



## Linking Measurements with Modeling Tools - A challenge for air pollution research


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## Overview

- Introduction
- Background
- Examples
- Conclusions



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## Impact on Health

Region	Percentage change	Reference
Asia	4.9% (2.3-7.6)	HEI, 2004
Europe	6.0% (4.0-8.0)	Katsouyanni, 2001
Latin America	6.1% (1.6-10.7)	PAHO, 2005*
United States	2.1% (0.9-3.3)	Dominici, 2003
Worldwide	6.5% (5.1-7.6)	Stieb, 2002


**PM<sub>10</sub> and Mortality Risk**

PAN American Health Organization, 2005

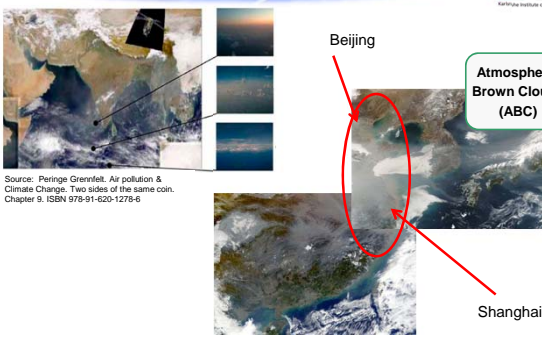
\* Based on studies in Mexico City, São Paulo, Santiago de Chile

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## Impact on Climate Change



Beijing

Shanghai


**Atmospheric Brown Clouds (ABC)**

Source: Peking University, Air pollution & Climate Change. Two sides of the same coin. Chapter 9. ISBN 978-91-620-1278-6

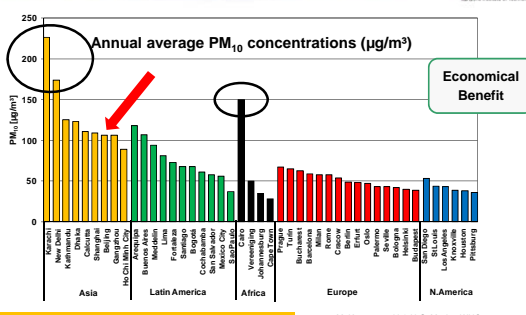
NASA/GODDARD / NYT

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## Impact on Economy



Annual average PM<sub>10</sub> concentrations (µg/m<sup>3</sup>)

**Economical Benefit**


Reduction benefit is 10 times higher as for ozone, e.g. Mexico City about \$2 Bill.

Molina and Molina, 2002

M. Krzyzanowski & H-G. Mucke, WHO update by Jordan et al, CEPAL

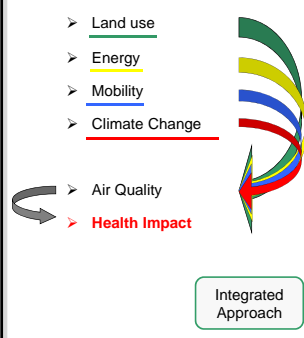
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## What Affects Air Quality ?

- Land use
- Energy
- Mobility
- Climate Change
- Air Quality
- Health Impact



**Integrated Approach**



Global surface warming (°C)

Santiago de Chile

Bogotá

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### What Affects Air Quality ?

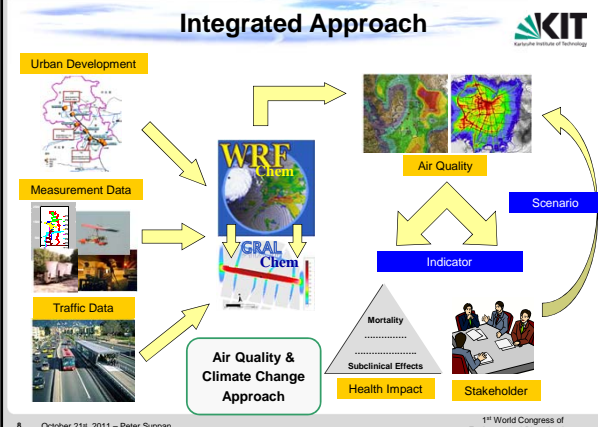
The complex interactions of causes of emissions – transmission - air pollution - deposition / exposure and climate change need detailed investigations on the causal chain

*Only multidisciplinary approaches allow a holistic analysis*

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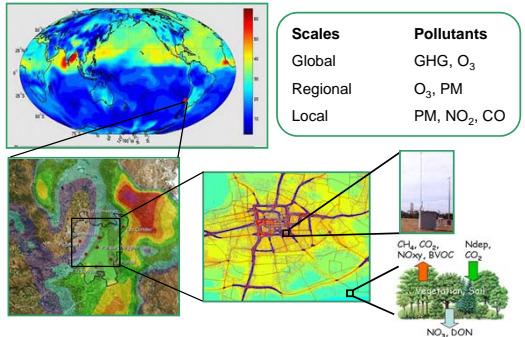
### Integrated Approach



