

Institute for Meteorology and Climate Research (IMK-IFU) of the Karlsruhe Institute of Technology (KIT)

and Helmholtz Graduate School for Climate and Environmental Research (GRACE)

Dr. Peter Suppan

Institute for Meteorology and Climate Research (IMK-IFU), KIT Campus Alpine, Bavaria



What's KIT ?

Karlsruhe Institute of Technology
stands for the triad of



■ **Research**



■ **Teaching**



■ **Innovation**

Two Partners Strong in Research

Research Centre Karlsruhe (FZK)

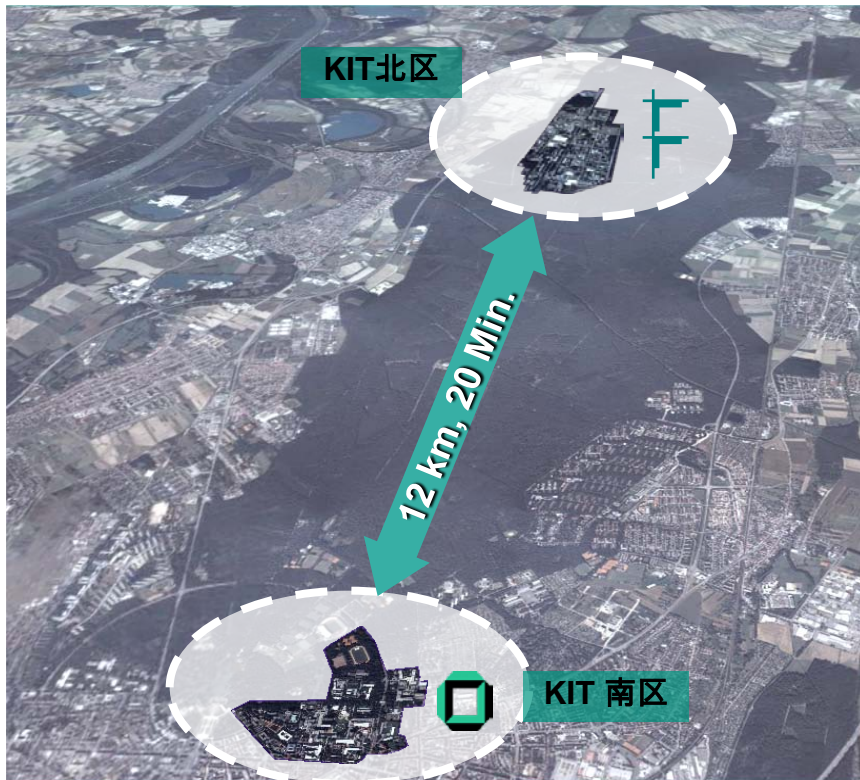
- Program-based research of top international level
- One of the largest and most successful natural and engineering science research institutions in Europe
- Member of the Helmholtz Association of National Research Centers

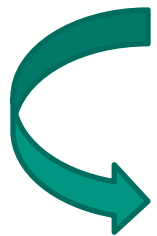
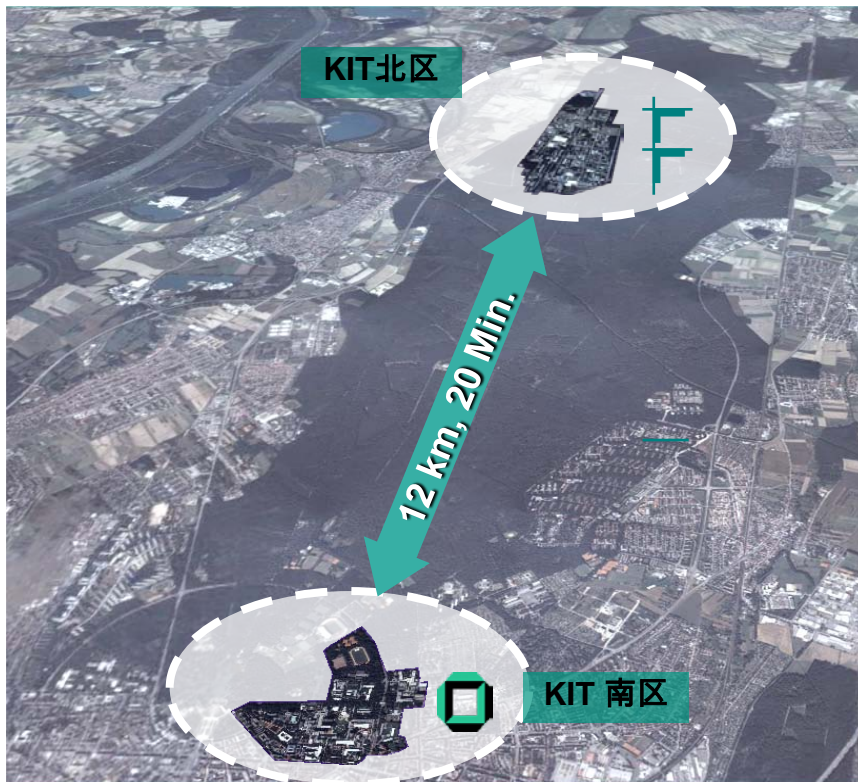
University Karlsruhe (TH)

- Winner of the 2006 Excellence Initiative launched by the Federal Republic of Germany and the federal states
- One of the universities strongest in research worldwide
- Highest acquisition of DFG third-party funds per capita



