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## Mesures in situ des concentrations en particules à l'aide du Light Optical Aerosol Counter (LOAC)

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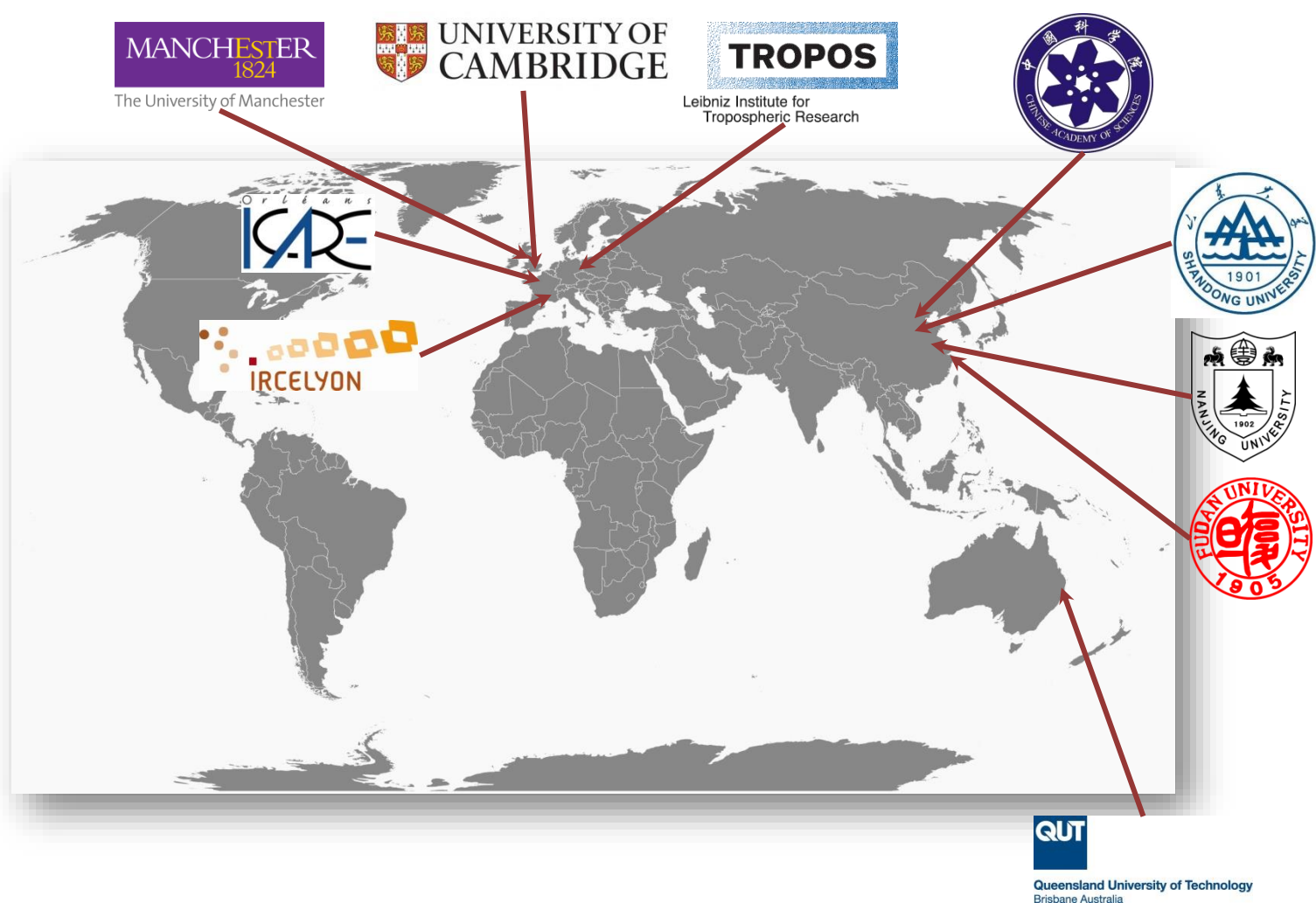
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### Introduction

