



Evaluating the Efficiency of Emergency Measures

taken to reduce or mitigate air pollution episodes in urban areas

Supervisor

Adrien BOUZONVILLE

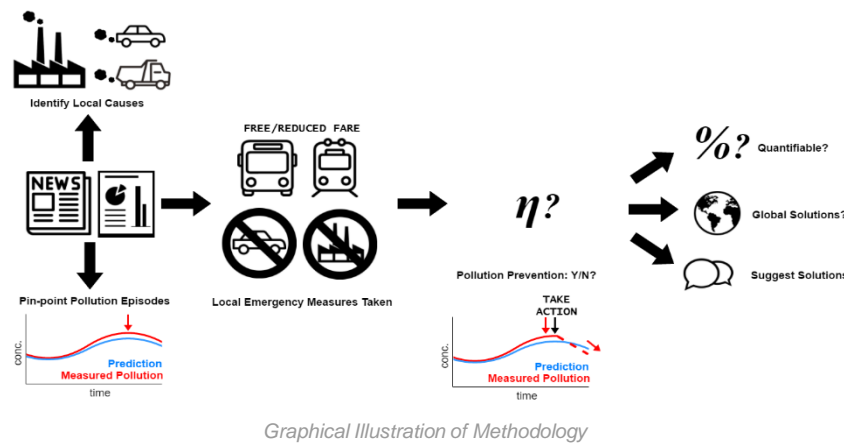
Authors

Alena KENGCHON
Raja Sekhar GUTHI
Yoann KIBLER
Altafur RAHMAN

Context and Position of the Project

Air Pollution Risks in Urban Areas

- ▶ **A big environmental risk to health:** WHO estimates air pollution causes annual 3 million premature deaths
- ▶ **Peak pollution episodes:** Certain weather conditions favour accumulation of pollutant concentrations
- ▶ **Prediction:** Air quality forecasts are done using dispersion models that take into account weather forecasts and pollutant emissions
- ▶ **Emergency Measures:** Cities take measures to reduce pollution by measures such as offering free public transport, imposing speed limits, enforcing alternate plate number driving)
- ▶ **Communication and Implementation:** Measures are often communicated through local media and enforced by threatening fines on users violating rules



Graphical Illustration of Methodology

Scientific Methodology

Open Access Data & Analysis

- ▶ **Media Review:** Archives of news searched to investigate details of peak pollution episodes and the emergency measures taken
- ▶ **Concerned Pollutants:** The link between target pollutant and its sources
- ▶ **Concentrations Time Series:** Pollutant concentrations are measured, reported in and validated. These are collected for analysis.
- ▶ **Weather Data:** Temperature and wind speed have the biggest influences on peak pollution episodes. Historical weather data of the location is gathered.
- ▶ **Data Analysis:** Collected data is carefully analyzed.

Results and Conclusion

Evaluation of the Measures

- ▶ **Brussels: 12 March 2014**
High PM10 (> 70 µg/m³ for 4 days) observed due to low pressure conditions.
- ▶ **Limited speed to 50 km/hr:** Resulted in 5% increase in PM10 concentrations on the first day, and 7% drop the second day, during which wind speed remained low and constant.
- ▶ **End of the Episode:** Third day of the measure, wind speed increased 4 times, and PM10 concentrations dropped 47%. The emergency measure was hence considered ineffective.
- ▶ **Paris: 17 March 2014**
High PM10 (>80 µg/m³ for 4 days) observed due to temperature inversion and low wind speed.
- ▶ **Free Transportation:** implemented during the episode (5-17 March) but was not sufficient to stem the increase of PM10 level
- ▶ **17 March Alternate Number Plate Traffic:** one day after, coupled with increased wind speed, 4% decrease in PM10 emission was observed. Both emergency measures can be considered ineffective.
- ▶ **Bay Area, California: 19 June 2008; 29-30 August 2007 (1 event); 22-23, 26 June & 17, 20-21 July 2006 (4 events)**
High Ozone AQI Level (> 100) (>70 O₃ 8hr avg ppb)
- ▶ **Precursors:** NO_x and VOCs, mainly from motorized vehicles and also households. UV light contributes.
- ▶ **Free Transportation Days:** on the first day of 5 out of 6 events, all coincided with reduced temperature and increased wind speed, ozone concentration drop were observed (15-50%). The unsuccessful FTD was coupled with increased temperature and decreased wind speed. Two consecutive FTDs were generally more effective.

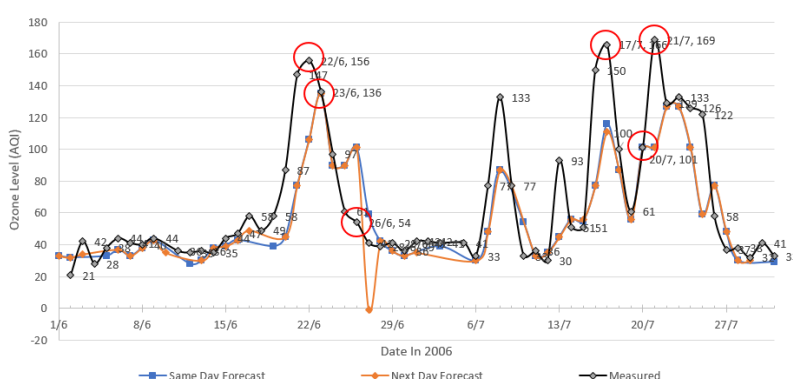
Conclusions

- ▶ Changes in weather conditions (increased wind speed, decreased temperature) had more significant impact on pollution concentration than emergency measures.
- ▶ Several measures also were implemented too late.
- ▶ The emergency measures were considered ineffective.

References

- ▶ AirNow, 2008a. CA forecasted data 2006-2008 | AirNow, 2008b. Daily AQI by county: California Contra Costa 2006-2008 | Airparif, 2014. Bilan de l'épisode de pollution et de la circulation alternée | NOAA, 2008. Normals Daily from station Concord Buchanan Field CA US | SudInfo, 2014. Pics de pollution (SMOG) sur la Belgique: la vitesse sera limitée ce jeudi et vendredi | WHO, 2016. Ambient (outdoor) air quality and health fact sheet
- ▶ **Picture Credit:** Pollution event in Paris D161208 - Eiffel tower from Montmartre.jpg: Tangopaso
Derivative work: Mariordo

Concord June-July 2006 Forecasts-Measured Values of Ozone Level



Examples of a Study of Measured Air Pollution, Forecasted Pollution, Temperature Range, and Wind Speed

Concord June-July 2006 Measured Values of Ozone Level with Maximum-Minimum Temperature and Average Wind Speed

