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Roadmap for modelling work for the revision of the EU Thematic Strategy

41st Meeting of the
Task Force for Integrated Assessment Modelling
Bilthoven, May 7-9, 2012

Two main topics

- EC4MACS:
  Latest model improvements (compliance with AQ limit values)
  and Final Assessment

- Revision of TSAP:
  Roadmap for scenario modelling

EC4MACS: Improved modelling of the linkage between AQ limit values and transboundary pollution

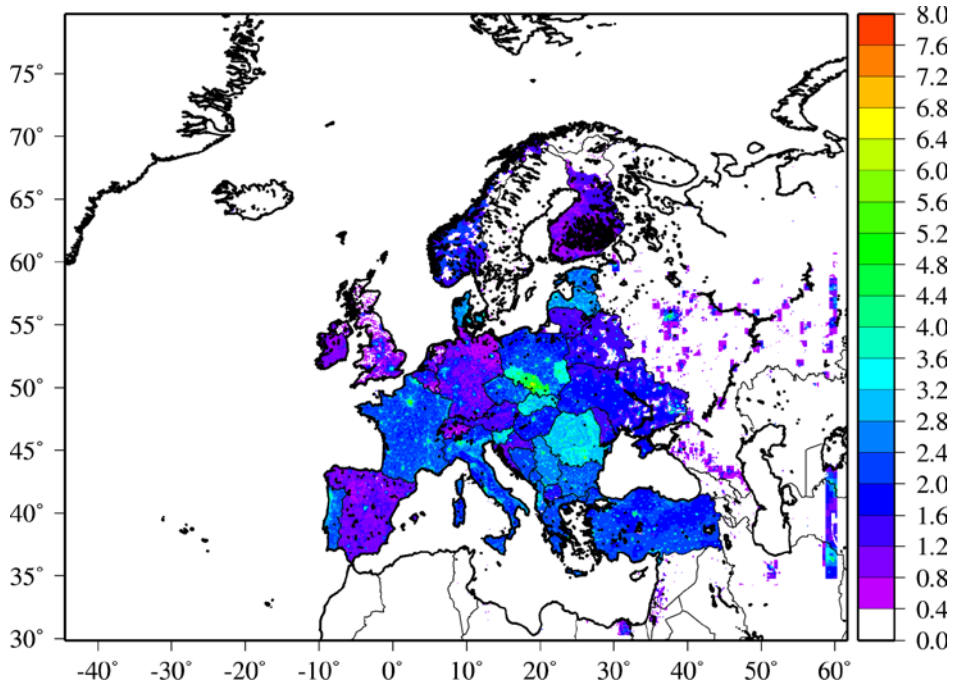
- New methodology for European-scale compliance assessment with CHIMERE/EMEP models for PM, NO_2, O_3.

- Improved 'City-delta' methodology:
  - 7*7km CHIMERE/EMEP/LOTOS/RCG calculations with fine-scale meteorology used for adjusting urban background concentrations
  - Additional estimate of maximum contribution of vehicles within street canyons, depending on emission strength
  - Should allow comparison of various statistics with AQ limit values to indicate potential for violation of limit values

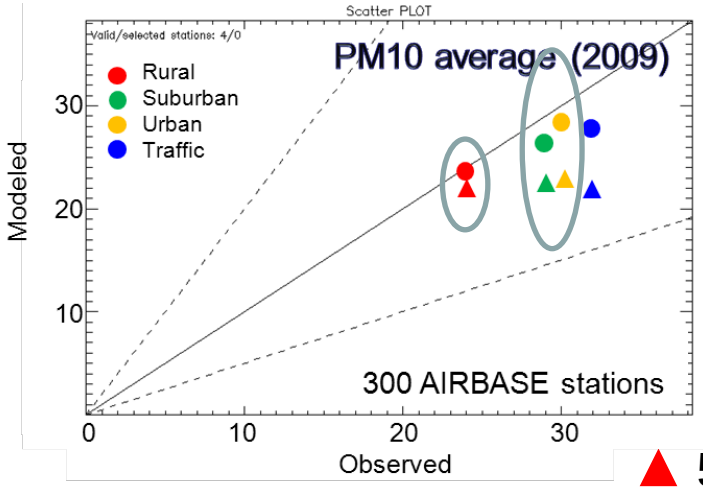
Updated PM2.5 fine-scale inventory for SNAP Sector 2 (domestic)

