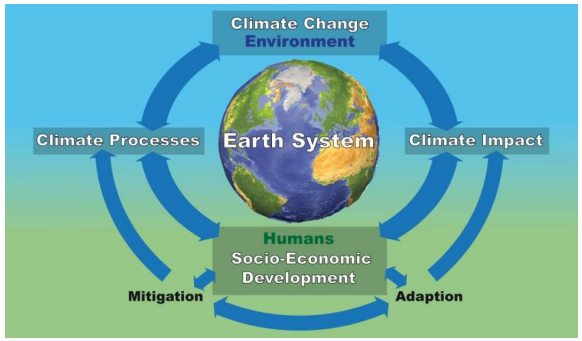
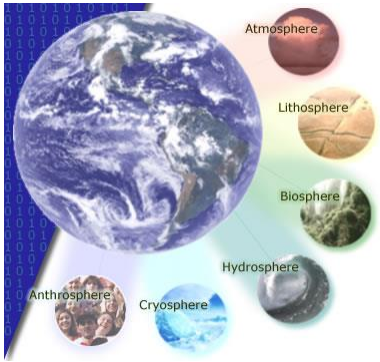
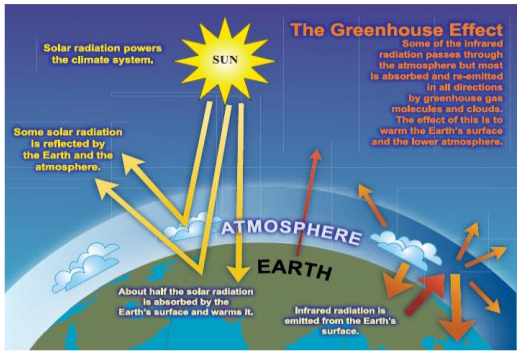
Master Program

Earth and Climate System Science (ECSS)







Dr. Hans-Stefan Bauer (ECSS Coordinator)

Prof. Dr. Volker Wulfmeyer (Head ECSS Master Course)

Planet under pressure: The Anthropocene

Food security and health

Land use (desertification, deforestation)

Population growth

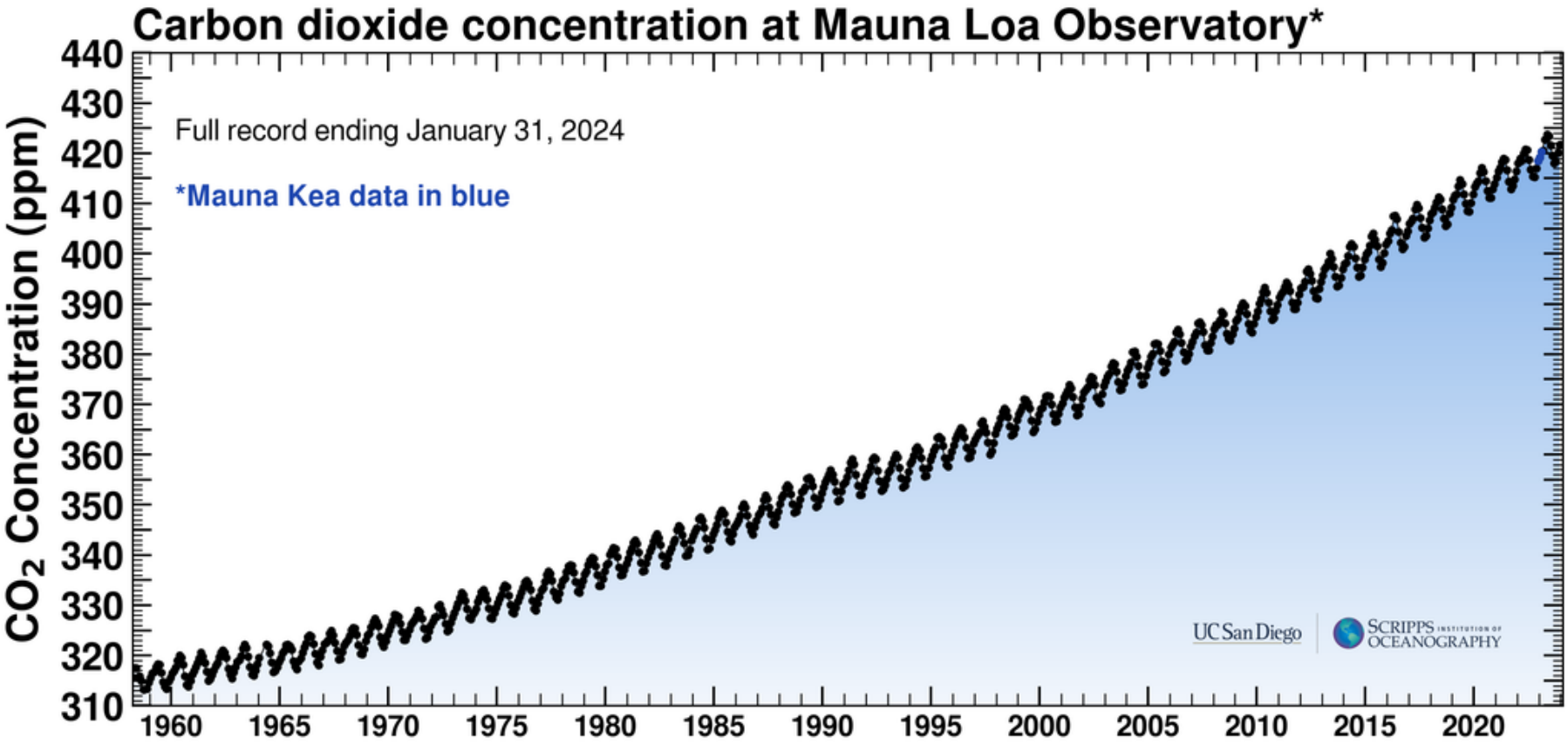
Energy production and demand

Climate variability and change

Socio-economic and political development

Vision: equitable, sustainable development

Climate Change



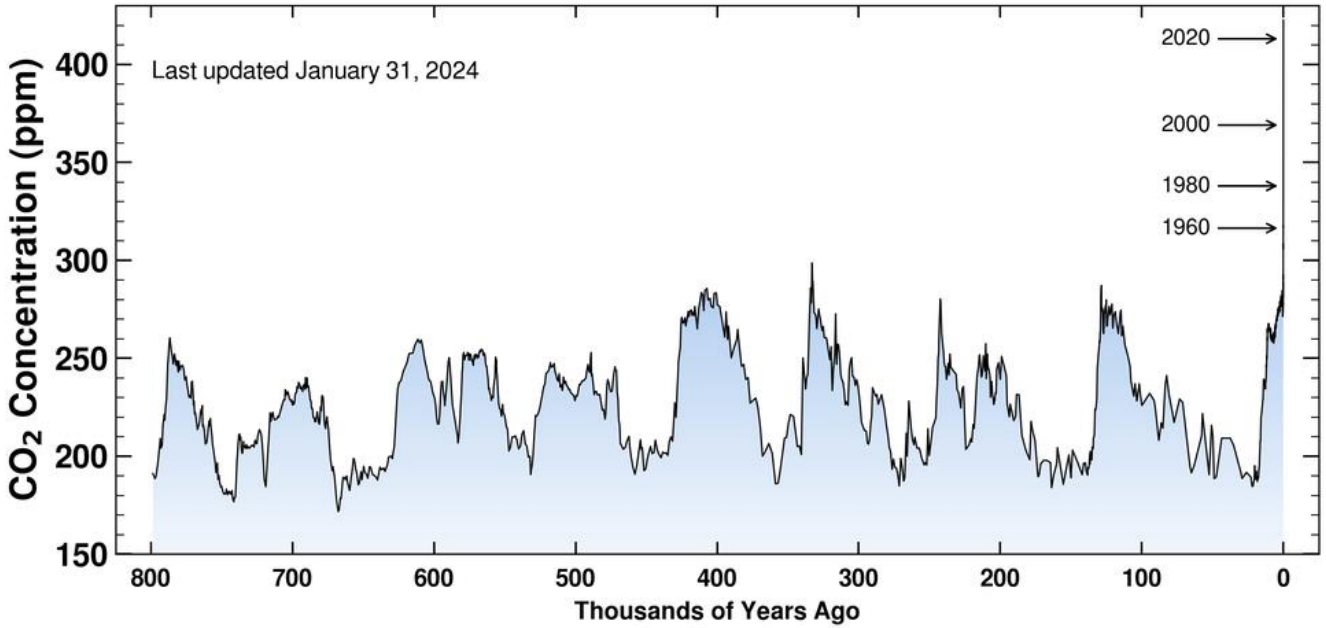
Source: Scripps Institution of Oceanography

