

Black carbon concentration at an inland area in Korea

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Introduction

- Korea has been suffered from Yellow Dust coming from the west during the spring season and PM2.5 transported from the west even during the winter season, so that the air pollution is ubiquitous at any time.
- We used a Multi Angle Absorption Photometer(MAAP) to evaluate the BC concentration at an inland area, more specifically Byeongcheon, Cheonan, Korea.
- In this study, the ambient BC concentration of the inland rural area has been monitored for approximately 18 months (Apr. - Sep, 2012 & Sep, 2014 – May, 2015).

Motivation

- Black carbon(BC) has been studied for many years in the atmospheric sciences community since it was known to act as a positive radiative forcing (Andrea, 2000).
- Not only the environmental implication but also the effects of particles on illness (Nel, 2005) creates necessity for the research of the BC, which is prevalent in the ambient aerosol due to the soot generated in sources such as diesel engines.

Method & Experiment

BC measurement



- The BC concentration was measured by the MAAP(Multi Angle Absorption Photometer, Thermo Scientific, 2012).
- Data was recorded every 1 minute and ordered from 00:00 to 23:59 each day.
- We separated the weekday data and weekend data for each month.
- After separation, the data ordered from 00:00 to 23:59 was arithmetically averaged every minute for weekdays and weekends respectively by C# program.

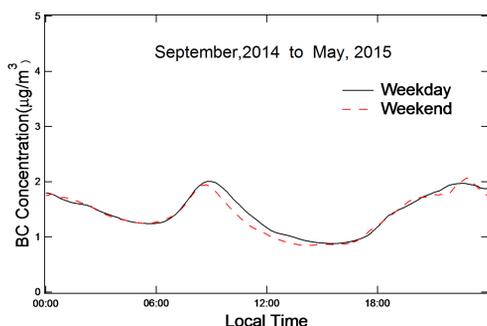
Geographical condition near the monitoring site



- BC concentration was monitored at the KOREATECH (Korea University of Technology and Education) located in Byeongcheon, Cheonan, Korea.
- The monitoring site is surrounded by rice fields, 2-lane road, stream flows and a factory where automotive brake pads are mass produced.
- As a result, the monitoring site represents the combination of rural characteristics and urban characteristics.

Result & Discussion

Diurnal patterns of BC concentration

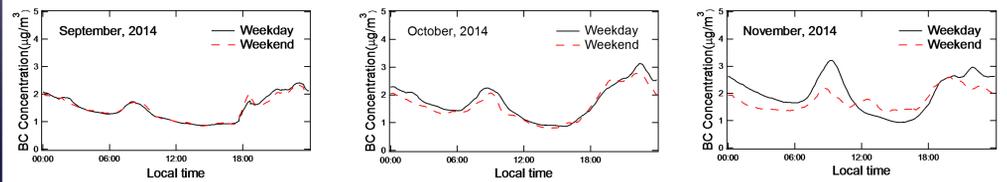


- The decrease between midnight and 6:00 seems probably due to the reduced traffic and the fact that the mixing height is constantly maintained.
- The increase from 6:00 to 8:30 is thought to be influenced by the morning rush hour, and the increase after 18:00 to 21:00 is also affected by the evening rush hour.

- These BC concentration values are comparable to those measured at metropolitan cities such as London and Barcelona (Reche et al., 2011).
- The increase in the BC concentration during the morning rush hour and the evening rush hour ought to be results from road traffic emissions.

