LOEWE
Exzellente Forschung für Hessens Zukunft

FACE$_2$FACE

Hochschule Geisenheim University

Sustainable grape and wine production in the context of climate change
ClimWine 2016
April 10-13, 2016 - Bordeaux

Elevated CO_2-concentration: Impact on growth and grape quality of *Vitis vinifera* cvs. Riesling and Cabernet Sauvignon for two accompanied vintages

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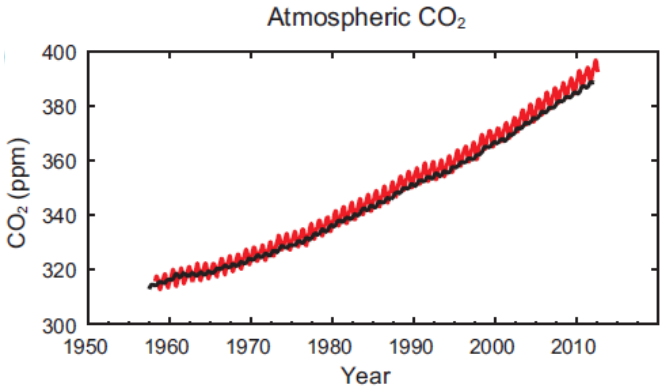
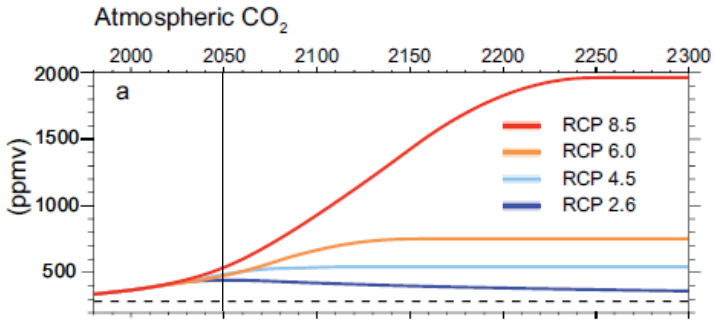
MPI

Climate Change
CO_2-concentration

- Intergovernmental Panel on Climate Change (IPPC, 2013)



Multiple observed indicators of a changing global carbon cycle: atmospheric concentrations of carbon dioxide (CO_2) from Mauna Loa (19°32´N, 155°34´W – red) and South Pole (89°59´S, 24°48´W – black) since 1958



Atmopspheric CO_2, as simulated by Earth System Models of Intermediate Complexity (EMICs) for the four Representative Concentration Pathways (RPC) up to 2300 (Zickfeld et. al 2013). The dashed line indicates the pre-industrial CO_2 concentration.

- predicted annual atmospheric CO_2-increase between 1.5-3 ppm regarding to several emission-scenarios
- mid of 21st century → +20 % CO_2 (80-100 ppm)

⇩

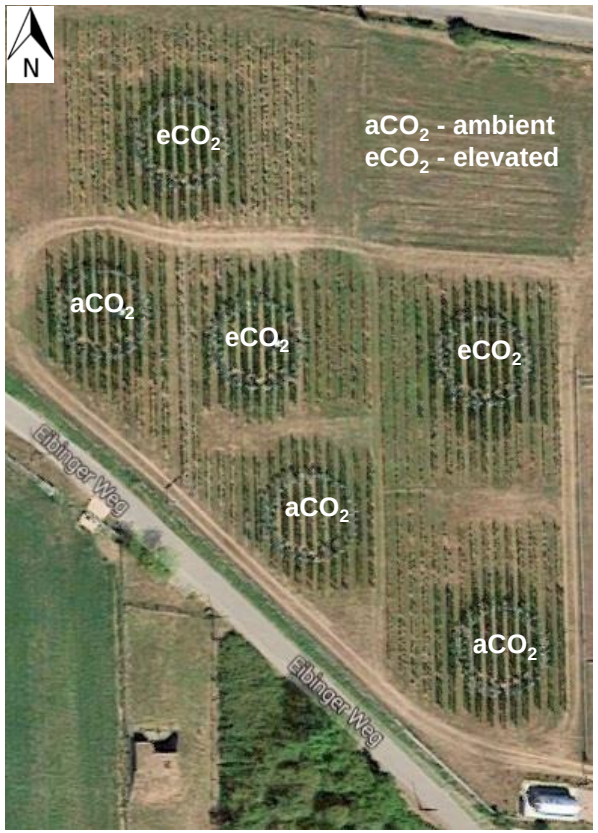
- FACE2FACE - consequences of climate change, adaption to climate change and reduction of greenhouse gas emissions to 2050
- LOEWE research cluster FACE2FACE combines two FACE facilities at Geisenheim University and Justus-Liebig-University Giessen and national partners
- impact of elevated atmospheric CO_2 on special crops (vegetables & grapevines)