*Latest CO_2 reading: 422.13 ppm

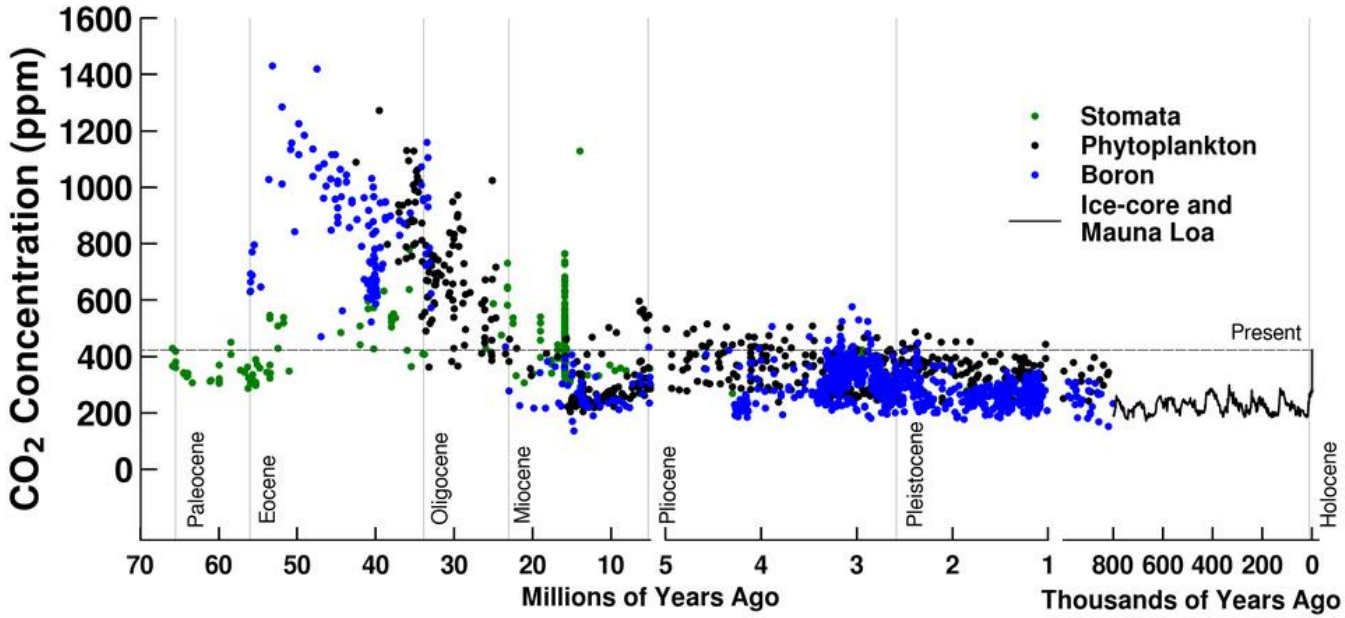
(31.01.2024)

https://scripps.ucsd.edu/bluemoon/co2_400/mlo_full_record.png

https://scripps.ucsd.edu/programs/keelingcurve/



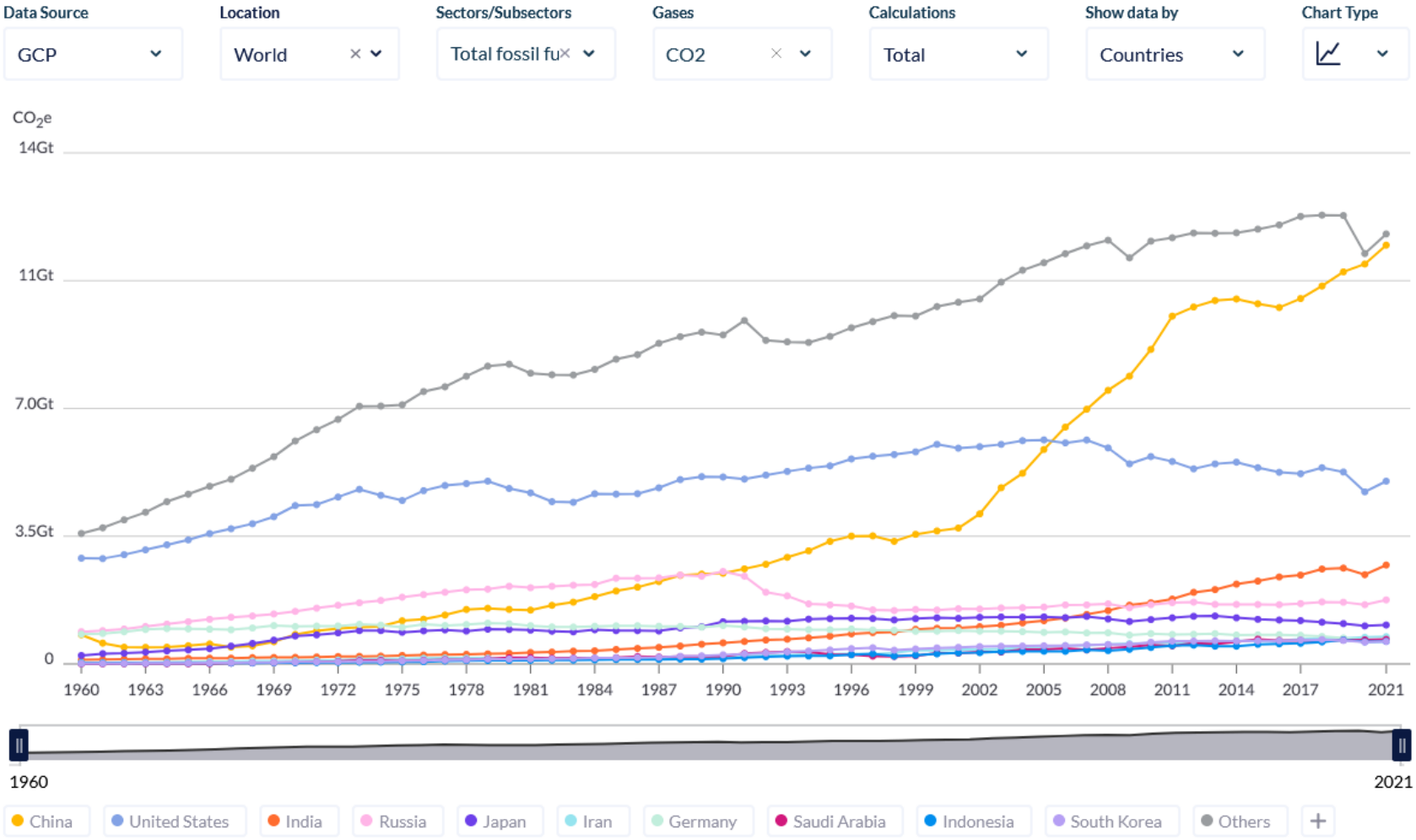
Inclusion of gas analyses from ice cores.



Inclusion of analyses from ocean sediments.

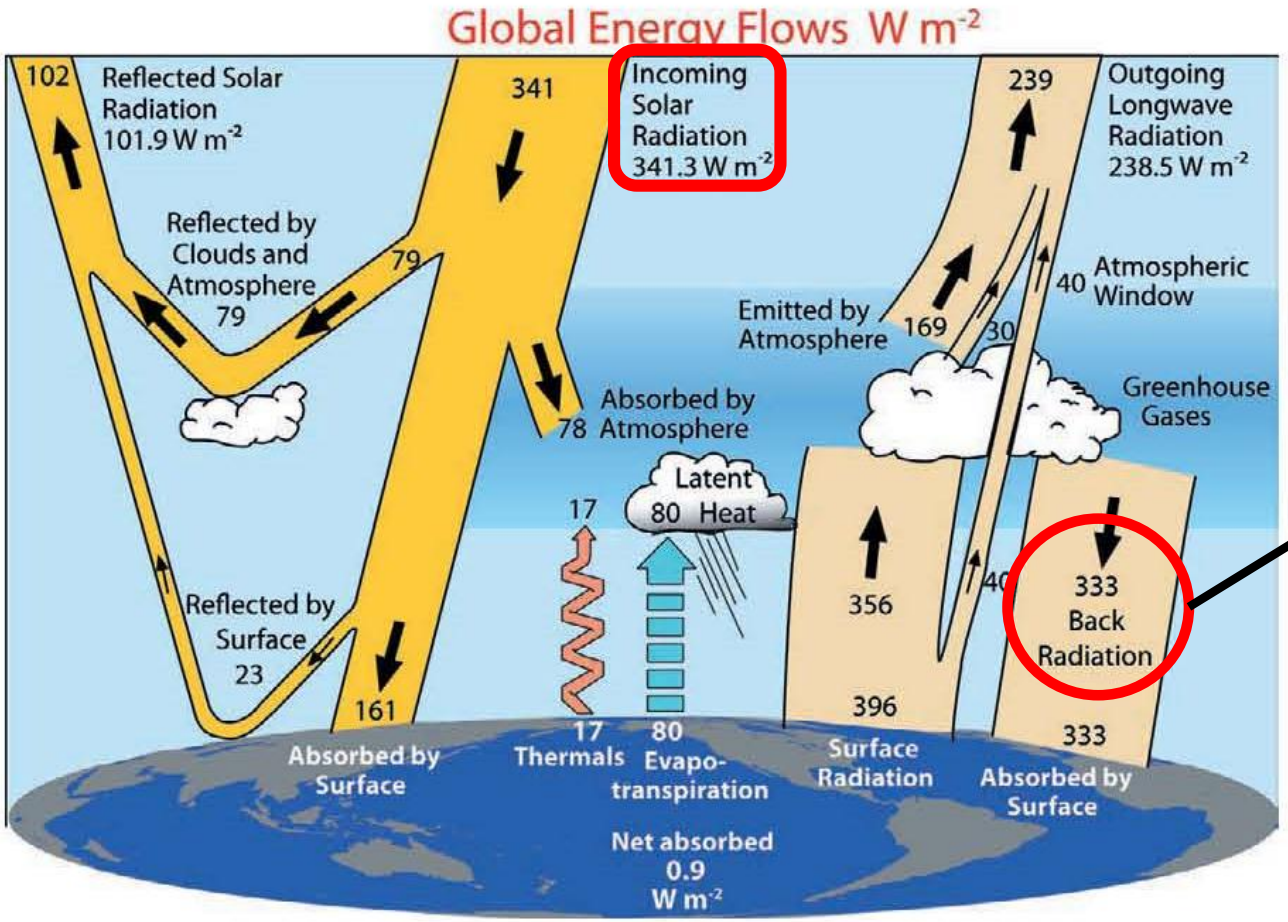
Todays values occured for the last time more than 1 millon years ago.

