Landsat ET Mapping Applications over Forested Landscapes

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Project overview

TOOLS

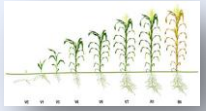
STARFM	Multi-sensor data fusion
DMS	Thermal image sharpening
ALEXI	Multi-scale ET modeling

ASSETS

		SW/TIR
GEO	Hourly	5km/5km
MODIS	Daily	250m/1km
Landsat	16 day	30m/100m
Lsat-like		~20-60m/ --

APPLICATIONS

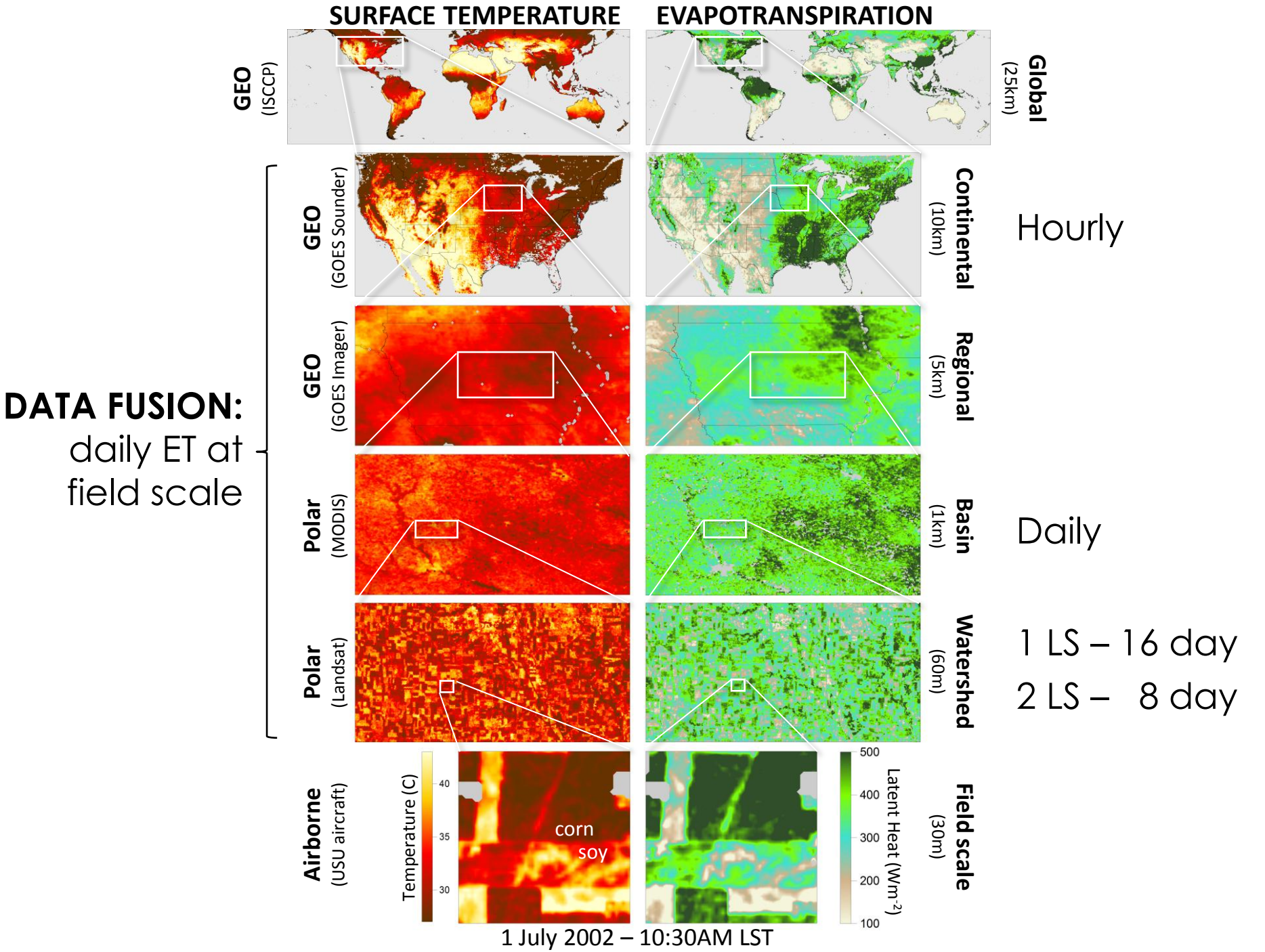
(daily/30 m)



Crop phenology metrics

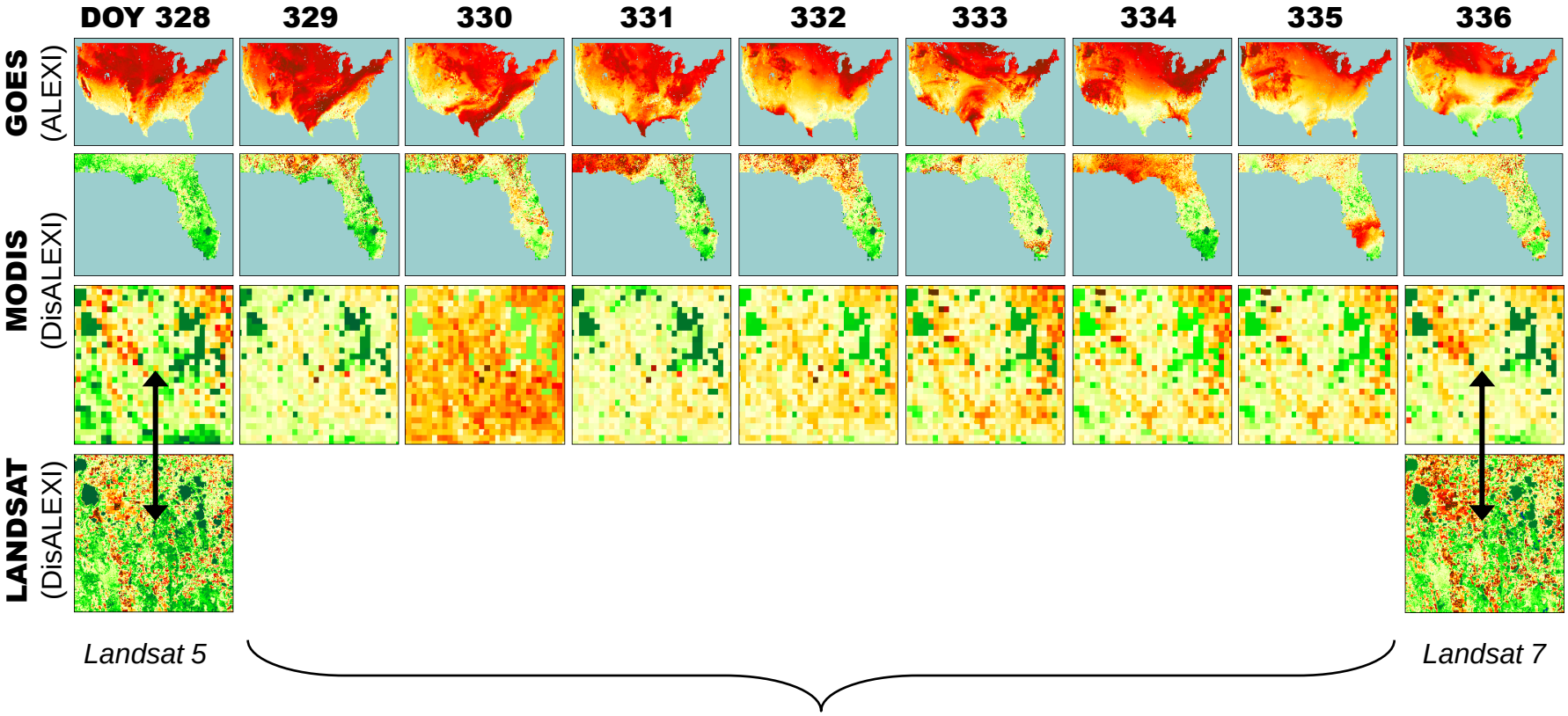
Crop water use (Evapotranspiration)

Crop stress (drought early warning)


SURFACE TEMPERATURE
EVAPOTRANSPIRATION
GEO (ISCCP)
Global (25km)
GEO (GOES Sounder)
Continental (10km)
Hourly
GEO (GOES Imager)
Regional (5km)
DATA FUSION:
daily ET at field scale
Polar (MODIS)
Basin (1km)
Daily
Polar (Landsat)
Watershed (60m)
1 LS – 16 day
2 LS – 8 day
Airborne (USU aircraft)
Temperature (C)
40
35
30
corn
soy
Latent Heat (Wm-2)
500
400
300
200
100
Field scale (30m)
1 July 2002 – 10:30AM LST