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### Problem: Scales



Scales	Pollutants
Global	GHG, O <sub>3</sub>
Regional	O <sub>3</sub> , PM
Local	PM, NO <sub>2</sub> , CO

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### Measurement & Modeling Tools

- In-situ measurements
  - Active & passive measurements
- Remote sensing measurements
  - Horizontal & vertical
- Aircraft measurements
- Air pollution dispersion models on all scales
  - Box, Gaussian, Eulerian & Lagrangian models
- Models for different compartments
  - Hydrology, biosphere, soil, ...

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### Eruption of Eyjafjallajökull (E15)

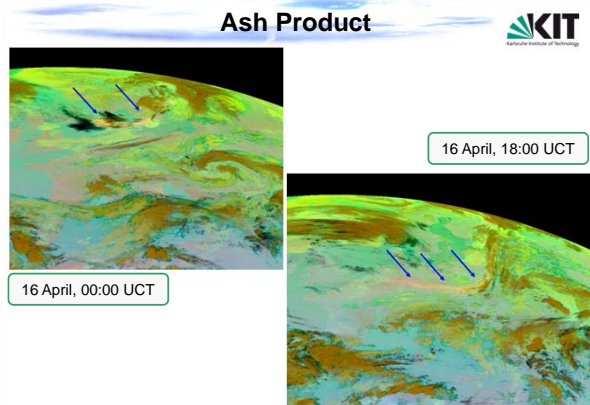


14 April: eruption plume rose to up to 9.5 km height deflected to the east by westerly winds  
16 April: pulsating eruptive plume reaches above 8 km, with overall height of 5 km  
17 April: eruption plume loaded with tephra (ash) rises to more than 8 km