卡尔斯鲁厄科技研究所





260 km



- KIT 阿尔卑斯区 -



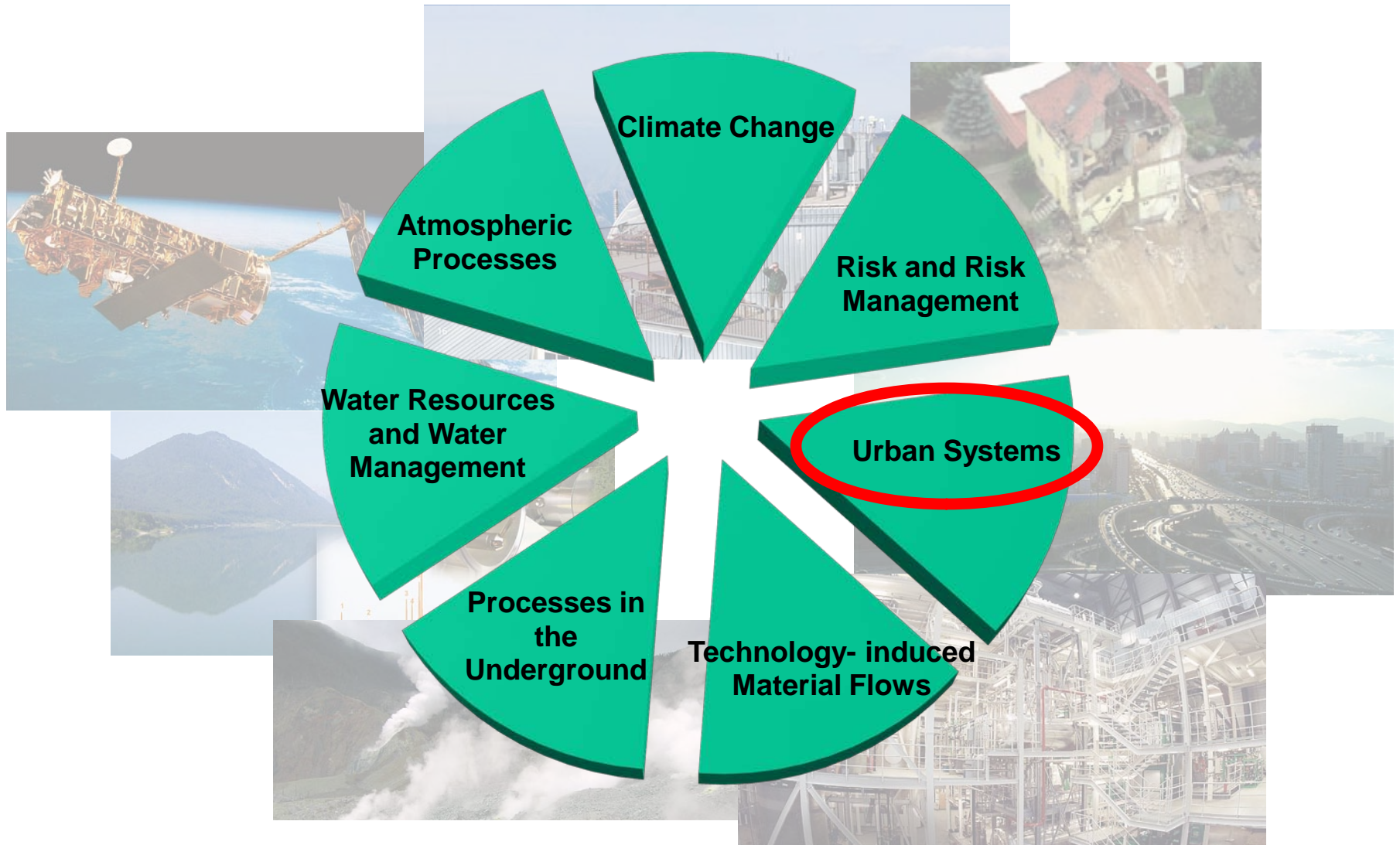
KIT - Centres

Energy

Climate and Environment

Nano and Micro Scale Science

Astroparticle Physics



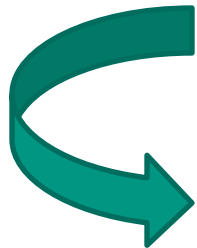
Topic: Urban Systems

Speaker PD Dr. Stefan Norra & Dr. Peter Suppan

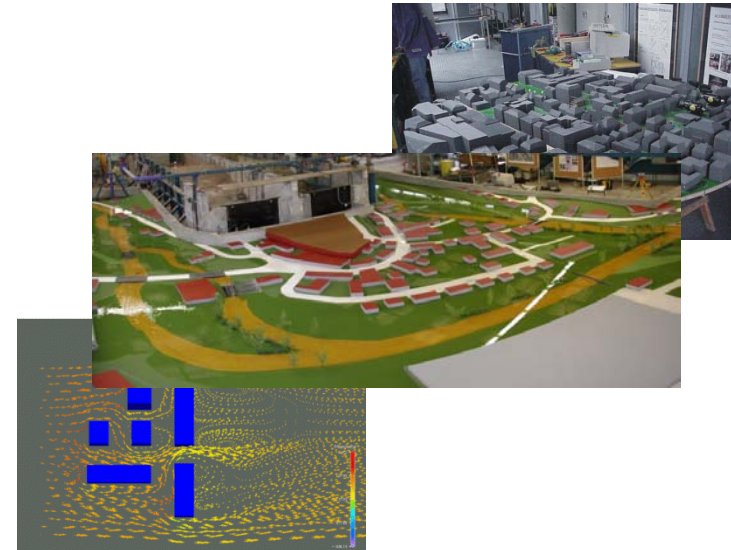


- Climate Change, Natural Disasters, Environmental Pollution
- Ecosystems
- **Atmosphere and Urban Climate**
- Management of Water Resources, Material Flows, and Energy Flows

- Infrastructure
- Social Vulnerability
- Urban Development Scenarios



Health impact



Graduate School



KIT-GRACE

KIT-GRACE - GRAduate school for Climate and Environment



www.grace.kit.edu



Support
for the PhD Thesis

Preparation
for careers in science and business

Improvement
of competitiveness of the KIT

Development
of analytical and problem solving skills concerning complex environmental challenges