**Collaborators**  
An international consortium :



### Objectives

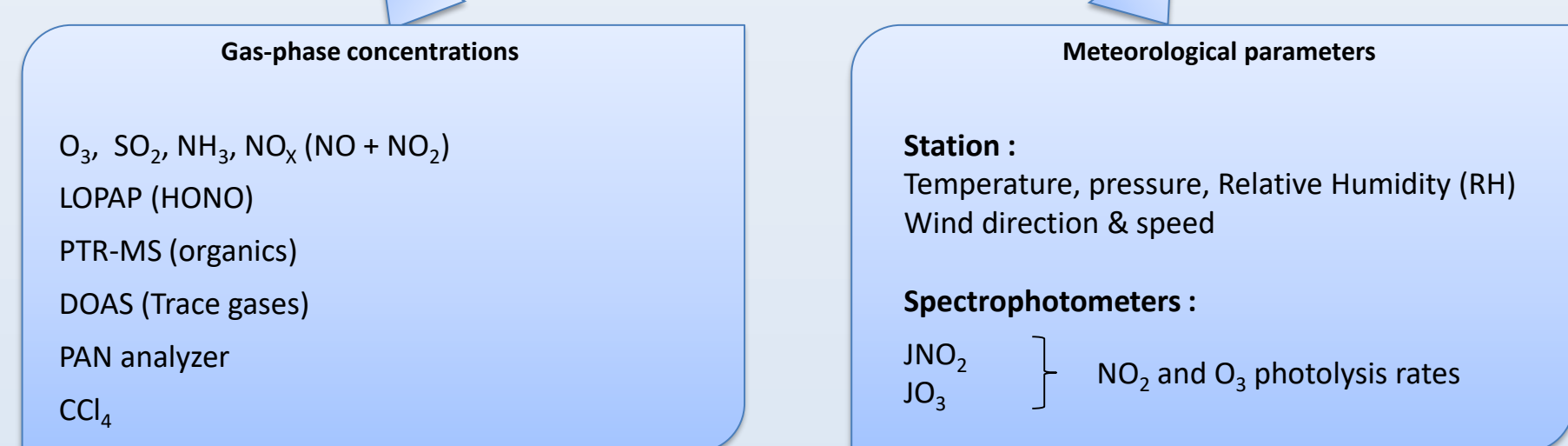
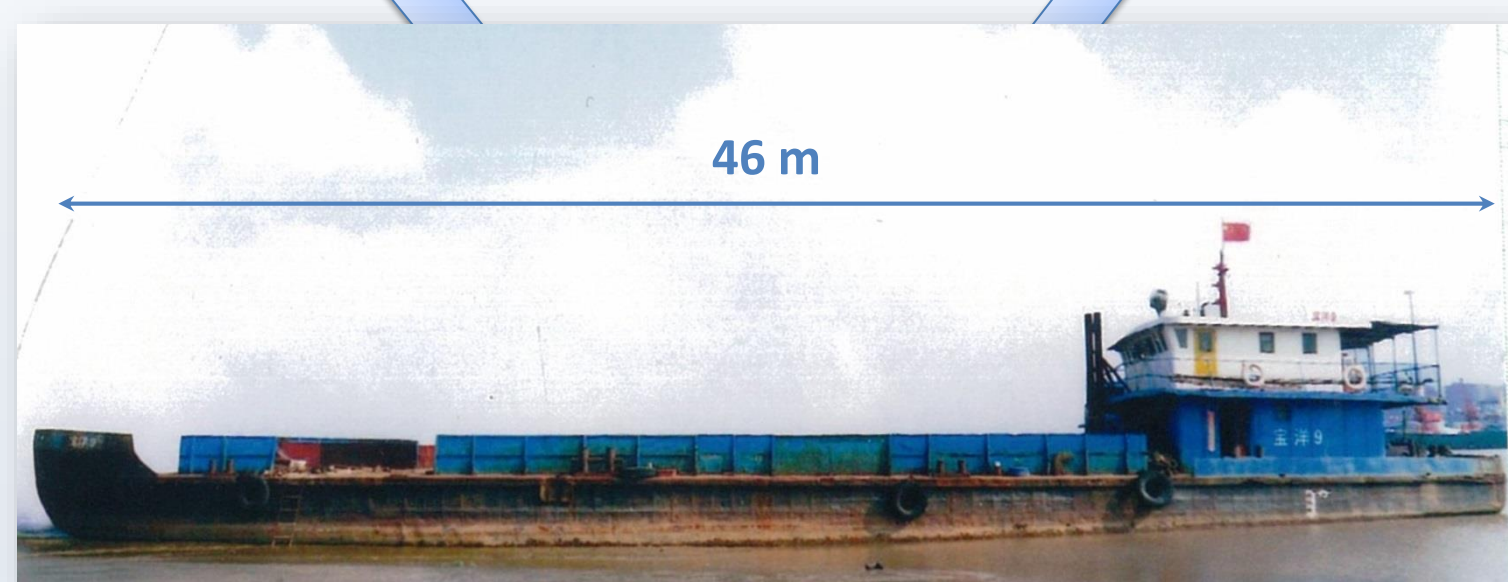
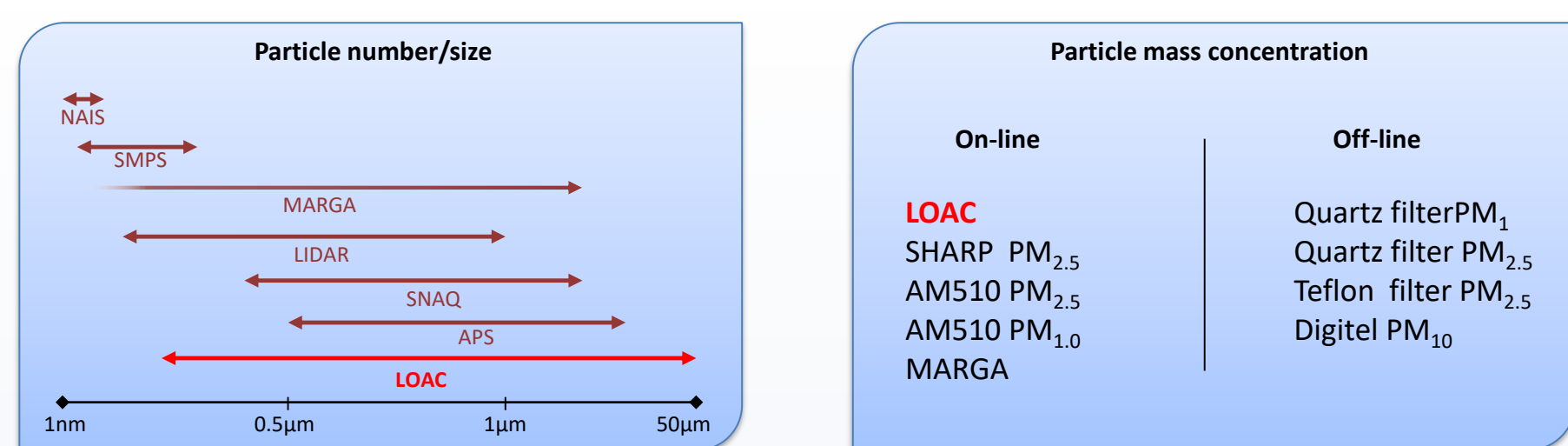
- Ships emissions
- Yangtze river air pollution during heating season
- Aerosol chemical and optical properties
- Photochemistry over Yangtze river
- Fog chemistry
- Dry/wet deposition of nutrient into the river



