



# Current status of the EC FP7 project MEGAPOLI: Megacities: Emissions, urban, regional and Global Atmospheric POLLution and climate effects, and Integrated tools for assessment and mitigation

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and

the MEGAPOLI consortium  
(see on: <http://megapoli.info>)

MEGAPOLI/CityZen/MILAGRO Splinter Meeting  
European Geosciences Union General Assembly 2010  
4 May, Vienna, Austria



## MEGAPOLI Partners:



Nr	Beneficiary name	short name	Country
1	Danish Meteorological Institute	DMI	Denmark
2	Foundation for Research and Technology, Hellas, University of Patras	FORTH	Greece
3	Max Planck Institute for Chemistry	MPIC	Germany
4	ARIANET Consulting (SME)	ARIANET	Italy
5	Aristotle University Thessaloniki	AUTH	Greece
6	Centre National de Recherche Scientifique (LISA, LAMP, LSCE, GAME, LGGE, Sapfir)	CNRS	France
7	Finnish Meteorological Institute	FMI	Finland
8	Joint Research Center, Ispra	JRC	Italy
9	International Centre for Theoretical Physics	ICTP	Italy
10	King's College London	KCL	UK
11	Nansen Environmental and Remote Sensing Center	NERSC	Norway
12	Norwegian Institute for Air Research	NILU	Norway
13	Paul Scherrer Institute	PSI	Switzerland
14	TNO-Built Environment and Geosciences	TNO	The Netherlands
15	UK MetOffice	MetO	UK
16	University of Hamburg	UHam	Germany
17	University of Helsinki	UHel	Finland
18	University of Hertfordshire – Centre for Atmospheric and Instrum. Research	UH-CAIR	UK
19	University of Stuttgart	USTUTT	Germany
20	World Meteorological Organization	WMO	Switzerland (Int.)
21	Charles University, Prague	CUNI	Czech Republic
22	Institute of Tropospheric Research	IFT	Germany
23	Centre for Atmospheric Science, University of Cambridge	UCam	UK

# Megacities: Emissions, Impact on Air Quality and Climate, and Improved Tools for Mitigation Assessments (MEGAPOLI)



EC 7FP project for: ENV.2007.1.1.2.1. Megacities and regional hot-spots air quality and climate

Project duration: Oct. 2008 – Oct. 2011

27 European research organisations from 11 countries are involved.

Coordinator: A. Baklanov (DMI)

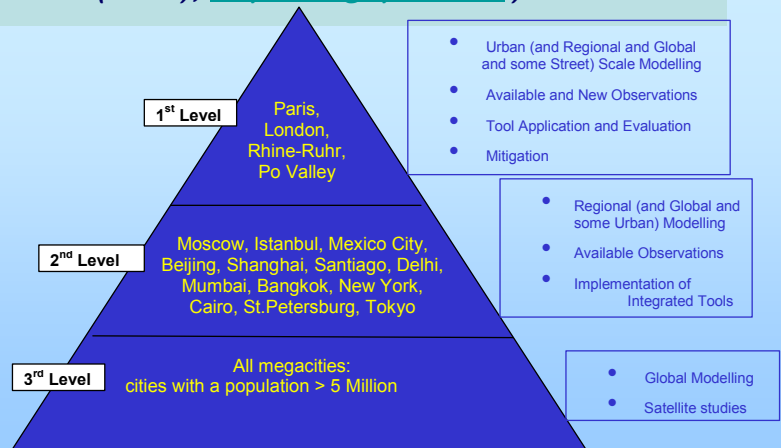
Vice-coordinators: M. Lawrence (MPIC) and S. Pandis (FRTHUP)

(see: *Nature*, 455, 142-143 (2008), <http://megapoli.info>)

The main aim of the project is

(i) to assess impacts of growing megacities and large air-pollution “hot-spots” on air pollution and feedbacks between air quality, climate and climate change on different scales, and

(ii) to develop improved integrated tools for prediction of air pollution in cities.



