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# Sensitivity of a satellite-derived drought index under soil moisture-limited vs. energy-limited evapotranspiration

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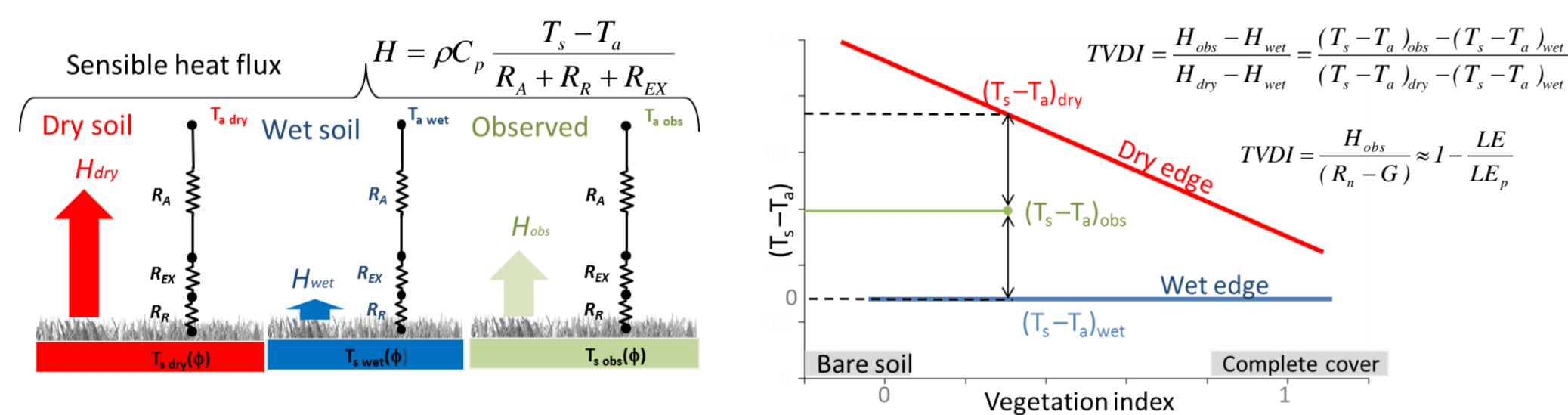
## Introduction

**Soil moisture** is a critical control of **evapotranspiration** or latent heat flux (LE) in dryland areas which cover 40% of the Earth. However, these areas also undergo periods of radiation-controlled evapotranspiration which compromises some satellite approaches estimating LE with surface temperature.

