ADaptation of Viticulture to CLIMate change:
High resolution observations of adaptation scenarii for viticulture
Report from ADVICLIM, part 2

○ Update from:
  ○ Bordeaux Sciences Agro/ INRA UMR EGFV : Saint-Emilion/Pomerol
  ○ Geisenheim University: Rheingau
  ○ Iasi University: Cotnari
  ○ Plumpton College: Rock Lodge Vineyard
  ○ CNRS (Rennes and Brest)

○ The next steps:
  ○ Predicting future climate variability and change
  ○ Simulating the impact of climate change on grapevine phenology and viticultural activities
  ○ Information transfer to the viticultural sector
90 temperature sensors (1 sensor for 210 ha) recording min and max temps hourly.

dee Rességuier L., Le Roux R., Petitjean T, van Leeuwen C.
Automatic data transmission

Temperature sensors

LoRa gateways (x 4)

WEB Platform

de Rességuier L., Le Roux R., Petitjean T, van Leeuwen C.
Spatial variability of minimum temperature during the 2016 vegetative season

Mean of minimum daily temperature (°C) 01 Apr. through 30 Sept. 2016
Spatial variability of maximum temperature during the 2016 vegetative season

Mean of maximum daily temperature (°C) 01 Apr. through 30 Sept. 2016

de Rességuier L., Le Roux R., Petitjean T, van Leeuwen C.
Spatial distribution of Winkler index calculations (2016)

Winkler Index 2016 (degree days)

1936

1619

de Rességuier L., Le Roux R., Petitjean T, van Leeuwen C.
Geisenheim, Rheingau, Germany
Temperature sensors at Rüdesheim (Rheingau)

31 temperature sensors, recording hourly minimum and maximum temperatures.

All on Riesling cultivar.
April - October mean temperature (2016)

Temperature variability: ca. 1.3 °C

Hofmann M., Stoll M.
April - October mean temperature

Height dependance of temperature

\[ R^2 = 0.63 \]

\(-0.55 \, ^\circ\text{C} \text{ per 100 m} \)
Date of flowering (E-L 23) 2016

Earliest date: 16th June
Latest: 28th June
Total Soluble Solids (TSS) 21th Sep., 2017

Lowest TSS: 14.6° Brix (64° Oechsle)
Highest TSS: 23° Brix (101° Oechsle)
Climate modeling at the vineyard scale

**Huglin bioclimatic index modelled in 2016 (Geisenheim)**

Le Roux R., Quenol H. Mapping adapted from model developed in Le Roux et al, Agricultural and forest Meteorology, 2017
Cotnari, Romania

Irimia et al., TAAC 131(3-4)/2018
Marked change in vineyard suitability since 1980

<table>
<thead>
<tr>
<th>Suitability class</th>
<th>Suitability subclass</th>
<th>% in the Cotnari vineyard area 1961-1980</th>
<th>% in the Cotnari vineyard area 1981-2013</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>ha</td>
<td>%</td>
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<tr>
<td>Red wines</td>
<td>10</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>9</td>
<td>-</td>
<td>-</td>
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<tr>
<td>White quality wines</td>
<td>8</td>
<td>-</td>
<td>-</td>
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<td>7</td>
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<td>White table wines</td>
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<td>4.0</td>
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<tr>
<td></td>
<td>5</td>
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<tr>
<td>Unsuitable</td>
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<tr>
<td>Total</td>
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<td>2037.4</td>
<td>100</td>
</tr>
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</table>

Irimia et al., TAAC 131(3-4)/2018
Predicted evolution of Huglin index 2000-2100

Irimia and Patriche, 2018 (unpublished data)
Positioning of temperature sensors in the field at Rock Lodge vineyard

Plumpton College, Sussex, UK
Cumulative growing degree days (Winkler Index) for sensors at Rock Lodge Vineyard (2016)

Slate A., Cortiula-Phelipot C., Foss C.
Spatialised Winkler index over Rock Lodge vineyard (2015-2017)

