

An open source tool to estimate regional and field-scale evapotranspiration

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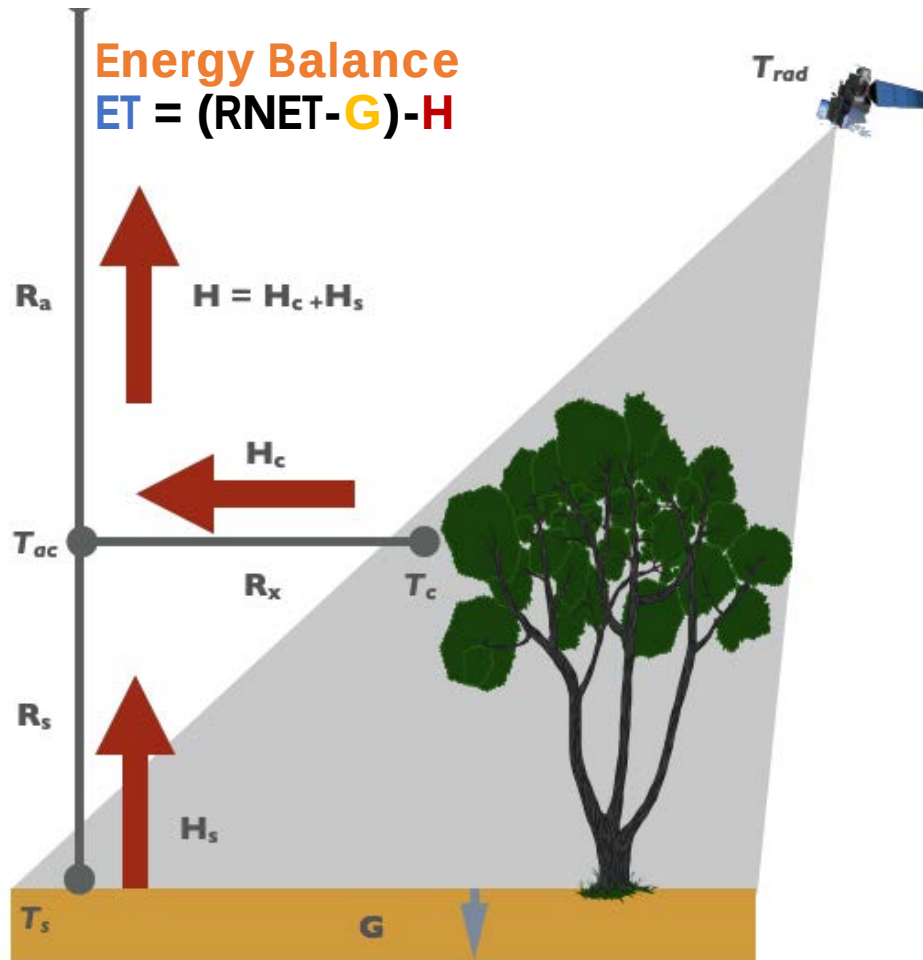
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University of Nebraska, Robert Daughtery Institute

Overview

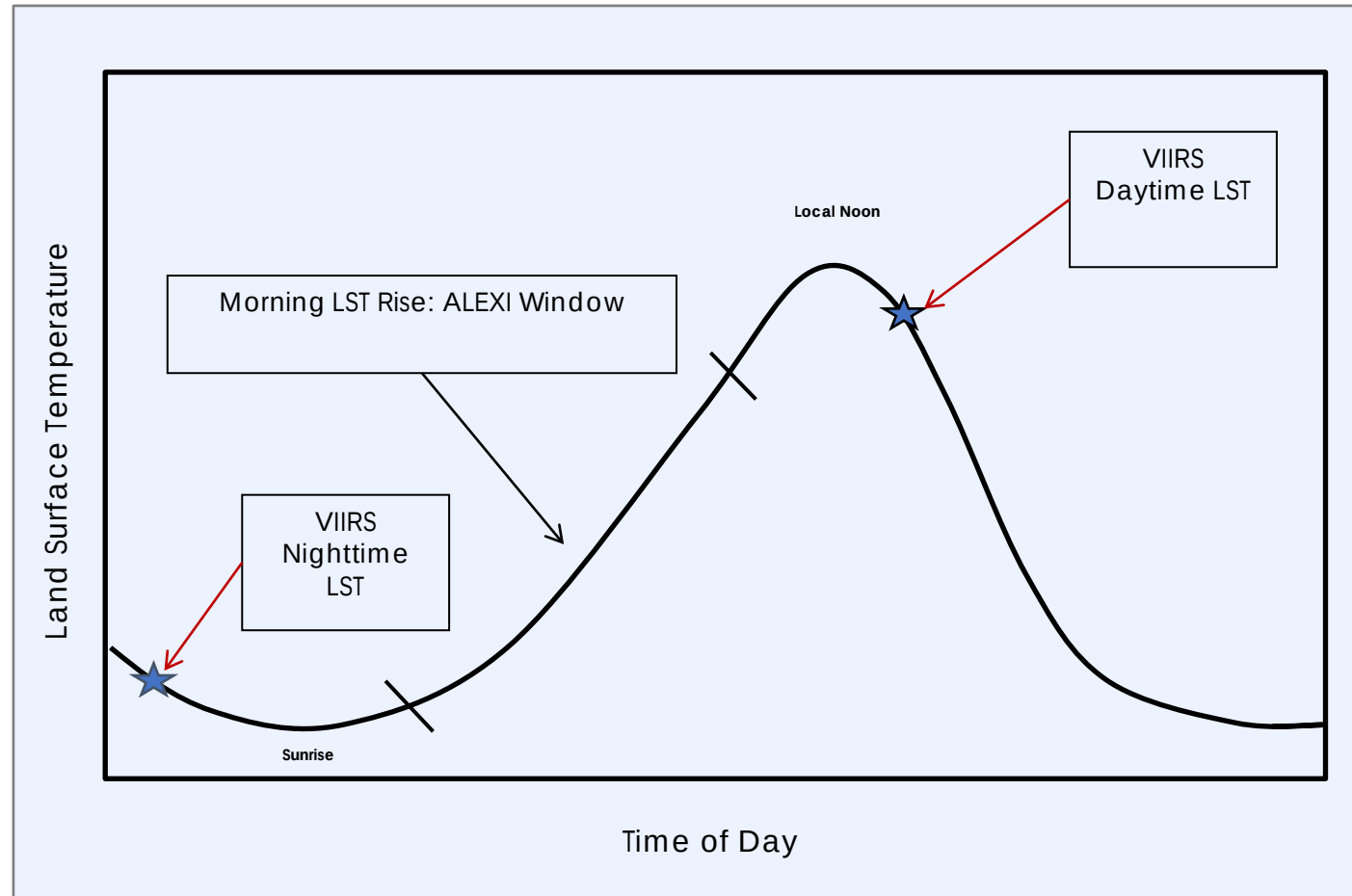
- Two-Source Energy Balance (TSEB)
- ALEXI
- DisALEXI
- PyDisALEXI
- Conclusions

Two Source Energy Balance (TSEB)