Planet under pressure: The Anthropocene



https://www.climatewatchdata.org/ghg-emissions?breakBy=sector&source=75

The Global Energy Budget

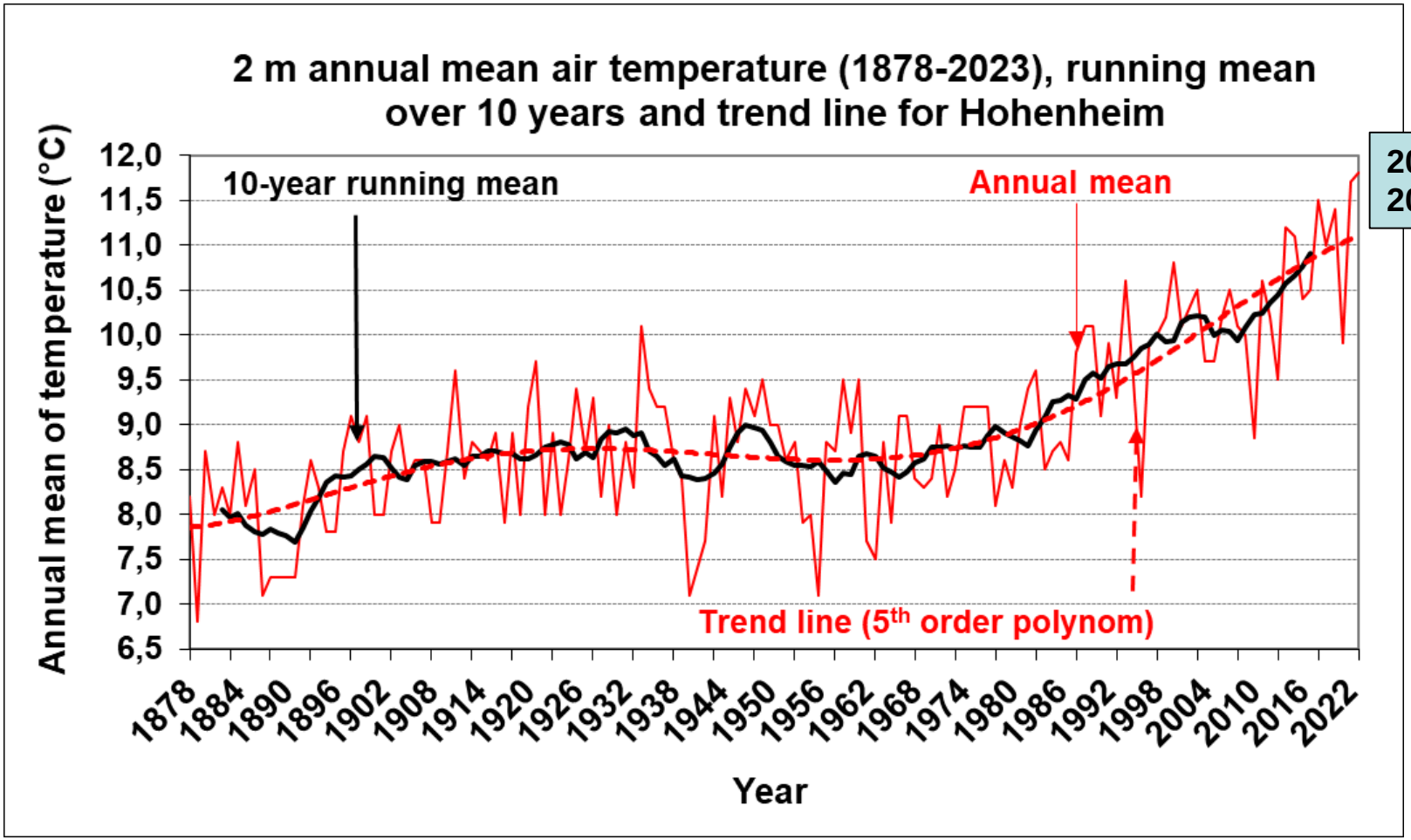


Greenhouse gases increase this Flux.

FIG. 1. The global annual mean Earth's energy budget for the Mar 2000 to May 2004 period (W m^{-2}). The broad arrows indicate the schematic flow of energy in proportion to their importance.

