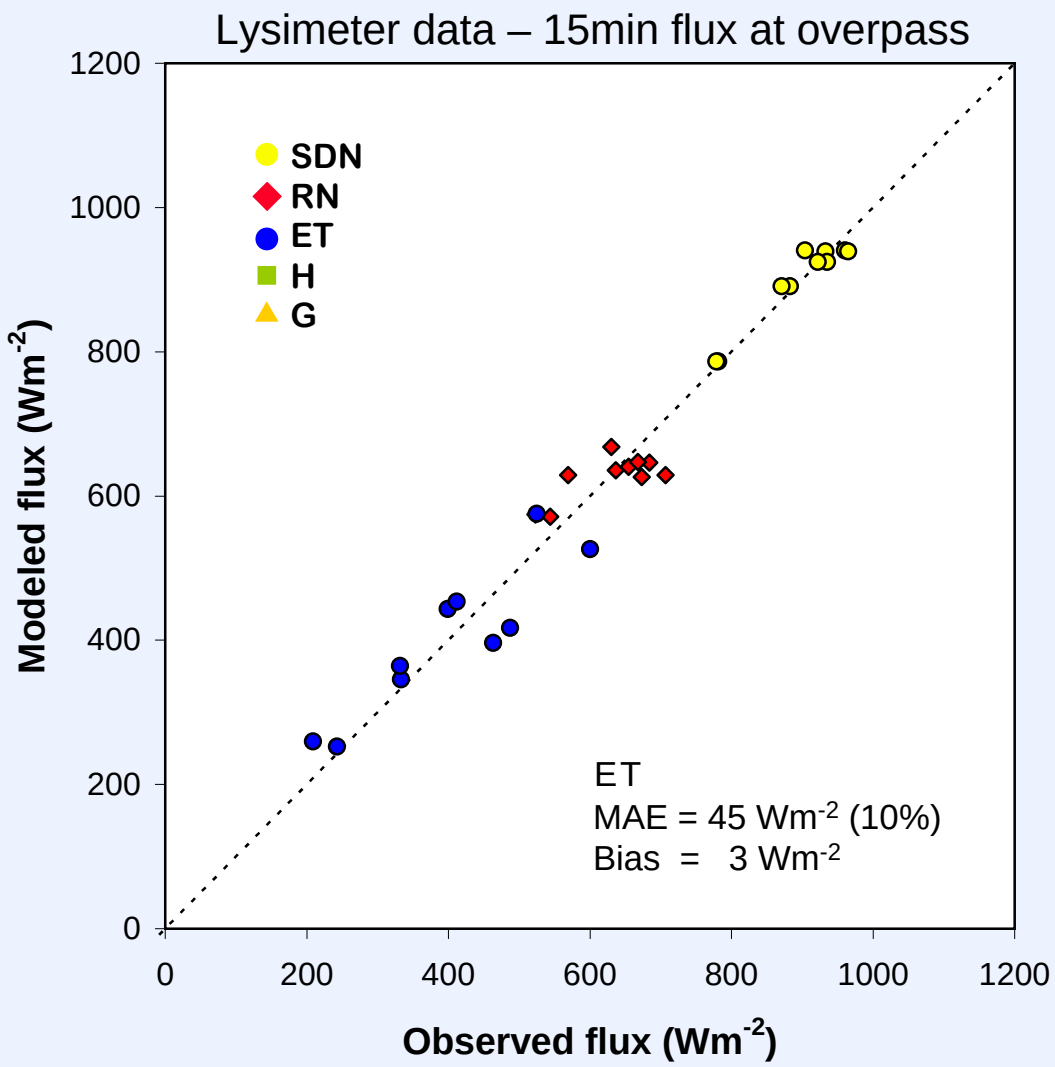
Aircraft NDVI (1m)

Aircraft TIR (3m)


ET LOW
ET HIGH
June 26
August 6
400
350
300
250
200
600
500
400
300
200
Latent Heat
(W m-2)
Latent Heat
(W m-2)