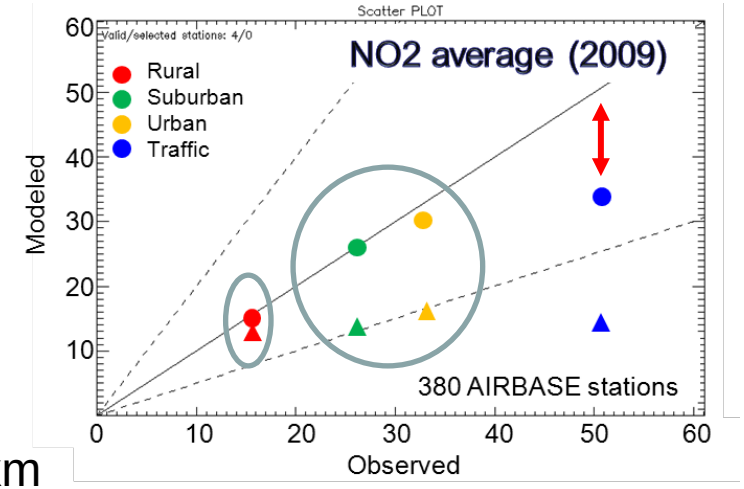
Model validations for PM2.5/PM10 showed systematic problems in winter throughout Europe

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

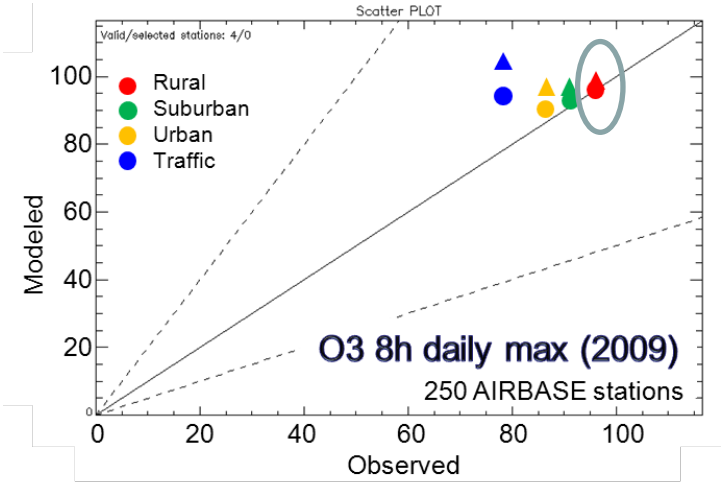


Comparison 7*7 km vs 50*50 km resolution modelling





▲ 50 km ● 7 km



- Consistent behaviour for rural stations.
- Significant resolution increments for PM10 and NO2 at urban and suburban stations.
- Improved representation of the spatial correlation
- Net gain but problems remain with traffic stations (not so important for PM10)

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;

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

- $[NO_2]_{SS}$: Street canyon concentrations – from AIRBASE
- $[NO_2]_B$, $[NO_x]_B$, $[O_3]_B$: Observed urban background – from AIRBASE
- p: NO/NO_2 ratio – from GAINS

Parameterizations for

- $[NO_x]$: local traffic emissions (time profile known)
- τ: mixing time in the street canyon

derived from regression of hourly AIRBASE observations for each station with NO_2 exceedance

