



ADVID

Cluster dos Vinhos da Região do Douro
Douro Region Wine Cluster

VITICULTURAL ZONING IN EUROPE: CLIMATE CHANGE CHALLENGES

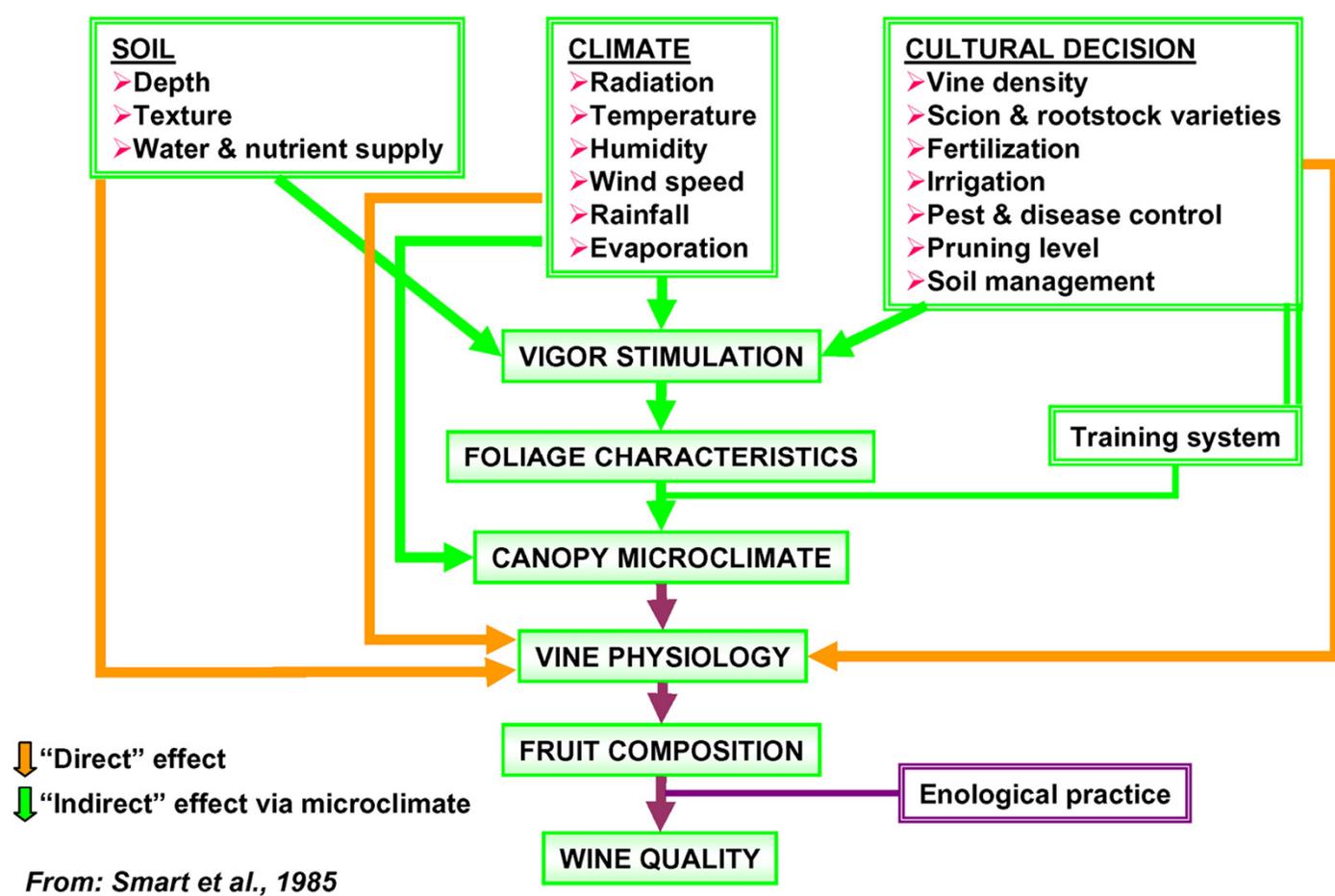
JOÃO ANDRADE SANTOS

12 | 04' LISBOA | 13 | 04' PORTO 2012
FUNDAÇÃO LUSO-AMERICANA | ALFÂNDEGA DO PORTO

Introduction



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Climatic forcing ...

Methods for viticultural zoning



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▣ 15 bioclimatic indices

■ 4 fundamental indices

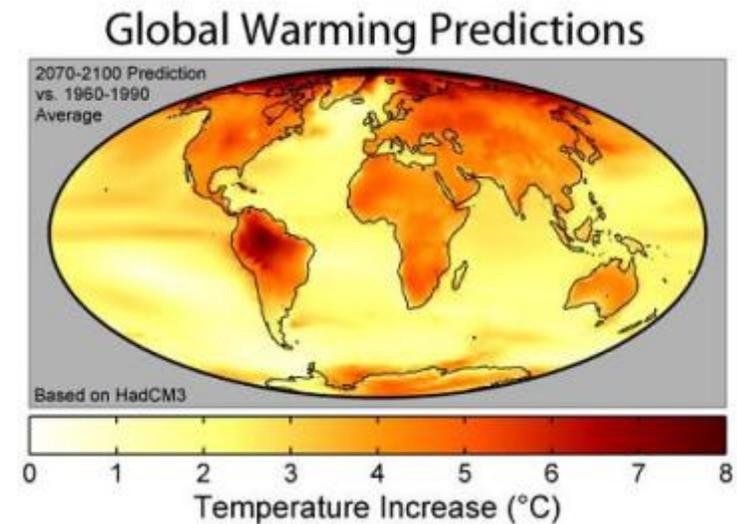
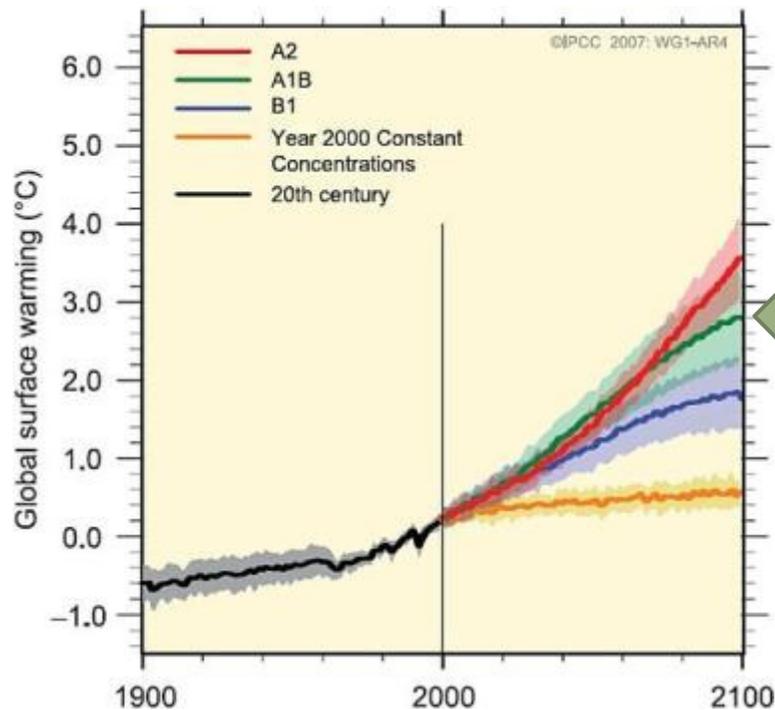
▣ Key references:

- Santos JA, Malheiro AC, Pinto JG, Jones GV (2012). Macroclimate and viticultural zoning in Europe: observed trends and atmospheric forcing. *Clim Res* 51: 89-103 (doi: 10.3354/cr01056)
- Malheiro AC, Santos JA, Fraga H, Pinto JG (2010) Climate change scenarios applied to viticultural zoning in Europe. *Clim Res* 43:163-177
- Santos JA, Malheiro AC, Karremann MK, Pinto JG (2011) Statistical modelling of grapevine yield in the Port Wine region under present and future climate conditions. *Int J Biometeorol* 55:119-131
- Jones GV, Duff AA, Hall A, Myers JW (2010) Spatial analysis of climate winegrape growing regions in the Western United States. *Am J Enol Vitic* 61:313-326

Methods for climate change projections



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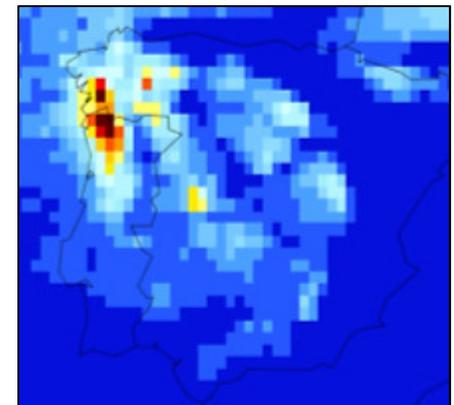
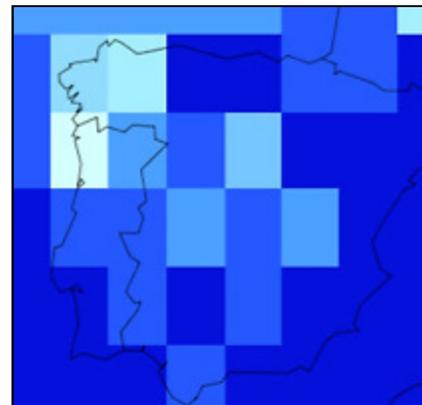
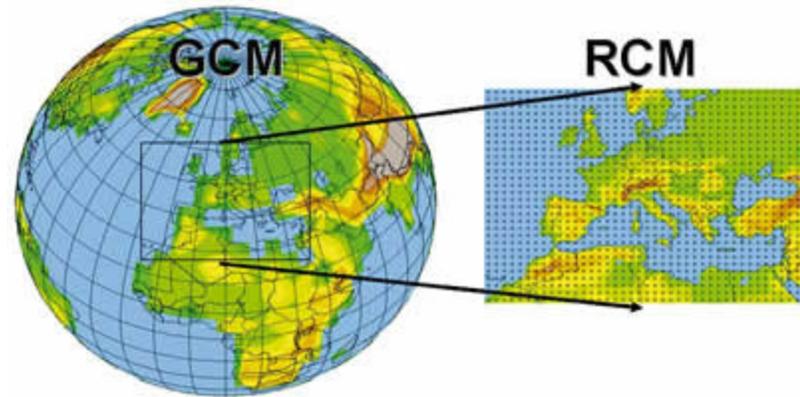
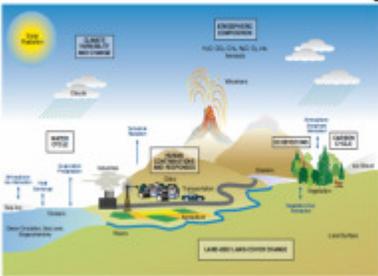
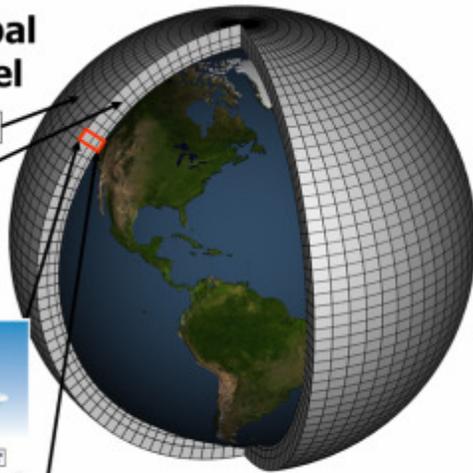
Climate models for regional projections ...

Atmospheric Modelling & Downscaling



Schematic for Global Atmospheric Model

Horizontal Grid (Latitude-Longitude)
Vertical Grid (Height or Pressure)

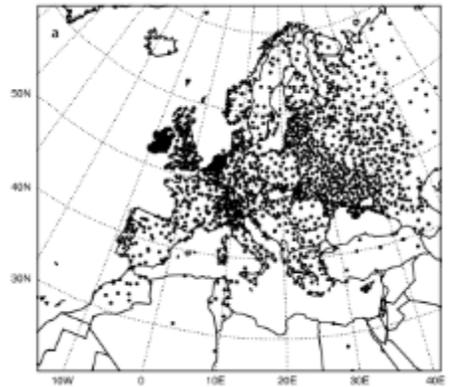


Data



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- Climatic variables for bioclimatic indices: daily TG, TN, TX & RR
- 1st part: viticultural zoning for current climates:
 - **Station-based** dataset E-OBS (ECA&D)
 - Grid: 0.25° latitude x longitude (~25 km)
 - Baseline period: 1950-2010
- 2nd part: viticultural zoning for future climates:
 - Ensemble of 16 **simulated** datasets from 15 RCMs
 - Grid: 0.25° latitude x 0.25° longitude
 - 1961-2000 (model validation/calibration)
 - 2011-2070 – A1B emission scenario (ensemble projections)



