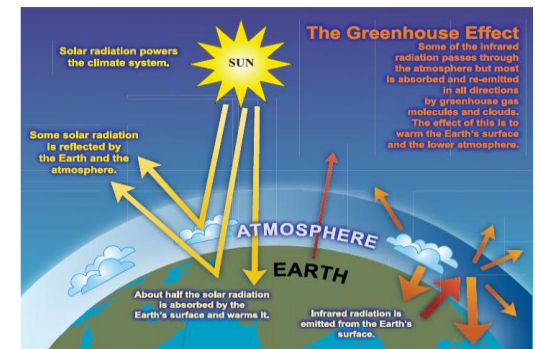
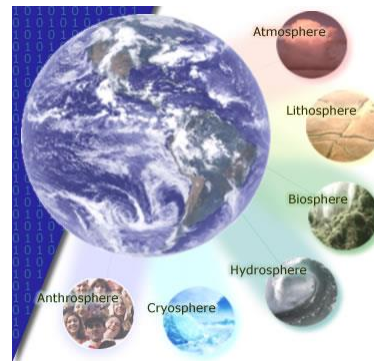
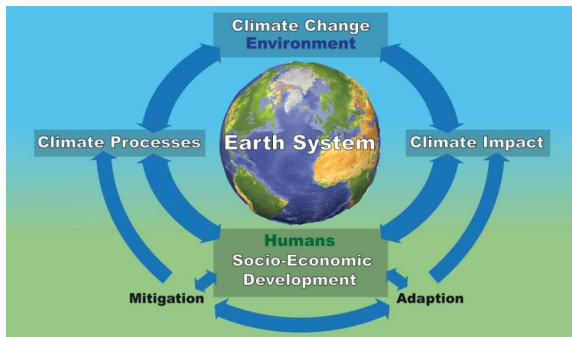


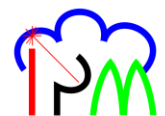
Master Program

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)



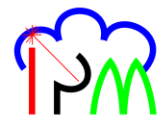
Population
growth

Energy
production
and demand

Climate variability
and change

Socio-economic and political development

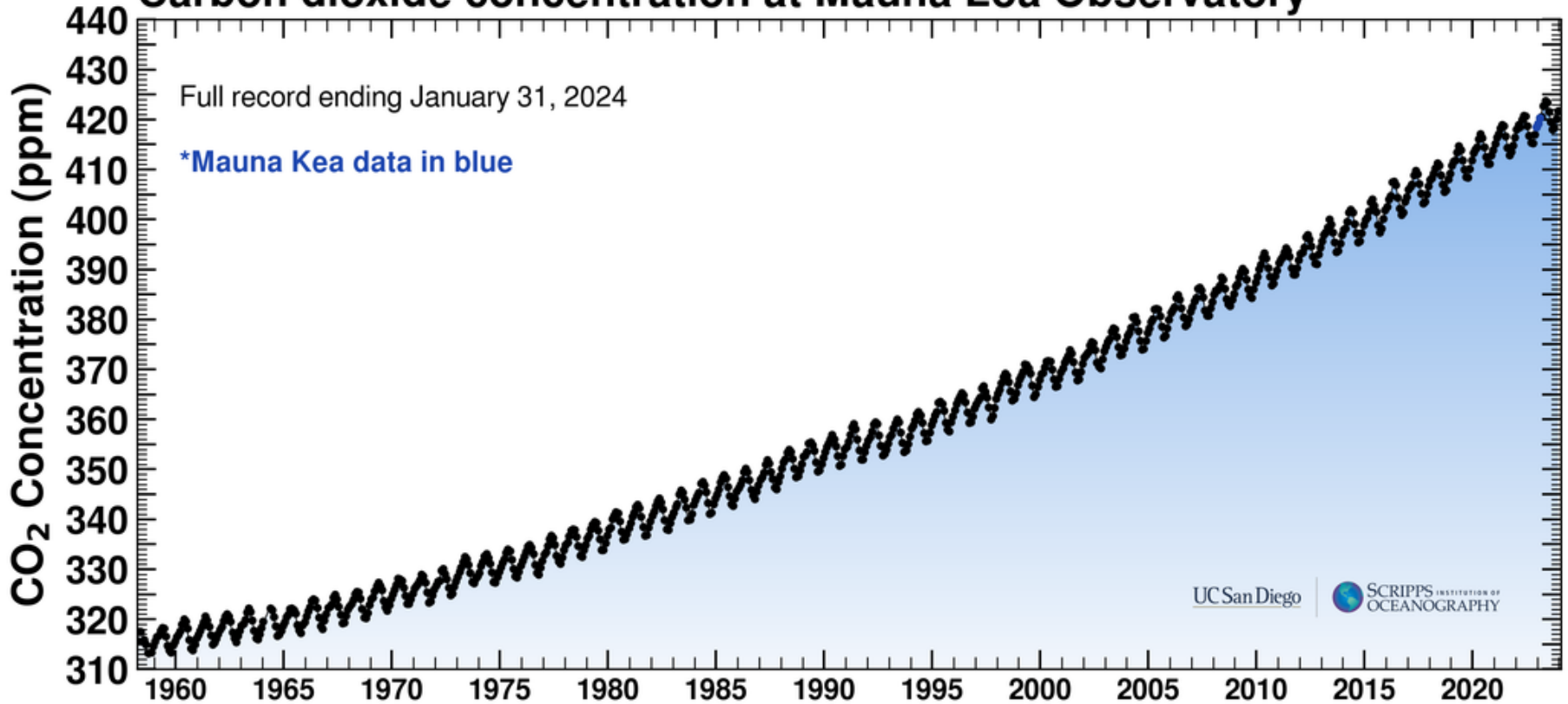
Vision: equitable, sustainable development



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Climate Change

Carbon dioxide concentration at Mauna Loa Observatory*

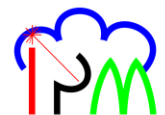


Source: Scripps Institution of Oceanography

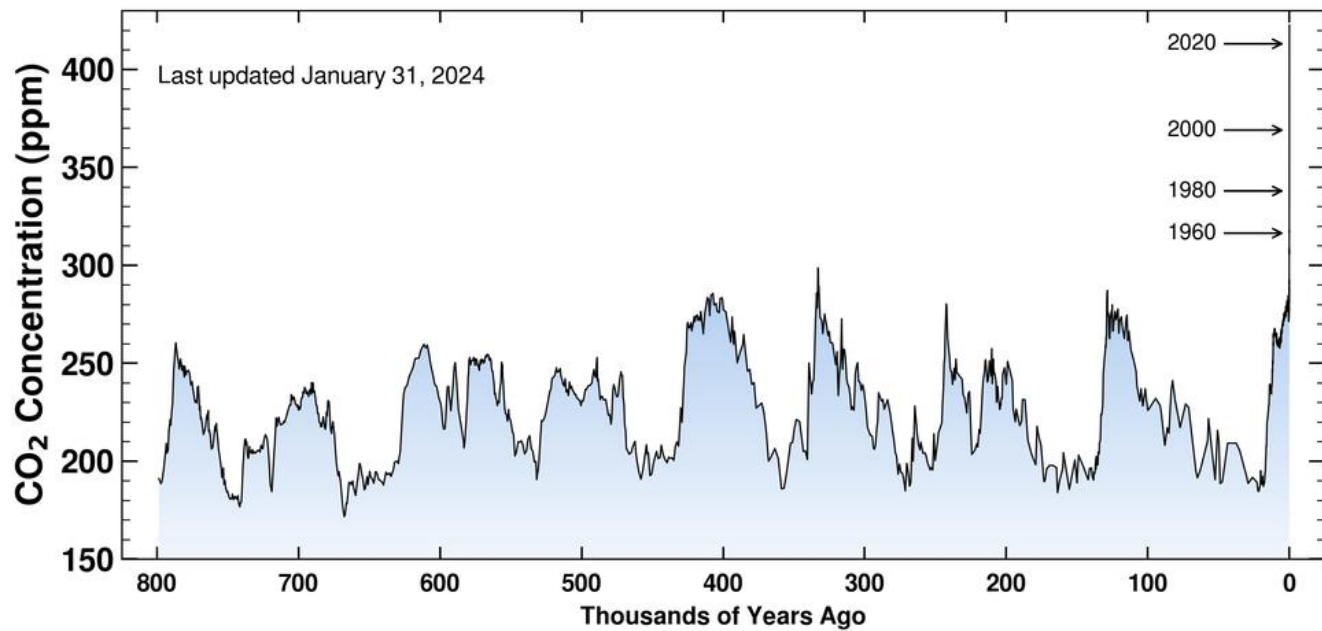
*Latest CO₂ reading: **422.13 ppm**
(31.01.2024)