Source: Trenberth et al. BAMS 2009

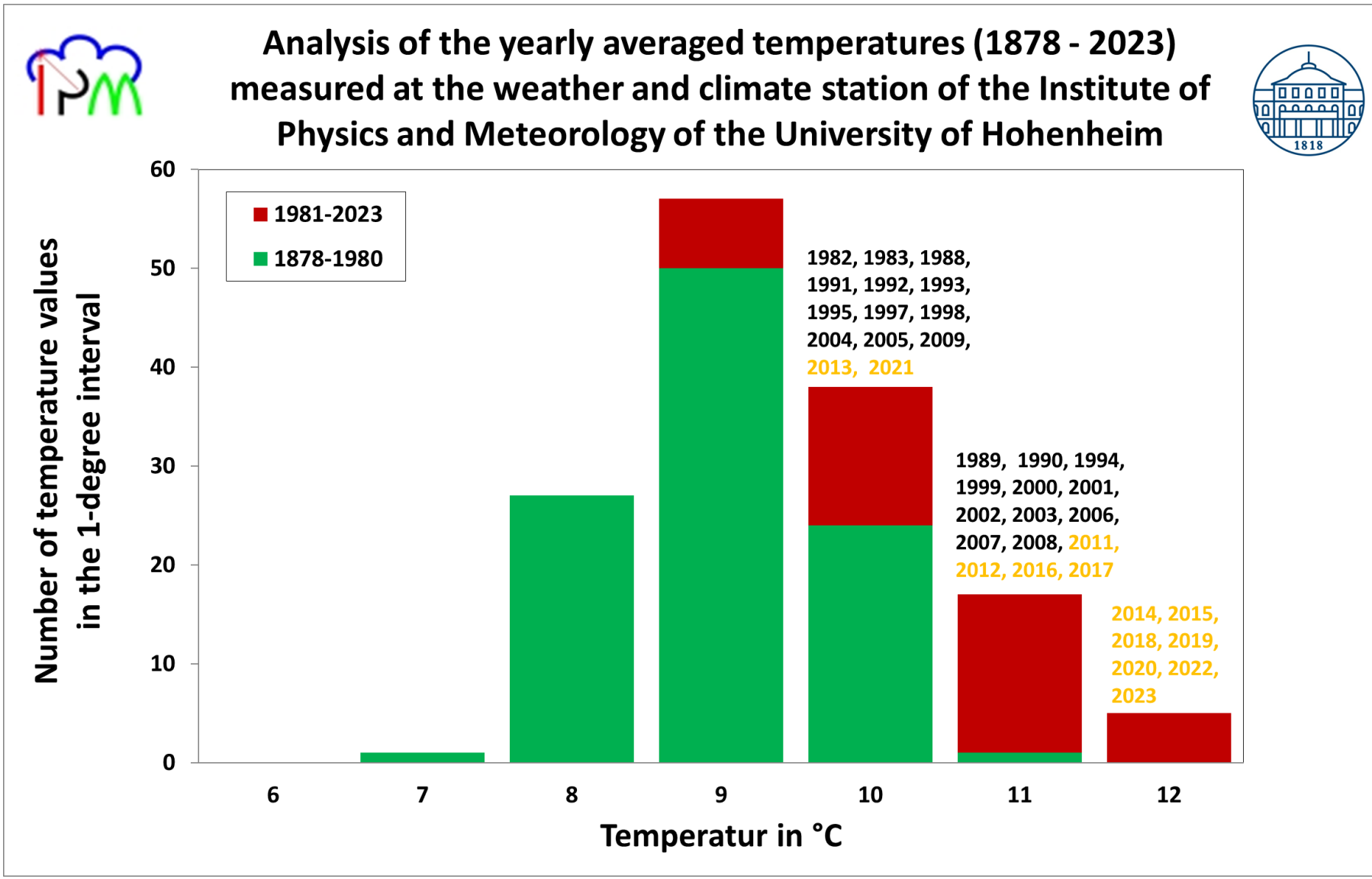
University of Hohenheim Climate Station



2022: 11.7 C
2023: 11.8 C

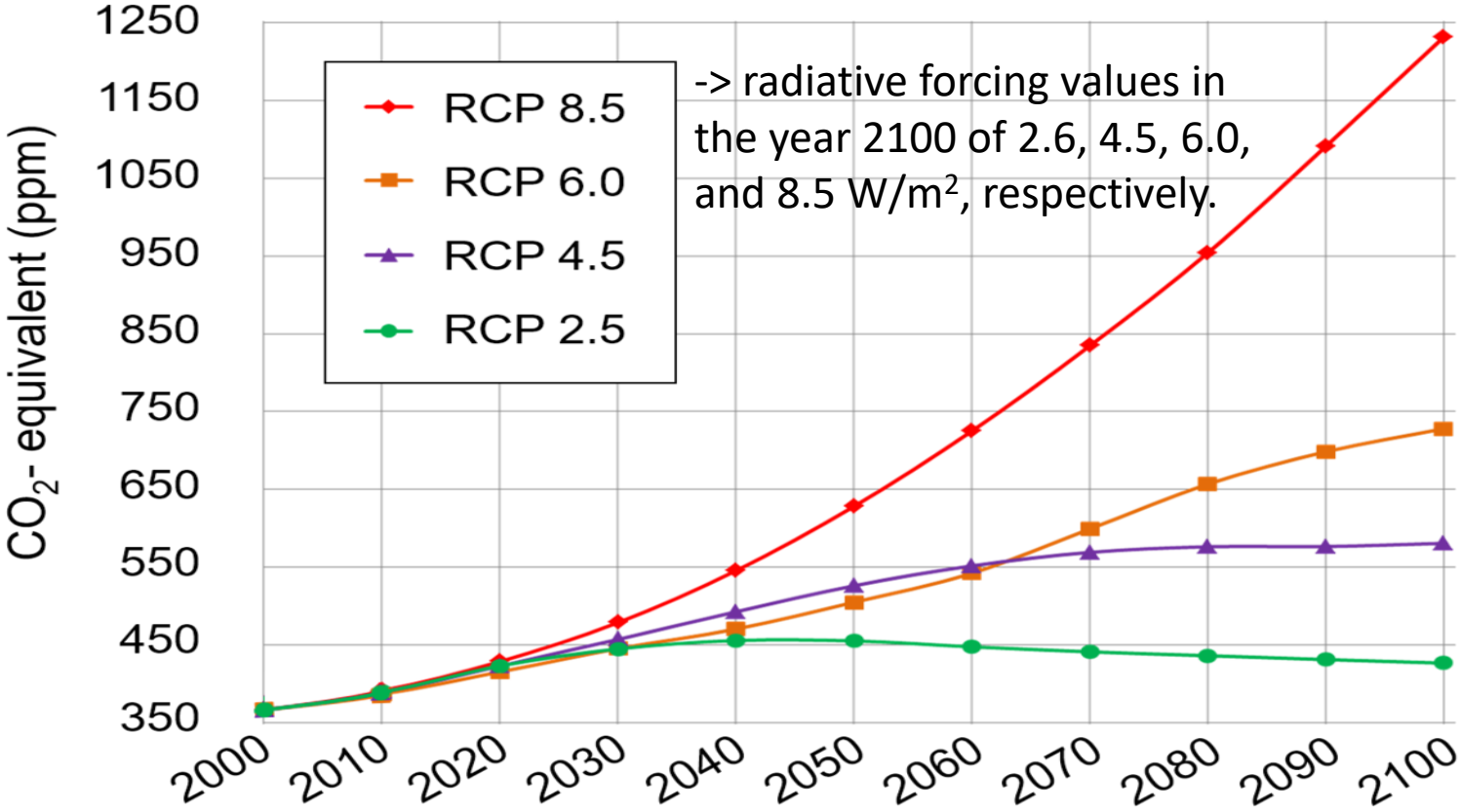
Already <u>2.5 K</u> temperature increase at this continental site between mid 20th century and today! (almost 3 K since the beginning of the recording).

Frequency distribution of annual mean temperatures



IPCC AR5 Greenhouse Gas Concentration Pathways

Representative Concentration Pathways (RCPs) from the fifth Assessment Report by the International Panel on Climate Change



-> radiative forcing values in the year 2100 of 2.6, 4.5, 6.0, and 8.5 W/m^2, respectively.

https://en.wikipedia.org/wiki/Representative_Concentration_Pathways

Climate Projections

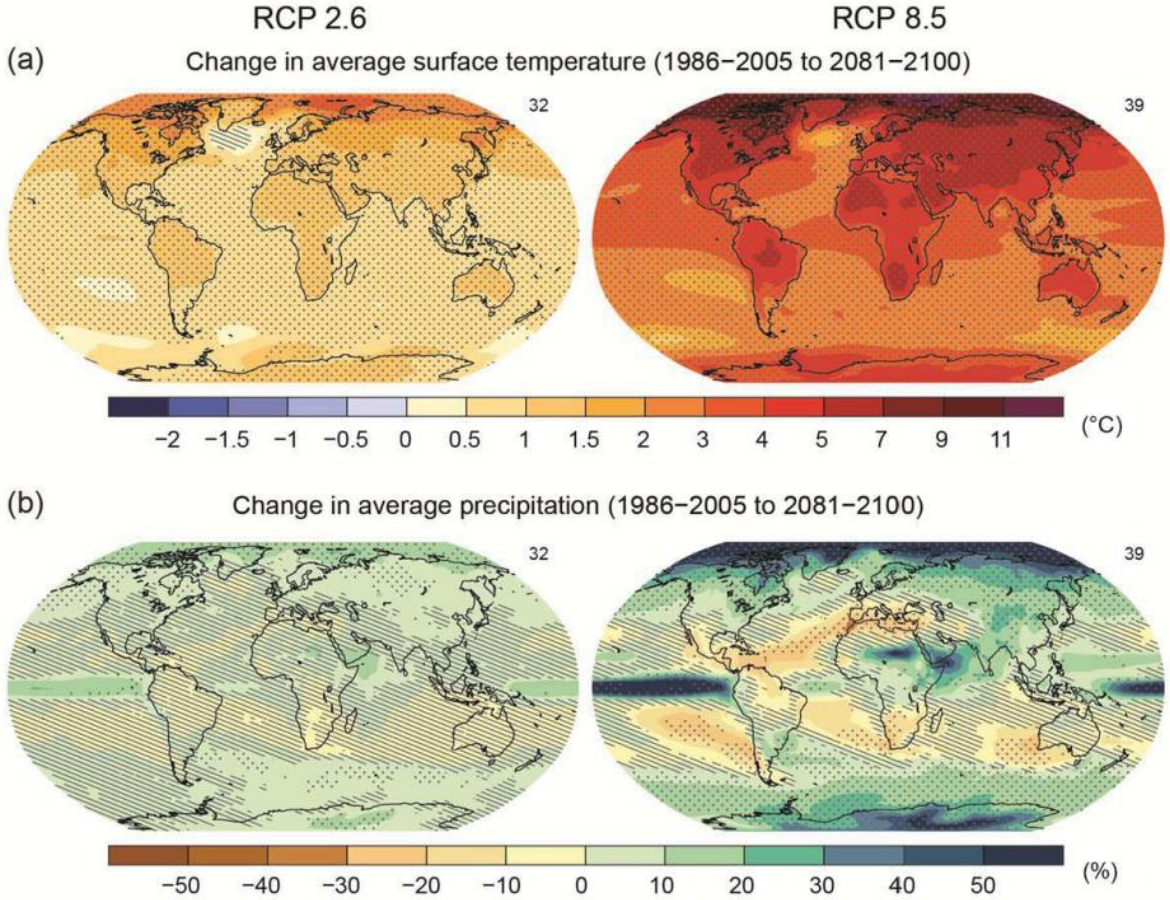


Figure SPM.7 | Change in average surface temperature **(a)** and change in average precipitation **(b)** based on multi-model mean projections for 2081–2100 relative to 1986–2005 under the RCP2.6 (left) and RCP8.5 (right) scenarios. The number of models used to calculate the multi-model mean is indicated in the upper right corner of each panel. Stippling (i.e., dots) shows regions where the projected change is large compared to natural internal variability and where at least 90% of models agree on the sign of change. Hatching (i.e., diagonal lines) shows regions where the projected change is less than one standard deviation of the natural internal variability. *{2.2, Figure 2.2}*

IPCC 5th Assessment Report 2013

https://www.ipcc.ch/site/assets/uploads/2018/02/SYR_AR5_FINAL_full.pdf

Important: Those changes in temperature and precipitation amount and distributipon effect almost everything in our daily life – and those consequences become clearer and clearer …

- Ocean level rise
- Distribution of tropical diseases
- Changes needed in agriculture and forestry
- Changes and reduction of biodiversity
- Increase of extreme events – both severe precipitation and droughts
- Increased bush and forest fire thread (even in regions where more precipitation is predicted).
- …

