Improving ECOSTRESS Evapotranspiration Estimates Using Harmonized Landsat Sentinel-2 Imagery

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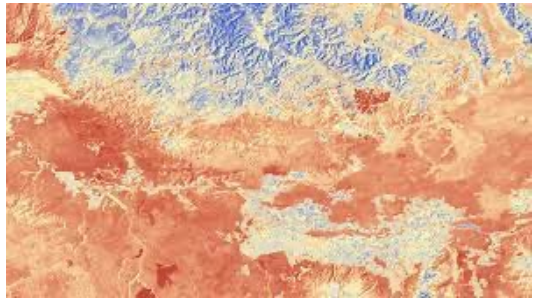
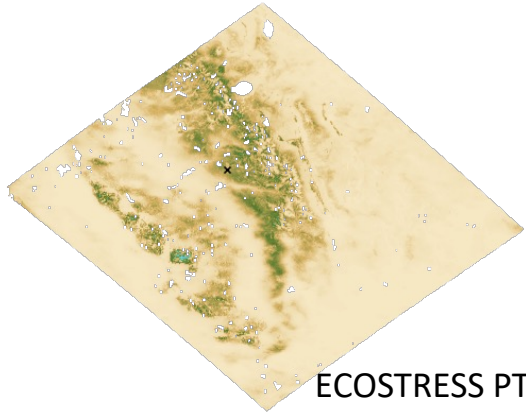
Background

- Emerging remote sensing-based evapotranspiration (ET) mapping
- **State-of-the-art**: ECOsystem Spaceborne Thermal Radiometer Experiment on Space Station (ECOSTRESS) mission
  - ECOSTRESS land surface temperature (LST) and emissivity
  - Priestley-Taylor Jet Propulsion Laboratory (PT-JPL) algorithm for estimating ECOSTRESS-based ET
- How can we improve accuracy, and spatial and temporal resolutions of ECOSTRESS-based ET estimates?

Image credit: NASA



ECOSTRESS LST



ECOSTRESS PT-JPL ET

Rationale

- Higher resolution optical remote sensing inputs
- Harmonized Landsat and Sentinel-2 (HLS)
  - Temporal resolution: 2–3 days
  - Spatial resolution: 30 m
- Understand sources of errors
- Ground observations from AmeriFlux network

AMERIFLUX

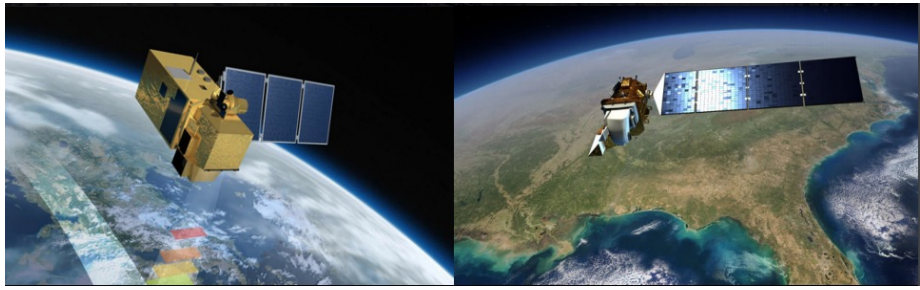
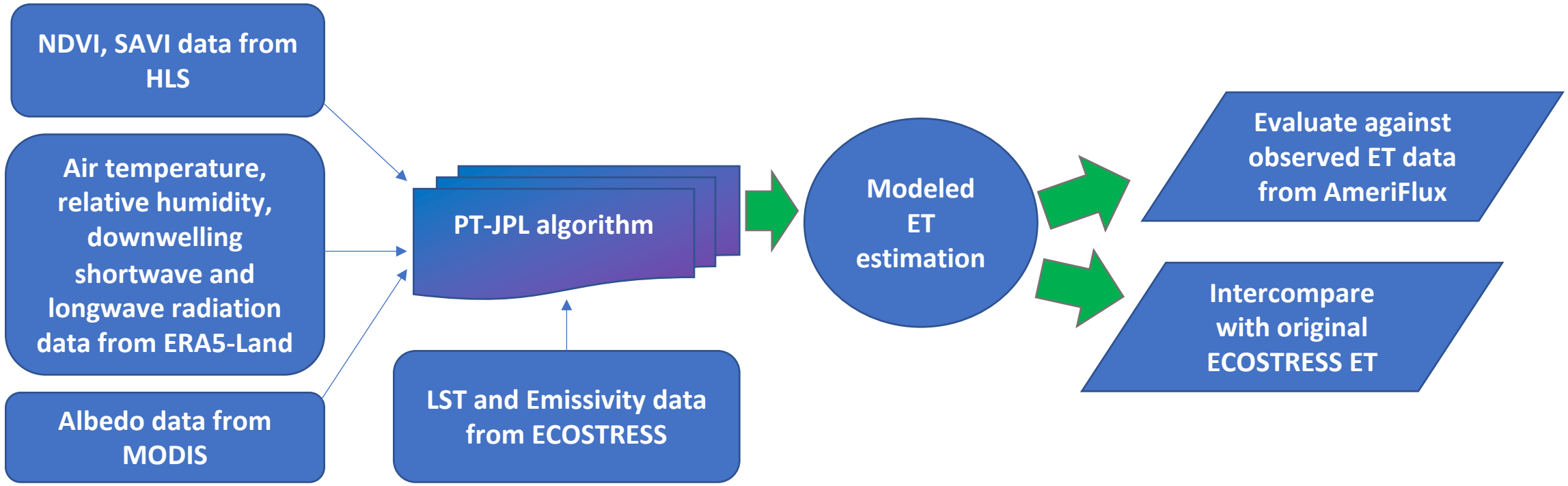


