

Hydro Science and Engineering – HSE

Welcome Event

Andreas Hartmann, Bernhard Vowinckel, Peter Krebs, Sabine Hahn-Bernhofer, Christian Bernhofer

TU Dresden, 23 Oct 2024

TU Dresden

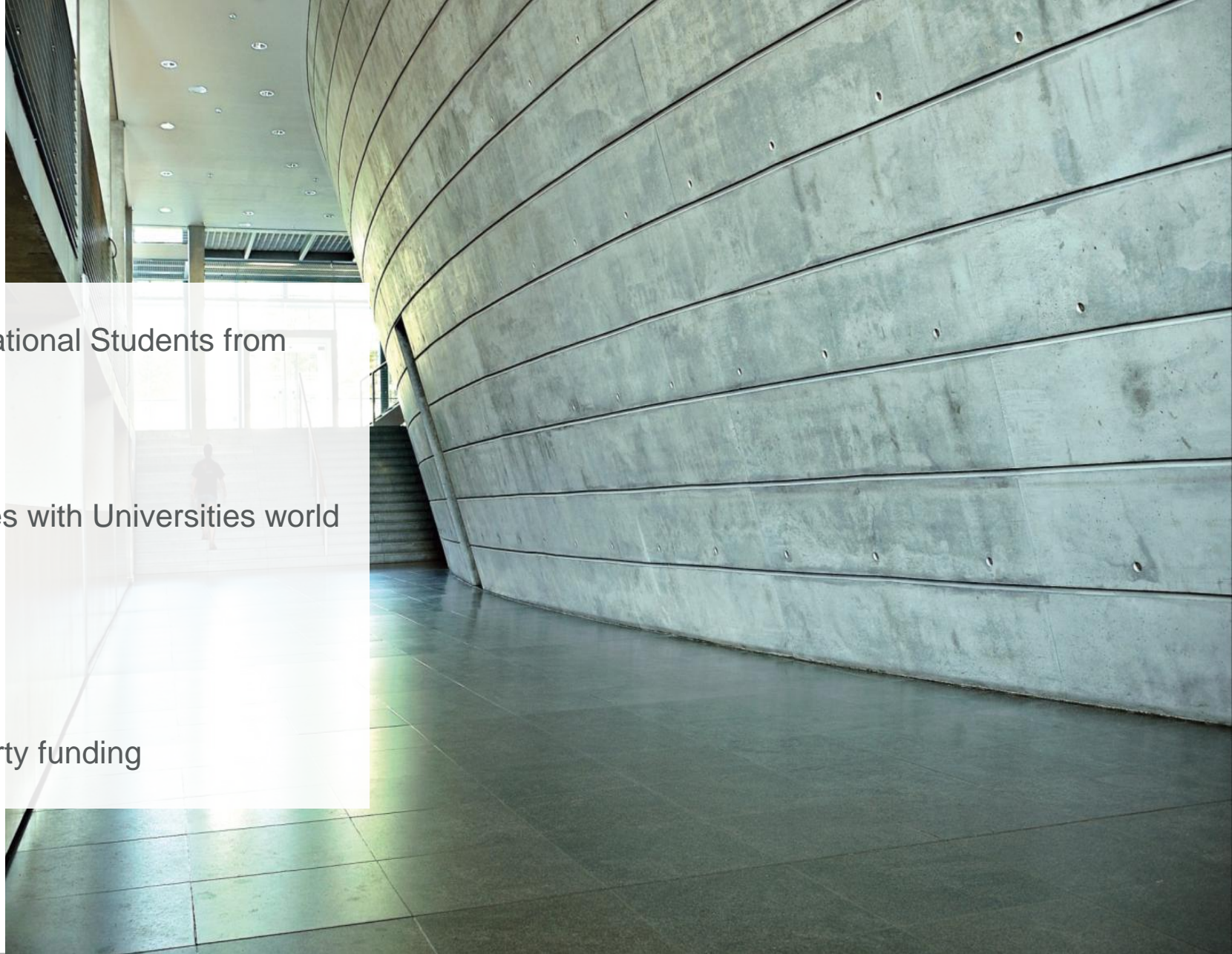
TU Dresden: more than 190 years of history

- 1828 Foundation as technical education site Dresden
- 1890 Royal Saxon Technical High School
- 1945 Destroyed after 2nd world war
- 1946 New start of TH Dresden
- 1961 Designation as University of Technology (Technische Universität, TU)
- 1990 Development towards a full university
- 2012 University of Excellence
- 2019 University of Excellence



TU Dresden: Numbers and facts

- 29'000 Students, with 5'400 international Students from app. 124 Nations
- 119 Study courses
- Numerous cooperation programmes with Universities world wide
- 8'300 employees
of which 3'400 third party funded
- 773 Mio Euro total budget in 2023
of which 361 Mio Euro are third party funding



5 Schools, 17 Faculties

School of Civil and Environmental Engineering

- Faculty of Architecture
- Faculty of Civil Engineering
- Faculty of Environmental Sciences
- Faculty of Transportation and Traffic Science
- Faculty of Business and Economics



**TECHNISCHE
UNIVERSITÄT
DRESDEN**

School of Medicine

- Faculty of Medicine Carl Gustav Carus

School of Science

- Faculty of Mathematics
- Faculty of Biology
- Faculty of Chemistry and Food Chemistry
- Faculty of Physics
- Faculty of Psychology