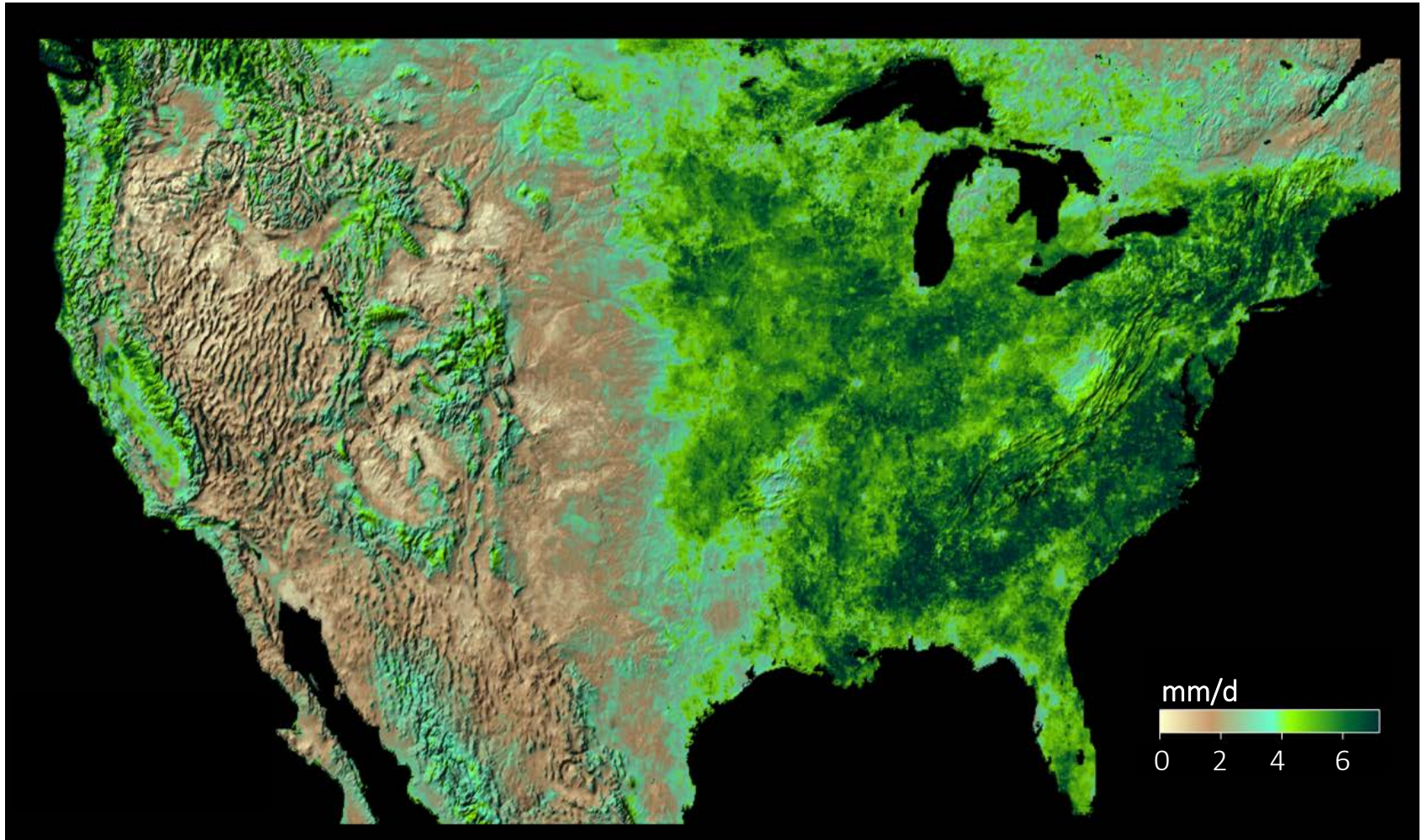


- Treats soil/plant-atmosphere coupling differences explicitly.
- Uses land surface temperature (LST) as a surrogate to soil-moisture content.
- Accommodates off-nadir thermal sensor view angles.
- Provides information on soil/plant fluxes and stress.

Atmosphere Land Exchange Inverse (ALEXI)

