

## Project Summary

The MEGAPOLI project brings together leading European research groups, state-of-the-art scientific tools and key players from countries outside Europe to investigate interactions among megacities, air quality and climate. Project will include both basic and applied research, and bridge spatial and temporal scales connecting local emissions, air quality and weather with global atmospheric chemistry and climate.

## Objectives

- to assess impacts of megacities and large air-pollution hot-spots on local, regional, and global air quality,
- to quantify feedbacks among megacity air quality, local and regional climate, global climate change,
- to develop improved integrated tools for prediction of air pollution in megacities.

## Introduction Background

For the past few hundred years, human population has been clustering in increasingly large settlements. In 2007, the world's urban population exceeded the rural. At present, there are about 30 cities worldwide with a population exceeding 7 mln (Fig. 1).

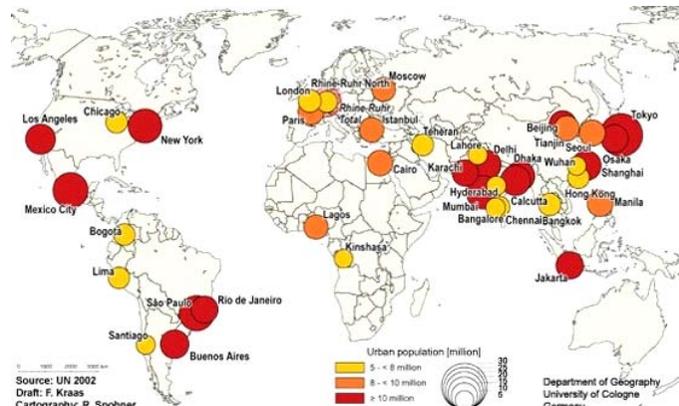


Figure 1: Worldwide megacities (Source UN, 2002).

These numbers are expected to grow considerably in the near future. Such coherent urban areas with more than about 5 mln people are usually called megacities. In Europe there are 6 major centers that clearly qualify as megacities: London, Paris, the Rhine-Ruhr region, the Po Valley, Moscow, and Istanbul.

Our hypothesis is that megacities around the world have an impact on air quality not only locally, but also regionally and globally and therefore can also influence the climate of our planet. In Fig. 2 a schematic description of how megacities, air quality and climate interact is presented. Some of the links shown have already been considered by previous studies and

are reasonably well-understood. However, a complete quantitative picture of these interactions is clearly missing. Understanding and quantifying these missing links is the focus of MEGAPOLI. The project addresses, at different levels, practically all major megacities around the globe. Three levels of details are used (Fig. 3).

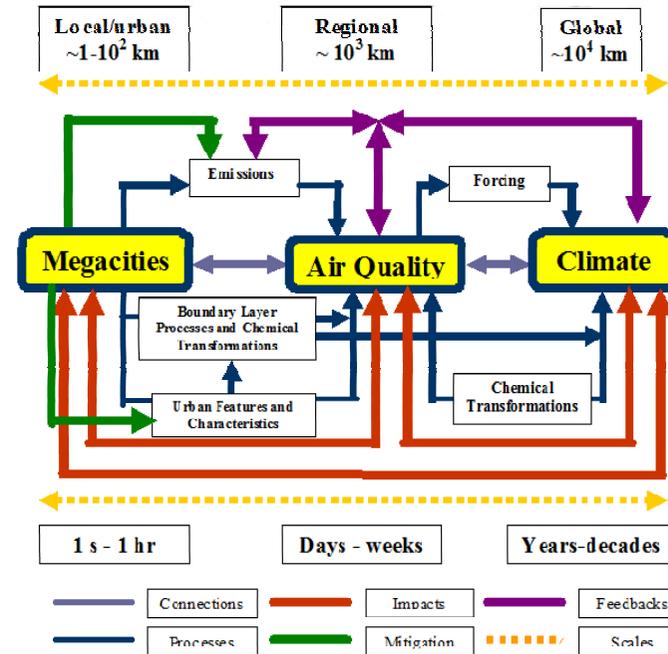


Figure 2: Main linkages between megacities, air quality and climate, as well as feedbacks, ecosystem, health, weather impact pathways, and mitigation routes.