NO2 street canyon modelling: Future scenarios

- $[NO_2]_{ss} = f([NO_x], \tau, p, [NO_2]_B, [NO_x]_B, [O_3]_B)$

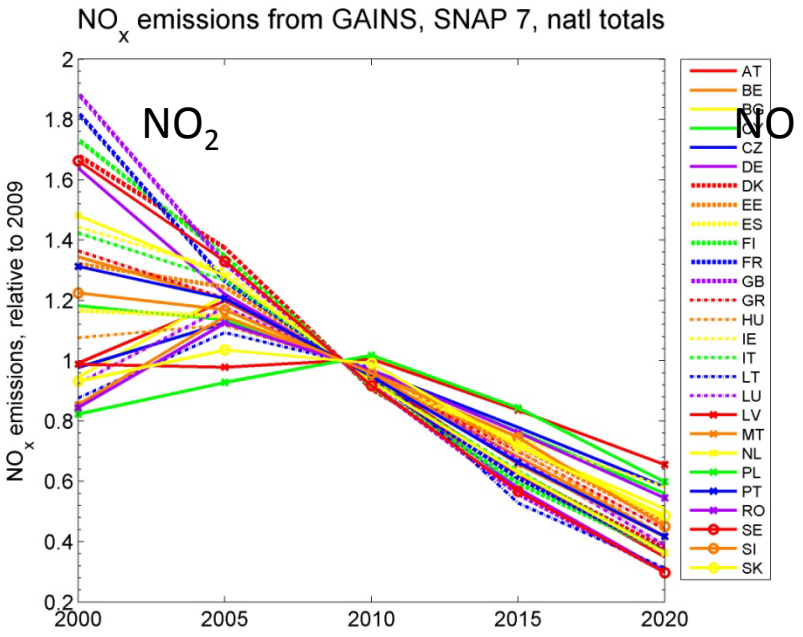
⇒ Parameterisation; emission term scaled with future emissions

Site specific! ⇒ GAINS

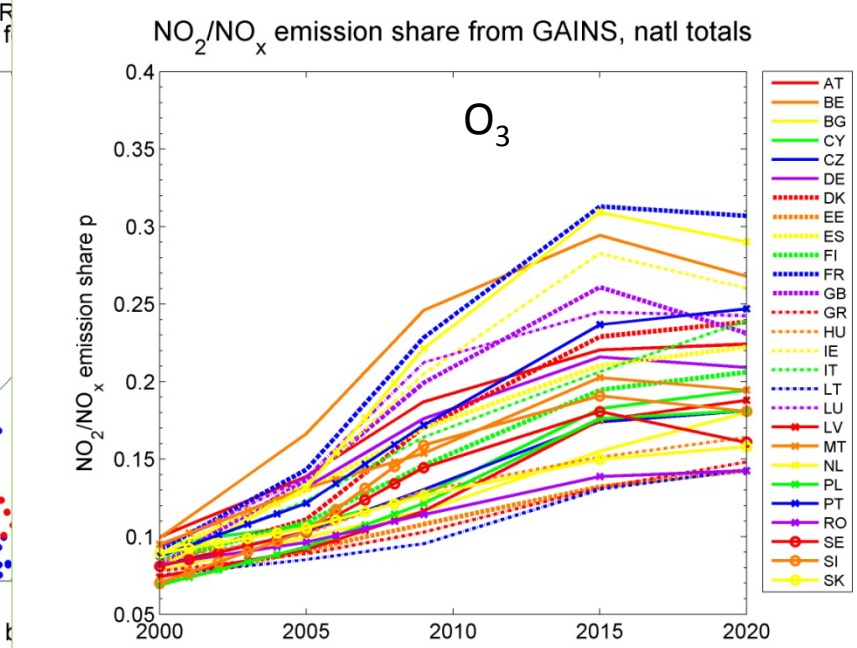
available from dispersion models (EMEP + CHIMERE downscaling), possibly site-specific correction

CHIMERE as local background:

Evolution of national NO_x traffic emissions:



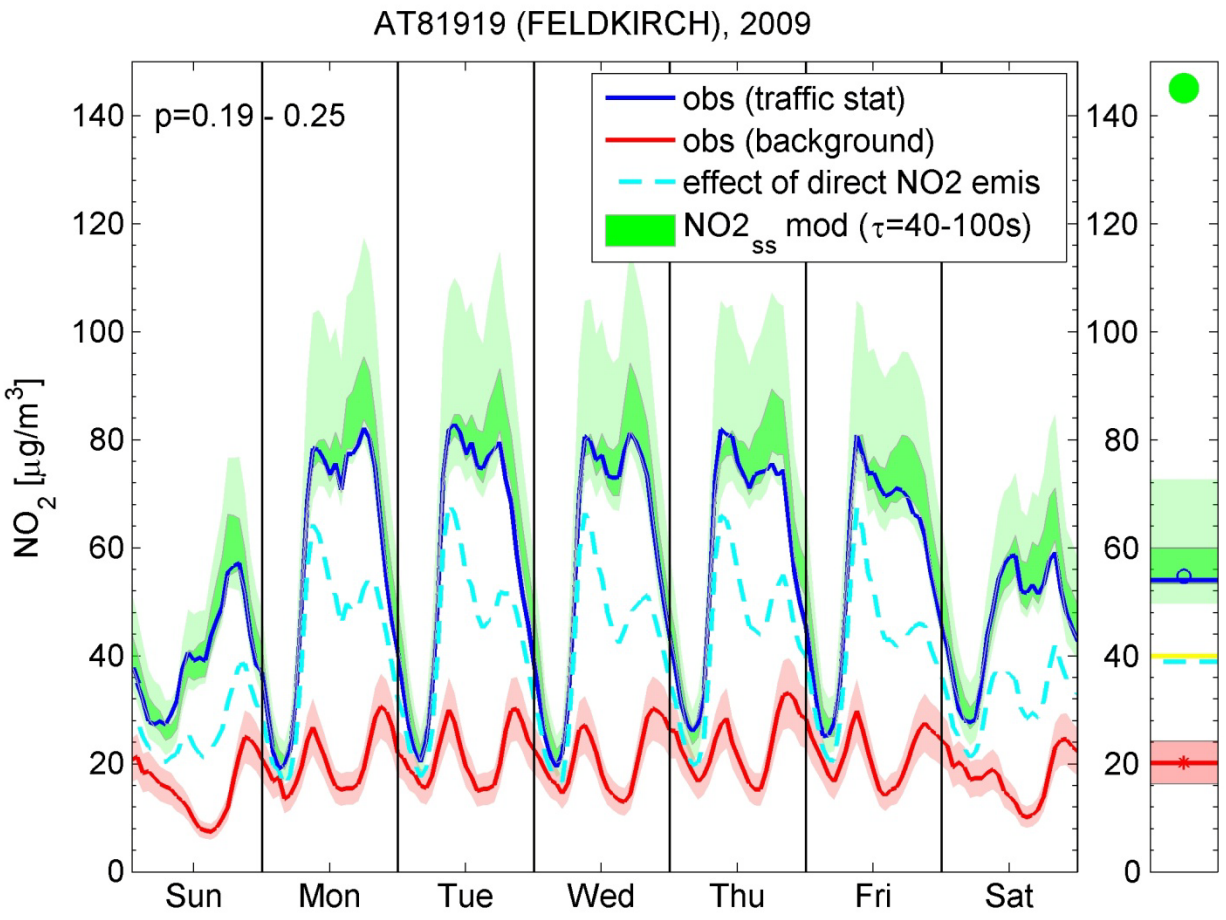
Evolution of NO_2 traffic emission share p:



Extension to the weekly pattern (hourly resolution)

Extension of annual mean model to weekly pattern:

- Needs daily cycle of J (solar irradiation) and k (temperature).
- J: observed daily cycle for Juelich (DE) scaled with country average radiation

