

# Size – segregated organic/ inorganic composition of particulate emissions in periods of extensive biomass burning

E.Kireeva<sup>1</sup>, O. Popovicheva<sup>1</sup>, Dac Loc Nguyen<sup>2</sup>, Xuan Anh Nguyen<sup>2</sup>

<sup>1</sup> Institute of Nuclear Physics, Moscow State University;

<sup>2</sup> Institute of Geophysics - Vietnam Academy of Science and Technology, Ha Noi, Vietnam

e-mail: elenakireeva2@gmail.com

## Abstract

Aerosols significantly impact the regional environment, including climate change, specifically in periods of extensive biomass burning (BB). Emissions and properties of BB aerosols are highly source-dependent, depending on burning practice, combustion phase (open flaming vs. smoldering), and type of biomass. Quantification of BB emissions is in the focus of current research and abatement strategies, especially given that the impacts of BB on regional air quality in highly populated areas are remaining rather uncertain.

This work reports the measurements during the dry season of 2013 in Son La Province, northwest Vietnam, and of 2015 in Ba Vi Province, Central Vietnam. We focus on physico-chemical properties of aerosols, affected by biomass burning activities from agricultural and domestic combustion sources. The characterization of near-source emissions from traditional burning activities (on-field burning and domestic cooking) as well as traffic emission is specifically conducted in order to identify the major functional groups in ambient smoke.

## Sampling

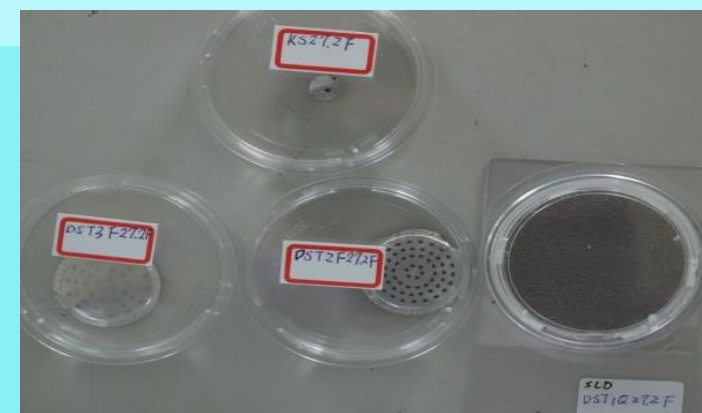
### Dekati 3 stage cascade impactor PM10



- ✓ Sizes: PM 2.5
- ✓ PM 1-2.5
- ✓ PM 2.5-1

#### PM 2.5 mass concentration:

- ✓ Low smoke: PM 2.5 < 40 ug/m<sup>3</sup>
- ✓ Moderate smoke: 40 ug/m<sup>3</sup> < PM2.5 < 80 ug/m<sup>3</sup>
- ✓ High smoke: PM 2.5 > 80 ug/m<sup>3</sup>



### MiniVol



## Organic/inorganic content by FTIR spectroscopy



### Shimadzu IR Prestige-21

Comparative analysis of particle organic/inorganic composition is carried out by Fourier Transform IR (FTIR) spectroscopy

- ✓ Mode: **DRS**
- ✓ Resolution: 4 cm<sup>-1</sup>
- ✓ Number of scan: 100
- ✓ Background: Atmosphere