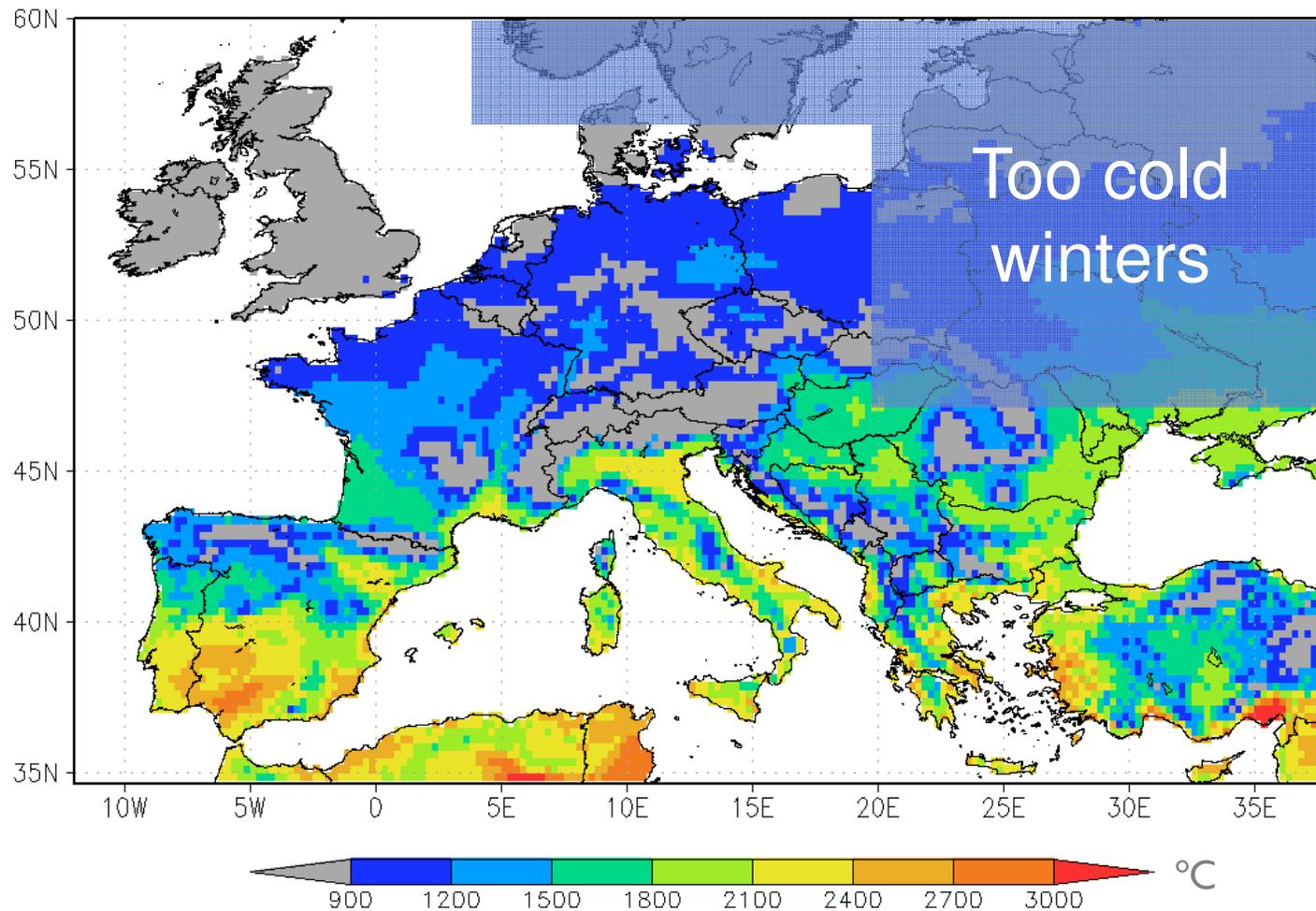
Results...

Huglin Index (OBS)

degree-day index (Thermal & radiative basic requirements)



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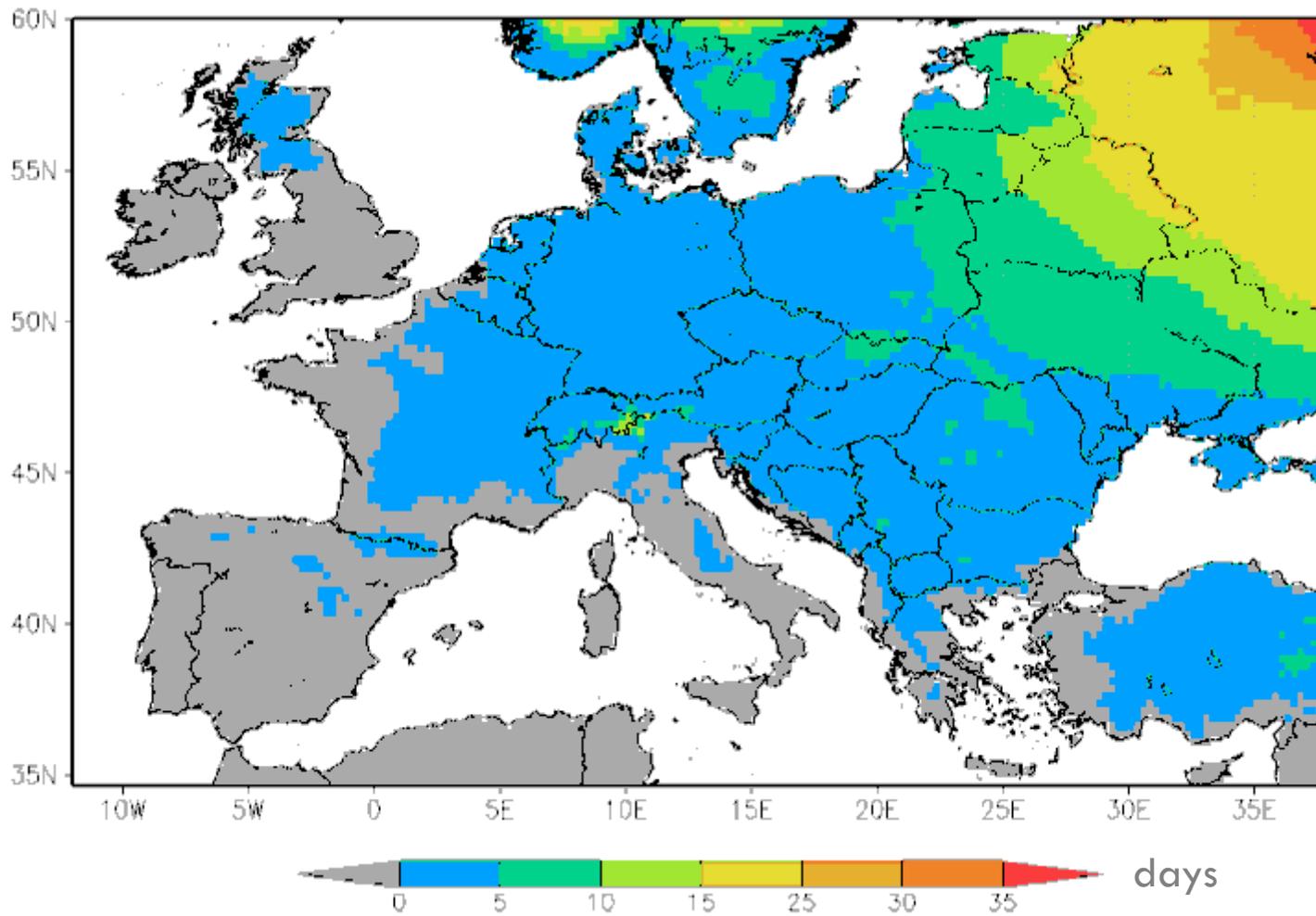
Suitability widely depends on grapevine variety: early-late cultivars