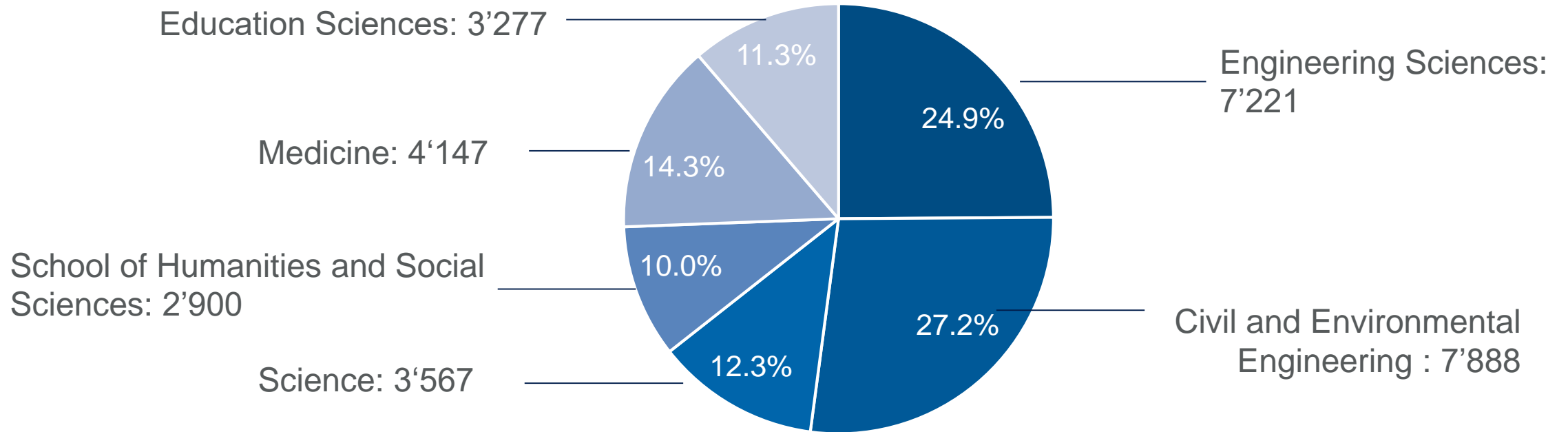
School of Engineering Sciences

- Faculty of Electrical and Computer Engineering
- Faculty of Computer Science
- Faculty of Mechanical Science and Engineering

School of Humanities and Social Sciences

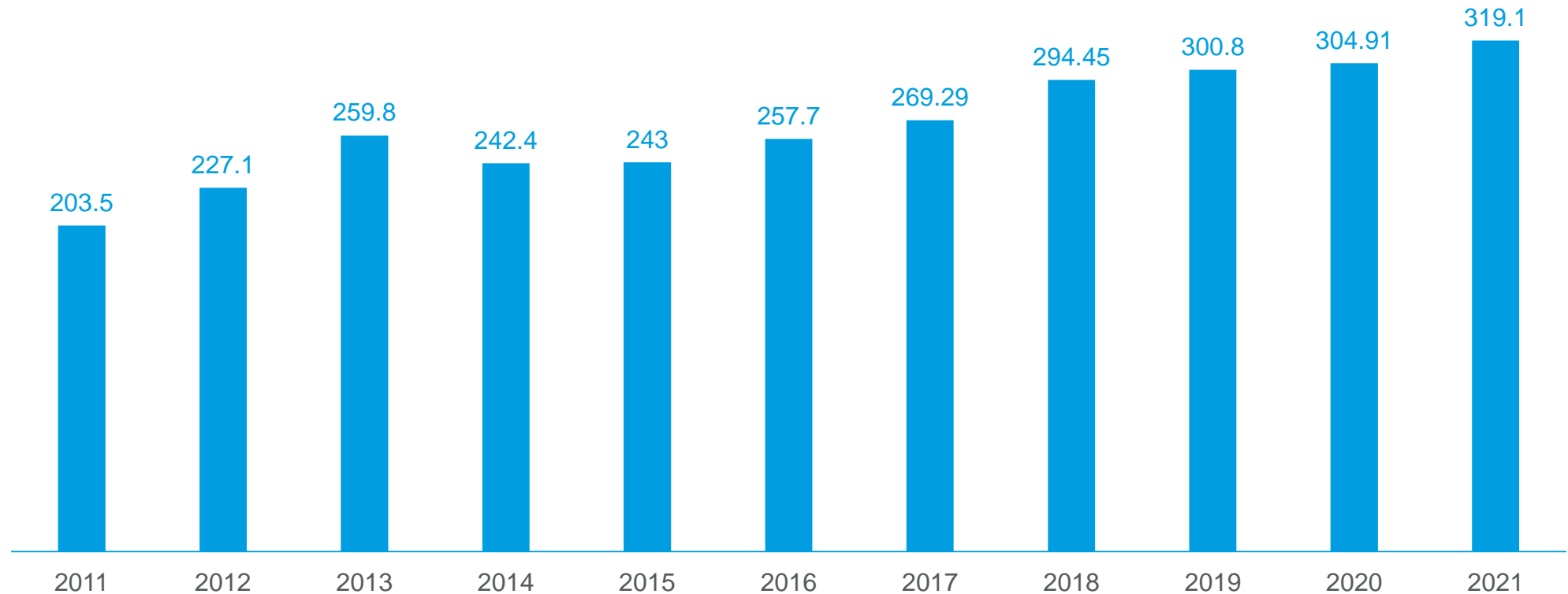
- Faculty of Education
- Faculty of Philosophy
- Faculty of Linguistics, Literature and Cultural Studies

