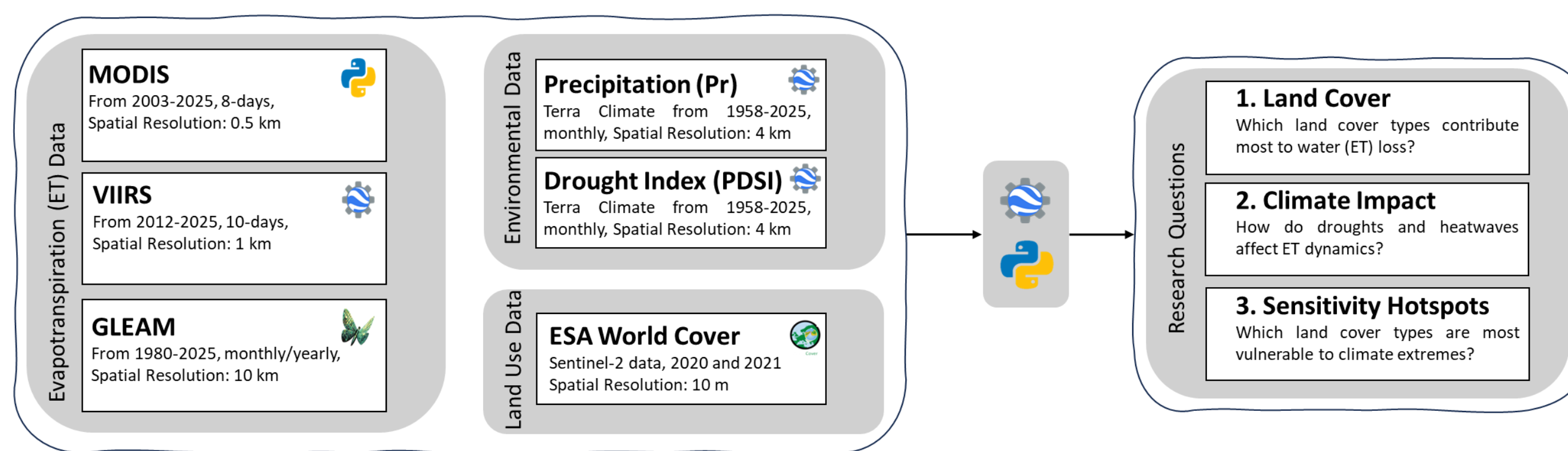




Introduction & Methodology

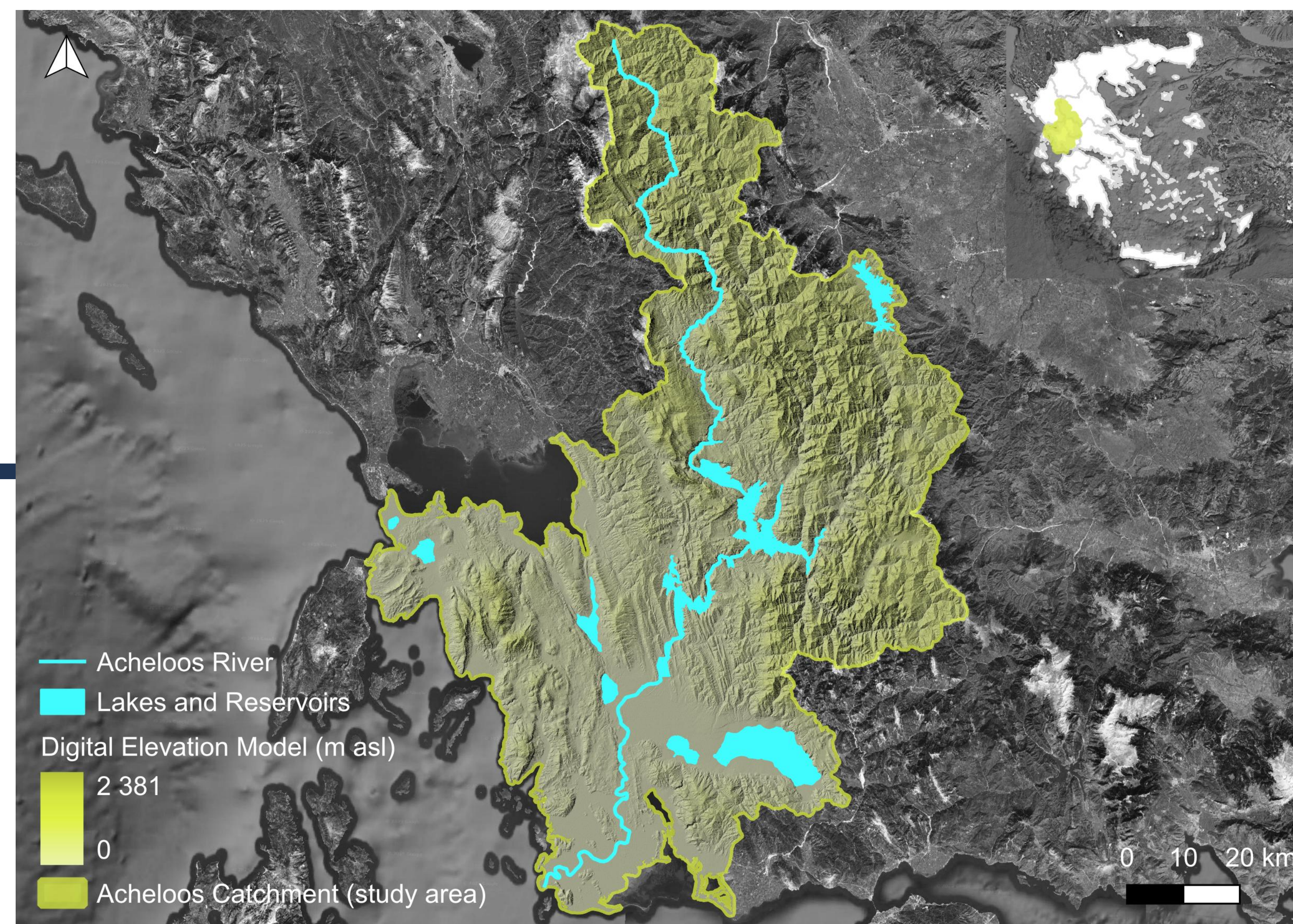
- Evapotranspiration (ET), the **largest water flux** through which water returns to the atmosphere in vapor form, plays a central role in the terrestrial water and energy cycles.
- In the **water-limited Mediterranean basin**, relatively small changes in green water fluxes (ET) affect **water resources** and overall **ecosystem functioning**.
- Sustainable water resources management in these regions therefore requires accurate spatiotemporal characterization of ET losses.
- Here, focusing on the Acheloos river basin, **we quantified the spatial variability of ET and its temporal dynamics at the seasonal, annual, and inter-annual time scales.**