Image credit: ESA, NASA

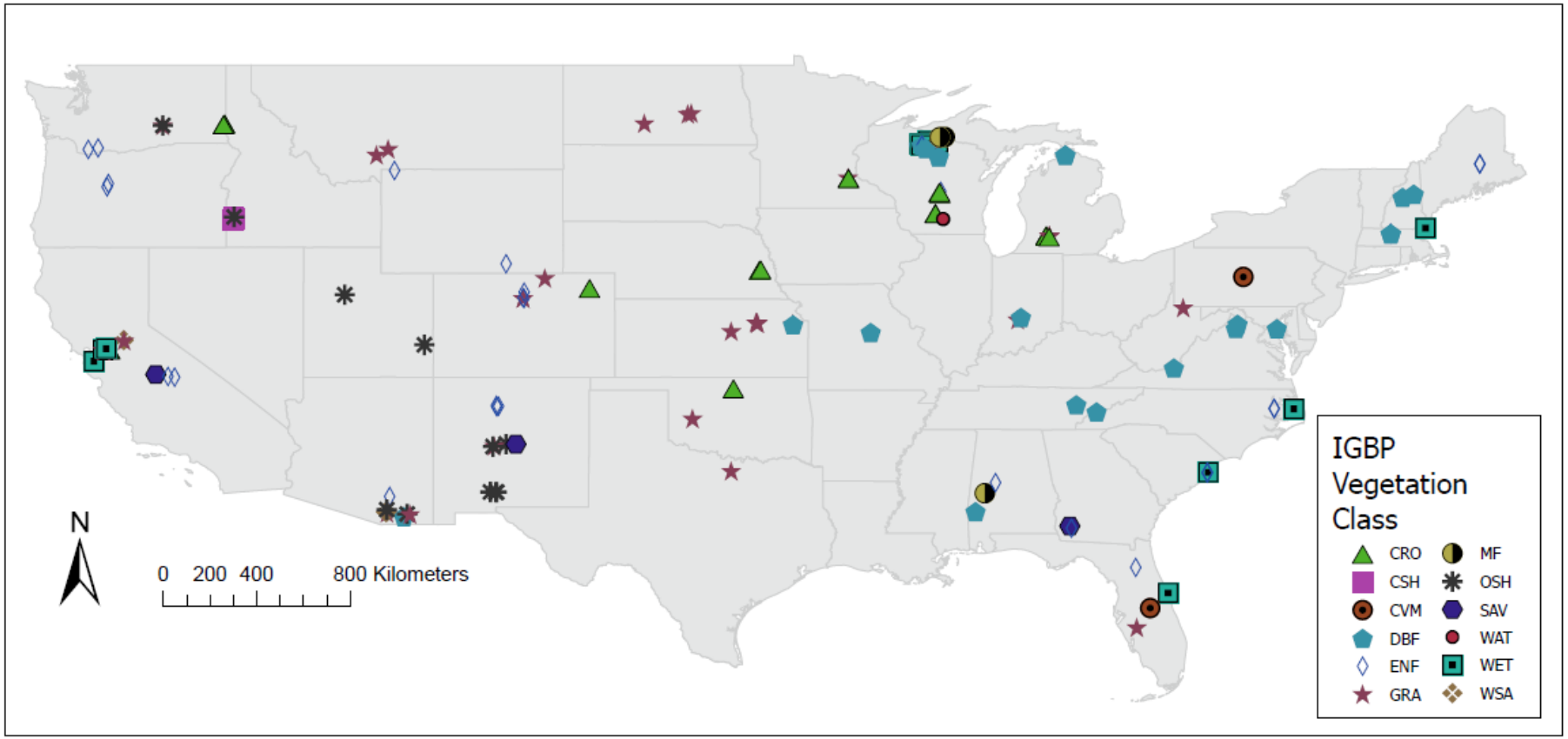
Objectives

- Develop and evaluate HLS-enhanced ECOSTRESS PT-JPL ET, and intercompare with the original ECOSTRESS PT-JPL ET
- Diagnose sources of errors contributing to the HLS-enhanced ECOSTRESS PT-JPL ET

