SPATIAL-TEMPORAL ANALYSIS OF CLIMATE CHANGE AND INFLUENCE OF MEDITERRANEAN SEA ON VITICULTURE SITE VALENCIA DO

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The facts

- France: during the last 25 years, the harvest time moved from late October to early September.
- By the 2050 by the worst case scenario, the 85% decrease in wine production in Bordeaux, Rhone, and Toscany region.
- South Africa – by the 2050, expected 55% descrease in wine production.
- English wine is back! 400 commercial wineayards, sparkling wines are beating the French rivals.

Source: Theguardian

Context

The climate change has an impact on viticulture in function of:

- Evolution of vine growing and its characteristics.
- Evolution differs according to a different location of regions in accordance with local topographical characteristics.
- Necessity of adaptation.

Methodology

- Analyse of historical meteorological data retrieved from weather stations.
- Data retrieved: daily temperature (min, max, mean) and daily precipitation.
- Bioclimatic indexes analysis.
- Confrontation of historical data to modelized data in function of climate change (RCP scenarios) for historical and future period.
- Uncertainty, data analysis, critical approach to data analysis;

Valencia DO

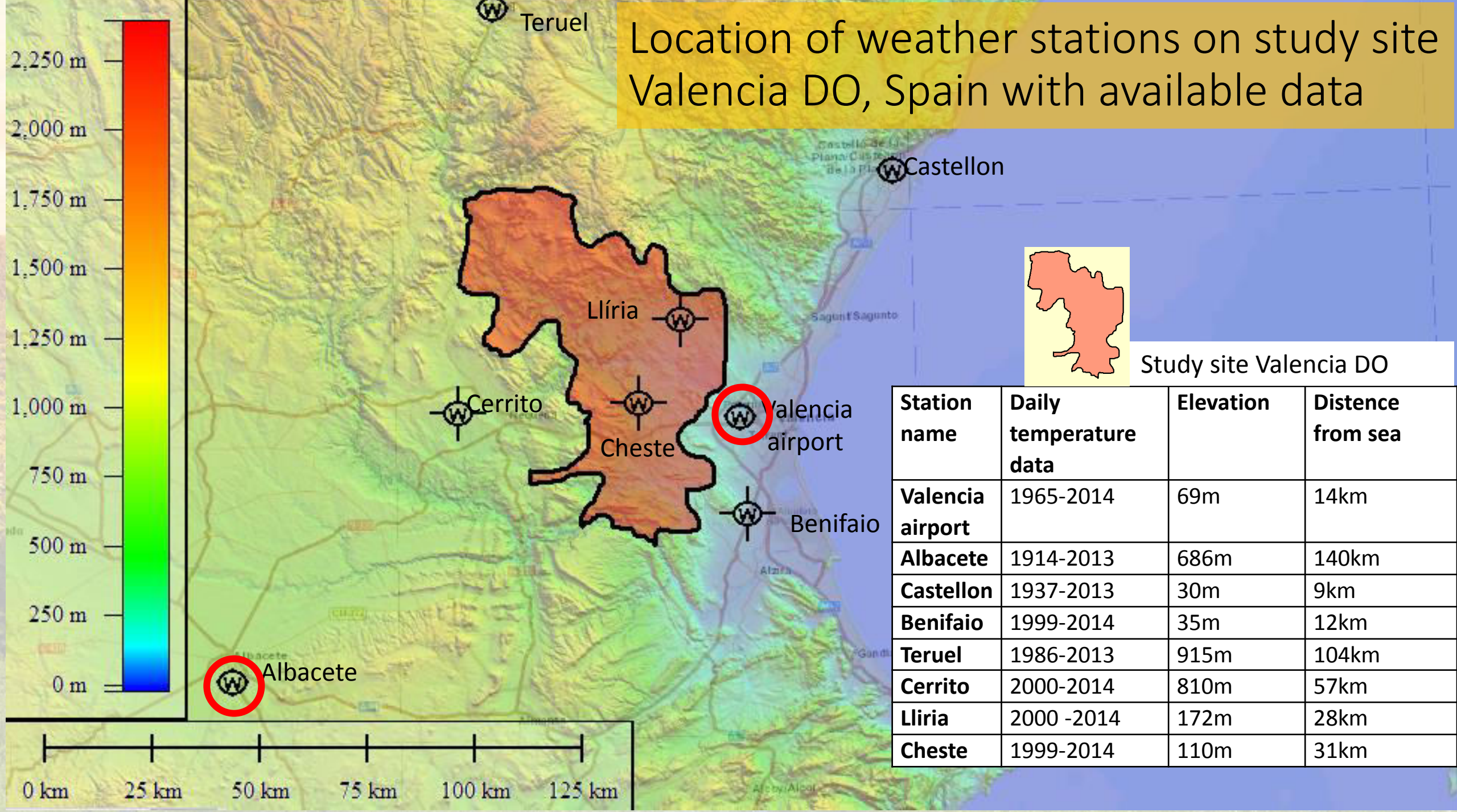
Bilbao
Bizkaiko Txakolina
Arabako Txakolina
Getariako Txakolina
La Coruña
Empordà Costa-Brava
Ribeira Sacra
Bierzo
Tierra de Léon
Rioja
Navarra
Coster del Sergre
Conca de Barberà
Somontano
Pla de Bages
Rias Baixas
Valdeorras
Cigales
Arlanza
Ribera del Duero
Priorat
Alella
Ribeiro
Monterrei
Campo de Borja
Montsant
Barcelona
Toro
Tierra del Vino de Zamora
Rueda
Penedès
Terra Alta
Tarragona
Calatayud
Cariñena
Arribes
Madrid
Mondéjar
Madrid
Uclés
Valencia
Méntrida
Valencia
Utiel-Requena
La Mancha
Ribera del Júcar
Manchuela
Ribera del Guadiana
Valdepeñas
Almansa
Alicante
Jumilla
Yecla
Alicante
Bullas
Sevilia
Montilla-Moriles
Condado de Huelva
Malaga
Jerez-Xérès-Sherry
Manzanilla de Sanlúcar
Málaga - Sierras de Málaga

Source: IVIA, 2016

VALENCIA
DENOMINACIÓN DE ORIGEN

Vinos del mediterráneo

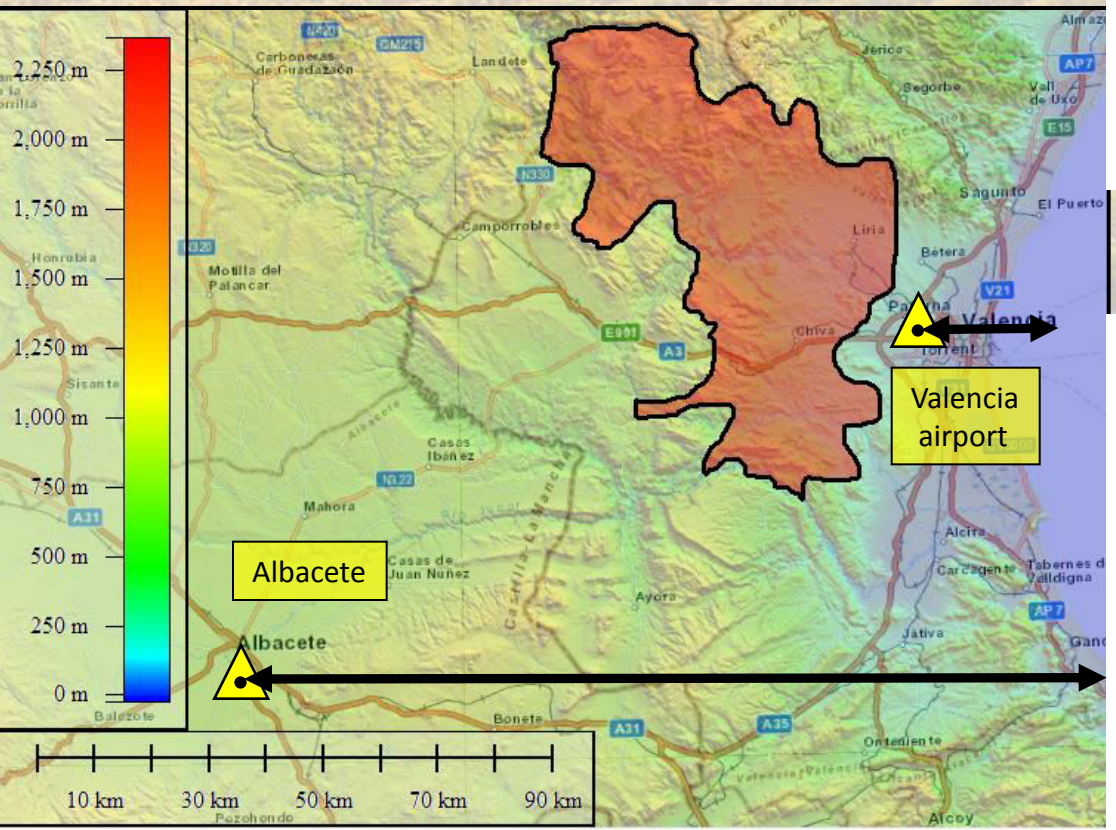
Location of weather stations on study site Valencia DO, Spain with available data