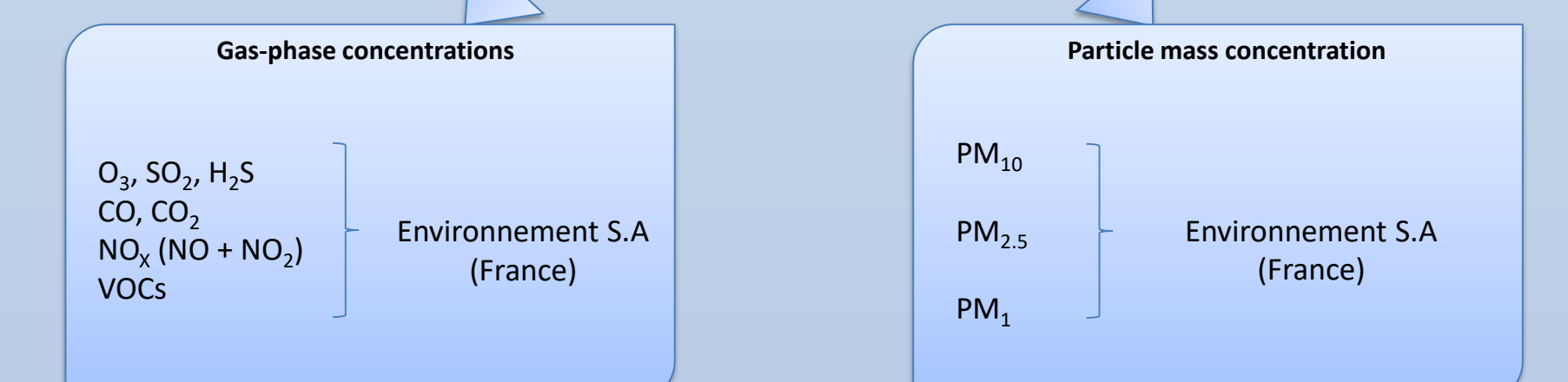
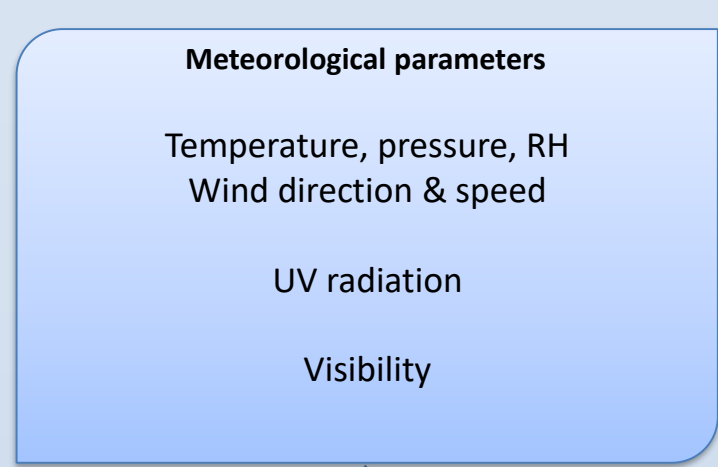
Dates: 20th november – 4th december 2015 (Day 324 → Day 338)  
Route: Round trip between Shanghai and Wuhan (2150 km)