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

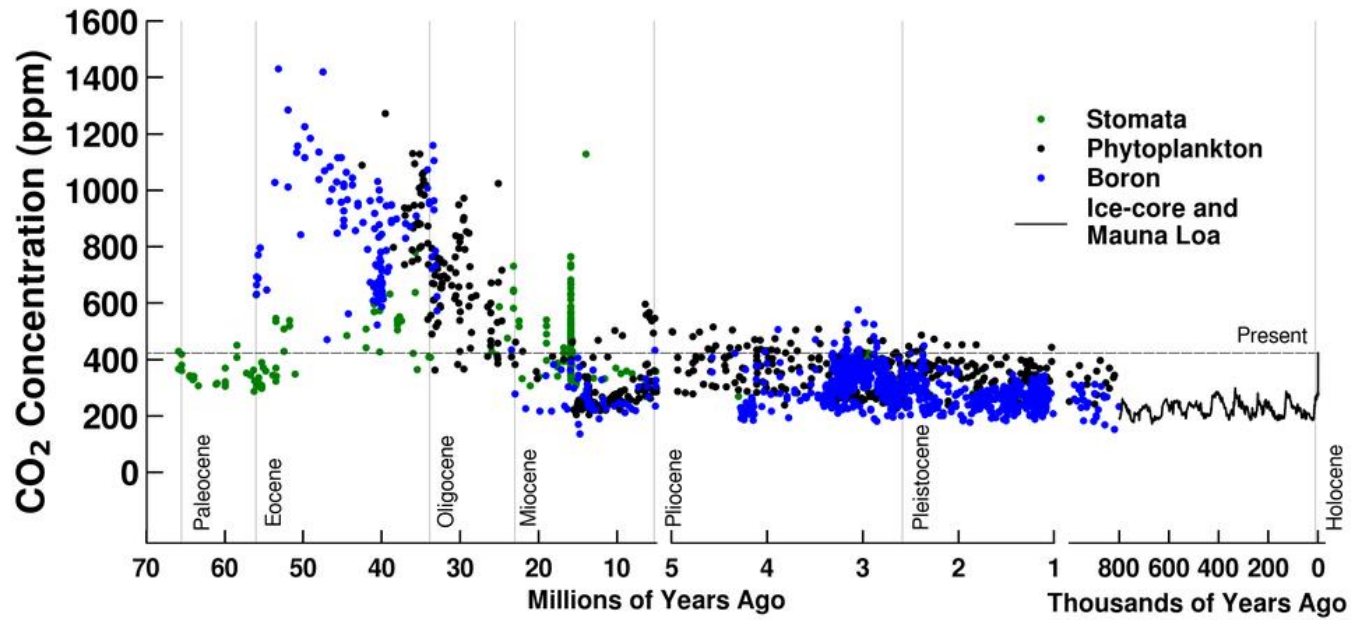
<https://scripps.ucsd.edu/programs/keelingcurve/>



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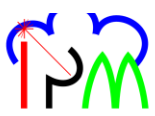


Inclusion of gas analyses from ice cores.

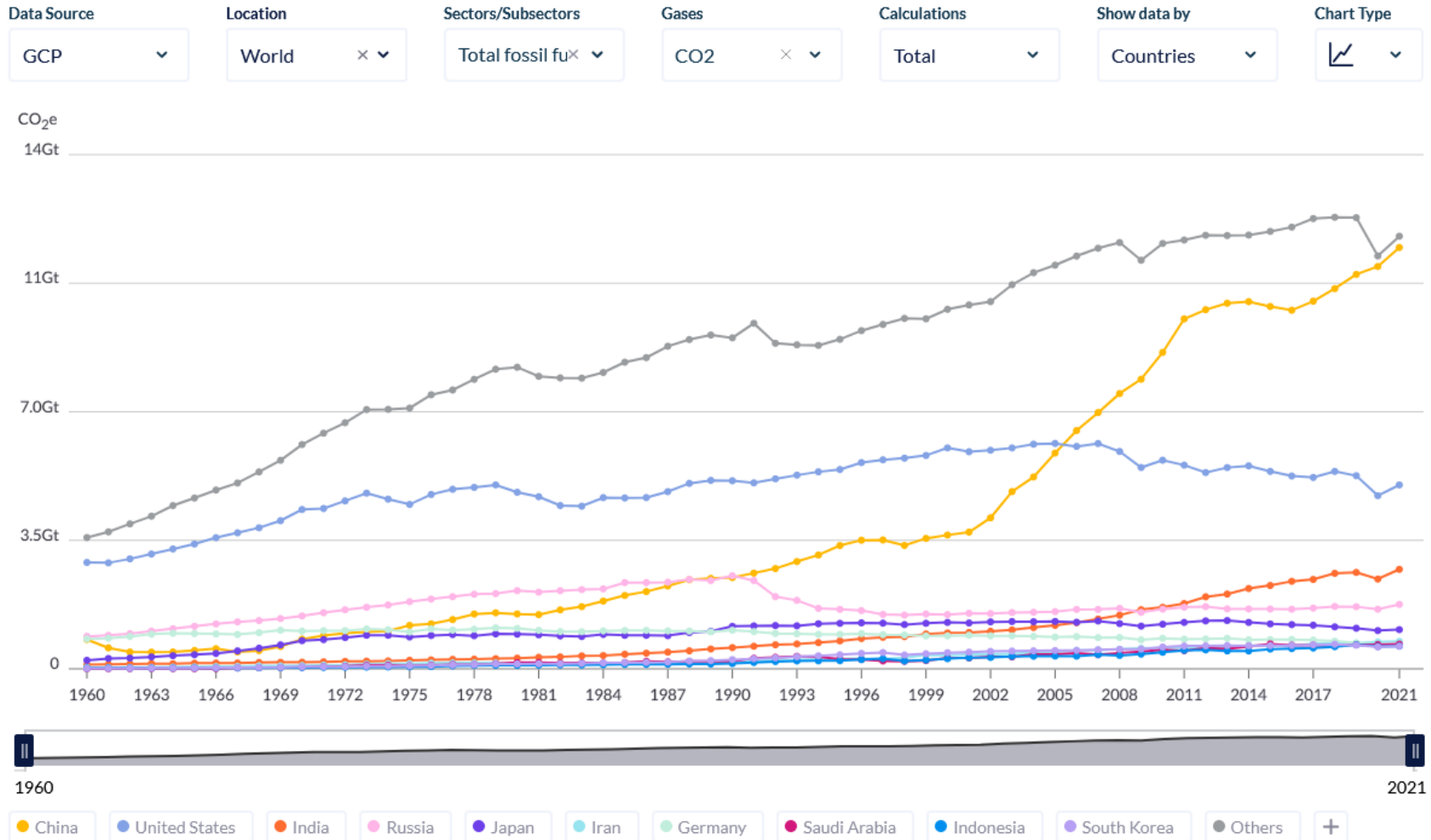


Inclusion of analyses from ocean sediments.