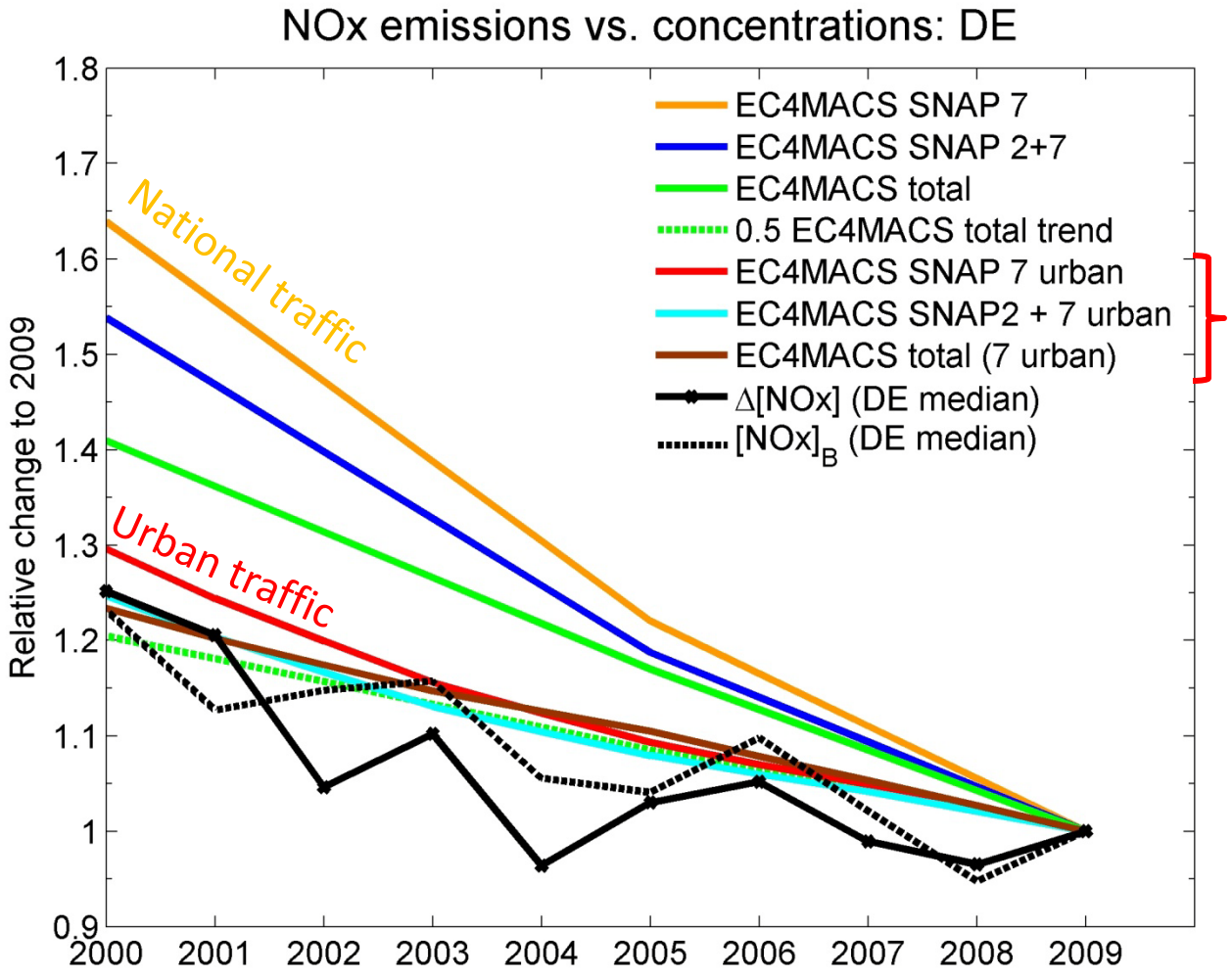


annual mean

$[NO_2]_B$ upper limit + τ=100s + higher p (0.25)