## Assessment of biomass burning and traffic sources

### ✓ On- field activities, Son La Province 2013

Burning of piled crop residues



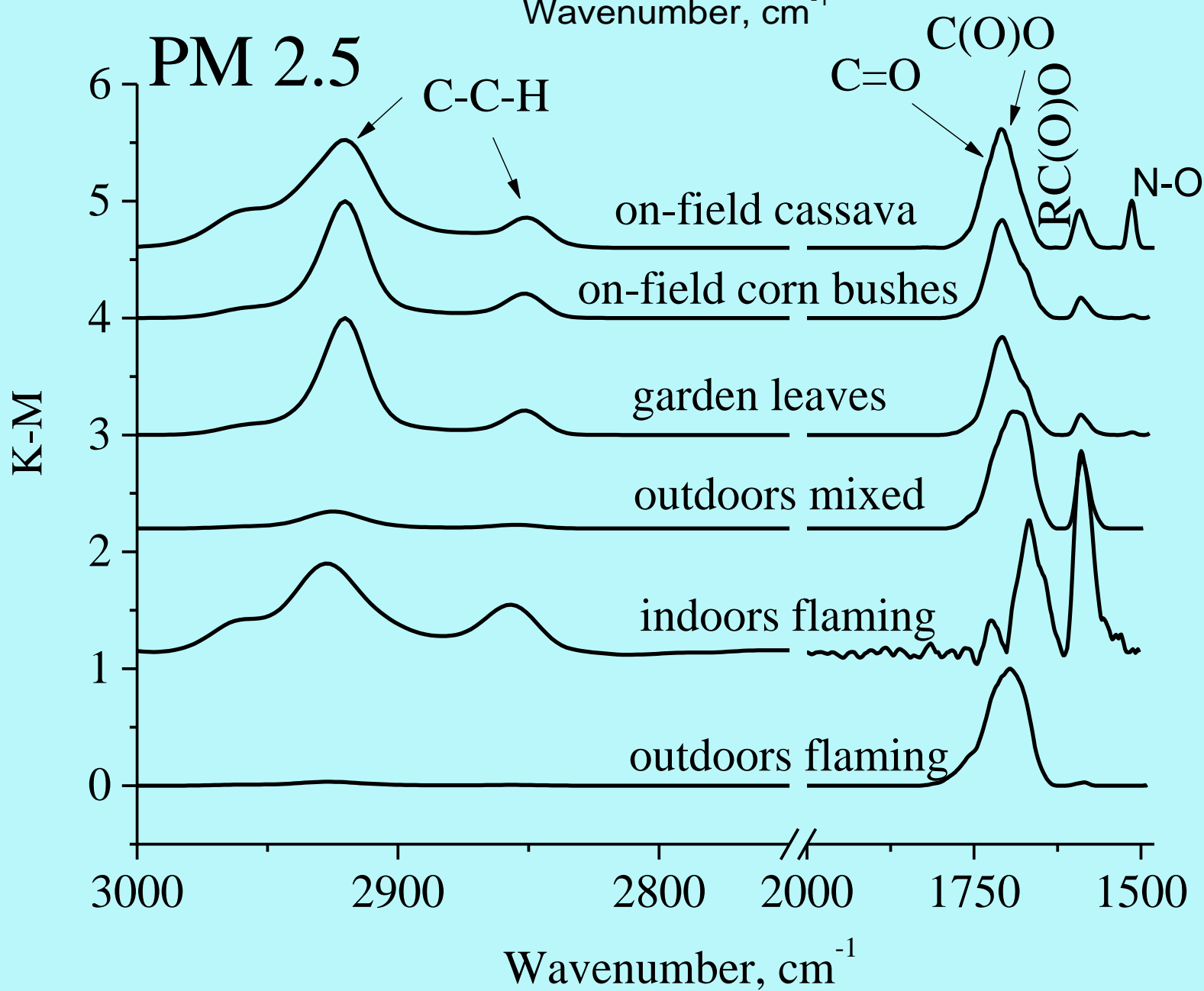
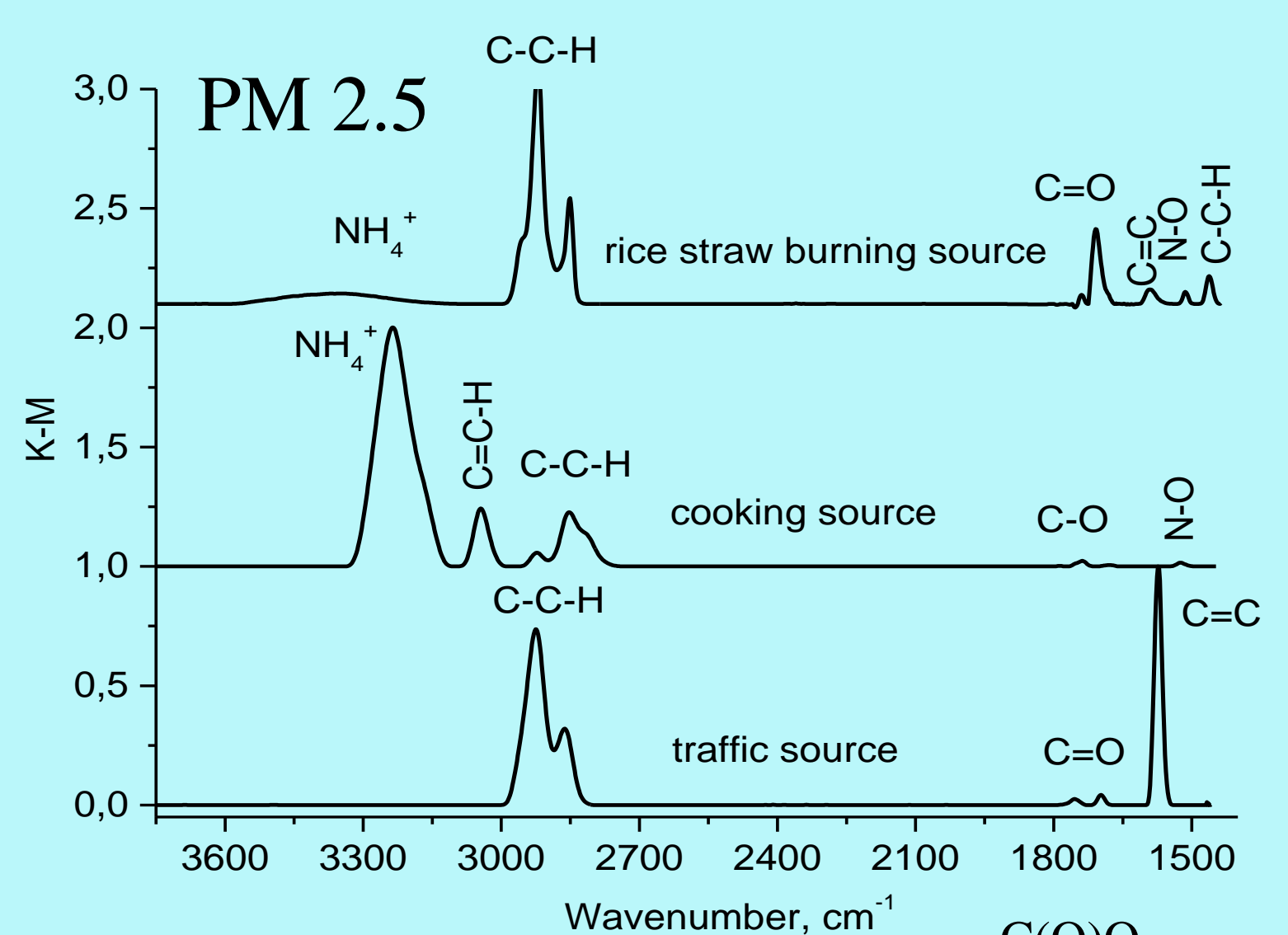
### ✓ Cooking activities, Son La Province 2013

