# CIAM Progress and future plans

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Center for Integrated Assessment Modelling (CIAM)

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### **Progress**

Cooperation with TFIAM, TFRN, TFEIP, TFMM, HTAP, EGTEI, MSC-W, CCE

#### CIAM reports:

- Inform negotiators about the scope for further environmental improvement and development of cost-effective scenarios for a range of environmental targets (CIAM 1-4/2011 reports and presented at several meetings); assessment of the health and environmental improvements resulting from the revised Protocol (CIAM 1/2012)
- Potential and costs of reducing ammonia (CIAM 5/2011)
- Participation in scale dependency exercise
- Implementation of new, long-lat high-resolution, source receptor and impact calculation in GAINS, inc. ozone-fluxes
- Implementation of the new WHO GBD (Global Burden of Disease)
   concentration-response functions



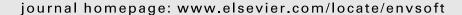
# Paper documenting GAINS methodology and recent applications in Europe

Environmental Modelling & Software 26 (2011) 1489–1501



Contents lists available at SciVerse ScienceDirect

#### Environmental Modelling & Software





Cost-effective control of air quality and greenhouse gases in Europe: Modeling and policy applications

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# Potential and costs of ammonia mitigation; CIAM report in collaboration with TFRN

- TFRN proposed three ambition levels of application of measures across the UNECE (A,B,C),
- CIAM cost-optimal scenarios to achieve various environmental targets (impact of LOW and MID shown below)

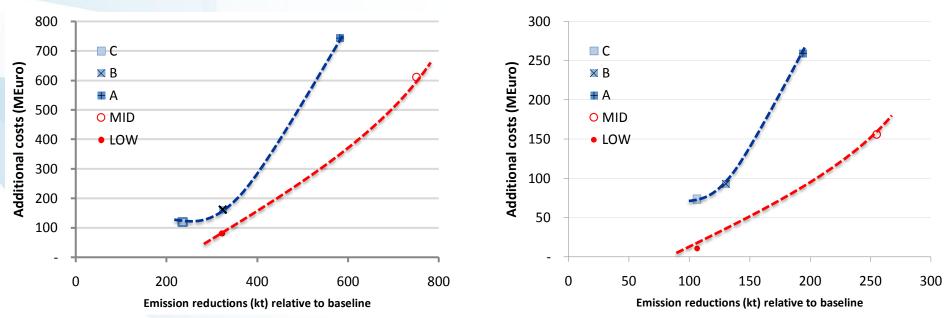


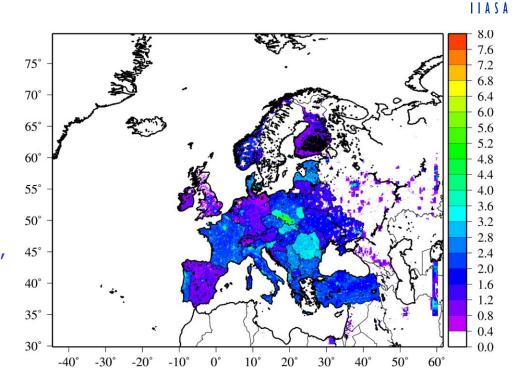
Figure A: Cost-effectiveness of the scenarios A, B and C in comparison to the MID and LOW scenarios described in the CIAM 4/2011 report. Left: EU27, right: non-EU countries.



## Updated PM2.5 fine-scale inventory for SNAP Sector 2 (domestic)

Model validations for PM2.5/PM10 showed systematic problems in winter throughout Europe

- New temporal profile for domestic heating proportional to heating degree days
- Fine scale (7km) emissions downscaled with population data, considering saturation of percapita emissions with increasing population density
- Correction of PM size distribution for Poland, spatial re-allocation to account for non-commercial coal use





### A Hybrid (observations/modelling) approach for the street canyon increment (Kiesewetter et al., 2012)



#### **Hypothesis:**

•  $NO_2/PM10$  street canyon increment are explained by direct dispersion of  $NO_2$  and  $NO_x/O_3$  chemistry:

$$[NO_2]_{ss} = f([NO_2]_B, [NO_x]_B, [O_3]_B, [NO_x], p(NO/NO_2), T)$$

For each station parameterization derived from historic data:

- [NO<sub>2</sub>]<sub>SS</sub>: Street canyon concentrations - from AIRBASE

-  $[NO_2]_B$ ,  $[NO_x]_B$ ,  $[O_3]_B$ : Observed urban background – from AIRBASE

- p: NO/NO<sub>2</sub> ratio - from GAINS

[NO<sub>x</sub>]: local traffic emissions (time profile known)

– т: mixing time in the street canyon, derived from

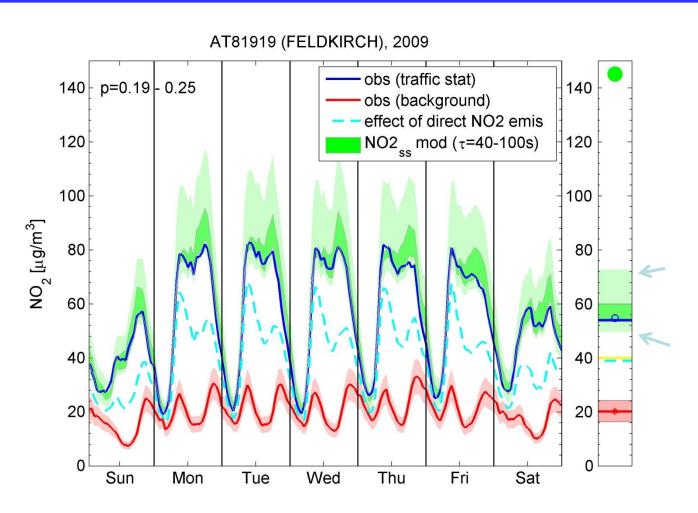
regression of hourly AIRBASE observations for

each station with NO<sub>2</sub> exceedance

For future scenarios, changes from GAINS/EMEP are used

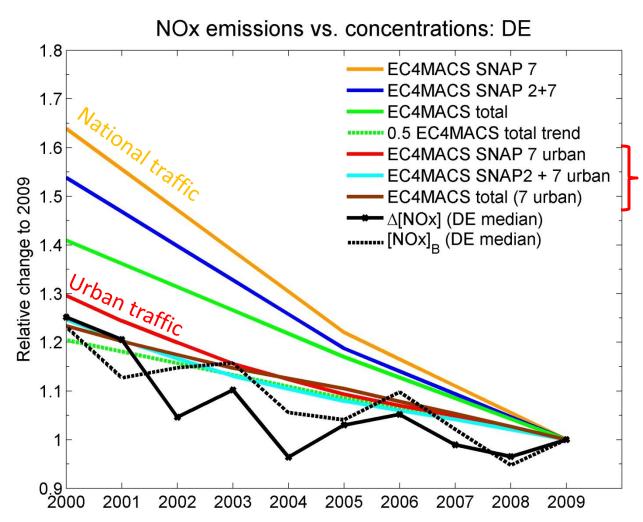
#### Parameterization of T derived from AIRBASE weekly patterns





#### Urban vs. national emission trend



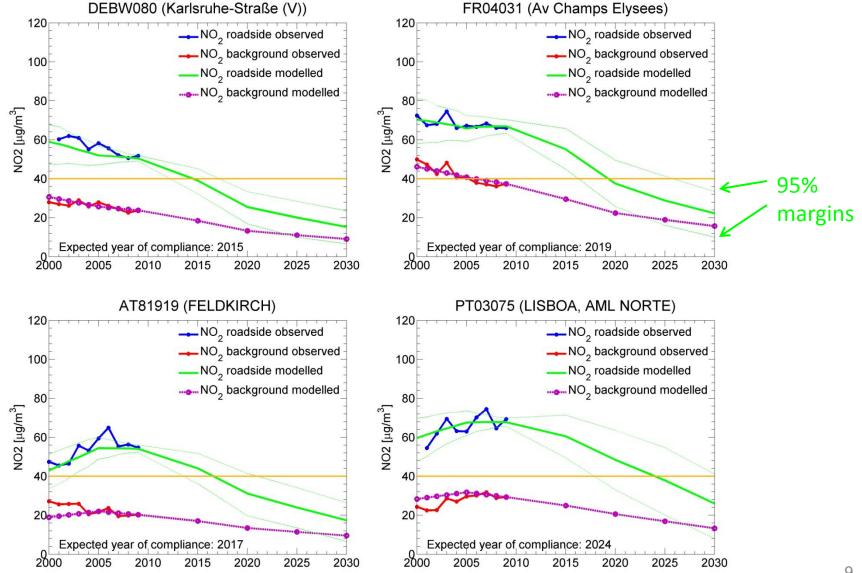


Urban emissions: Estimated via HBEFA emission factors, TREMOVE traffic activity model

