VALIDATION OF ATMOSPHERIC CHEMISTRY/AEROSOLS MODEL COUPLED TO REGIONAL CLIMATE MODEL IN HIGH RESOLUTION

Tomáš Halenka¹, Peter Huszár, Michal Belda and CECILIA WP7 team

¹ Regular associate of the Abdus Salam ICTP, Trieste, Italy
E-mail: tomas.halenka@mff.cuni.cz
Outline

• Motivation (previous study on SE Asia, QUANTIFY, resolution issue in complex terrain)
• CECILIA Project
• Project couples
• First results RegCM-CAMx (1991-2000)
• Conclusions
Anthropogenic Aerosols over East Asia (Giorgi et al. 2002)

- Summer cooling has been observed in recent decades over many regions of East Asia.
- At the same time, anthropogenic sulfate and fossil fuel soot emissions have drastically increased due to the economic development of the region.
- This study investigates the impact of sulfur and soot emissions from fossil fuel burning on the regional climate of East Asia.
  - Intercomparison of 5-year simulations (1993-1997) with and without aerosol effects.
Sulfur emission over East Asia

Sulfur Emission \((g \text{ S/m}^2\text{ yr}^{-1})\)
Effects of Aerosols on Temperature and Precipitation

Temperature Differences

Precipitation Differences
Priority thematic areas: 1.1.6.3.I.3.2
Duration: 1 June 2006 - 31 May 2009
Budget: 2.750 k EUR
Number of partners: 16
Number of participating countries: 12
Coordinator: Charles University, Prague, T. Halenka

http://www.cecilia-eu.org
Motivation
Interactions

WP1: Assessment and provision of climate change information for downscaling and impacts

WP3: Statistical downscaling, localization, validation, and scenario construction

WP2: Regional climate modelling experiments

WP4: Climate change and extreme events

WP5: Climate change impacts in hydrology and water management

WP6: Climate change impacts on agriculture and forestry sectors

WP7: Climate change impacts on air quality and health
Foreseen domains (10 km)
WP7

Objectives

Exploitation of the sensitivity of air-pollution levels to potential climate change based on data analysis of long simulations of offline chemistry air quality models (AQM) driven by Regional Climate Models (RCMs) for present climate and for future projections.

Comparison of air-pollution levels simulated by online and offline regional air-quality models during certain episodes of the present climate.

Estimation of the key species exceedances of the EU limits for the protection of human health, vegetation and ecosystems as well as WHO guidelines for present climate and for future projections.
Goals

To study the impact of climate change on air quality
To study the contribution of air composition change to climate change impact
To estimate the importance of bigger urban and industrial areas in local scale by high resolution modelling
Coupling and chemistry

• meteorological fields generated by RegCM3
• drive CAMx transport and dry/wet deposition
• preprocessor utility developed for transforming RegCM fields to CAMx input fields and formats
• problems with the emission inventories available, at this stage emissions from EMEP 50 km x 50 km database interpolated.
• testing VOC speciation technique, biogenic emissions of isopren and monoterpenes calculated as a function of 2m temperature, global radiation and landuse by Guenther et al. (1993,1994).
• boundary conditions from RegCM – CAMx @ 50km (ENSEMBLES, Krueger, Zanis),
• CB-IV chemistry mechanism is used (Gery et al.,1989).
RegCM – CAMx 10x10 km (1991-2000)
RegCM – CAMx ($O_3$, AOT40)

April-September: forestry impacts

May-July: agriculture impacts
Comparison with measurement (NO$_2$)
Comparison with measurement ($SO_2$)
Comparison with measurement ($O_3$)

Ozone 30-day running average at Svatouch 1991 - 2000

Ozone 30-day running average at Košetice 1991 - 2000

Ozone 30-day running average at Stará Lesná 1991 - 2000

Ozone 30-day running average at Illmitz 1991 - 2000
Comparison with measurement (O$_3$ daily maxima)

Ozone 30-day running average daily maxima at Svratouch 1991 - 2000

Ozone 30-day running average daily maxima at Košetice 1991 - 2000

Ozone 30-day running average daily maxima at Stará Lesná 1991 - 2000

Ozone 30-day running average daily maxima at Illmitz 1991 - 2000
Daily variability of $O_3$, 2000 average

Average Winter/Summer $O_3$ daily variation at Svratouch 1991-2000

Average Winter/Summer $O_3$ daily variation at Košetice 1991-2000

Average Winter/Summer $O_3$ daily variation at Stará Lesná 1991-2000

Average Winter/Summer $O_3$ daily variation at Illmitz 1991-2000
Sensitivity experiment for precipitation and cloud water
Outlooks

• Further validation of 10 years time slices for CECILIA (control)
• Looking for possibilities of emission resolution increase
• Further application in QUANTIFY and CECILIA (climate scenario, effective emission indices)
• Feedback – two way on-line coupling
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THANKS FOR YOUR ATTENTION