Development of a Healthy Urban Route Planner for cyclists and pedestrians in Amsterdam

Gert-Jan Steeneveld, Corné Vreugdenhil, Michiel van der Molen, Arend Ligtenberg
1: Meteorology and Air Quality Section, 2: Laboratory of Geo-information

Background

Cities are typically several degrees warmer than the countryside, especially during hot summer days. The frecuency of hot spells are foreseen to increase by climate change (Molenaar et al 2016). Contrasting urban morphology provides a temperature variation between neighborhoods. At the same time, citizens are subject to spatiotemporally varying air pollution concentration due to intense motorised traffic.

Objective

This study develops a route planner for pedestrians, runners and cyclists for finding the most healthy route between their departure and destination (minimum urban heat and air polluton concentrations)

Methods

The Weather Research and Forecasting model at a novel 100 m spatial resolution is used for forecasting weather and air quality in Amsterdam. (Ronda et al, 2017) WRF is fed with high resolution land use data and pollution emissions from the TNO-MACC database and traffic counts (Fig.1). The route planner uses OpenStreetMap data, the open source pgRouting, enabling geospatial routing. The model computes (using PGrouting in PostGIS, with network data stored in the database in PostgreSQL) at that moment the best route. The most healthy route is calculated according to the Dijkstra (1959) algorithm, where the air pollution and temperature are taken as the cost variable to minimize.

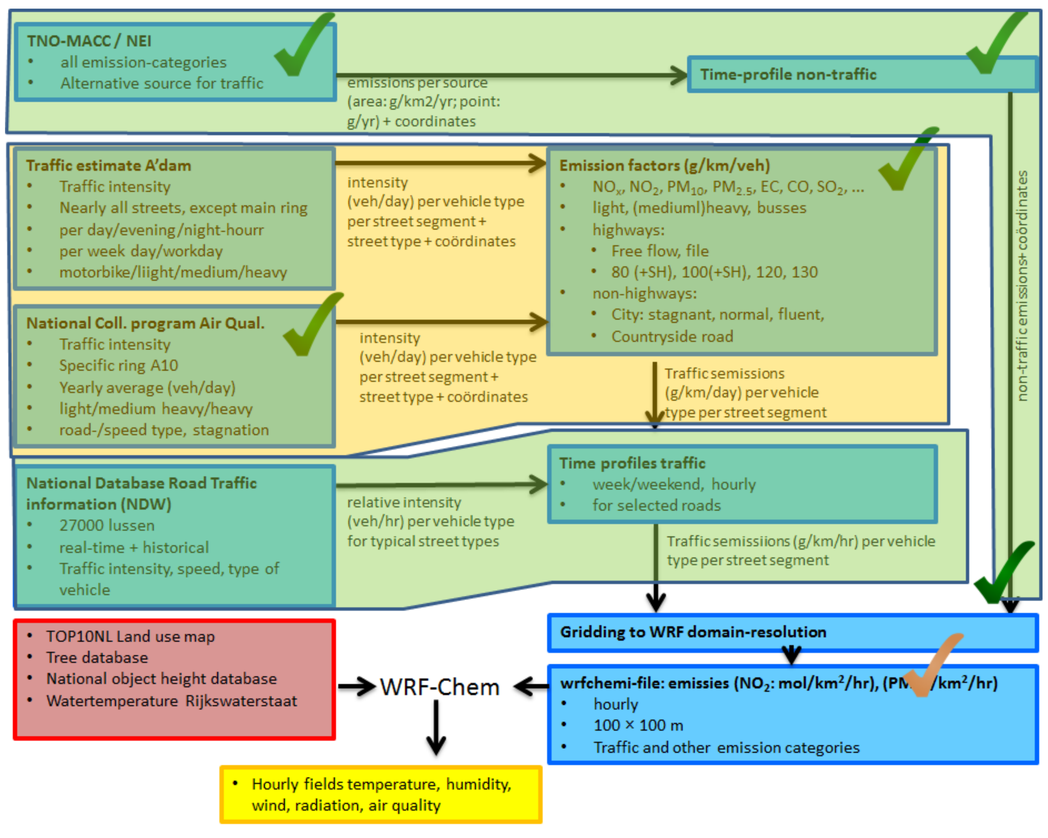
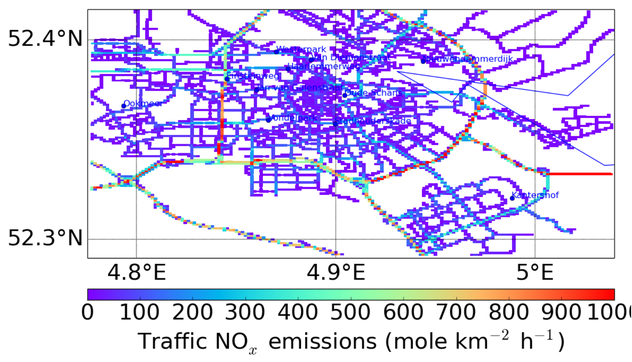


