





A case study on the impact of aerosol-radiation feedback on meteorological and regional pollutant distributions

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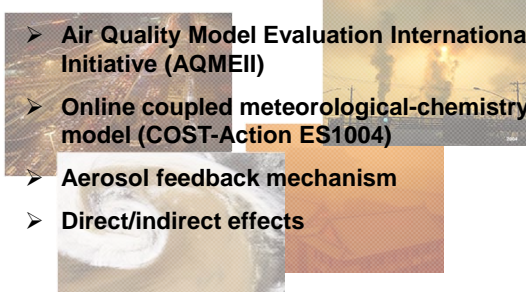


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Motivation

- Air Quality Model Evaluation International Initiative (AQMEII)
- Online coupled meteorological-chemistry model (COST-Action ES1004)
- Aerosol feedback mechanism
- Direct/indirect effects



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Model Setup

- Model: WRF/chem 3.3 (April 2011)
- RADM2 gas phase chemistry
- MADE/SORGAM modal aerosol module
 - Nucleation mode < 0.1 μm; accumulation mode 0.1-2 μm; coarse mode >2 μm
- Summer episode: 2 months - June / July 2006
- Free development of feedback effects → no FDDA
- Hourly AQMEII 'standard' emissions → TNO
- Biogenic emissions online → Guenther et al., 1994
- Sea salt emissions → Ginoux et al., 2001

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Model runs

- Baseline case; without any aerosol feedback effects
→ **BASE**
- Direct aerosol-radiative effect and semi direct effect
→ **RFB**
- Direct aerosol-radiative effect plus indirect aerosol effect (semi-direct effects; first and second indirect effect included)
→ **RFBC**

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Definitions



- **Direct effect**
→ **downward solar radiation**
- **Semi direct effect**
→ **temperature, boundary layer and subsequent effect on radiation, change of cloud properties, e.g. "burning off", liquid water path**
- **Indirect effect**
→ **radiation properties of clouds (e.g. cloud albedo, lifetime, cloud droplet number)**

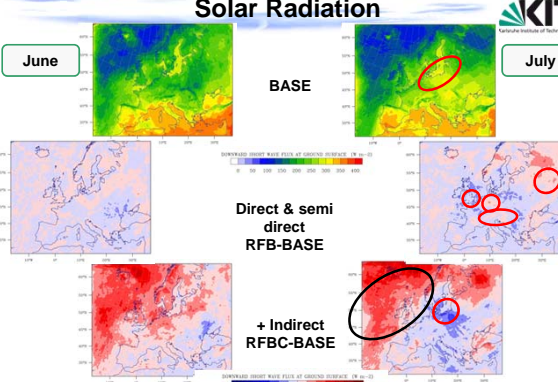
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Solar Radiation




June

July

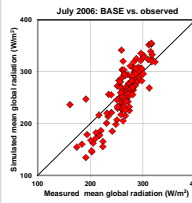


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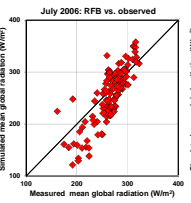
Solar Radiation