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### Ash Product

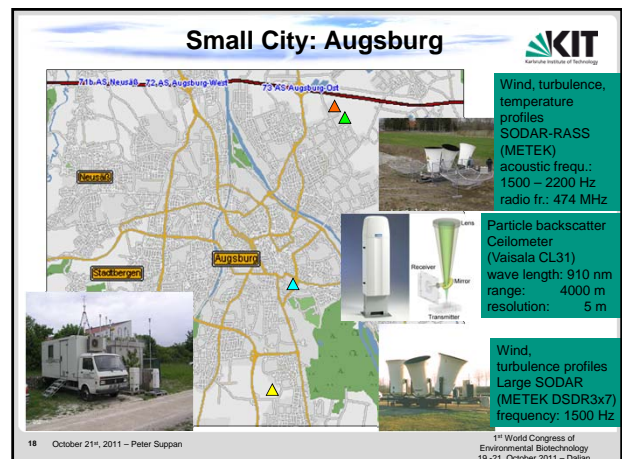
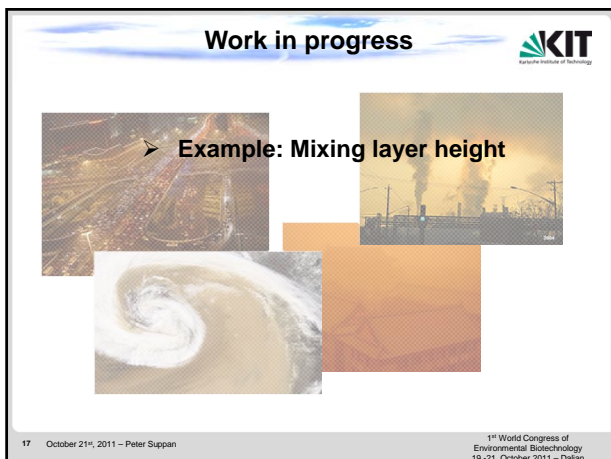
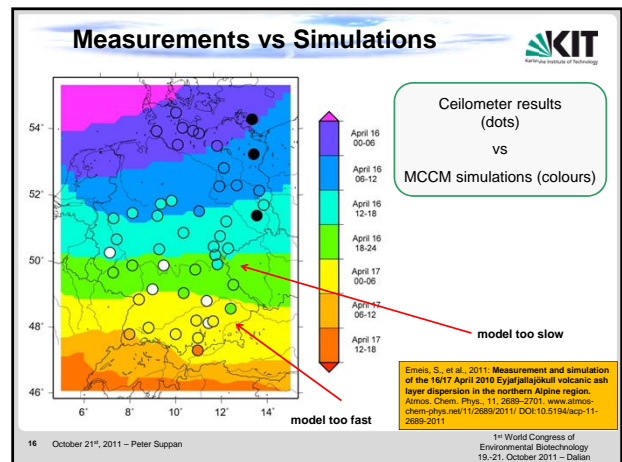
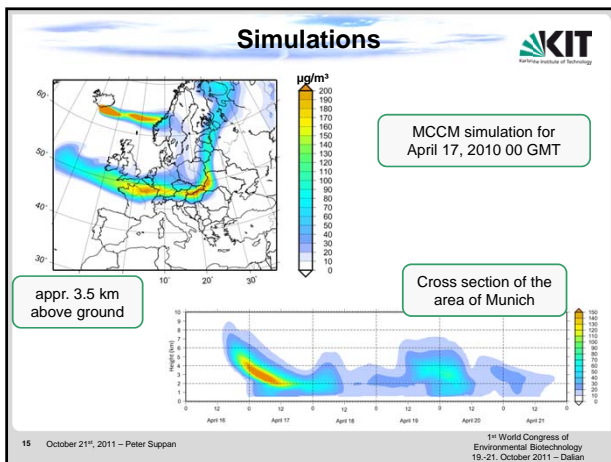
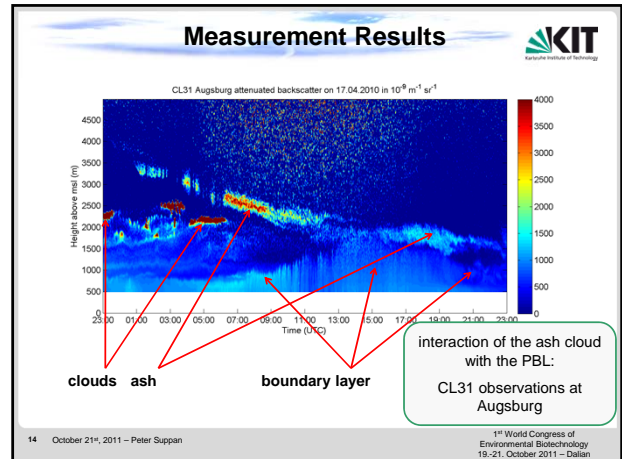
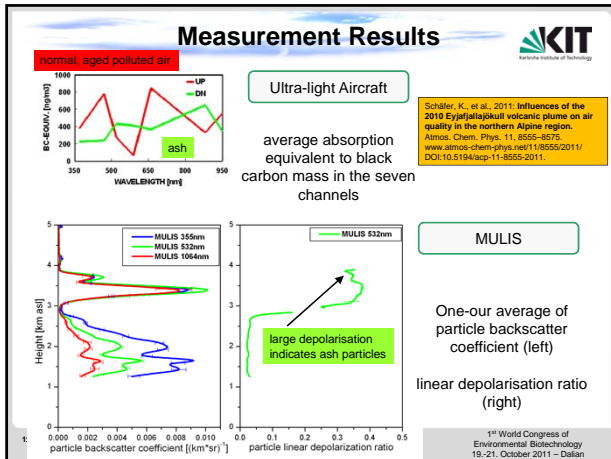