Tmin < -17°C (OBS)

Lower lethal limit for grapevine



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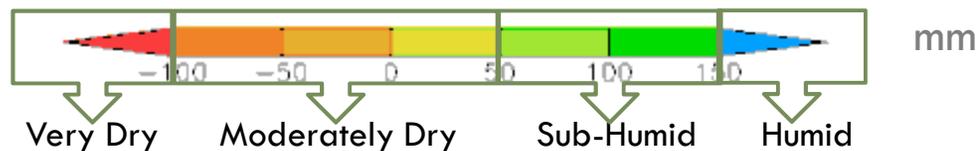
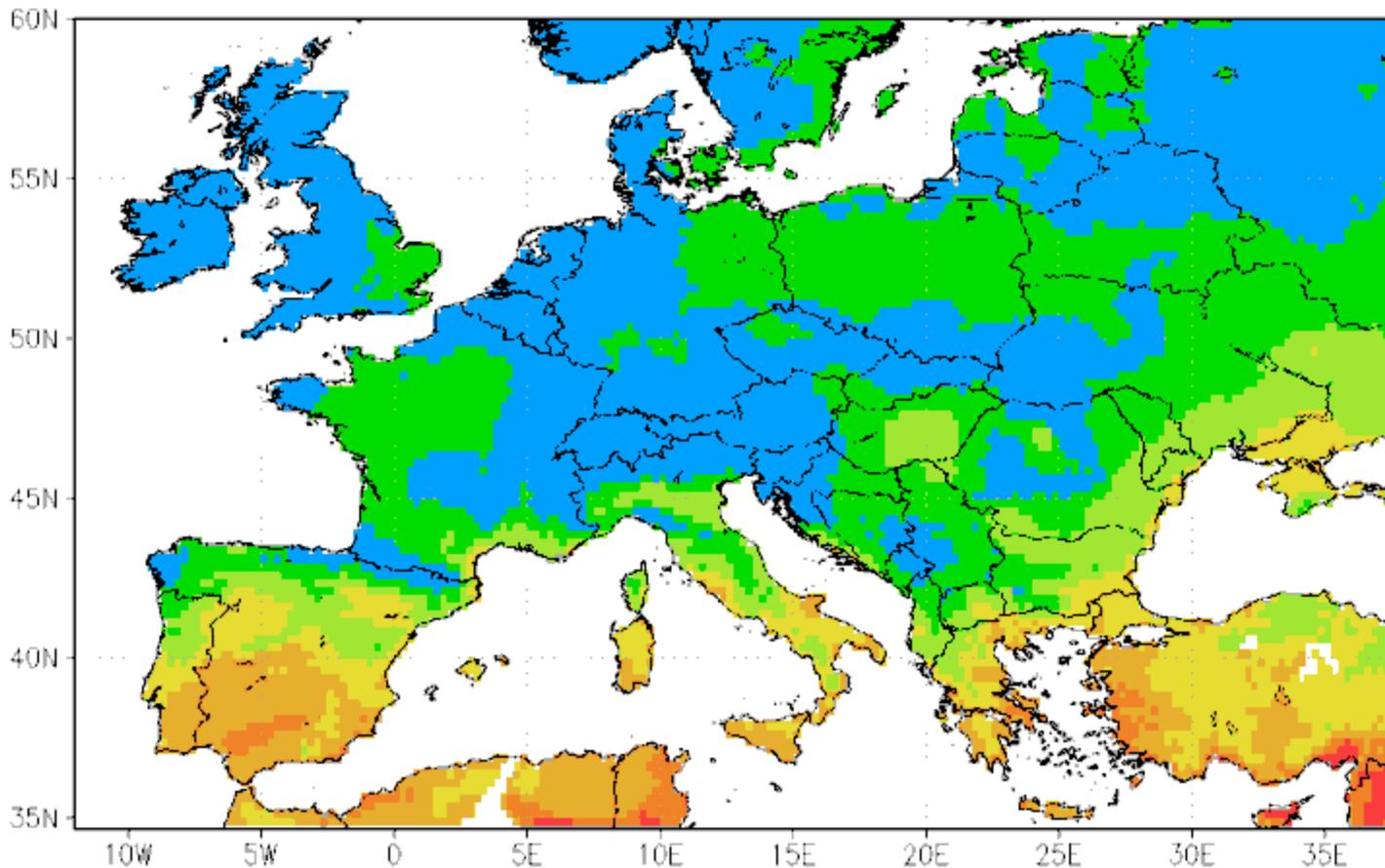
Important limitation to winegrape growth in northern and eastern Europe

Dryness Index (OBS)

Potential soil water balance (water stress assessment)



