A SYSTEM FOR INFORMATION AND FORECASTING OF AIR QUALITY OVER BULGARIA

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Elevated concentrations of air pollutants can pose a significant public health concern. A trustworthy air pollution forecasting system can help in on time protection of the population and possible emission abatement measures. A project to create Bulgarian Chemical Weather Forecast and Information System aims to provide forecast information that is timely, informative, and reliable. Developed by the National Institute of Meteorology and Hydrology and affiliated with the BULGARIAN ACADEMY OF SCIENCES Geophysical Institute.
Key points

- It is designed to deliver forecasts twice a day (00 and 12 UTC) for the next 48 hours
- US EPA Models-3 is used here (CMAQ, MM5, SMOKE)
- ALADIN output is used as a primary meteorological background
Three nested modelling domains are used:

ALADIN, MM5, CMAQ
Data flow diagram

ALADIN
6 h output (GRIB)

MM5
1 h output (binary)

AEMIS
area emiss. (NetCDF)

AreaSource
inventory (gridded)

AUTH, Greece: MM5/CAMx

CW.BC1
Interpol. (binary)

MCIP
1 h output (NetCDF)

SMOKE
LPS proc.
BgS proc.
A,P,B merge (1 h,NetCDF)

PointSource inventory (φ, λ)

LandUse (gridded) (NetCDF)

BCond.
CW.BC2 (NetCDF)

CMAQ
1 h output (NetCDF)

Post-processing
WEB, etc.

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Boundary conditions

- Provided by the chemical weather forecasting system running in Aristotle University of Thessaloniki
- 3 domains: Europe (50km), Balkans (10km) and Athens (2km)

Layer 1 O3a

a=bcon_CW.ncf

August 1, 2008 0:00:00
Min= 0.000 at (34.1), Max= 0.029 at (20.1)
CMAQ emissions:

- Emision sources: TNO high resolution (14 x 7 km) for 2003 given by SNAPs;
- Gridding to CMAQ domain – GIS used
- Temporal allocation – daily, weekly and monthly profiles (TNO);
- Speciation of VOC and PM2.5
  - Speciation profiles USA EPA data base
  - The weighted averages of speciation profiles as SNAP specific splitting factors;

SMOKE (modified data files)

- Grided land- use data to compute biogenic emissions
- LPS emissions (plume rise calculations)
- Merge As, LPS and BgS
Validation for the year 2000 using tropospheric ozone

• Before using BGCW operationally validation is needed

• We have background measurements of ozone for the whole year 2000:
  - peak Rojen (Rodopi mountains, South of Bulgaria)
  - city of Ahtopol (Black Sea coast, South-East of Bulgaria)

Two scenarios:

A: all kinds of emissions and boundary conditions are accounted for

B: boundary values of all pollutants are set to zero
Left: Very good with slight underestimation of measurement data

Right: One should always account for boundary conditions over such a small area

**BC – almost 90% of pollution level**

\[ Y = 1.04 \times X \]
\[ X_m = 45.1, Y_m = 47.5 \]
\[ R^2 = 0.95882 \]

\[ Y = 0.0752 \times X \]
\[ X_m = 44.1, Y_m = 3.06 \]
\[ R^2 = 0.45 \]
- The maximum of climatic ozone field is close to the minimum of the ADM field
- A maximum in the South-Western part of the country
- Additional maximum in ADM field (Maritza – Iztok TTPs)
• The modeling system has a satisfactory performance with respect to O3;
• Despite using boundary conditions from another system the basic spatial and temporal patterns are captured by the model;
• The best simulation quality refers summer time daily maximums;
• There are essential discrepancies when estimating the recommended ozone indexes;
• The reasonable performance of the BGCW system for the case 2000 justifies its use as a forecasting and informational system to be used by various users;
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