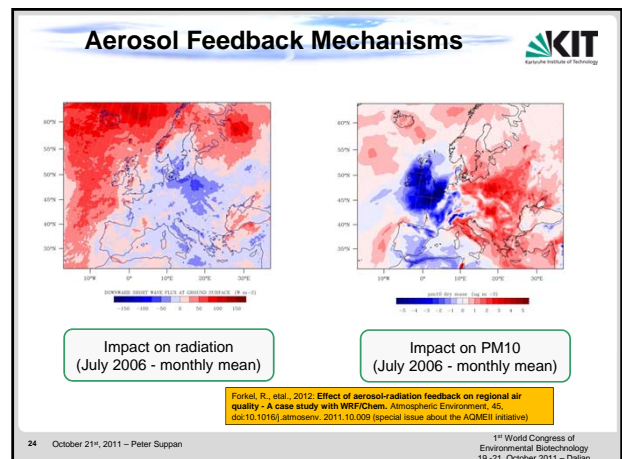
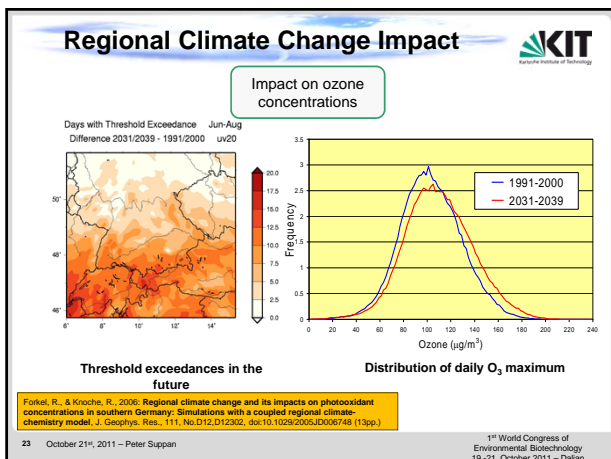
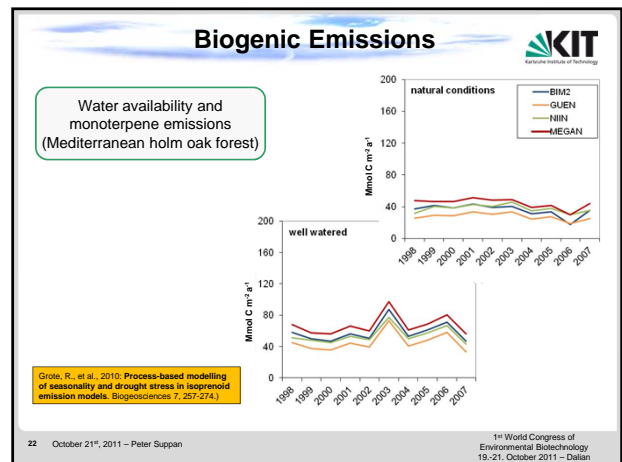
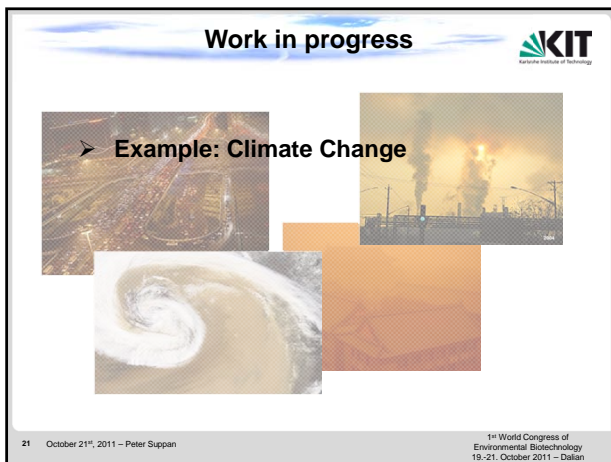
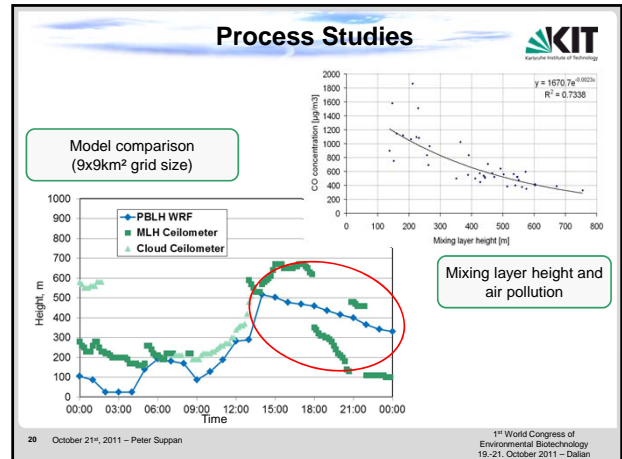
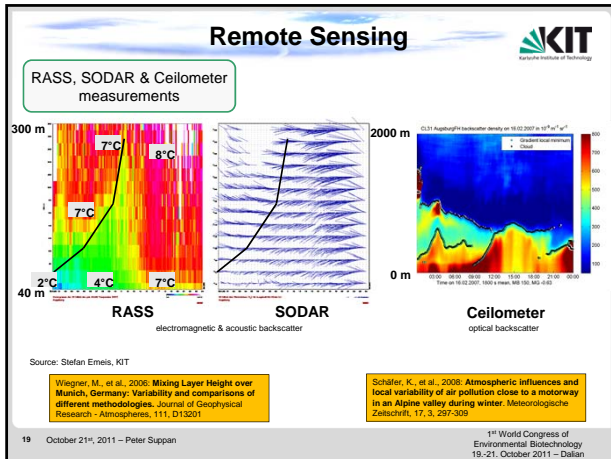
16 April, 00:00 UCT

16 April, 18:00 UCT


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## Conclusions




- Measurements are mainly representative for a certain location
- Models can integrate locations and can overcome the scale problem
- Measurement & modeling platforms have to go hand in hand
- Only holistic and multidisciplinary approaches can help to get a deeper knowledge about air quality & climate change issues
- Only this understanding allows investigations in future developments and recommendations for decision makers and stakeholders to improve air quality and to limit climate change

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## Thank you very much for your attention



**Cooperation Partners**

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Johannes Rehnlein, Ricardo Jordán	Economic Commission for Latin America and the Caribbean (ECLAC/CEPAL) in the UN