Students in Schools



- **Total number 29'000**
- **5400 or 18.5% international students**

Third party funding at TU Dresden in Mio EUR – 2011 to 2021



Excellence strategy

CLUSTERS OF EXCELLENCE

- Funding of research themes related to grand challenges

→ 3 Clusters at TU Dresden

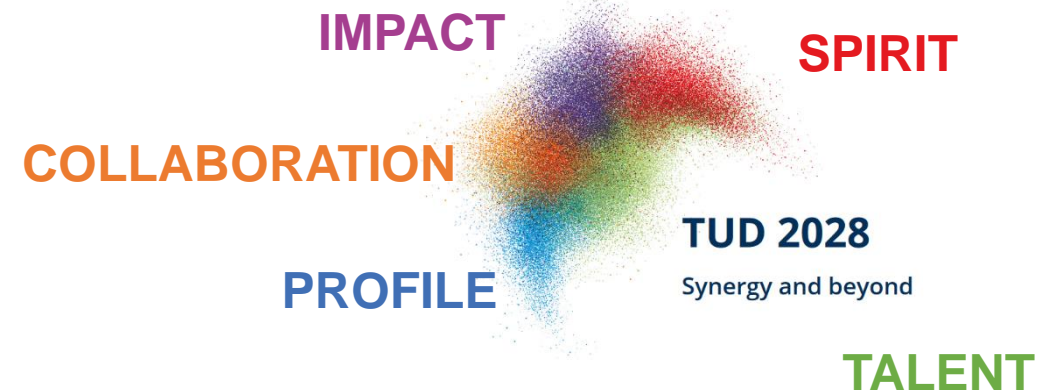


UNIVERSITIES OF EXCELLENCE

(eligible if $2 \geq$ Clusters)

- Long-term funding of Universities/ University clusters

→ TU Dresden is one of eleven German Universities of Excellence



Research

Grand challenges in water science and management

- Extremes are intensifying and occurring more frequently
- Overexploitation of water resources – conflict of interests
- Deterioration of water quality
- Deterioration of aquatic ecosystems and loss of biodiversity
- Loss of non-renewable nutrients
- New pollutants, micro-pollutants, micro-plastics, bio-pollutants
- Water for food production
- Access to safe drinking water for all
- Safeguard hygienic living conditions for all
- Lack of data and monitoring

→ How can we achieve Water Security?



We have to face that

Extremes

- occur more often
- might appear in combination and amplify
- intensify impacts on societies and environment

