OZONE DEPOSITION OVER A MIXED SUBURBAN FOREST

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- ## Introduction

We analysed a 10-yr halfhourly O_3 flux dataset, obtained by applying the gradient method. A correlative data-analysis on monthly basis was performed to explore new site-specific relations between the O_3 deposition and measured environmental variables.

- ## Location

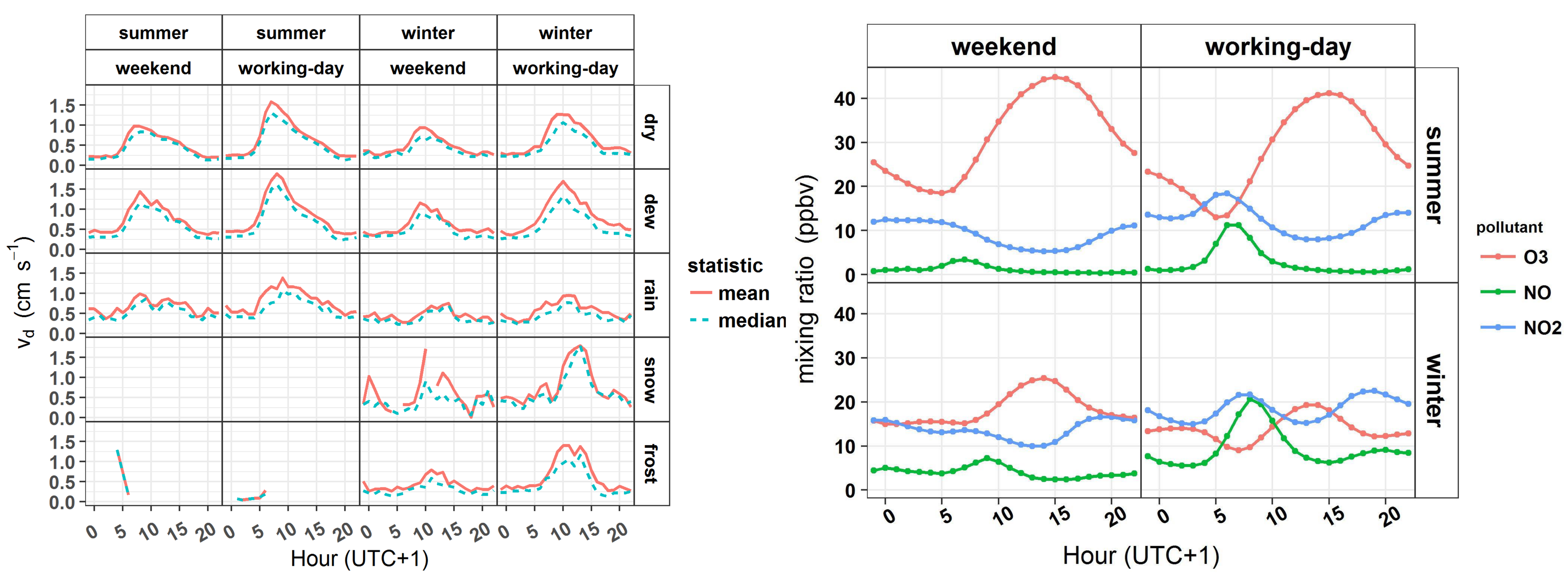
The forest under investigation is a suburban mixed forest (forest cover of ± 3 km^2), which is situated in the deposition plume from the petrochemical refinery and industry from the port of Antwerp (Fig.). Prevalent southwesterly winds blow air masses containing SO_2, NO_x, soot over forests and heathlands downwind of the port. Also the presence of suburban traffic and the adjacent E19 highway constitute important NO_x emitting sources in the immediate proximity of the forest.