Experimental setup
Free Air Carbon dioxide Enrichment - FACE

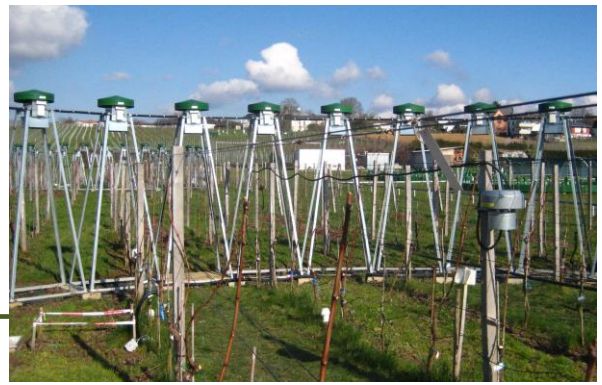
Hochschule Geisenheim University

- Geisenheim FACE-facility-grapevines (50°N, 8°E)
- ring system (Ø 12 m) with two treatments, n=3
  - aCO_2 – ambient: CO_2 400 ppm
  - eCO_2 – elevated: CO_2 + 20 %
  - varieties: Riesling Kl. 198-30 Gm, SO4
    Cabernet Sauvignon, 161-49
  - spacing: 1.80 m x 0.9 m / 1.60 m^2 per vine
  - cane pruned 5 nodes/m^2