$[NO_2]_B$ lower limit + τ=40s + national avg. p (0.17)

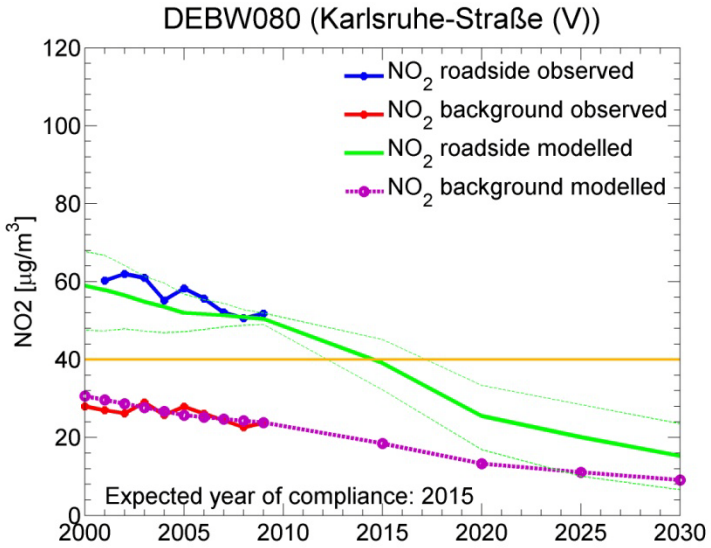
Urban vs. national emission trend

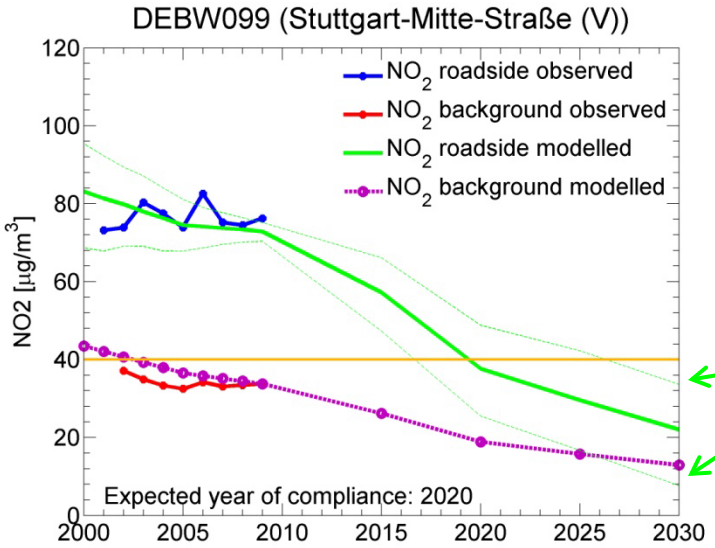


Urban emissions:
Estimated via HBEFA emission factors, TREMOVE traffic activity model

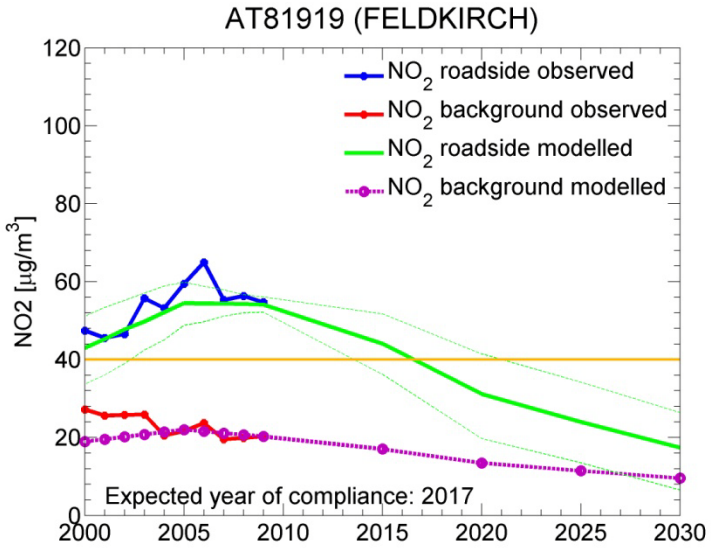
In the past, urban traffic NOx emissions declined slower than total country traffic emissions –
Future changes will be computed within GAINS