KIT GRACE – GRADuate school for Climate and Environment



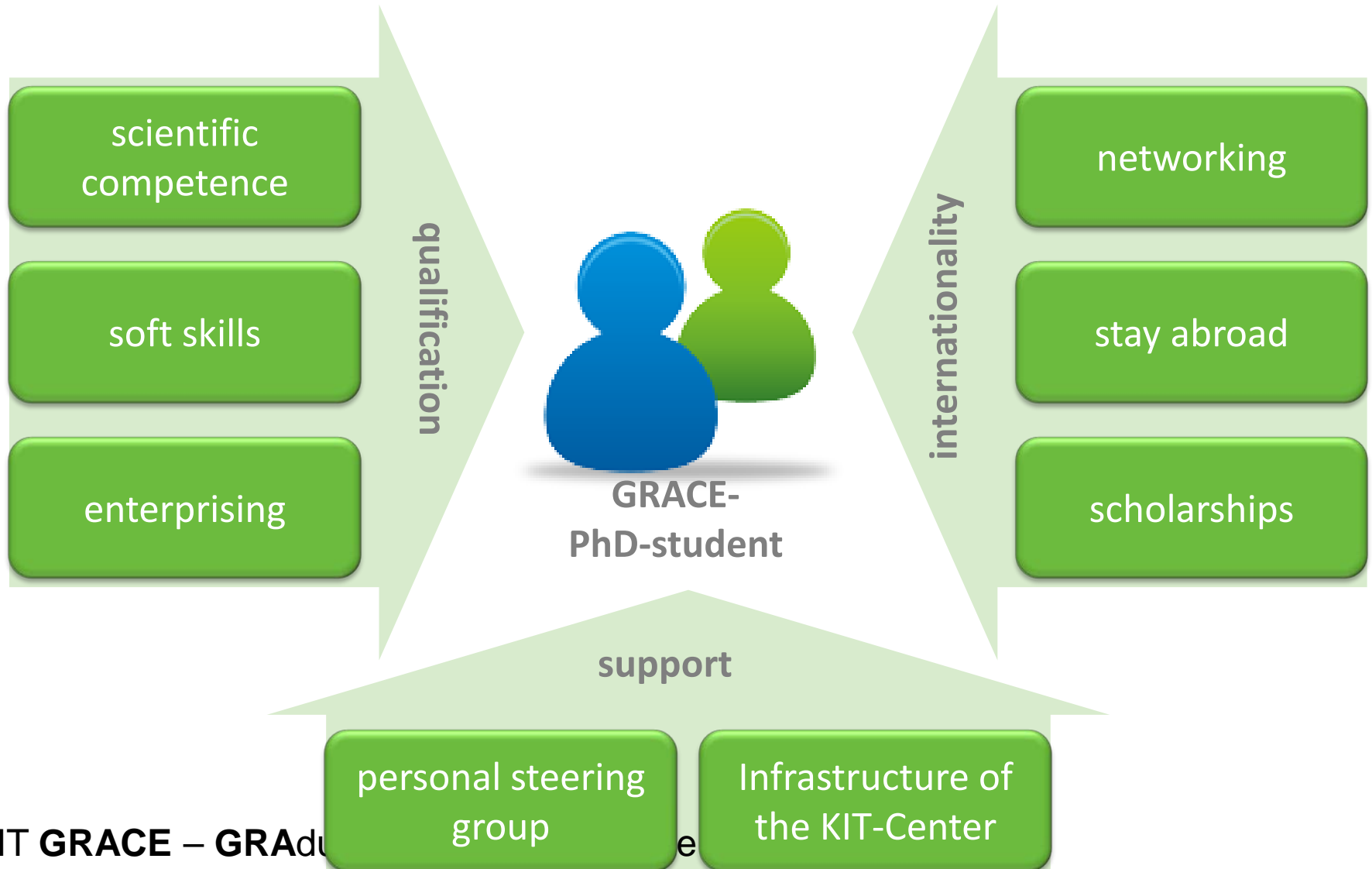
Expansion
of individual soft skills

Support
of enterprising mentality

Support
of international perspectives and intercultural communication skills

Founded
by the Helmholtz Association

KIT GRACE – GRADuate school for Climate and Environment

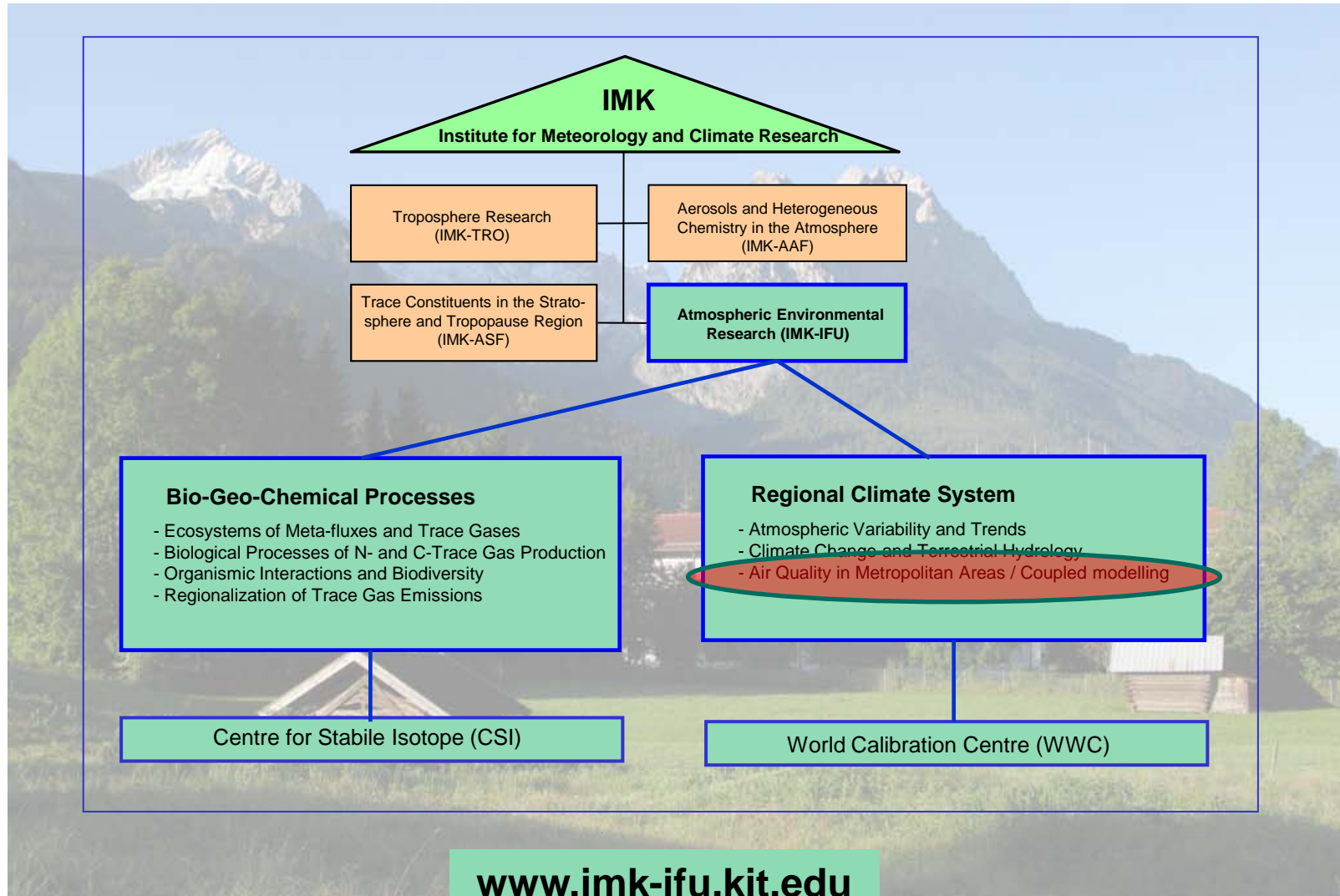


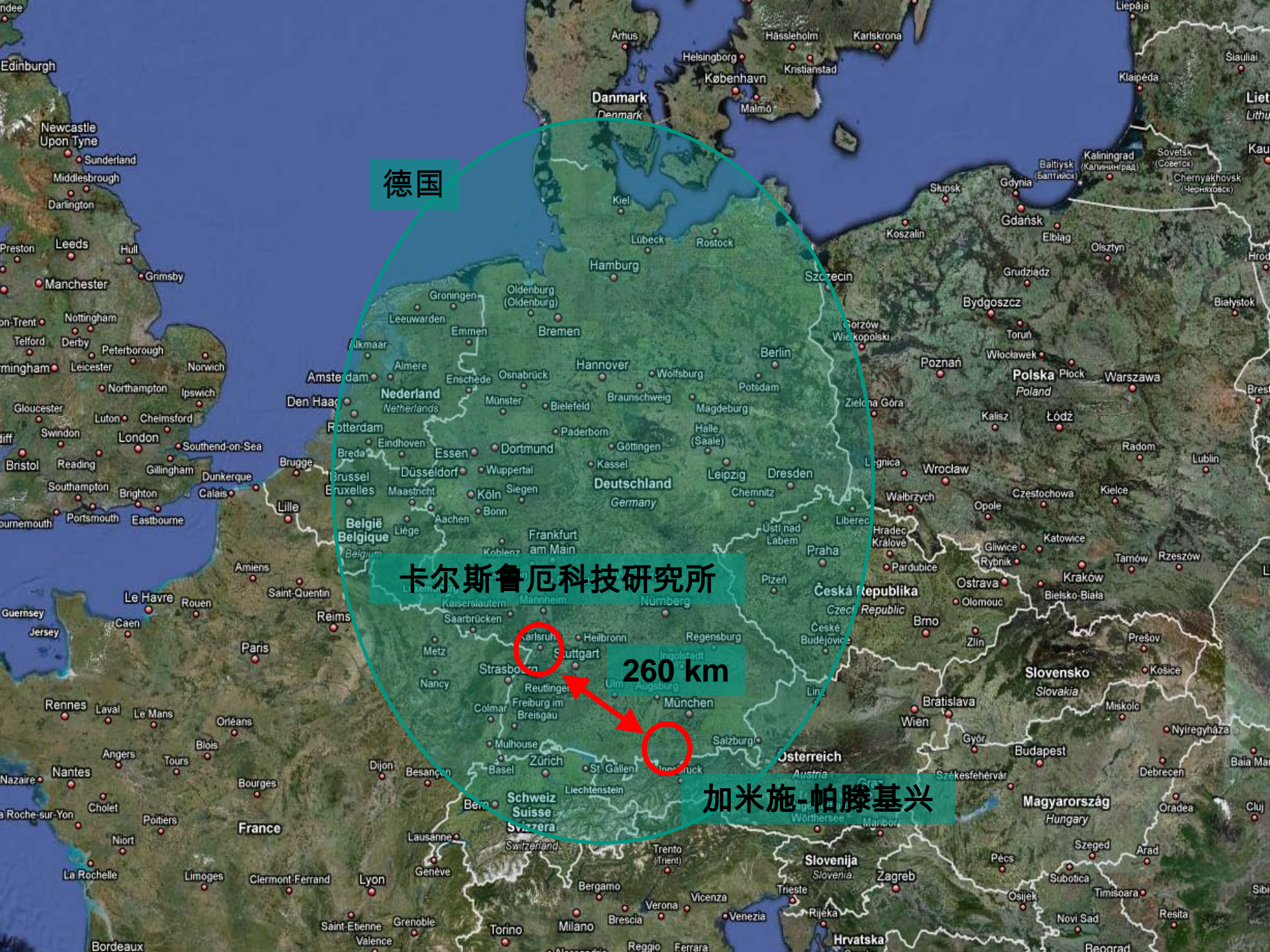
Qualification – individualized module plan

module	ECTS	year 1	year 2	year 3
thematically	4-6	Environmental Science ^{lecture}		Environmental Fluid Mechanics ^{sum.school}
			Advanced Water Technology ^{lecture}	
across themes	4-6		Sensors + Signals in Remote Sensing ^{lecture + laboratory}	Syst. Sustainability Assessment ^{sum.school}
individual competence	2-4	Scientific Writing ^{lecture}		Entrepreneurship (Block ESADE)
				Nature ^{Paper}
stay abroad	-		3 Mon. UC Davis (USA)	