Flux data currently available

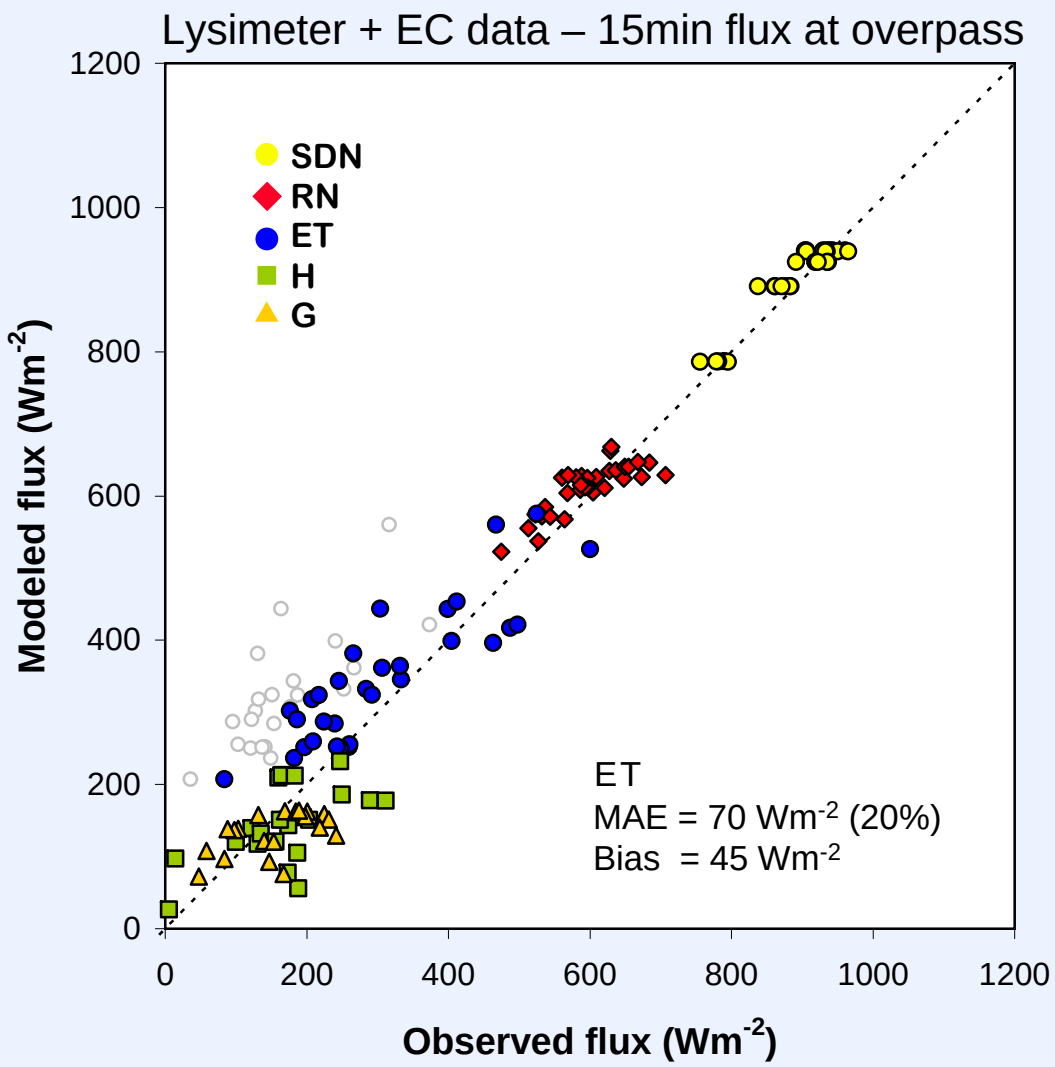
Comparison with observed fluxes



L5 scenes:

- 06/26
- 07/05
- 07/21
- 08/06
- 09/23

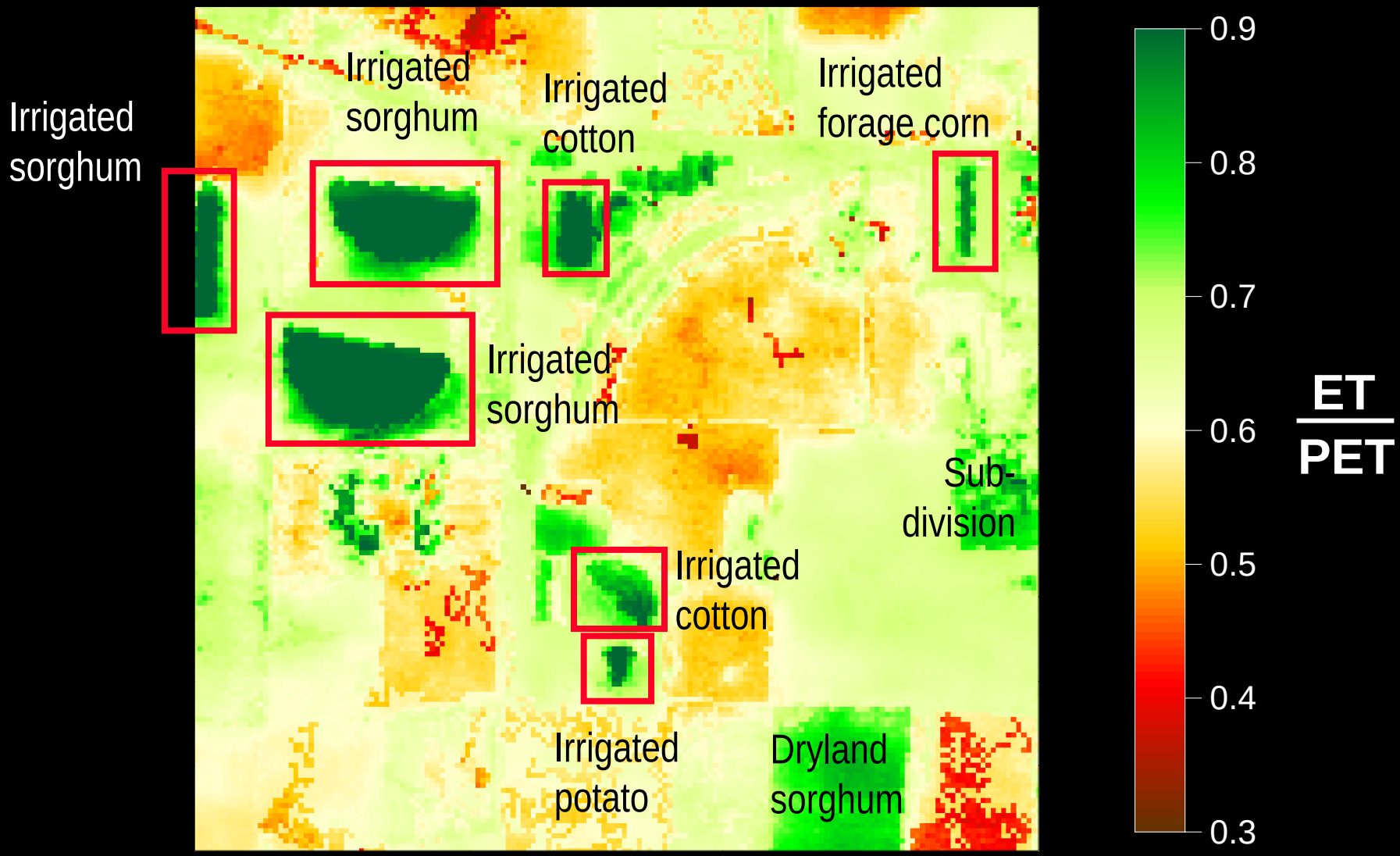
Comparison with observed fluxes



L5 scenes:

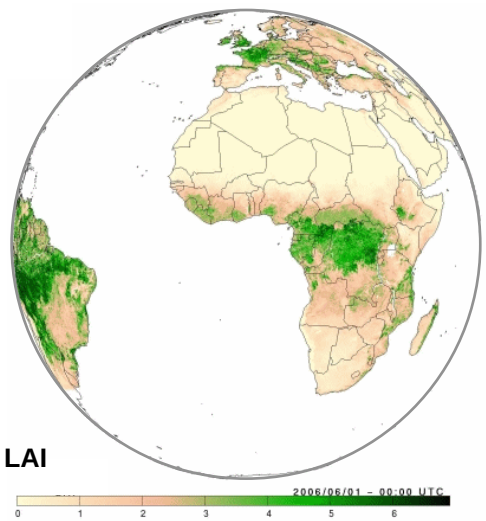
- 06/26
- 07/05
- 07/21
- 08/06
- 09/23

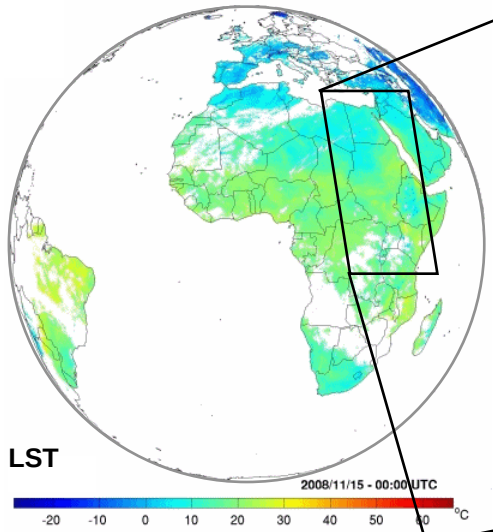
CPRL - August 6, 2008



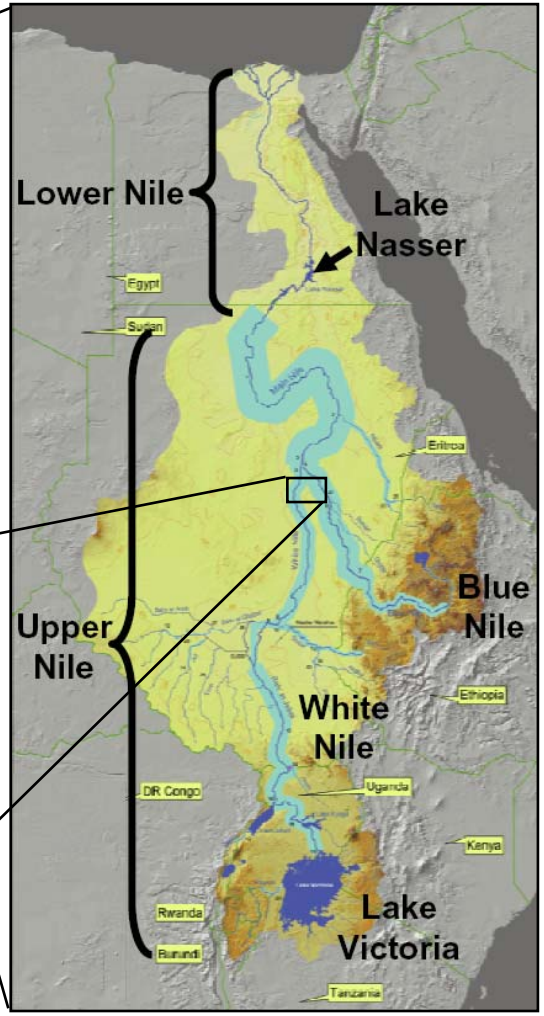
Nile Basin Initiative Decision Support

METEOSAT COVERAGE





L7-ETM+ 1/12/02 USGS Image Gallery



CONCLUSIONS

- Sharpening can improve information content in Landsat TIR band imagery
- 100-m native TIR resolution ~ cutoff for utility over US irrigated ag
- Need to identify optimal VI