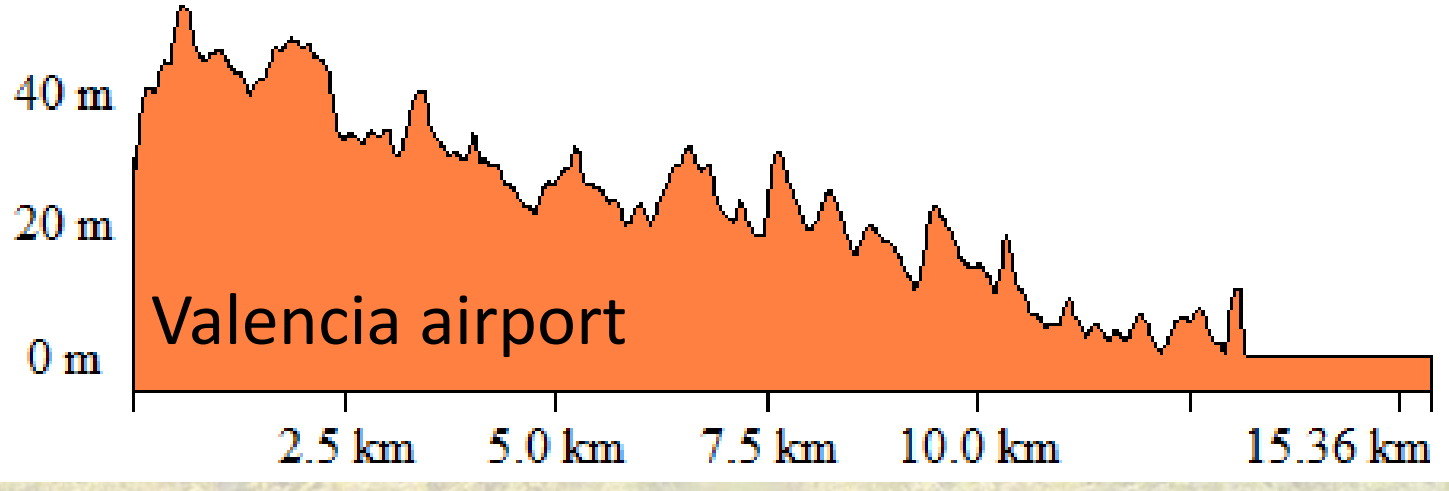


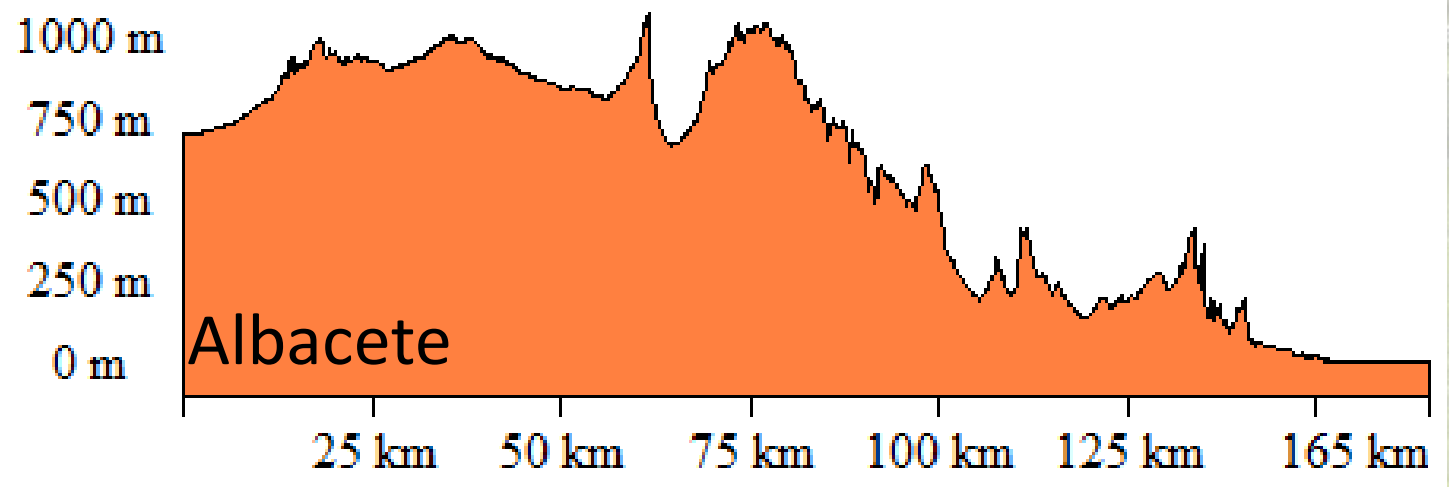
Study site Valencia DO

Station name	Daily temperature data	Elevation	Distence from sea
Valencia airport	1965-2014	69m	14km
Albacete	1914-2013	686m	140km
Castellon	1937-2013	30m	9km
Benifaio	1999-2014	35m	12km
Teruel	1986-2013	915m	104km
Cerrito	2000-2014	810m	57km
Lliria	2000 -2014	172m	28km
Cheste	1999-2014	110m	31km

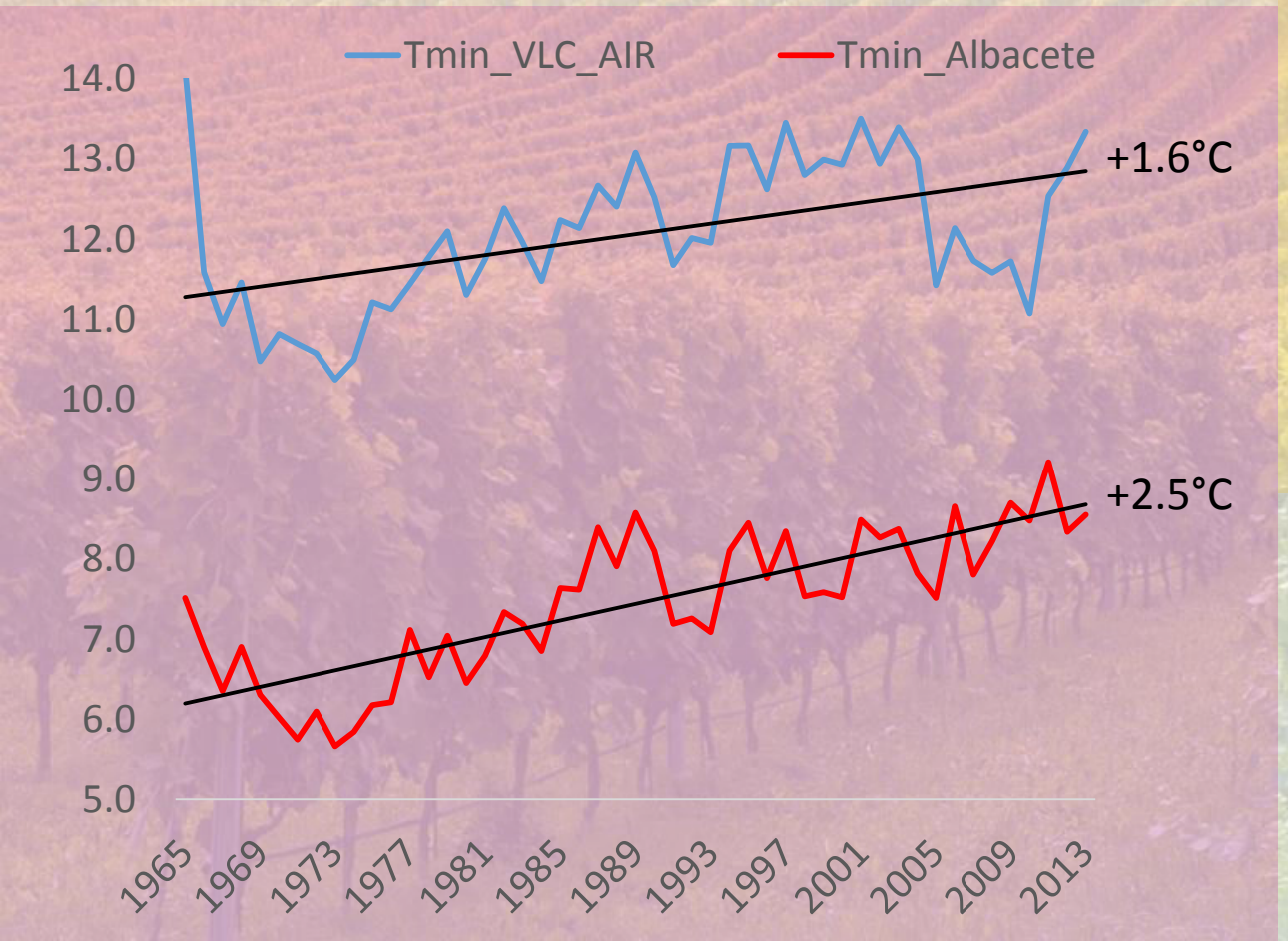
Topographic profiles: meteorological stations toward Mediterranean sea