Figure: location of the forest measuring site nearby Antwerp and wind rose

- ## Material and methods

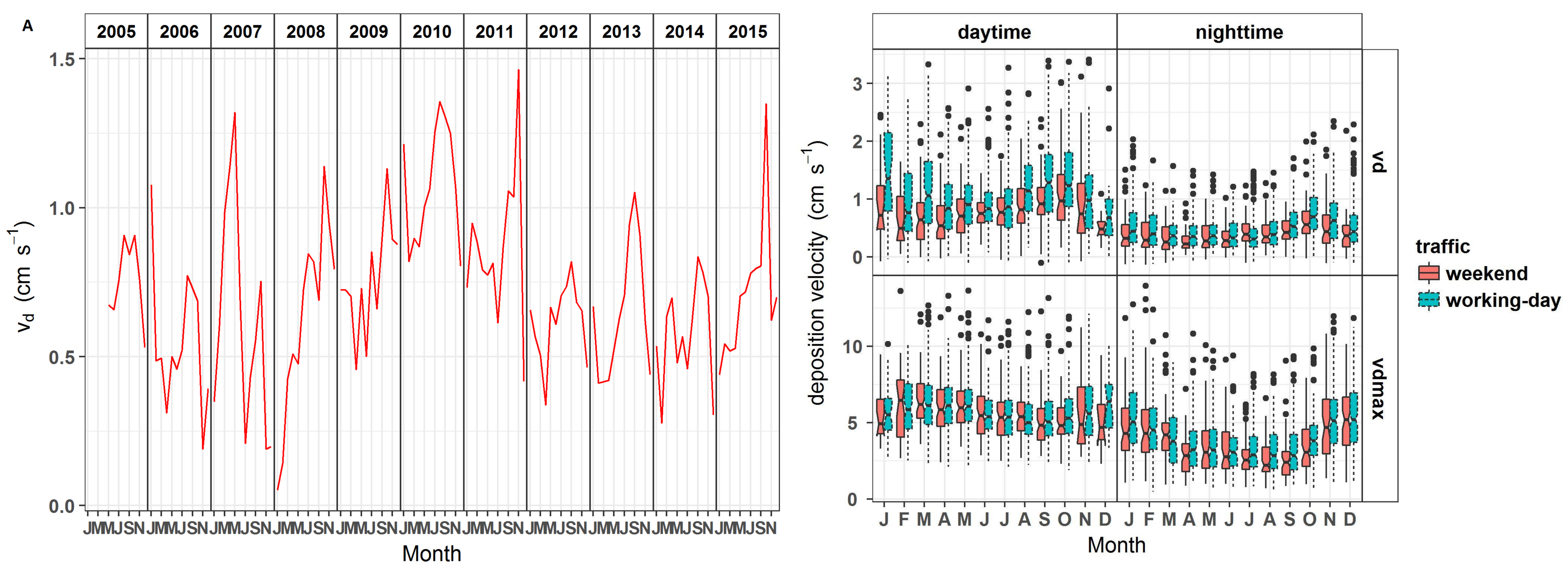
A 40m high welded scaffold tower is situated in a 2 ha Scots pine (Pinus sylvestris *L.*) stand, with a tree height of 21 m. Other Scots pine and oak stands can be found in the close vicinity of the measurement tower or in more remote patches. Ozone concentrations from two inlets above the canopy have been measured using a UV Photometric Analyser (model TEI 49C followed by model TEI49I). Gaseous NOx (NO + NO_2) concentrations have been analysed with a chemiluminescence monitor (CLD700 AL, Ecophysics, Switzerland).

