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The inclusion of near-term radiative forcing into a multi-pollutant/multi-effect framework

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Air pollutants have also effects on climate change in the near-term



There are concerns about climate effects of air pollutants:

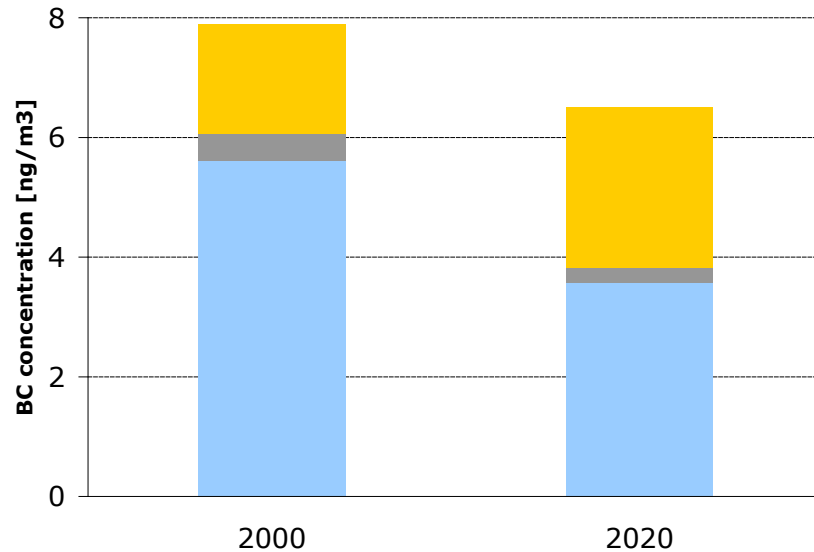
1. Near-term forcing of air pollutants

- Warming: BC, CH₄, O₃ (i.e., CH₄, CO, VOC, NO_x)
- Cooling: SO₂, OC
- accelerates or delays ongoing climate change at the regional scale,
- changes regional weather circulation and precipitation patterns.

2. increases arctic melting through deposition of black carbon

BC concentrations in the Arctic

from European sources (preliminary GAINS/EMEP calculations)



- From wood burning in Norway
- Other Norwegian sources
- Other European sources

How could near-term climate effects be introduced into GAINS?