## Connections between megacities, air quality & climate

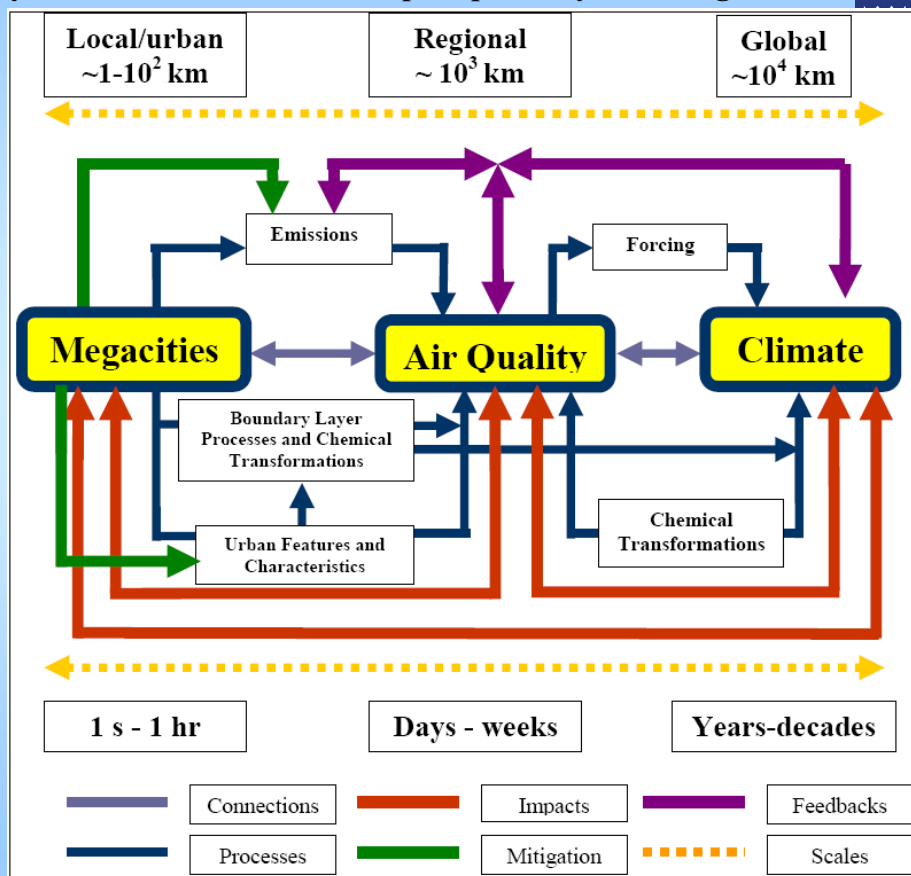
main feedbacks, ecosystem, health & weather impact pathways, & mitigation routes

• Our hypothesis is that megacities around the world have an impact on air quality not only locally, but also regionally and globally and can influence the climate.

• 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.

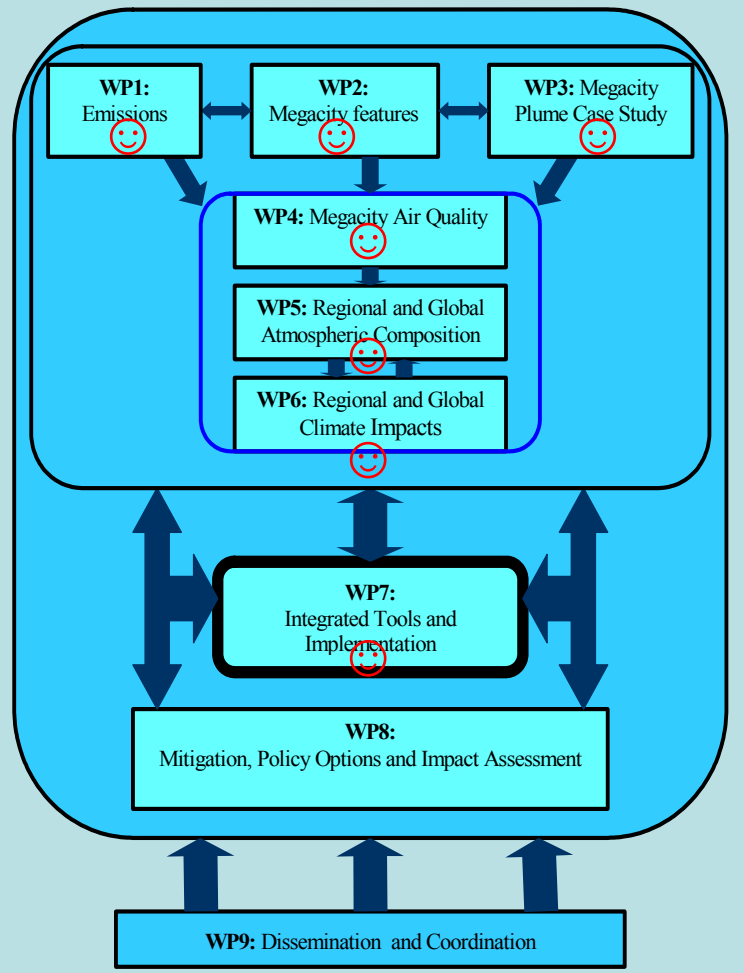
• Understanding and quantifying these missing links is the focus of MEGAPOLI.