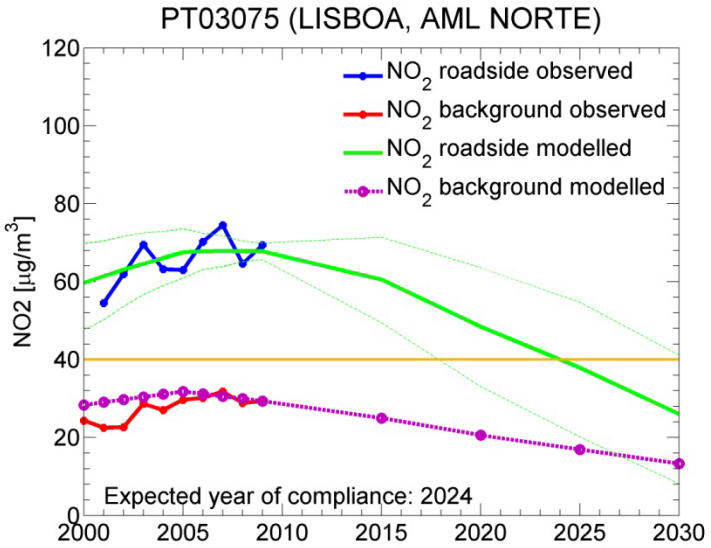
Scenario calculations with the tuned parameters (1): Some examples



