BULGARIAN NATIONAL CHEMICAL WEATHER FORECASTING AND INFORMATION SYSTEM – MODEL SETUP, EMISSION INVENTORIES, AND PREPROCESSING

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Outlines

- Models, domains
- Operational design of BCWF
- Emission input
- Emission modeling
- CMAQ calculations , output
- BCWF testing
- Future Work and Conclusion

Models, domains

	Model	Usage
1	**MM5 - the 5th generation PSU/NCAR Meso-meteorological Model**	**used as meteorological pre-processor to CMAQ**
2	**SMOKE (Sparse Matrix Operator Kernel Emissions Modelling System)**	**emission pre-processor to CMAQ**
3	**CMAQ - (Community Multi-scale Air Quality model)**	**the chemical-transport model (CTM) – the most important part of the System**

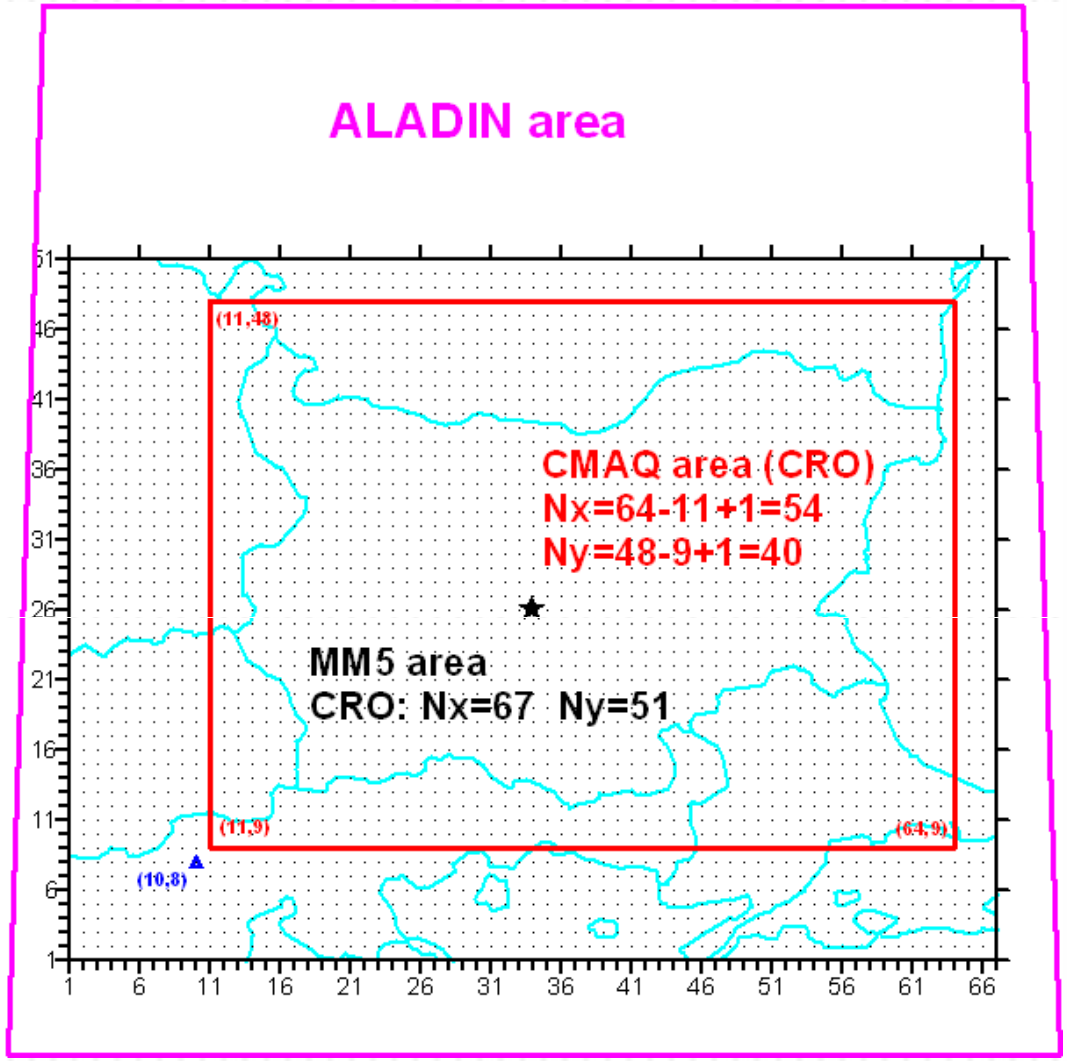
Experience: (Projects ACCENT, QUANTIFY)