Droughts



Floods



Ecosystem
impacts

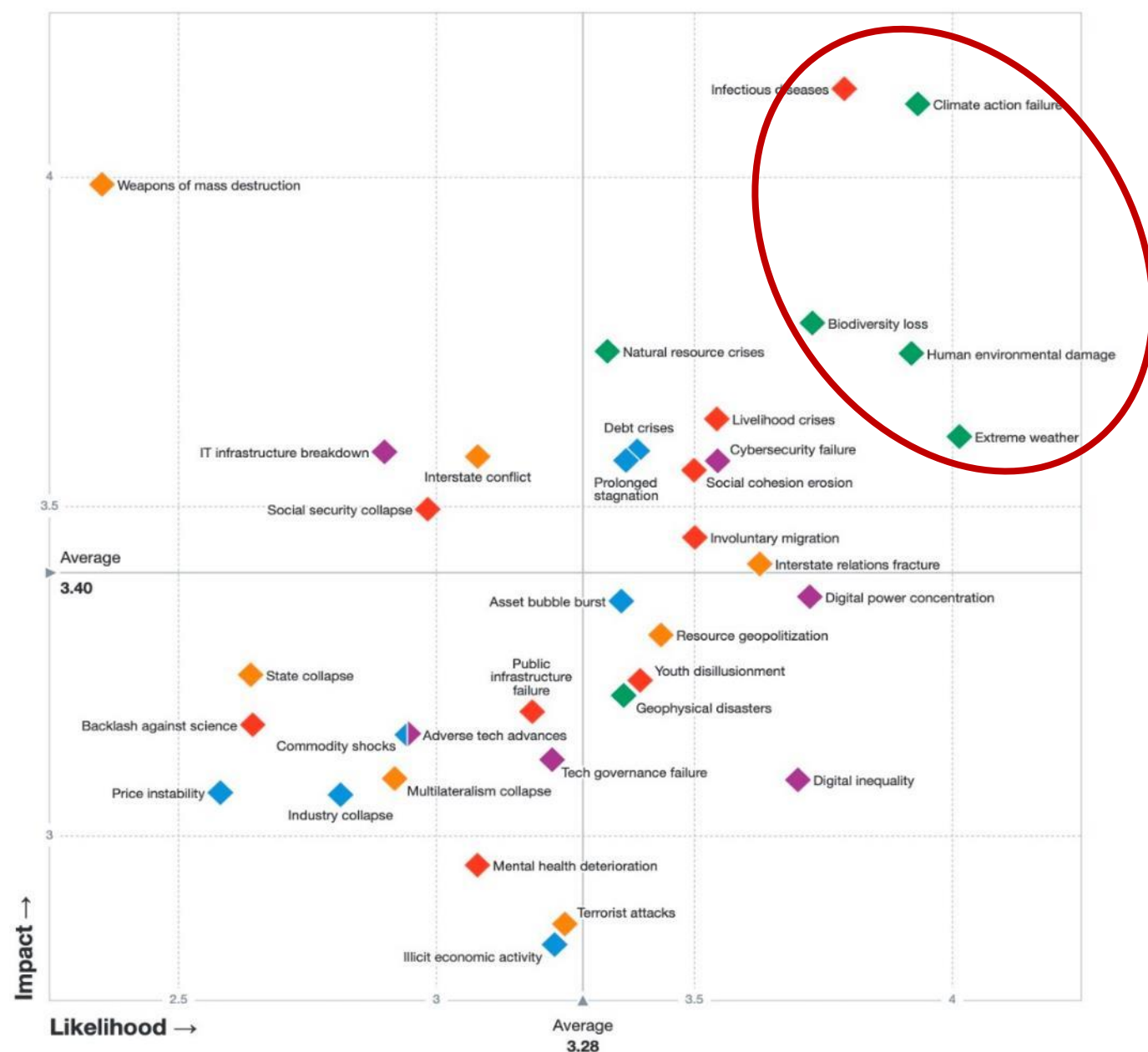


We have to face that

Environmental extremes are likely to happen and causing most severe impacts

World Economic Forum
Global Risk Perception Survey (2021)

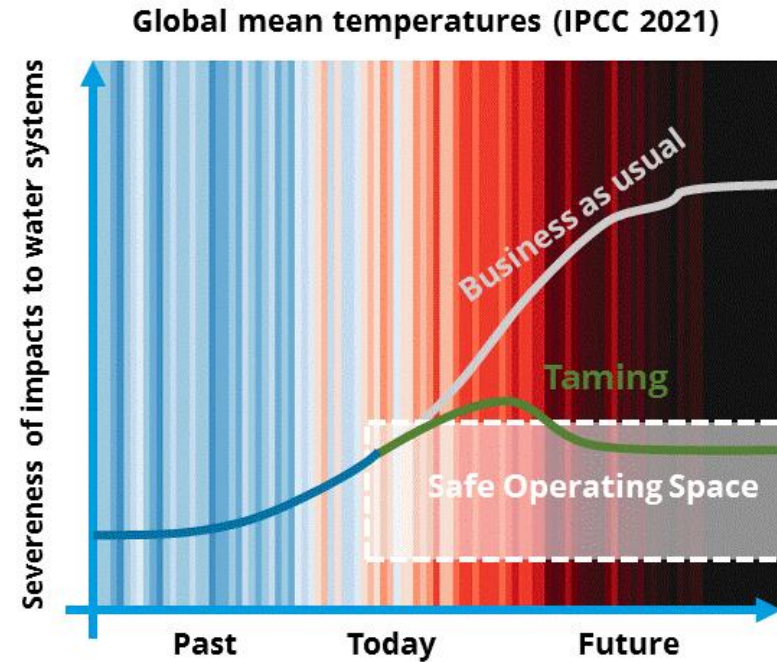
Integrated water resources management is a way to counteract to these impacts!



We have to face that

Business as usual
is misleading

We need to develop “safe
operating spaces”!



- ⇒ Erosion of forests and soil
- ⇒ High urban runoff
- ⇒ Increasing pollutants (chemicals, bio-pollutants)
- ⇒ Loss of ecosystem services and biodiversity
- ⇒ Self-amplifying dynamics
- ⇒ Maladaptive infrastructure
- ⇒ ...

- ⇒ **Resilient forests**
- ⇒ **Non-polluting cities**
- ⇒ **Contaminants below harmful thresholds**
- ⇒ **Stimulated ecosystem services and biodiversity**
- ⇒ **Controlled dynamics**
- ⇒ **Smart infrastructure**
- ⇒

Emerging field water research

Institutional cooperation of TUD and UFZ (Helmholtz Center for Environment Research) based on a global IWRM project

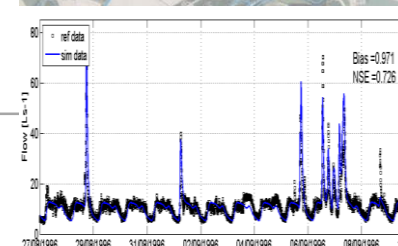
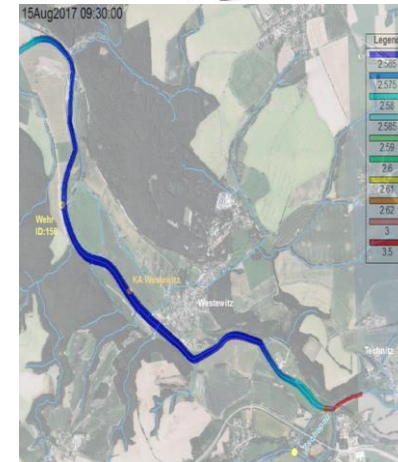
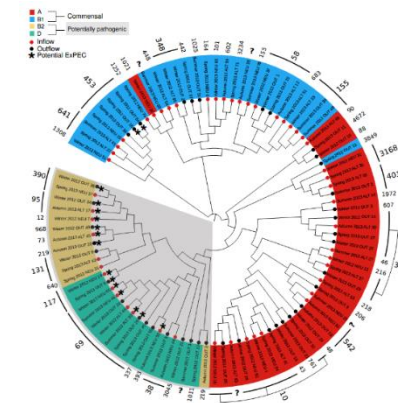
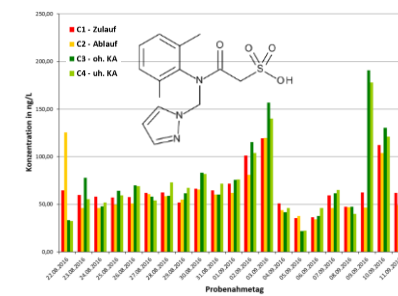
Complementary know how