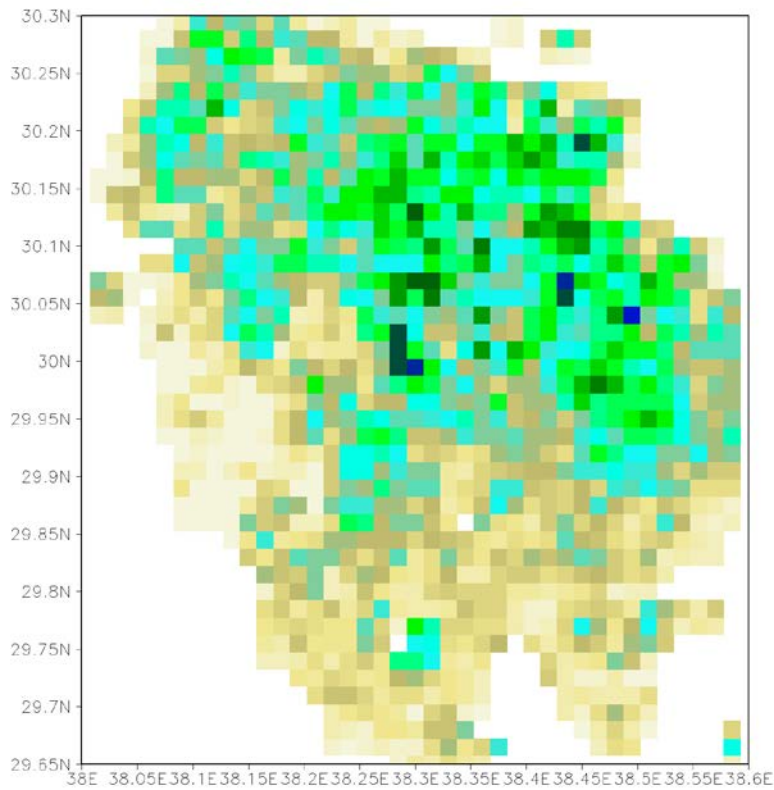


ALEXI: GOES Evapotranspiration

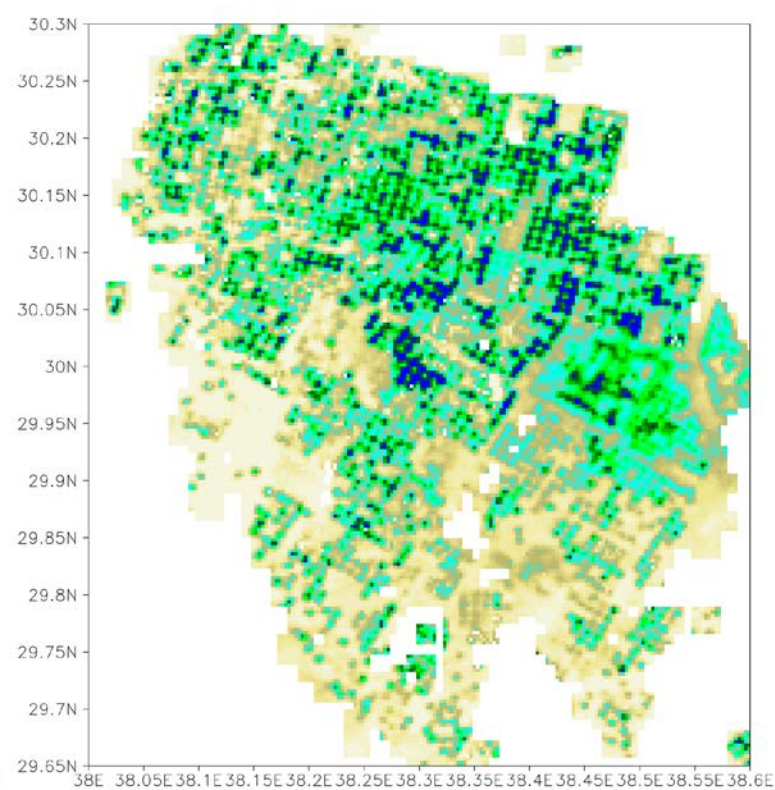


ALEXI: Polar orbiters

Current MODIS Capability (1000-m)



VIIRS Capability (375-m)