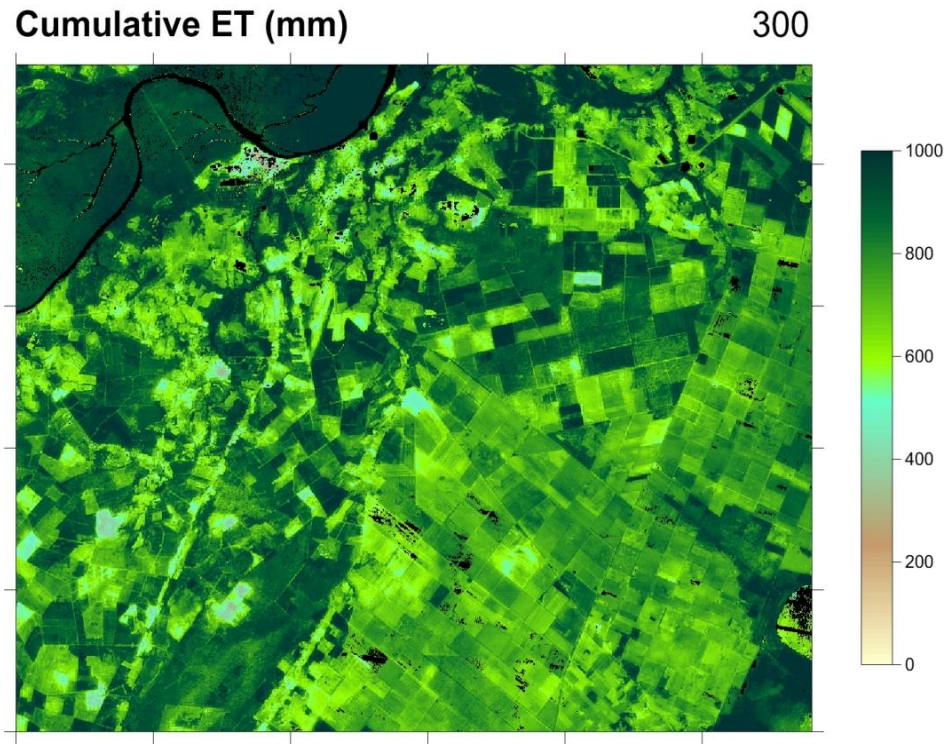
GOES/MODIS/Landsat FUSION

Daily Evapotranspiration – Orlando, FL, 2002



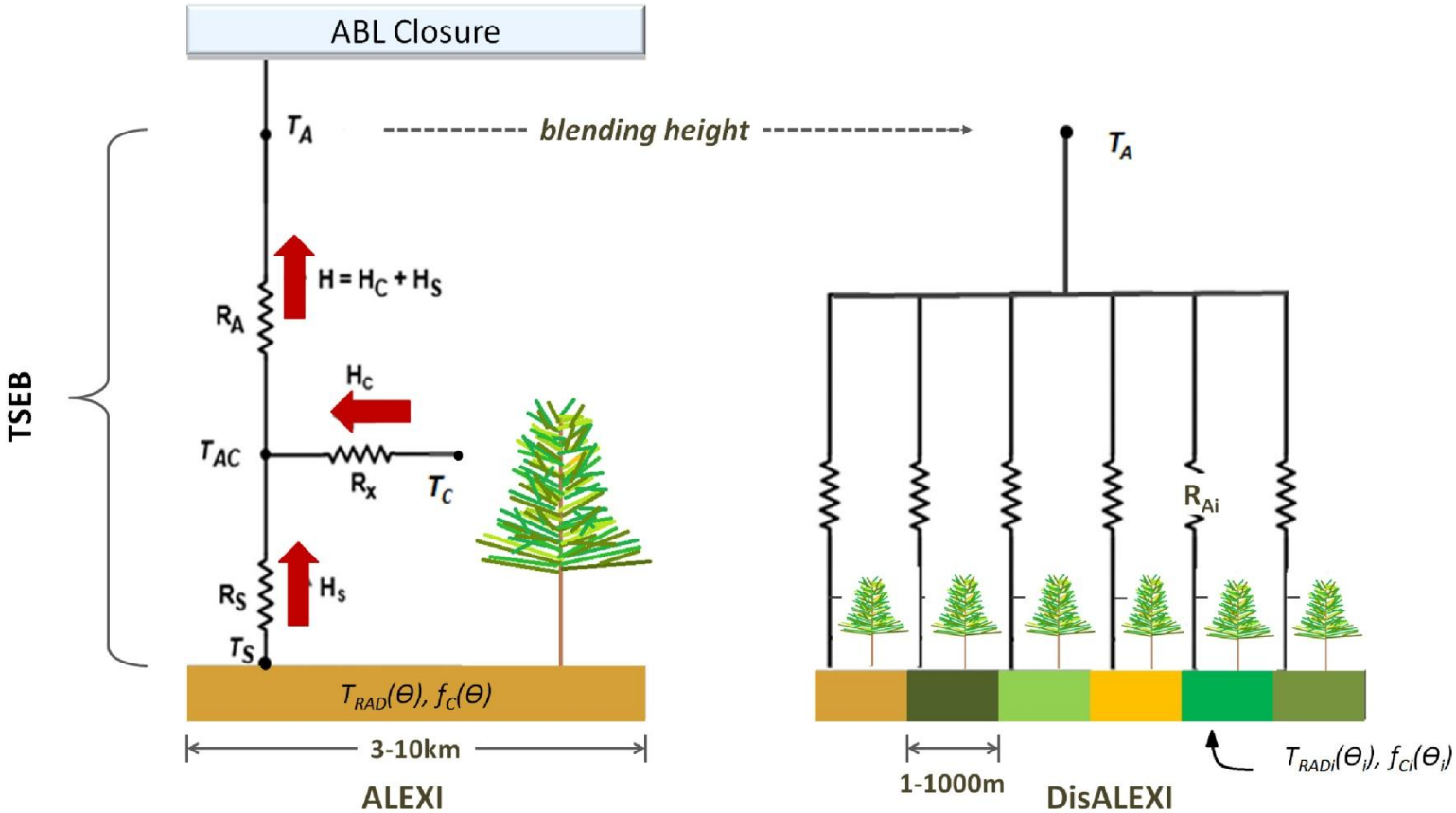
Spatial Temporal Adaptive Reflectance Fusion Model (STARFM) *(Gao et al, 2006)*

Loblolly Pine Plantation, NC



Yang, Y., et al. (2015). Daily Landsat-scale evapotranspiration estimation over a managed pine plantation in North Carolina, USA using multi-satellite data fusion. *Remote Sens. Environ., in preparation*

Landsat 8 - 2013

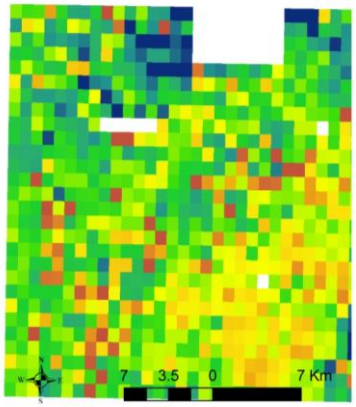


LST:	GOES	MODIS/Landsat
LAI:	MODIS	MODIS/Landsat
HEIGHT:	Landcover, fc	$h_c = h_{cmin}*(1-f_c) + h_{cmax}*f_c)$

