TACTIC

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Influence of scale in water resources management for heterogeneous semiarid rangelands.

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Why?

Semiarid rangelands (grasslands with scattered trees and shrubs) are a mosaic of land uses, Livestock is the main economic activity, but agriculture or conservational uses are also crucial.

They are highly controlled by the availability of water. Although the vegetation is adapted to variable climatic conditions and dry periods, the increase in drought intensity, duration, and frequency, the changes in agricultural practices, and other socioeconomic and environmental factors precipitate their degradation.

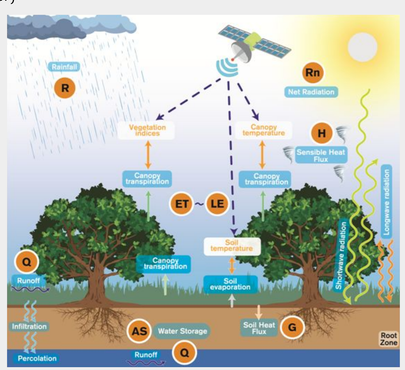
The combined differential functioning and characteristics of the vegetation components and communities affect water dynamics, resulting in high spatiotemporal variability that creates distinct patches. The precision, resolution, and accuracy of the information required for water management differ according to the scales: from the local to the basin.

We want to assess the optimal spatiotemporal scale when monitoring semiarid mosaic vegetation cover and its water consumption.

How?

We evaluated the **water use patterns** of the typical vegetation patches (**tree + grass savanna, grassland, crop area, and creek shore**) estimated by different modeling approaches integrating remote sensed data (MODIS, Landsat, Sentinel 2) with different spatial resolutions (sr):

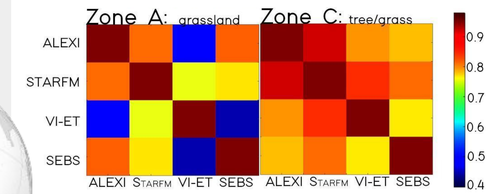
1. In a semiarid savanna from **Spain** (Andreu et al., 2023 [1]): 1) SEBS [2] sr: 5km, 2) ALEXI-disALEXI [3] sr: 1km, 3) STARFM [4] sr: 30m, and 4) Kc-FAO56 [5] sr: 30m.
2. In a semiarid savanna from **South Africa** (Andreu et al., 2019 [6]): 1) TSEB [7] sr: 1km, and 2) a first attempt with Kc-FAO with Sentinel 2, sr: 10m. In this last case, there are too many gaps and we need yet to fill them with MODIS/Landsat.



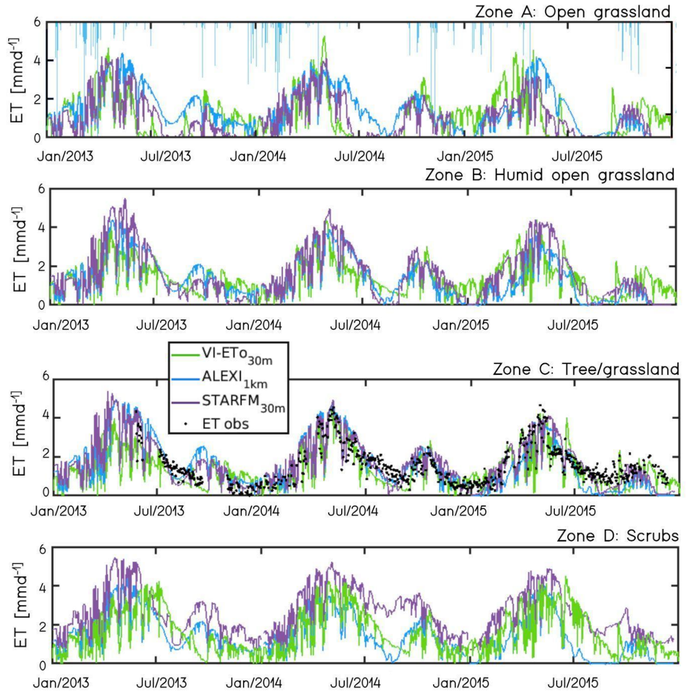
Water Balance
R = ET + Q + AS

Energy Balance
R = LE + H +G

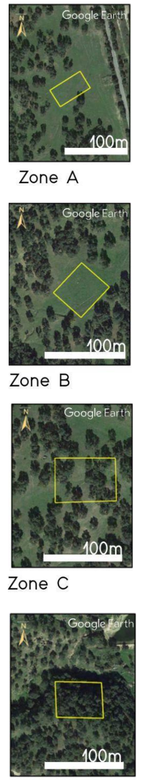
Results

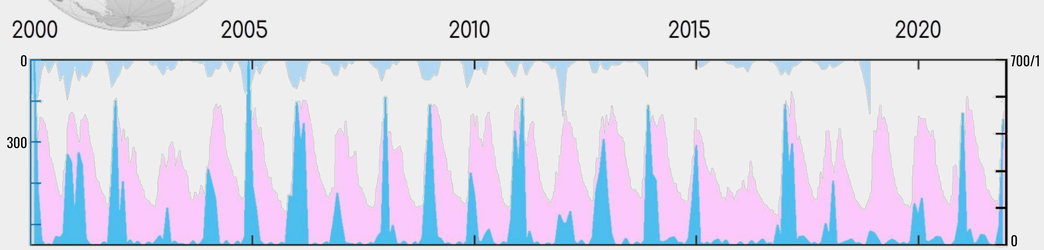


Model correlation for Zone C: tree + grass and Zone A: Open grassland.



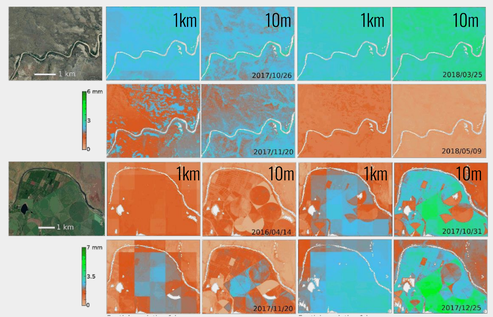
Daily ET estimated for all zones (A, B, C, and D) using VI-ETo (30 m), DisALEXI (1 km), and STARFM (30 m) models. In Zone C, daily ET measured by the ECT-1 is plotted (ET observations are the black dots). Aerial image from © Google Maps.





Latent Heat Flux computed with TSEB using MODIS (1 km)

Spatial resolution of ET with TSEB [km] and Kc-FAO56 [m]. Aerial image by © Google



Conclusions

1. **Low resolution** is sufficient for management at the basin level, e.g., **drought** periods.
2. **Higher resolution** allows to identify areas with different water storage capacities or vegetation growth.
   For **livestock management**: support grazing rotations, delimitation of vulnerable areas containing.
3. **Combining models** with conceptual and operational differences may improve the outcomes.

[1] [2] [3] [4] [5] [6] [7]