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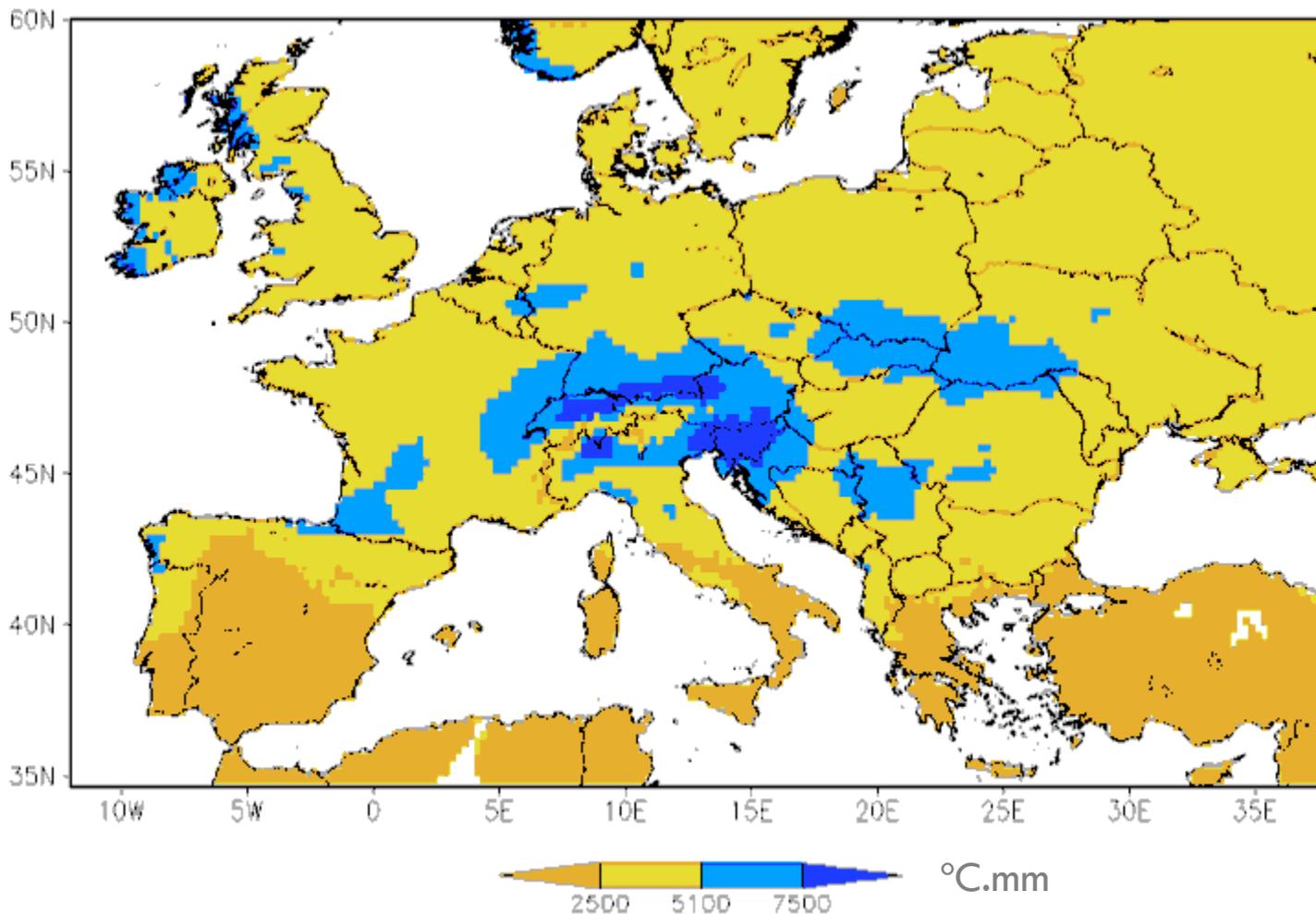
**Moderate
limitation to
winegrape
growth in
some
southern
regions**

Hydrothermic Index (OBS)

Excessive precipitation/humidity levels

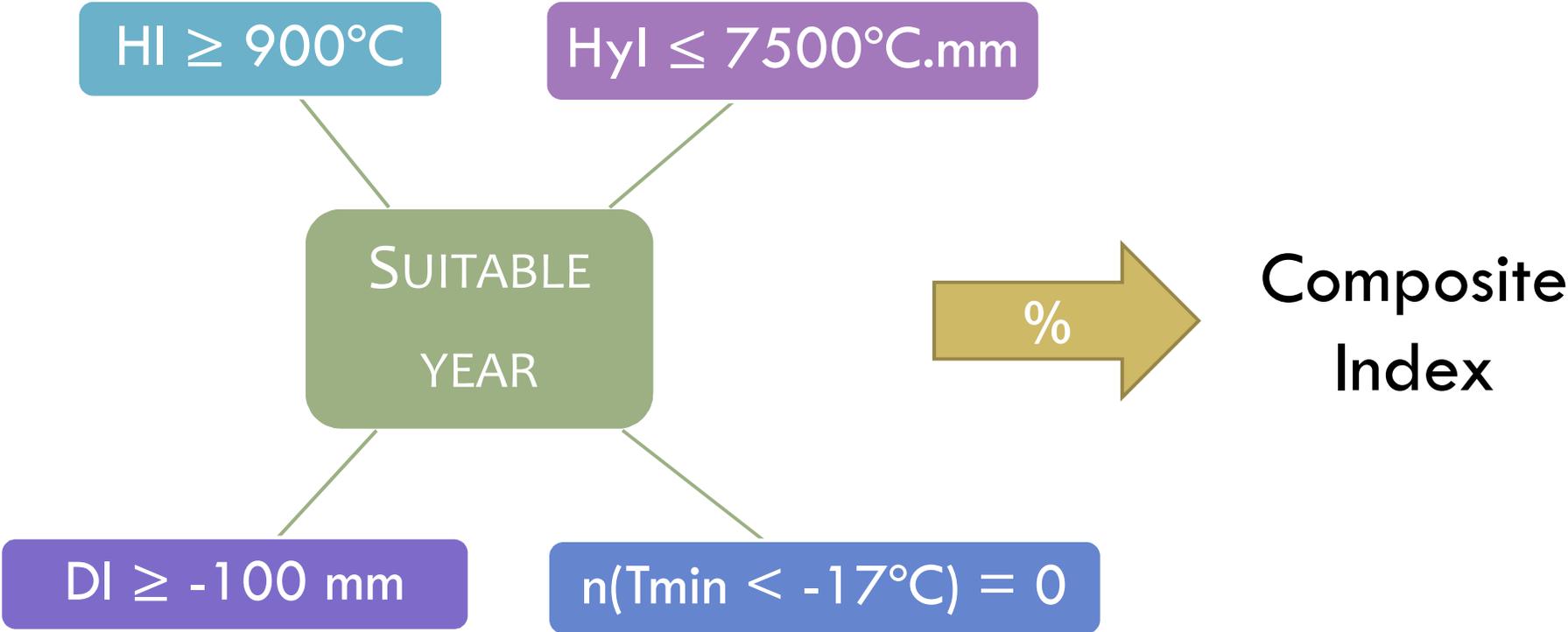


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Moderate
limitation to
winegrape
growth in
blue areas
(risk of downy
mildew disease
and pests)

Composite Index (OBS)