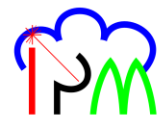
Today's values occurred for the last time more than 1 million years ago.



Planet under pressure: The Anthropocene

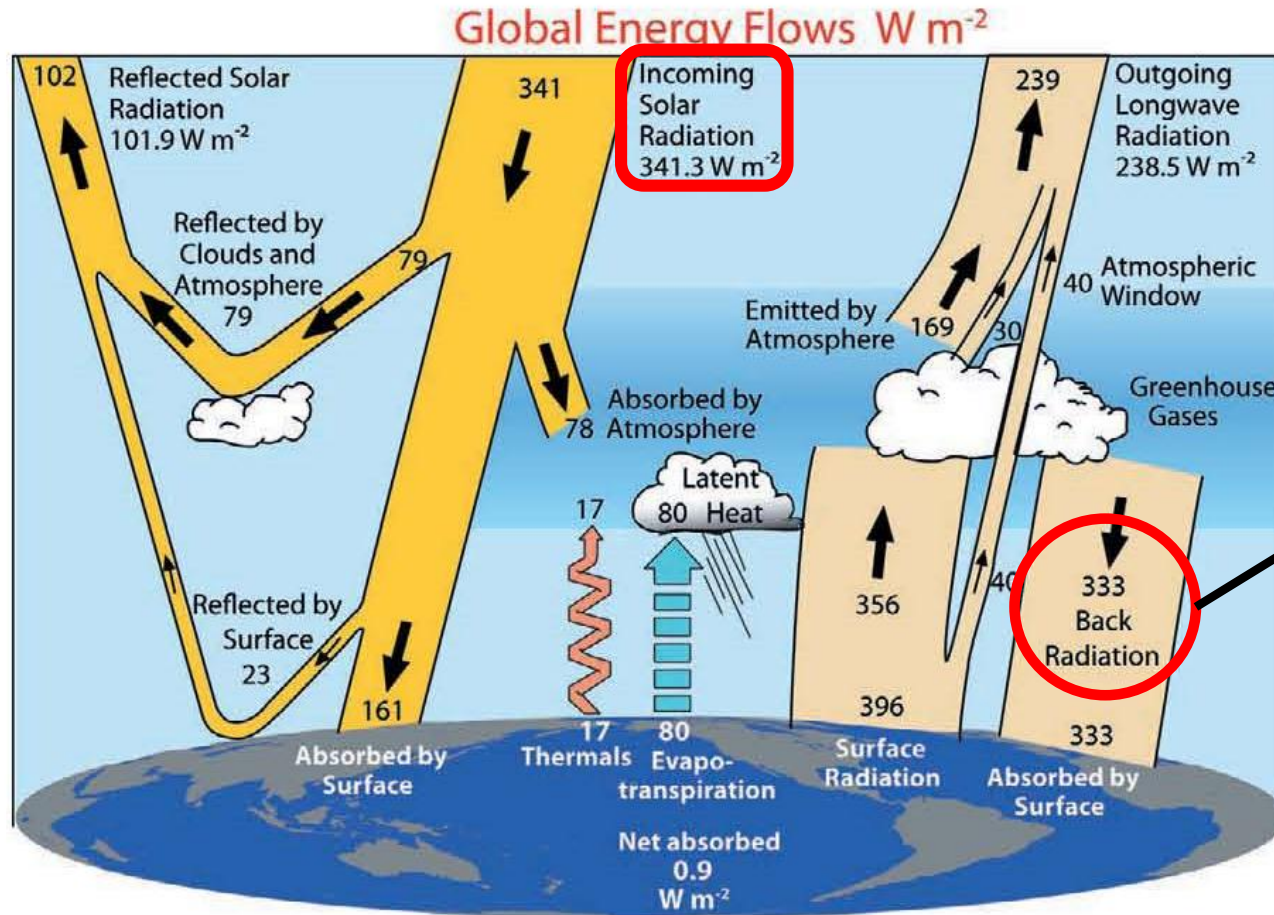


<https://www.climatewatchdata.org/ghg-emissions?breakBy=sector&source=75>



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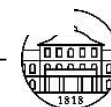
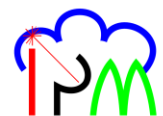
The Global Energy Budget



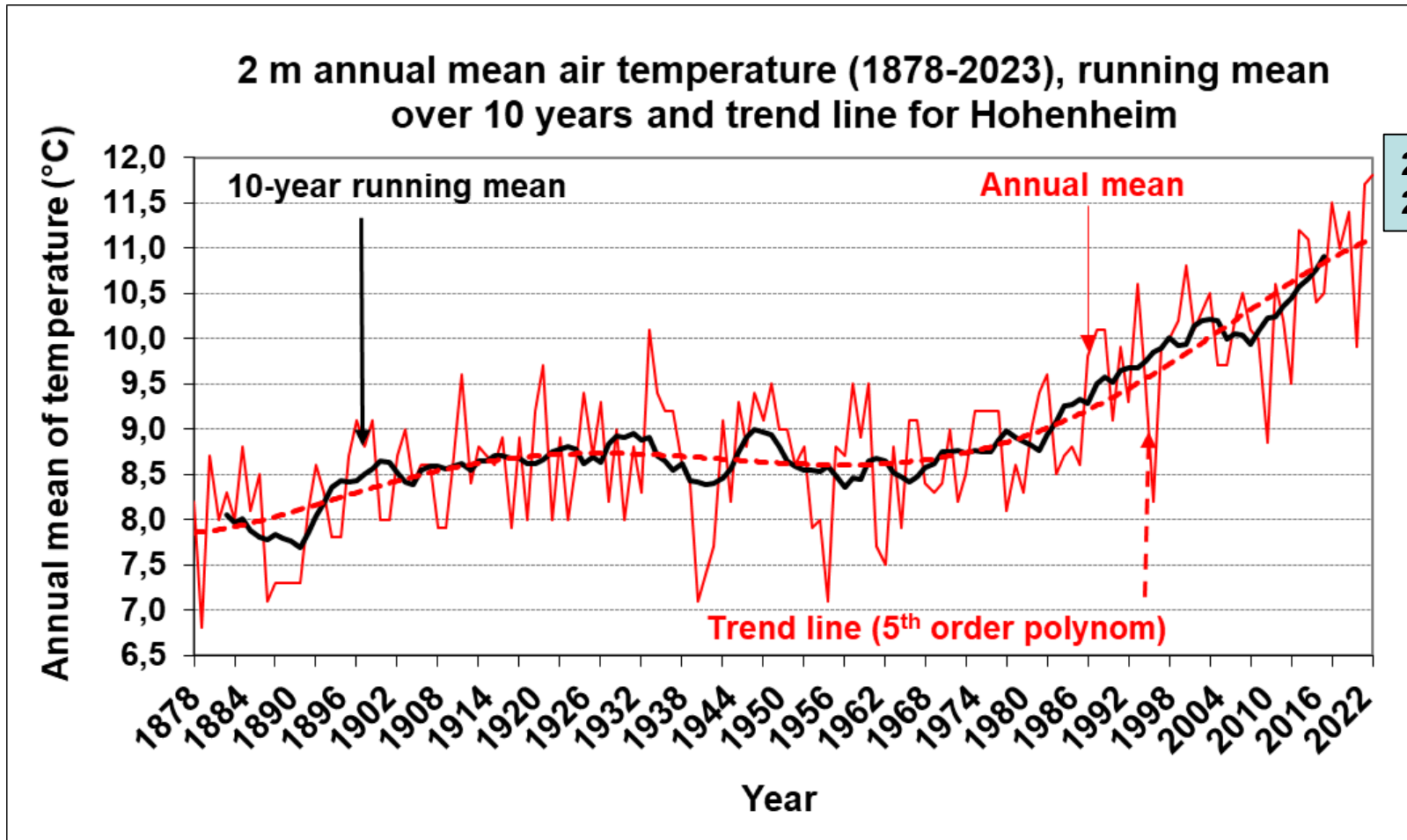
Greenhouse gases increase this Flux.