Source: Corentin Cortiula-Phelipot, 2018

Cortiula-Phelipot C., Foss C.
Topographical map displaying orientation

Cortiula-Phelipot C., Foss C.
Topographical map displaying slope
### Physical properties of the temperature sensor positions

<table>
<thead>
<tr>
<th>Variety</th>
<th>Sensor</th>
<th>Alt (m)</th>
<th>Slope(°)</th>
<th>Orientation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pinot Meunier</td>
<td>PM_12</td>
<td>58</td>
<td>5.4</td>
<td>South</td>
</tr>
<tr>
<td>Pinot Meunier</td>
<td>PM_19</td>
<td>55</td>
<td>6</td>
<td>South</td>
</tr>
<tr>
<td>Pinot Meunier</td>
<td>PM_55</td>
<td>56</td>
<td>3</td>
<td>South-east</td>
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<tr>
<td>Pinot Meunier</td>
<td>PM_59</td>
<td>60</td>
<td>4</td>
<td>South</td>
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<tr>
<td>Acolon</td>
<td>AC_27</td>
<td>44</td>
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</tr>
<tr>
<td>Acolon</td>
<td>AC_53</td>
<td>44</td>
<td>1.9</td>
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<td>Bacchus</td>
<td>BA_80T</td>
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<td>3.7</td>
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<td>Bacchus</td>
<td>BA_80B</td>
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<td>Dornfelder</td>
<td>DO_24</td>
<td>42</td>
<td>4.2</td>
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<td>Ortega</td>
<td>OR_37</td>
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<td>Pinot Blanc</td>
<td>PB_62</td>
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<td>Pinot Noir</td>
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<td>Regner</td>
<td>RE_4</td>
<td>42</td>
<td>4.4</td>
<td>North-east</td>
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<td>Riesling</td>
<td>RI_42</td>
<td>33</td>
<td>4.8</td>
<td>South</td>
</tr>
</tbody>
</table>

Cortiula-Phelipot C., Foss C.
Relationship between altitude and mean minimum growing season temperature (2016)

Slate A., Cortiula-Phelipot C., Foss C.
Simulating future climate variability and change

Huglin Index for the period 1986 to 2005 (based on EuroCordex data)

Huglin Class (Degree-Days °C)
- Very cold
- Cold
- Temperate
- Warm temperate
- Warm
- Very warm

Le Roux R., PhD thesis 2017
Climate change modelling at the regional scale

**Huglin Index for the period 2031 to 2050 and 2081 to 2100 according to the climate scenarios RCP4.5 and RCP8.5 (based on EuroCordex data)**

Le Roux R., PhD thesis 2017
Modeling of the Winkler Index in the Saint Emilion wine region with a resolution of 8 km according to scenario RCP8.5 for the period 2081-2100 (on the right) and 25 m using statistical downscaling from the large-scale model output (on the left). (Le Roux, 2017)
Simulating the impact of climate change on grapevine phenology and viticultural activities: The SEVE model

Tissot, Neethling, Rouan, Barbeau, Quénol, Le Coq
Simulating the impact of climate change on grapevine phenology

Simulation results for the year 2060

Tissot, Neethling, Rouan, Barbeau, Quénol, Le Coq
Modelling agronomic actions and decision processes

Based on:
- Current climate data and predictions
- Phenological observations and models
- Life-cycle assessments
- Environmental and economic impacts
Simulating the impact of adaptation responses

Potential adaptation strategies to climate change

Conclusions

• Climatic analysis and modeling at the global and regional scales are not accurate enough to take into account local variability.

• Agro-climatic modeling at a local scale allows an improved framework for developing adaptation options in response to future climate change.

• The Life-ADVICLIM project is generating climate and phenological models adapted to the vineyard scale, integrating climate change scenarios.

• The final step is the information transfer to the viticultural sector

www.adviclim.eu
Thank you all for your attention

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