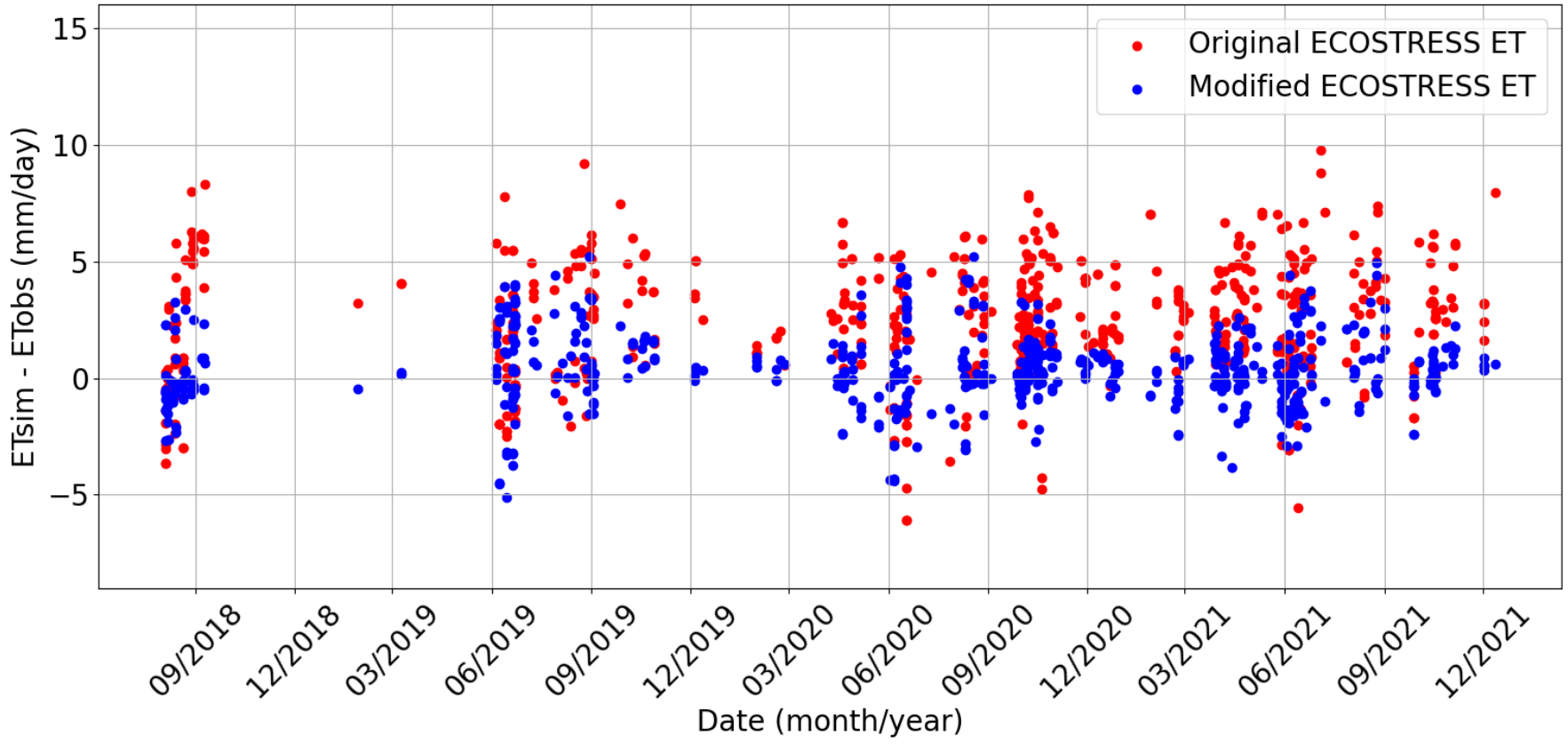
Diagram of Data and Method