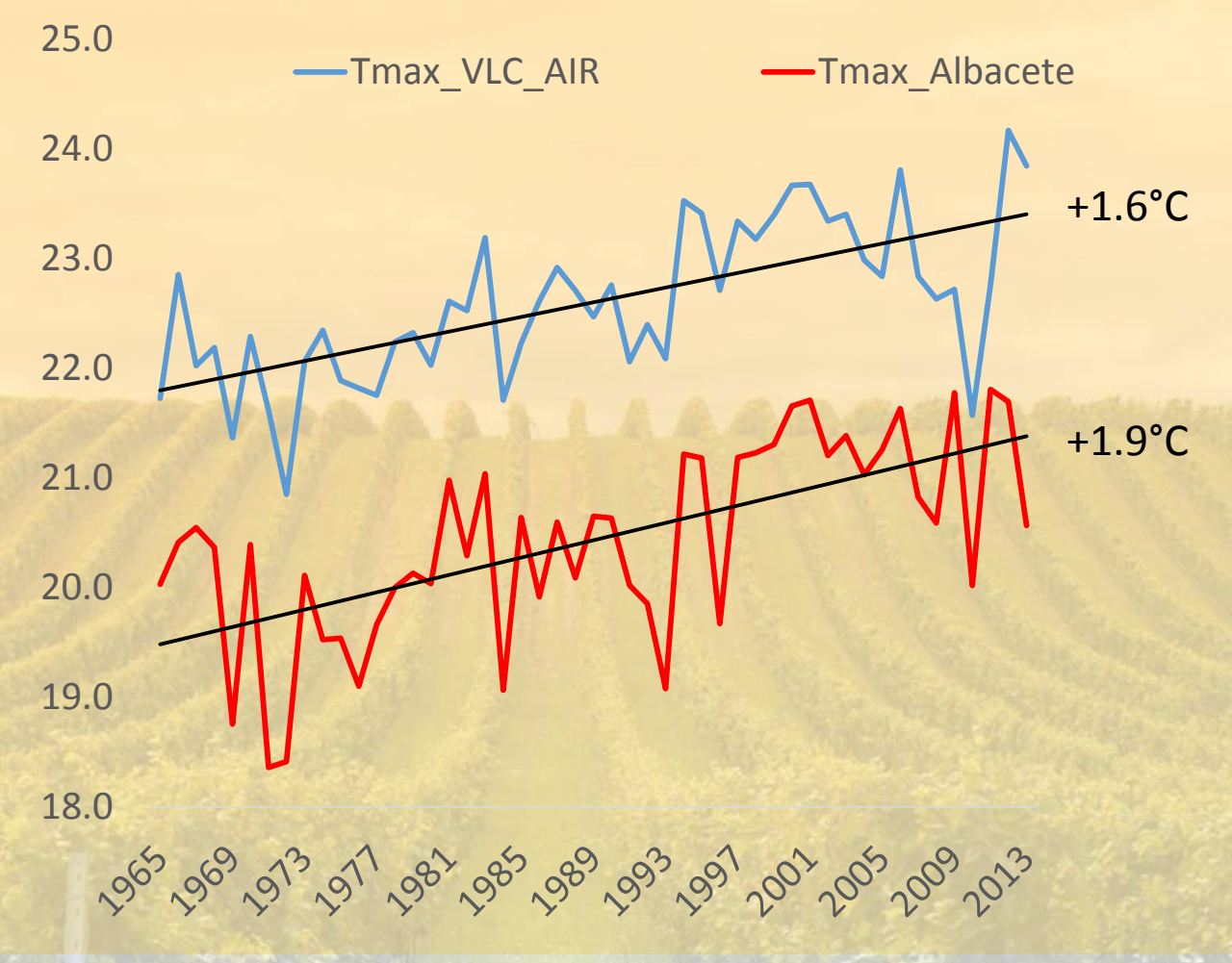






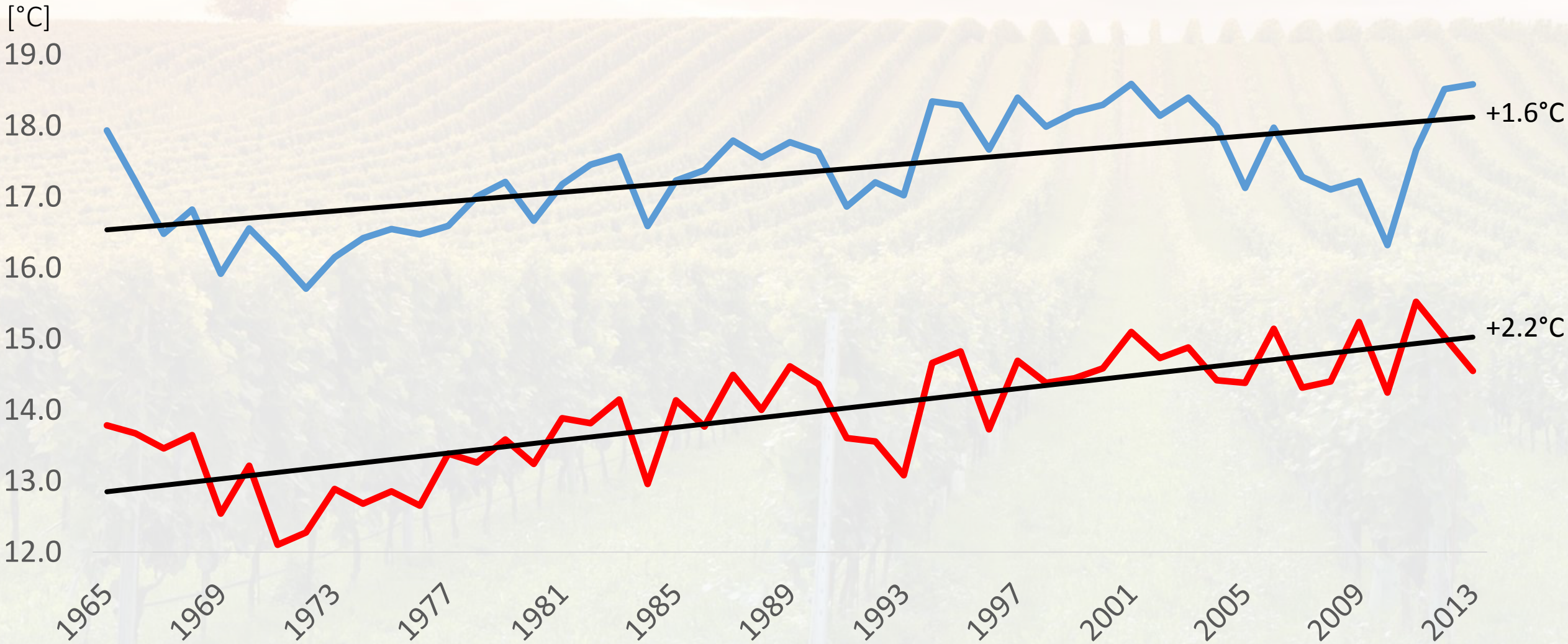
Progress of minimum and maximum temperature





Progress of mean temperature for study period 1965-2013

Meteorological station	Increase of mean temeprature [°C]
VLC_air	1.6
Albacete	2.2