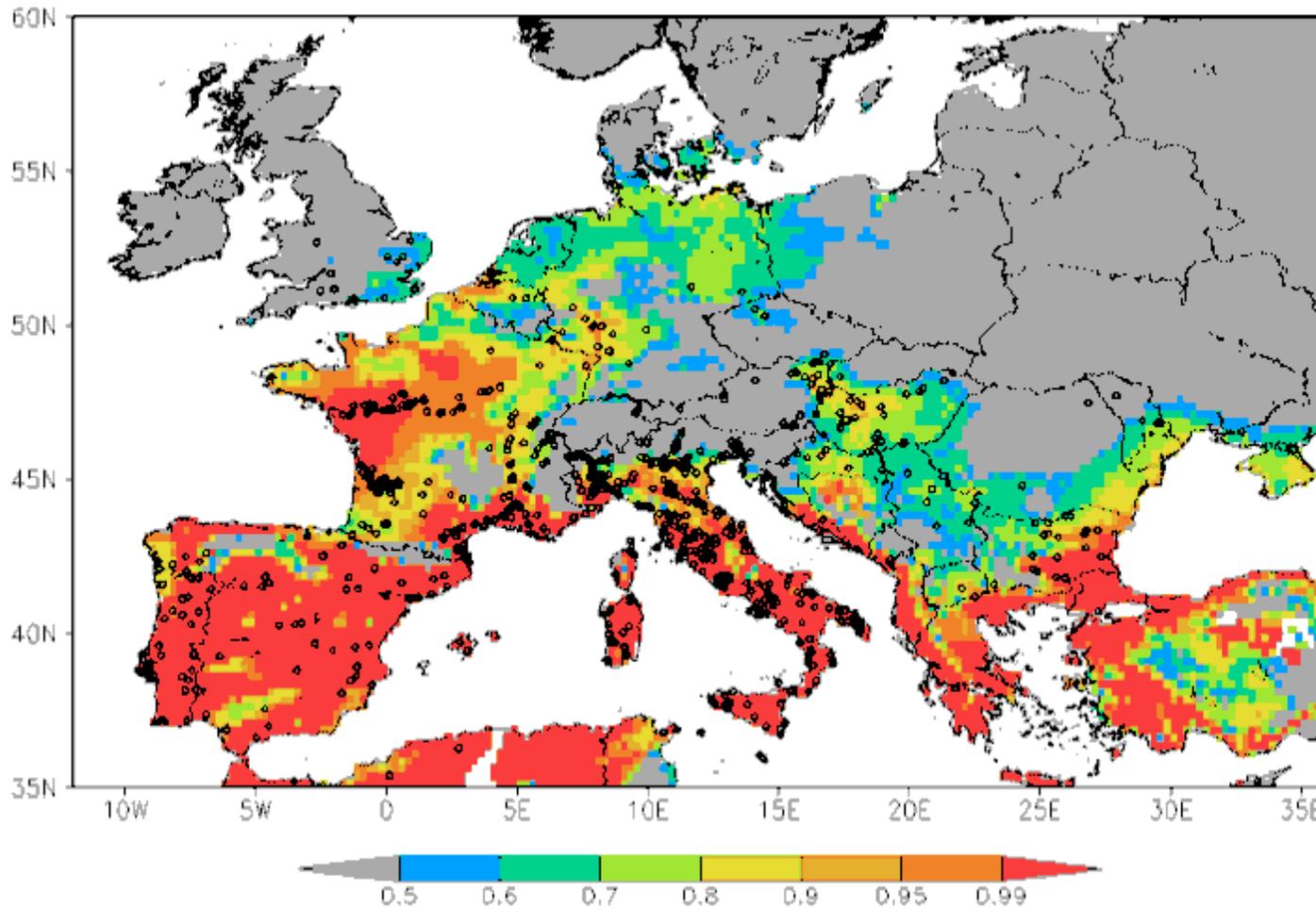


Suitable climate: Compl > 50%

Composite Index (OBS: 1980-2010)



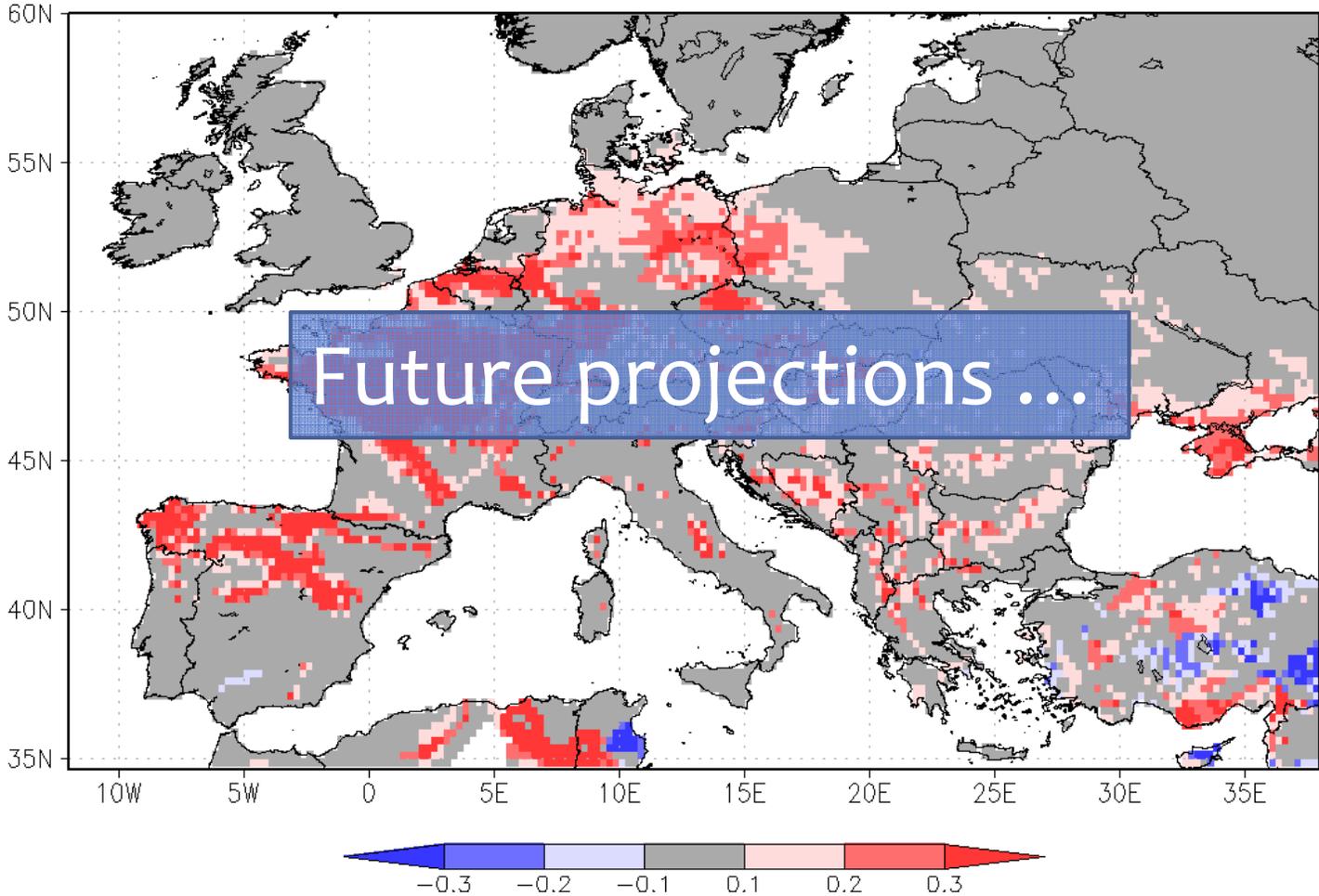
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Composite Index allows a **realistic** viticultural zoning in Europe

