

THE IMPACT OF WEATHER ON AIR QUALITY

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Introduction

Kilingi-Nõmme is the town with population of 1671 (2018) and area 4,26 km².
Coordinates: 58°08'59"N
24°57'41"E (Figure 1).



Figure 1. Study site location.

The purpose of the project

The purpose of the study is to identify relations between the concentration of black carbon in the air and weather parameters (current temperature, relative humidity, barometric pressure, precipitation).

Research questions

- Which weather parameters affect the concentration of black carbon in the air?
- Which seasonal differences can be identified in black carbon concentration?

Hypotheses

- Temperature affects black carbon concentration in the air the most.
- There is less black carbon in the air during the warm season compared to the cold season.

Air quality standards in the European Union

Table 1. 24-Hour PM_{2.5} Standard (µg/m³).

PM _{2.5}	Air quality
0-12,0	Good
12,1-35,4	Moderate
35,5-55,4	Unhealthy for sensitive groups
55,5-150,4	Unhealthy
150,5-250,4	Very unhealthy

Methods

Data collection methods

- Daily atmospheric measurements (Figure 2):
 - ✓ current temperature (°C)
 - ✓ precipitation (mm)
 - ✓ relative humidity (%)
 - ✓ air pressure (mb)
- Daily measurements of the concentration of black carbon (ng/m³):
 - ✓ 14 measurement periods (Figure 5 and 6)
 - ✓ 14 days during each period
 - ✓ time 8:05-8:45



Figure 2. Weather measurements.

Data Analysis

- Descriptive statistics
- Correlation analysis

Semi-structured interview (Figure 3)



Figure 3. Interview.

Factors, which affect our air quality

- Local heating systems
- Burning trash / bonfires (Figure 4)
- Old air heat pumps
- Old vehicles
- Forest fires
- Weather



Figure 4. Bonfires.

Results

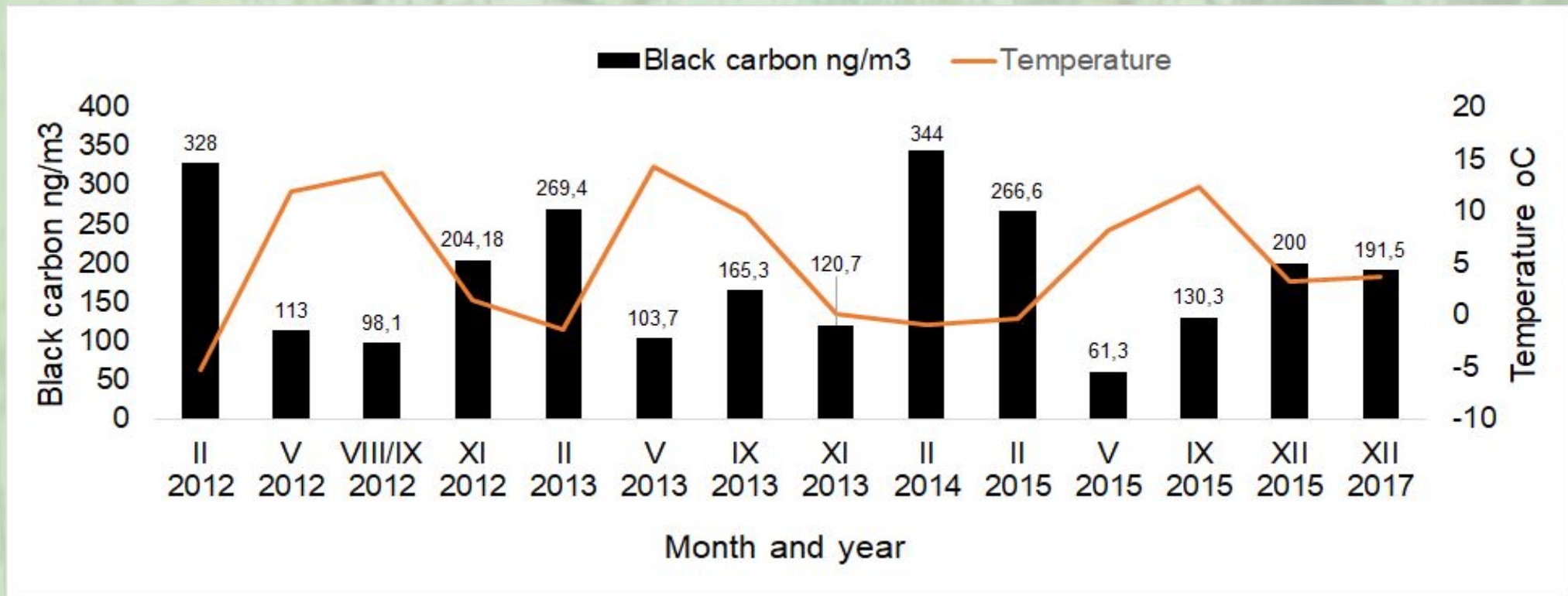


Figure 5. The concentration of black carbon and current temperature.