## Work Packages (WPs) structure & integration

WP No.	Title	Lead Participant(s)
1	Emissions	H. Denier van der Gon P. Builtjes
2	Megacity Environments: Features, Processes and Effects	S. Grimmond I. Esau
3	Megacity Plume Case Study	M. Beekmann U. Baltensperger
4	Megacity Air Quality	N. Moussiopoulos
5	Regional and Global Atmospheric Composition	J. Kukkonen A. Stohl
6	Regional and Global Climate Effects	W. Collins F. Giorgi
7	Integrated Tools and Implementation	R. Sokhi H. Schlünzen
8	Mitigation, Policy Options and Impact Assessment	R. Friedrich D. van den Hout
9	Dissemination and Coordination	A. Baklanov S. Pandis M. Lawrence



## Recent MEGAPOLI Research



- **Field campaigns in Paris:**
  - summer - July 2009,
  - winter - Jan-Feb 2010,
  - modelling;
- **Emissions database and future megacity scenario development;**
- **Continued model development from urban to global scale, analysis and interactions => ensemble of models;**
- **Bringing it together with integrated modelling and mitigations scenarios;**
- **Modelling to quantify feedbacks among megacity air quality, local and regional climate, and global climate change;**
- **Assessing different mitigation options to reduce health impacts of megacity emissions.**



Centre National  
de Recherche Scientifique

# WP3: Paris Plume Study



Summer campaign – 1-31 Jul 2009

Winter campaign – 15Jan-15Feb 2010



### Measurement Campaign

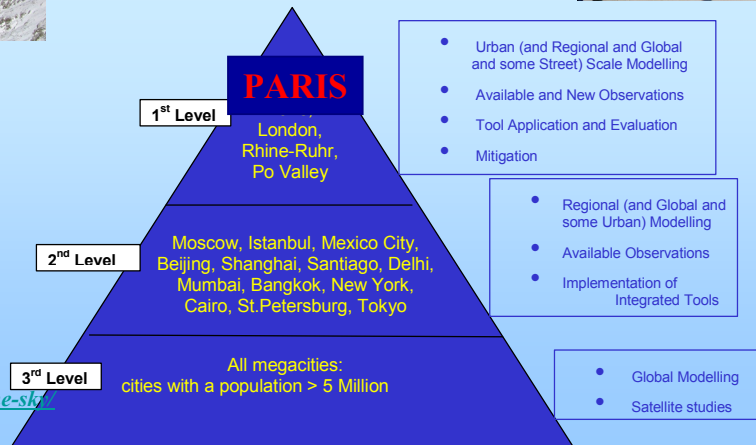
30 research institutions from France and other European countries, both MEGAPOLI Teams and Collaborators

### More details:

Matthias Beekmann, Leader of CNRS Team

See Euronews TV program during this week:

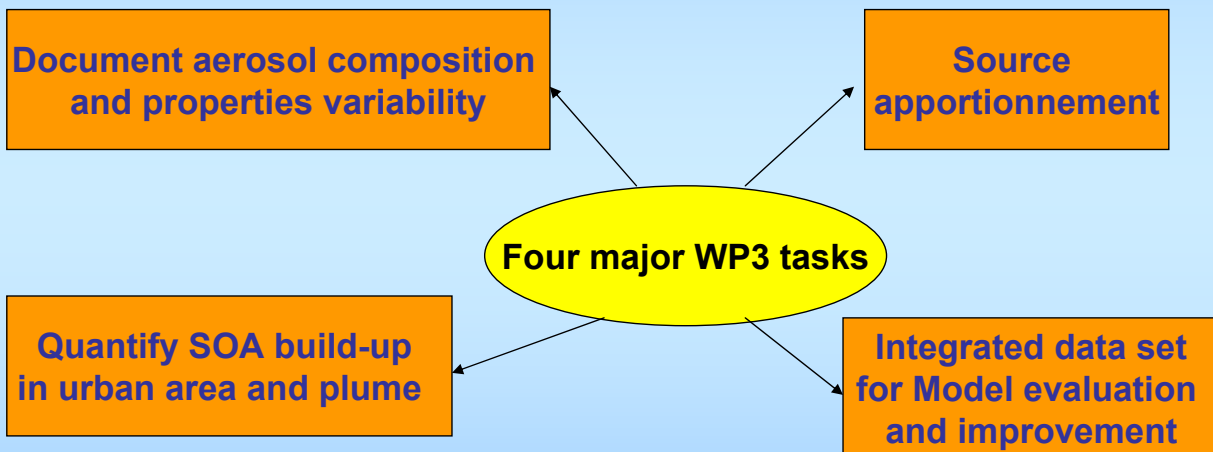
<http://www.euronews.net/2010/02/25/the-city-and-the-sky/>



# WP3: Paris Campaign Objectives



Provide new experimental data to better quantify sources of primary and secondary carbonaceous aerosol in a large agglomeration and its plume



Summer campaign – 1-31 Jul 2009

Winter campaign – Jan-Feb 2010

30 research institutions from France and other European countries, both MEGAPOLI Teams and Collaborators