Competences on the entire water cycle on quantity and quality

app. 30 professors dealing with water as a main content

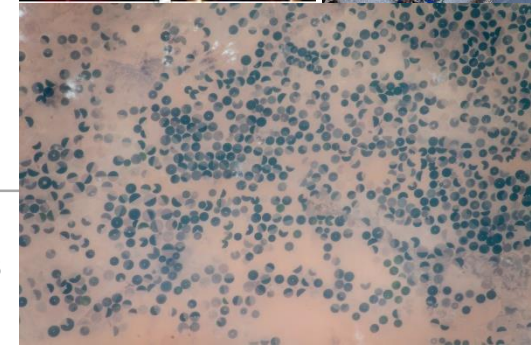
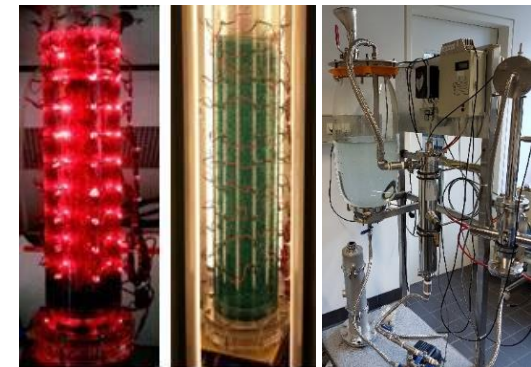
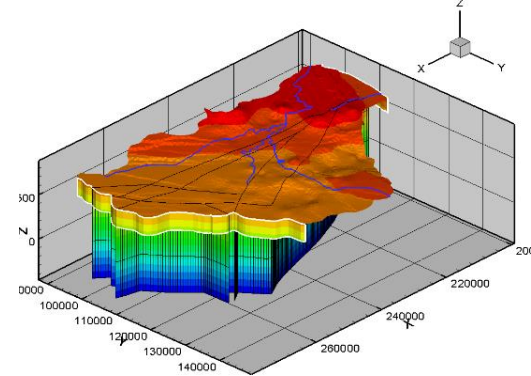
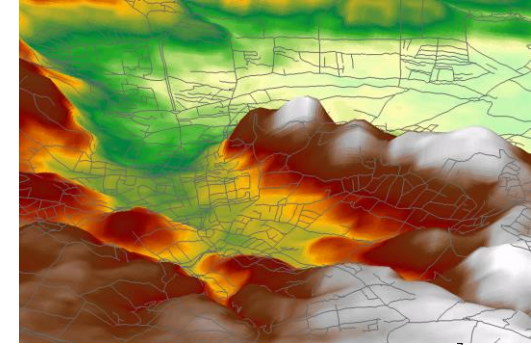
4 joint appointments

