

CITEAIR II International conference

Preparing for the Future: Cities for Cities – Tools to Improving Air Quality and Tackling Climate Change

Networking workshop: The CITEAIR II Level 1 Forecast

Ljubljana, June 2 2010

The workshop started at 14:30 in the premises of the CITYHOTEL at Dalmatinova cesta 15, Ljubljana, Slovenia.

List of participants:

		Name	Surname	Institution	Country
1	Mrs.	Beathe	Arends	Province of South Holland	The Neetherlands
2	Mr.	Ivan	Belšić	Institute of Medical Research and Occupational Health	Croatia
3	Mrs.	Michalina	Bielawska	ARMAG	Poland
4	Mrs.	Lysa	Blyth	VITO	Belgium
5	Mr.	Linton	Chorbet	CHMI	Czech Republic
6	Mr.	Silvije	Davila	Institute of Medical Research and Occupational Health	Croatia
7	Mrs.	Sylke	Davison	DCMR	The Neetherladnds
8	Mr.	Hermann	Heich	Heich Consult	Germany
9	Mr.	Arthur	de Pas	AIRPARIF	France
10	Ms.	Maria	Holmers	Gotehnborg Environmental Administration	Sweden
11	Ms.	Cecile	Honore	AIRPARIF	France
12	Mr.	Oliver	Jung	Polis	Belgium
13	Mr.	Andrej	Klemenc	REC Slovenia	Slovenia
14	Ms.	Maria	Kazmukova	URM	Czech Republic
15	Mr.	Phillipe	Lemeloise	AIRPARIF	France
16	Mrs.	Karine	Leger	AIRPARIF	France
17	Mr.	Benjamin	Lukan	Institute of Public Health - Maribor	Slovenia
18	Mrs.	Synetta	Metelko	Individual researcher	Slovenia
19	Mr.	Tamo	Pauklin	Estonian Enviornmental Research Centre	Estonia
20	Ms.	Delphine	Pernot	Airpairf	France
21	Ms.	Laurence	Rouil	Ineris	France
22	Mr.	Krešimir	Šega	Institute of Medical Research and Occupational Health	Croatia
23	Mr.	Anthony	Ung	Ineris	France
24	Mr.	Sef	van den Elshout	DCMR	The Neetherladnds
25	Mr.	Bart	Wester	DCMR	The Neetherladnds
26	Mr.	John	White	EPA	USA

Introduction to the workshop was made by *Laurence Rouil* (Ineris) who moderated the workshop.

Forecasting air quality is a request expressed both by public and European regulation. Many models are available to forecast air quality, but they are not always easy to use at urban scale. So the challenge for the project is to develop a tool to provide the information of what will happen for today and for tomorrow regarding air quality in cities. Those are key issues of the workshop in question.

So far a methodology has been set up with three levels of complexity. The first level has been applied to four test-cities among the CITEAIR II partners. New test based on the data from other cities will be run to further validate the methodology and consolidate the evaluation stage. Therefore, the level 1 forecast methodology will be ready for the cities who want to implement it for their area.

- *Anthony Ung* (Ineris) presented approach with **three levels of complexity of the CITEAIR methodology on air quality forecast**

Recall of the methodology developed:

- Level 1 :
 - Forecast of the air quality index (the CAQI), for PM₁₀, O₃ and NO₂, background and traffic scales
 - Statistical approach
 - Based on measurement data (provided by the cities) and the Prev'air system outputs. Prev'air is a large scale forecast system, using a deterministic approach. It provides a forecast, available since 2003, for the European and French scales; for D, D+1, D+2; for prevention of exposure, daily broadcast of information through the internet. It uses CHIMERE model and is available for CITEAIR 2 project. Prev'air provides an horizontal and vertical resolution, but for the CITEAIR project, we just use the horizontal data.
- Why do we state that Level 1 is a simplified approach: A deterministic forecast needs meteorological data, full emission inventory, boundary conditions, measuring station data for analysis and validation, so it is very complex. But with the CITEAIR II level 1 forecast, just a set of monitor data and a capacity to analyze them are needed. If any city want to join the forecast, it is easy to implement the level 1.
- The level 2 and 3 are presented during the workshop, but the focus will be on level 1.
- Level 2 :
 - Objective: to produce a forecast map of CAQI over urban areas.
 - Input : Level 1 forecast, Chimere CTM fields, 2D emissions, population, ...
 - Method: Kriging's interpolation of forecast concentrations on a finer grid, with auxiliary variables (emissions, population, ...) as external drift
 - Selection of variables for external drift : Forecast concentration, density of population, emission gridded inventory
- Level 3 :
 - Objective: to forecast CAQI at fine-scale resolution over urban areas.
 - Input : full and local emission
 - Method: high resolution chemistry-transport models (CTMs), using local emission inventories

Question : What is 2D emission for level 2 forecast?

→Level 2 aims at building-up a map of each sub-CAQI of sub pollutant to do the level 2, so you need additional data to spatialize the Sub-CAQI forecasts produced by Level 1. The 2D (i.e. surfacic) emission data will be used – if possible and suitable - as external data to support the interpolation step of Level 2.

- Cecile Honore presented Level the CITEAIR II **Level 1 forecast - concept, accuracy and validation**
 1. general concept
 - recall of the general methodology : statistical forecasting of daily maximum (O₃ and NO₂) and average concentration, at each monitoring station, based on European-wide forecasts, available for D+0 and D+1, and monitoring data for the day before
 - model formulation based on a multi linear equation with predictors that need to be determined and coefficients that need to be computed
 - Model set-up is performed with 2008 data, evaluation is performed with respect to 2009 data



- Performance of the level 1 is studied with respect to observations but also to large scale model forecast. It shows that this forecast is better than the European model forecast.