Research Questions

We synthesized remotely sensed ET products together with auxiliary geospatial and environmental variables to address the following research questions:

- Which land cover contributes the most to the ET losses over the basin?
- How does ET variability relates to recent hydrometeorological extremes?
- What are the hotspots with the most sensitive land cover?



Study Area

The **Acheloos River basin** (7531 km²) one of the most important hydrological systems of Greece with regards to water supply (domestic and irrigation uses), hydropower, and ecosystem services, is a vital hydrological system in Western Greece, characterized by a complex topographic terrain and a ~220 km river corridor.

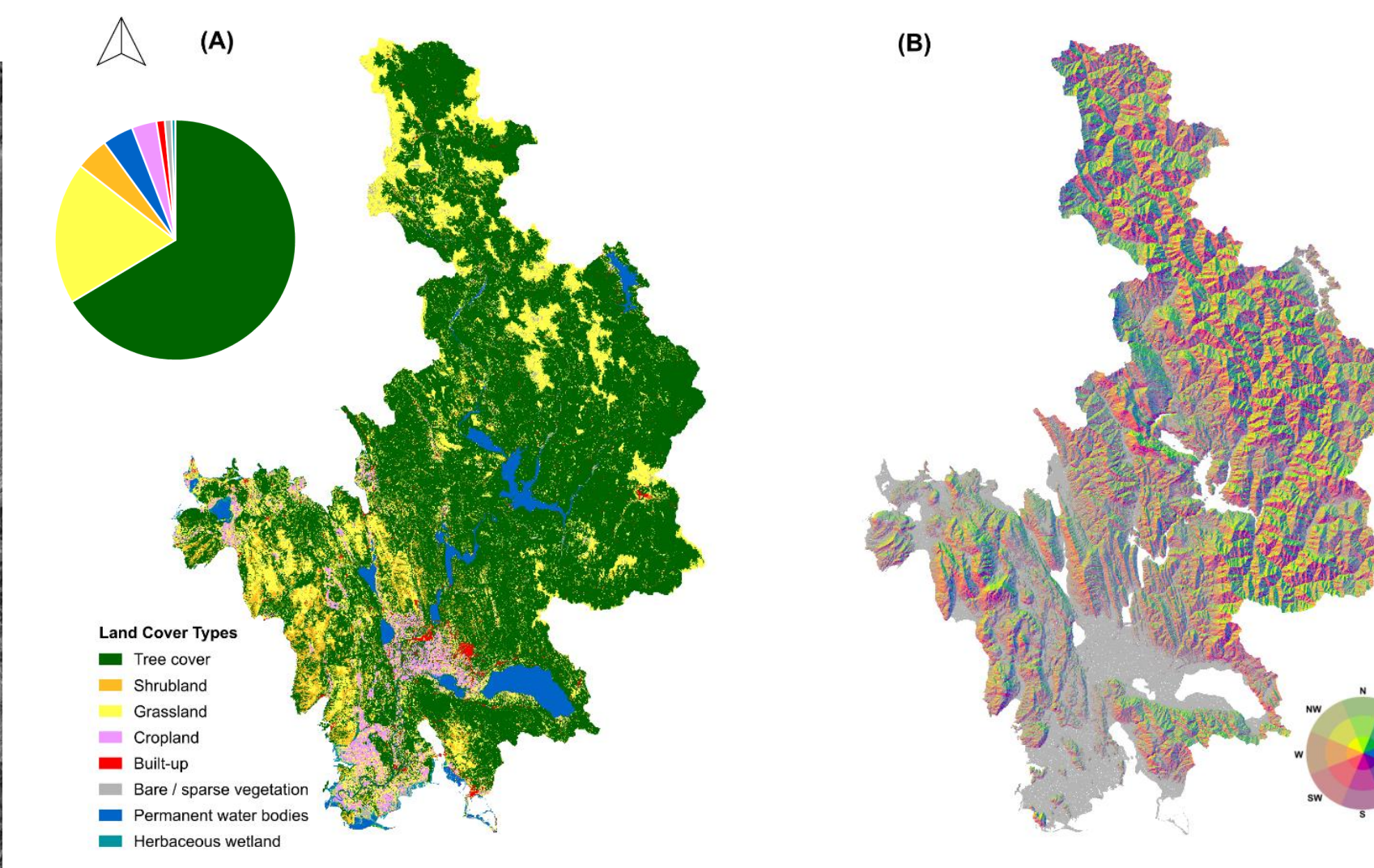


Figure (1). (A) Land cover distribution across the Acheloos catchment (10 m resolution; ESA WorldCover 2021 [1]). Tree cover is the dominant class, occupying 66 % of the basin, followed by grassland (19 %), Shrubland (4.4 %), and Cropland (3 %). (B) An overview of the topographic relief of the area, with slope and aspect being jointly illustrated, based on the analyzed Digital Elevation Model (30 m resolution; NASA Shuttle Radar Topography Mission [2]).