More details: Matthias Beekmann, Leader of CNRS Team





# Measurements Overview

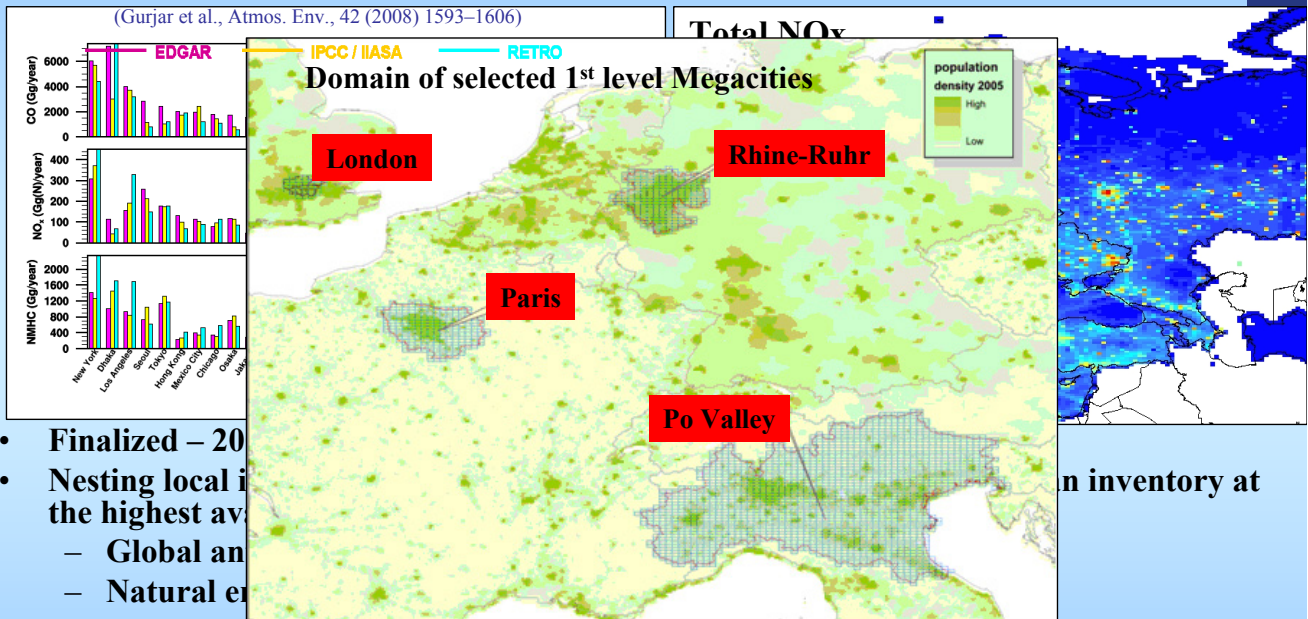


- Aerosol chemical composition (fast measurements)
- Detailed organic speciation (12 h filter samples)
- Size distribution
- Optical properties (scattering and absorption coefficient)
- Hygroscopic growth factor and CCN concentration
- Backscatter lidar (aerosol extinction + PBL height)
- Detailed gas phase measurements: O<sub>3</sub>, NO<sub>y</sub>, NO<sub>x</sub>, CO, OH, NMHCs, OVOC, etc.
- Gas phase column measurements (NO<sub>2</sub>, HCHO, O<sub>3</sub>, ....)
- C-14 measurements (24 h)
- Meteorological measurements (wind profile, turbulence, radiation, precipitation, ....)



# WP1: Emissions

(Courtesy of Hugo Denier van der Gonne & Jeroen Kuenen; TNO Team)



- Finalized – 2010
- Nesting local inventories at the highest available resolution
  - Global and regional inventories
  - Natural emissions
  - European emissions
  - Comparison with GEMS
  - Megacity emissions
  - Heat flux inventories

*Acknowledge the local Megacity Emission inventory authorities in Paris (Airparif), London, Rhine-Ruhr, and Po Valley for their cooperation and EGDAR team, JRC, Italy*



UNIVERSITY OF HELSINKI



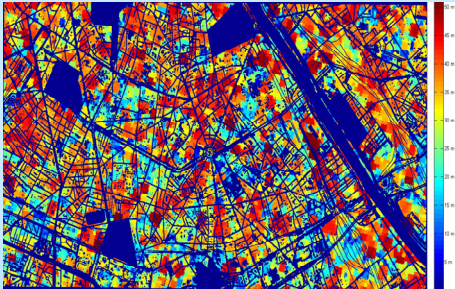
# WP2: Megacity Features

(Courtesy of Pauli Sievinen et al.; UHel & FMI Teams)

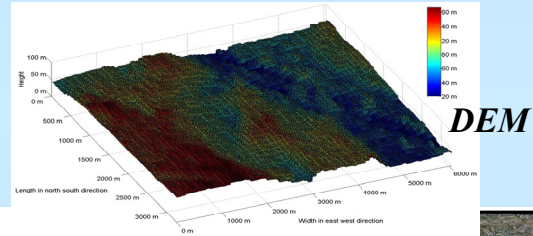


- Paris Morphology database (use satellite observations and digital maps)
- Rough-resolution area: Paris (13x10 km<sup>2</sup>) & High-resolution area: Place d'Italie in southern part of Paris (6x3 km<sup>2</sup>)
- Thematic layers include: *Water, Streets, Parks, Trees, Buildings, Buildings' height, Terrain Digital Elevation Model (DEM), etc.*

## Buildings' height



Streets



DEM

## High-resolution area

- Place d'Italie in southern part of Paris (6x3 km<sup>2</sup>)



## AREAS



FORTH

Foundation for Research & Technology, Hellas

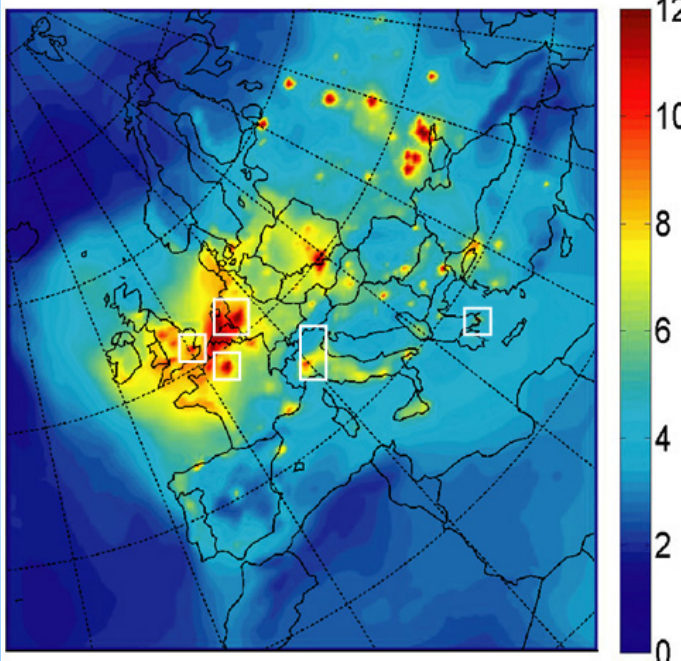
# WP4: Megacity Air Quality

(Courtesy of Spyros Pandis et al.; FORTH Team)