Early warning and forecast system for air quality around TPPs "M-I"

Climate change impact on air quality – CECILIA project

Models, domains

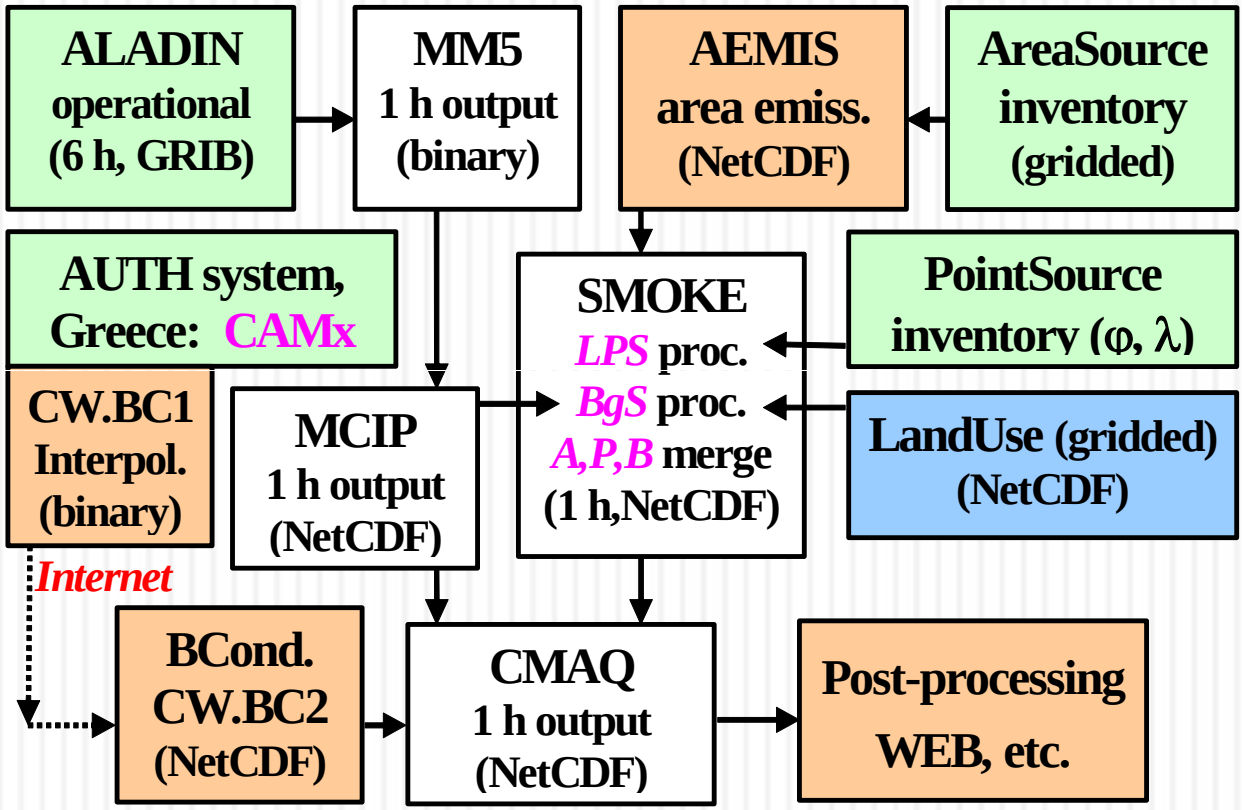
Different models domains



Operational design of BCWF

BGCW is planned to be run twice a day (00 and 12 UTC) and to produce 48-hour forecast (overlapping of successive forecasts).

2-days forecast calculation flow (Data+Models+Scripts+Fortran_codes):



Emission Input

(the most uncertain part of the task)

Emission Inventory :

- On annual basis – SNAPs, big areas (countries, munic.)
- Some pollutants are estimated as groups – VOC, PM2.5
- The emissions have to be gridded

Temporal allocation profiles (TNO, The Netherlands)

- Daily Factors (common for all SNAPs)
- Weekly Factors (by SNAPs)
- Yearly Factors (by SNAPs)

Speciation profiles

Source: US EPA, http://www.epa.gov/ttn/chief/emch/speciation/index.html

- VOC's and PM2.5 speciation profiles

VOCs→10 LP (ISOP, OLE, PAR, ALD2, TERPB, XYL, ETH, NR, FORM, TOL);

PM2.5→5 FPM

- Coincidence between SNAPs and US SCC (several sources per SNAP)