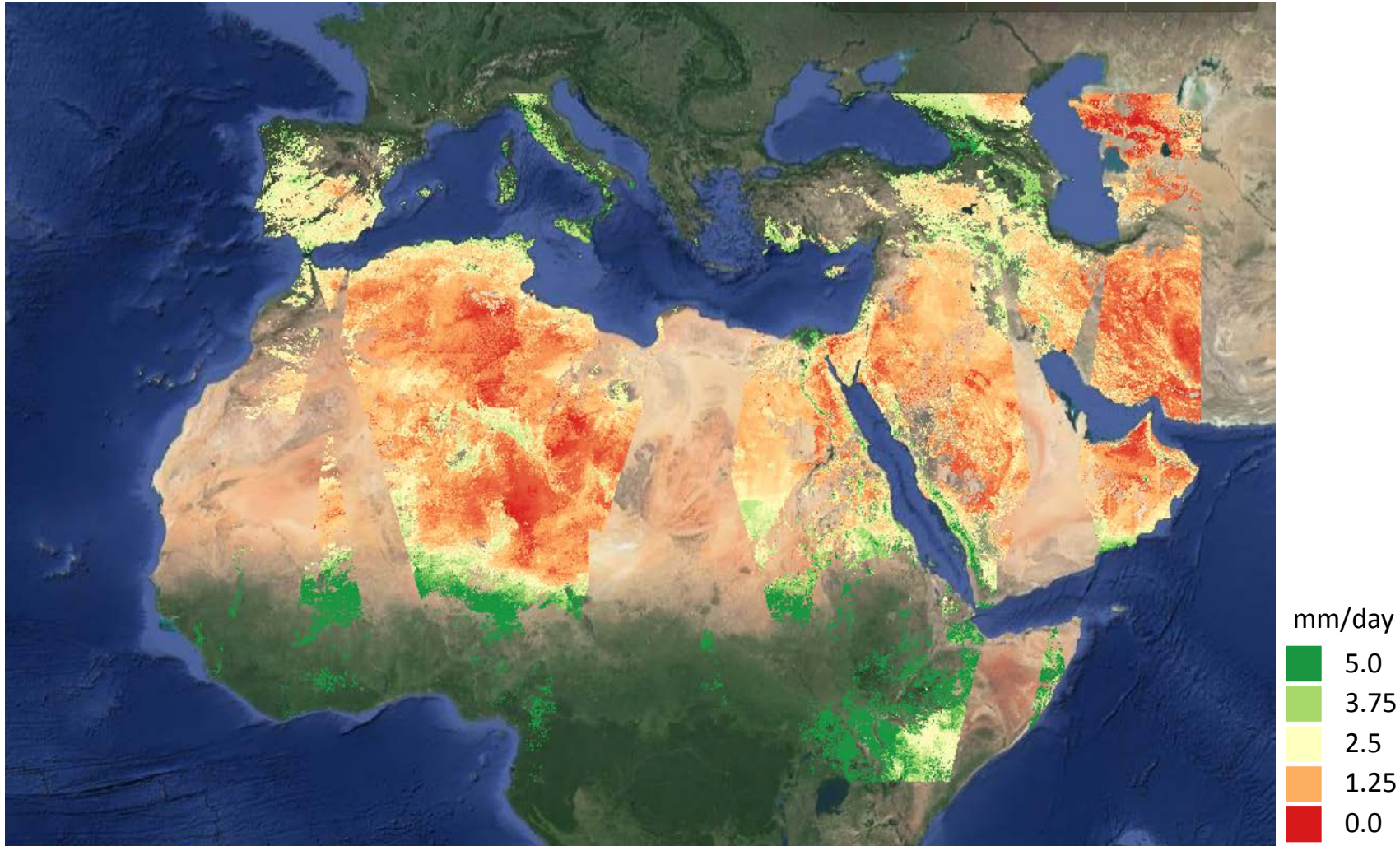


w/m²

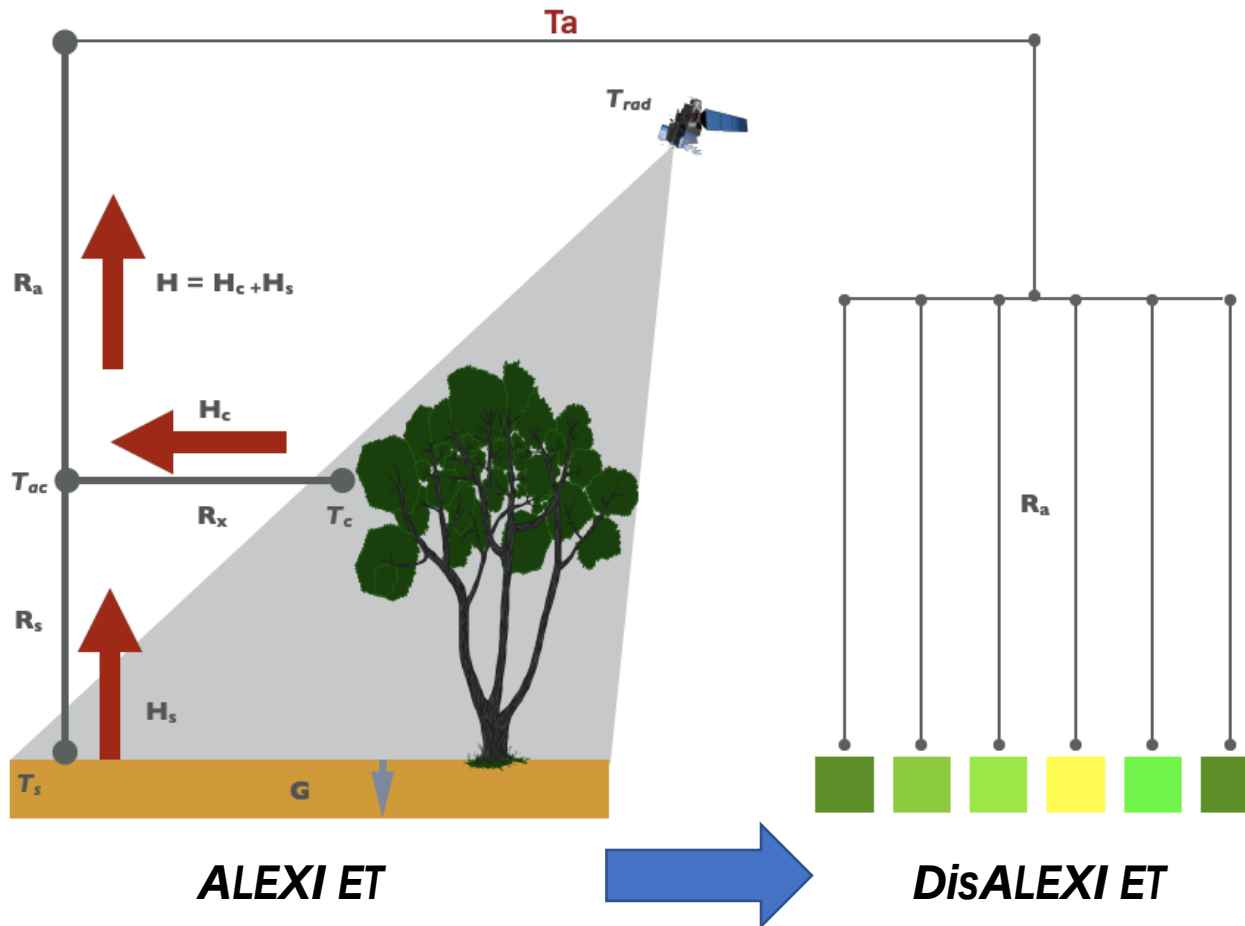


ALEXI: VIIRS 375-m MENA

Development of a High-Resolution (375-m) VIIRS ET Product

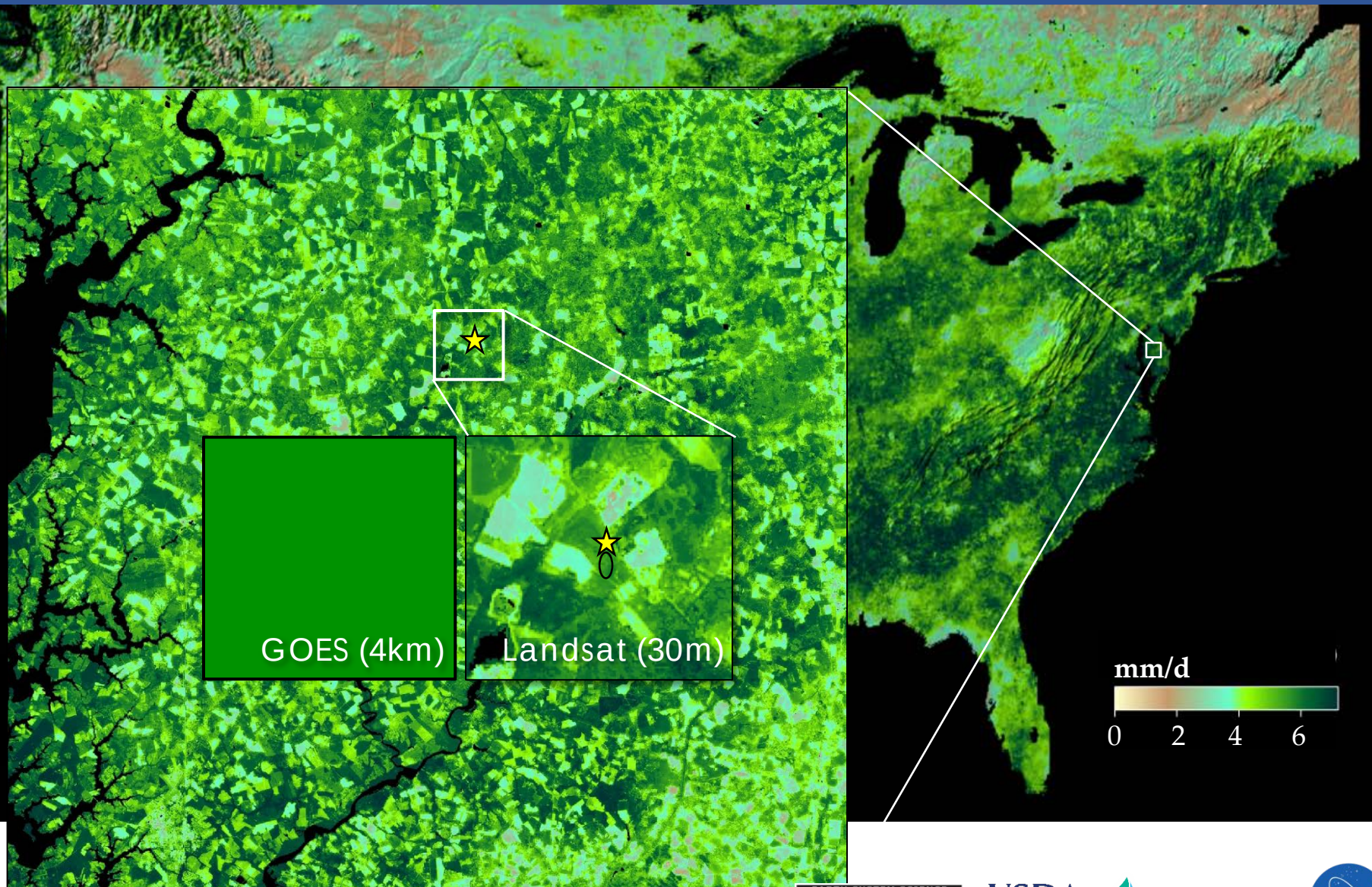


Disaggregated ALEXI (DisALEXI)



An initial guess air temperature map is iteratively altered until the aggregated daytime fluxes retrieved by DisALEXI match the ALEXI fluxes at the scale of the ALEXI grid.