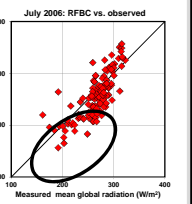
July 2006: BASE vs. observed



July 2006: RFB vs. observed




July 2006: RFBC vs. observed



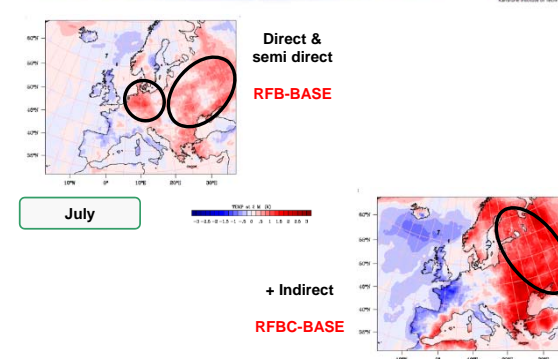
Simulated versus Observed

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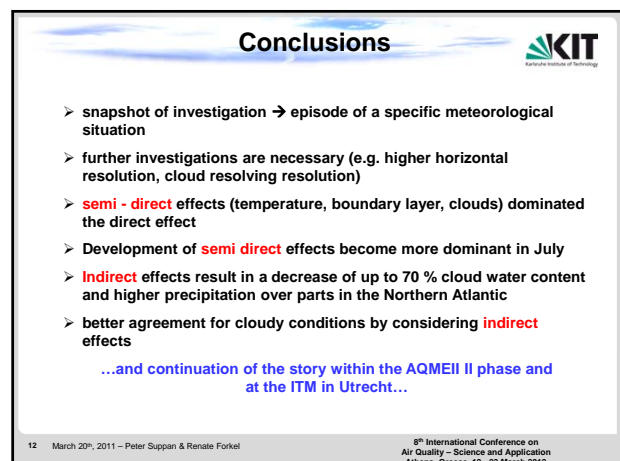
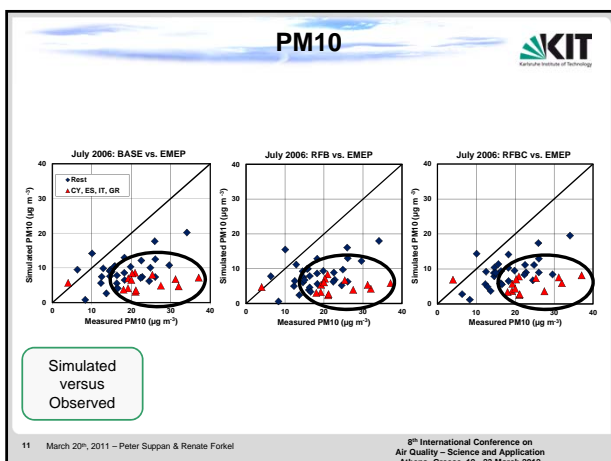
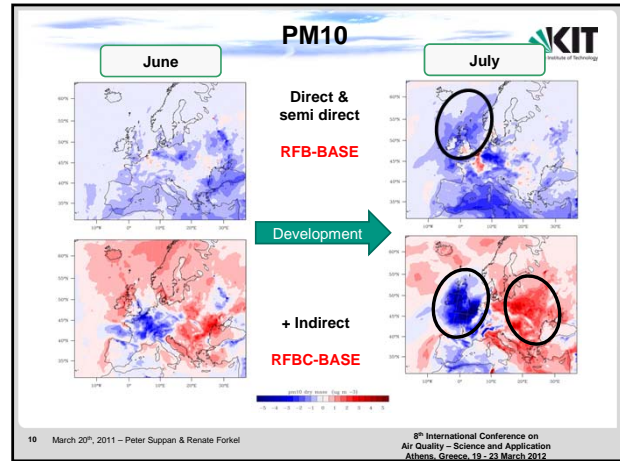
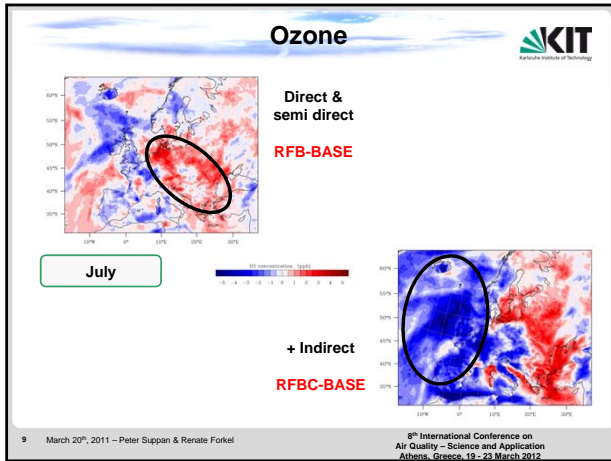
Temperature



July



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Thank you very much for your attention



Publication
Rensie Förstel, Johannes Warhahn, Ayse Buus Hansen, Stuart McKeen, Steven Peckham, Georg Groll, Peter Suppan (2012): **Effect of aerosol-radiation feedback on regional air quality - A case study with WRF/Chem**. Atmospheric Environment, 45, doi:10.1016/j.atmosenv.2011.10.009 (special issue about the ACMERE initiative)