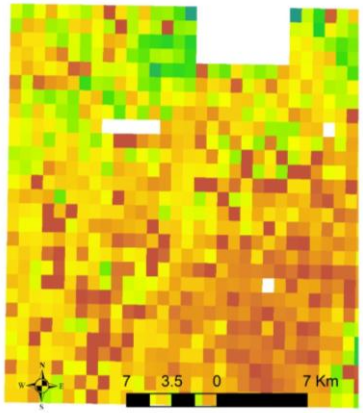
Gap-filling with STARFM

STARFM

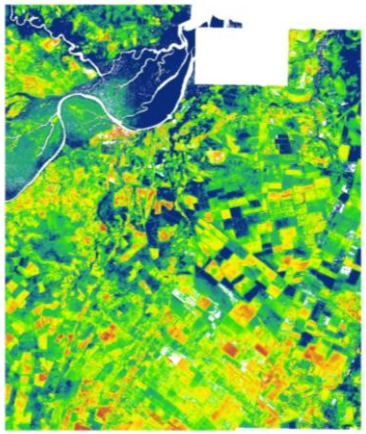
MODIS ET 104



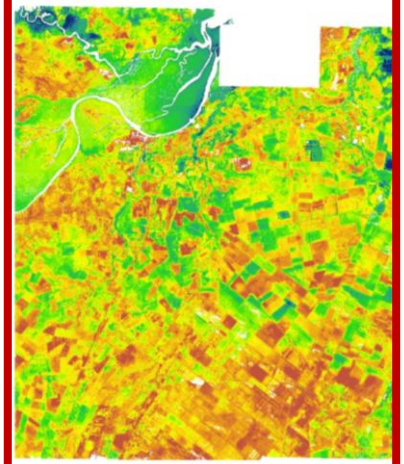
MODIS ET 96



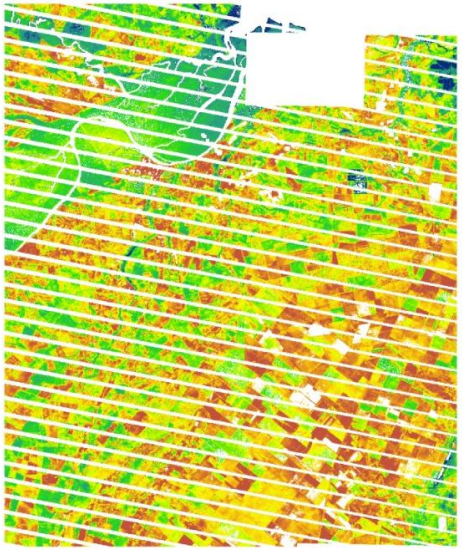
Landsat ET 104



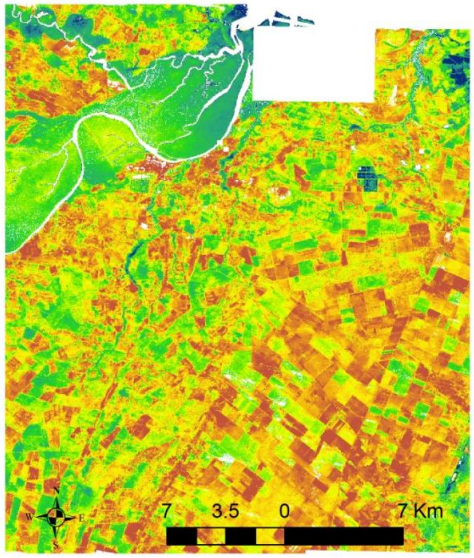
STARFM ET 96



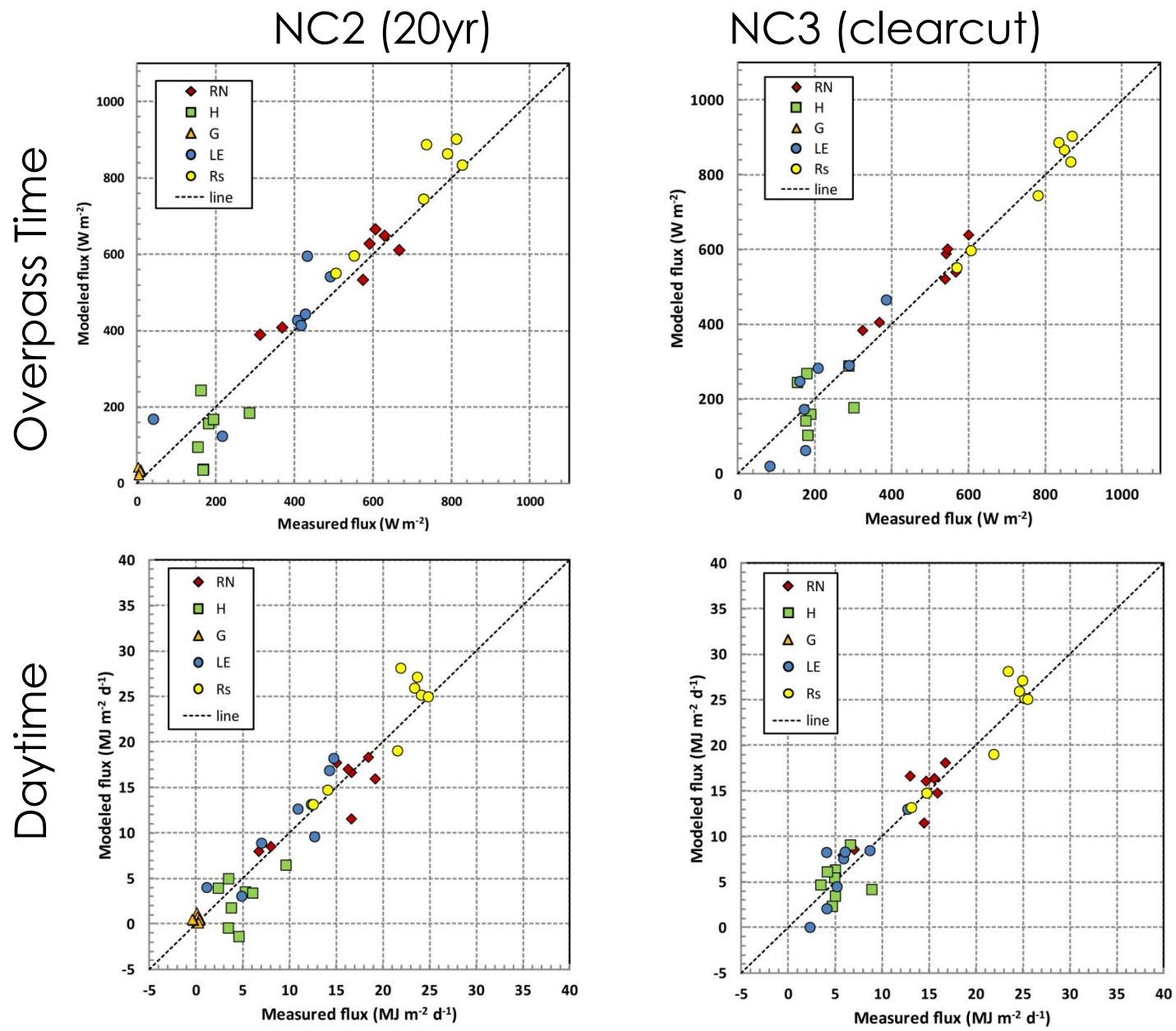