KIT GRACE – GRADuate school for Climate and Environment

Institute for Meteorology and Climate Research (IMK-IFU)





德国

卡尔斯鲁厄科技研究所

260 km

加米施-帕滕基兴



卡尔斯鲁厄气象与气候研究所
- KIT 阿尔卑斯区 -

德国最高峰
楚格峰 2962米

卡尔斯鲁厄气象与气候研究所
- KIT 阿尔卑斯区 -

Institut für Meteorologie und
Klimaforschung (IMK-IFU)
- KIT Campus Alpin -



卡尔斯鲁厄科技研究所 (KIT) 卡尔斯鲁厄气象与气候研究所大气环境研究中心 (IMK-IFU) 组成

Atmospheric Environmental Research

大气环境研究



平流层臭氧损耗

空气质量



生物多样性



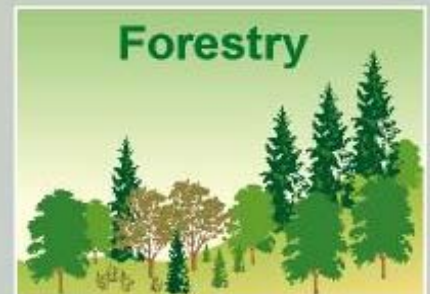
沙漠化



水



森林



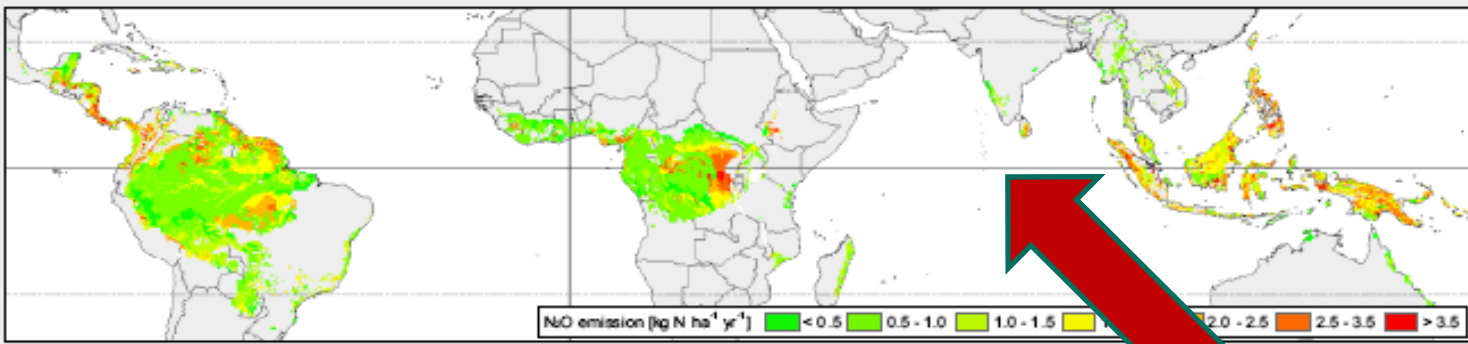
Climate Change

气候变化

(source: IPCC 2001, WG1 Report, Summary)

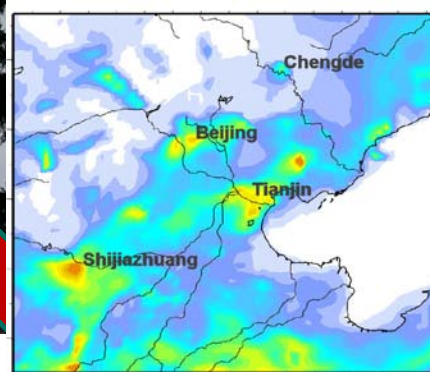
(来源：IPCC2001, WG1报告, 摘要部分)

The Challenge

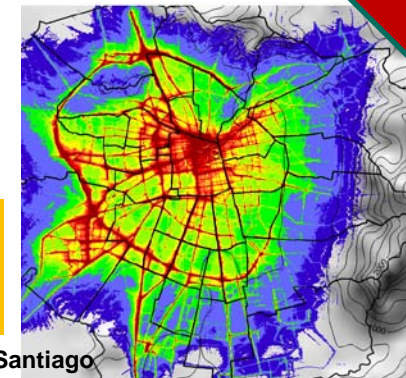


global scale
(remote sensing)

national scale
(aircraft meas.)



plot scale
(chamber meas.) (aircraft meas./remote sensing)



...from measurements to modeling
...from the micro to the macro scale and vice versa
(laboratory meas.)

IMK-IFU Research projects

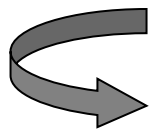
IMK-IFU 研究范围



Impact on Air Quality

- Land use
- Energy
- Mobility
- Climate Change

- Air Quality
- **Health Impact**



Integrated
Approach

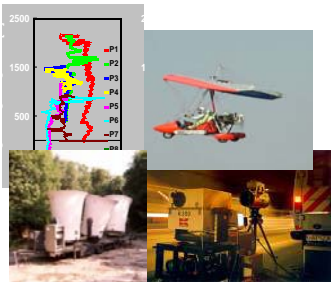


Integrated Approach

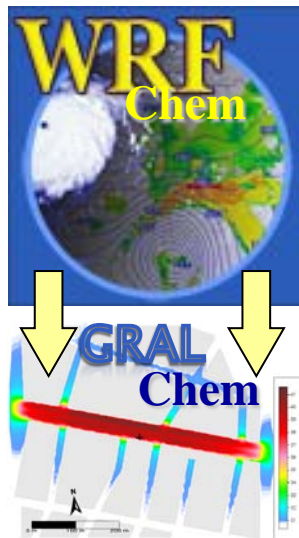
Urban Development



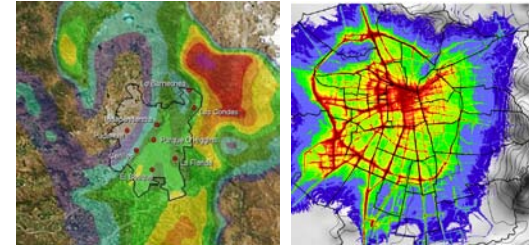
Measurement Data



Traffic Data



**Air Quality &
Climate Change
Approach**



Air Quality

Scenario

Indicator

Mortality

Subclinical Effects

Health Impact



Stakeholder

Dust Storms

Beijing

18.04.2006



Photos by Stefan Norra

SEM Images

Geogenic particles

Kali-Feldspar

UNI KARLSRUHE 1 μm EHT = 10.00 kV Mag = 25.00 K X Signal A = InLens LEO 1530
Date : 8 Dec 2008 File Name = IMG_557_01.tif