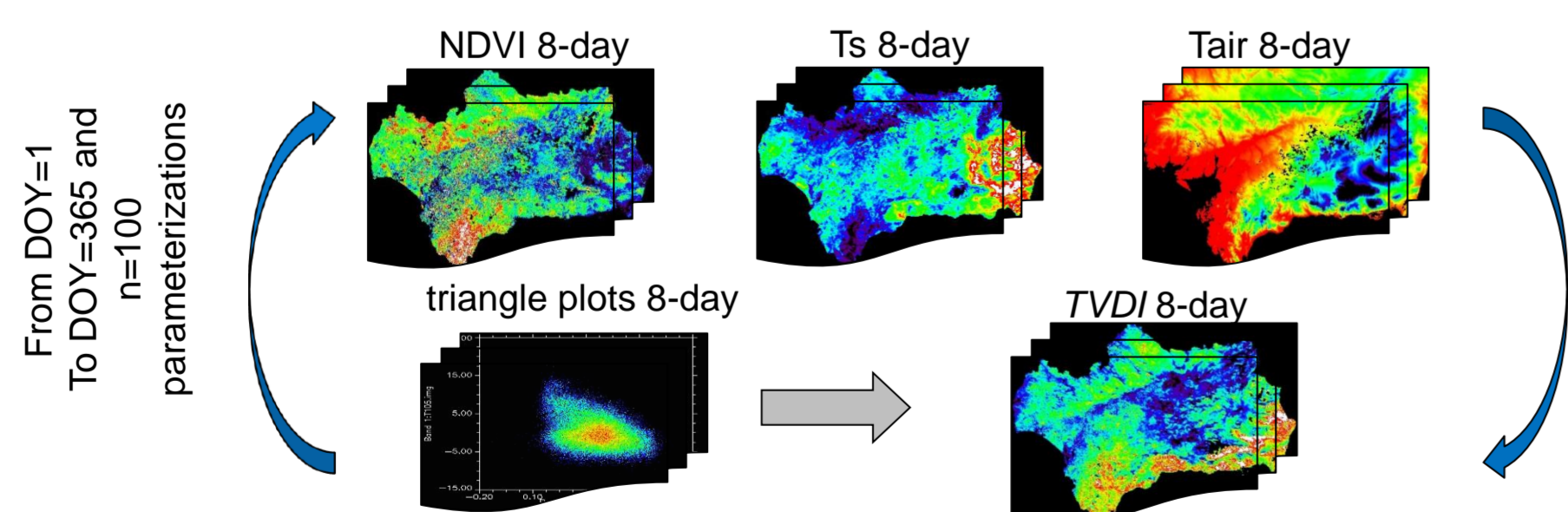
We tested the use of the **Temperature Vegetation Dryness Index (TVDI)** from Sandholt et al. (2002) to estimate the ratio of actual/potential LE using **MODIS 8-day satellite** data. We established the conditions for operational application in large regions with bioclimatic gradients and the accuracy of the method.

## Methodology

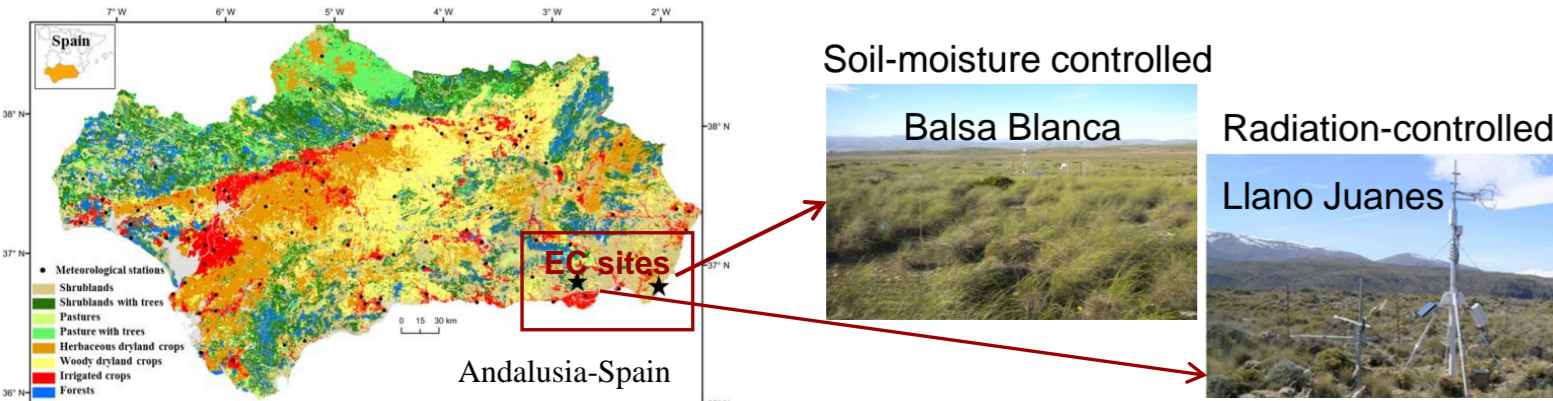
**1. Regional estimates of TVDI** from triangle plots of radiometric temperature ( $T_s$ ) minus air temperature ( $T_{air}$ ) vs. **NDVI**. It **requires wet** and **dry** areas in each image and homogeneous climatic conditions in the region.