DisALEXI: Downscaling example

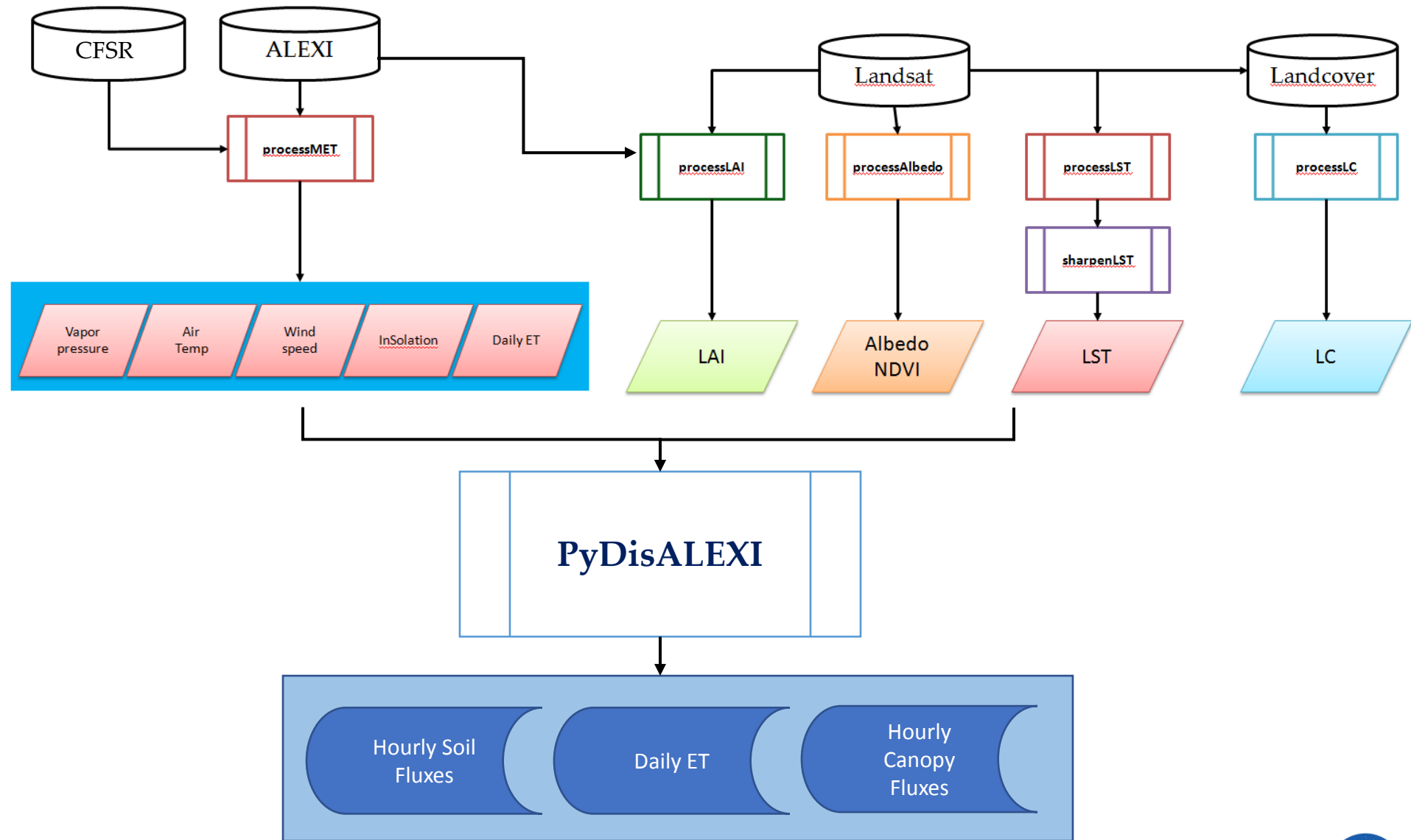


PyDisALEXI

PyDisALEXI is an open source implementation of the DisALEXI fusion suite. It is primarily composed of the following freely available python modules.

- Continuum's Anaconda python distribution is used:
 - NumPy
 - SciPy
 - Pandas
- Other important modules
 - Geospatial Data Abstraction Library (GDAL)
 - Pythonic implementation of RTTOV, pyrttov
 - joblib