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

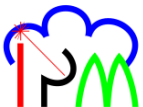


University of Hohenheim Climate Station



2022: 11.7 C
2023: 11.8 C

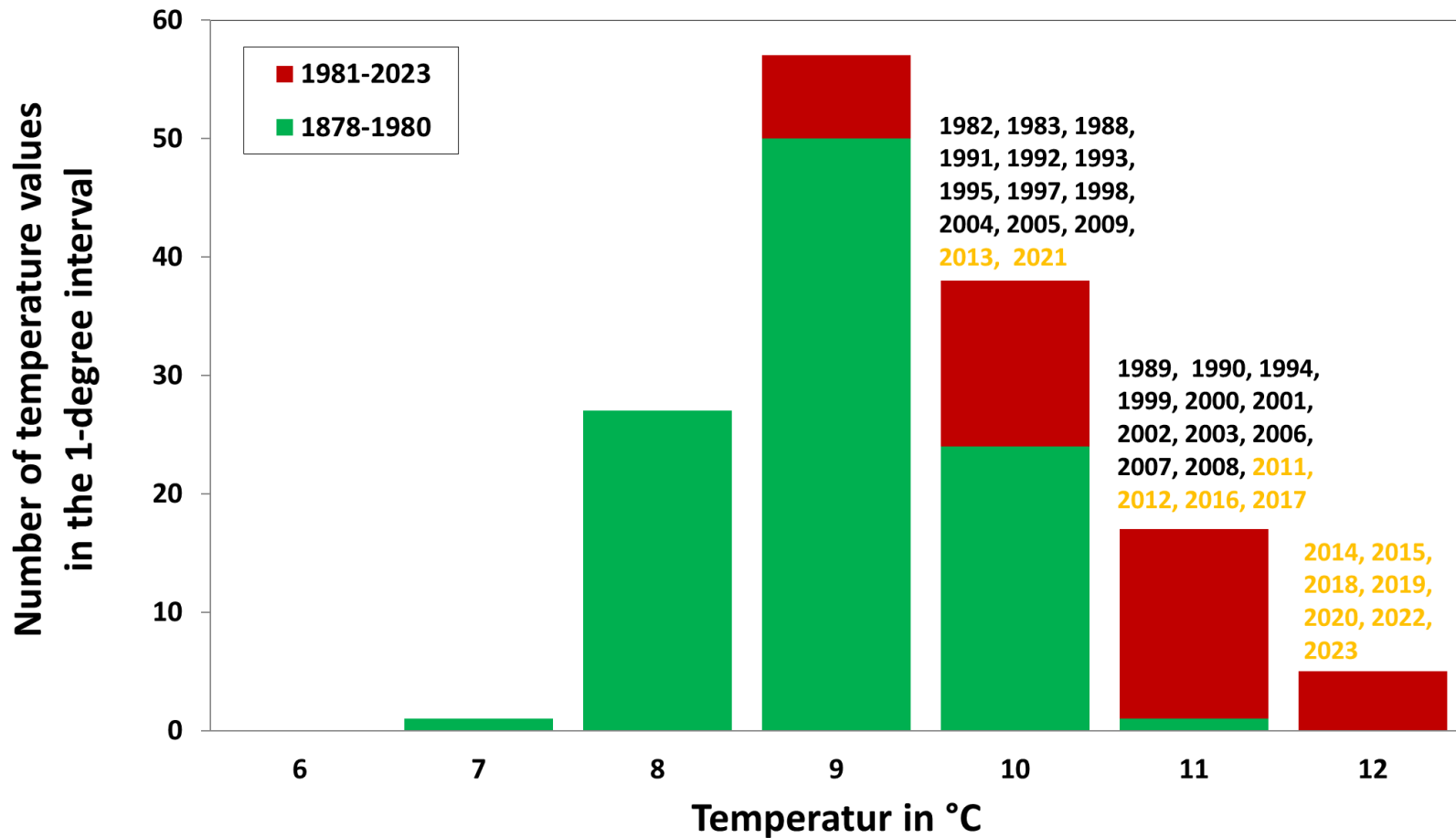
Already 2.5 K temperature increase at this continental site between mid 20th century and today! (almost 3 K since the beginning of the recording).



Frequency distribution of annual mean temperatures

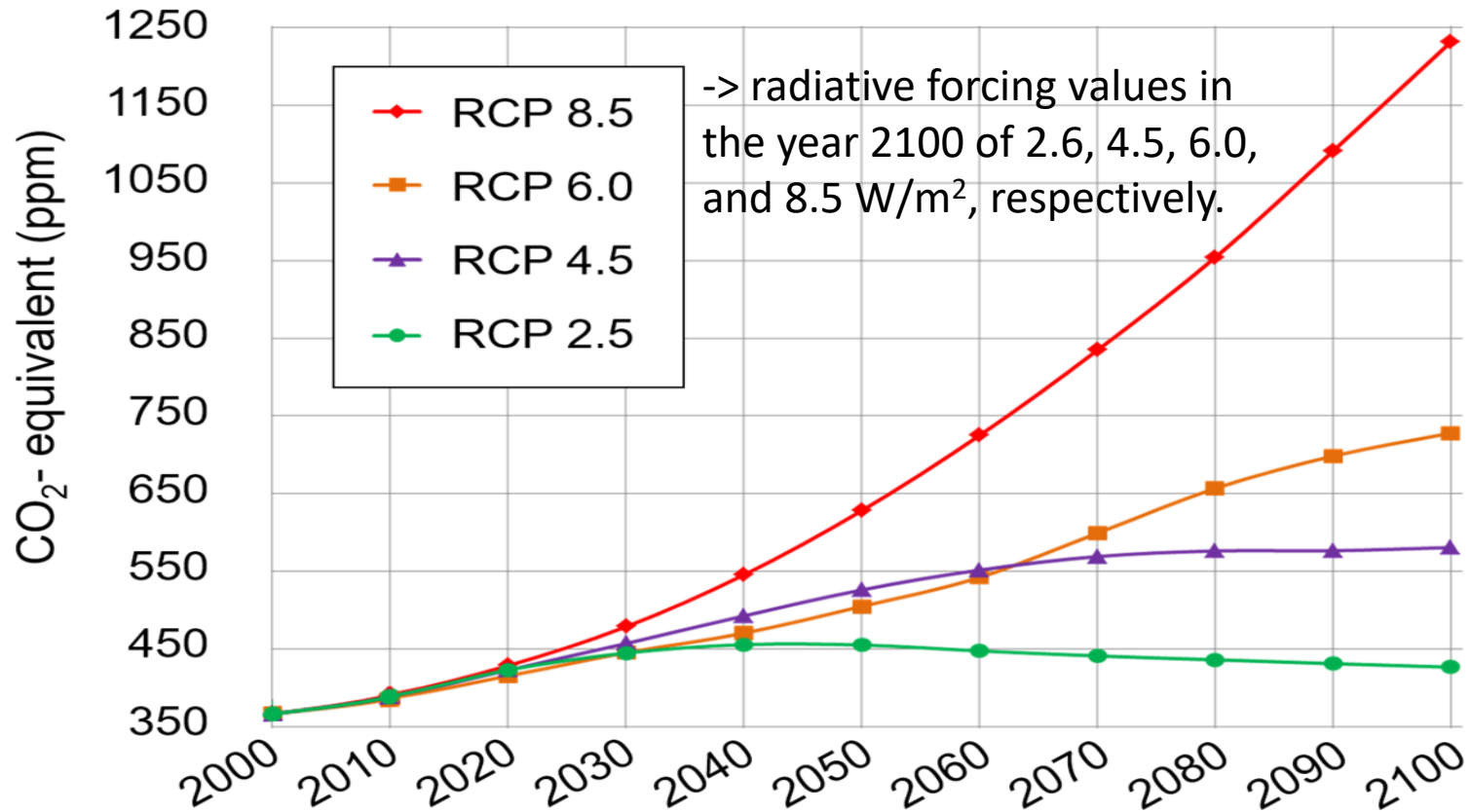


Analysis of the yearly averaged temperatures (1878 - 2023) measured at the weather and climate station of the Institute of Physics and Meteorology of the University of Hohenheim

