Downscaling of remote sensing time series: thermal zone classification approach in Gironde region

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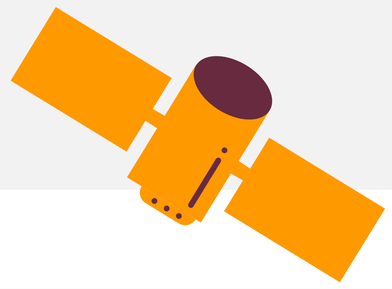


Introduction

Challenges of local climate modelling are multiple:

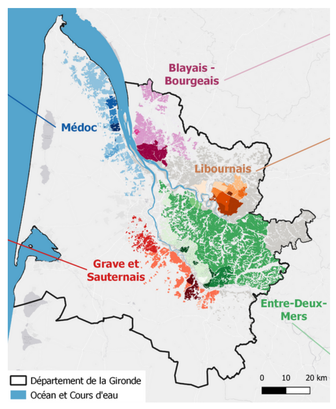
- taking into account the local environment,
- fine temporal and spatial scales,
- reliable time series of climate data,
- ease of implementation and reproducibility of the method.

At the local scale, recent studies have demonstrated the **contribution of spatialization methods for ground-based climate observation data considering topographic factors** such as altitude, slope, aspect, and geographic coordinates (Le Roux et al, 2017; De Rességuier et al, 2020).

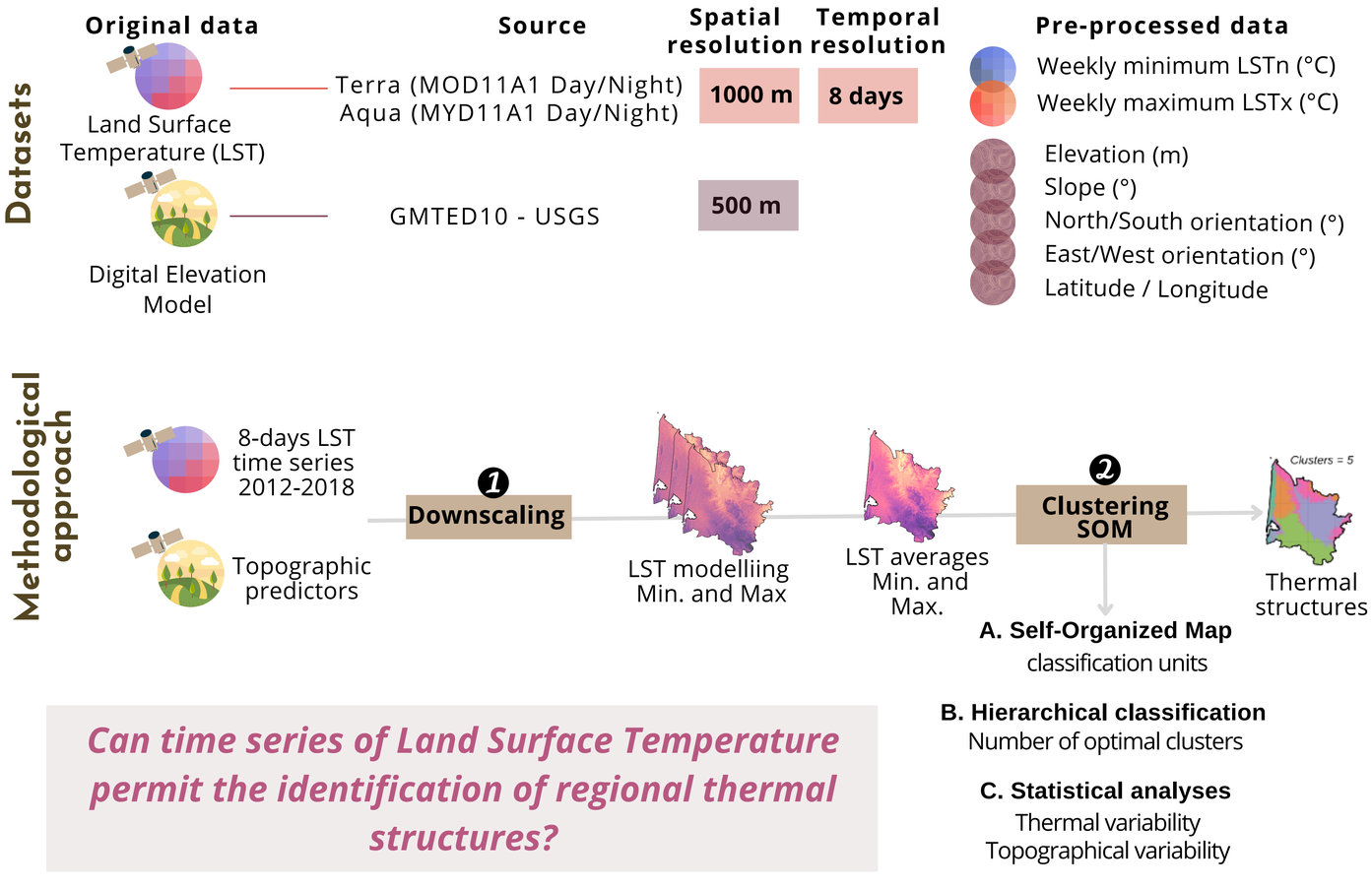
Limits identified : reproducibility and sustainability of this type of climate study.