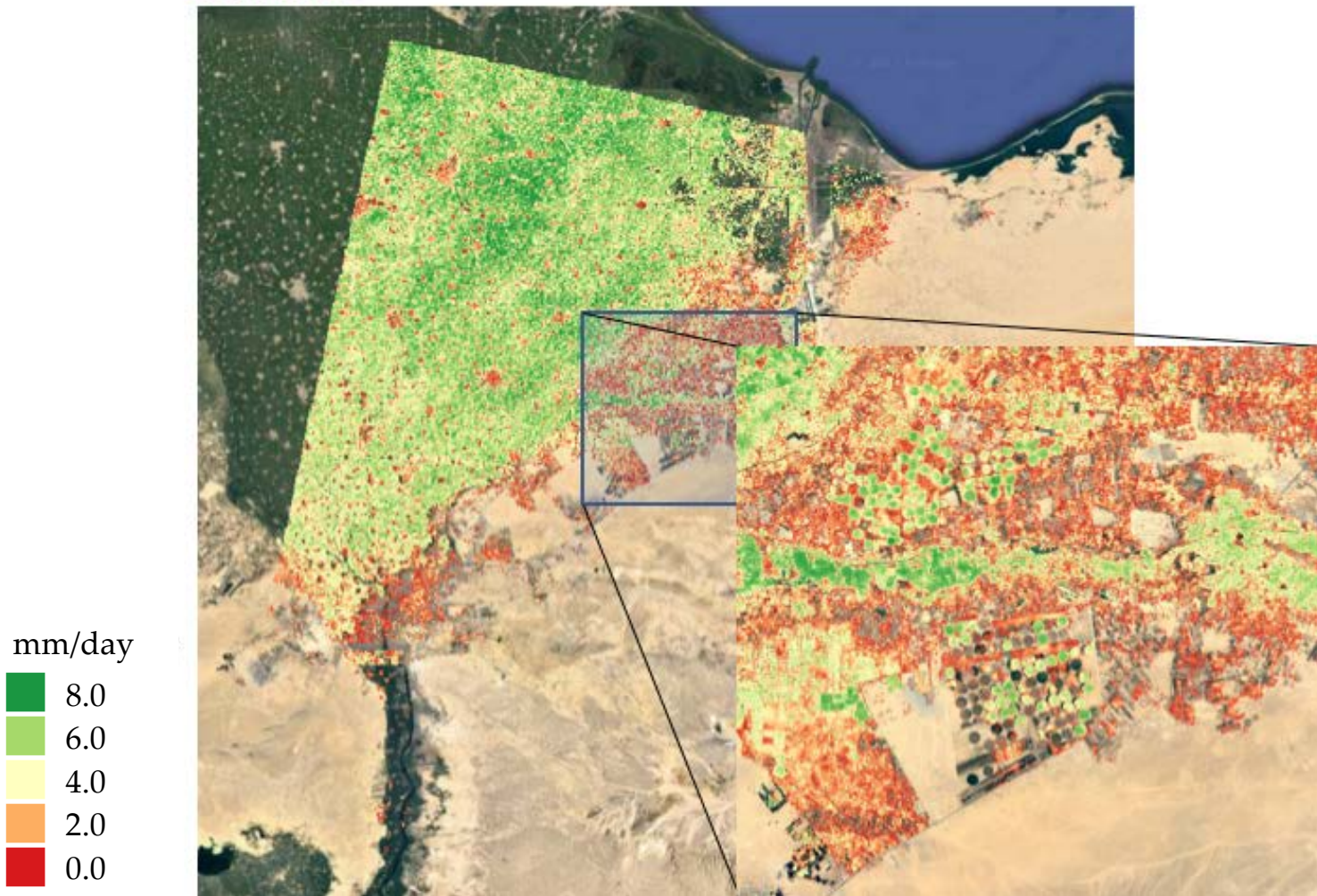
PyDisALEXI: flowchart



PyDisALEXI: Example

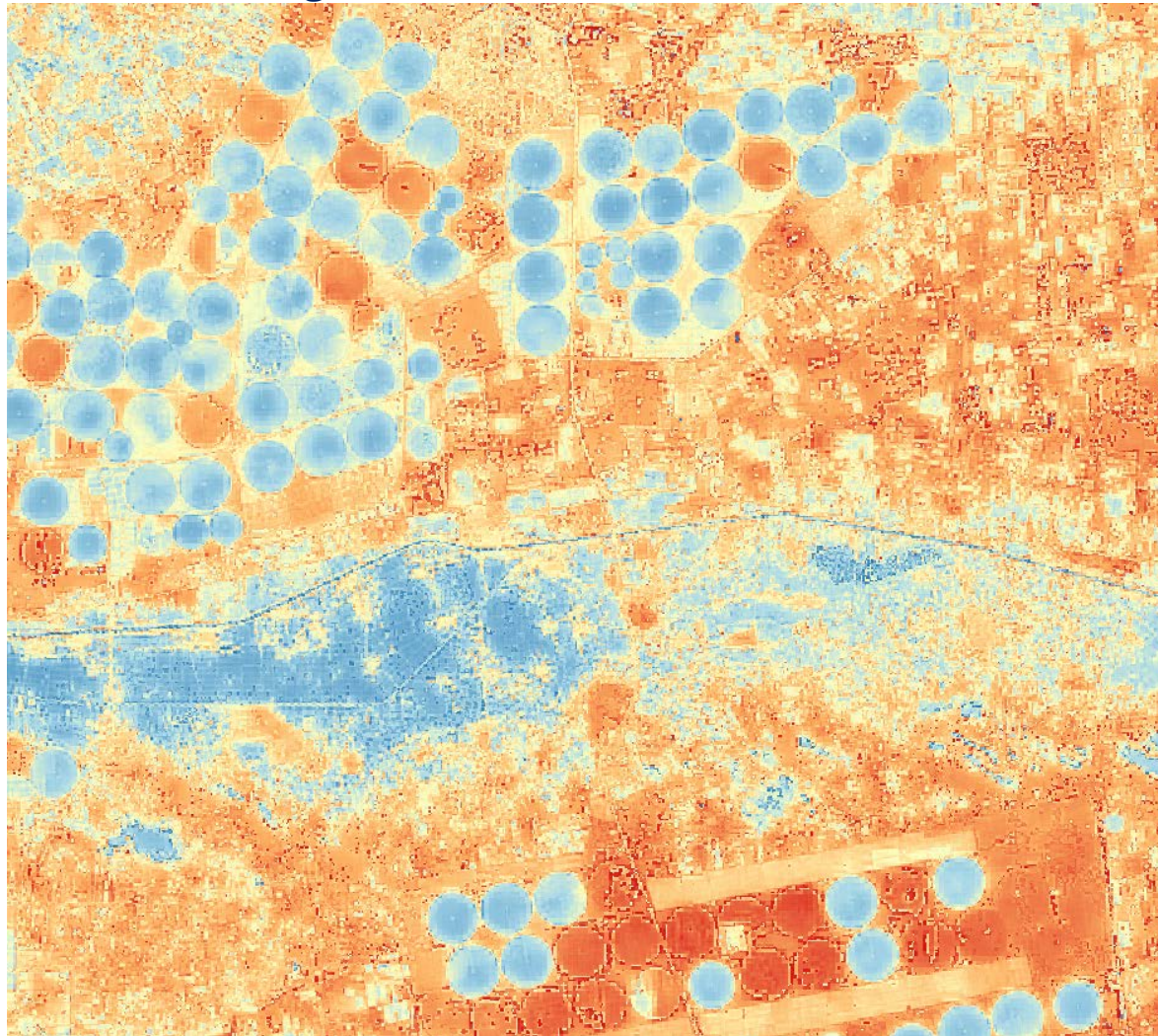
Nile Delta Irrigation Aug. 9, 2015

Landsat ET



Input data: Land Surface Temperature (LST)

Nile Delta Irrigation

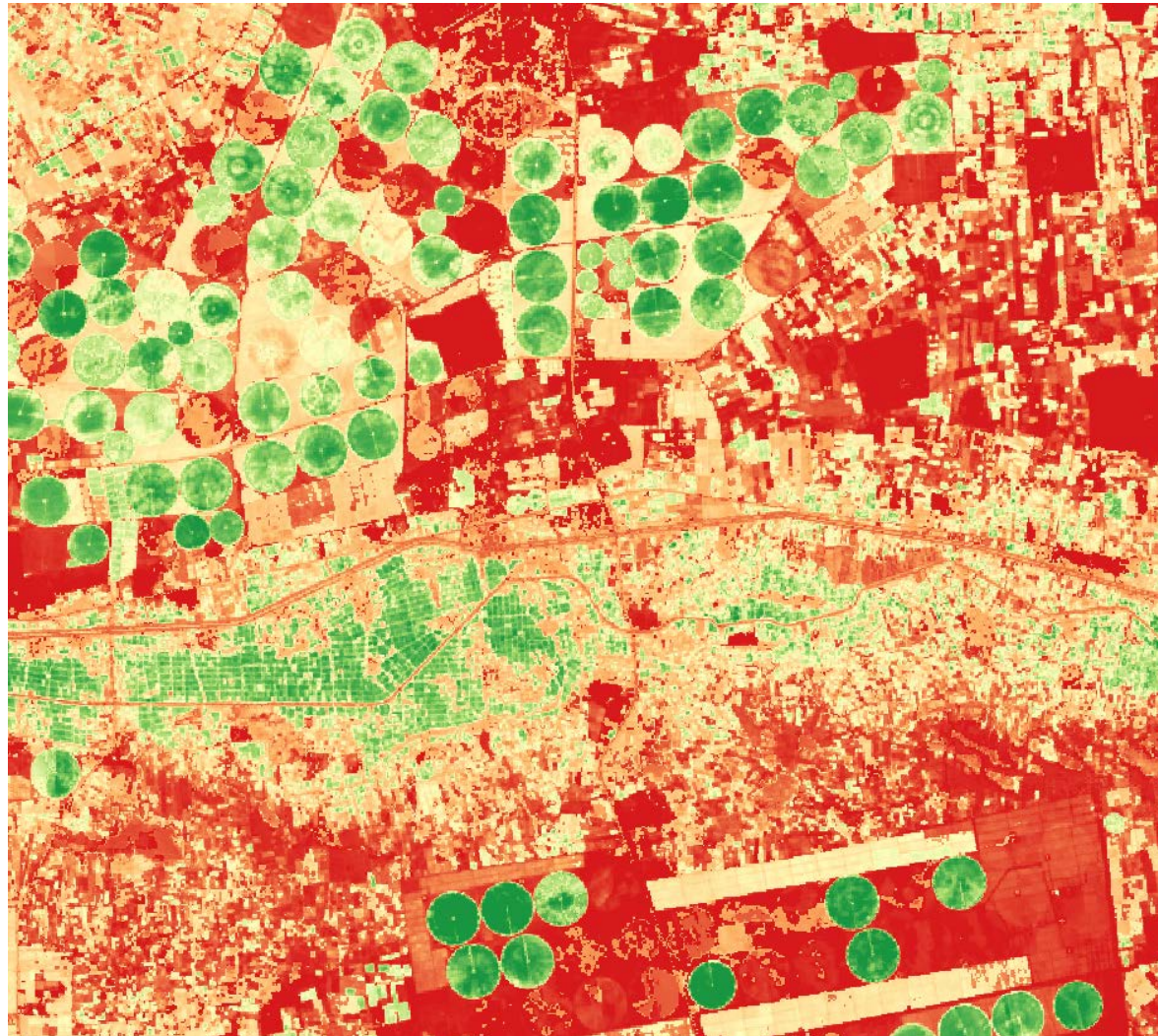


Sharpened LST (K)