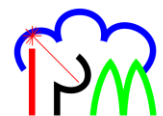


IPCC AR5 Greenhouse Gas Concentration Pathways

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



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



Climate Projections

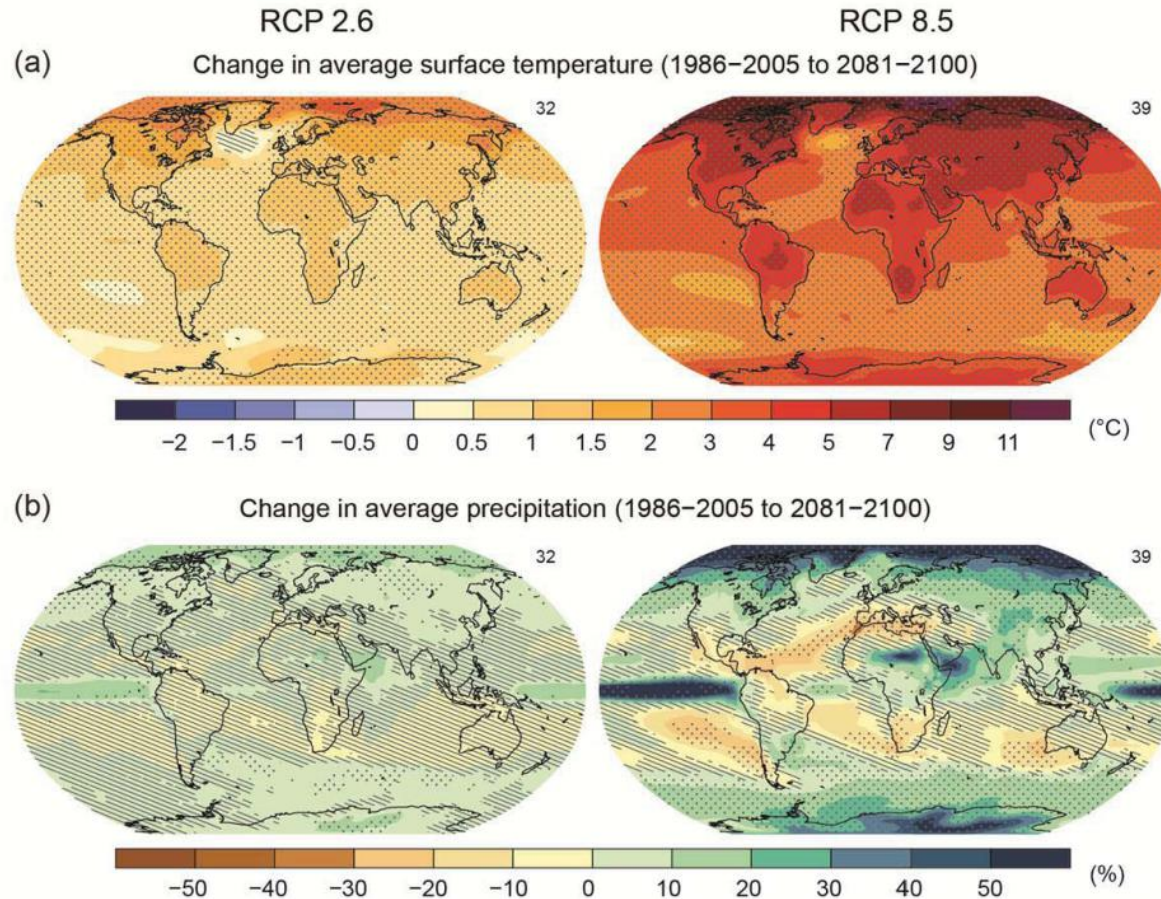
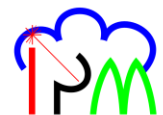


Figure SPM.7 | Change in average surface temperature **(a)** and change in average precipitation **(b)** based on multi-model mean projections for 2081–2100 relative to 1986–2005 under the RCP2.6 (left) and RCP8.5 (right) scenarios. The number of models used to calculate the multi-model mean is indicated 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

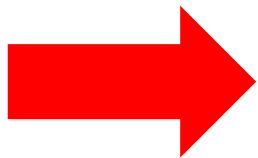
https://www.ipcc.ch/site/assets/uploads/2018/02/SYR_AR5_FINAL_full.pdf



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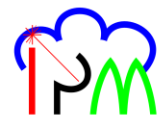
Important: Those changes in temperature and precipitation amount and distribution effect almost everything in our daily life – and those consequences become clearer and clearer ...

- 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 threat (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