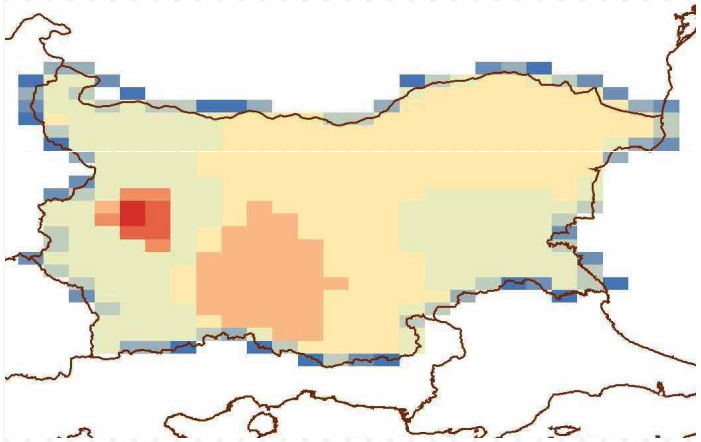
Emission Modeling

Smoke

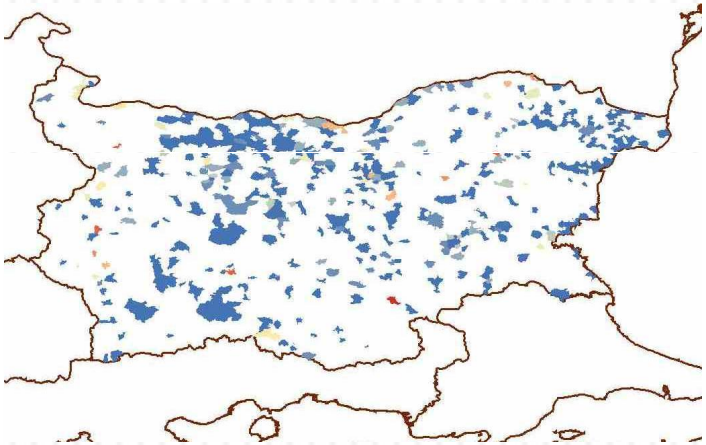
- emission preprocessor for CMAQ – used only for LPS, Biog.Emissions and Merging

BCWF emissions:

- Test runs made with GEMS 0.25° inventory (TNO, The Netherlands) National Inventory 2005 and later (Ar.Sources – gridded, LPS - φ, λ, h, V, T)
- (to have better spatial resolution)



GEMS 0.25deg emissions, pm10 from Snap 2



National emissions , pm10 from Snap 2

Emission Modeling

Area emissions

FORTRAN Code AEmis created.

AEmis is doing the speciation and temporal allocation

Input: gridded inventory, temporal and speciation profiles

Output: NetCDF files for 1-hour emissions for the days of forecast

Large Point Sources emissions

SMOKE's *LPS Processing* used (*Plume-rise calculated, multi-levels*)

Input: **Stacks' parameters (*φ, λ, H, D, T, V***

meteodata – MCIP output

Output: NetCDF files for 1-hour emissions for the days of forecast

Emission Modeling

Biogenic emissions

SMOKE's Biogenic Processing

Input: *1. gridded LandUse data from USGS 1-km data base, 24 categories*

2. meteodata – MCIP output

Output: ***NetCDF files for 1-hour emissions for the days of forecast***

CMAQ emission input

SMOKE's MrgGrid Processing used to merge Area, LPS and Biogenic emission files as a common NetCDF file, 1-hour basis, for the days of forecast