Landsat ET 96



Gapfilled Landsat ET 96

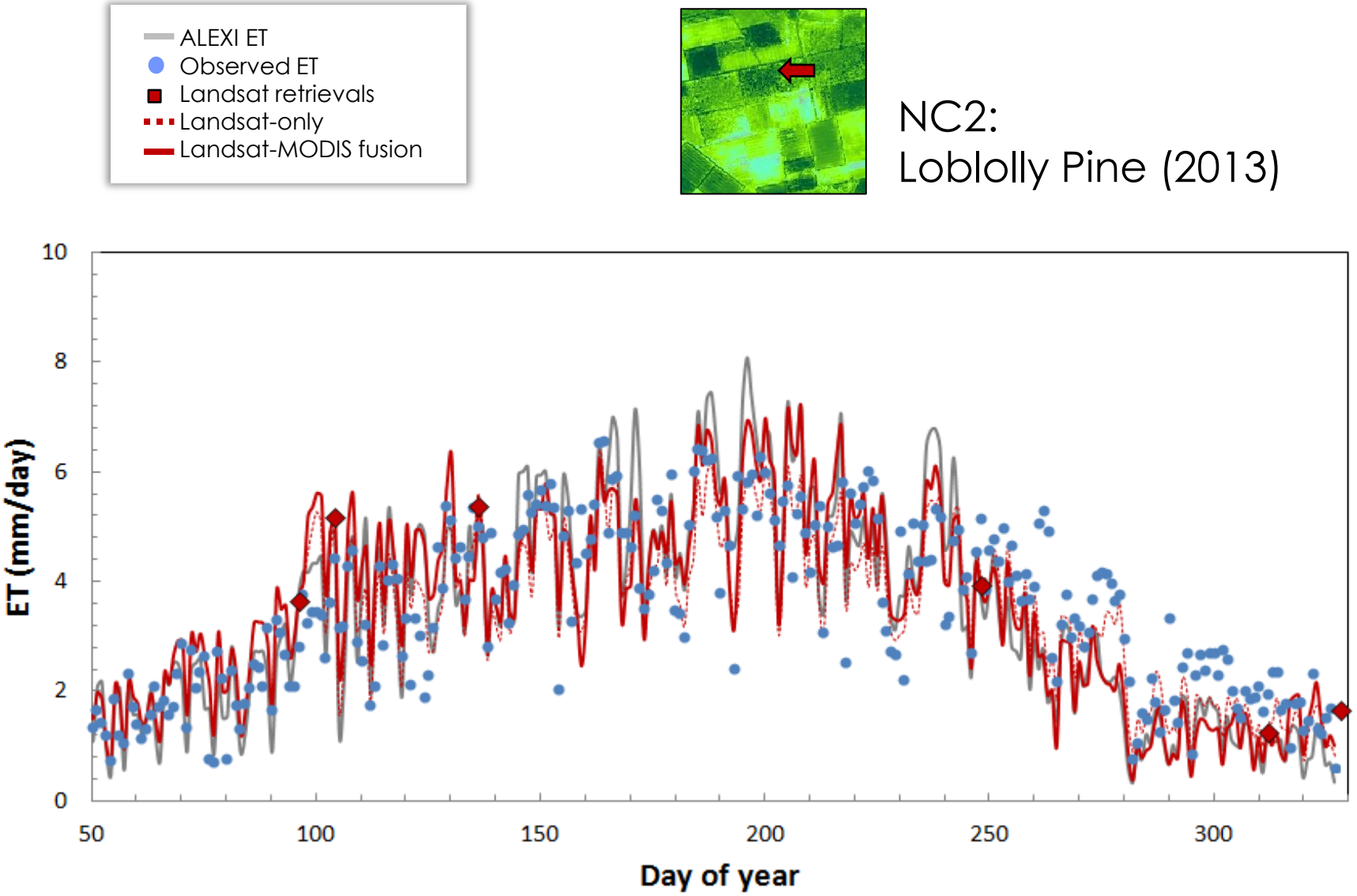


Flux evaluation on Landsat dates

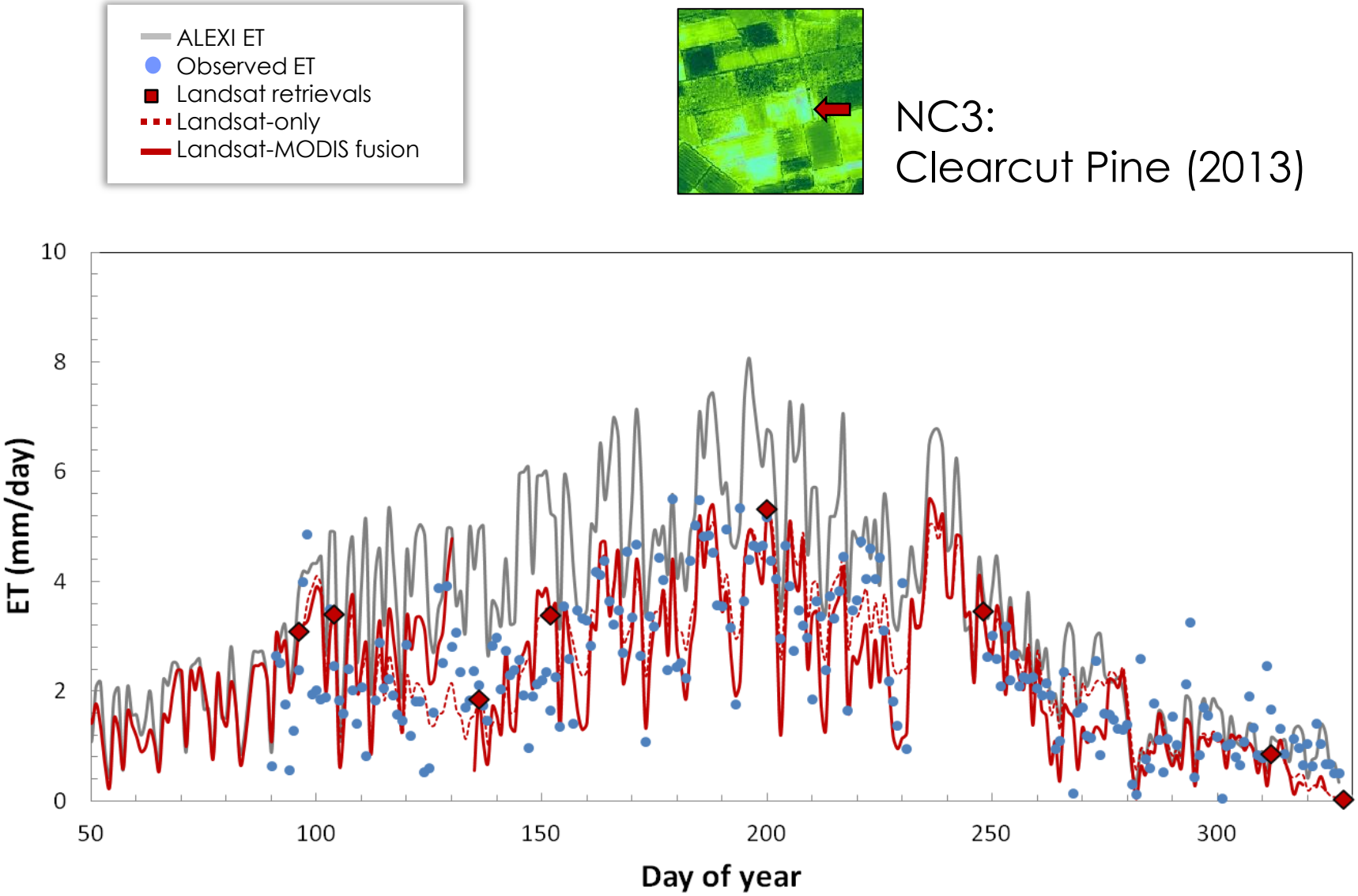


Effect of forest management

NC2:
Loblolly Pine (2013)

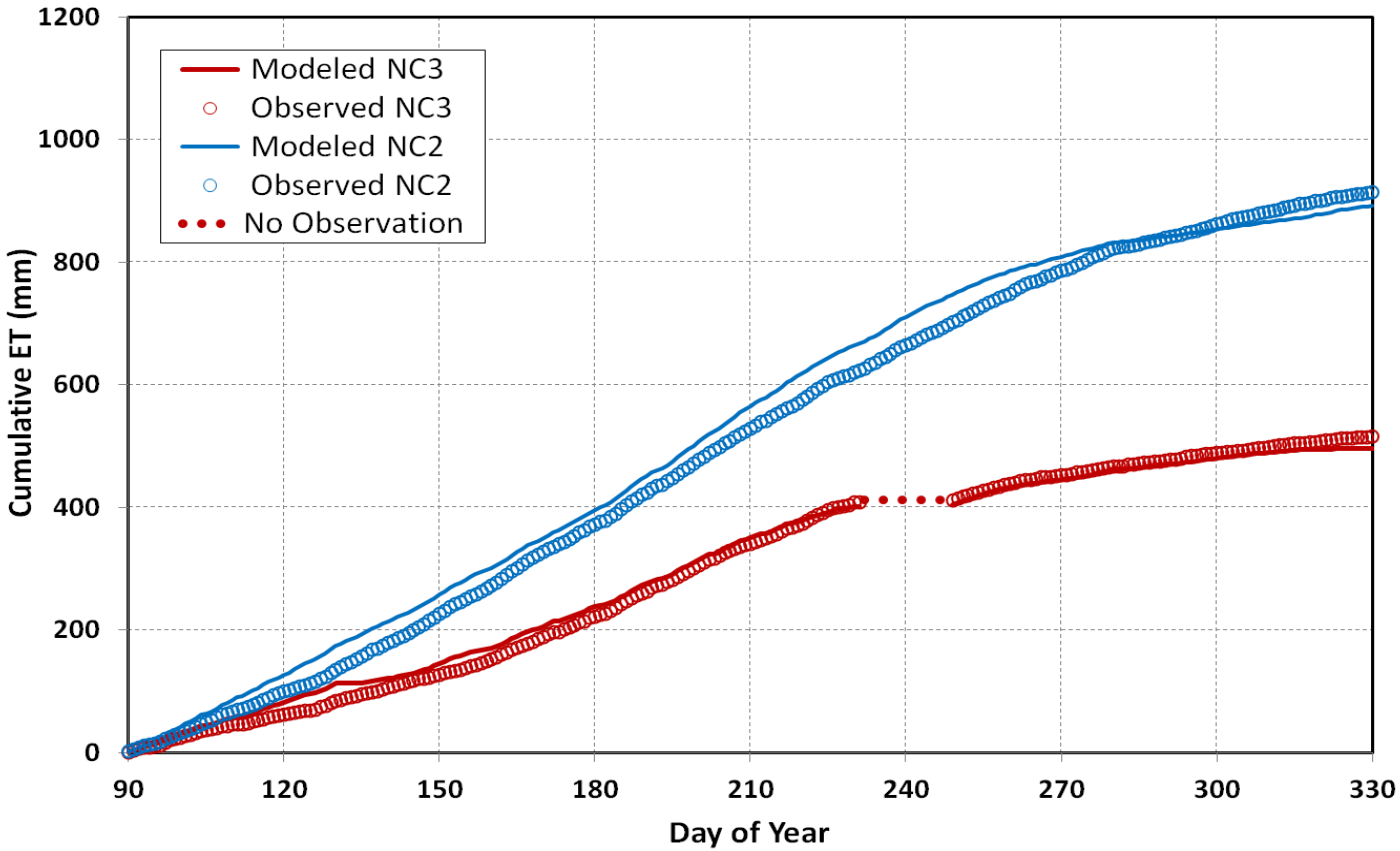


Effect of forest management



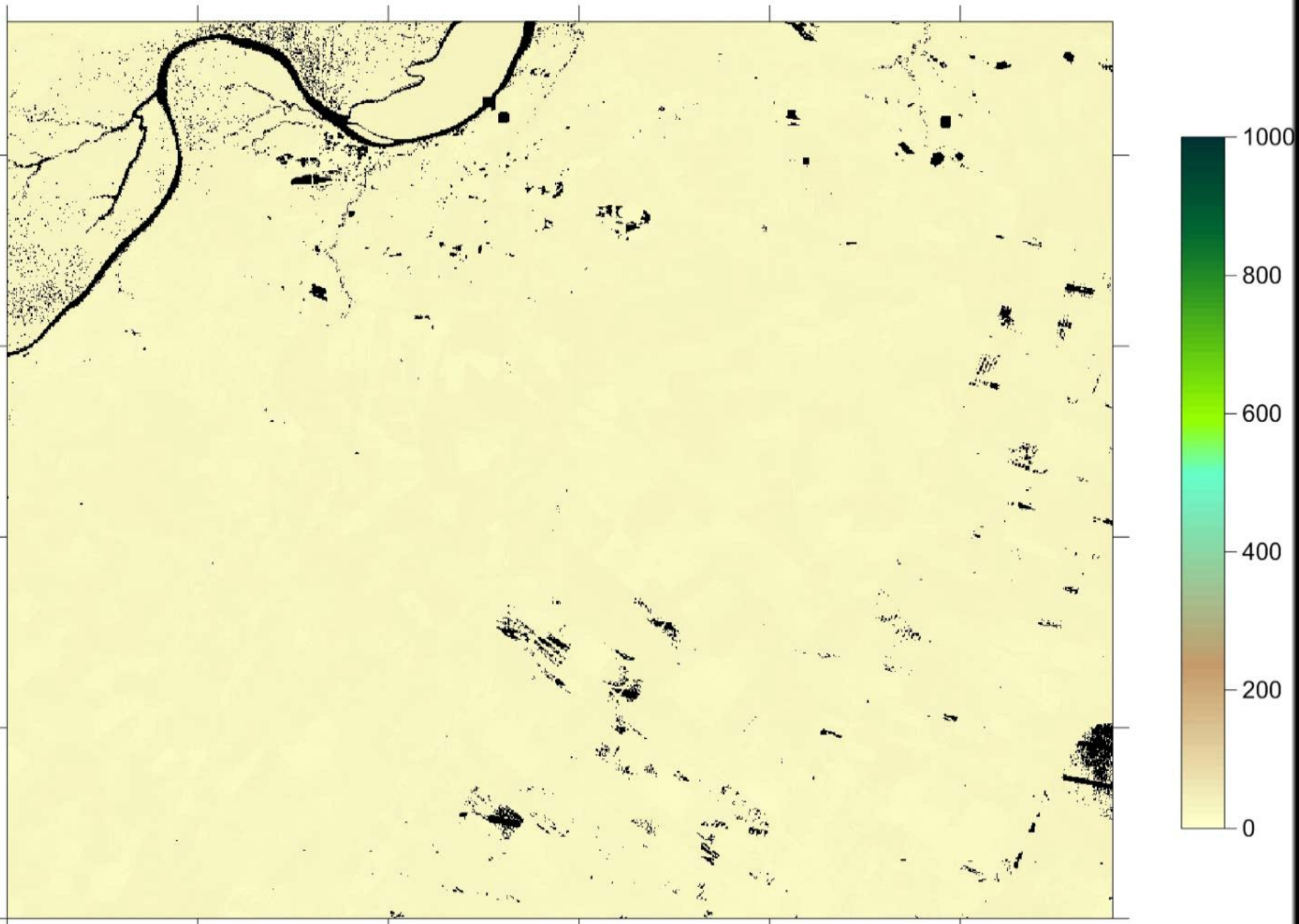
NC3:
Clearcut Pine (2013)