Input data: MODIS-Terra, meteorological station data in 2008



**2. Flux data** from Eddy Covariance sites for validation of the TVDI



## Objectives

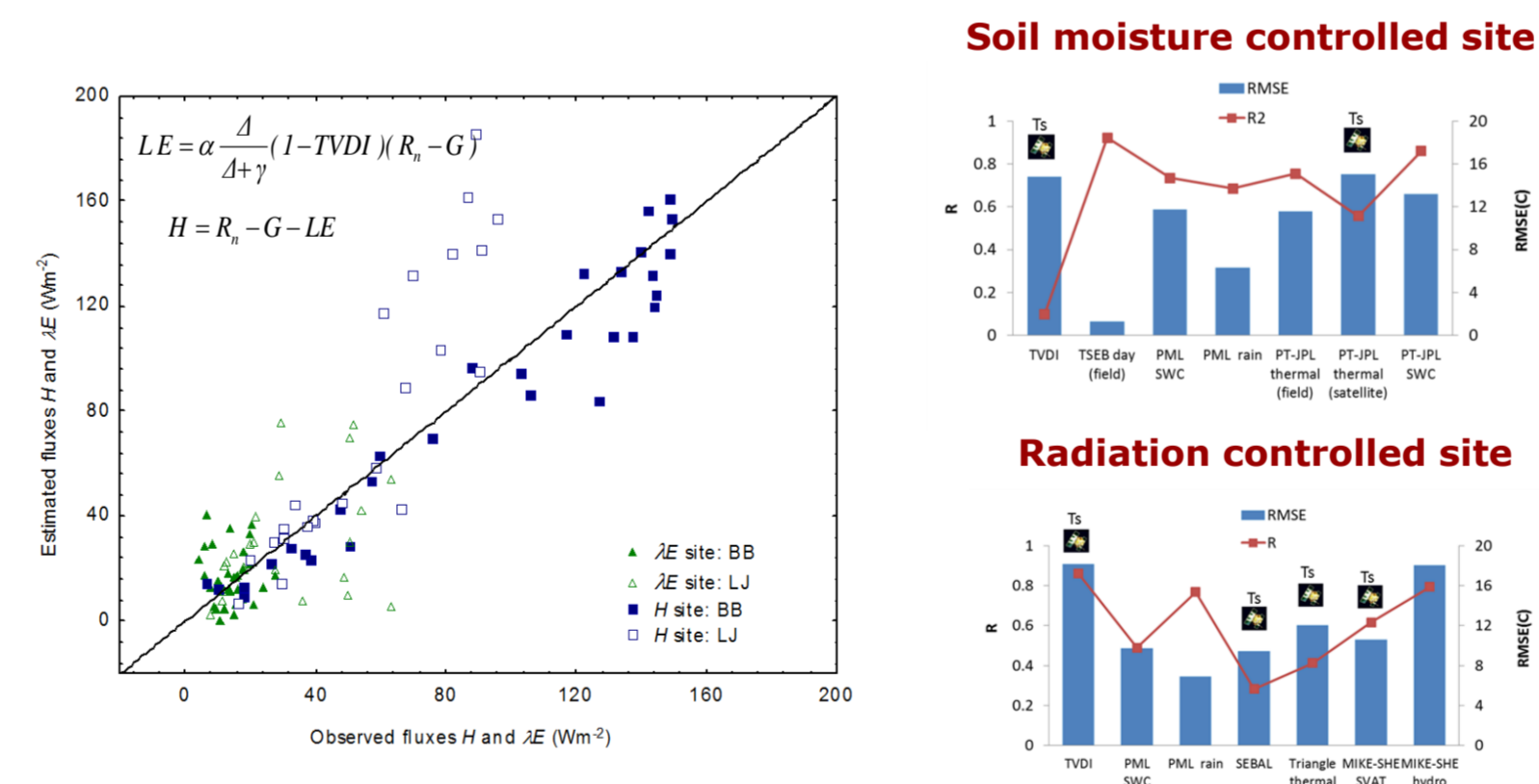
- a) **Validate** surface energy fluxes derived from the TVDI at sites with different evapotranspiration controls and compare with alternative methods.
- b) Assess the role of **spatial heterogeneity** of climatic variables on TVDI errors.
- c) **Sensitivity** of the TVDI to parameterizations for (i) Tair inputs, (ii) land cover types and (iii) algorithm determining hydrological boundaries