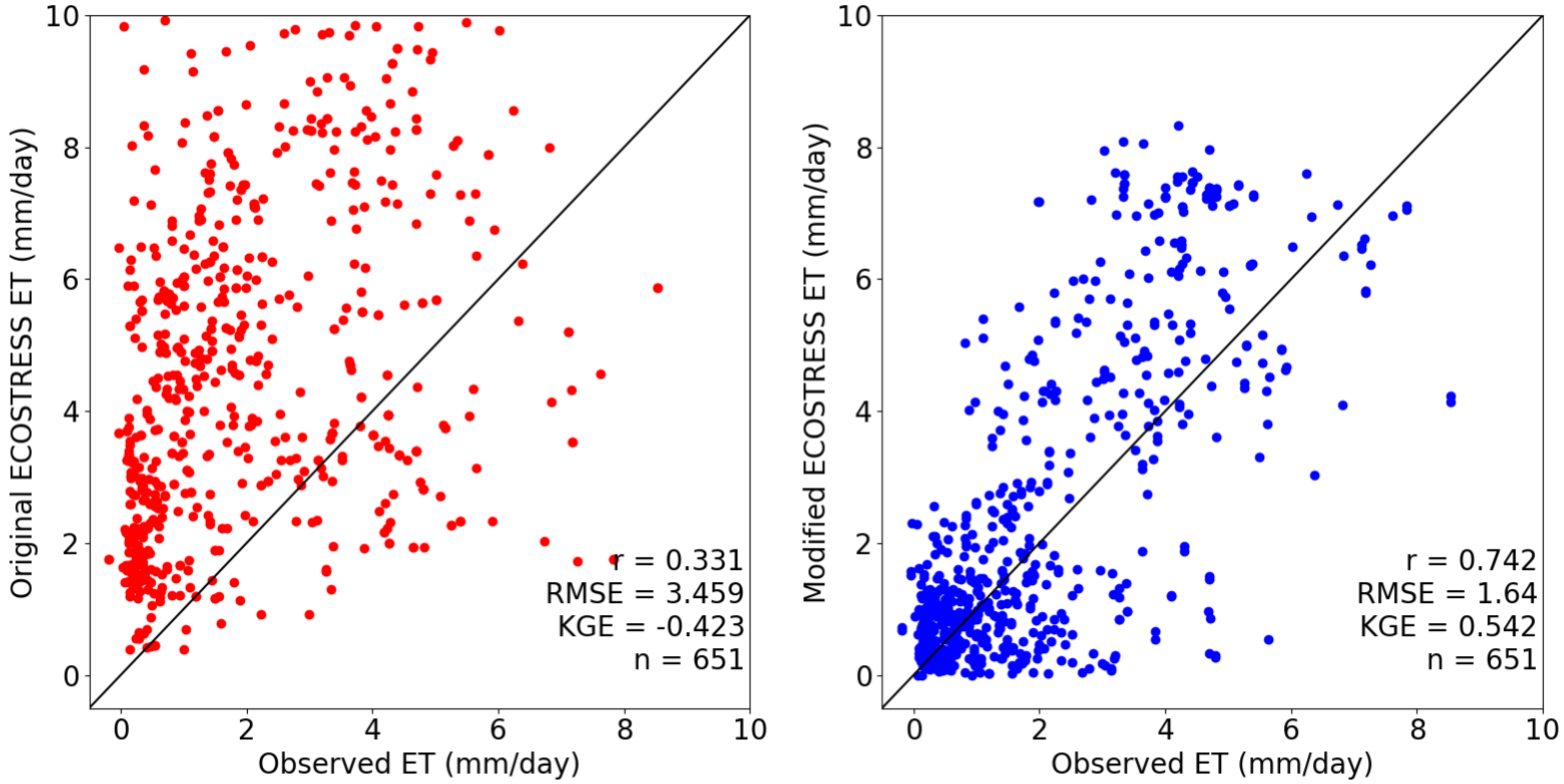
Selected 156 AmeriFlux Sites based on data availability