Effect of forest management



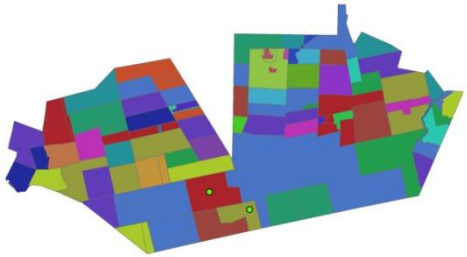
Cumulative ET (mm)

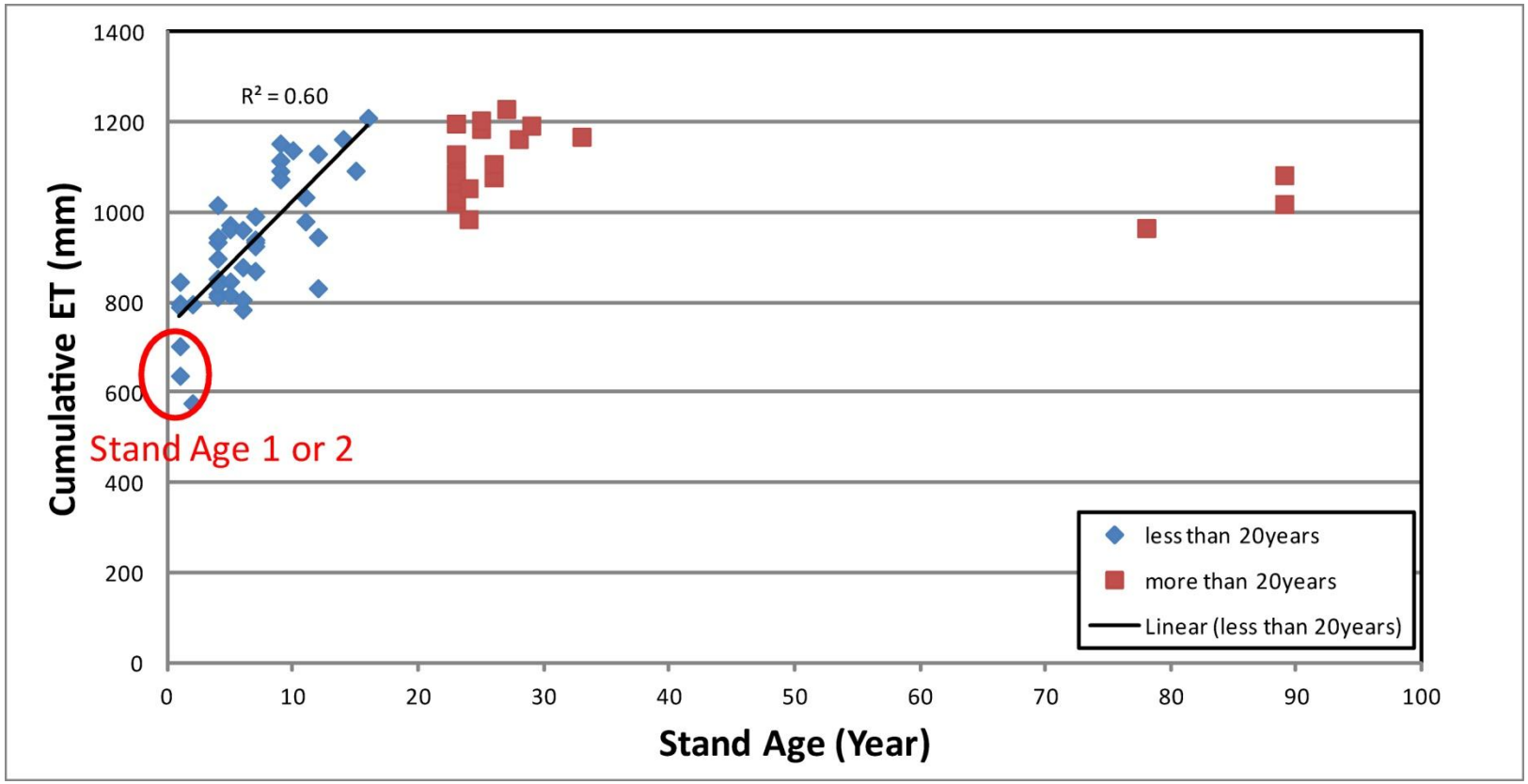
105



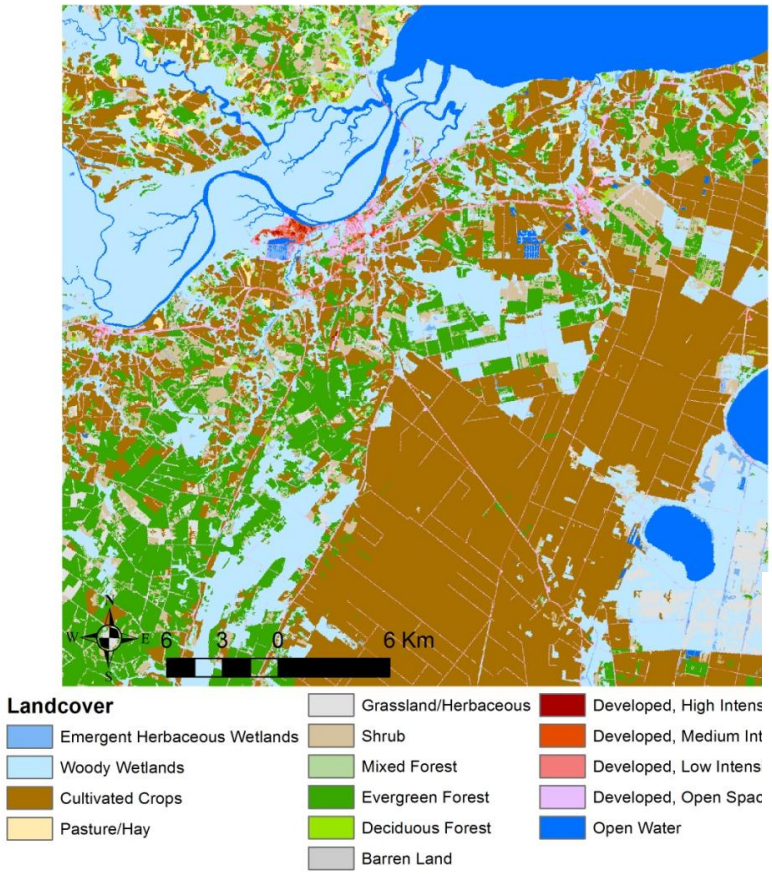
Water use variability with stand age

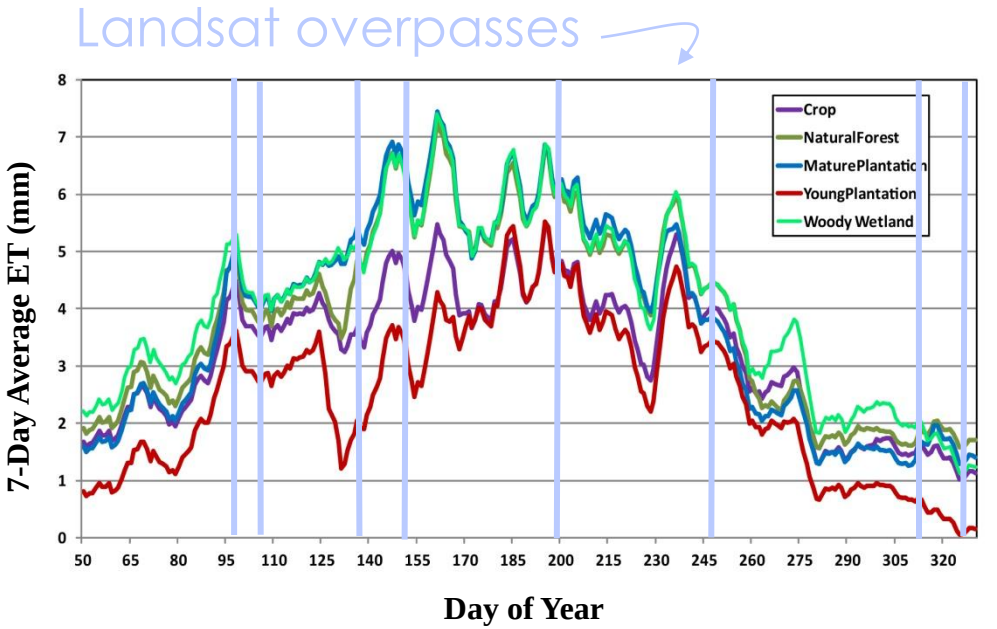
Pine Plantation Stand Age

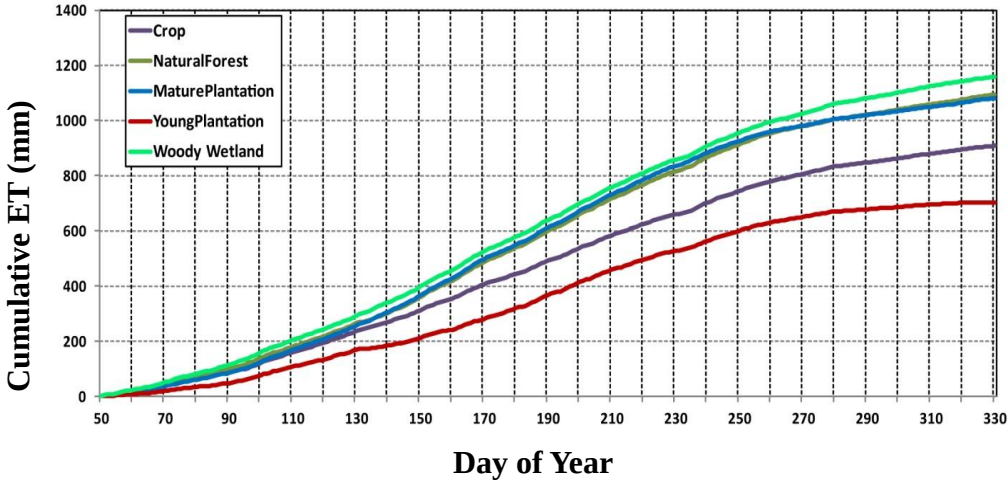




Water use variability with land use

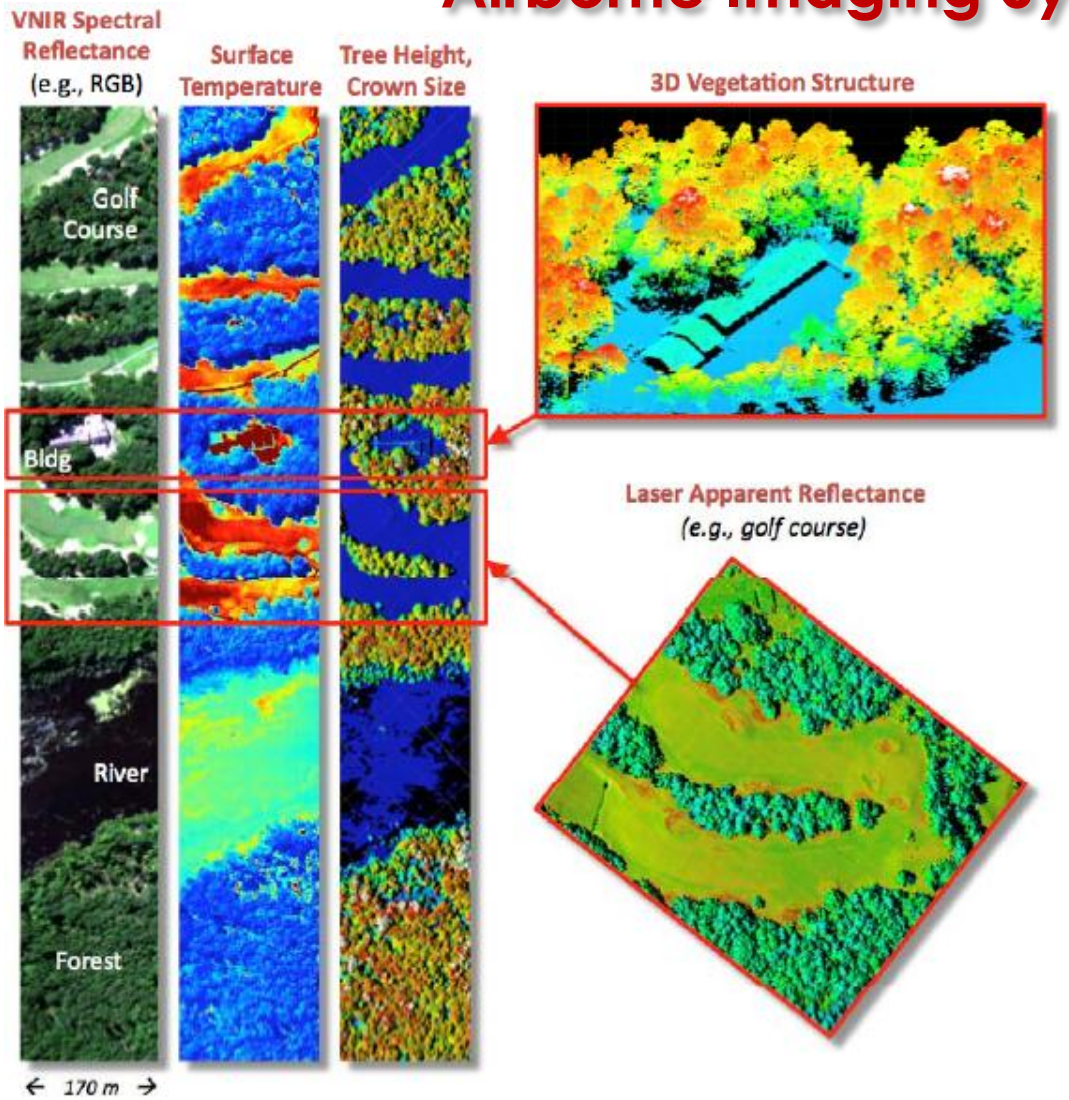