In the past, urban traffic NOx emissions declined slower than total country traffic emissions – Future changes will be computed within GAINS

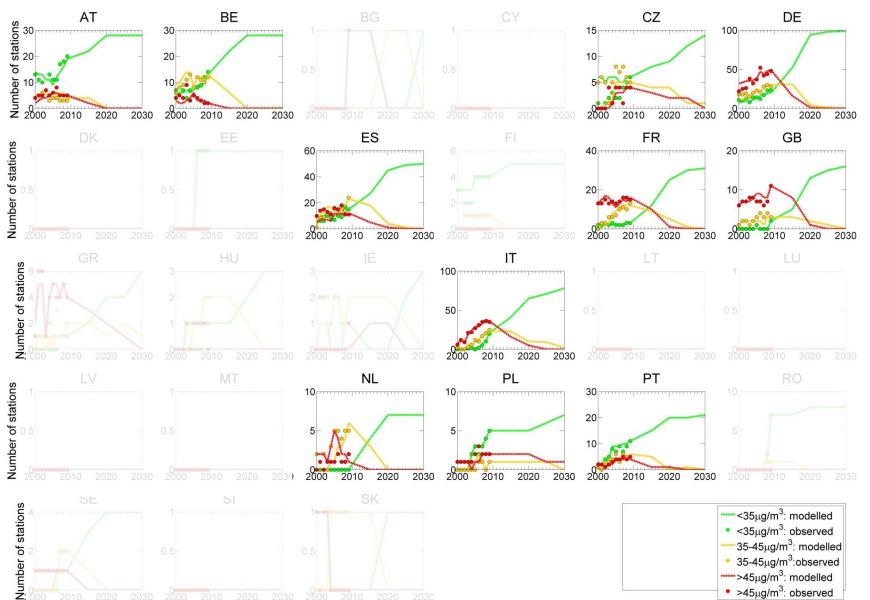
## Scenario calculations for specific stations: Some initial examples





### Illustrative scenario calculations: compliance

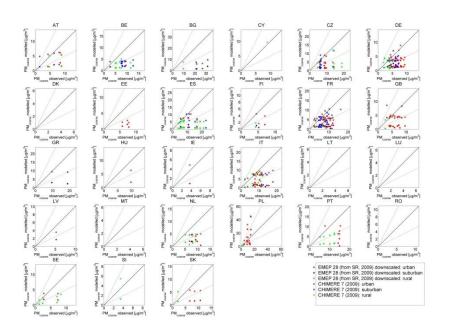




#### Approach for modelling PM10 exceedances



 Coarse fraction: EMEP+CHIMERE model vs observations 2009



#### Fine fraction:

- 28 km model (S/R) results downscaled to 7 km using on local low-level emissions (~urban background)
- For each station, local dispersion characteristics of fine PM derived from τ determined for NO2

#### Coarse fraction:

- Poor fit of model results (emissions?, re-suspension?)
- How could sources of coarse emissions change in future?
- Hypothesis: Only few measures would influence coarse fraction (street cleaning?)1

### CIAM workplan

- Bilateral consultations
- HTAP workshop on global emission scenarios for 2030 (Oct 8-10)
- Workshop on nitrogen scenarios for 21<sup>st</sup> century (Oct 11-12)
- Global coverage, gridded global emission scenarios (0.5 x 0.5 degree), download from web
- Analysis of mitigation potentials of near term forcing
- Projections extended to 2050
- Improving emission calculations for BC, OM; high-emitting vehicles, flaring in oil and gas industry, agricultural and waste open burning
- Extension to include Hg; first GAINS version ready