### Materials & Methods

#### Ship



#### Monitoring van



### LOAC

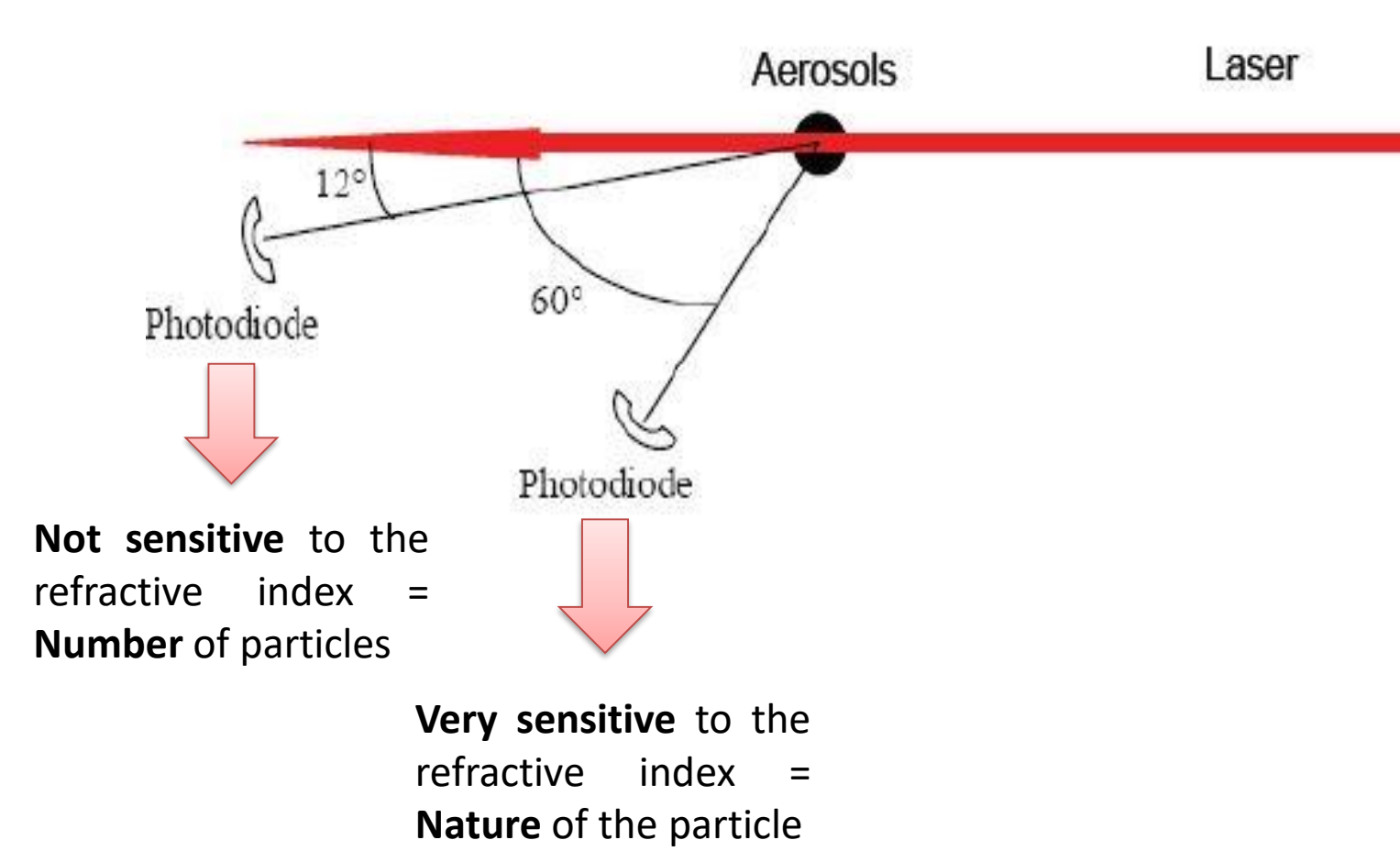
**LOAC = Light Optical Aerosol Counter**

- Developed by LPC2E, MeteoMODEM, Environnement S.A.
- Light instrument (approx. 300 g, pump included)
- Optical measurement ( $\lambda = 650 \text{ nm}$ ) based on Mie scattering theory
- Size range : 0.2 – 50  $\mu\text{m}$  within 19 size classes
- Aerosol nature identification
  - Mineral
  - Carbonaceous particles
  - Inorganic
  - Droplets
- Limitations: Very sensitive to the background electronic noise