## Scientific Questions

- What is the change of exposure of the overall population to the major air pollutants as people move into megacities? What are the health impacts of this exposure?
- How do megacities affect air quality on regional and global scales?
- What is the range of influence for major air pollutants (ozone, particulate matter, etc.)?
- What are the major physical and chemical transformations of air pollutants as they are moving away from megacities? What happens to the organic particulate matter, volatile organic compounds, etc.?
- How accurate are the current emission inventories for megacities in Europe and around the world? What are the major gaps?
- How large is the current impact of megacities on regional and global climate?
- How will the growth of megacities affect future climate at global and regional scales?

- What is the impact of large-scale dynamic processes on air pollution from megacities?
- What are the key feedbacks between air quality, local climate and global climate change relevant to megacities? For example, how will climate change affect air quality in megacities?
- How should megacities (emissions, processing inside megacities, meteorology) be parameterized in regional and global models?
- What type of modelling tools should be used for the simulation of multi-scale megacity air quality - climate interactions?
- Which policy options are available to influence the emissions of air pollutants and greenhouse gases in megacities and how can these options be assessed?

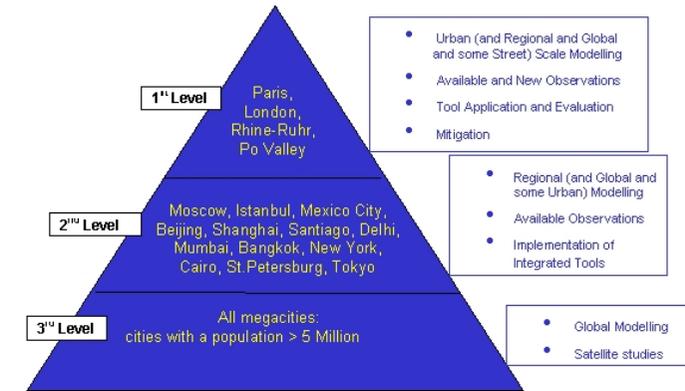


Figure 3: The pyramid of megacities in focus.

## Scientific Tasks

- Develop and evaluate integrated methods to improve megacity emission data;
- Investigate physical and chemical processes starting from the megacity street level, continuing to the city, regional and global scales;
- Assess regional and global air quality impacts of megacity plumes;
- Determine the main mechanisms of regional meteorology/climate forcing due to megacity plumes;
- Assess global megacity pollutant forcing on climate;
- Examine feedback mechanisms including effects of climate change on megacity air quality;
- Develop integrated tools for prediction of megacity air quality;
- Evaluate these integrated tools and use them in case studies;
- Develop a methodology to estimate the impacts of different scenarios of megacity development on human health and climate change;
- Propose and assess mitigation options to reduce the impacts of megacity emissions.



### Work Packages

- WP1: Emissions  
(*P. Builtjes, H. Denier van der Gon*)
- WP2: Megacity features  
(*S. Grimmond, I. Esau*)
- WP3: Megacity plume case study  
(*M. Beekmann, U. Baltensperger*)
- WP4: Megacity air quality  
(*N. Moussiopoulos*)
- WP5: Regional and global atmospheric composition  
(*J. Kukkonen, A. Stohl*)
- WP6: Regional and global climate impacts  
(*W. Collins, F. Giorgi*)
- WP7: Integrated tools and implementation  
(*R. Sokhi, H. Schlunzen*)
- WP8: Mitigation, policy options and impact assessment  
(*R. Friedrich, D. van den Hout*)