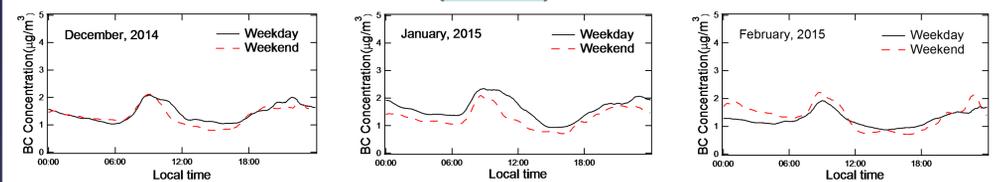
The diurnal variations of the BC concentration by season, 2014 & 2015

Autumn



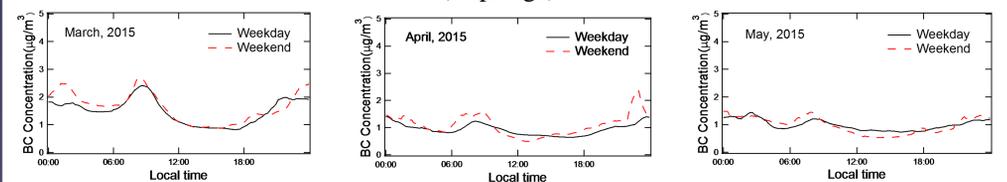
- The increase from 6:00 to 8:30 is thought to be influenced by the morning rush hour, and the increase after 18:00 to 21:00 is also affected by the evening rush hour.
- Especially, the BC concentration during the morning rush hour in November was measured to be higher than that in September and October because of various events on campus.
- The high BC after midnight might be caused by the night traffic population and low mixing height.

Winter



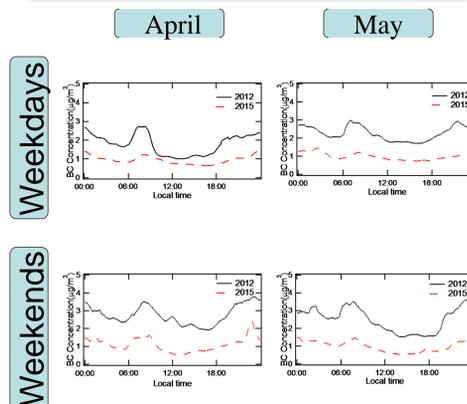
- The diurnal variations of BC concentration were in very similar pattern each other because of similar temperature and rainfall.
- The BC concentration in winter was measured to be lower than that in autumn because of low temperature and atmospheric turbulent mixing by stronger wind.

Spring

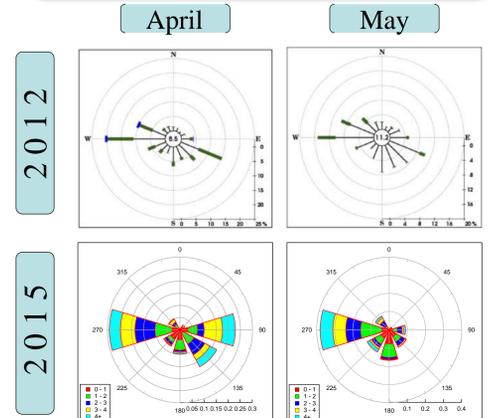


- The diurnal variation of the BC concentration for March is different from that for April and May because of increased traffic density caused by the start of a new school semester.
- No distinct difference between weekdays and weekends was found in May, resulting from typical windy season and intermittent rains.

Comparison of BC concentration between 2012 & 2015



Wind rose, 2012 & 2015



- Generally, the BC concentration was measured to be higher in 2012 than in 2015.

Summary

- BC concentration in an inland area was monitored for 18 months and the pattern of diurnal variation was found to be similar to those measured in urban areas.
- The BC concentration averaged for 9 months shows similar patterns between weekdays and weekends.
- On weekdays, BC concentrations were definitely influenced by traffic density, adjacent factory, biomass burning, and burning of straw pile at farming fields.
- On weekends, the diurnal patterns of BC concentration were presumably influenced by several factors including pollutants from the adjacent factory, biomass burning, burning of straw pile at farming fields.

References

Andreae, 2001, Nature; Kwon et al., 2013, AAQ; Jarvi et al., 2007, ACPD; Nel, 2005, Science;

Acknowledgements

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