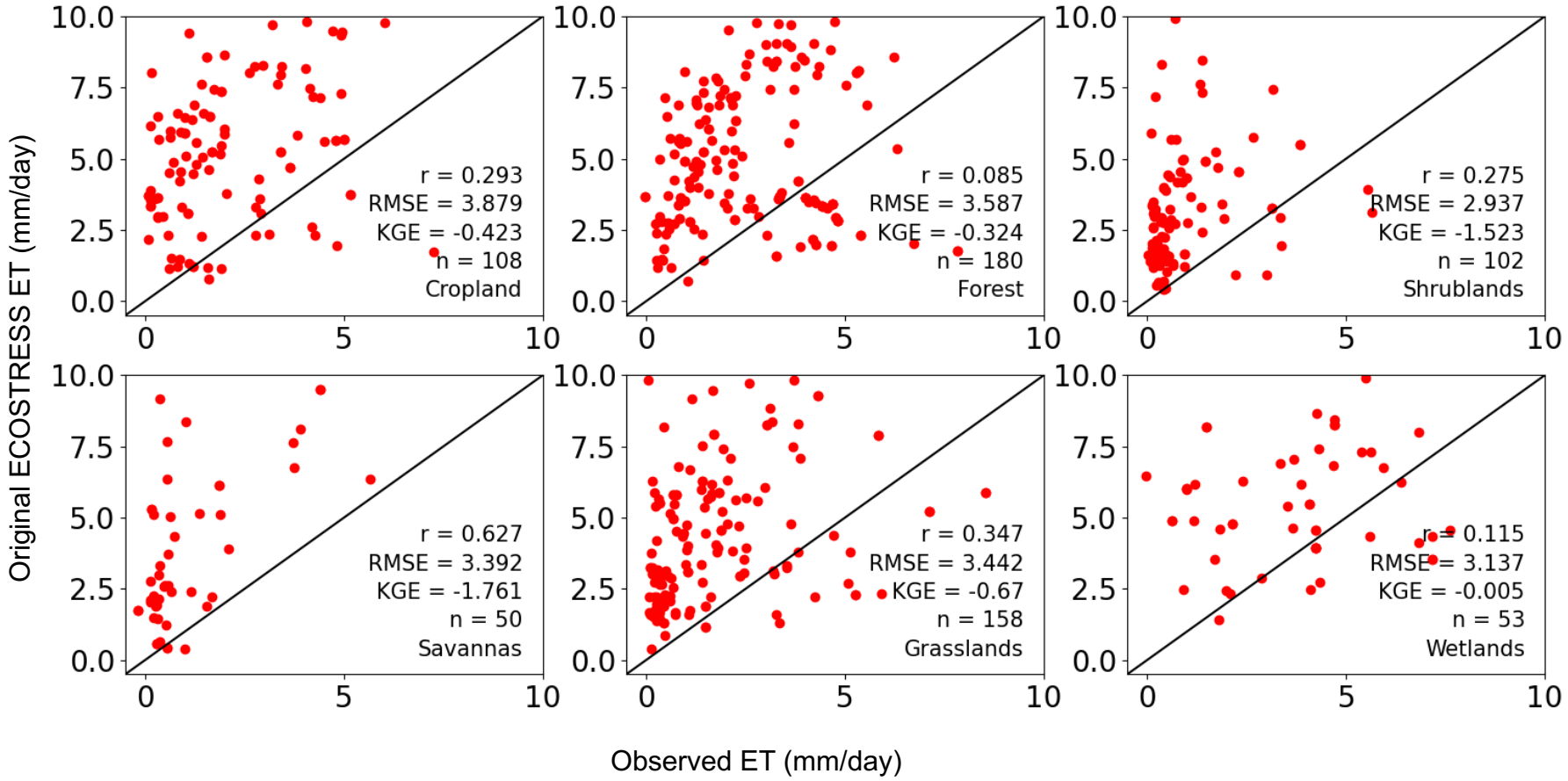
Differences Between Modeled ET and Observed ET