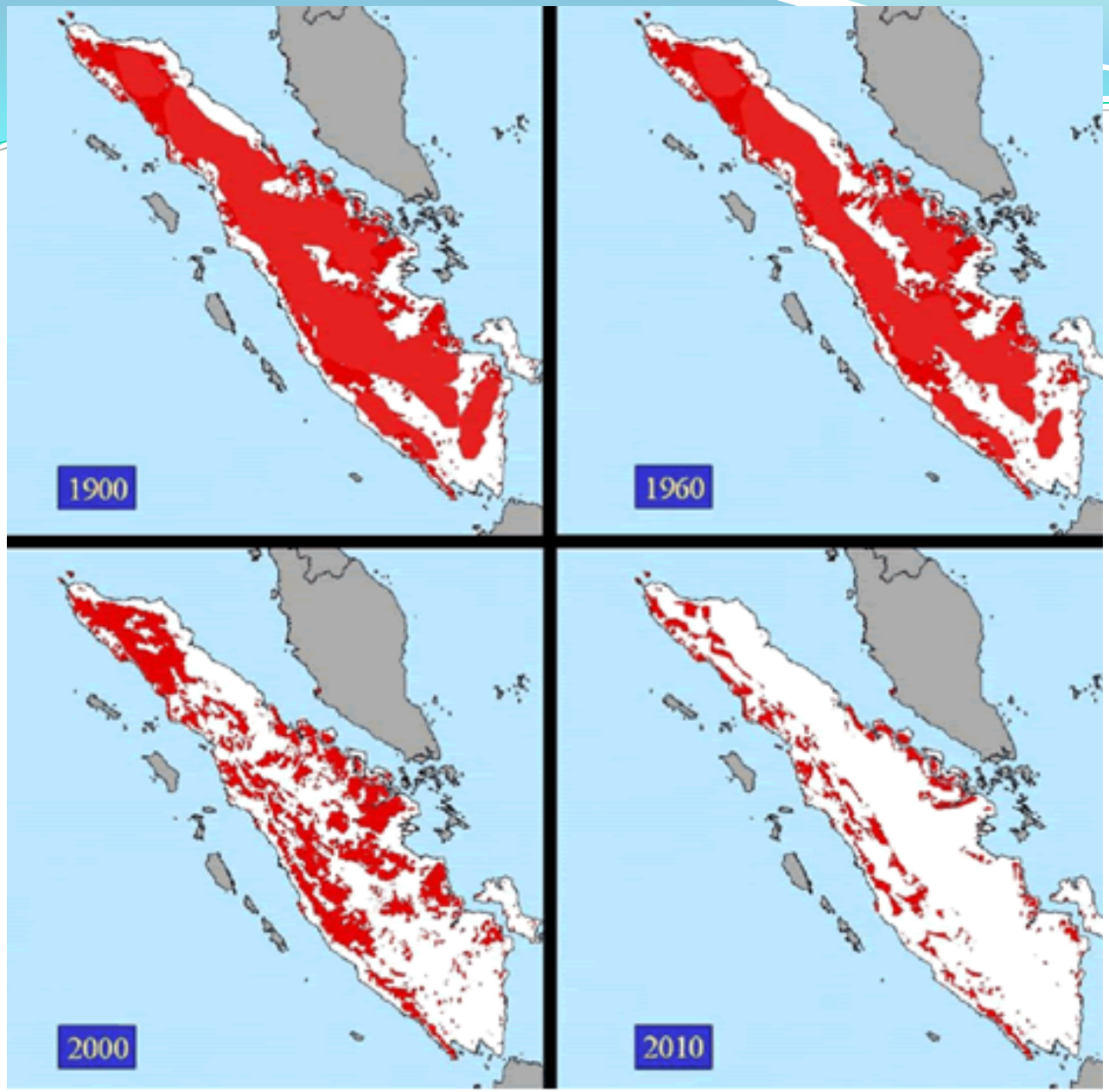
Here you see the strong connection and interdisciplinarity of the offered master course.

In addition, human made changes worsen the problem …

Land Cover Change

Chongqing, China

https://earthengine.google.com/timelapse/

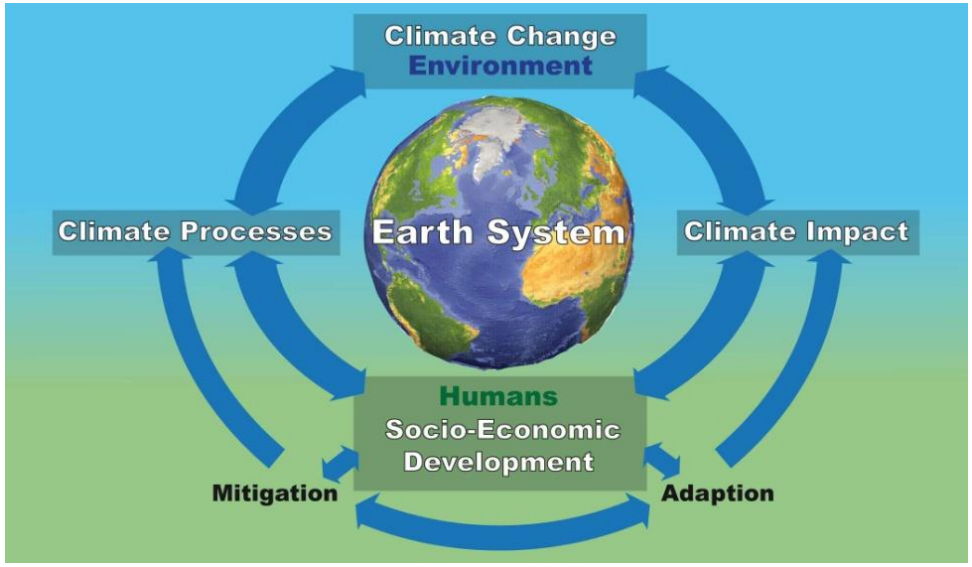


Loss of tropical rain forest in Indonesia between 1900 and 2010.

Red_ areas covered by tropical rain forest.

Aim of the master course

“Earth and Climate System Sciences (ECSS)”



- **Analyze and evaluate the state of the Earth system**
- **Understand the interaction and feedbacks between the system components**
- **Model subcomponents of this system**
- **…**

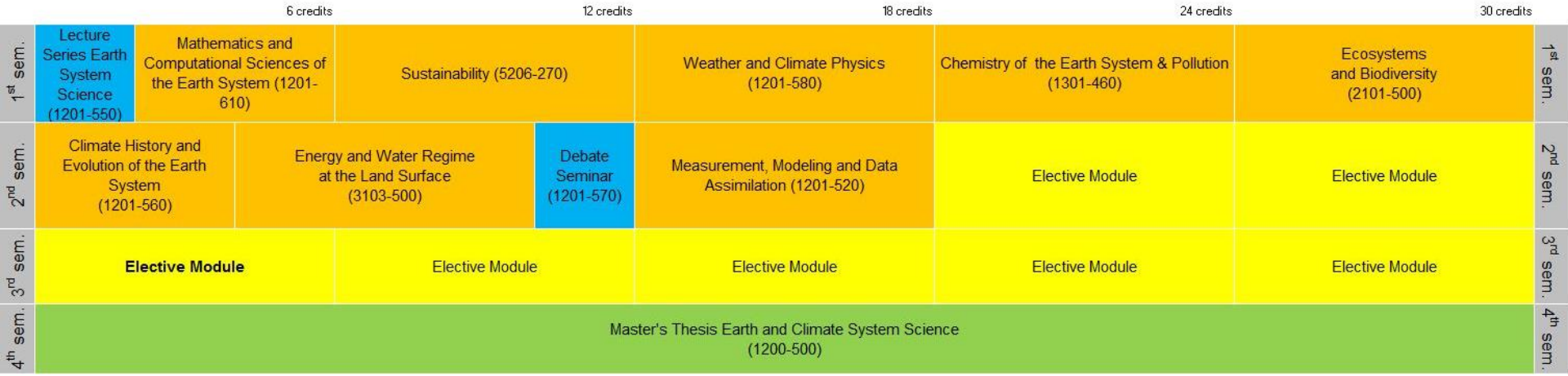
https://www.uni-hohenheim.de/en/earth-and-climate-system-science-masters

Requirements

- Interest in natural sciences
- Interest in agriculture and economics
- Interdisciplinary thinking
- Transdisciplinary communication and collaboration
- Basic knowledge in physics and mathematics
- Basic knowledge in English
  - Either certified, e.g. B2 level, TOEFL test, …
  - Or finished English bachelor
  - Or application from a country where English is an official language (e.g. U.K, USA, Australia, New Zealand, …)

Curriculum

Strong thematic interaction between modules.



Examples for offered elective modules in Hohenheim:

- Special Topics of Earth and Climate System Science
- Remote Sensing of the Earth System
- Agricultural and Forest Meteorology
- Measurement, Modelling and Data Assimilation II
- Spatial Data Analysis with geographic information systems (GIS)
- Statistics for Natural Sciences
- Global Change Issues
- Ecotoxicology and Environmental Analytics
- Poverty and Development Strategies
- …

You can select modules related to different specializations as:

- Earth System Processes and Simulation
- Agroecosystems and Food Security
- Sustainability and Environmental Resources

Earth and Climate System Science at the University of Hohenheim:

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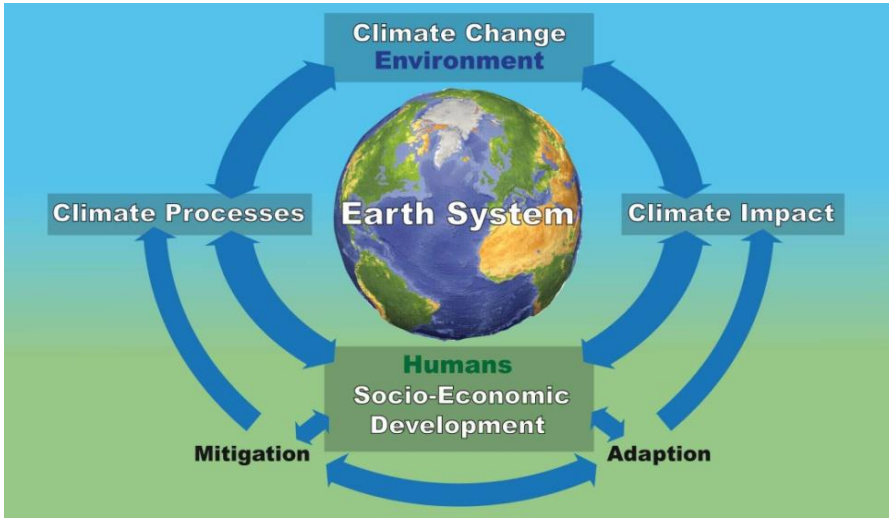

Adapted from 4AR IPCC

In a transdisciplinary context, the students know the forces driving the state and changes in the Earth system.