Differences in the Composite Index (OBS)

1980/2010 – 1950/1979

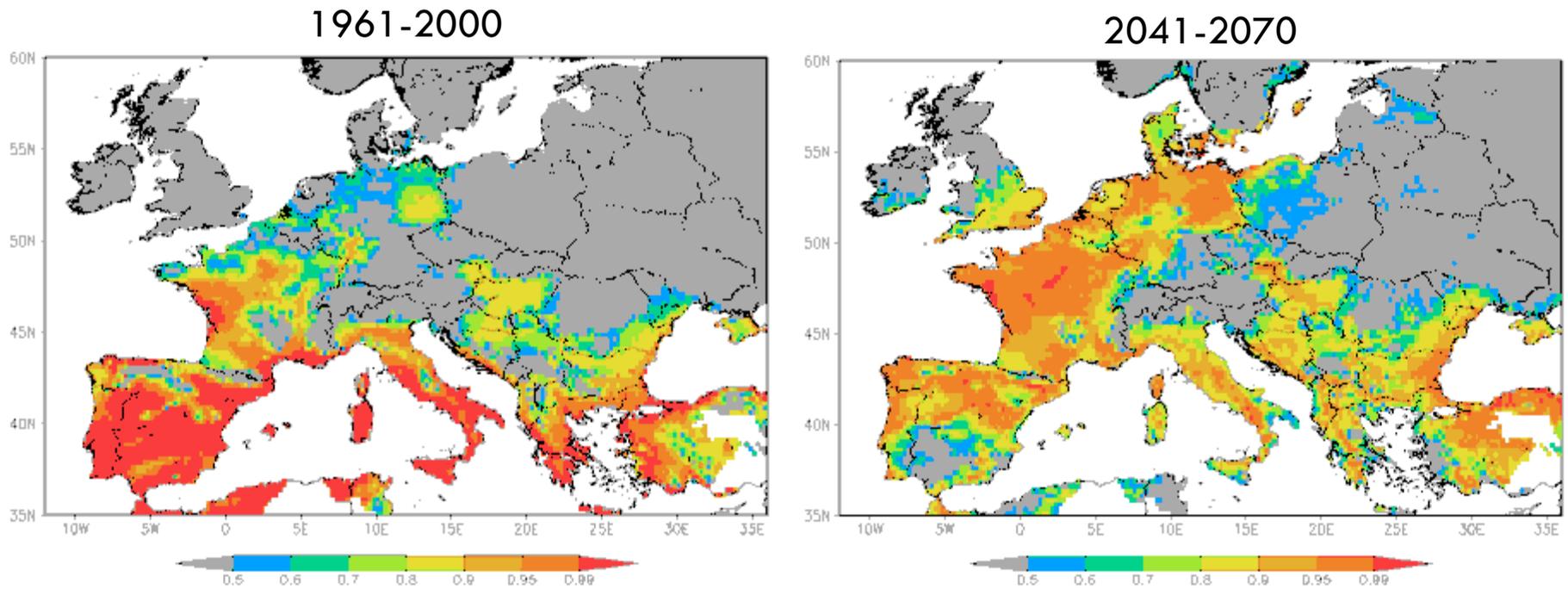


**Recent-past
increase in
climate
suitability
for viticulture**

Composite Index

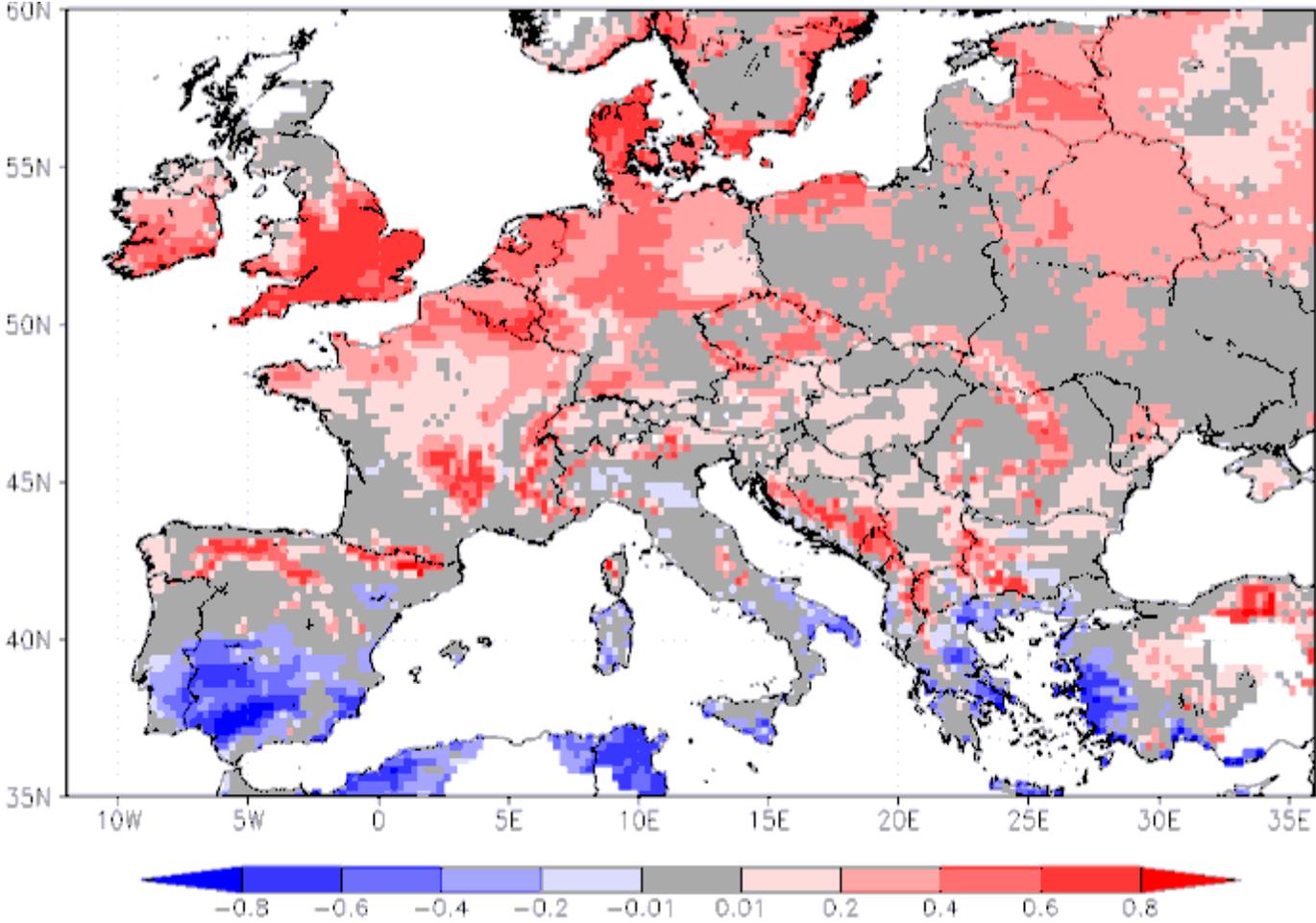


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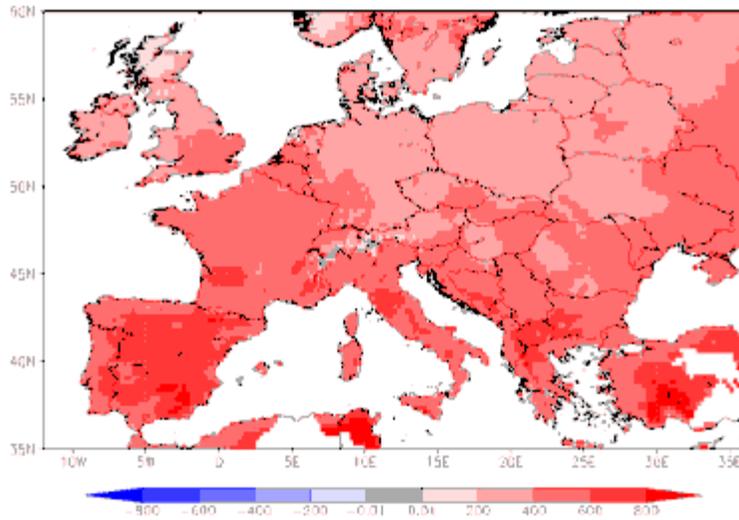


**Northward displacement of the “optimal regions”
and reduction in their extension**

Differences in the Composite Index 2041/2070 – 1961/2000

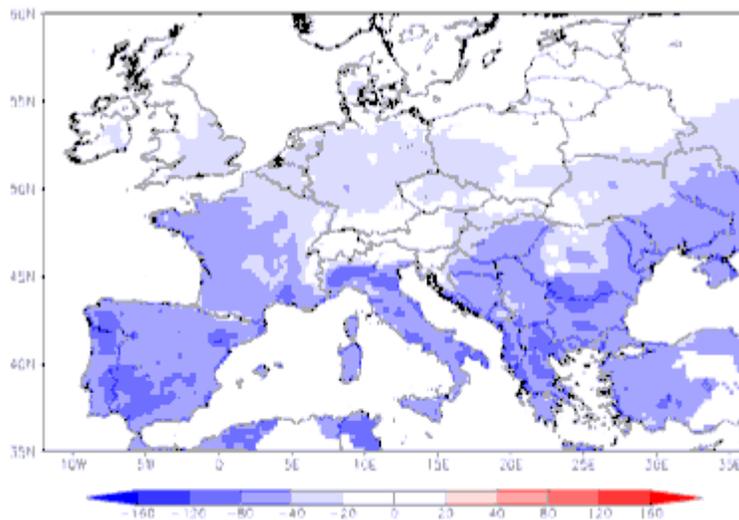


Main contributors to projected changes



Change in HI (A1B)

Significant **warming** of the growing season



Change in DI (A1B)

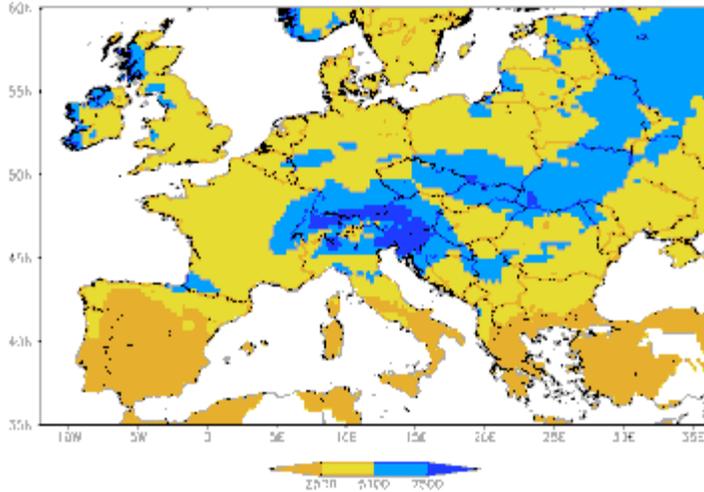