ACCURATE CO-REGISTRATION OF SHORTWAVE and TIR BANDS IS CRITICAL

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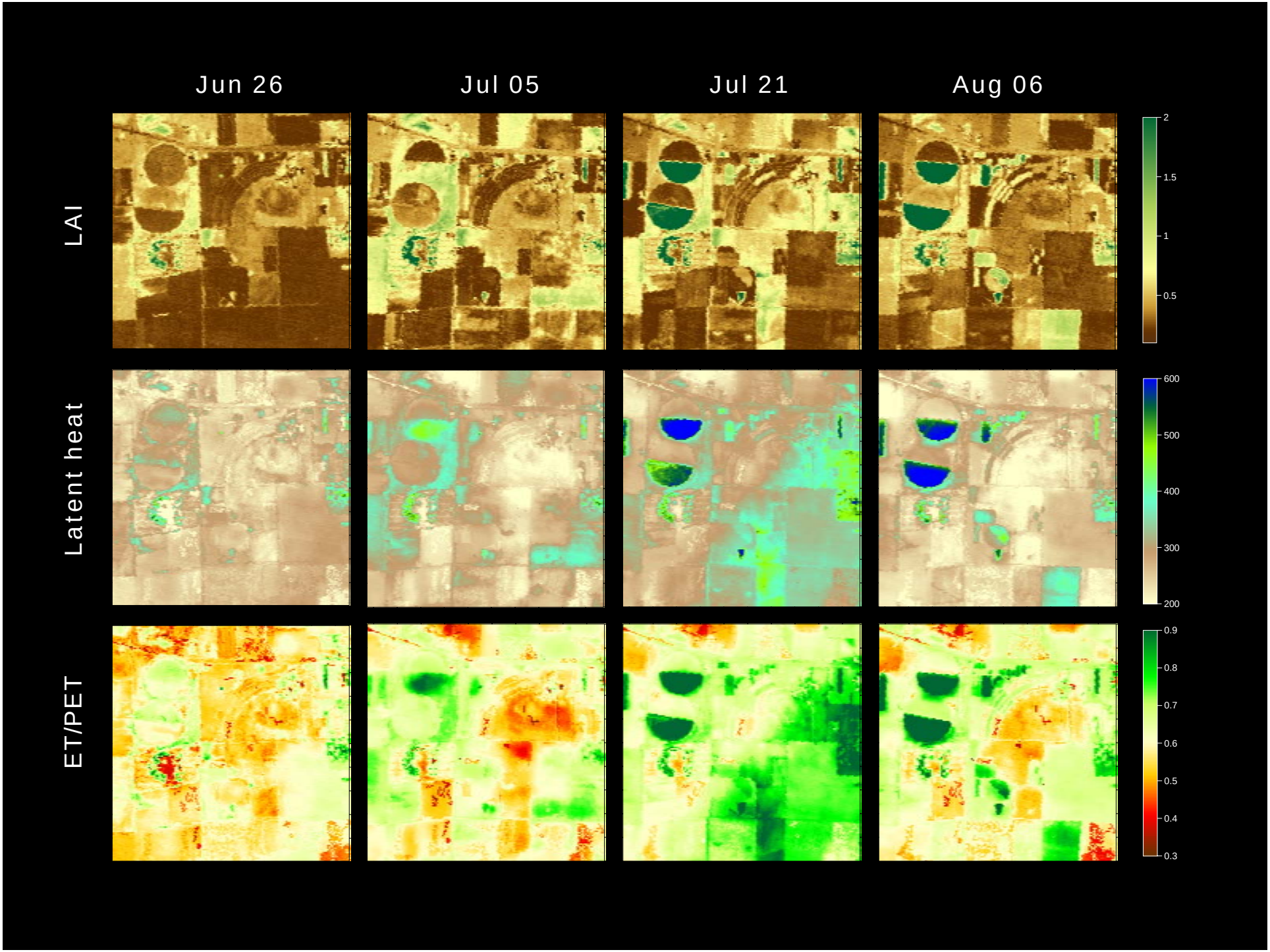
Jun 26
Jul 05
Jul 21
Aug 06
LAI
Latent heat
ET/PET
2
1.5
1
0.5
600
500
400
300
200
0.9
0.8
0.7
0.6
0.5
0.4
0.3