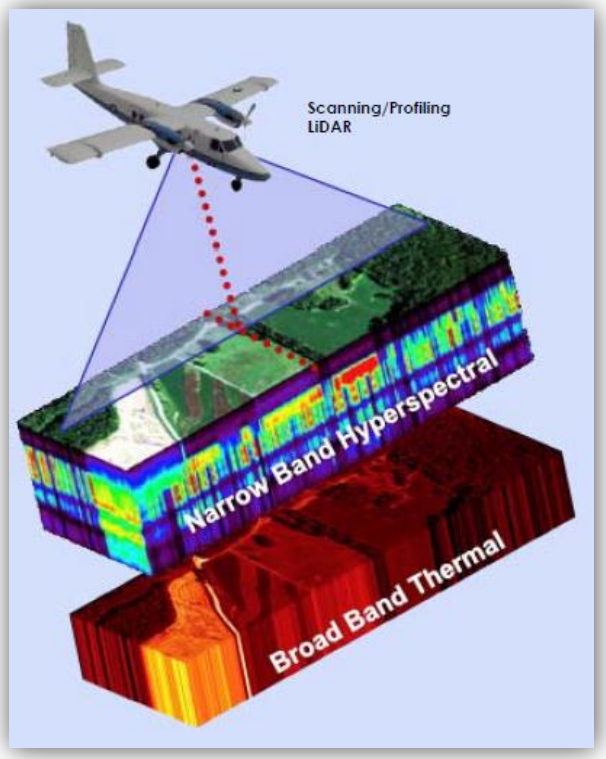




NASA G-LiHT airborne system

Goddard's LiDAR, Hyperspectral and Thermal Airborne Imaging System

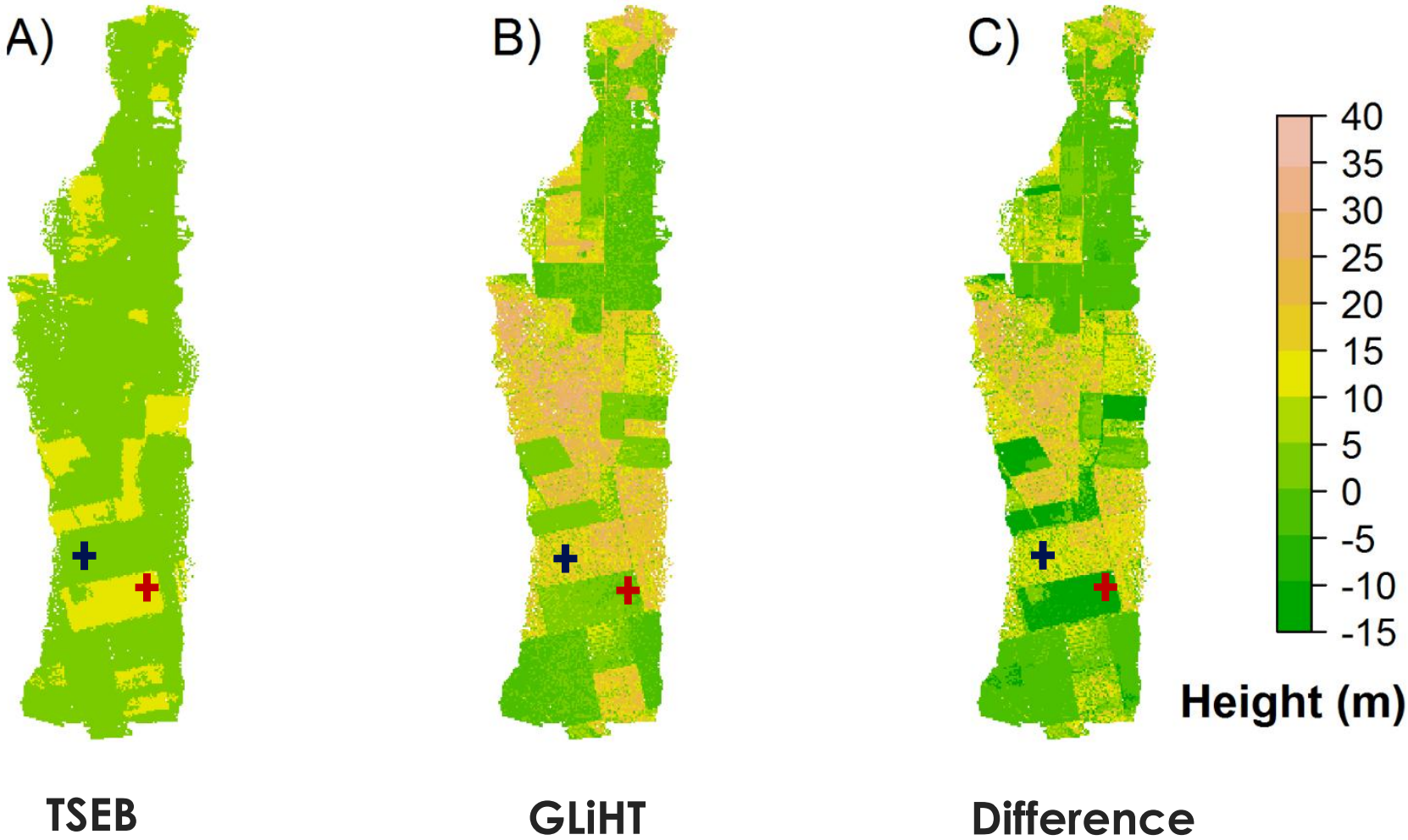




Collaborator B. Cook

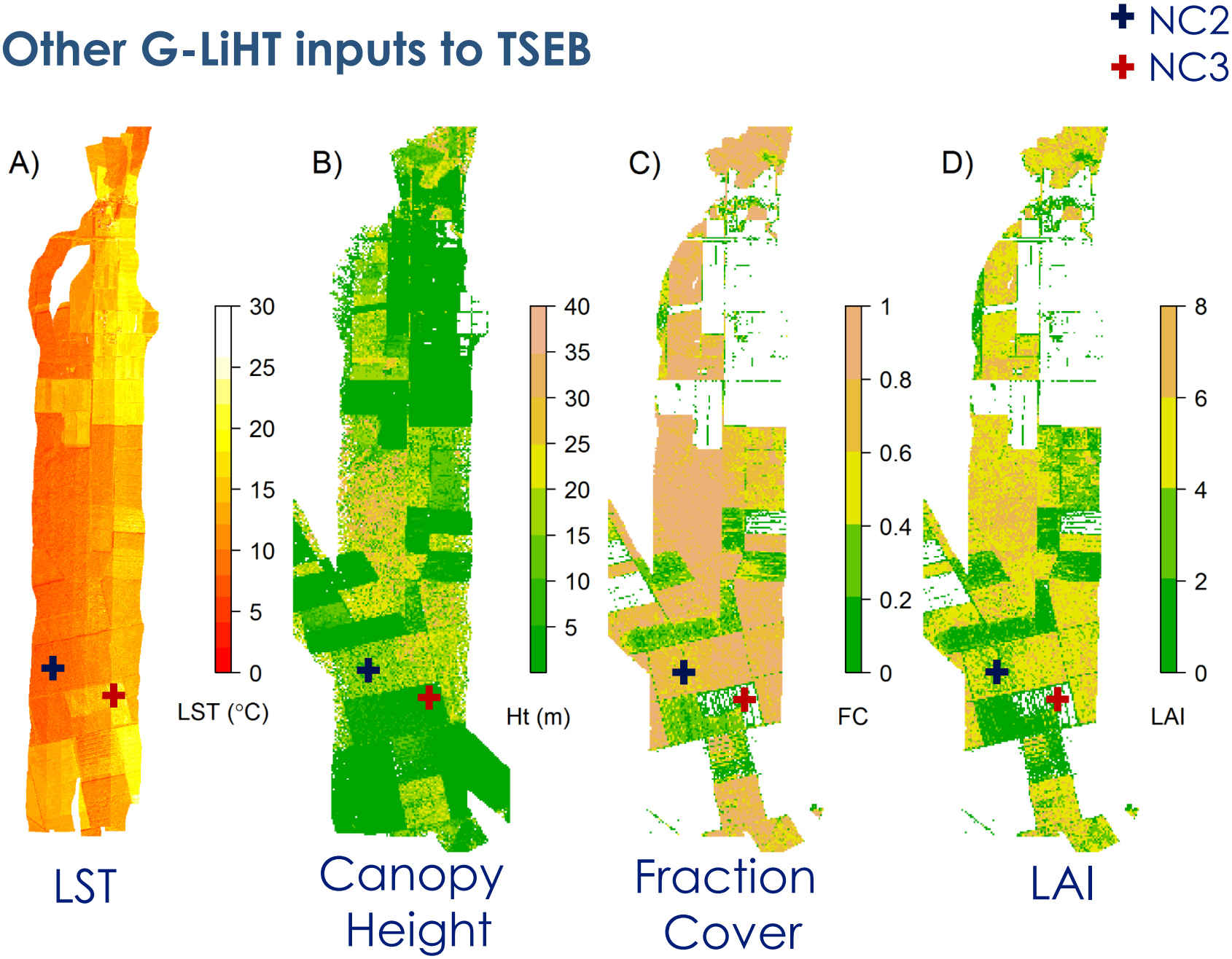
NASA G-LiHT airborne system

Canopy height over Parker Tract



NASA G-LiHT airborne system

Other G-LiHT inputs to TSEB



Conclusions

For further investigation:

- Study differences in water balances among different land cover types (natural/managed forests, crops).
- How has ET and runoff (P - ET) in the region changed over time?
- How does forest age affect ET and water yield? How might this kind of information impact management of water yield through forest cutting?
- Can we use Landsat ET to validate watershed/regional hydrological models?