Significant **drying** of the growing season

Main climate change risks



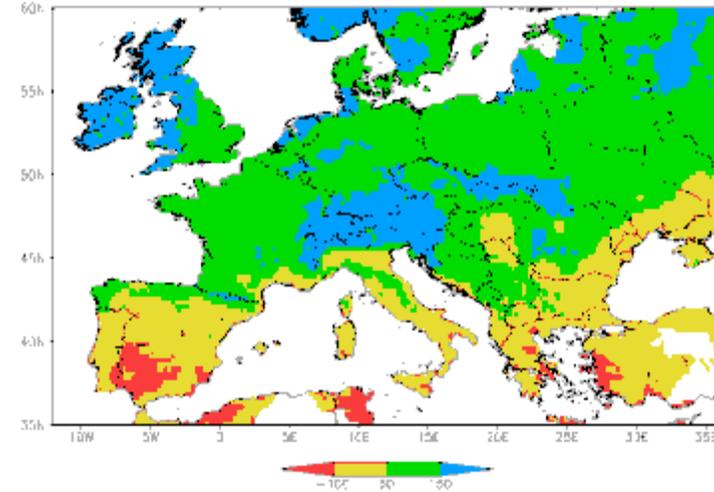
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H_yI – A1B (2041-2070)



pests & diseases

DI – A1B (2041-2070)



water stress

Adaptation/mitigation measures



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Short-term measures:

Irrigation

Changes in agricultural practices and
in soil management

Plant protection against water &
thermal stresses

More effective control of pests &
diseases

Fertilization

Long-term measures:

Selection of suitable grapevine
varieties

Changes in the vineyards microclimate
(e.g. solar exposure, altitude, vine
density)

Genetic breeding

Thank you!