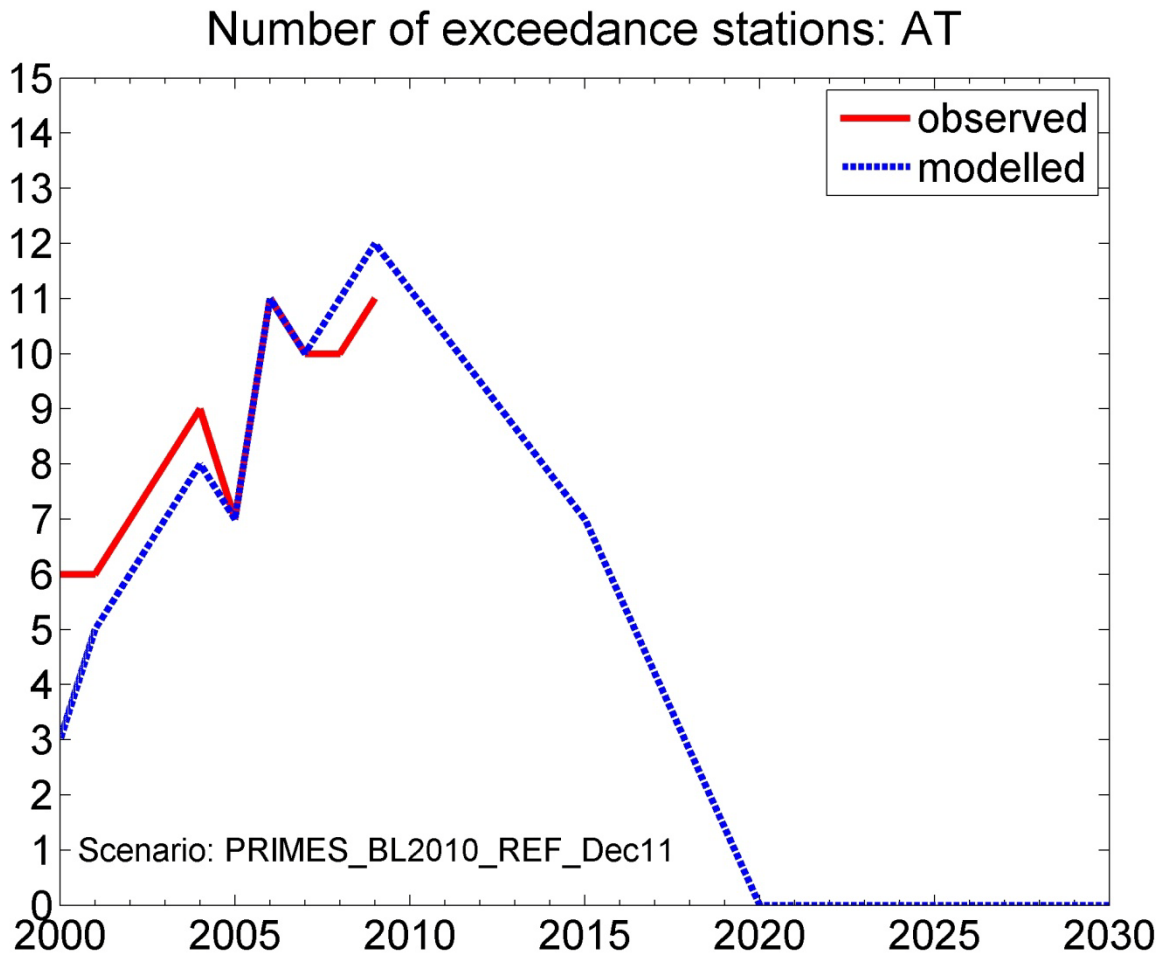


95% margins





Scenario calculations with the tuned parameters (2): Compliance



EC4MACS Final Assessment

Part 1: Emissions to 2030 – available soon

- Based on PRIMES 2010
- CLE + MTFR

Part 2: Air quality impacts + benefits: available in August

- with new EMEP model (long/lat)
- With new EC4MACS/City-delta downscaling
- 7 km urban background/compliance with AQ limit values

TSAP draft scenarios

Ready for TSAP- SEG meeting June 21

Based on PRIMES 2010 up to 2050: Reference, Low Carbon

- Current legislation (CLE) baseline
  - with real-life Euro-5 and planned Euro-6 emission factors
- Maximum Technically Feasible Reductions (MTFR) - EU only
  - excluding premature scrapping of existing stock,
  - Gothenburg agreement for non-EU countries and baseline for hemispheric background
  - MTFR for ships
- Maximum Control Efforts MCE, combining
  - PRIMES Low Carbon scenario, healthy diet,
  - premature scrapping of existing stock to the extent that this is not already included in the PRIMES low carbon scenario,
  - hot spot measures,
  - MTFR for non-EU countries, baseline for hemispheric background
  - MTFR for ships including slow steaming

A new round of bilateral consultations

- July-October 2012

- Focus on
  - June 2012 Draft TSAP scenarios (available via GAINS-online)
  - 2005 emission inventories,
  - penetration of emission control measures,
  - applicability limits for additional emission control measures,
  - national peculiarities, etc.

  IIASA will prepare list of key questions for each country and provide access to working version of TSAP scenario

  Information will be used for final TSAP scenario, applied to PRIMES 2012

- Reserve dates with Janusz Cofala (cofala@iiasa.ac.at)

Final TSAP scenarios (tentative)

Ready in Spring 2013

- Based on PRIMES 2012
- Incorporating information from bilaterals,
- new information on sectoral emission reduction potentials from Task 3 of the Service contract (vehicles, small combustion sources, agriculture, ships)

- Group 1: What-if scenarios
  - CLE, MTFR, MCE up to 2050

- Group 2: Optimized policy scenarios for 2030:
  - YOLL target only – 25%/50%/75% gap closure
  - Ozone target only – 25%/50%/75% gap closure
  - Eutrophication target only – 25%/50%/75% gap closure
  - Acidification target only – 25%/50%/75% gap closure
  - Joint optimizations for 25%/50%/75% gap closures for all effects