HUGLIN index

$$HI = \sum_{1\,apr}^{30\,sep} \frac{(Tmean - 10) + (Tmin - 10)}{2} \cdot k$$

k= 1.02

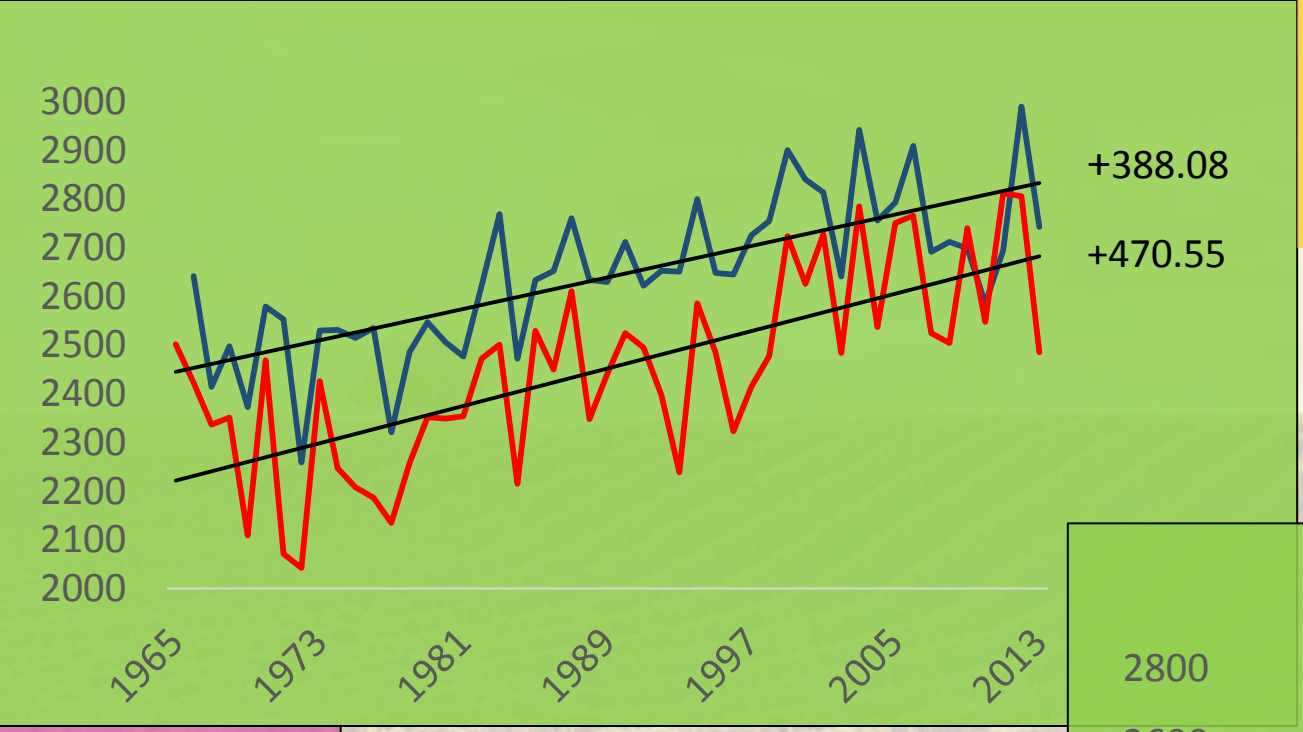
Huglin class	Index points	Wine varieties
Very cold	≤ 1500	Muller-Thurgau, Pinot blanc, Gamay, Gewurztraminer
Cold	1500-1800	Riesling, Pinot noir, Chardonnay, Merlot, Cabernet franc
Cool	1800-2100	Cabernet-Sauvignon, Ugni Blanc, Syrah
Warm	2100-2400	Grenache, Mourvèdre, Carignan
Hot	2400-3000	Potential which exceeds the heliothermal needs to ripen the varieties, even the late ones (with some associated risks of stress)
Very hot	>3000	There is no heliothermal constraint for the grapes to ripen

WINKLER index

$$WI = \sum_{1\,apr}^{31\,oct} (Tmean - 10°C)$$

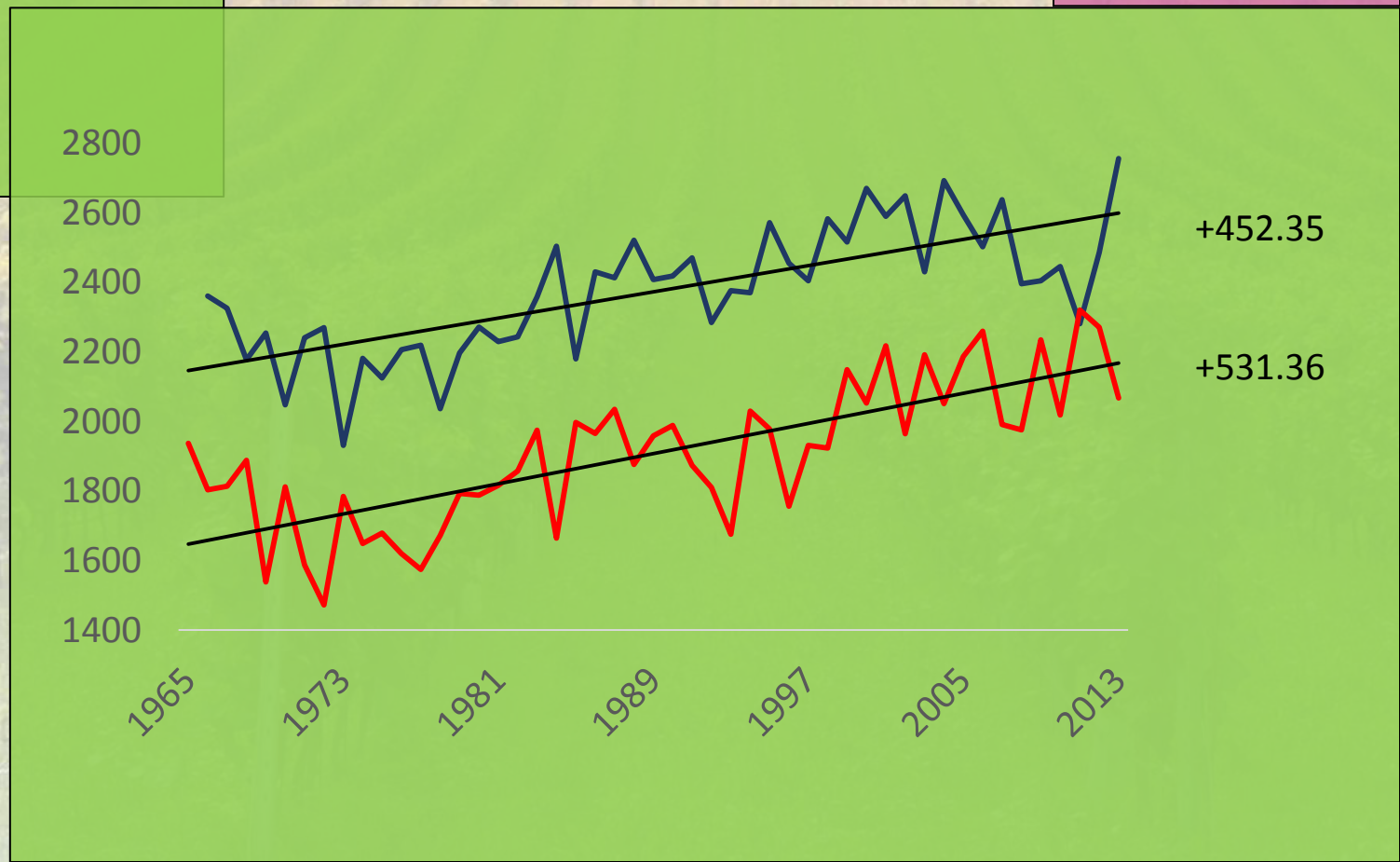
Region	Index points	Wine varieties
Region I	850-1389	pinot noir, riesling, chardonnay, gewurztraminer, pinot grigio sauvignon blanc
Region II	1389-1667	cabernet sauvignon, chardonnay, merlot, semillon, syrah
Region III	1671-1950	grenache, barbera, tempranillo, syrah,
Region IV	1951-2220	carignan, cinsault, mourvedre, tempranillo
Region V	>2221	primitivo, nero d'avola, palomino, fiano