app. 250 scientists in total

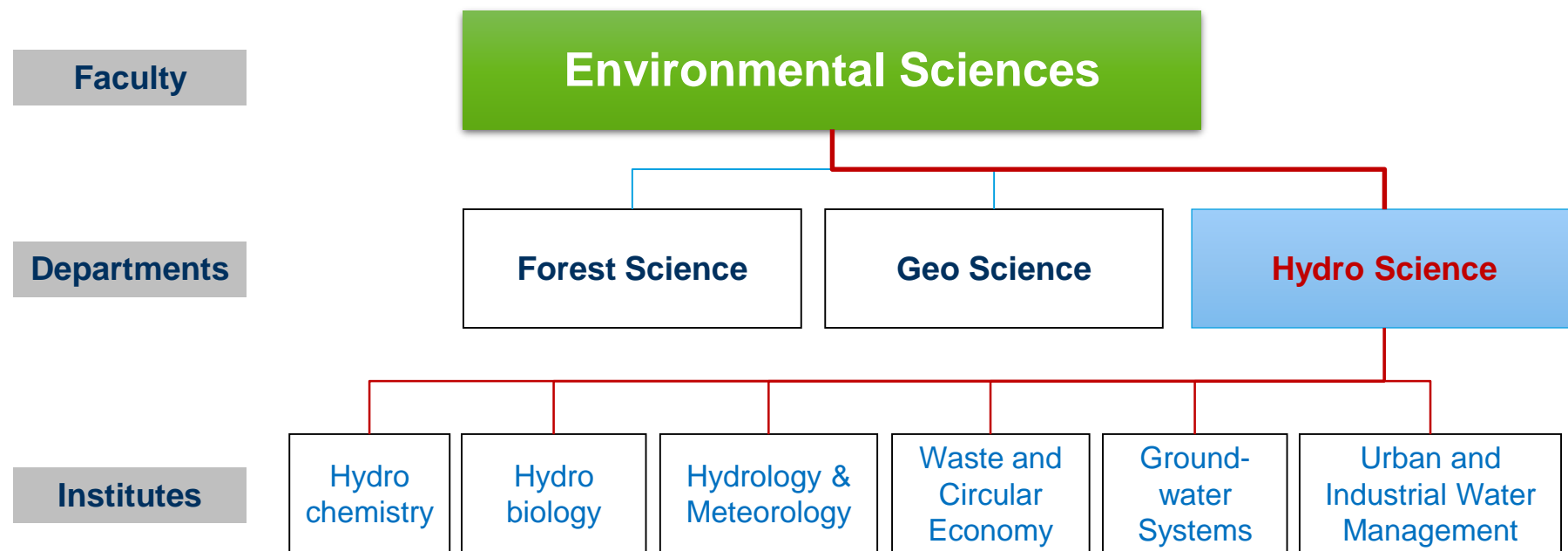


Current focus topics of EFW

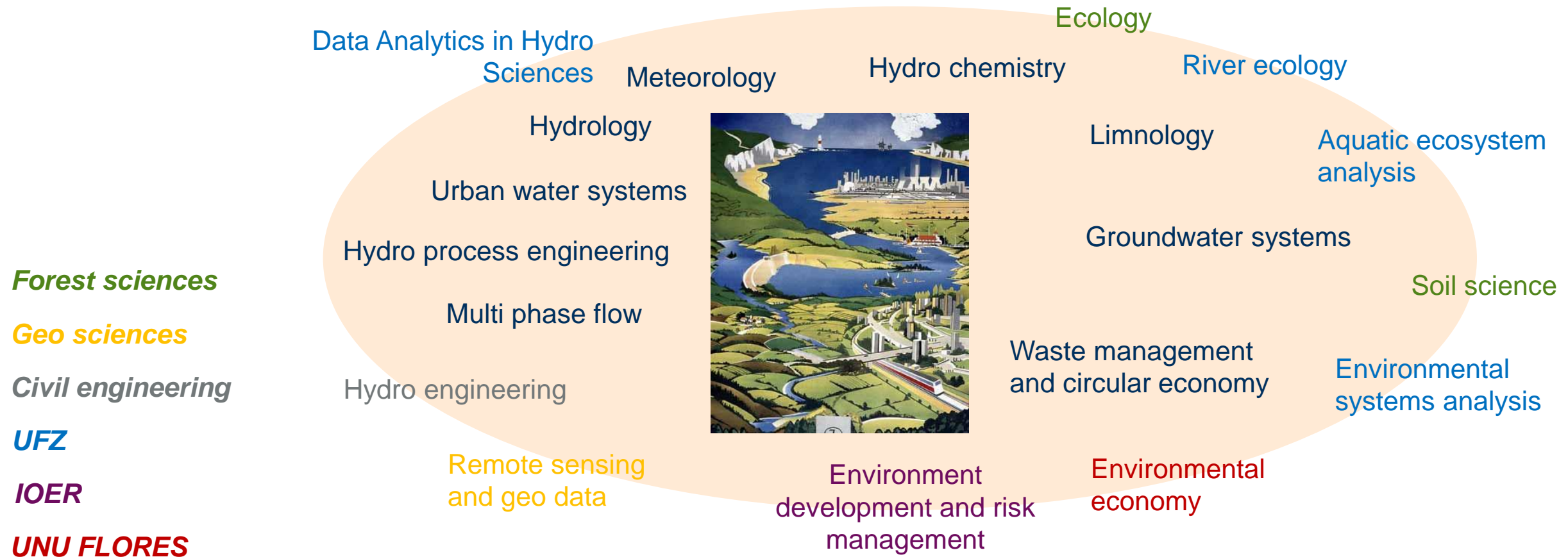
- **The impact of extremes on chemical and ecological water quality**
 - Interactions of dynamics, flow and quality across space and time scales
- **Climate change – projection, protection and adaptation**
 - Improvement of spatial and temporal resolution, water-extremes, resilience
- **Antibiotic resistances in water and wastewater**
 - Predicting the impact of anthropogenic pressure on the spread of antibiotic resistance in aquatic environments
- **Data and information scarcity**
 - Coping with information scarcity in hydro systems – data, patterns, processes and projections
- **Extremes- and water resilient urban spaces**
 - Management of urban waters at the interfaces to climate and environmental systems
- **Transformation towards healthy forests**
 - The role of forests in water balance and vice versa