2. Case study

Example of Seville was presented:

10 station provide data to the COW, with 8 in background situation. NO₂ is measured by all stations, PM10 and O₃ only by some.

SA for D+1 is better than the European approach, but there are still some problem with higher picks.

The model was calibrated with 2008 data and the evaluation is based on 2009 data.

So far for the remaining problems with the picks have not been studied into detail .. It just has been checked into the station data to know if there were no problem. At present the opinion of local person monitoring the data is needed to understand better situations in question.

3. Summary and perspectives

- For Seville background:
 - o Overall improvement for CAQI and CAQI class forecast
 - Better picture in terms of species
 - o No significant difference for O₃
 - o Great improvement for PM10 and NO₂ but...
 - ... Still some problems with high values
- For Rotterdam traffic:
 - o Slight improvement for CAQI and CAQI class forecast
 - Greater improvement for NO₂
 - o Still some problems with species forecast
- Perspectives:
 - o Test the applicability and robustness of this approach to other CITEAIR cities (with the help of CHMI)
 - o Operational implementation within www.airqualitynow.eu

Question: you are developing a very complex approach for forecasting the concentration however the final results with the index is quite simplified. Wouldn't it be easier to only forecast the index ?

→ The goal at the end is to forecast the index. But it is more flexible to forecast the concentrations than to do the index: a new pollutant or a new station can be added without losing the benefits of previous work. The concentration will be available as they are calculated, for example for the planning sanitary measures, for each pollutant, and for each station if the cities want to get them or to calculate them.

Question: is it the predictor (and its amount) the same for Seville and Rotterdam? What about the methodology?

→ At the beginning of the process, the potential predictors are similar from one city to the another, but then the program adjusts the list of predictors selecting those who are better (i.e. that explain the highest amount of variability of the measurement data) for a city.

A user can add other potential predictors to those already included.

For example, complete and simplified methodologies have been developed with a long (with meteorological data) and a short list of predictors. The work that has been carried out shows that the results are still satisfying for the short list of predictors.

Question: is it fine tune for the traffic and background situation?

→ The selection of predictors must be done at the beginning for the traffic and the background situation.

Question: wouldn't be simpler to separate Europe in for example 4 zones, and then to have 4 lists of predictor similar for every cities in ?

We would lose precision. It is better to have a tuning of the forecast for each city. Moreover, this tuning is automatic.

- Anthony Ung presented **the application of the Level 1 forecast - Practical steps and advantages of the application in European cities**

First 4 cities partners in the project, and then involvement of 10 others cities.

To be involved in the forecast, a city only needs to deliver its data for 2008 and 2009 formatted, then the SA model will be run by the CITEAIR partners (INERIS). The validation needs to be done by the cities, with the help of the CITEAIR partners.

Three alternatives for application into the COW: the cities can choose to use the tools developed within CITEAIR II, or they can choose to deliver their own forecast:

- Forecast based on the developed tools:
 - o 2008 and 2009 formatted data (city in charge)



- Set-up of the SA models (CITEAIR II partners in charge)
- SA models validation (city in charge; assistance from CITEAIR II based on guidebook)
- CITEAIR II Guidebook will include advice to support validation
- Based on the developed tools, **a city operates the forecast themselves**
 - Handover of the tools from CITEAIR to the city
 - Signature of a license agreement
 - Advantage: Possibility to use specific predictors, own model output...
 - But need to operate the tools by the city!
 - A city delivers their own forecast to www.airqualitynow.eu

For the list of tools needed: see presentation

Practical steps:

- 1) put the list of stations to the right format
- 2) get the measurements at the right format
- 3) Launch of CHIMERE twice because 2 years are needed.

Question : how often the CHIMERE model will change ?

→ For the CHIMERE model used for CITEAIR II are on a 50kmx50km grid, but there is already model outputs on 25kmx25km grid. The model changes regularly, and an update of the SA models is then necessary.

Question: Is the goal a single forecast at a city level or is it a forecast for background and a forecast for a traffic mix ?

→ There should be two forecasts: one for background index and one for traffic index.

Question : How the forecast will be provided for the cities that want to apply it ?

→ Under option 1 (see here above), the tools will be implemented on the CITEAIR website, however the validation work still needs to be done by the city. No special skills are therefore needed for the cities. The results will be made available through a ftp server by private access.

Question : during a previous presentation during the workshop, it has been shown that the forecast will be available on the COW website, but what if the cities want the concentration data forecast ?

→ During the validation phase the concentration forecasted could be send to the cities through a FTP area. It is something that we didn't think before, but it can be imagined that those information on forecasted concentrations will be provided not only during the validation phase.

At the end of the workshop Ms. Laurance Rouil turned to participants and asked whether cities are interested to use the presented forecasting system, based on one of the approaches. No firm answer has been provided so far, however some participants confirmed their preparedness to take a more detailed look into details on what has been presented on the workshop and evaluate whether it is better for them to adopt the forecast in question or to keep on using their old one.

The discussion that followed brought to evidence that ARMAAG and VITO have their own forecast systems. ARMAAG uses CMAQ model forecasts and VITO uses a neural network approach, with PBL height and PM10 as predictors for PM10 forecasts.

The discussion also showed that consultation process has been launched: some cities have been contacted to know if they want to participate to the phase where the forecast is tested.

Nota Bene: a city can test this approach even if it has its own forecast system. It can decide afterwards which forecast will be displayed on airqualitynow web site.

It was concluded that the CITEAIR II guidebook will include the description of the method, the tools, the validation process.

The methodology presented is also applicable for a city that has another CTM than Prev'air. It will just need to be adjusted.

The workshop was finished at 15:45.

Based on the notes written by Delphine Pernot made by

Andrej Klemenc

Ljubljana, July 10 2010



European Union
European Regional Development Fund