## Conclusion

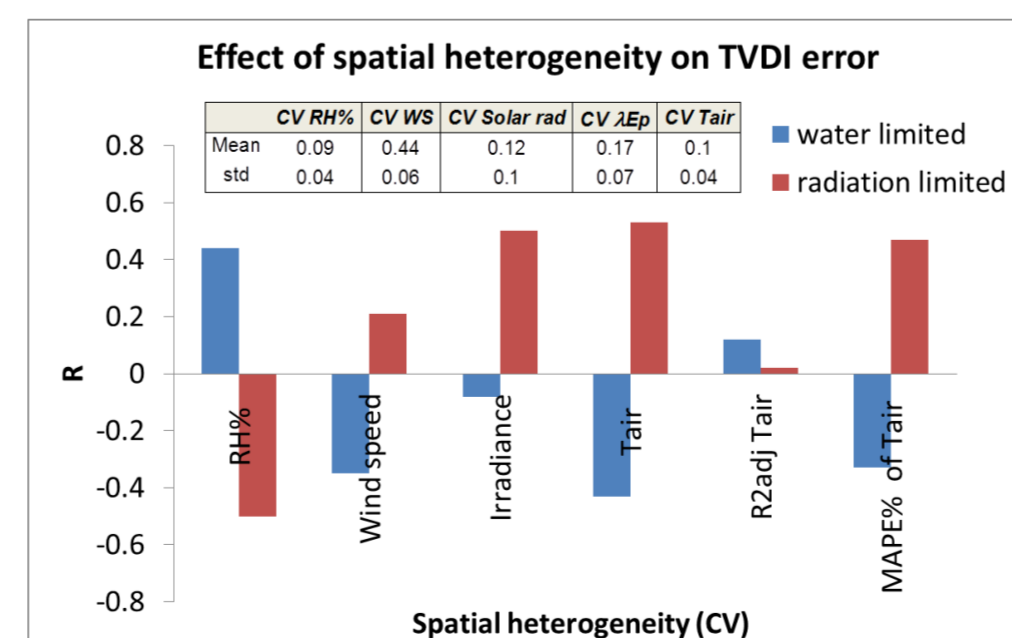
- a) **Validation:** TVDI was reliable to estimate latent and sensible heat fluxes only under *soil moisture-controlled evapotranspiration* conditions
- b) **The effect of spatial heterogeneity in climatic variables depends also on LE controls.** Under energy-controlled LE, TVDI errors were related with radiation spatial heterogeneity. In soil moisture-controlled LE, errors were related with water vapor, while radiation was not significant.
- c) TVDI accuracy was highly **sensitive** to the quality of Tair inputs and the algorithm used to extract hydrological boundaries.

## Results

a) **Validation of surface fluxes** from TVDI at two field sites with Eddy Covariance data