- LST calculated using the RTTOV atmospheric radiative transfer model to convert Brightness Temperature to LST.
- Landsat 8 TIRS product has a native resolution of 100 m.
- Sharpened to 30 m by the Data Mining Sharpening (DMS) tool using visible (30 m) and TIRS (100 m) data.

Input data: Leaf Area Index (LAI)

Nile Delta Irrigation

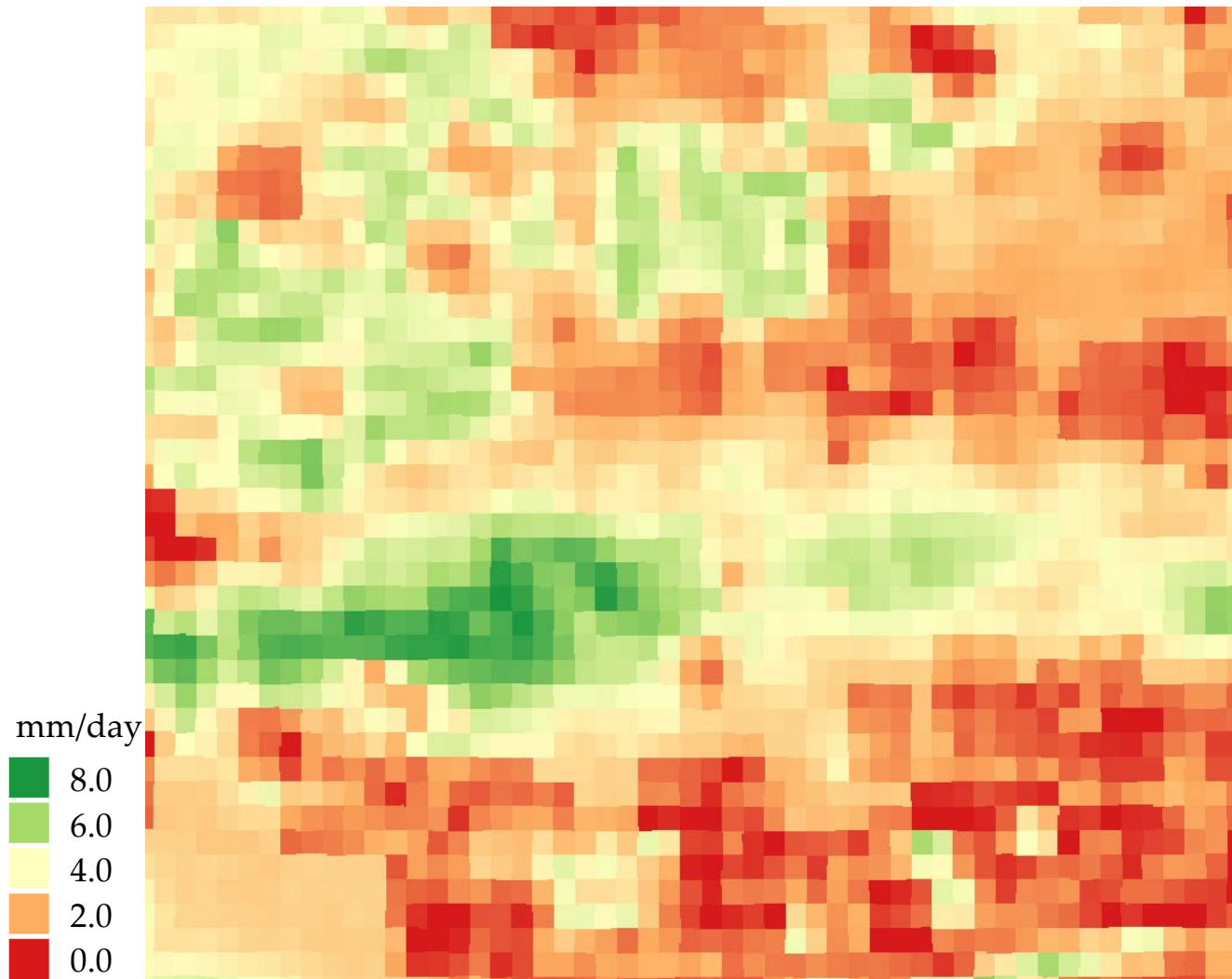


Landsat LAI

- 30 m LAI product
downscaled LAI from
lower resolution
instruments (i.e.
MODIS 1 km , VIIRS
375 m)
- LAI is downscaled to
30 m by the Data
Mining Sharpening
(DMS) tool using
visible (30 m) and LAI
at coarser scales
data.