Spatial dynamics & cross-product uncertainties in ET

- A **distinct offset** is observed between the analyzed ET products: VIIRS reports higher mean values and greater spatial variability (836.6 ± 152 mm/yr) compared to the more conservative estimates of GLEAM (624.7 ± 118.5 mm/yr) and MODIS (572.5 ± 110.2 mm/yr).
- Long-term mean annual **precipitation** averages 939.1 ± 66.0 mm/year while the Palmer Drought Severity Index ranges in 0.037 ± 0.52 (mean \pm standard deviation).
- Tree covered areas display higher values ET in comparison to areas with lower vegetation** (i.e., grass-, shrub-, and crop-lands) and this pattern is consistent across the three analyzed ET datasets.

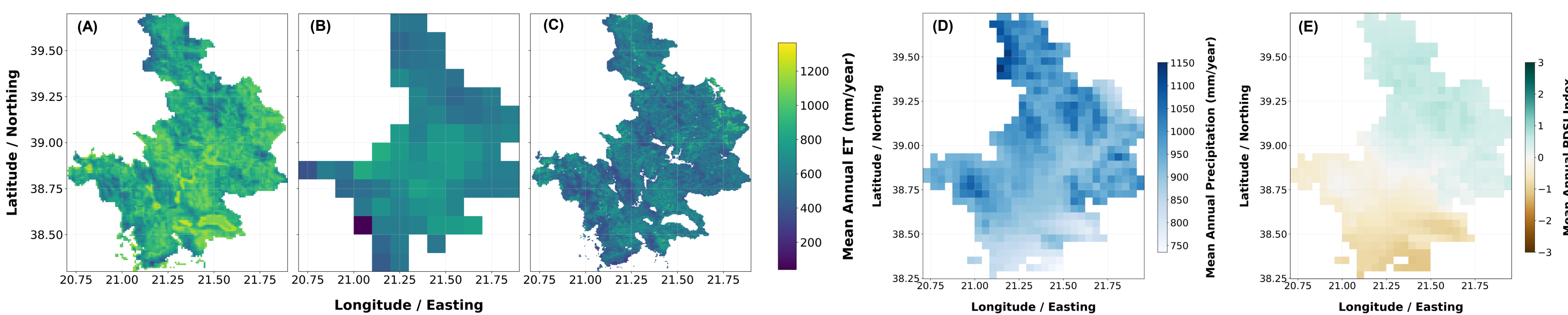


Figure (1). Spatial distribution of the long-term (2013-2024) mean annual hydroclimatic variables over the study area, i.e., mean annual Evapotranspiration (ET) as derived from (A) VIIRS [3], (B) GLEAM [4], and (C) MODIS [5] as well as (D) mean annual Precipitation (Pr) and (E) Palmer Drought Severity Index (PDSI), from the TerraClimate dataset [6], depicting the long-term hydro-meteorological conditions over the study area.

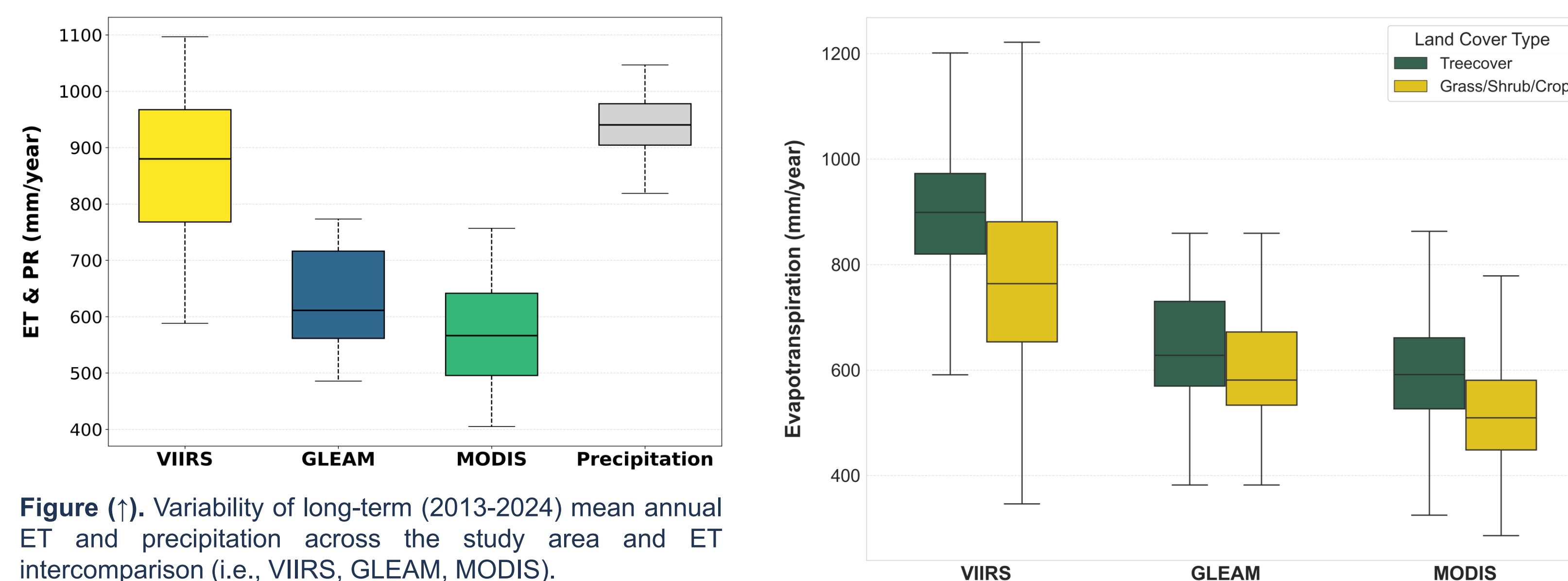


Figure (1). Variability of long-term (2013-2024) mean annual ET and precipitation across the study area and ET intercomparison (i.e., VIIRS, GLEAM, MODIS).