Progress of bioclimatic indexes 1965-2013



Huglin progress

Winkler progress

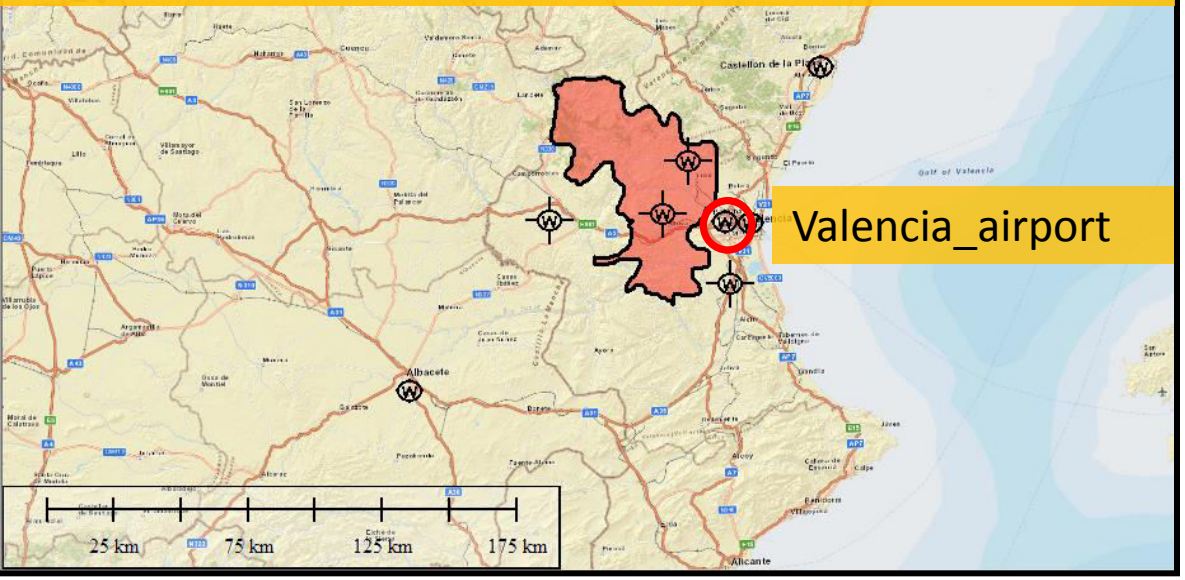


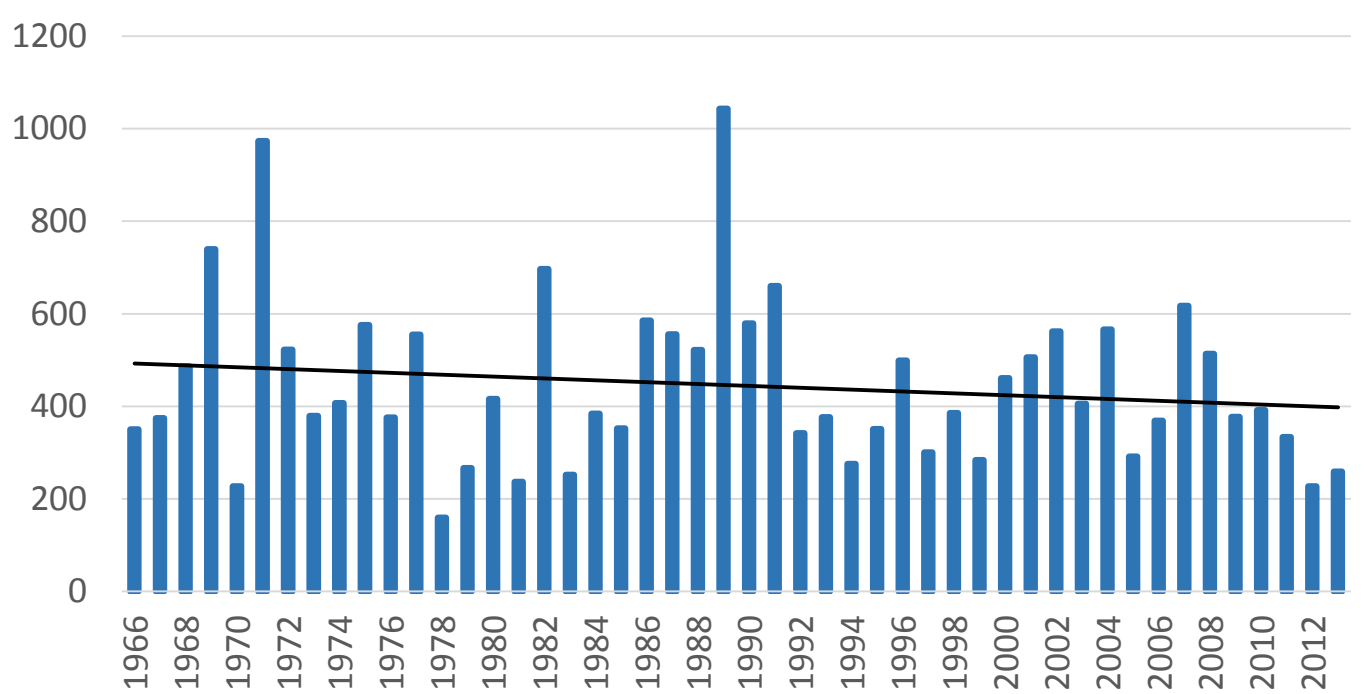
Analysis of average temperature and average bioclimatic indexes increase during 1965-2013

	Valencia DO [°C]
Temperature mean	1,9
Temperature minimum	2,0
Temperature maximum	1,8

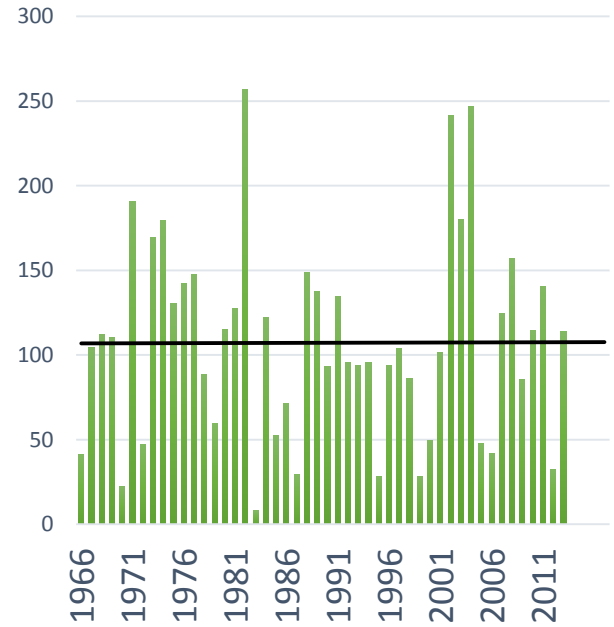
	Valencia DO [bioclimatic points]
HUGLIN	429,3
WINKLER	491,9

Precipitation in seasons – Valencia airport

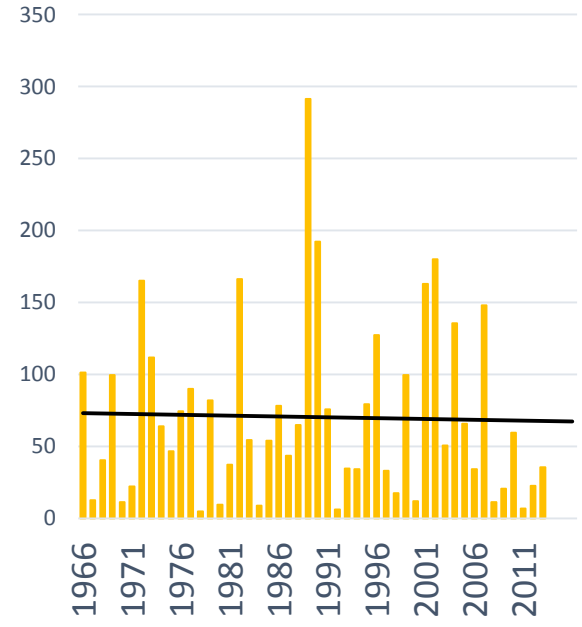




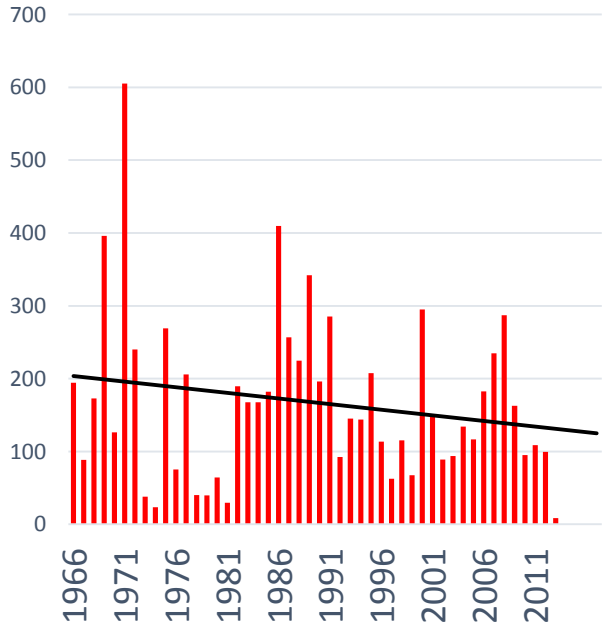
SPRING (1)



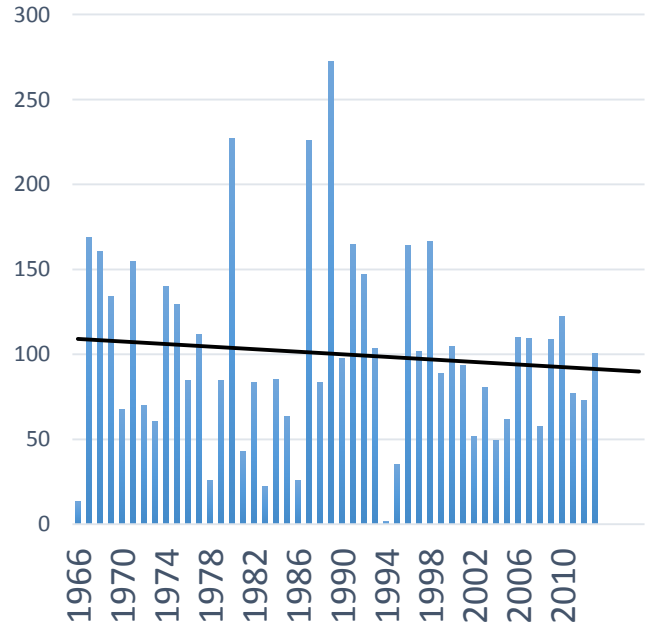
SOMMER (2)