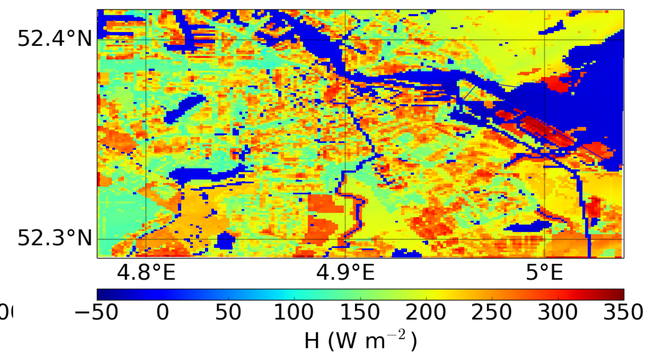
Figure 1. Organization of the NO_x and heat emission fields into WRF-Chem

Results

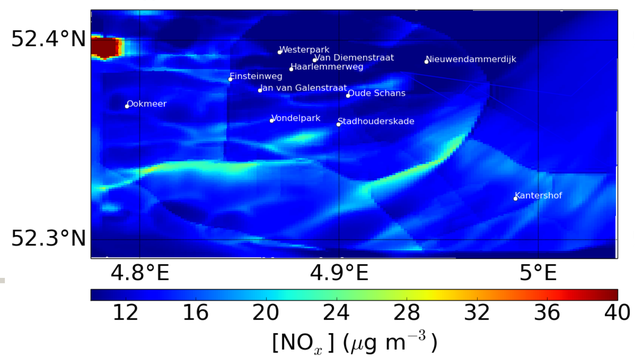
NO_x Emissions



Sensible heat flux



NO_x Concentrations



Temperature 2 m

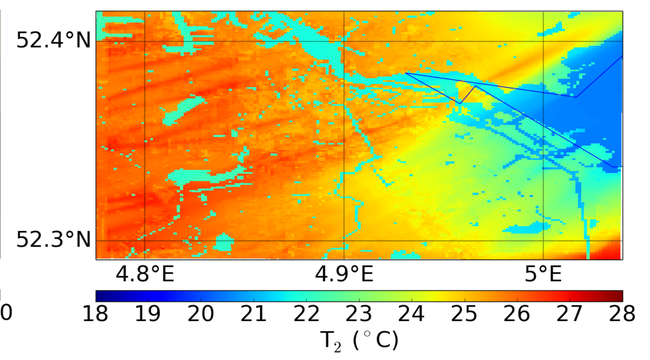
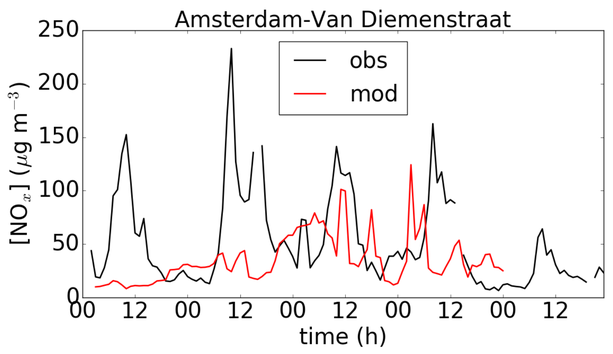


Figure 2. Top: Modelled emissions of NO_x and sensible heat flux for Amsterdam area. Bottom: Resulting fields of NO_x concentration and 2-m Temperature. Model results valid for a heat wave episode 30 June 2015 11:00 (NO_x) and 14:00 (T_2)

Validation



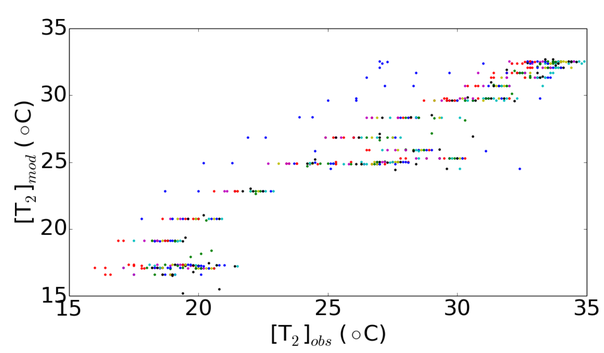


Figure 3. Validation of NO_x concentration and 2m Temperature using locally observed data.

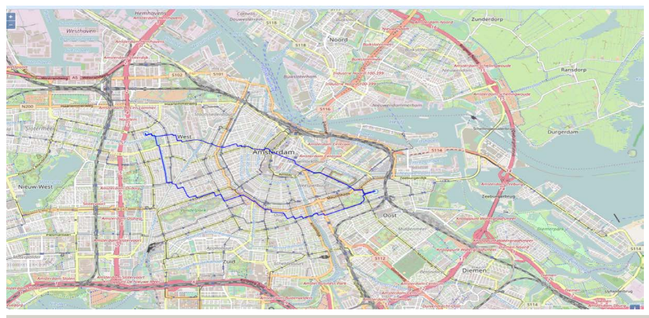


Figure 4. An example for a route planning system for Amsterdam for the shortest or fastest route. The most healthy route will be added.

Conclusion

- High resolution forecasting of urban weather and air quality provides essential data for healthy route planners for urban commuters and an opportunity for minimizing individual exposure.

References

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Wageningen University & Research
P.O. Box 47, 6700 AA Wageningen
Contact: gert-jan.steeneveld@wur.nl
T + 31 (0)317 48 38 39
www.wur.nl/maq