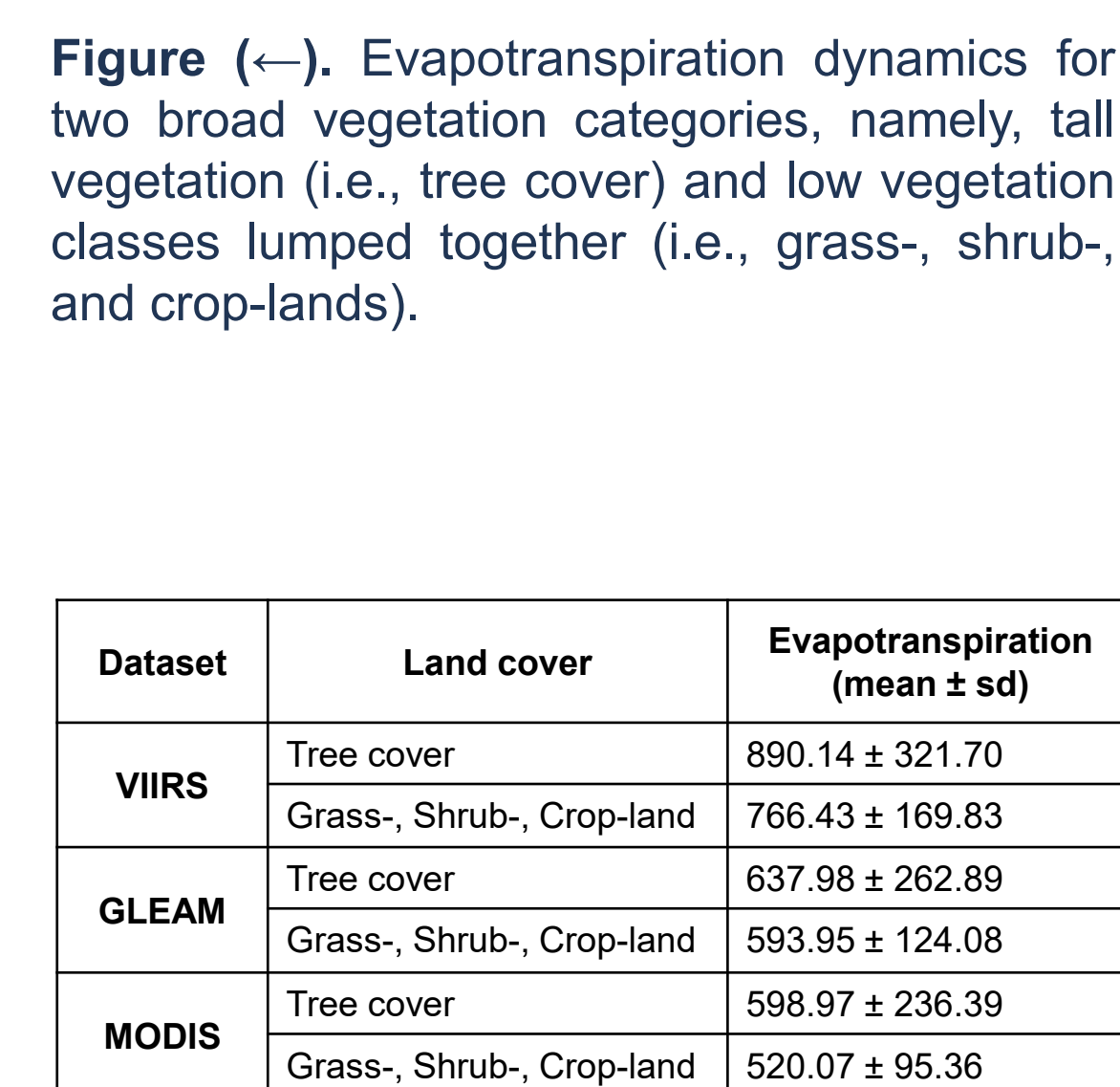
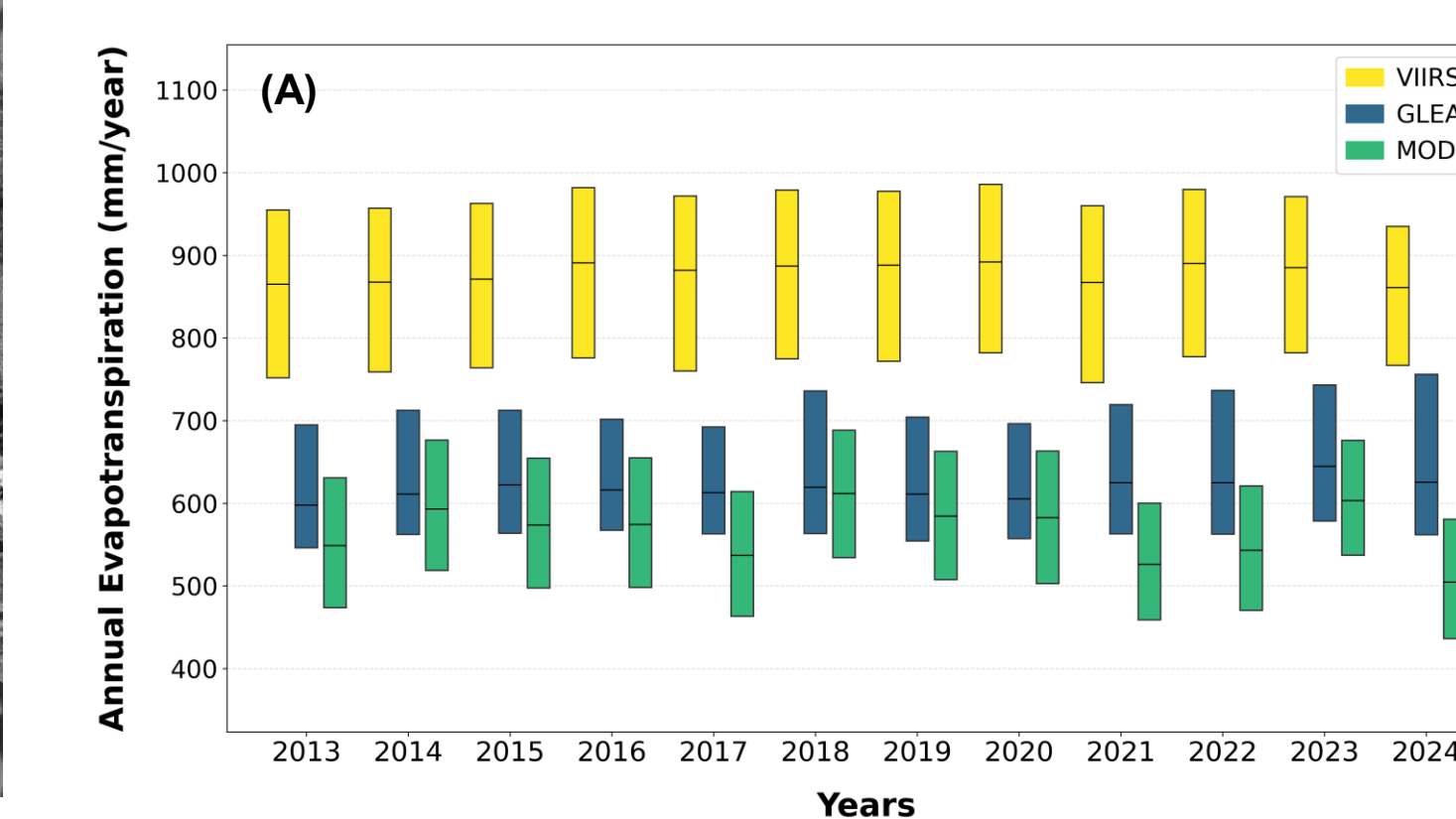