They are capable of analyzing and predicting system changes and feedback mechanisms.

They are able to present these results to the public and to advise decision makers.

Full English course.

Highlights:

- **Transdisciplinary teaching of all faculties**
- **Operation and analyses of regional weather and climate models**
- **Application of remote sensing for Earth System observations**
- **Field work**

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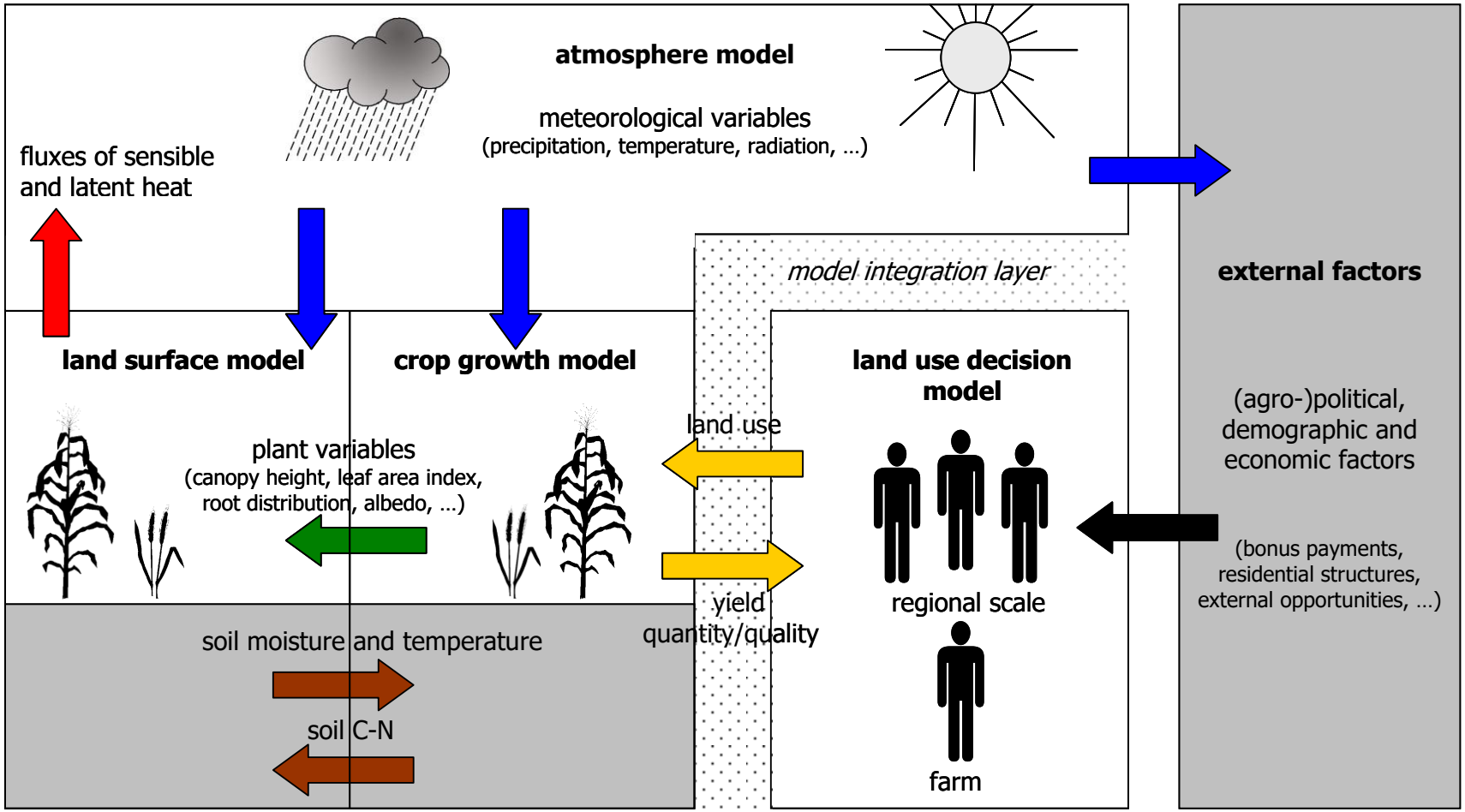
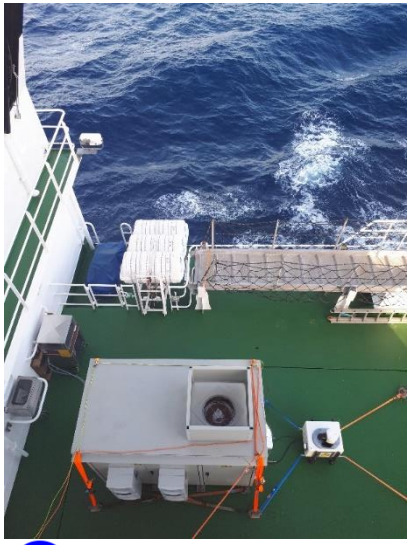
Research at the University of Hohenheim

Integrated Land System Model: DFG FOR 1695

(see https://klimawandel.uni-hohenheim.de/en/65926)



IPM Lidar Systems on the Research Vessel Merian south-east of Barbados, European-US-American Campaign EUREC4A, January-February 2020