Burnt types: typical wood logs gathered near mountain



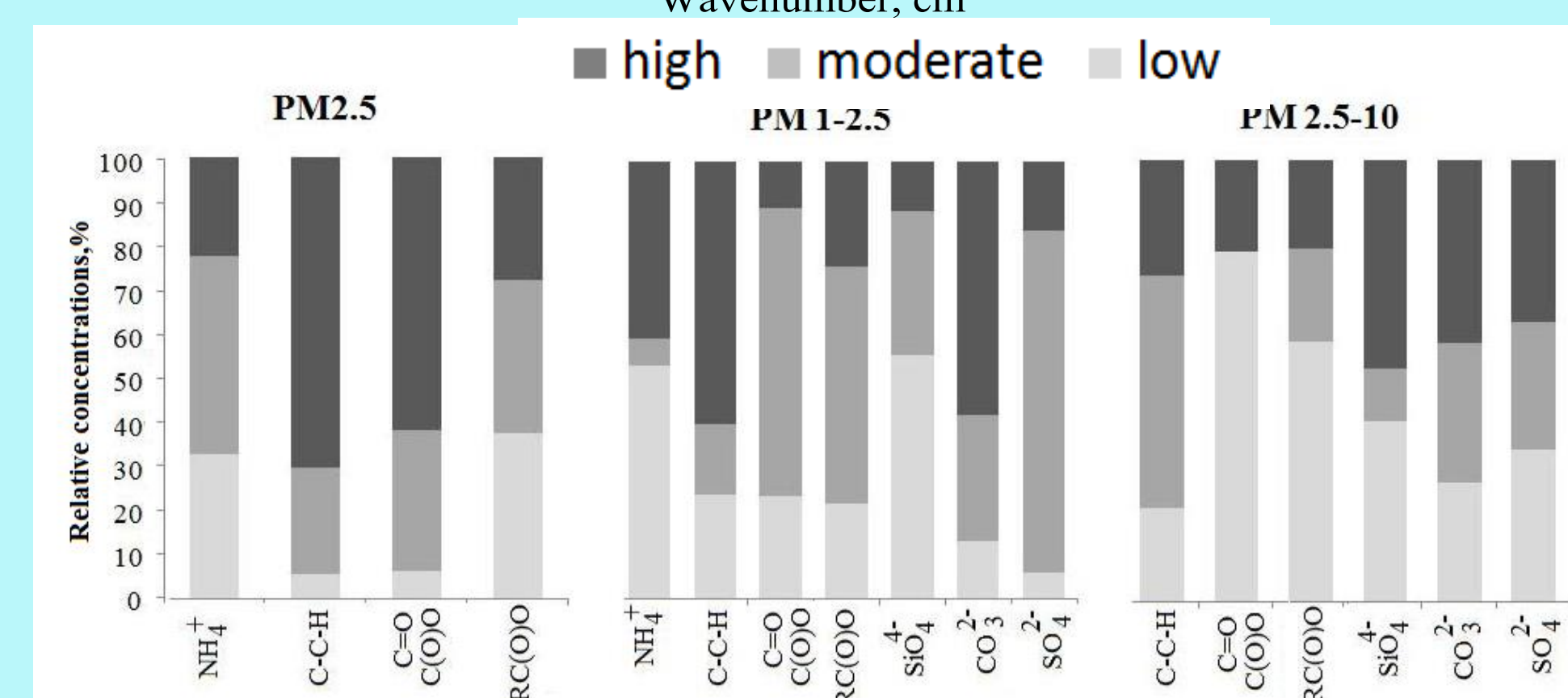