1984

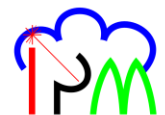


Chongqing, China

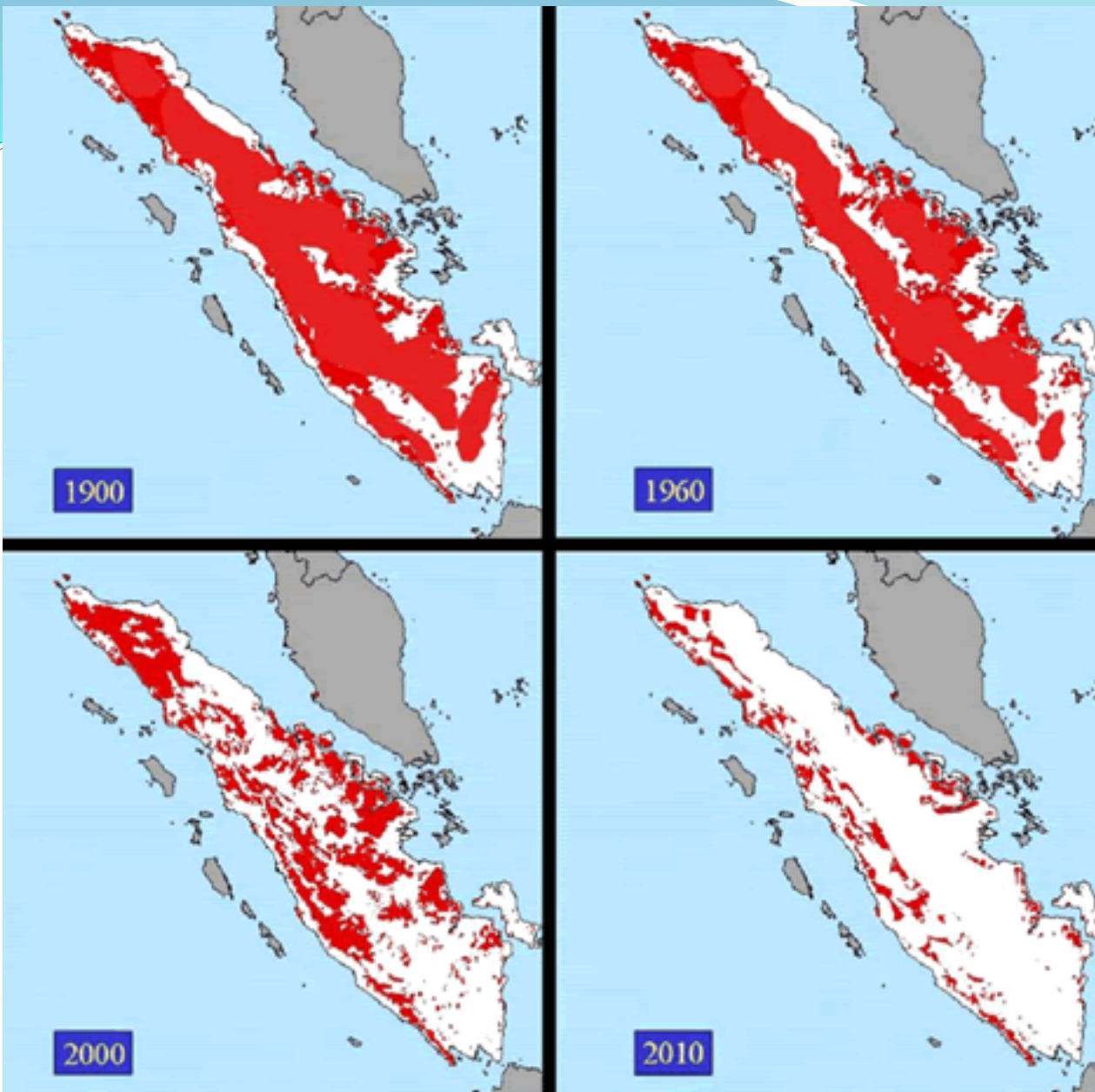
2016



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

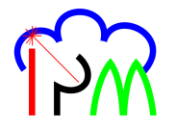


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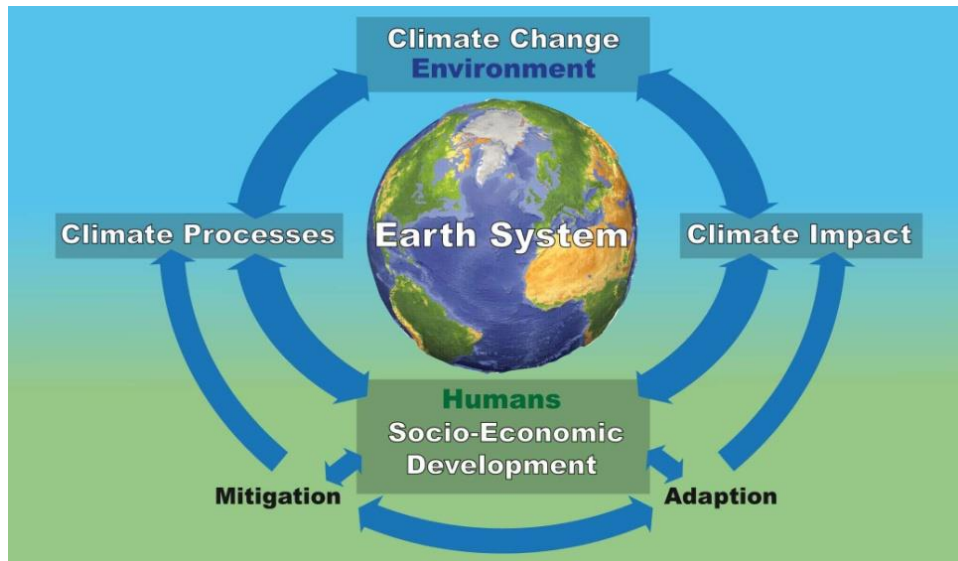
Loss of tropical rain forest in Indonesia between 1900 and 2010.

Red_ areas covered by tropical rain forest.



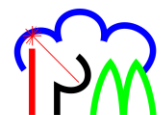
Aim of the master course

“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.

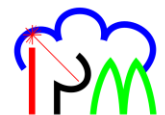
	6 credits		12 credits		18 credits		24 credits		30 credits	
1 st sem.	Lecture Series Earth System Science (1201-550)	Mathematics and Computational Sciences of the Earth System (1201-610)	Sustainability (5206-270)		Weather and Climate Physics (1201-580)		Chemistry of the Earth System & Pollution (1301-460)		Ecosystems and Biodiversity (2101-500)	
2 nd sem.	Climate History and Evolution of the Earth System (1201-560)		Energy and Water Regime at the Land Surface (3103-500)		Debate Seminar (1201-570)	Measurement, Modeling and Data Assimilation (1201-520)		Elective Module		Elective Module
3 rd sem.	Elective Module		Elective Module		Elective Module		Elective Module		Elective Module	
4 th sem.	Master's Thesis Earth and Climate System Science (1200-500)									

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
- ...

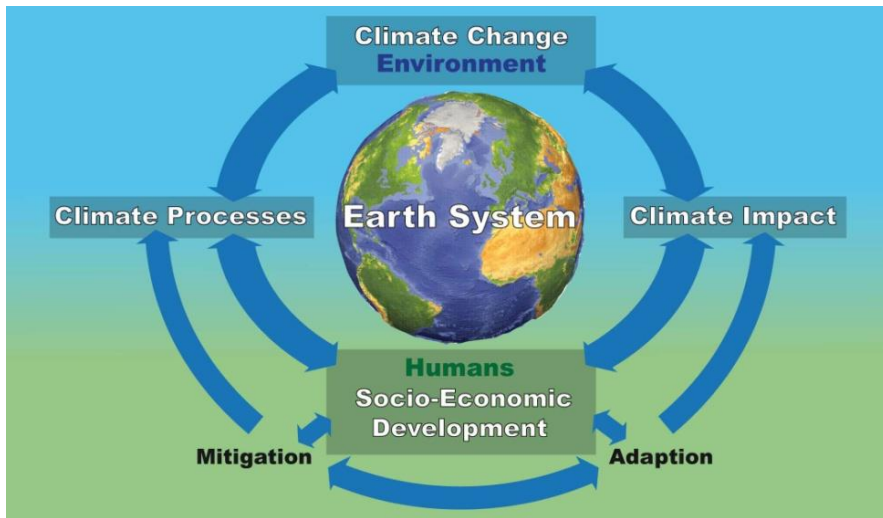
You can select modules related to different specializations as:

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



Earth and Climate System Science at the University of Hohenheim:

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



Adapted from 4AR IPCC

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

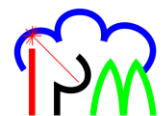
They are capable of analyzing and predicting system changes and feedback mechanisms.