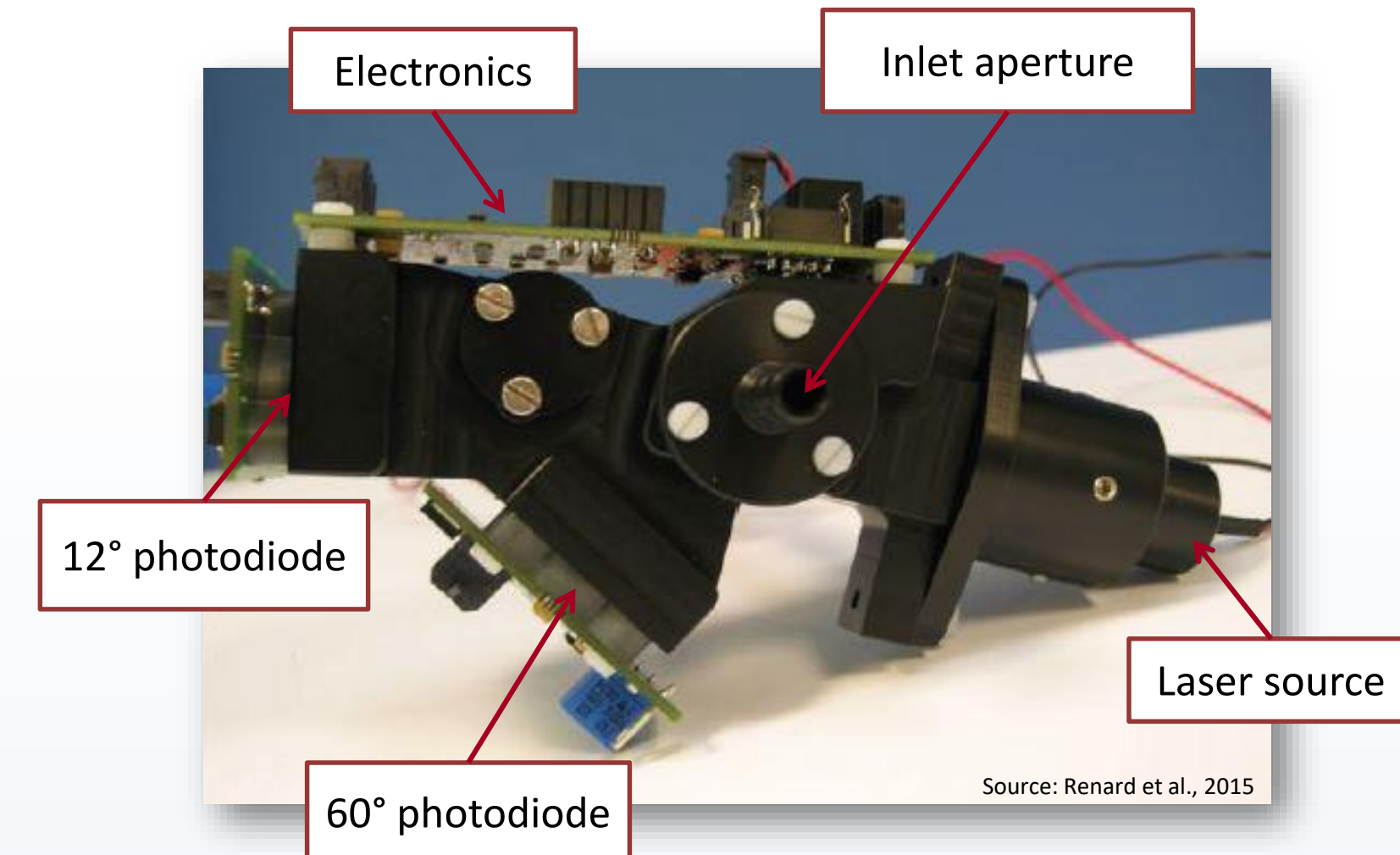
Class	Diameter ( $\mu\text{m}$ )
1	0.2–0.3
2	0.4–0.5
3	0.5–0.6
4	0.6–0.7
5	0.7–0.9
6	0.9–1.1
7	1.1–1.3
8	1.3–3
9	3–5
10	5–7.5
11	7.5–10
12	10–12.5
13	12.5–15
14	15–17.5
15	17.5–20
16	20–22
17	22–30
18	30–40
19	40–50