Soot sphere

UNI KARLSRUHE 1 μm EHT = 15.00 kV Mag = 30.00 K X Signal A = InLens LEO 1530
Date : 15 Oct 2008 File Name = IMG_540_15.tif WD = 7.7 mm VZ LEM

Anthropogenic particles

Fly ash

Halite

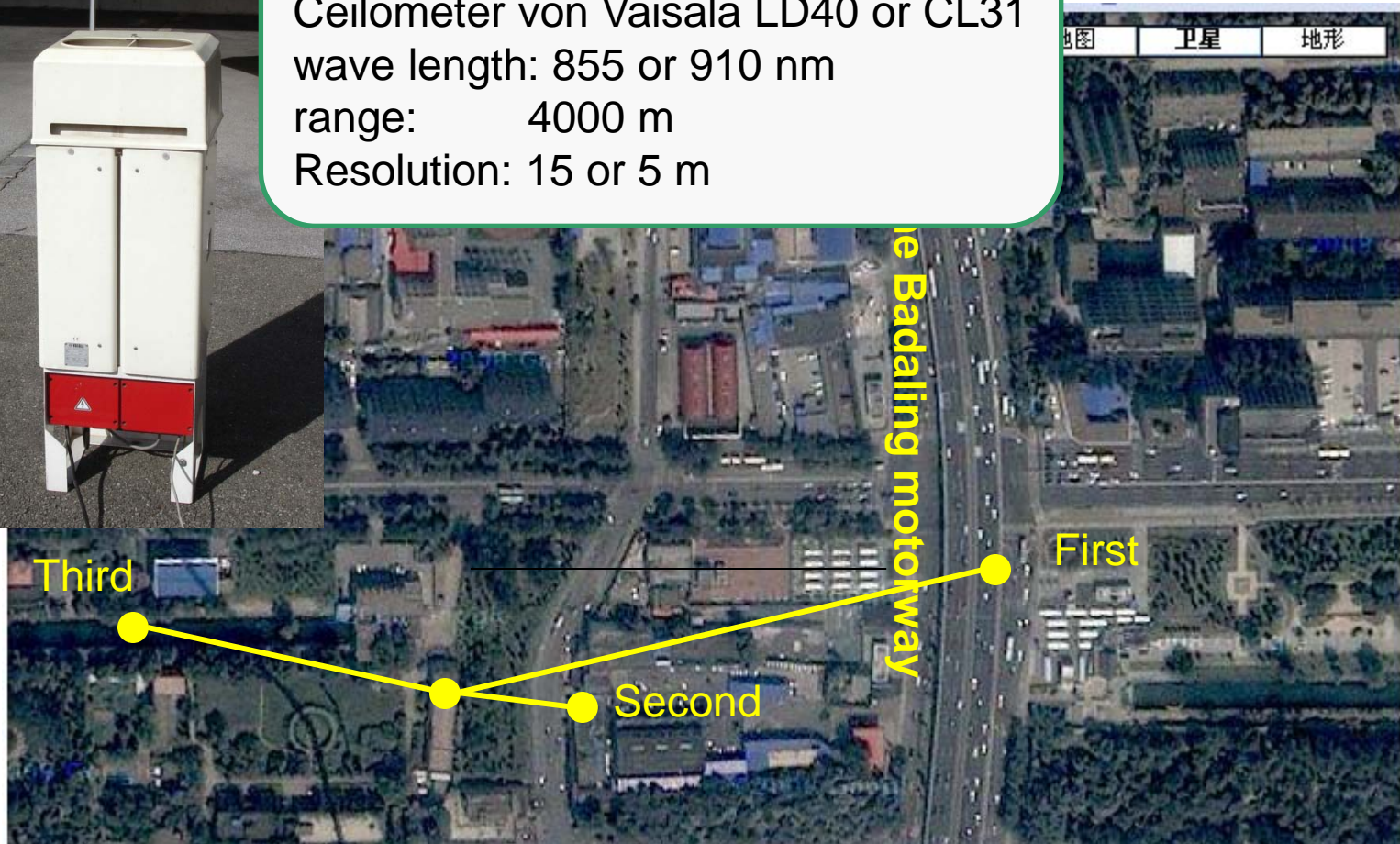
UNI KARLSRUHE 2 μm EHT = 10.00 kV WD = 6 mm Signal A = InLens
LEO1530 LEM:pp File Name = 1Tag2W_06.tif Date : 30 May 2005