Input data: ALEXI daily ET

Nile Delta Irrigation

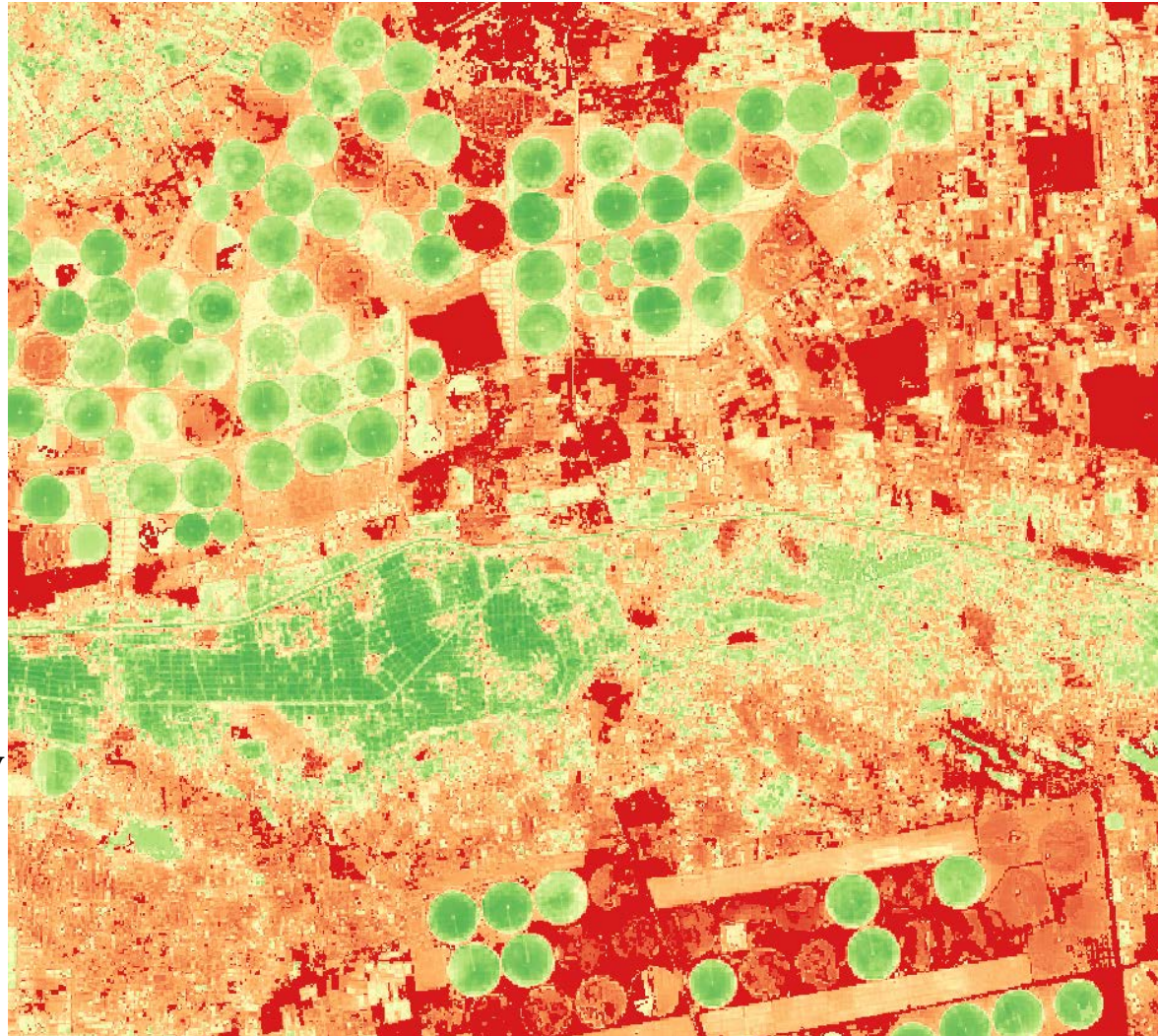


VIIRS daily ET mm/d

- Daily ET calculated at VIIRS 375 m data using the ALEXI model.

Initial results: Landsat daily ET

Nile Delta Irrigation



Landsat daily ET mm/d

- Landsat Daily ET downscaled from ALEXI using the PyDisALEXI model.

Conclusions

- Discussed previously developed models ALEXI and DisALEXI.
- PyDisALEXI will allow for more people to use DisALEXI and should be easily portable to apps/online portals.
- The higher resolution ET will allow for:
 - improved accounting of current water use and crop water productivity
 - Monitoring changes in water use with changing climate and land-use

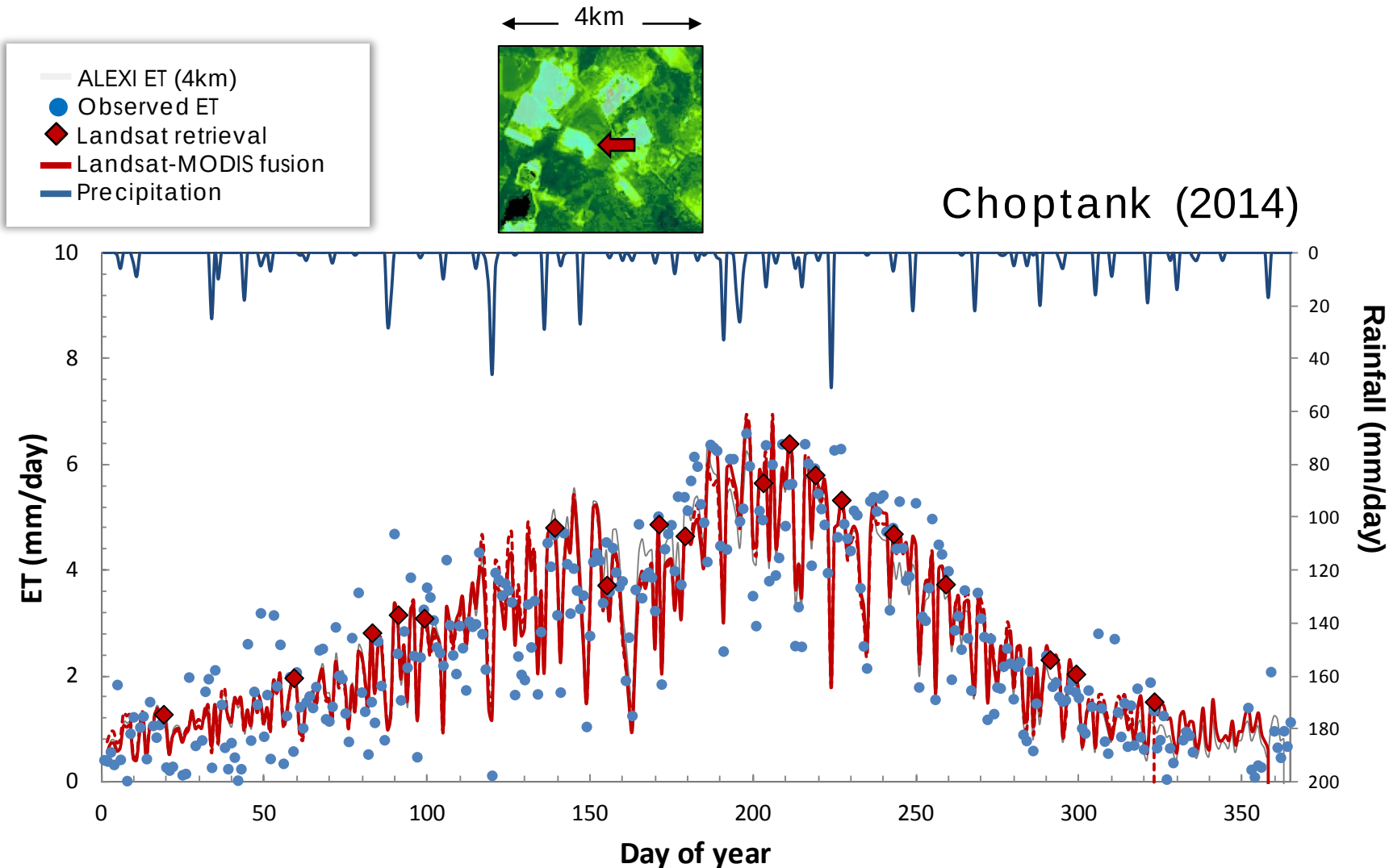
Questions

DisALEXI: Water use for irrigation

Gallo Vineyards, Lodi CA



DisALEXI: Downscaling example



Sun, L. et al. (2016). Monitoring daily evapotranspiration at field-scale over an agricultural landscape on the Eastern Shore of Maryland. *Remote Sens. Environ.*, in preparation