Figure (1). Evapotranspiration dynamics for two broad vegetation categories, namely, tall vegetation (i.e., tree cover) and low vegetation classes lumped together (i.e., grass-, shrub-, and crop-lands).

Dataset	Land cover	Evapotranspiration (mean \pm sd)
VIIRS	Tree cover	890.14 \pm 321.70
	Grass-, Shrub-, Crop-land	766.43 \pm 169.83
GLEAM	Tree cover	637.98 \pm 262.89
	Grass-, Shrub-, Crop-land	593.95 \pm 124.08
MODIS	Tree cover	598.97 \pm 236.39
	Grass-, Shrub-, Crop-land	520.07 \pm 95.36

Temporal dynamics at the annual & seasonal time scales



- Evapotranspiration fluxes display pronounced **seasonality**, typical in Mediterranean climates, with peak values occurring during summer months.
- Green water fluxes from **tall vegetation** during the growing season are higher than the contribution from **lower vegetation**, a pattern that is consistent across all three analyzed ET datasets

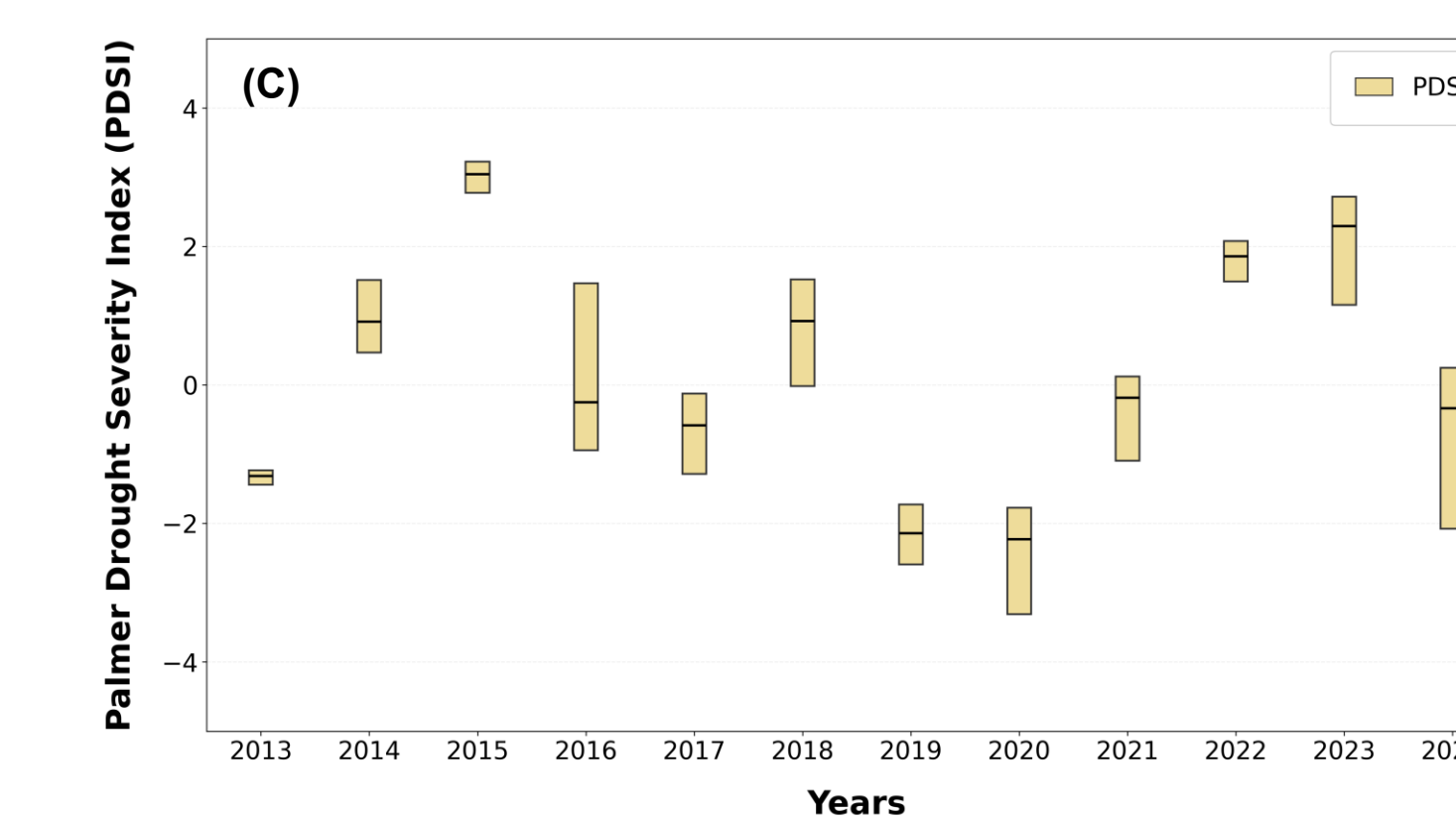
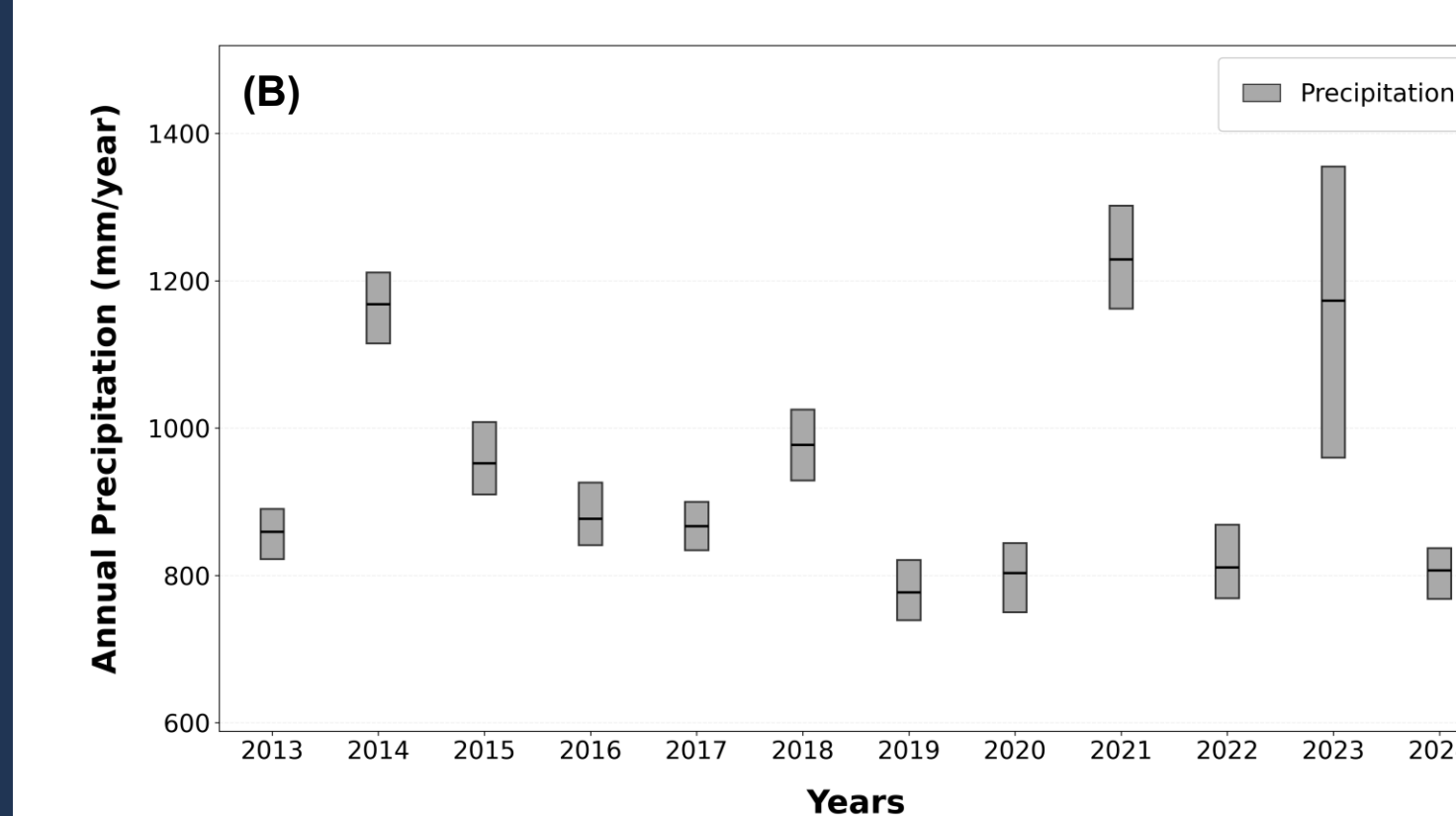


Figure (1). Interannual variability of the main water balance components, i.e., (A) evapotranspiration fluxes based on the three analyzed datasets (VIIRS, GLEAM, and MODIS), and (B) total precipitation, as well as (C) the Palmer Drought Severity Index over the Acheloos river basin from 2013 to 2024. Mean values and the 25th and 75th percentiles are illustrated.