Structure of Faculty and Department



Water-Platform on water research at TU Dresden



International Education

Study courses in Hydro Science



Hydro Science – structure and PIs



Ecology
(Forest Science)
Schuldt



Site Ecology
(Forest Science)
Orlowski



Soil Science
(Forest Science)
Kalbitz



Hydro Engineering
(Civil Engineering)
Stamm, Pohl



Flood Risk Management
(IOER / Env. Sciences)
Schanze

Faculty

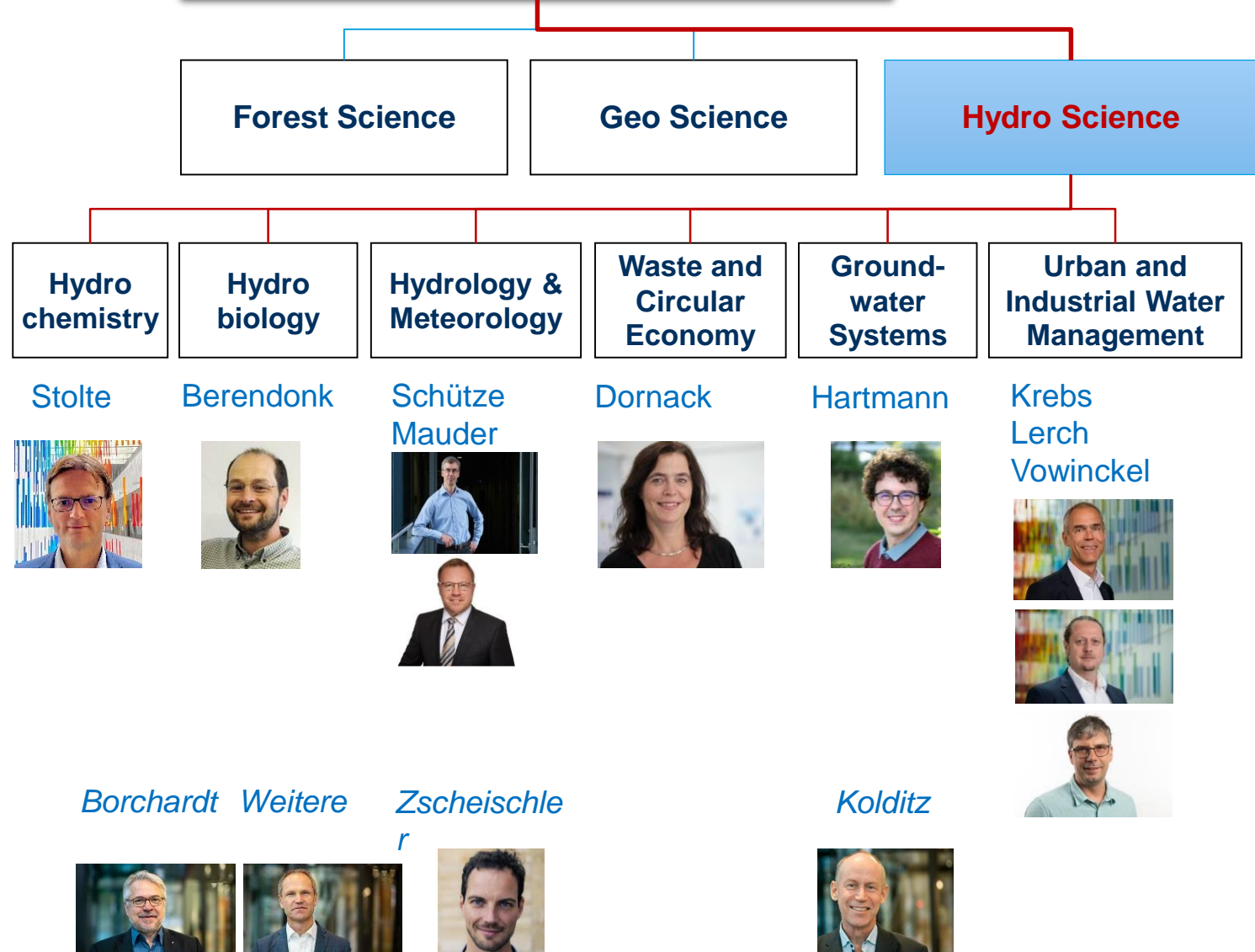
Departments

Institutes

Professors

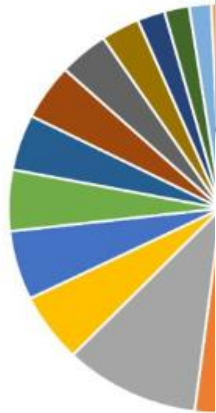
Joint appointments
with UFZ

Environmental Sciences



EPOS Programmes

development-relevant postgraduate study courses



- Germany
- Bangladesh
- Viet Nam
- Marokko
- Mexiko
- Costa Rica
- Oman



Semester 1 TU Dresden, Germa

The programme starts with first semester at TUD, where students take either non-engineering or engine subjects to complement the background and build a solid foundation for everyone. A fieldtrip to flood-prone areas is organised.

Semester 2

Semester 3

Semester 4

Groundwater and Global Change - Impacts and Adaptation

GroundwatCh

The Joint Master Degree Programme on Groundwater and Global Change - Impacts and Adaptation (acronym GroundwatCh) offers a distinctive curriculum built on the cornerstones of hydrology, hydrogeology, climatology, impacts and adaptation.

D J E

Erasmus Mundus, Delft (the Netherlands), Dresden (Germany) and Lisbon (Portugal)
⌚ 24 months, starts in September

International Education

UNEP Courses by CIPSEM

(Centre for International Postgraduate Studies
of Environmental Management)

- Since 1977 (!)
- 4 courses per year with 20 “students” from 20 countries
- Half year’s course on environmental management
- 3 one-month courses on various subjects – Water is directly or indirectly a core topic every year
- People from established positions, sent by their employers
- Global alumni network of more than 2500 former students of some 140 countries



Means of teaching



Lectures, Lab classes, Study tours/Excursions, Field classes, Workshops etc.