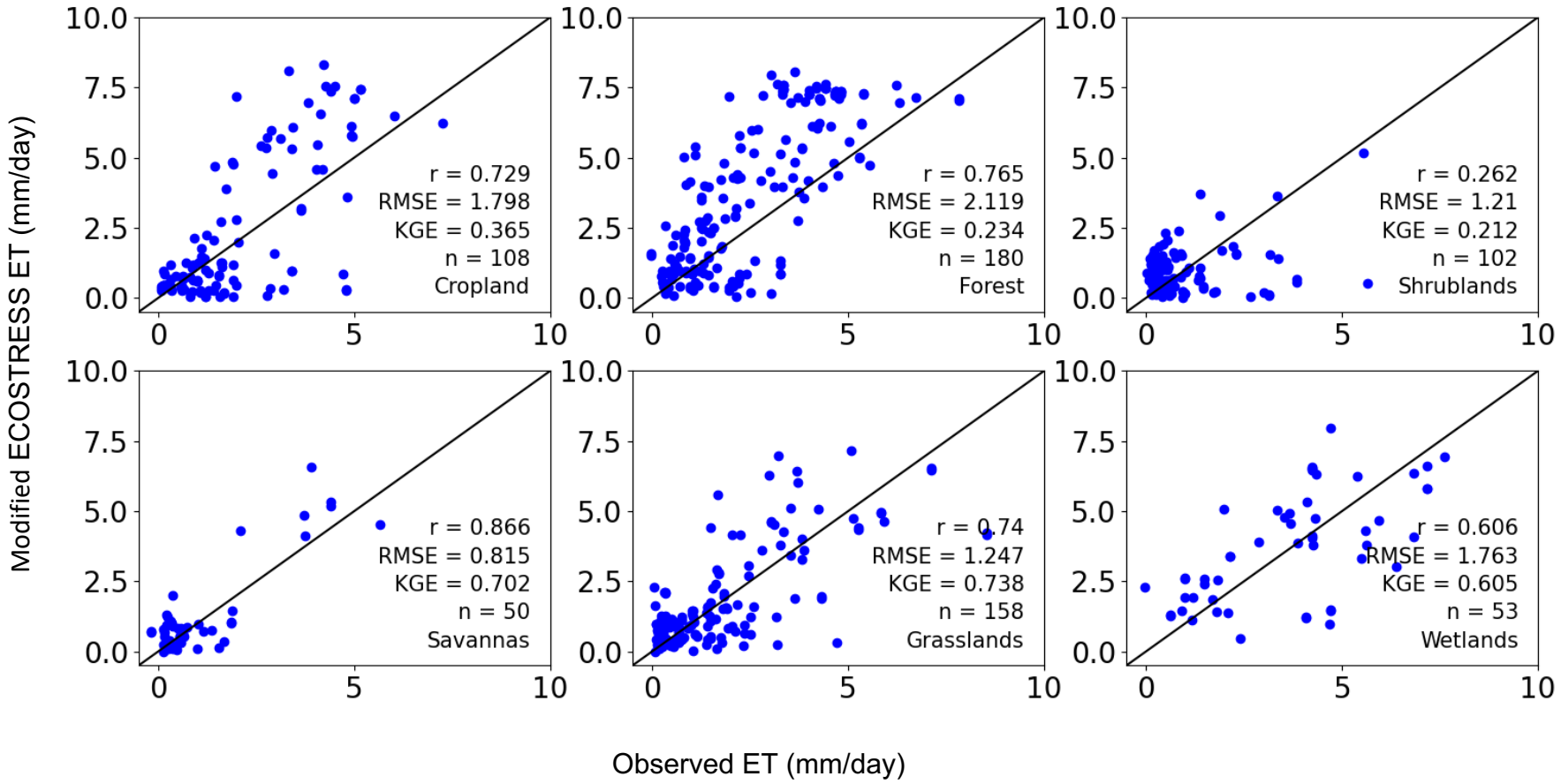
Correlations Between Modeled and Observed ET