CMAQ Calculations

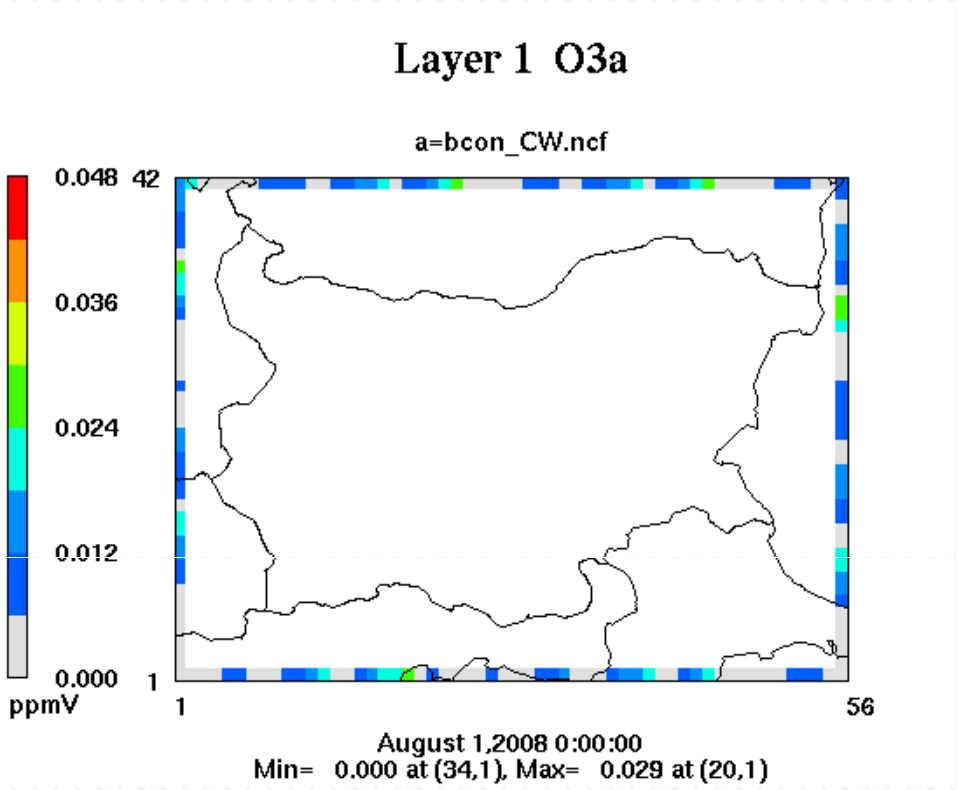
Initial conditions: Previous run concentration file (twice a day)

Boundary conditions: From AUTH, Greece, CAMx forecast

- Interpolation of CAMx concentrations in BGCW boundary points
- Upload via Internet the created binary file to a server
- Vertical interpolation and spices redistribution, NetCDF file created

AUTH System, Grid02
Δx = Δy = 10 km

CMAQ Boundary file



CMAQ Output

CMAQ Output

NetCDF file on 1-hour basis for 2 days of forecast (14 layers)

Pollutants: 78 pollutants, from which:

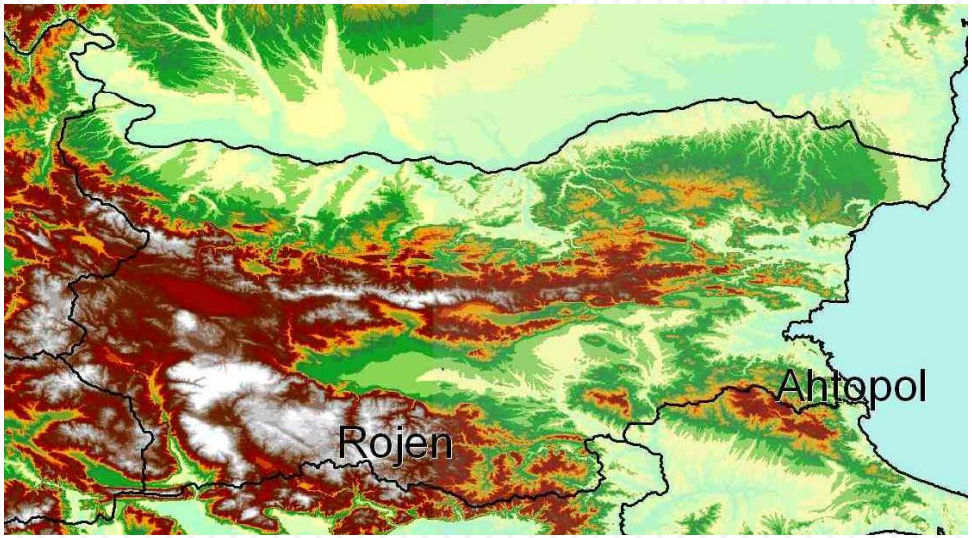
- 52 gaseous (NOx, SOx, Ozone etc.)
- 21 aerosols (Coarse, Aitken and Accumulation modes)
- 5 aerosol distributions (3 by number, 2 by aerosol area)

Post-processing – Not defined, yet (Verdi, IDV or GIS Software – open source or commercial)