Connected particles

Source: Stefan Norra, KIT

Sampling Strategies

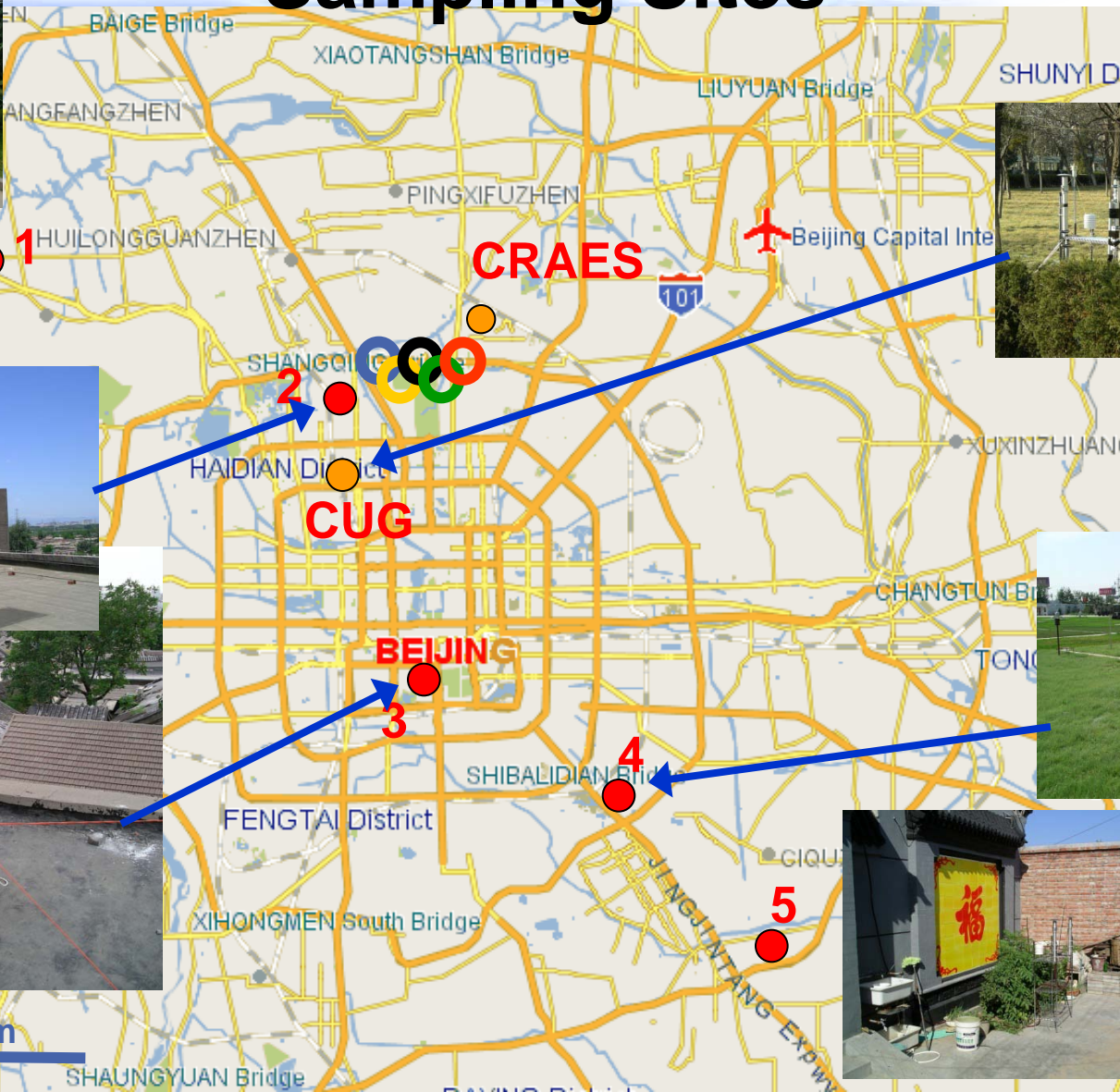
Optical remote sensing:
Ceilometer von Vaisala LD40 or CL31
wave length: 855 or 910 nm
range: 4000 m
Resolution: 15 or 5 m



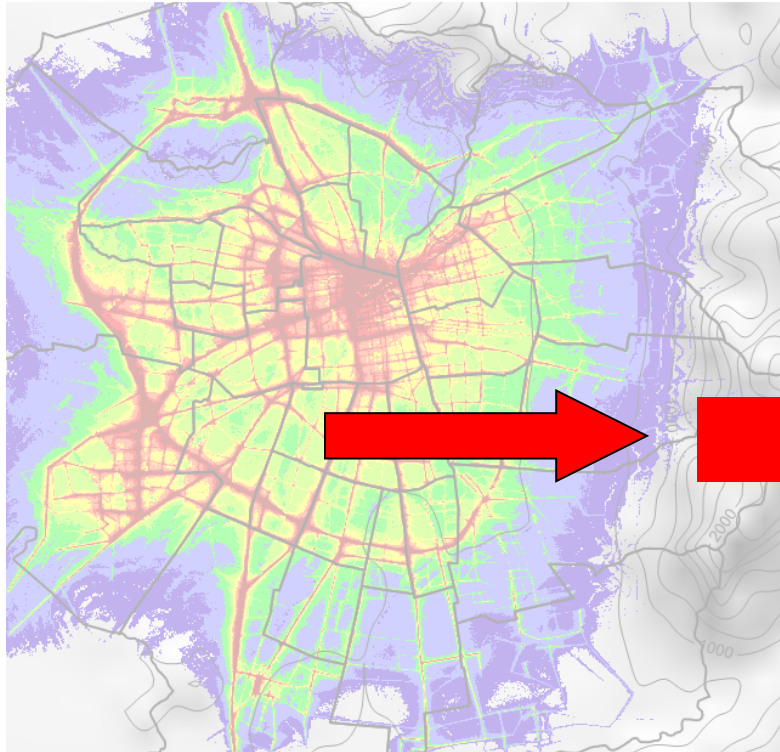
Münkel, C., "Mixing height determination with lidar ceilometers - results from Helsinki Testbed," Meteorol. Z. 16, 451-459 (2007).

Emeis, S., Schäfer, K., Münkel, C.: Observation of the structure of the urban boundary layer with different ceilometers and validation by RASS data. Meteorol. Z. 18, 2, 149-154 (2009)