In this context, we evaluated the **potential of MODIS thermal satellite images** validated with ground-based climate data (Morin et al, 2020). Previous studies have been encouraging, but questions remain to be explored at the **regional scale**, particularly in the dynamics of the massive use of bioclimatic indices to classify the climate of wine regions.

Several objectives were identified at regional scale in **Gironde area**:
1) to evaluate the downscaling method for land surface temperature time series,
2) to identify regional thermal structure variability.



Materials and methods

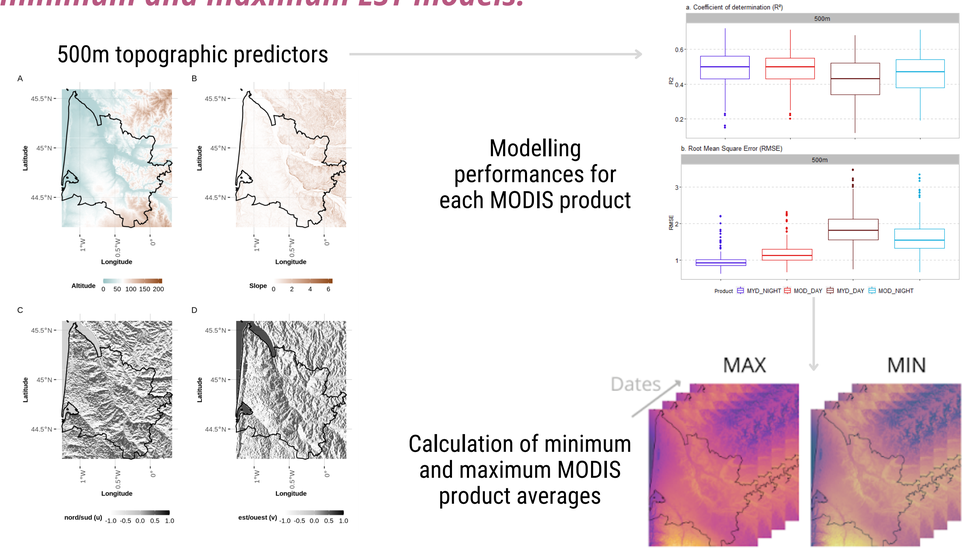


Can time series of Land Surface Temperature permit the identification of regional thermal structures?

1 Downscaling thermal satellite data

For the first step, 8-days land surface temperatures at 1000m were modeled at 500m from topographic predictors using Support Vector Regression to improve spatial resolution.

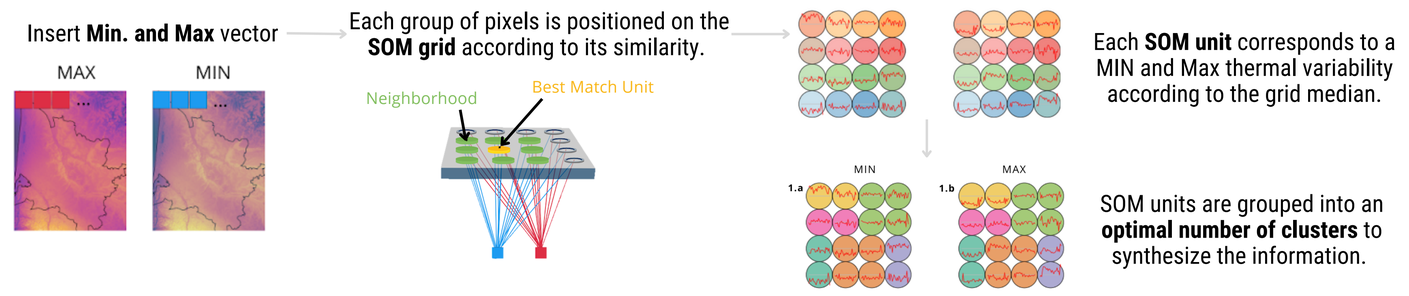
The topographic variables define the resolution of the 8-days minimum and maximum LST models.