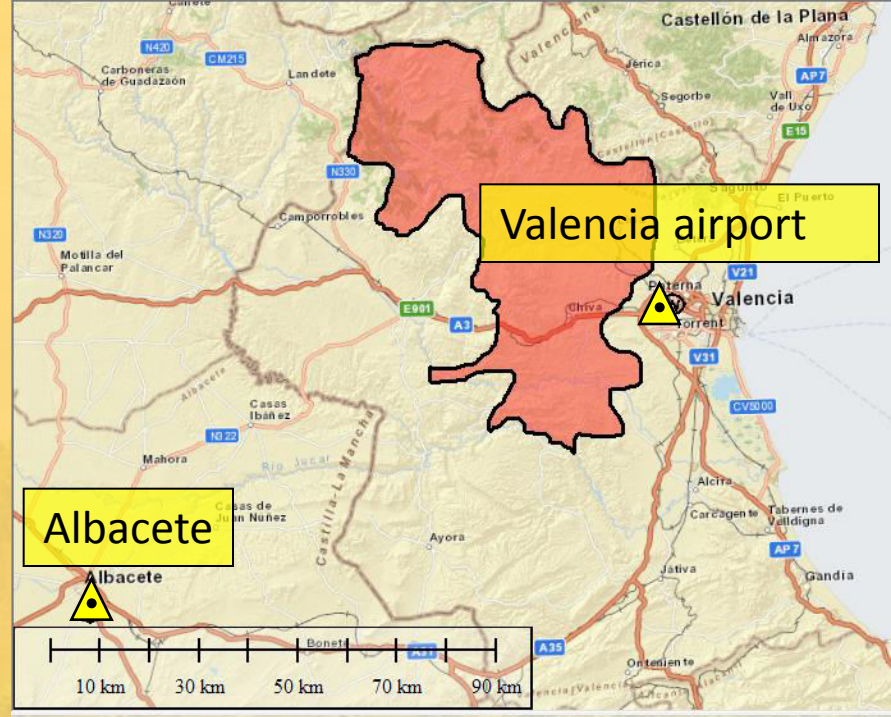
FALL (3)



WINTER (4)

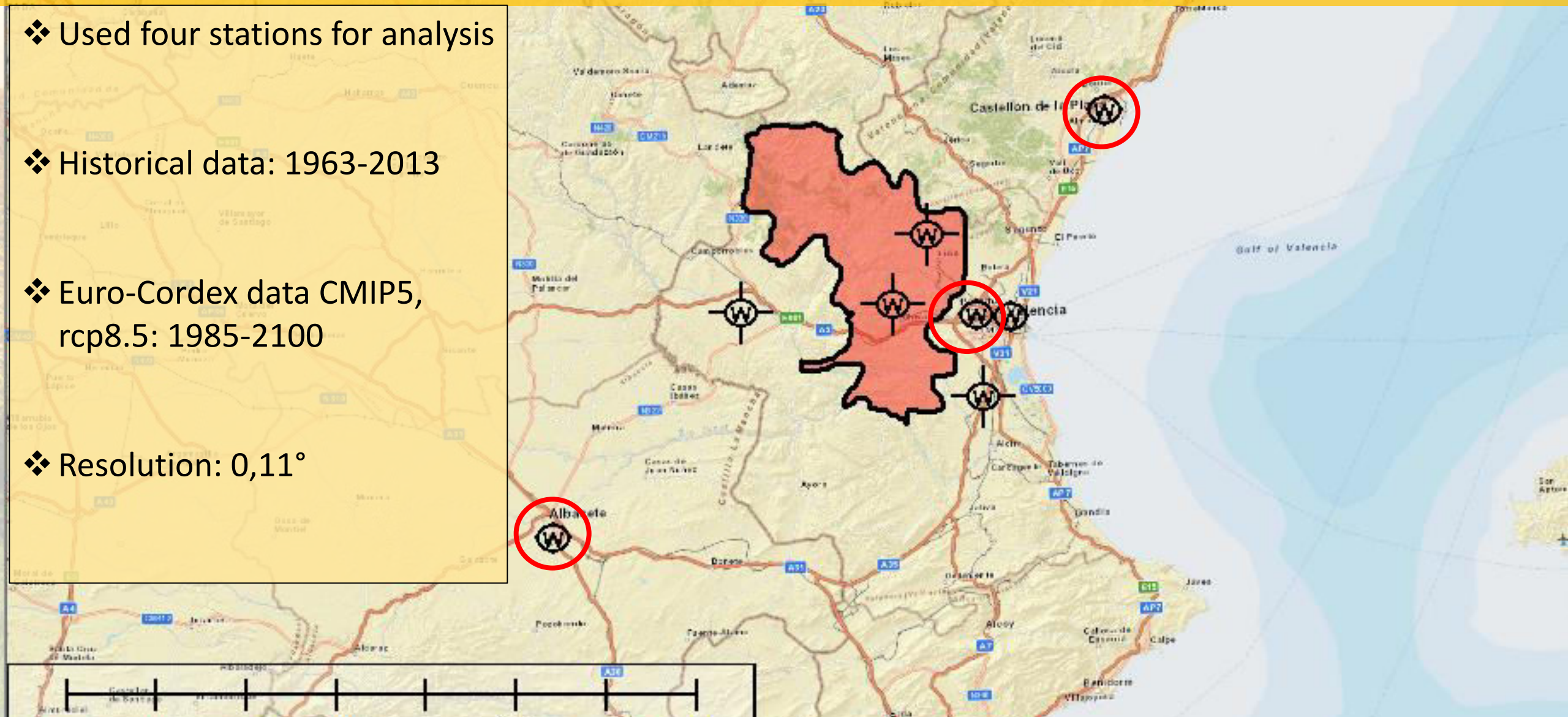


- The rise of temperature trend on all weather stations in the study period
- The highest increase (2.17°C) was detected on weather stations Albacete weather station
- The average rise of temperature at Valencia site: +1.88°C
- The increase of Huglin and Winkler index at all weather stations
- Precipitation decrease was noticed especially in fall season

