

[Eurodelta3 – Status and link with HTAP]

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Background and Rationale

- Initiated by the LTRAP / Task Force on Measurements and Modelling
- General goals of Eurodelta:
 - Improving and understanding processes relevant to regional CTM
 - Benchmarking the EMEP model
 - Uncertainty assessment (multi model approach)
- Eurodelta 1:
 - Evaluation and 2020 projections
- Eurodelta 2:
 - country-level and sectoral reductions responses
- Eurodelta 3 (current):
 - EMEP PM field campaigns Jun 2006, Jan 2007, Sept 2008 Feb 2009
 - Hindcast (Gothenburg effectiveness): 1990/1999/2008



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Experiment design

Higher constrain compared to previous exercises:

- Fixed 0.25 deg grid
- Meteorology (ECMWF/IFS 0.2deg)
- Boundary conditions
 - MACC 1.125deg reanalysis
 - Assimilation of O₃, CO, NOx and HCHO columns and GOME O3 profiles
- Emissions (EC4MACS)





Participating models and operating centres



Non-modelling participants:

DG JRC, CIEMAT, BSC, IPSL-CNRS, Univ of Brescia, NILU, CONCAWE, LWA

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PSI / RSE



Progress and Status

Apr12: Kick off ED3

Apr-Jun12:Prepare input dataJun-Oct12:Model setup

Nov 12: start 2009 campaign

- Nov12: Production of runs
- Dec12: Comparison model results
- Jan-Feb13: Consolidation observation database
- Apr-Nov13: Analysis report on 2009 campaign
- Dec13: Final report

Oct13: start 2008 campaign

Jan 14: start 2006 and 2007 campaigns

Q1 14: start hindcast experiment



Results

2009 Campaign







16

12

PM10 average concentrations

Quite some spread in the ensemble...



20 0BS /ugm-3 30

Some model are too conservative but other capture well the country variability FR

GB

Synthesis of model behaviour

- O3: underestimate (winter), esp. nighttime
- > NO2: no bias on average in ensemble
- PM25: underestimate except for two models

- Diurnal cycle overestimated in all models
- For PM2.5 SOA production could contribute



Summary for 2009 campaign

Common features :

- Large model variability despite experiment constrains
- SIA are well modelled
- Dust parameterizations remain uncertain
- Underestimate
 - TOM concentrations: SVOC emissions ?
 - PM peaks: Wood burning emissions?

Routes for improvement for individual models:

- CAMX : Low SOA production
- CHIM : Overestimate sulphates and sea salts, need to account for coarse nitrate
- CMAQ : Underestimates PM10 concentrations
- MINNI : Underestimates the PBL
- EMEP : Low TOM concentrations, high wet deposition
- LOTO : Low TOM and PM10 concentrations
- RCGC : Noisy wind blown dust parameterization





Results of specific relevance to HTAP

Sensitivity to boundary conditions

O3 Profiles

- RCTM largely follow MACC in the free troposphere, but there are exceptions
- MACC is better than ED3 ensemble in troposphere, not close to surface



Ozone (ppb)

	Models			MACCA	
Altitude range	0-2km	>2-8km	Altitude range	0-2km	>2-8km
Mean (obs/models, ppb)	41.98 / 39.8	57.53 / 61.61	Mean(obs/MACC, ppb)	33.6 / 40.69	56.81 / 59.79
SD (obs/models, ppb)	10.70 / 8.33	5.44 / 9.05	SD (obs/MACC, ppb)	16.09 / 8.90	0.94 / 3.43
Bias(ppb)	-1.6 (-4%)	-4.1 (-7%)	Bias(ppb)	7.1 (21%)	3.0 (5%)
MGE (ppb)	5.6 (13%)	8.3 (14%)	MGE (ppb)	7.2 (21%)	3.0 (5%)
RMSE(ppb)	7.1 (17%)	10.1 (19%)	RMSE(ppb)	10.1 (30%)	4.1 (7%)
r	0.76	0.06	r	0.98	0.25

Statistics get worse compare to MACCA, statistics improve compare to MACCA

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Mean (all stations): 20090225-20090326





Dust average concentrations

CHIM and CAMX have only dust at boundary condition
EMEP, MINNI, RCGC and LOTO have wind blown dust



2009 Campaign



Fraction of SOA in Total Org. Matter

1.0

0.9

0.8

0.7

0.6

0.5

0.4

0.3.

0.2

0.1

407

The contribution of the global model can be high in the outskirts of the domain

SO₂ vs. SO₄²⁻

- \blacktriangleright SO₄²⁻ smeared out compared to SO₂
- Inflow at the boundaries
- MACC as a lower spatial correlation and a positive bias for SO₄²⁻





Links between ED&HTAP

Base year

- Production of Regional HTAP runs: 2008 (+2010?)
 - Use ED3 framework with HTAP emissions over Europe
- Validation
 - Include HTAP models in PM evaluation over Europe for EMEP campaigns (1 month, 2008, 2009)
- Deliver for impacts studies
 - Health
 - Ecosystem
 - Climate



Links between ED&HTAP

Perturbation experiments

- ED3 hindcast workpackage:
 - AQ trends over Europe 1990-2008
 - Disentangle emissions / meteorology / boundary conditions
- Need a reference global hindcast for boundary conditions
 - CCMI/ACCMIP?
- Need a quantification of RCTM sensitivity to changing bound. cond.
 - +/- 20% sensitivity for individual GCTMs
 - Multi-GCTM ensemble
 - Present: HTAP base year
 - Past: S/R parameterisation





Summary

ED3:

- Kick Off Spring 2012
- Case studies:
 - 4 x EMEP 1-month campaign
 - Very stringent exercise
 - Focus secondary aerosol
 - First report final in Dec13
 - Modelling completed Q1 2014
- Hindcast 1990-2008:
 - Starting Q1 2014

Link with HTAP:

- Production / Impact studies
- Validation of regional and global models for PM in Europe (case studies)
- Hindcast 1990/1999/2008
 - Use sensitivity runs of HTAP base year ensemble for uncertainty analysis