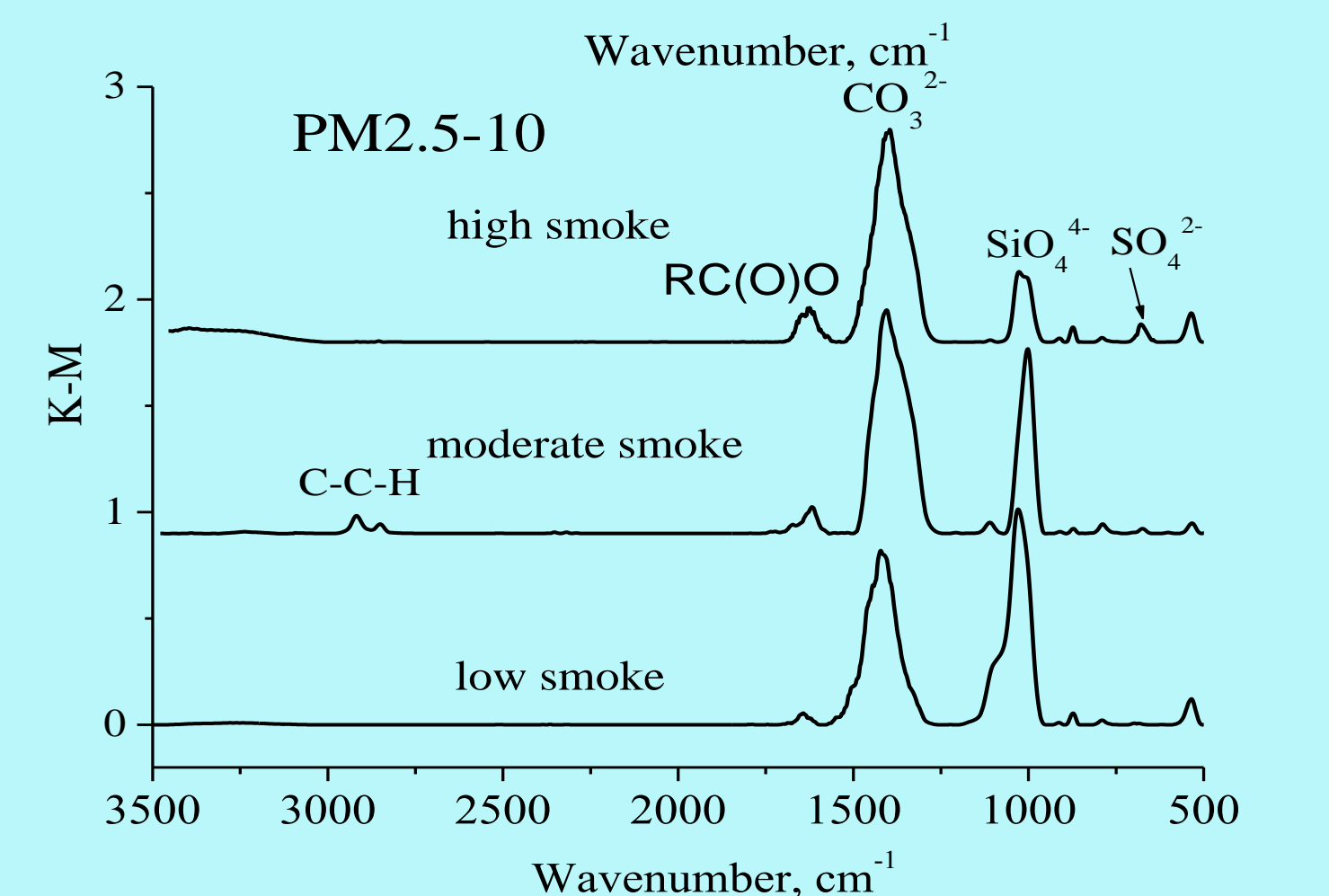
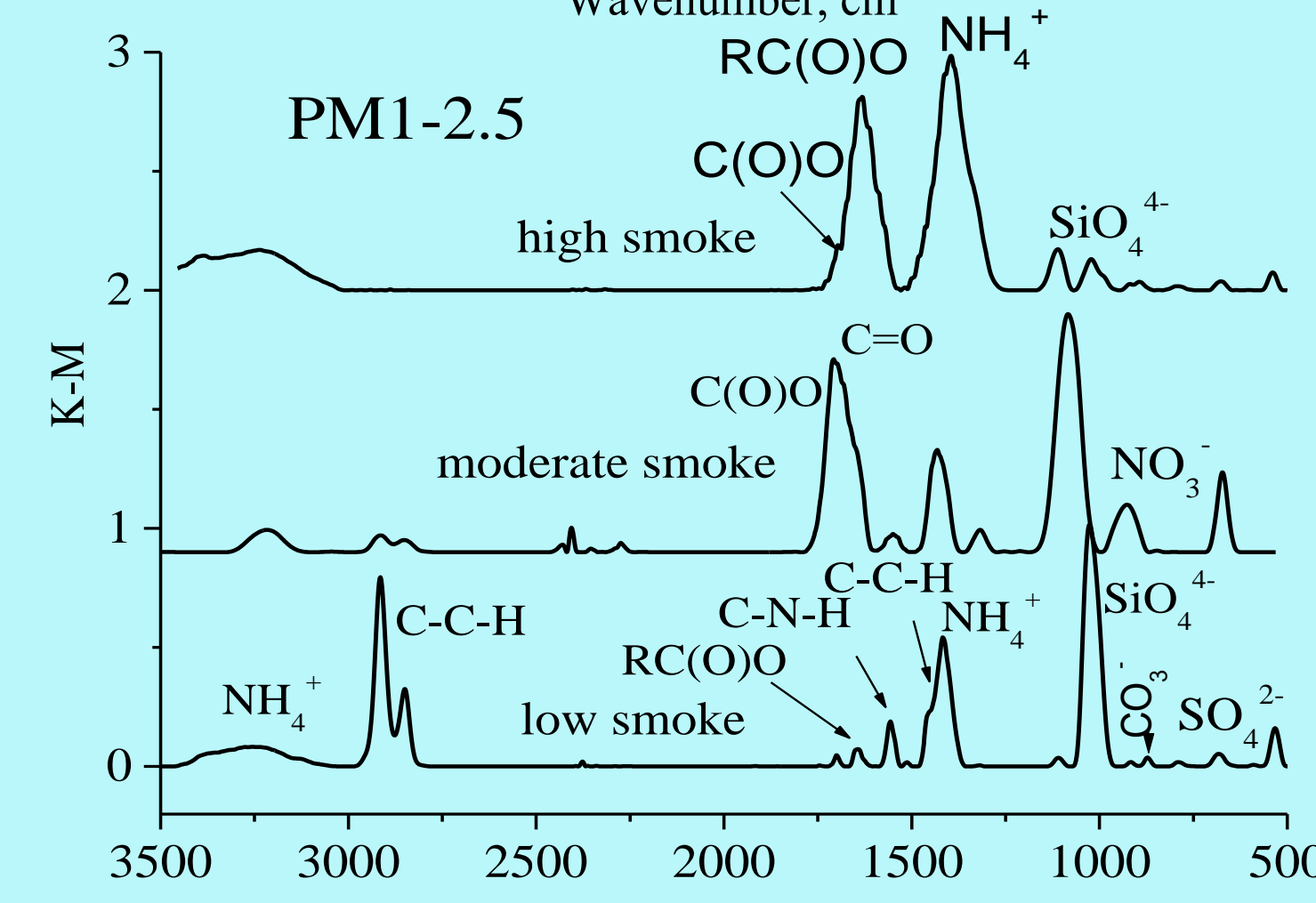