Cooperation at TUD:

MSc Tropical Forestry; Wasserwirtschaft, Hydrologie; Faculty of Civil Engineering

International Cooperation:

IHE Delft, IST Lisbon, UPC Barcelona, University Ljubljana through the 2 Erasmus Mundus programmes

Flood Risk Management, Flash Flood WS

Hydro Science and Engineering (HSE)

- HSE is a master course in **“International Water Management”**
- Established in 2004; accredited in 2005, 2011 and 2019
- More than 550 graduates in HSE plus 300 Erasmus graduates by 2023
- Scholarships from DAAD (ca. 150) & Erasmus Mundus (FRM, ca. 210), GroundwatCh, ca. 135) & national institutions
- Applications/Year TUD (200), DAAD (100), EM FRM (400), EM GW (500)
- Typical students have
 - Interest in international water management
 - English (C1)
 - variety of BSc (Engineering, Natural or Environmental Science)
- General structure ...
 - basic courses in the 1st semester
 - advanced courses in the 2nd & 3rd semester

Structure of HSE master course

	Mandatory Modules	Electives	Total credits
1 st Semester, Basic Courses	10 cr	10 cr from “science list” 10 cr from “engrg. List”	30
2 nd & 3 rd Semester, Advanced Courses	10 cr	50 cr from a total of 100 cr offered (4 profiles are suggested)	60
4 th Semester, Master Thesis	30 cr		30
	50 cr	70 cr	120

1st Semester

Mandatory: Climatology and Hydrology (5 cr), Statistics (5 cr)

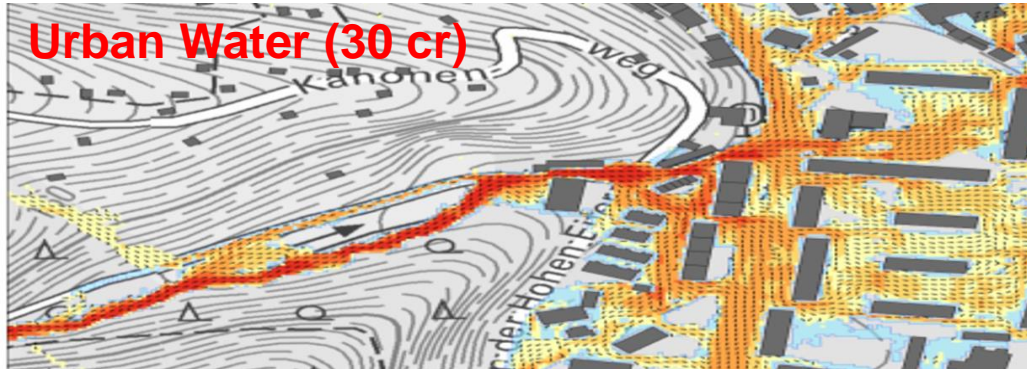
“Science List”: Hydrochemistry (5 cr), Soils (5 cr), Ecology (5 cr)

“Engrg. List”: Geodesy (5 cr), Hydraulic Engineering (5 cr), Hydromechanics (5 cr)

• Please do not go for the modules you already heard !

Profile offers ...

... according to personal preferences



Electives of the 2 nd /3 rd semester (choice of 50 cr out of 110 cr)	Summer Term	Winter Term
Study Project (mandatory)	5 cr	5 cr
Integrated Water Resources Management (IWRM; open for all Master students)	5 cr	5 cr
Urban Water / Modelling of Wastewater Systems	5 cr	5 cr
Water Quality and Water Treatment		5 cr
Drinking Water Supply		5 cr
Flood Risk Management I & II (partly with Hydrology)	10 cr	10 cr
Hydro Dynamics		5 cr
Watershed Management I & II	5 cr	5 cr
Watershed Management I & II	5 cr	5 cr
International Water Issues / Conflict Management (TropFor)	5 cr	
Circular Economy	5 cr	
Aquatic Ecology and Ecotoxicology		
Climate Change (with Geography and Forestry)		
Soil Water		5 cr
Ground Water		5 cr
Climate Systems & Climate Modelling		5 cr
Internship	(5cr)	5 cr

• Profit from the wide choice you have!!
• The idea is not to compose a study course from what you have done in the past

What to do after finalising the study programme?

Competencies after HSE

- Good understanding of natural & anthropogenic processes related to water
- Ability to find Science & Engineering solutions for water problems

	Job opportunities	
Return to home country	consulting, authorities, Capacity Development, ...	40%
PhD	At FRM universities or elsewhere	30%
International Org. & NGO	UNO (WMO), GIZ, Arche-Nova, ...	20%
Unrelated		10%

- If you consider to apply for a job in Germany – please learn German!

20 Years of Hydro Science and Engineering

15./16. November 2024,
from 5 PM onwards,
Venue: POT/81



What to Expect:

- Poster session.
- Panel Discussion.
- Social programme.
- Network with alumni, professors and professionals.

**20 Years of Brilliance...
Sustaining Our Legacy,
Innovating Our Future...**

Register now via <https://tud.link/umftue>

Or scan the following QR code.



[Registration](#) for you still open! Remaining places limited...

Thank you for your attention...

... welcome to Dresden ...

... and enjoy the Master Course!