M. Selim

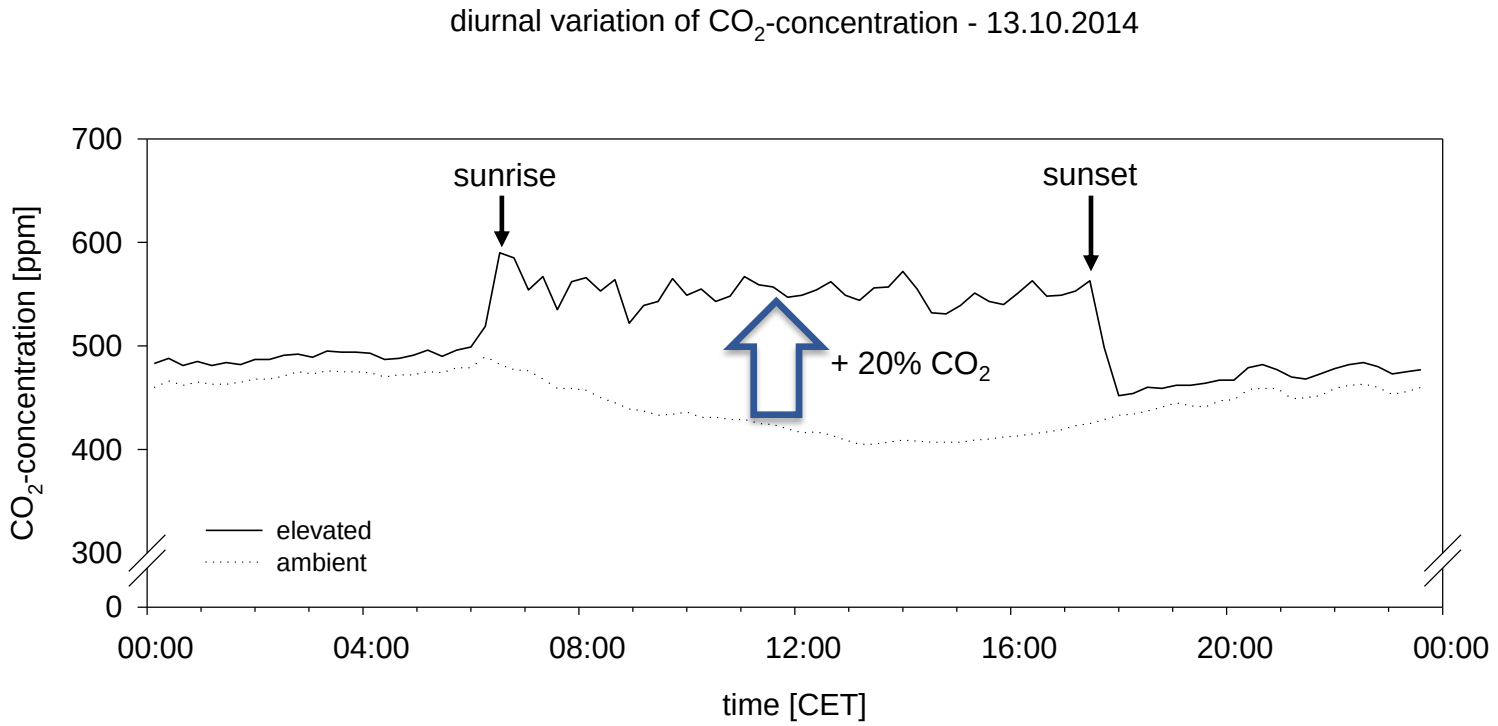


https://www.google.de/maps/place/Geisenheim



CO_2-concentration

- diurnal variation of CO_2-concentration - 13.10.2014 - elevated versus ambient
- fumigation from sunrise to sunset throughout the entire year



Conducted measurements
Season 2014 / 2015

- Pruning weight → fresh matter (FM), dry matter (DM) → water content (WC)
- Trunk diameter (min & max) → cross-section area → annual trunk growth rate (TGR) 2014-2015
- Leaf area measurements
  - Shoot length of primary (July) and secondary (August) shoots
  - Calculated as LA [cm^2] according to Mabrouk and Carbonneau (1996), Döring and Stöber (2011)
- Summer pruning at two stages in 2015, weighing of leaf biomass
  - 1^{st}: July, top and 2^{nd}: September, top & side
- Berry development
  - Sampling of berries from pre veraison to harvest in two weeks rotation of varieties
  - Analyses of: total soluble solids (TSS), single berry weight, pH, total acidity (TA)
- Grapevine yield
  - Quantification of single vine yield at harvest date
  - Botrytis monitoring for Riesling

Conclusion
Season 2014 / 2015

eCO_2 resulted in increase of:

- Annual trunk growth rate (2015) - Riesling
- Leaf area from secondary shoots (2015) - Riesling
- Leaf biomass for secondary shoots (2015) - Riesling
- Single berry weight (2015) during ripening - Riesling & Cabernet Sauvignon
- Tartaric acid (2015) during ripening - Cabernet Sauvignon
- Grapevine yield (2015) - Riesling & Cabernet Sauvignon
- Initial incidence of botrytis (2015) - Riesling
- Bunch architecture
    - no of berries per bunch, bunch weight (2014), bunch length (2015) - Riesling
    - no of berries per bunch, bunch weight (2015) - Cabernet Sauvignon

eCO_2 resulted in decrease of:

- Total soluble solids and pH (2015) during ripening - Cabernet Sauvignon

Thank you for your attention

Special thanks to:

Department of General & Organic Viticulture: Dr. S. Tittmann, J.A. Dittrich, P. Birkner, E. Laize, S. Samer, M. König, B. Gaubatz and co-workers
Department of Grapevine Breeding: Prof. Dr. E. Rühl, H. Konrad, R. Grundel and cellar staff
Department of Wine Chemistry & Beverage Research: Prof. Dr. H. Dietrich, Dr. C.-D. Patz, P. Kürbel, A. Rheinberger, A. Giehl, M.M.G. König
Department of Oenology: Prof. Dr. R. Jung, C. Schüssler
Project Coordination: Prof. Dr. C. Müller (JLU), Prof. Dr. H.R. Schultz (HGU)

This work (WP 3.1 & 3.2) is funded by the LOEWE excellence cluster FACE2FACE of the Hessen State Ministry of Higher Education, Research and the Arts.