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**

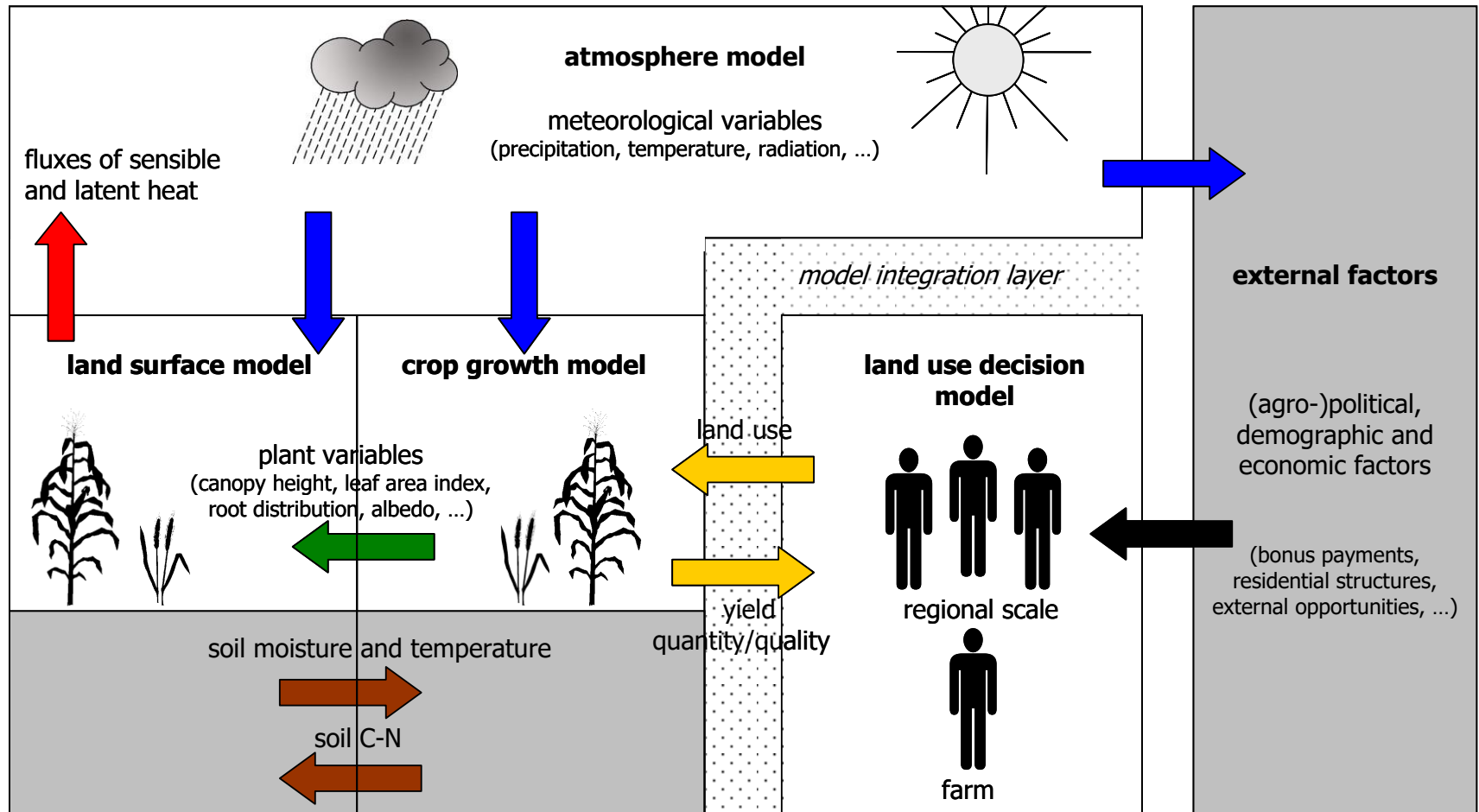


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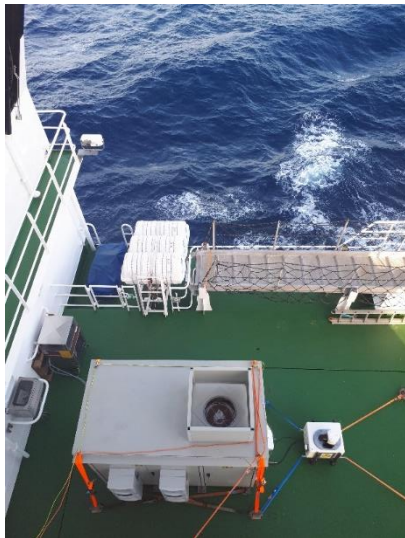
Research at the University of Hohenheim

Integrated Land System Model: DFG FOR 1695

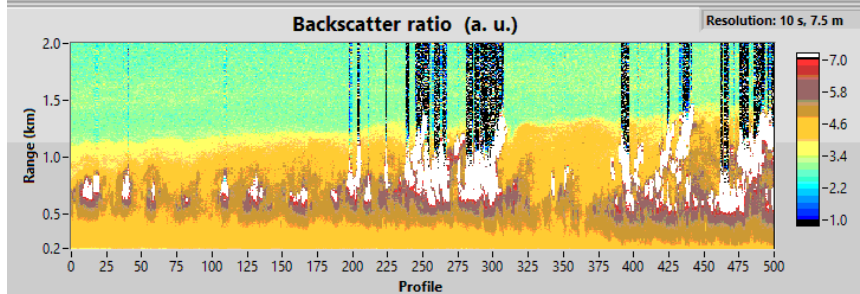
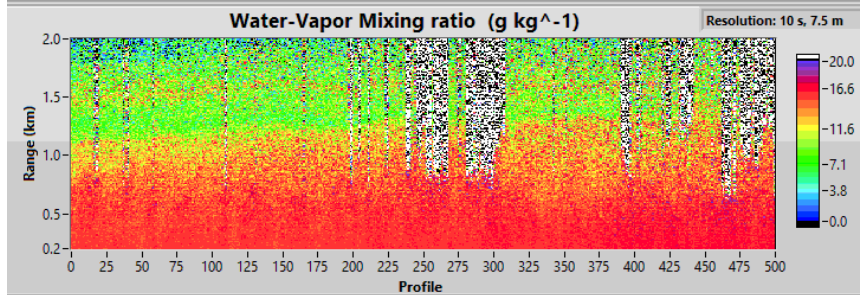
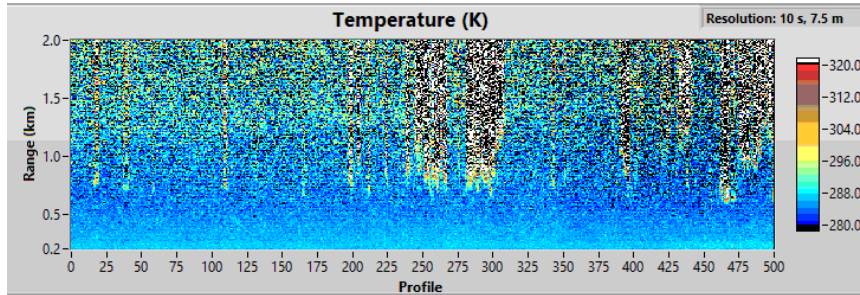
(see <https://klimawandel.uni-hohenheim.de/en/65926>)




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



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





UNIVERSITÄT HOHENHEIM
1818

All channels | Only Analog | Only PC | T profiles | WV MR prof. | BR profiles

Signal intensity (a.u.) vs Range (km)

- Elastic (an) [red line]
- WV (an) [blue line]
- RR1 (an) [green line]
- RR2 (an) [orange line]