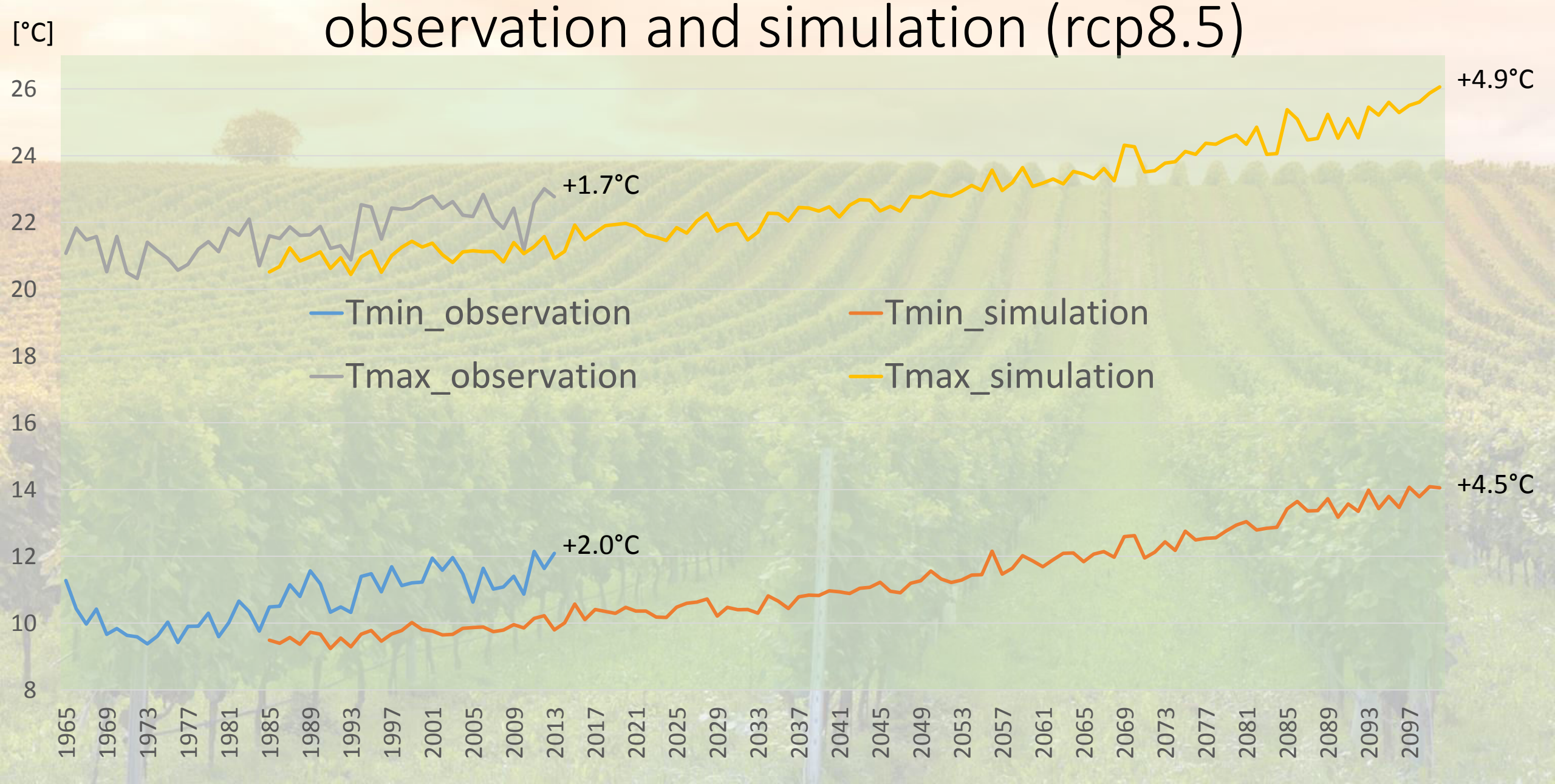


Temperature analysis in Valencia study site: observed and modeled data

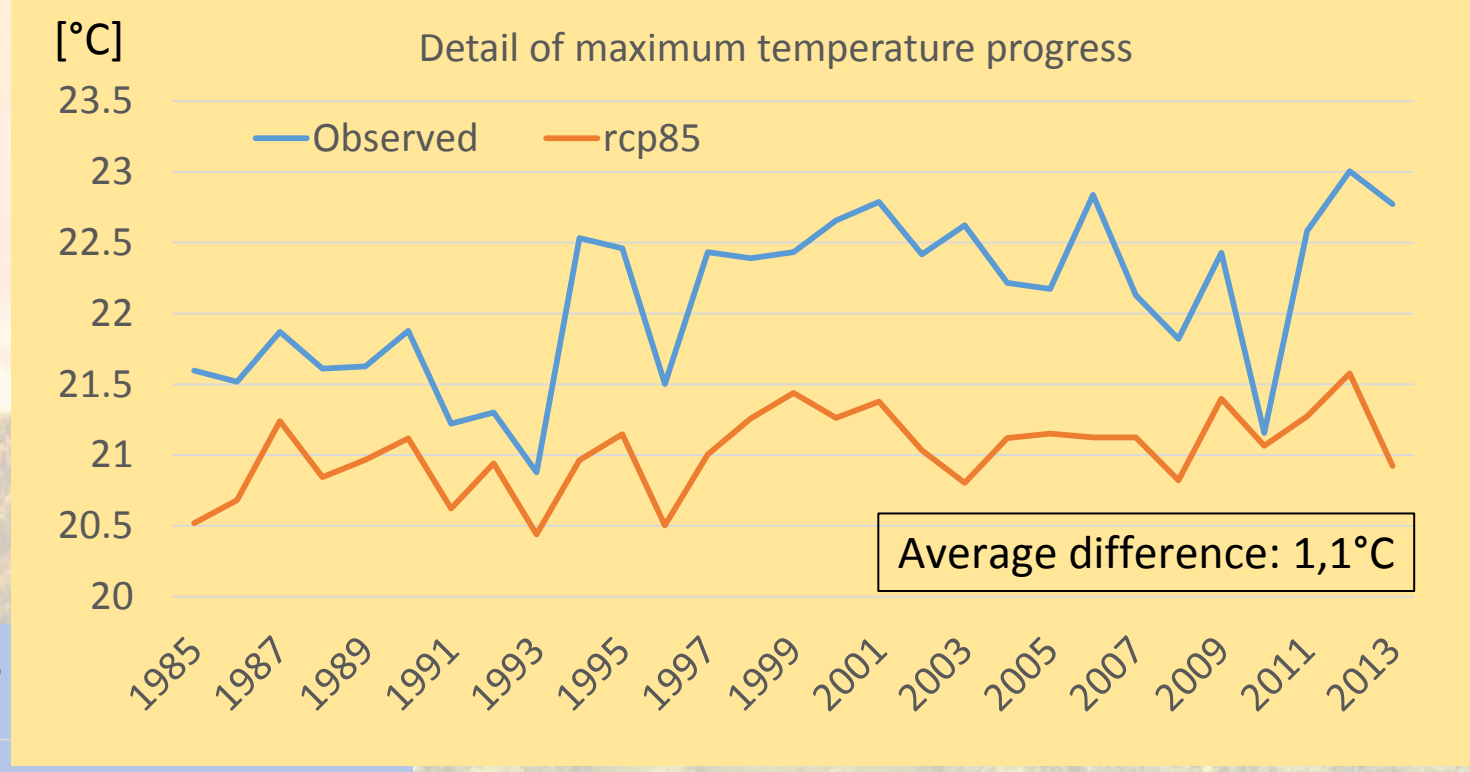
- Used four stations for analysis
- Historical data: 1963-2013
- Euro-Cordex data CMIP5, rcp8.5: 1985-2100
- Resolution: 0,11°

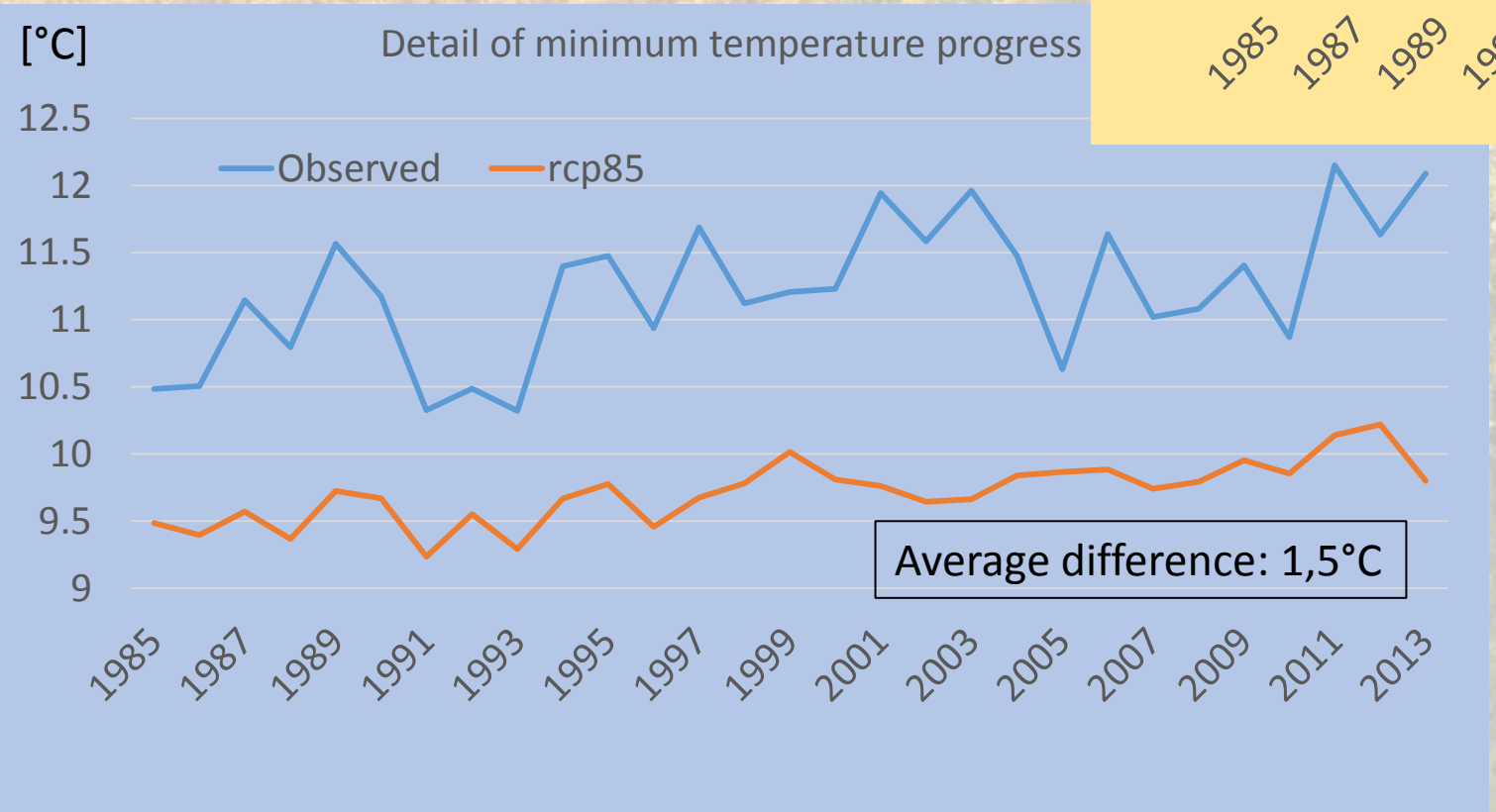


Temperature progress in Valencia DO: observation and simulation (rcp8.5)