BCWF Testing and Validation

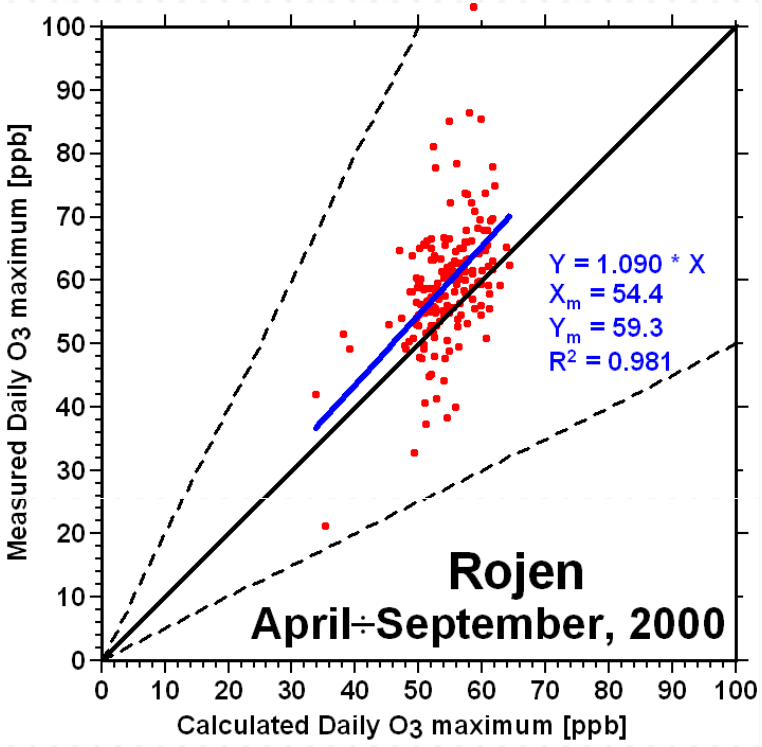
For verification, offline simulation for year 2000 is made. Ozone concentrations are compared with observational data gathered from 2 stations in Bulgaria – Rojen and Ahtopol.

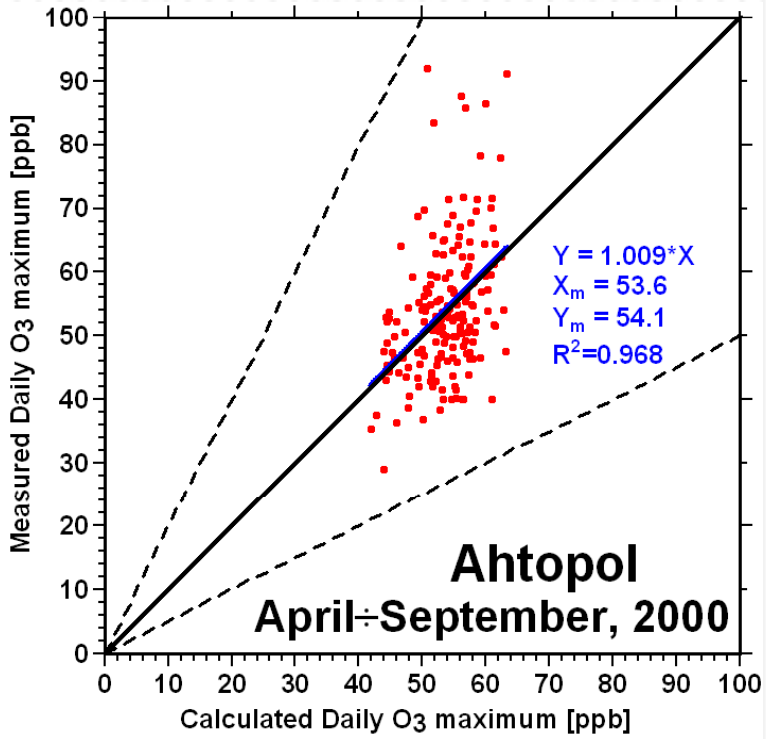
According to European ozone directive some indexes related with exposure, are more important than ozone concentrations. Such are AOT40 (Accum. Over Threshold of 40 ppb), NOD60 (Number Of Days with 8-hour avg greater than 60 ppb) and ADM (Avg Daily Maximum), and are also used for comparison with measurements.



BCWF VALIDATION

O3 Daily Maxima comparison





Future Work and Conclusion

- No validation with the current measurement data (comparison problems)
- No Post-proccesing tool selected
- **National emissions – not prepared, yet**

- Evaluation of BCWF simulations showed that the modelling system has a satisfactory performance with respect to O3 as shown from the plots discussed. Despite using boundary conditions from another modelling system the basic spatial and temporal O3 patterns are captured by the model. The best simulation quality refers summer time daily maxima. There are essential discrepancies when estimating the O3 indexes recommended by EU Ozone Directive. The reasonable performance of the BGCW system for the past time simulations justifies its use for future forecast and information from various users.

Takk

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