The correlation between the air temperature and the concentration of black carbon is negative (-0,52).

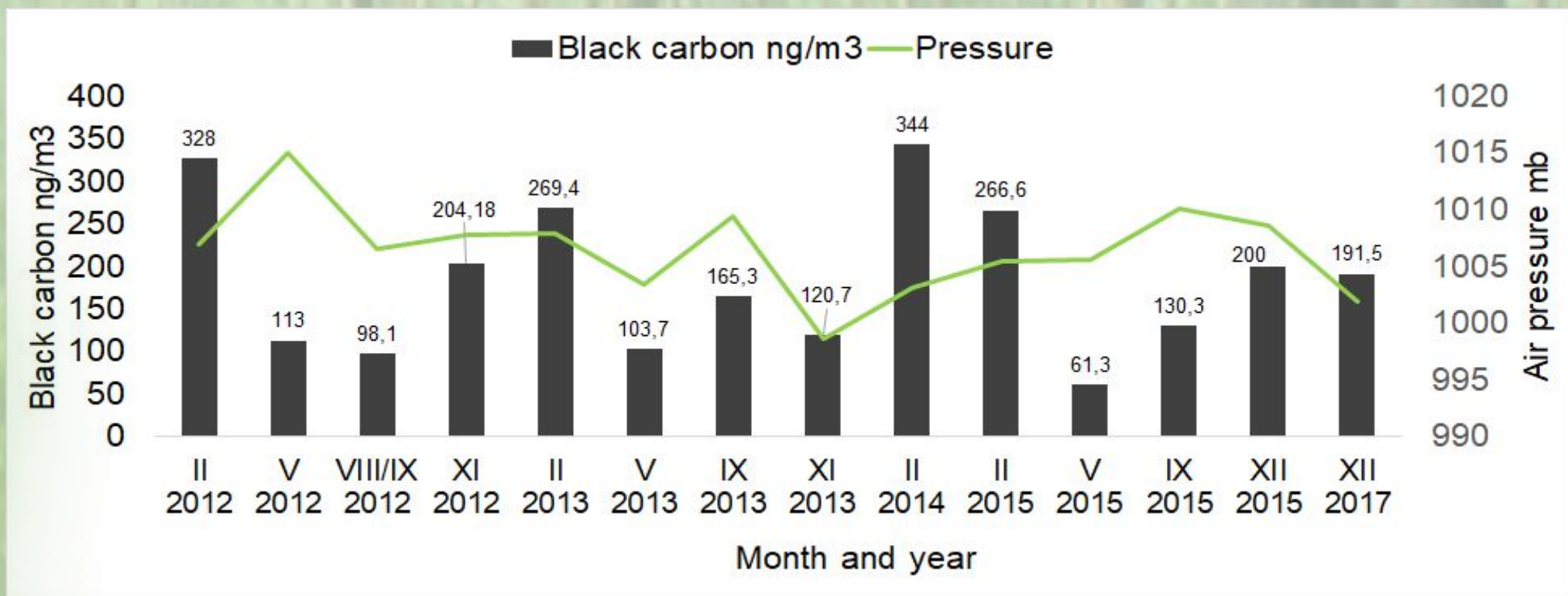


Figure 6. The concentration of black carbon and barometric pressure.

The correlation between the barometric air pressure and black carbon concentration is positive (0,2).

Table 2. Black carbon concentration, PM_{2.5} (particulate matter) and air quality in Kilingi-Nõmme 2012-2017.

Month	II	V	IX	XI	Average of all measurements
Black carbon concentration 24-hour µg/m³	0,30	0,10	0,13	0,14	0,17
PM _{2.5} 24-hour µg/m³	2,4-7,2	0,8-2,8	1,1-3,3	1,1-3,3	1,3-4,0

- There is no correlation between the relative humidity and black carbon concentration in the air.
- There is no correlation between the precipitation and the concentration of black carbon in the air.
- PM_{2.5} can be considered good throughout the year. The value is lowest (the best quality) in May and highest in February (Table 1 and 2).

Conclusions

- Air temperature and relative humidity affect the concentration of black carbon the air.
- The concentration of black carbon is the highest in February and lowest in May.
- Compared to the norms in EU the concentration of black carbon is low throughout the whole year and the air quality is good.

References

http://dspace.ut.ee/bitstream/handle/10062/32741/ketlin_reis.pdf
<http://airindex.eea.europa.eu/>
<https://www.epa.gov/>