## PMCAMx: PM1

(mg m<sup>-3</sup>)

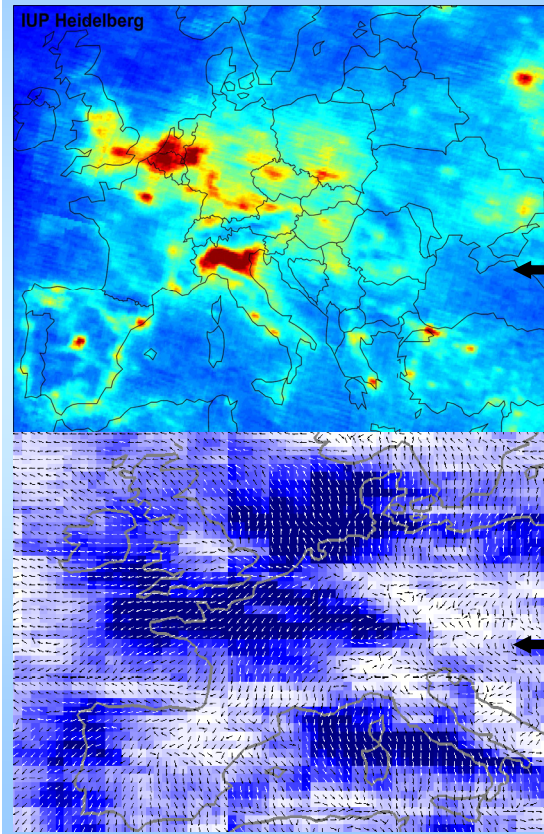


- Performed regional / urban scale modelling (employing PMCAMx)
- Predicted average PM1 for May 2008
- European domain: (res - 36x36 km)
- Megacities areas: Paris, London, Rhine-Ruhr, Po Valley, & Athens (resol - 12x12 & 4x4 km)
- Using new TNO Emissions!
- Models to be used in WP4:
  - MEMO/MARS
  - Enviro-HIRLAM
  - PMCAMx
  - WRF-CMAQ
  - OSCAR
  - SILAM (SALSA)





# WP5: Regional and Global Atmospheric Composition



(Courtesy of Michael Hayn et al., MPIC Team)

- **Regional pollution plumes: analysis with satellite  $\text{NO}_2$  retrievals**
- **Mean  $\text{NO}_2$  vertical column density for Jan 2003 - Jun 2004 (SCIAMACHY on ESA's Envisat)**
- **SCIAMACHY  $\text{NO}_2$**
- **ECMWF winds**
- **Strong correlation between wind direction and  $\text{NO}_2$  column up to several hundred km away from major sources (dark blue – wind direction has strong influence on  $\text{NO}_2$ )**