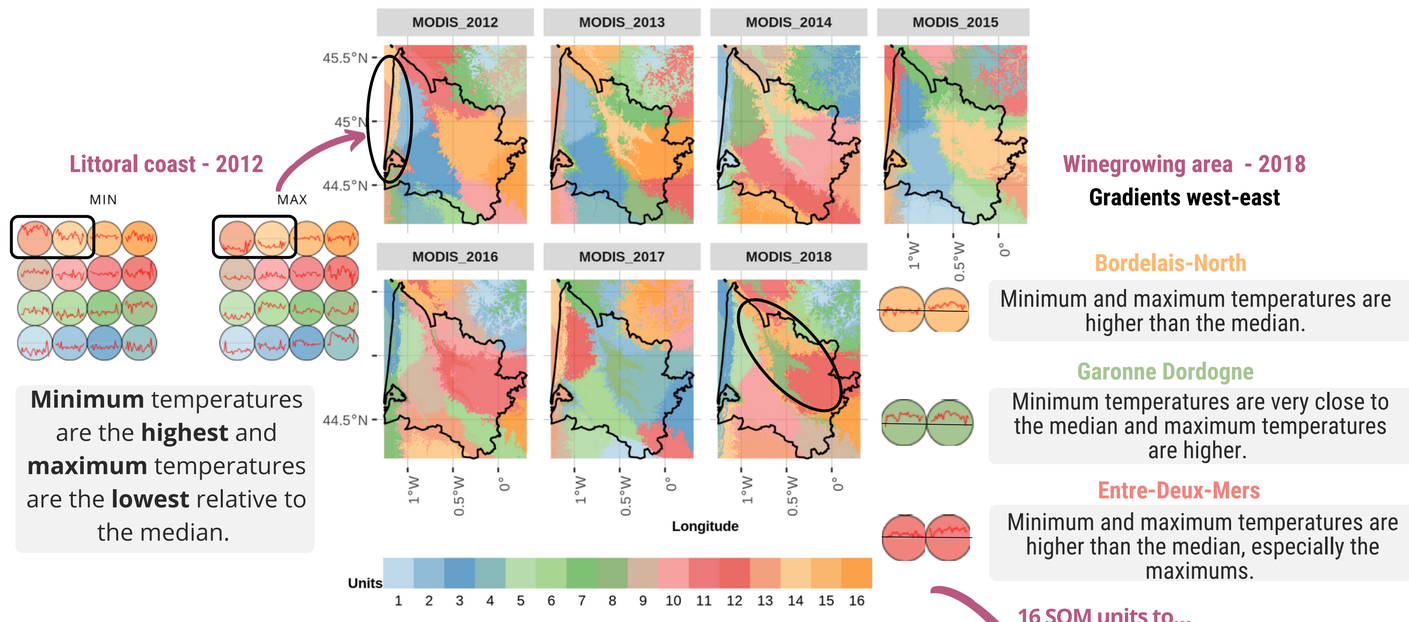
2 Regional thermal clustering

The second step was to identify regional thermal clusters using A) the Self-Organised-Map method to define 16 classification units, B) dimension reduction by an optimal cluster number and C) statistical analysis of temperatures and topographic predictors in the units and clusters.

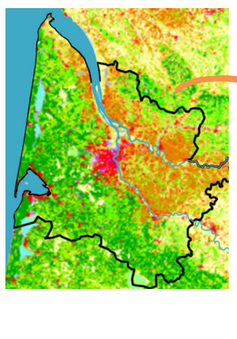
How thermal clusters are defined ?



A) 16 SOM units: Min. and Max. combination



B) Optimal number of clusters to group the diversity of SOM units

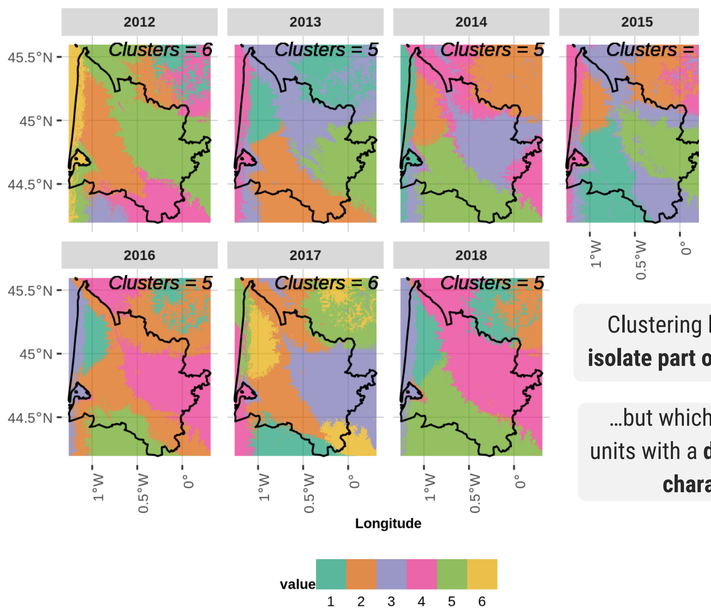


Vine growing region:
3 thermal structures

large unique cluster
2012, 2018

Gradient west-east
2013

Garonne -Dordogne
2014 to 2017



Clustering has allowed us to **isolate part of the wine region**...

...but which includes several units with a **diversity of thermal characteristics**.

Conclusion and perspectives

Methodological conclusions....

- **Downscaled minimum and maximum** LST at 500m allowed the identification of *regional structures*.
- The 16 SOM units demonstrate **high variability** in LSTs at the regional scale, which was interesting for the **wine region**...
- ... but the **clusters** helped to synthesize the information.
- Analyses **need to be evaluated** using dense ground data, and the **potential of the SOM** method is considerable.

↳ Clustering of LSTs using SOM has a strong potential to characterise **thermal variability at the regional scale**.

↳ The role of **topography** is important and verified, but **cannot fully reflect** the variability of LSTs at this scale.

...to next perspectives applications !