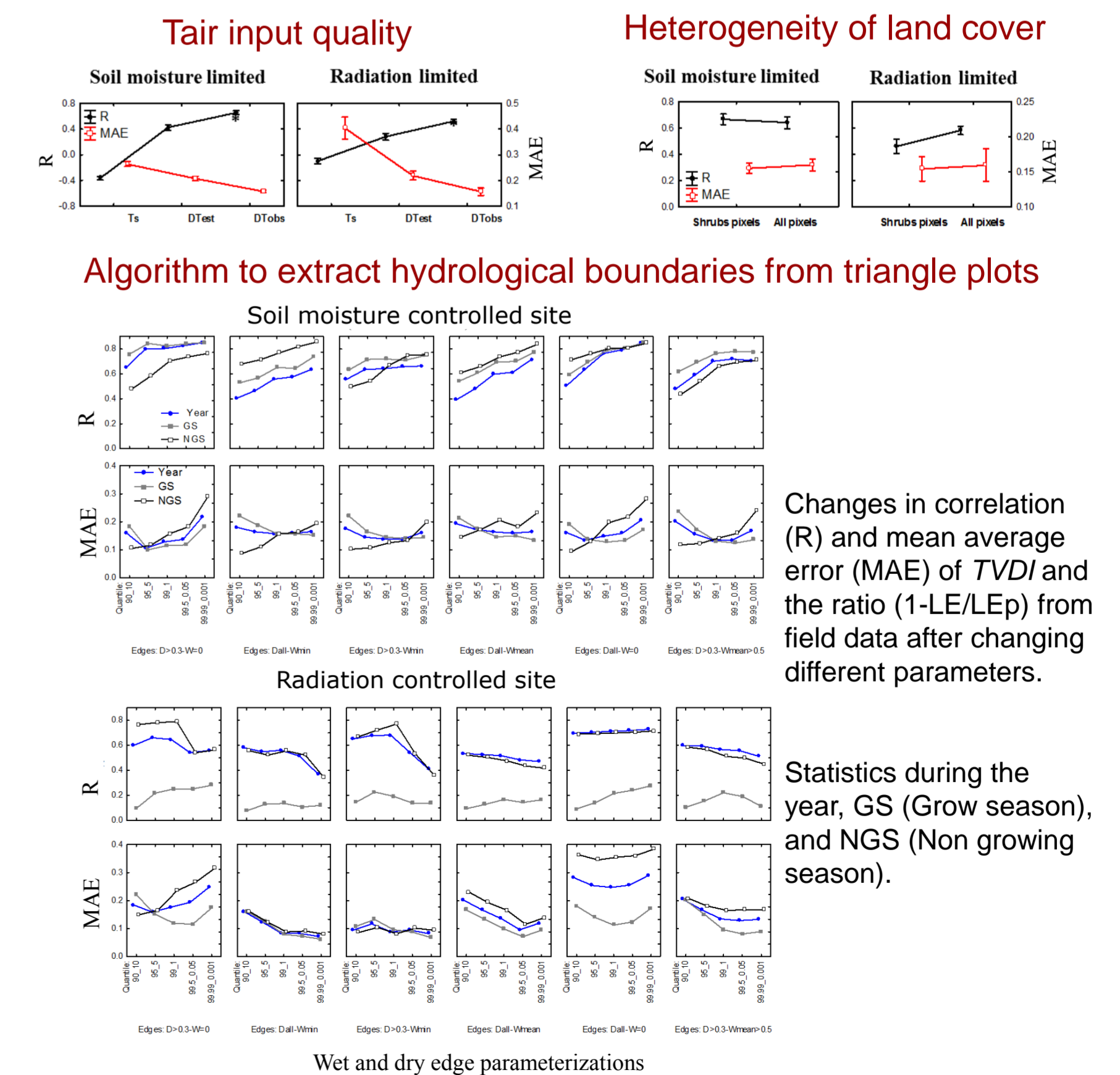


b) **Role of spatial heterogeneity of climatic variables in Andalusia region on TVDI accuracy**



Correlation of TVDI errors with spatial CV of climatic variables in the region indicates an effect of spatial heterogeneity. E.g. the TVDI errors are not affected by spatial gradients in wind speed (WS) in water limited conditions.

c) **Sensitivity analysis of the TVDI to parameterizations**



Changes in correlation (R) and mean average error (MAE) of TVDI and the ratio (1-LE/LEp) from field data after changing different parameters.

Statistics during the year, GS (Grow season), and NGS (Non growing season).

References in: [Garcia, et al., 2014, Remote Sensing of Environment, Volume 149, 100-117](#)

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