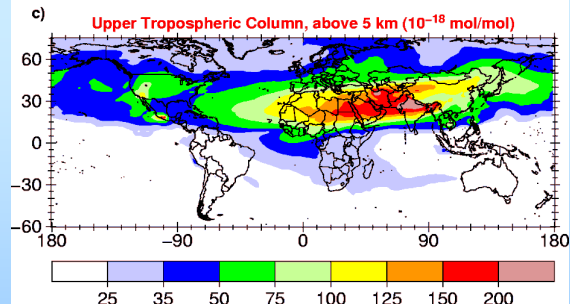
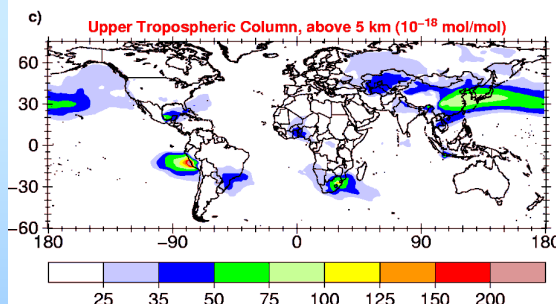
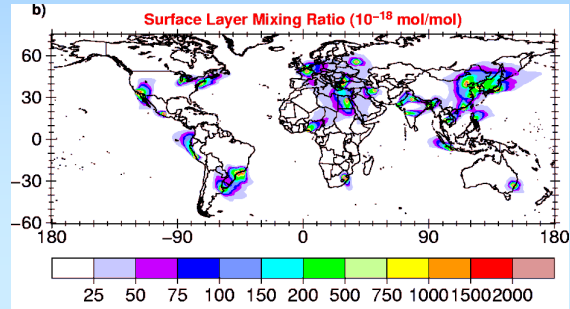
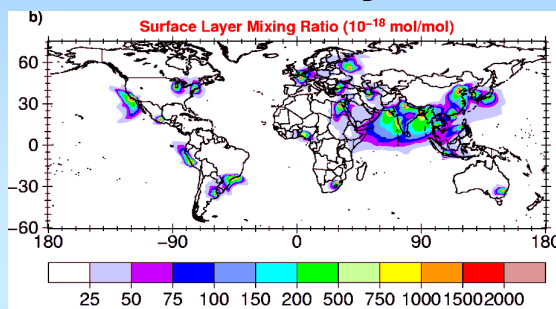


## WP5: Megacity Regional Pollution Potentials: Aerosol Tracers – First Results



### February

### July



Using EMAC (Jöckel et al., 2006), T106L31,  $r = 1 \mu\text{m}$ , 1998

(MPIC team: Daniel Kunkel et al.)





- Contributions from MEGAPOLI teams/ collaborators, end-users
- Descriptions of teams with researches involved
- Coming and recent presentations, publications, conferences
- Quarterly - Dec, Mar, Jun, Sep
- Next Issue N7 – Jun 2010

**MEGAPOLI NewsLetter**  
 November 2009  
 Issue 1

**MEGAPOLI Scientific Report 10-06**  
 Urbanized Turbulence-Resolving Model and Evaluation for Paris  
 MEGAPOLI Deliverable 2.4.1  
 Igor Esau

**MEGAPOLI Scientific Report 10-01**  
 Global to City Scale Urban Anthropogenic Heat Flux: Model and Variability  
 MEGAPOLI Deliverable 1.4  
 L. Allen, S. Bevers, F. Lindberg, Mario Iammarino, N. Kikvidze, CSB Gierman

**MEGAPOLI Scientific Report 09-02**  
 A base year (2005) MEGAPOLI European gridded emission inventory (1st version)  
 MEGAPOLI Deliverable 1.2  
 H.C. Dierler van der Goot, A.H. Visschedijk, H. van der Brugh, R. Droog, and J. Kuenen

**MEGAPOLI NewsLetter**  
 December 2008  
 Issue 1

**MEGAPOLI Scientific Report 10-03**  
 Evaluation of Zooming Approaches Describing Multiscale Physical Processes  
 MEGAPOLI Deliverable D4.1  
 Nicolas Moussopoulos, John Douras, George Tsagas (Eds.)

**MEGAPOLI Scientific Report 10-05**  
 Evaluation of Zooming Approaches Describing Multiscale Chemical Transformations  
 MEGAPOLI Deliverable 4.2  
 Dhurata Konyaj and Spyros N. Pandis

**MEGAPOLI Scientific Report 09-01**  
 Global radiative forcing from megacity emissions of long-lived greenhouse gases  
 MEGAPOLI Deliverable 6.1  
 William J. Collins

**MEGAPOLI Scientific Report 10-02**  
 Urban Morphological Database for Paris, France  
 MEGAPOLI Deliverable D2.1  
 Pascal Simeoni, Anni Hellsten, Jean Fraka, Jarkko Koskunen, Jarkko Koskunen

**MEGAPOLI Scientific Report 09-03**  
 First Year MEGAPOLI Dissemination Report  
 MEGAPOLI Deliverable 9.4.1  
 A. Baklanov, A. Mahura (Eds.)

**MEGAPOLI Deliverables**  
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