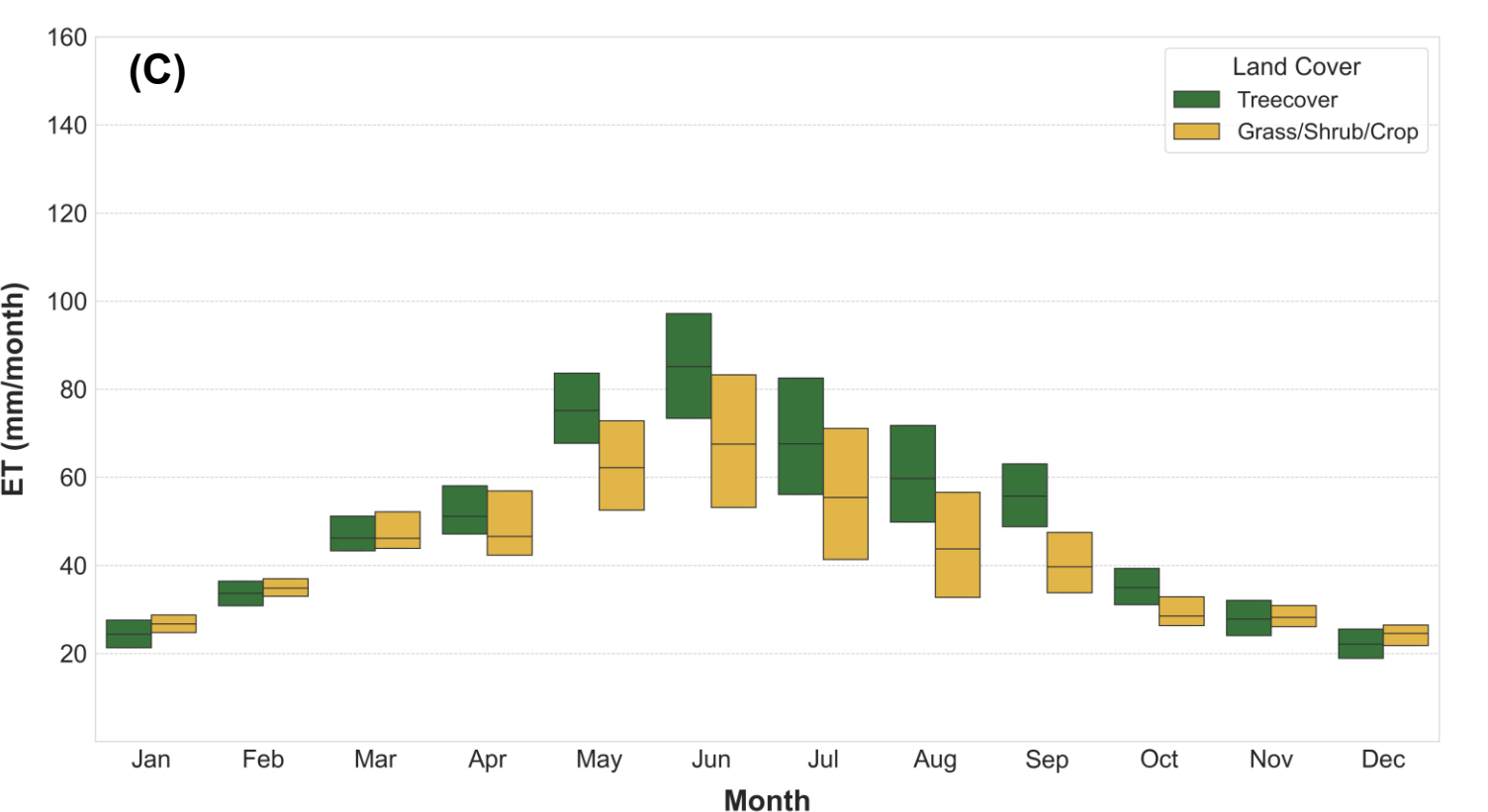
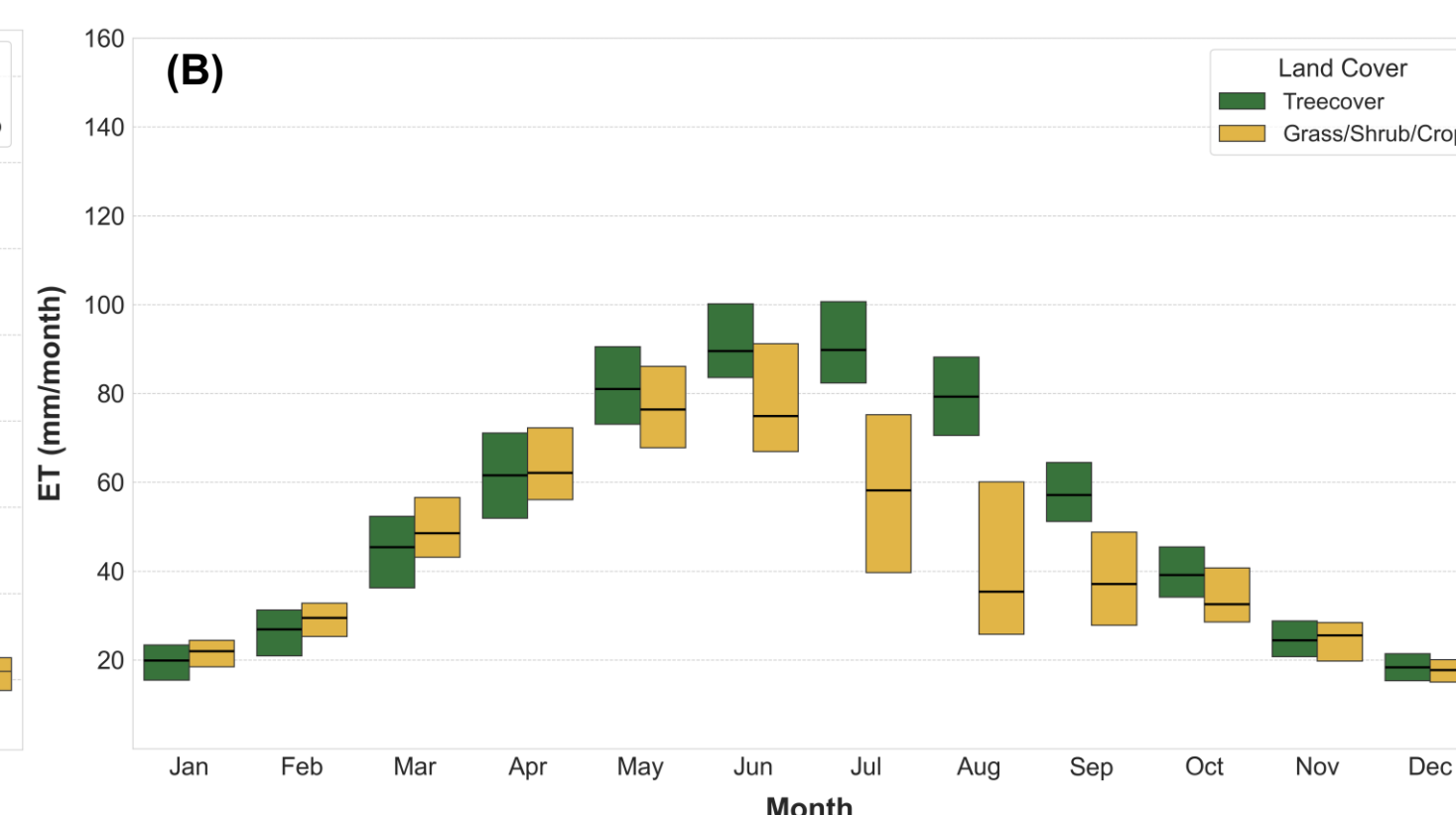
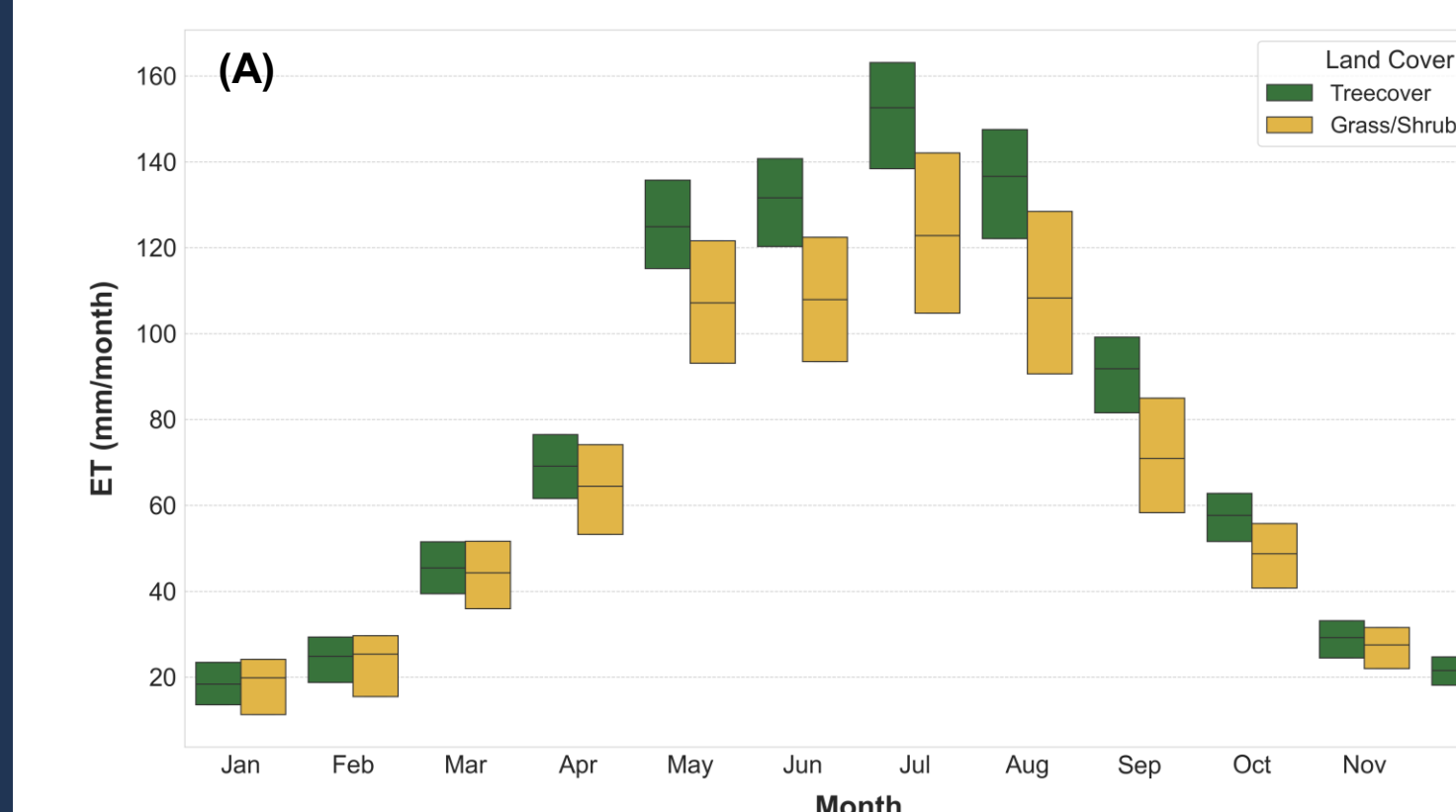


Figure (1). Seasonal dynamics of evapotranspiration fluxes across the study area, grouped based on two broad vegetation categories, i.e., tall vegetation (tree cover) and low vegetation (i.e., grass-, shrub-, and crop-lands) as estimated from the (A) VIIRS, (B) GLEAM and (C) MODIS datasets.

Bibliography

- [1] ESA WorldCover 10 m 2020 v100. European Space Agency, 2021. [2] Shuttle Radar Topography Mission (SRTM) Global 1 arc second V003. [3] USGS, VIIRS Evapotranspiration (Experimental Product). [4] Global land-surface evaporation estimated from satellite-based observations, HESS. [5] MOD16A2 MODIS/Terra Net Evapotranspiration 8-Day L4 Global 500m SIN Grid V006. [6] TerraClimate, a high-resolution global dataset of monthly climate and climatic water balance from 1958-2015, Sci. Data

Acknowledgements

This work was supported by the project 'Enhancing Forest Monitoring Infrastructure in the Mediterranean region for long-term climate-change impact assessment', funded by the European Forest Institute (G-06-2024-1)