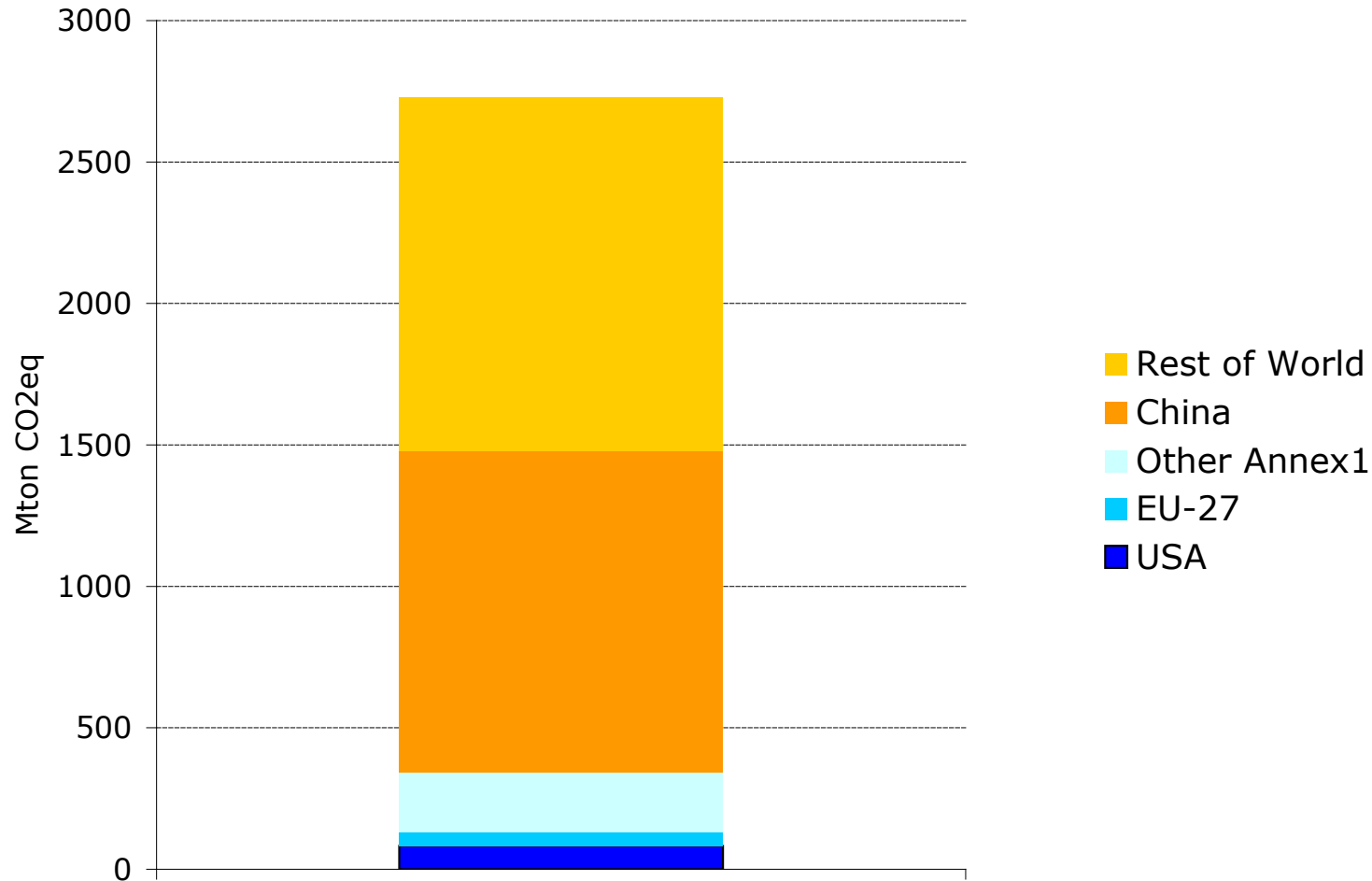
- Near-term climate impacts could be included into the GAINS multi-pollutant/multi-effect concept as **an additional effect of air pollutants**
- Relevant precursors:
SO₂, NO_x, NH₃, VOC, O₃, PM2.5, BC, OC, CO, CH₄
- Note that many pollutants are co-emitted, and isolated reductions of single pollutants (e.g., BC) are often not possible in reality.
GAINS captures these interdependencies!

Potential impact indicators



- As there is significant scientific uncertainty on the quantification of actual climate impacts, indicators should refer to physical indicators that can be quantified with reasonable robustness.
- Potential metrics (impact indicators):
 1. Instantaneous radiative forcing of sustained emissions (at regional and global scales)
 2. Deposition of black carbon in the arctic.
- These metrics would not interfere with UNFCCC objectives (long-term stabilization, reflected through 100 years GWP)
- As they do not involve CO₂, no conflict between control of air pollutants and CO₂ mitigation could be constructed

CH₄ mitigation potential <40 €/ton CO₂eq 2020, by World region



Potential approaches for GAINS optimization for CLRTAP protocol



Starting from an energy scenario that achieves given (long-term) climate objectives (expressed through GWP_{100}):

Option 1:

- Optimize for environmental targets on
 - health and ecosystems (as before),
 - near-term forcing and BC deposition to the arctic.

Option 2:

- Optimize for environmental targets on
 - health and ecosystems (as before),
 - under the condition that near-term forcing and BC deposition to arctic does not deteriorate

Work elements



- Development of cost curves for BC, OC, CO (CIAM)
- Quantification of source-impacts relationships (between national emissions and regional forcing)
 - Calculation of source-receptor relationships between (country) precursor emissions and (grid) column concentrations (MSC-W)
 - Estimation of (regional) radiative forcing from (grid) column concentrations (Uni.Oslo)
- Extension of GAINS optimization routine (GAINS)

Prototype implementation feasible in 2010
(depending on available resources!),
full implementation and validation thereafter

Conclusions



- Near-term forcing and BC deposition to the Arctic could be included as an additional effect of air pollutants into the existing multi-pollutant/multi-effect framework
- Suggested metrics:
 - Instantaneous radiative forcing at the regional/global scale
 - BC deposition to the Arctic
- A prototype version could be developed by spring 2010 (if funding is available)
- In a first step, such information could be used to prioritize reductions of precursor emissions to reduce PM_{2.5} levels