Sampling Sites

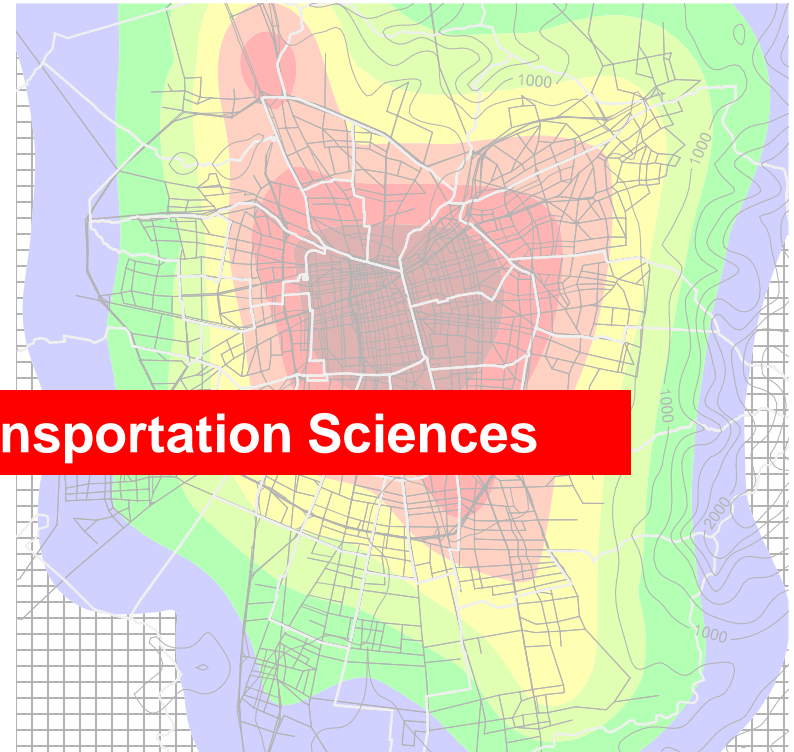


Coupling of Scales



Micro-scale modelling
e.g. NO_x with GRAL

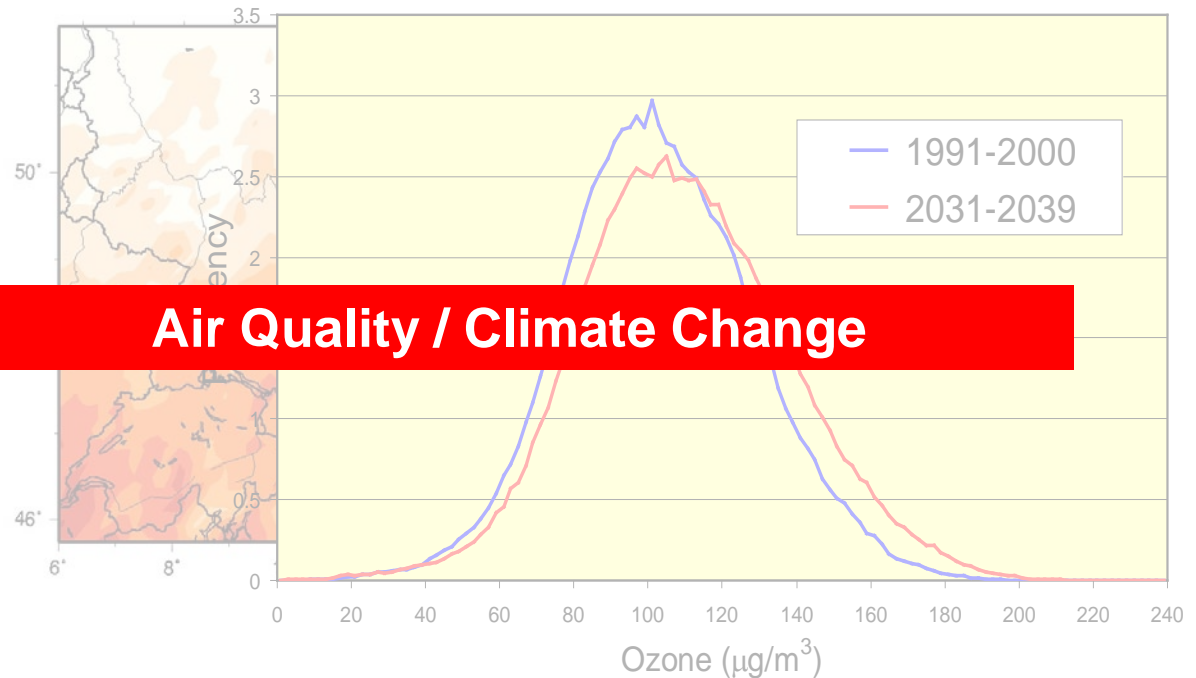
Transportation Sciences



Meso-scale modeling e.g.
 NO_2 with WRF/chem

Regional Climate Change Impact

Days with Threshold Exceedance Jun-Aug
Difference 2031/2039 - 1991/2000 uv20



Air Quality / Climate Change

Threshold exceedances in the future Distribution of daily O₃ maximum

Setup: 60-20 km grid
2x10 years period
Southern Germany

Source: R. Forkel (IMK-IFU)

Co-operations and Partners

- **Chinese Academy of Sciences (CAS), Beijing**
 - Prof. Yuesi Wang
 - Dr. Xin Jinyuan

- **China University of Geosciences (CUG), Beijing**
 - Prof. Kuang Cen

- **China University of Mining and Technology, Beijing (CUMTB)**
 - Prof. Longyi Shao

- **Chinese Research Academy of Environmental Sciences (CRAES), Beijing**
 - Prof. Chai Fahe
 - Prof. Chen Yizhen

- **German Meteorological Service (DWD), Freiburg**
 - Dipl.-Ing. Volker Dietze
 - Dipl.-Ing. Mathieu Fricker

- **Helmholtz Center Munich (HMGU)**
 - Prof. Dr. Annette Peters
 - Dr. Jürgen Schnelle-Kreis

- **Qingdao Research Academy of Environmental Sciences (QRAES)**
 - Prof. Sun Hekun



Capacity Building

*in cooperation with Prof. Longyi Shao (CUMTB),
Prof. Kuang Cen (CUG and Prof. Yuesi Wang (CAS-IAP)*

Rongrong Shen, full CSC PhD Student (4 years)

- aerosol measurements with the focus on source apportionment

Ruiguang Xu, full CSC PhD Student (4 years)

- air quality modeling with the focus on aerosol composition and distribution

Ling Hong, sandwich (IAP-CSC) PhD Student (4 years)

- air quality measurements with the focus on remote sensing techniques (SODAR, contactless)

Yu Yang, full CSC PhD Student (1 year)

- aerosol measurements with the focus on source apportionment / optical depth



Thank you very much for your attention



....and thank you for being here and welcome to Germany