### MEGAPOLI Project Participants

- Danish Meteorological Institute (Denmark) - Contact Persons: *Prof. Alexander Baklanov (coordinator), Dr. Alexander Mahura (manager)*
- Foundation for Research and Technology, Hellas, University of Patras (Greece) - *Prof. Spyros Pandis (vice-coordinator)*
- Max Planck Institute for Chemistry (Germany) - *Dr. Mark Lawrence (vice-coordinator)*
- ARIANET Consulting (Italy) – *Dr. Sandro Finardi*
- Aristotle University Thessaloniki (Greece) - *Prof. Nicolas Moussiopoulos*
- Centre National de Recherche Scientifique (incl. LISA, LaMP, LSCE, GAME, LGGE) (France) – *Dr. Matthias Beekmann*
- Finnish Meteorological Institute (Finland) – *Prof. Jaakko Kukkonen*
- Joint Research Center (Italy) – *Dr. Stefano Galmarini*
- International Centre for Theoretical Physics (Italy) - *Prof. Filippo Giorgi*
- King's College London; KCL (UK) – *Prof. Sue Grimmond*
- Nansen Environmental and Remote Sensing Center (Norway) – *Dr. Igor Esau*
- Norwegian Institute for Air Research (Norway) – *Dr. Andreas Stohl*
- Paul Scherrer Institute (Switzerland) – *Prof. Urs Baltensperger*
- TNO-Built Environment and Geosciences (The Netherlands) – *Prof. Peter Builtjes*
- UK MetOffice (UK) – *Dr. Bill Collins*
- University of Hamburg (Germany) – *Prof. Heinke Schlunzen*
- University of Helsinki (Finland) – *Prof. Markku Kulmala*
- University of Hertfordshire, Centre for Atmospheric and Instrumentation Research (UK) – *Prof. Ranjeet Sokhi*
- University of Stuttgart (Germany) – *Prof. Rainer Friedrich*
- World Meteorological Organization (Switzerland) – *Dr. Liisa Jalkanen*
- Charles University Prague (Czech Republic) – *Dr. Tomas Halenka*
- Institute of Tropospheric Research (Germany) – *Prof. Alfred Wiedensohler*
- Centre for Atmospheric Science, University of Cambridge (UK) – *Prof. John Pyle*

### MEGAPOLI Project web-site:

<http://megapoli.dmi.dk>

### MEGAPOLI Project Coordinator

**Prof. Alexander Baklanov**

Danish Meteorological Institute  
Lyngbyvej 100, DK-2100  
Copenhagen, Denmark

E-mail: [alb@dmi.dk](mailto:alb@dmi.dk)  
Phone: +45-3915-7441  
Fax: +45-3915-7460

### European Commission Scientific Officer

**Dr. Wolfram Schrimpf**

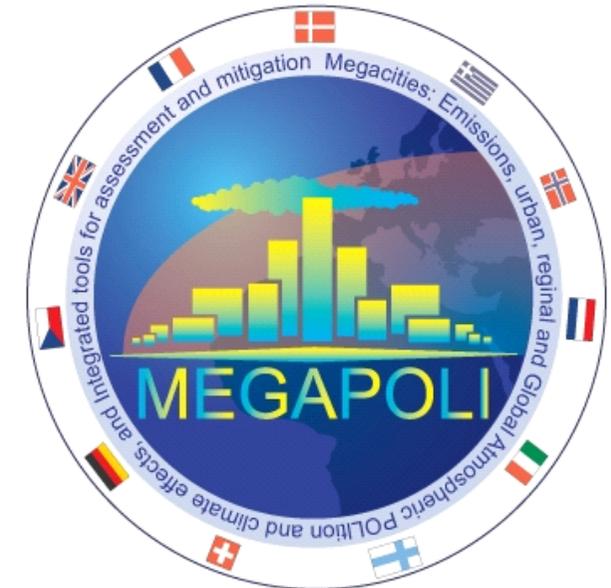
General Directorate for Research, European Commission  
CDMA, 3/006, B-1049  
Brussels, Belgium

E-mail: [Wolfram.Schrimpf@ec.europa.eu](mailto:Wolfram.Schrimpf@ec.europa.eu)  
Phone: +32-2-297-1504  
Fax: +32-2-299-5755



# MEGAPOLI

**Megacities: Emissions, urban, regional and Global Atmospheric POLLution and climate effects, and Integrated tools for assessment and mitigation**



EC FP7 Collaborative Project

2008-2011

Theme 6: Environment (including climate change)  
Sub-Area: ENV-2007.1.1.2.1:  
Megacities and regional hot-spots air quality and climate