### Principle

- 2 scattering angles : 12° and 60°

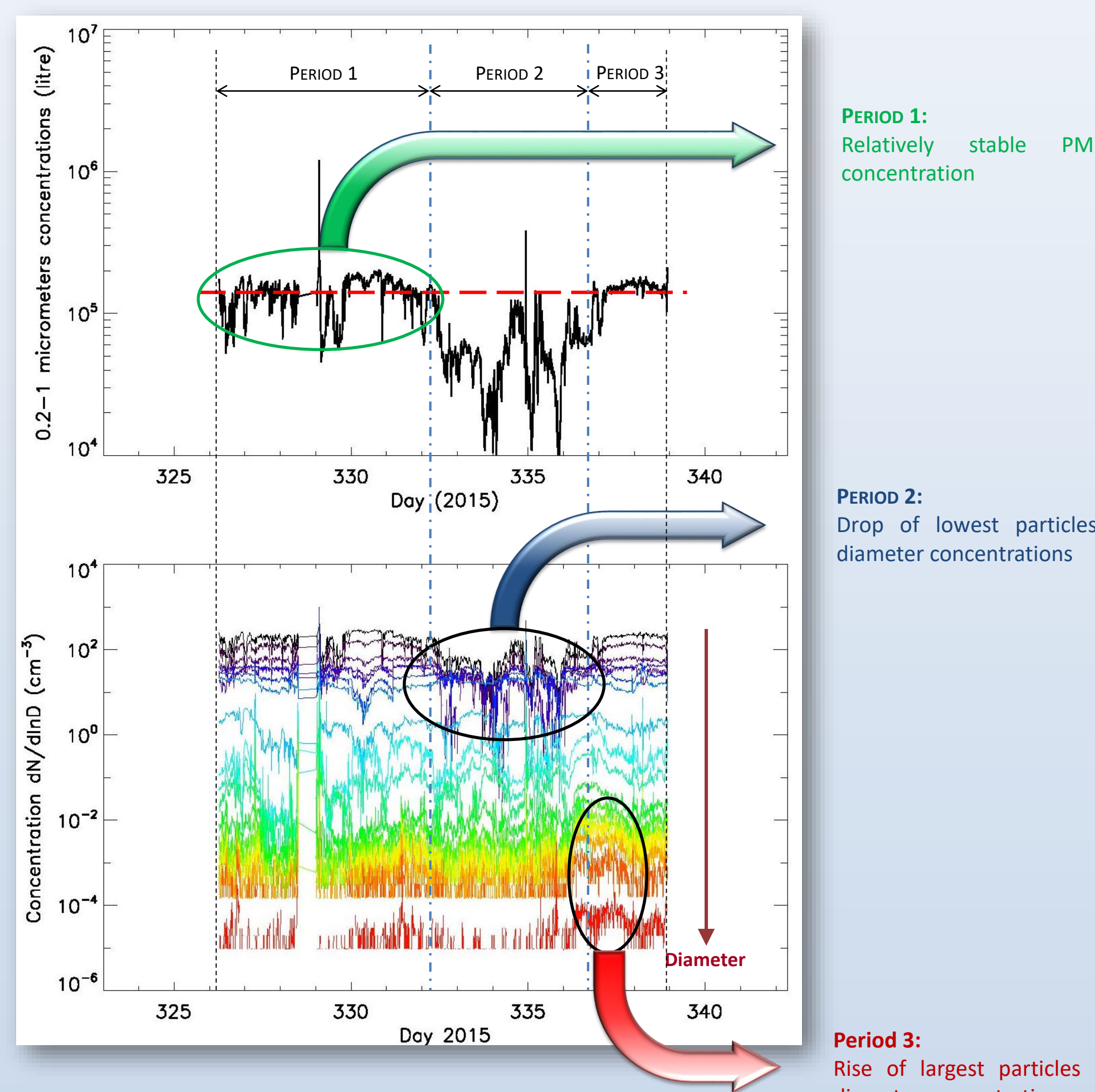


Not sensitive to the refractive index = Number of particles  
Very sensitive to the refractive index = Nature of the particle



### Results

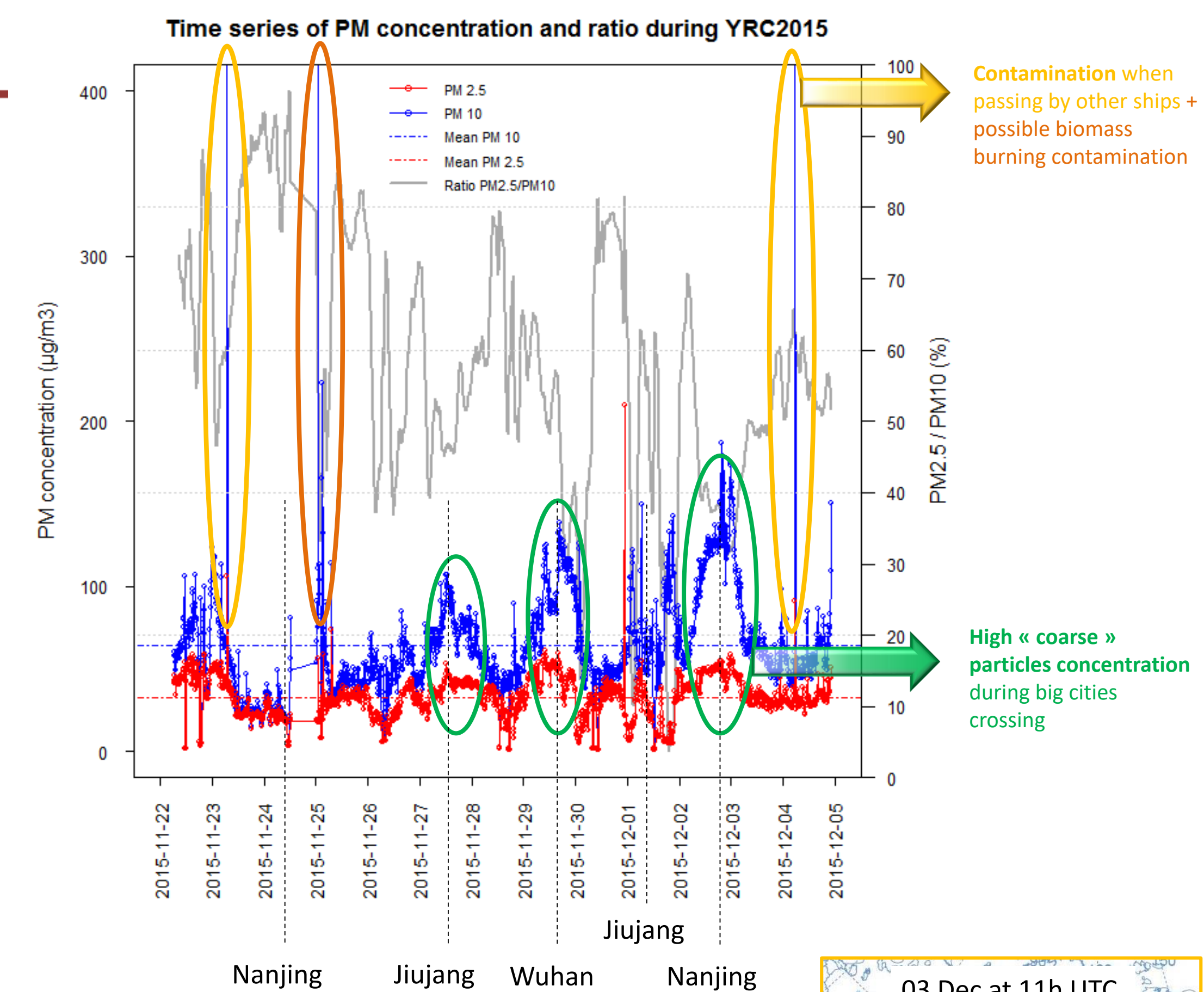
#### 1) Output data given by the LOAC during YRC15:



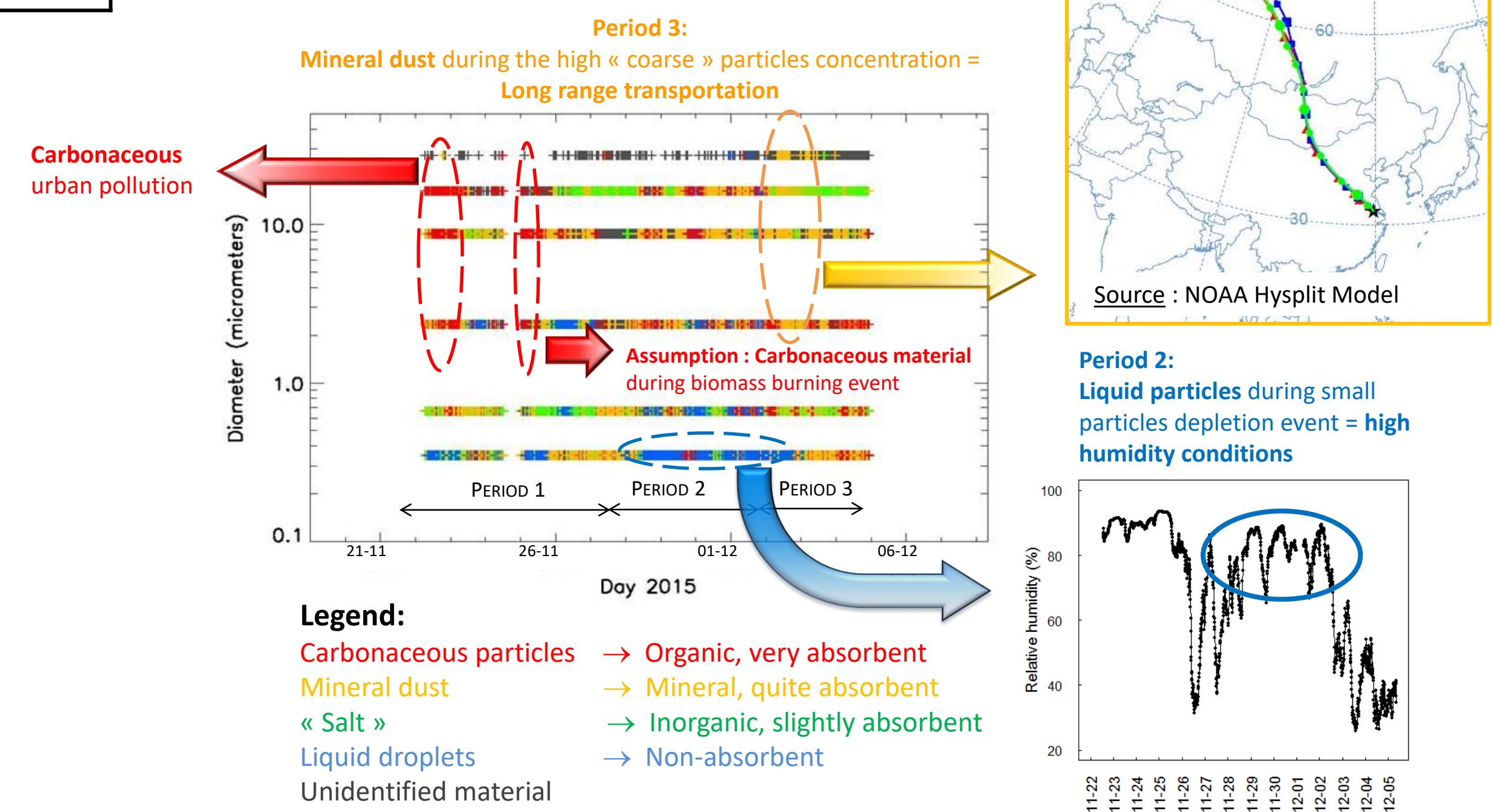
**PERIOD 1:** Relatively stable  $\text{PM}_{10}$  concentration  
**PERIOD 2:** Drop of lowest particles diameter concentrations  
**PERIOD 3:** Rise of largest particles diameter concentrations