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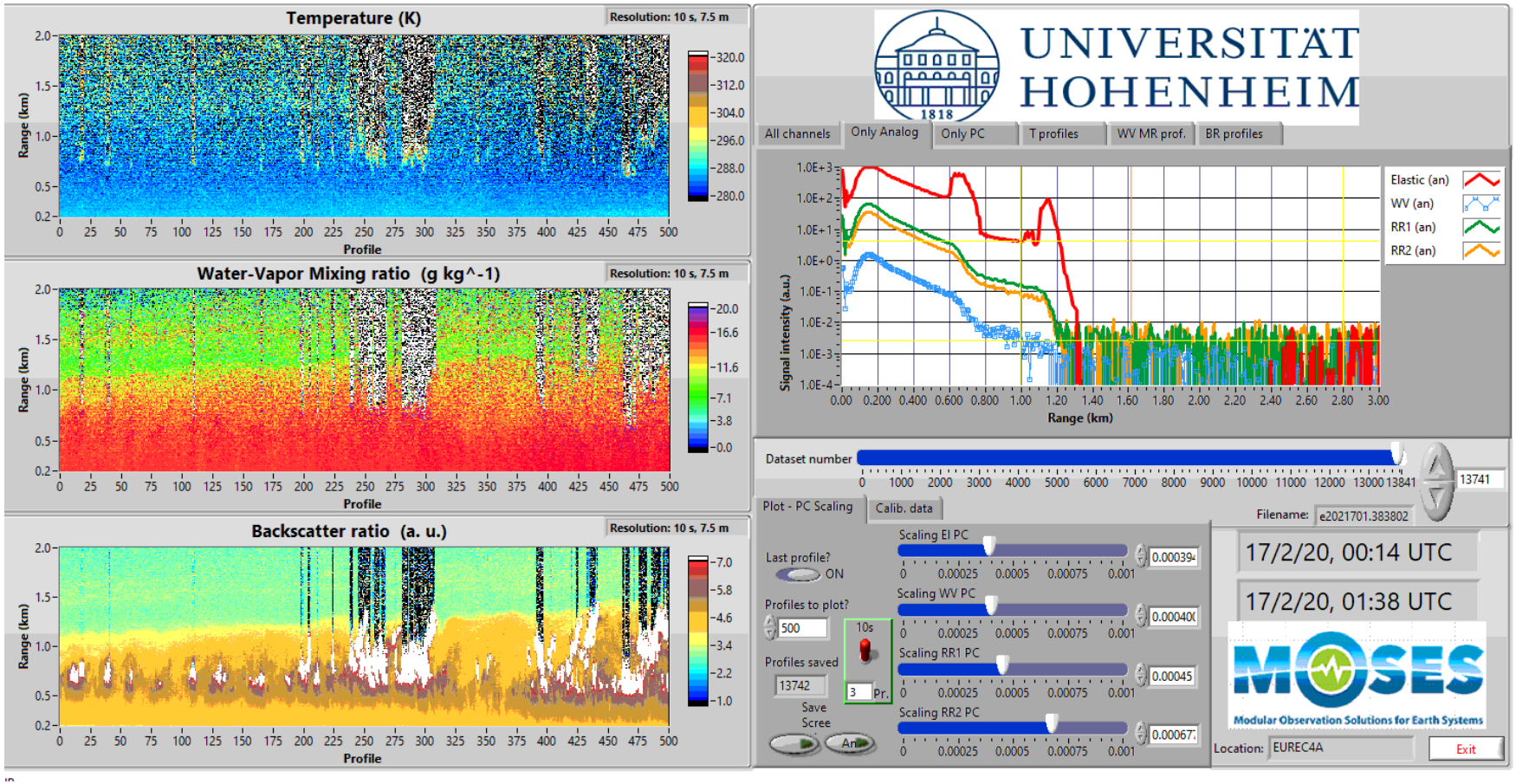
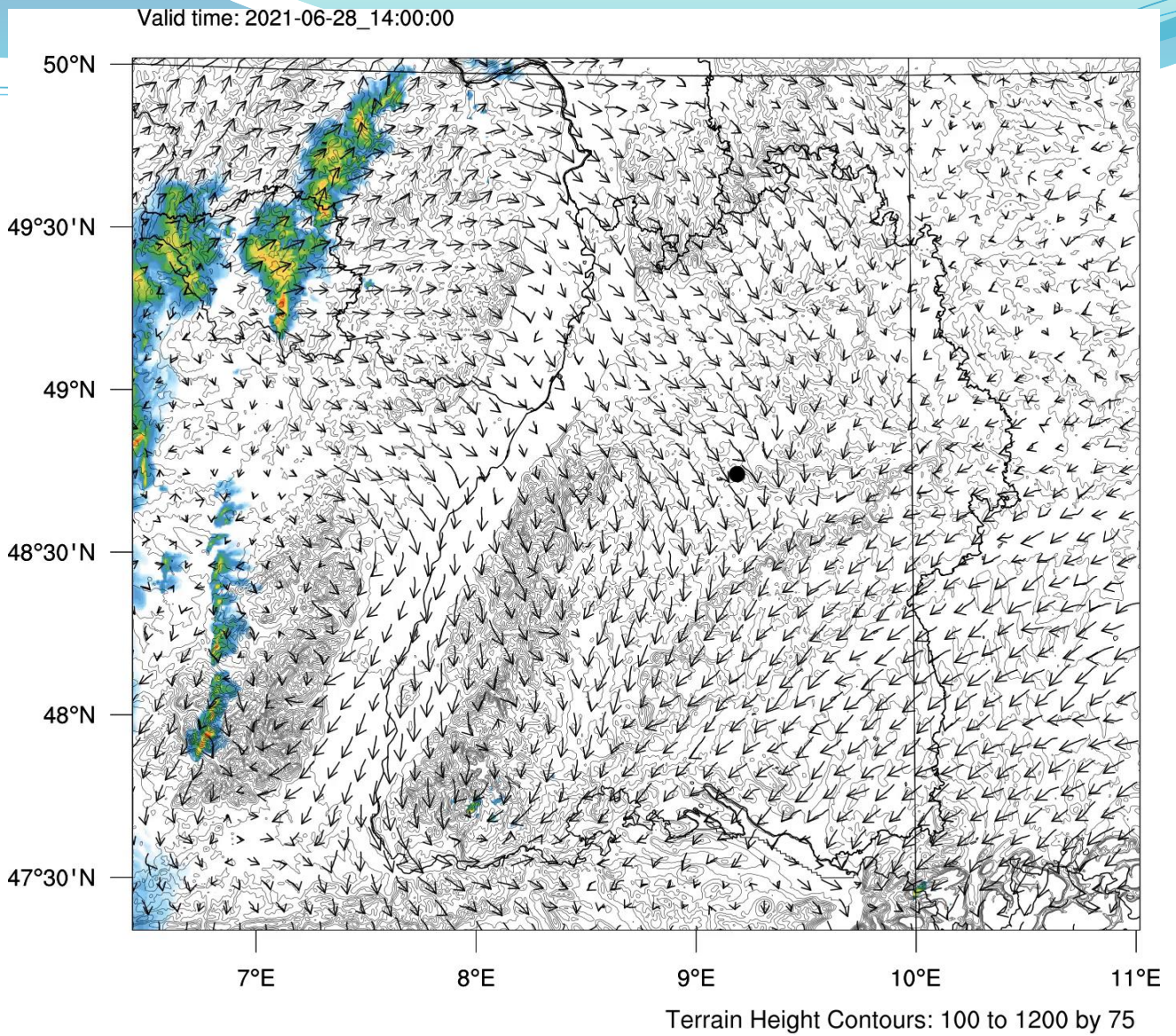
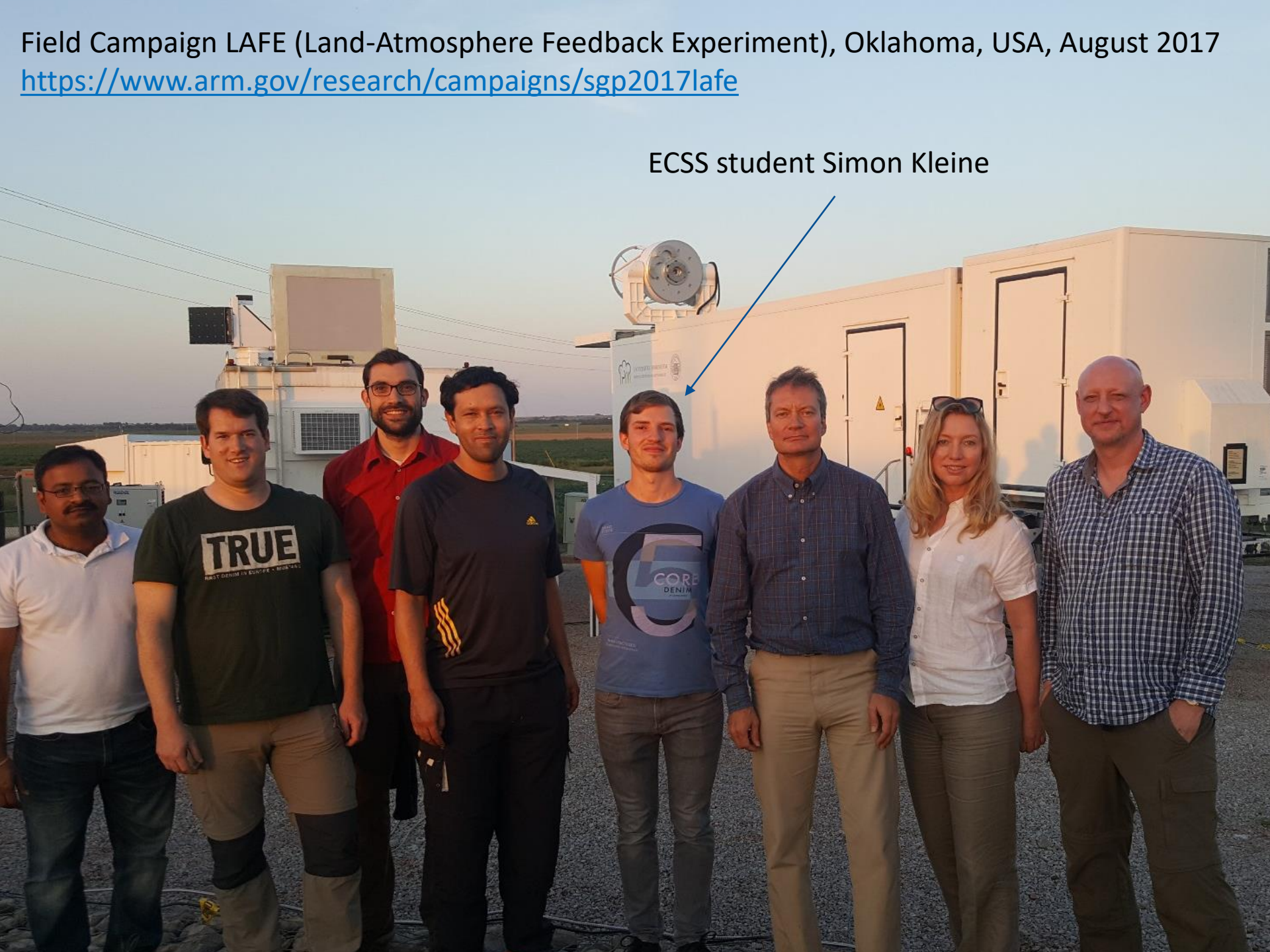


Parts of the roof of the Opera house were blown down.



Field Campaign LAFE (Land-Atmosphere Feedback Experiment), Oklahoma, USA, August 2017
https://www.arm.gov/research/campaigns/sgp2017lafe



Earth and Climate System Science at the University of Hohenheim:

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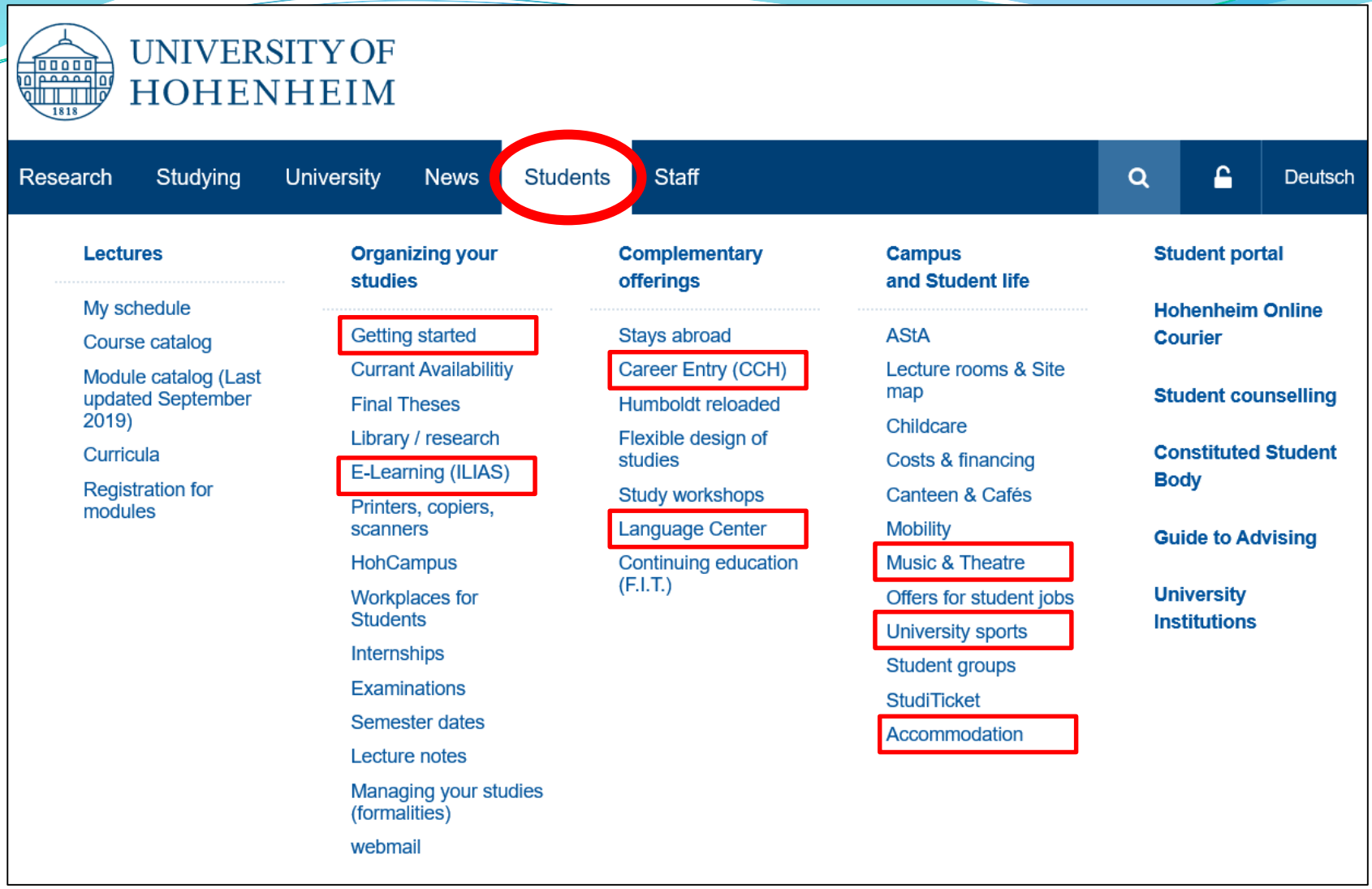
Career Options:

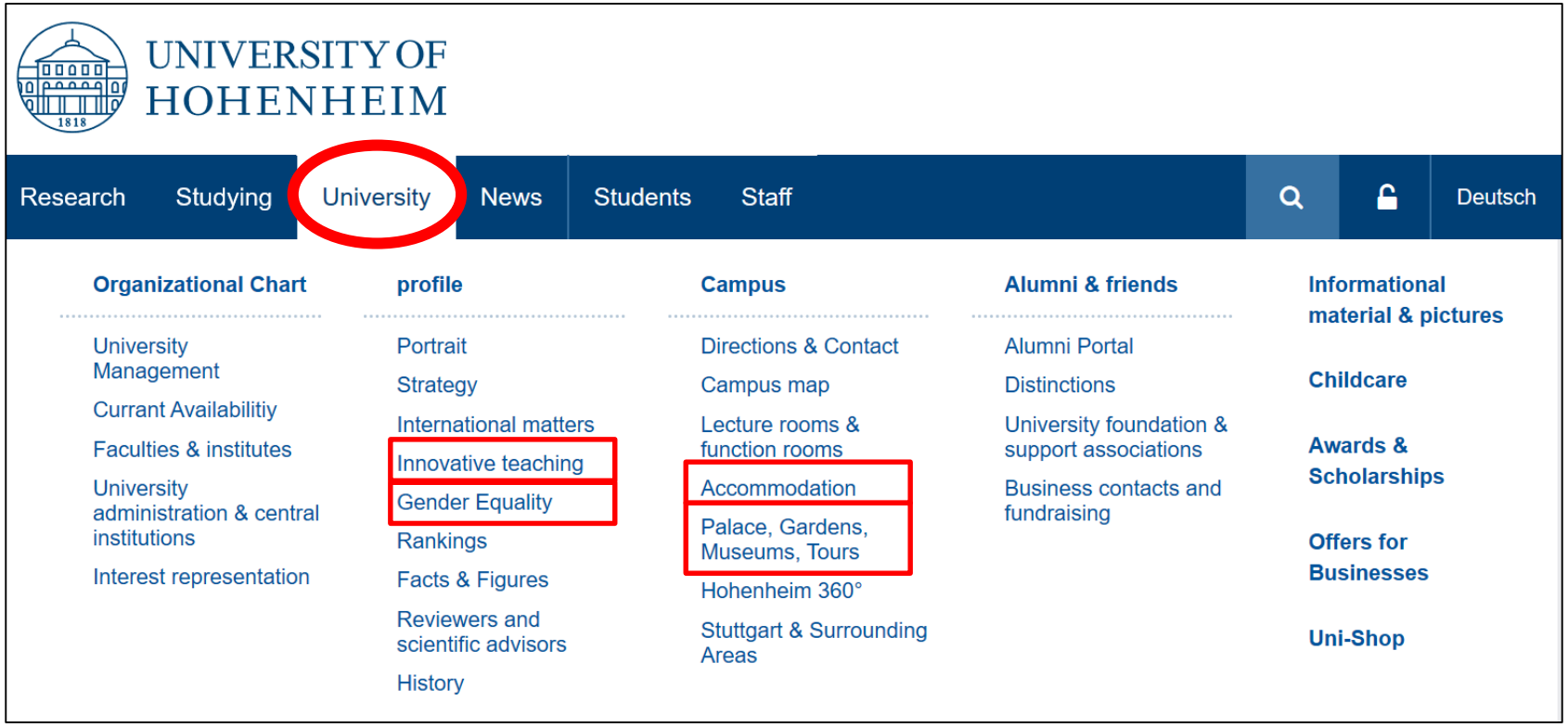
- **Very good career chances, transdisciplinary thinking is demanded in various sectors as well as practical skills like debate communication and programming**
- **Research in earth and climate system science at universities and public research institutes**
- **Applied counselling in industry and public administration**
- **Scientific writing, journalism**

University of Hohenheim

https://www.uni-hohenheim.de/en/palace



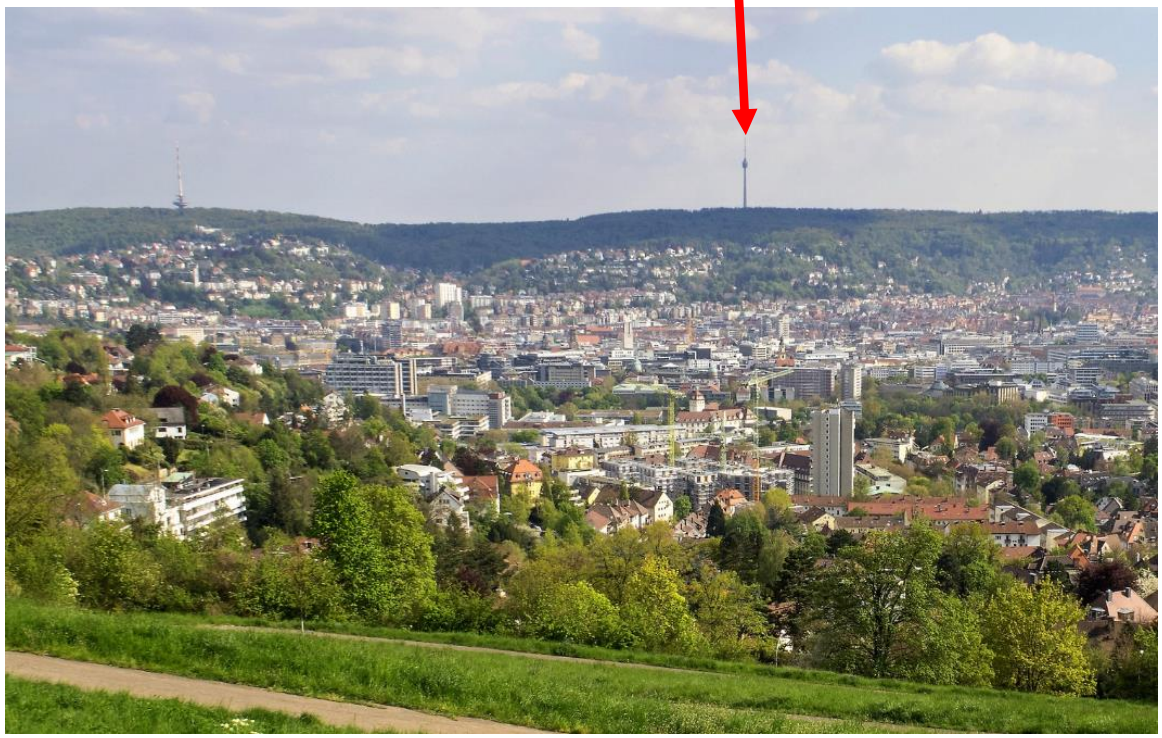
https://www.uni-hohenheim.de/en/english



https://www.uni-hohenheim.de/en/english

Stuttgart

The University is located ~5 km behind the TV tower.



https://www.freecountrymaps.com/map/country/germany-map-de/

https://www.fotocommunity.de/photo/stuttgart-aussicht-vom-bismarckturm-gumabe/38579764

https://www.uni-hohenheim.de/en/stuttgart-area

Population: 632.865 (end of 2022), including the environment approx. 2.8 Million

Thank you for your attention!

Questions ?