- ## Results and conclusions



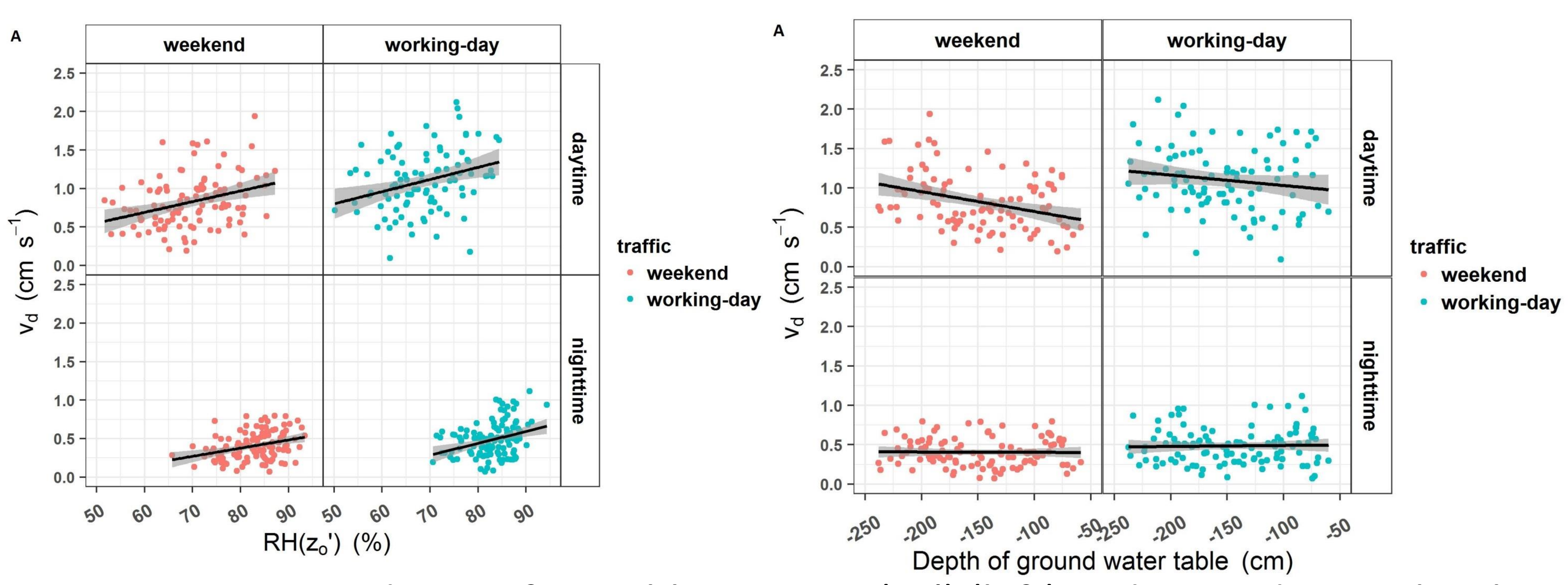
Figures: Diurnal course of halfhourly υ_d (left) and polluant concentrations (right)

Halfhourly υ_d is dependent on canopy wetness but also on traffic volume (upper left figure). Higher υ_d are measured during the working week, which is the result of lower measured O_3 (working-week effect, upper right figure) and higher fluxes (which are affected due to flux divergence in the O_3-NO-NO_2 triad)



Figures: Time series of monthly υ_d (left) and annual pattern of daily υ_d for weekend and working-days during day/nighttime (right)

Monthly υ_d are highly variable and can reach values up to 1.5 cm s^{-1} during spring (2007) or summer (2010) (left middle figure). Higher monthly υ_d are measured during daytime and towards autumn (right middle figure), which is not due to turbulence, but caused by higher relative humidity (RH(zo')), better conditions for soil uptake (low ground water level, low LAI) along with a higher chemical proclivity (leaf senescence). Traffic increases daytime υ_d particularly during the winter half-year.



Figures: Dependence of monthly υ_d on RH(zo') (left) and ground water level (right) for weekend and working-days during day/nighttime (right)

Results of an analysis of covariance revealed the significant impact of traffic volume, relative humidity (positive correlation, p < 0.0001, see left lower figure) and level of ground water table (negative correlation, $p = 0.0016$, see right lower figure) on monthly υ_d. Impact of traffic was more explicit during the daytime analysis, where traffic volume increased the υ_d by 0.3 cm s^{-1} ($p < 0.0001$).

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