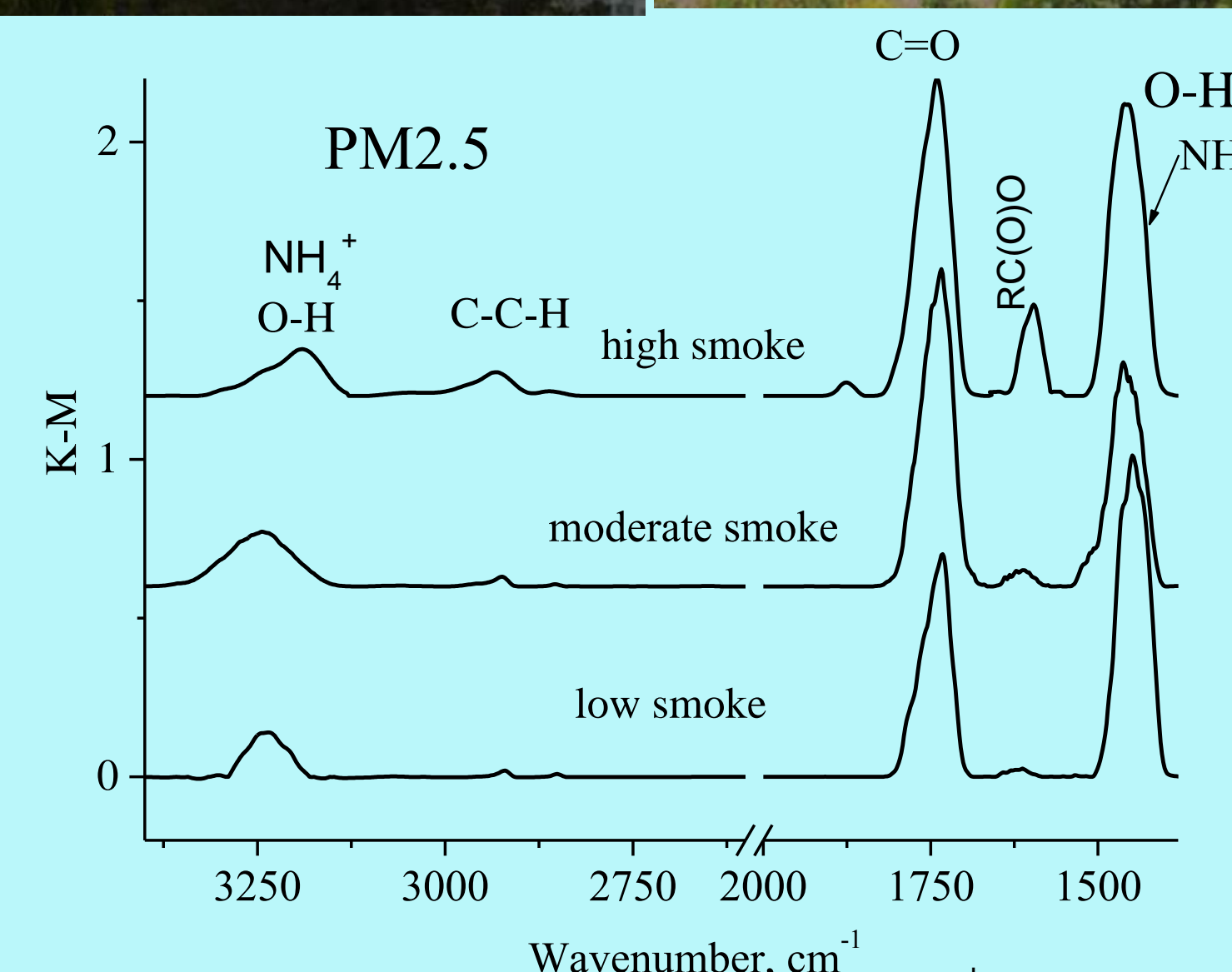
### ✓ Traffic emission, Hanoi, Kim-Lien tunnel 12 March 2015