hrsl.arsusda.gov/drought

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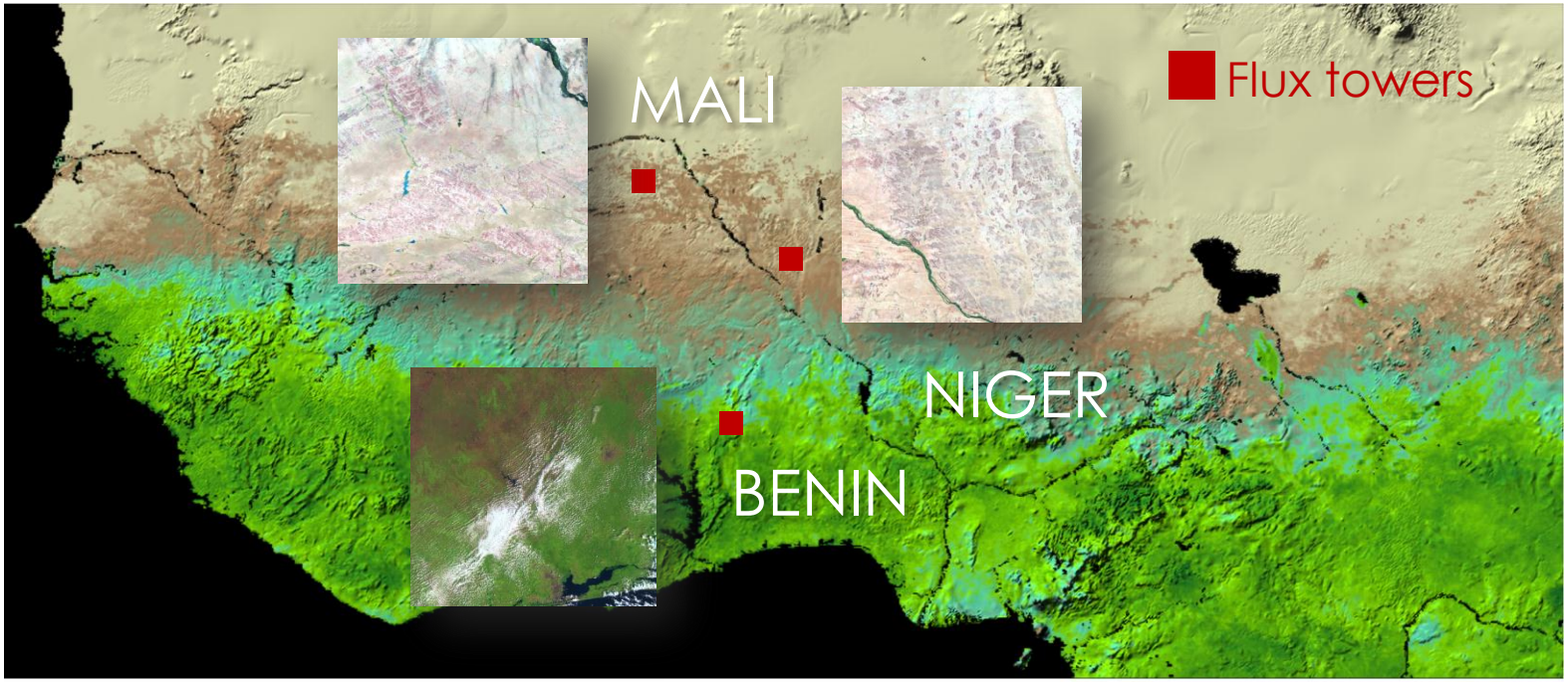
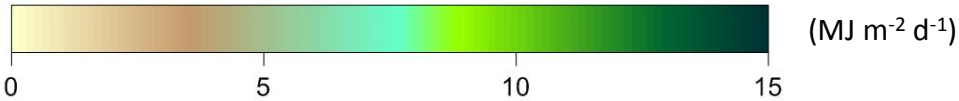
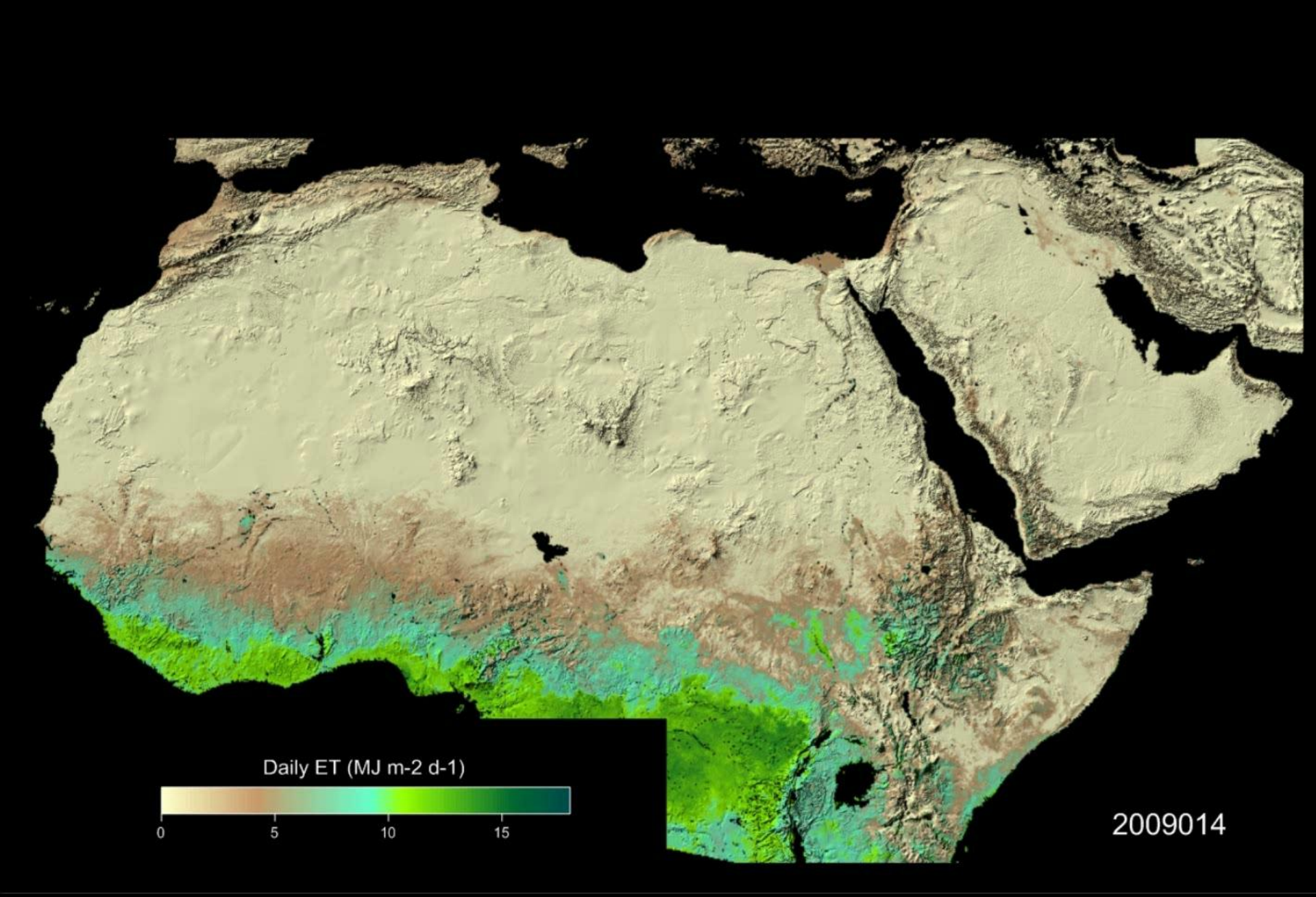
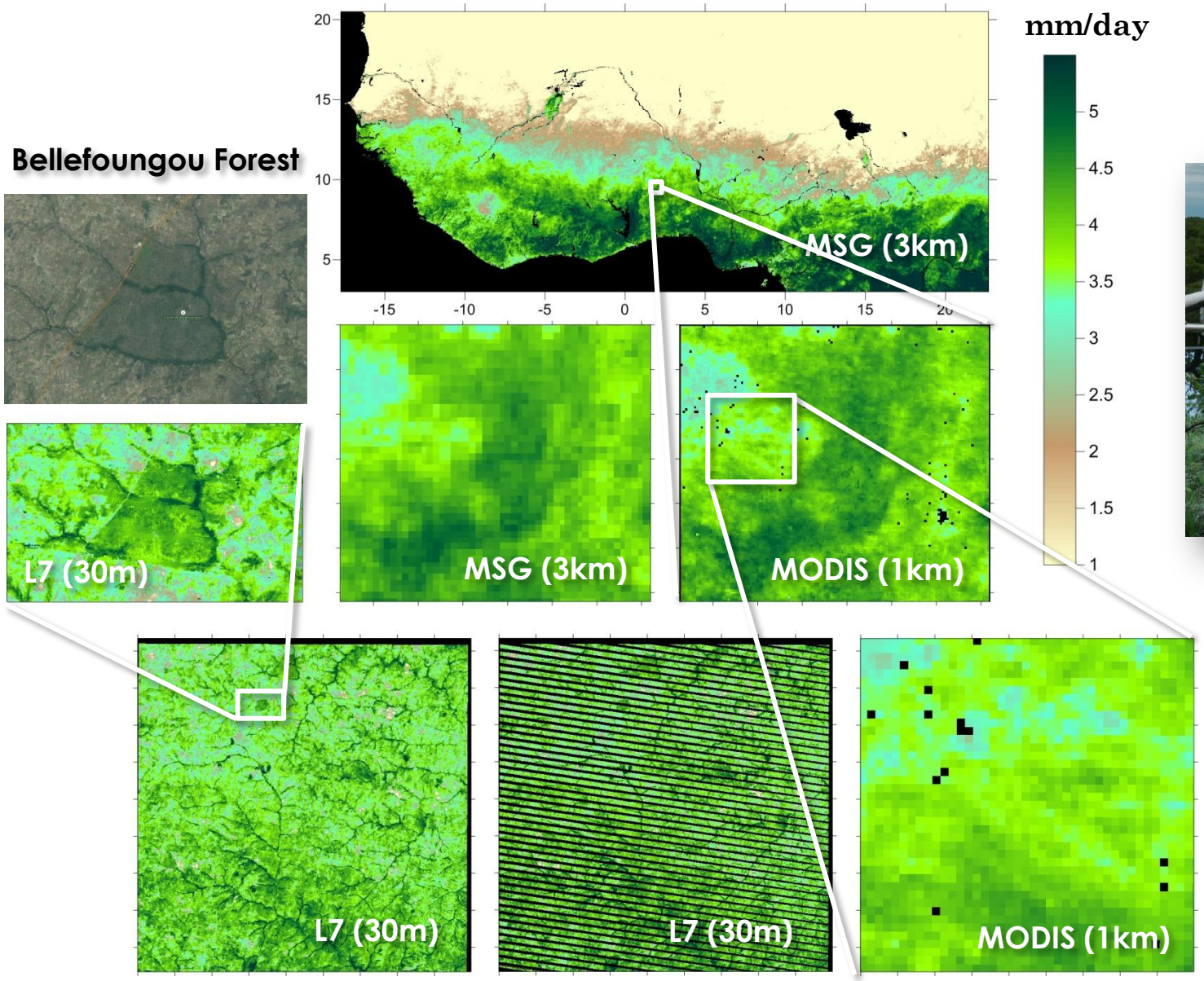
ALMIP AMMA Land Surface Model Intercomparison Project



African Monsoon Multidisciplinary Analysis (CNRM, CESBIO)




Daily ET (MJ m-2 d-1)
0
5
10
15
2009014

BENIN, AFRICA