Dataset number: 13741

Plot - PC Scaling | Calib. data | Filename: e2021701.383802

Last profile? ON

Profiles to plot? 500

Profiles saved? 13742

Scaling EI PC: 0.00039


Scaling WV PC: 0.00040

Scaling RR1 PC: 0.00045

Scaling RR2 PC: 0.00067

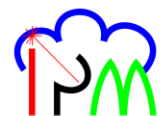
17/2/20, 00:14 UTC

17/2/20, 01:38 UTC



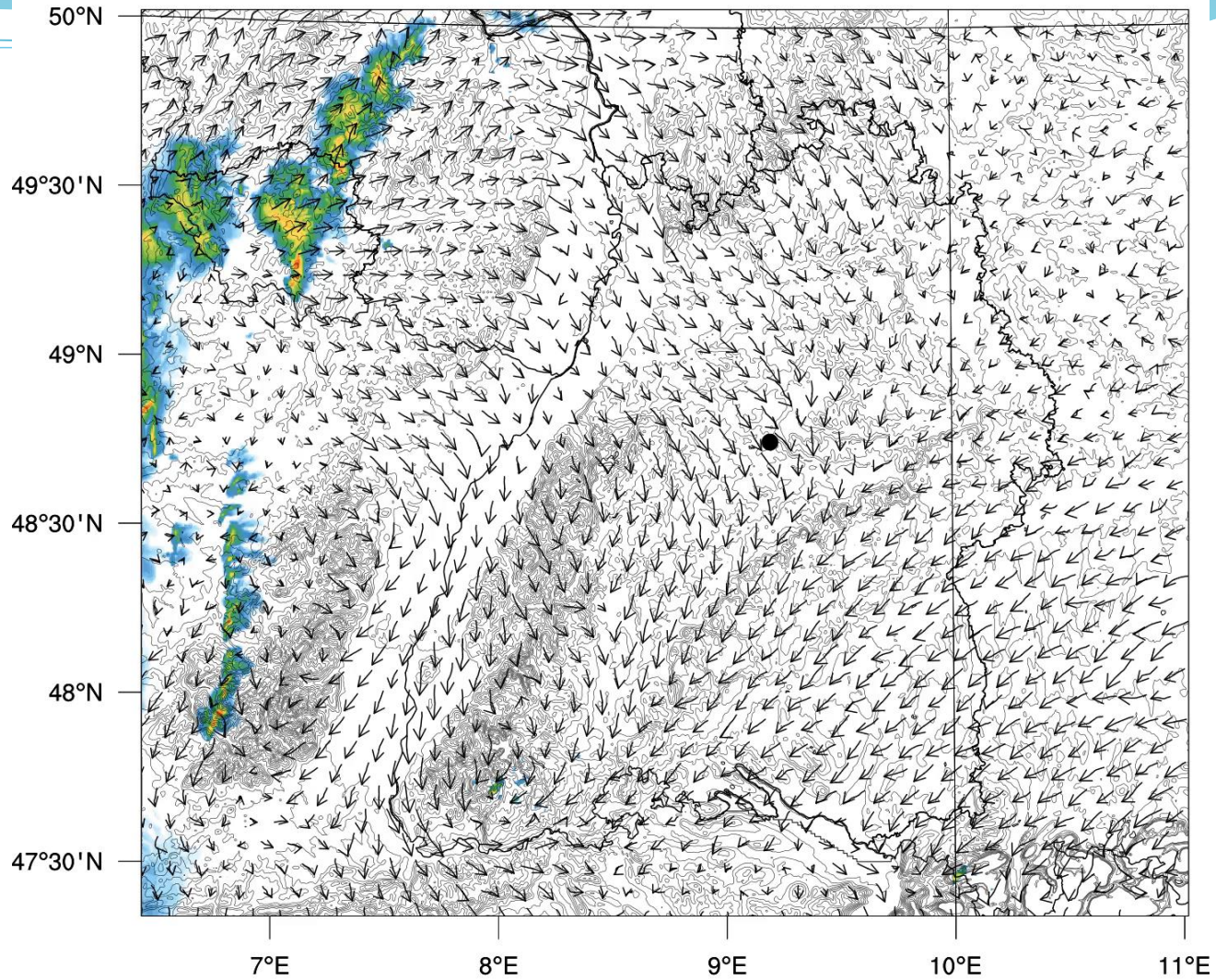
Modular Observation Solutions for Earth Systems

Location: EUREC4A | Exit



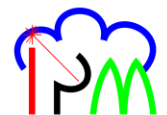
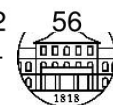


Parts of the roof of the Opera house were blown down.



Terrain Height Contours: 100 to 1200 by 75

Reflectivity (dbZ)



Field Campaign LAFE (Land-Atmosphere Feedback Experiment), Oklahoma, USA, August 2017

<https://www.arm.gov/research/campaigns/sgp2017lafe>

ECSS student Simon Kleine

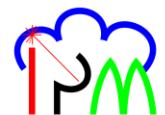


Earth and Climate System Science at the University of Hohenheim:

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

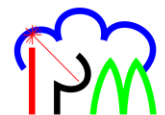
Career Options:

- **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>



UNIVERSITÄT
HOHENHEIM



Lectures

My schedule

Course catalog

Module catalog (Last updated September 2019)

Curricula

Registration for modules

Organizing your studies

Getting started

Current Availability

Final Theses

Library / research

E-Learning (ILIAS)

Printers, copiers, scanners

HohCampus

Workplaces for Students

Internships

Examinations

Semester dates

Lecture notes

Managing your studies (formalities)

webmail

Complementary offerings

Stays abroad

Career Entry (CCH)

Humboldt reloaded

Flexible design of studies

Study workshops

Language Center

Continuing education (F.I.T.)

Campus and Student life

ASTA

Lecture rooms & Site map

Childcare

Costs & financing

Canteen & Cafés

Mobility

Music & Theatre

Offers for student jobs

University sports

Student groups

StudiTicket

Accommodation

Student portal

Hohenheim Online Courier

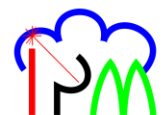
Student counselling

Constituted Student Body

Guide to Advising

University Institutions

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





UNIVERSITY OF
HOHENHEIM

Research

Studying

University

News

Students

Staff



Deutsch

Organizational Chart

University
Management

Current Availability

Faculties & institutes

University
administration & central
institutions

Interest representation

profile

Portrait

Strategy

International matters

Innovative teaching

Gender Equality

Rankings

Facts & Figures

Reviewers and
scientific advisors

History

Campus

Directions & Contact

Campus map

Lecture rooms &
function rooms

Accommodation

Palace, Gardens,
Museums, Tours

Hohenheim 360°

Stuttgart & Surrounding
Areas

Alumni & friends

Alumni Portal

Distinctions

University foundation &
support associations

Business contacts and
fundraising

Informational material & pictures

Childcare

Awards &
Scholarships

Offers for
Businesses

Uni-Shop

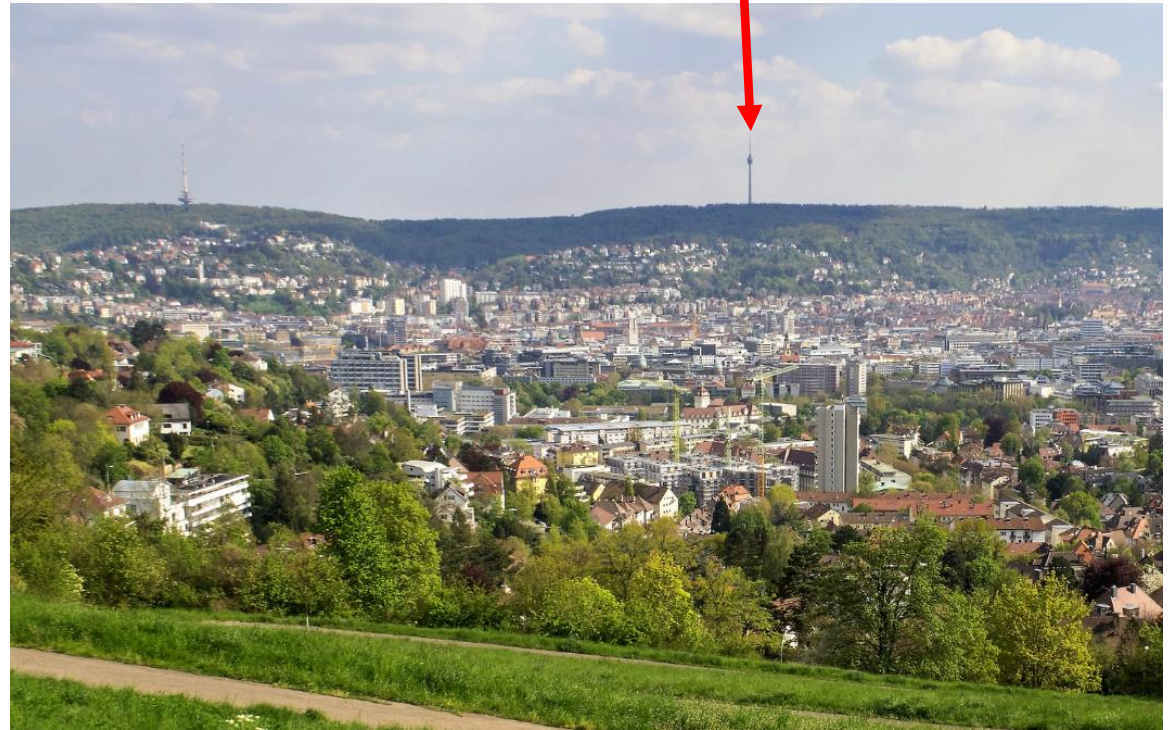
<https://www.uni-hohenheim.de/en/english>



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Stuttgart

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

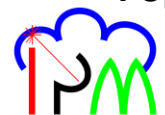


<https://www.freecountrymaps.com/map/country/germany-map-de/>

<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



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HOHENHEIM

Thank you for your attention!

Questions ?