PM2.5 is a few times higher the air quality standards



## Son La Biomass burning season, 2013

Observatory station, So La (21.33°N, 103.9 °E)  
24 February - 8 April 2013

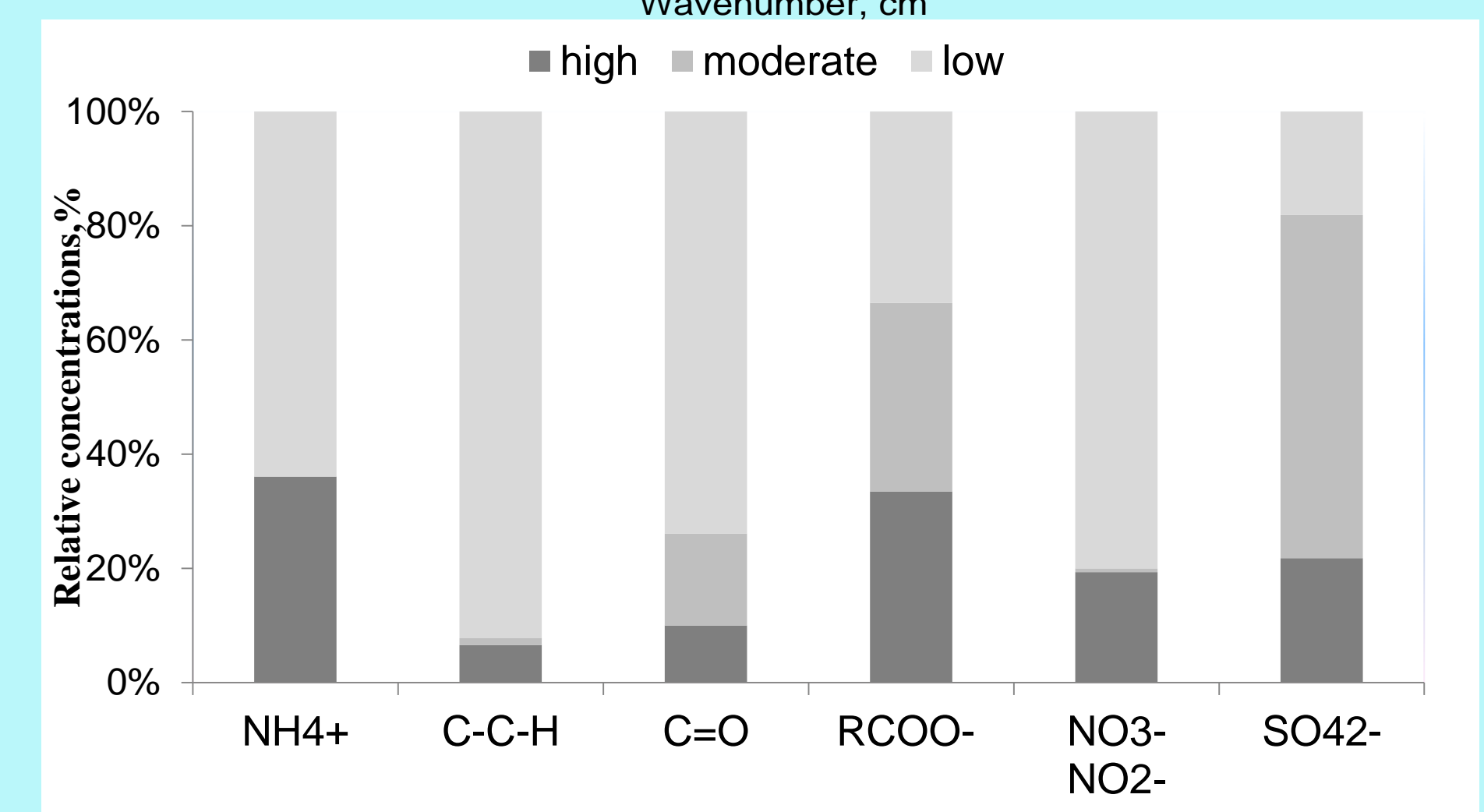
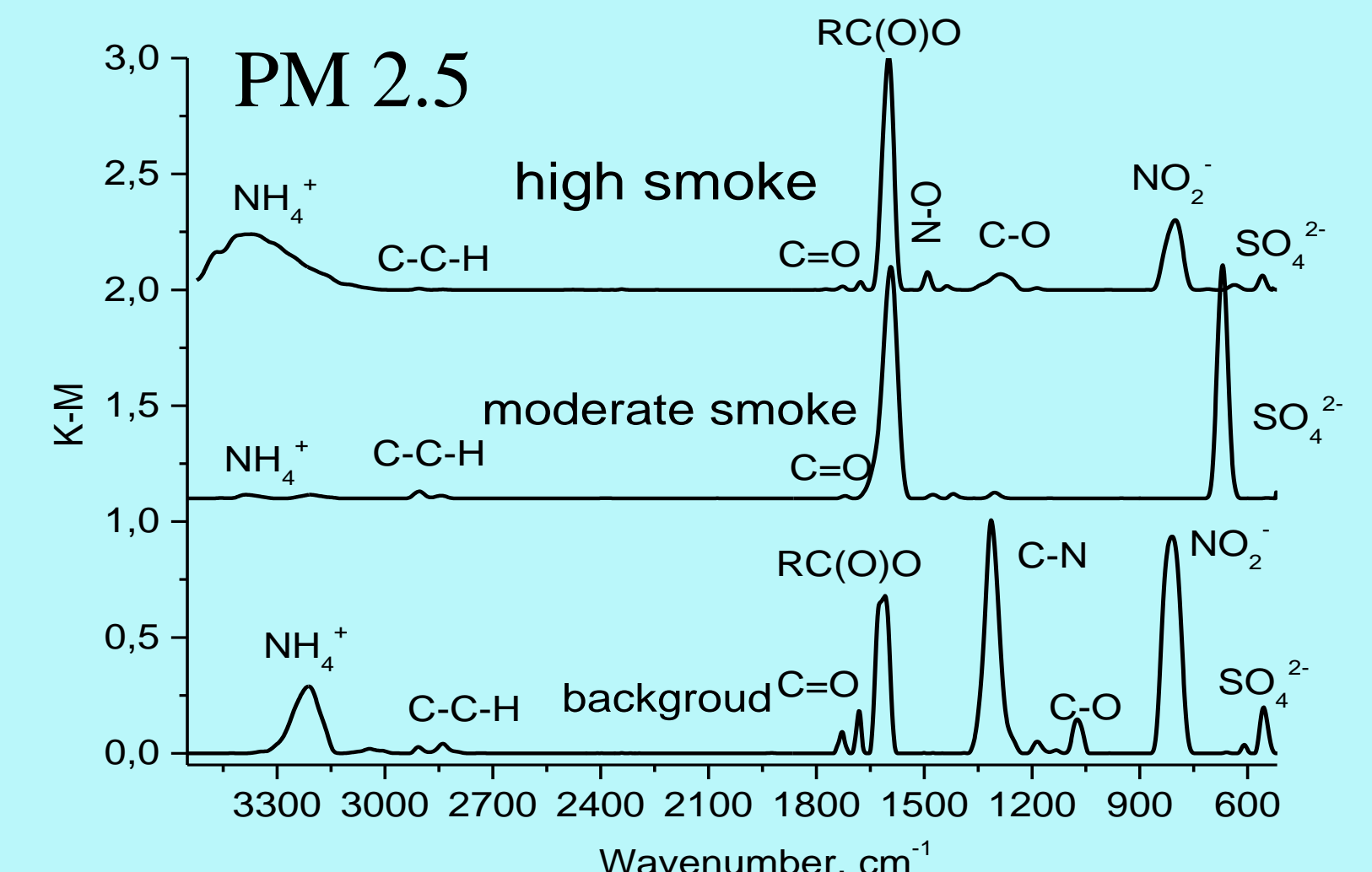


Relative concentrations of organic/inorganic functionalities

## Bavi biomass burning season, 2015

Bavi province near Hanoi about 60 km.  
27 May – 15 June 2015.

Post-harvest rice straw burning



Relative concentrations of organic/inorganic functionalities

## Conclusions

- ✓ Specific features of **on-field** emission: **nitrocompounds, ammonium, carboxylate carbonyls**
- ✓ **Ambient aerosols**: ammonium is prominent
- ✓ **Amines** on days of low smoke have a biogenic origin, they absent in high smoke periods.
- ✓ Specific features of **coarse particles** are dust functionalities: **sulfates, silicates, and carbonates**.
- ✓ Ambient aerosols PM<sub>2.5</sub>: relative concentrations of organic functionalities are increased with increasing smoke levels.