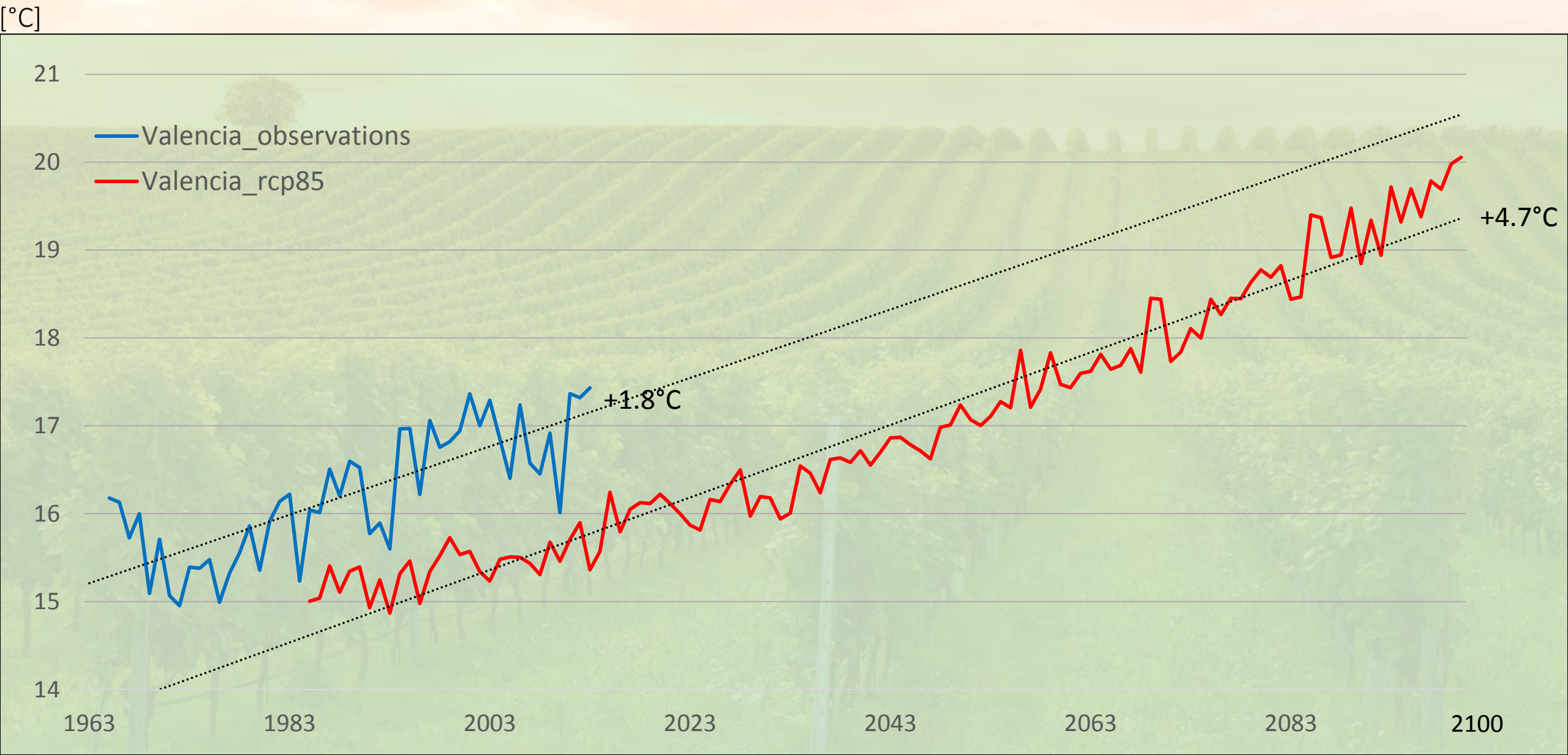


Minimum temperature progress – observations and simulation (rcp8.5) detail in Valencia DO (1985 – 2013)





Valencia DO average temperature progress



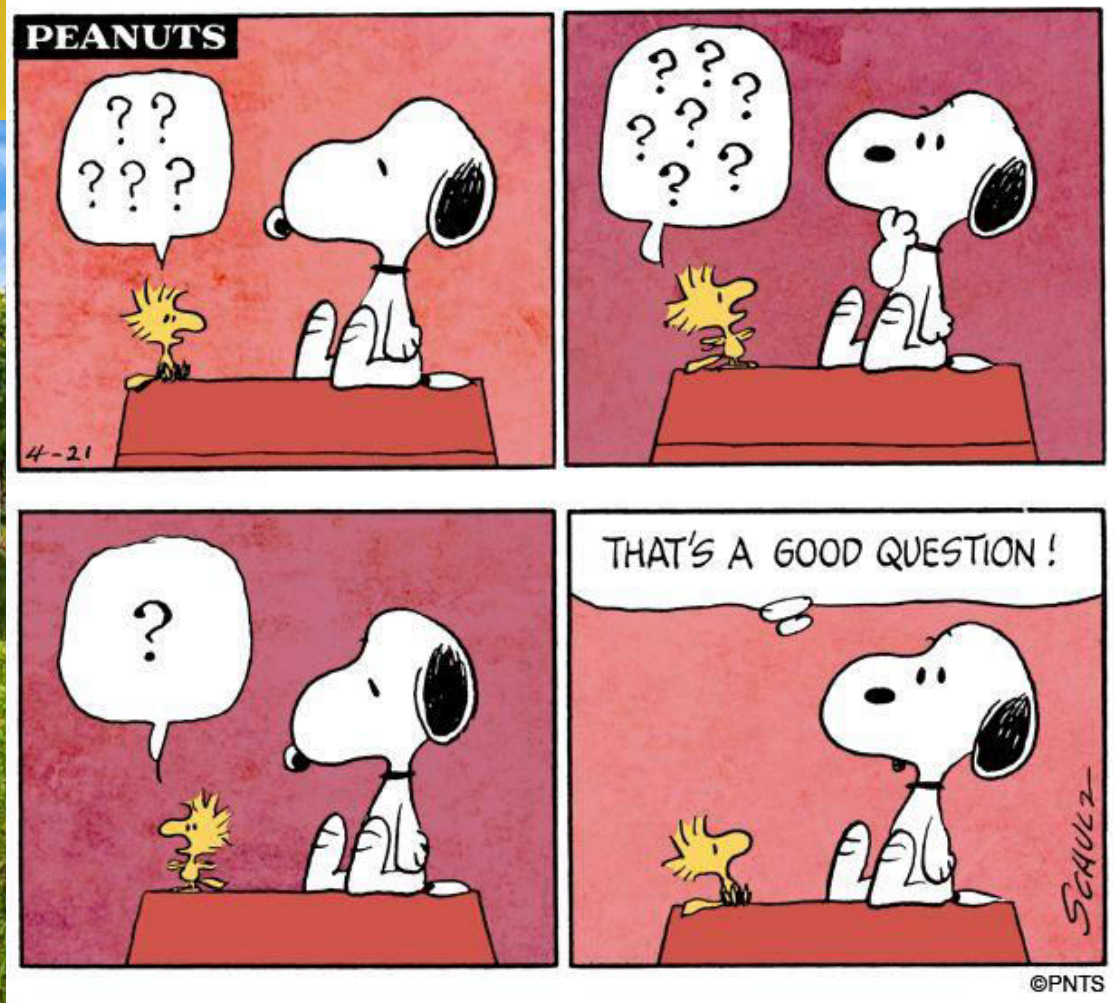
Limitations of comparison between observed and modelized data

- Uncertainties linked to the climate models = it is impossible to validate future of climate data.
- Climate model is a simplified representation of a climate system.
- Spatial resolution of the climate models is far higher in comparison to observed data on meteorological stations (point Vs. 0,11 degree net).

Conclusion

- Temperature and bioclimatic indexes increase in the last five decades, decrease of precipitation.
- Simulated rcp8.5 scenarios – significant increase of temperatures.
- Future steps: **Precipitation** analysis simulation 1985 – 2100, rcp4.5 scenario;
- Usage of all available weather stations for further climate change analysis.
- The outcome of this research will be beneficiary for **understanding local climate conditions**.
- **Possible adaptation** scenarios: other varieties, changing fertilizers, changing location, irrigation,..
- Comparative analysis with a second viticulture site: Brda wine region in Slovenia.

Thank you all for your attention



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