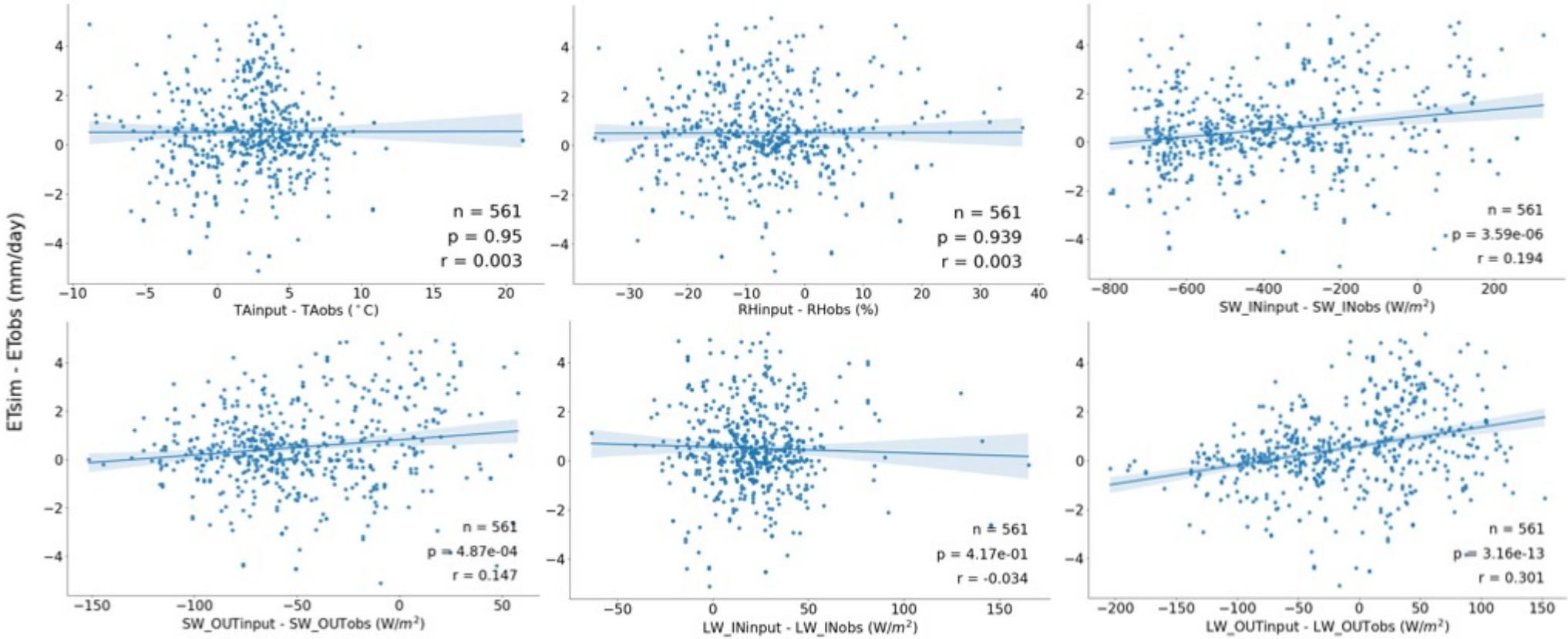
Correlation Between Modeled and Observed ET Grouped by Vegetation Classes: Original Product



Correlation Between Modeled and Observed ET Grouped by Vegetation Classes: HLS-based Product



Relationships Between Errors in ET and Errors in Input Variables



Conclusion and Discussion

- HLS-based PT-JPL model showed higher agreement with observed data at different conditions
- The highest improvement occurred in Savannas, followed by Grasslands, Cropland, Forest, Wetlands and Shrublands
- Errors of ET estimates are strongly associated with the errors of incoming and outgoing shortwave radiation, and outgoing longwave radiation inputs

Thank You!

Visit our lab website for more information:

https://aub.ie/ClimateAnalytics

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