#### For more details about the LOAC

- Renard et al., Small-angle light scattering by air-borne particulates, Meas.Sci.Technol., 2010a
- Renard et al., LOAC: a small aerosol optical counter/sizer for ground-based and balloon measurements of the size distribution and nature of atmospheric particles – Part 1: Principle of measurements and instrument evaluation, Atmos. Meas. Tech. Discuss, 2015
- Renard et al., LOAC: a small aerosol optical counter/sizer for ground-based and balloon measurements of the size distribution and nature of atmospheric particles – Part 2: First results from balloon and unmanned aerial vehicle flights, Atmos. Meas. Tech. Discuss, 2015

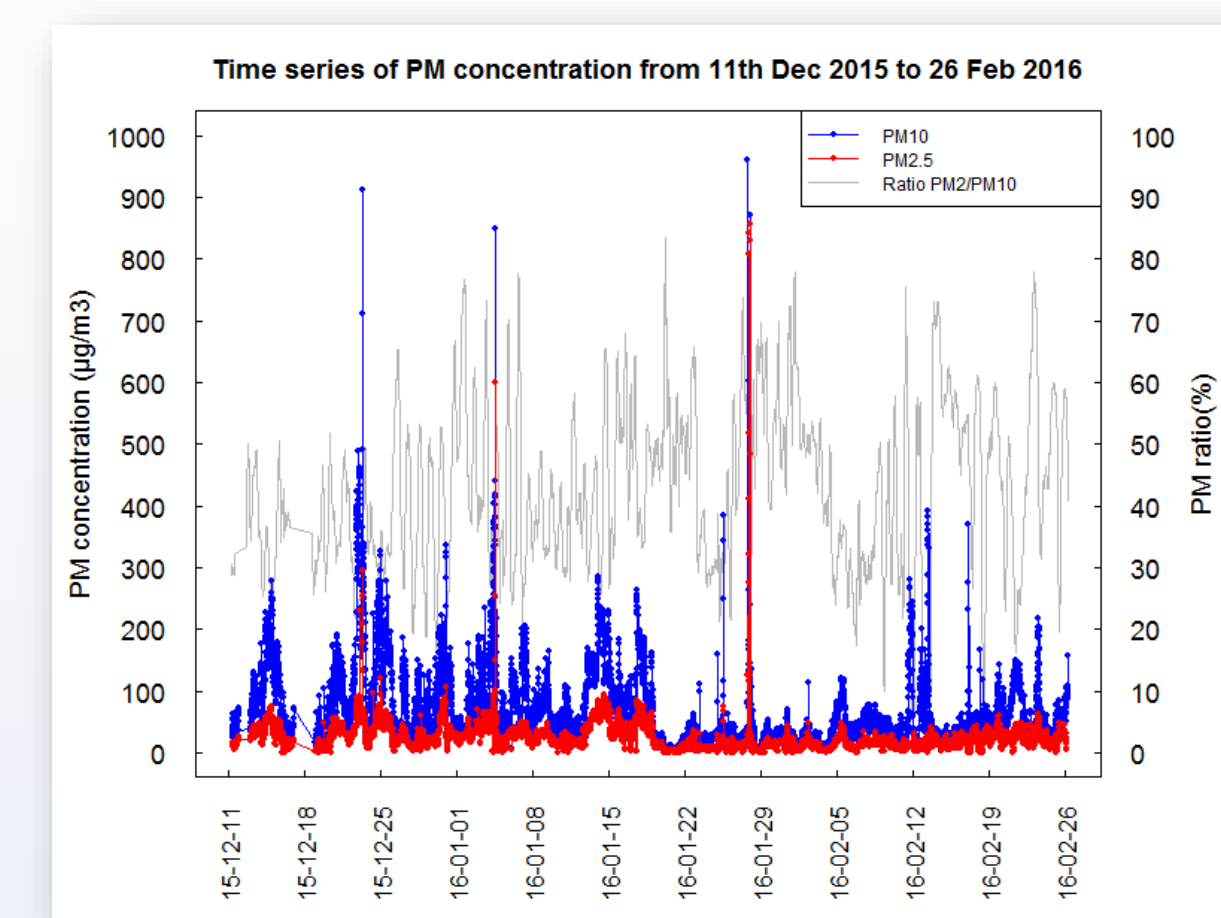


Contamination when passing by other ships + possible biomass burning contamination  
High « coarse » particles concentration during big cities crossing

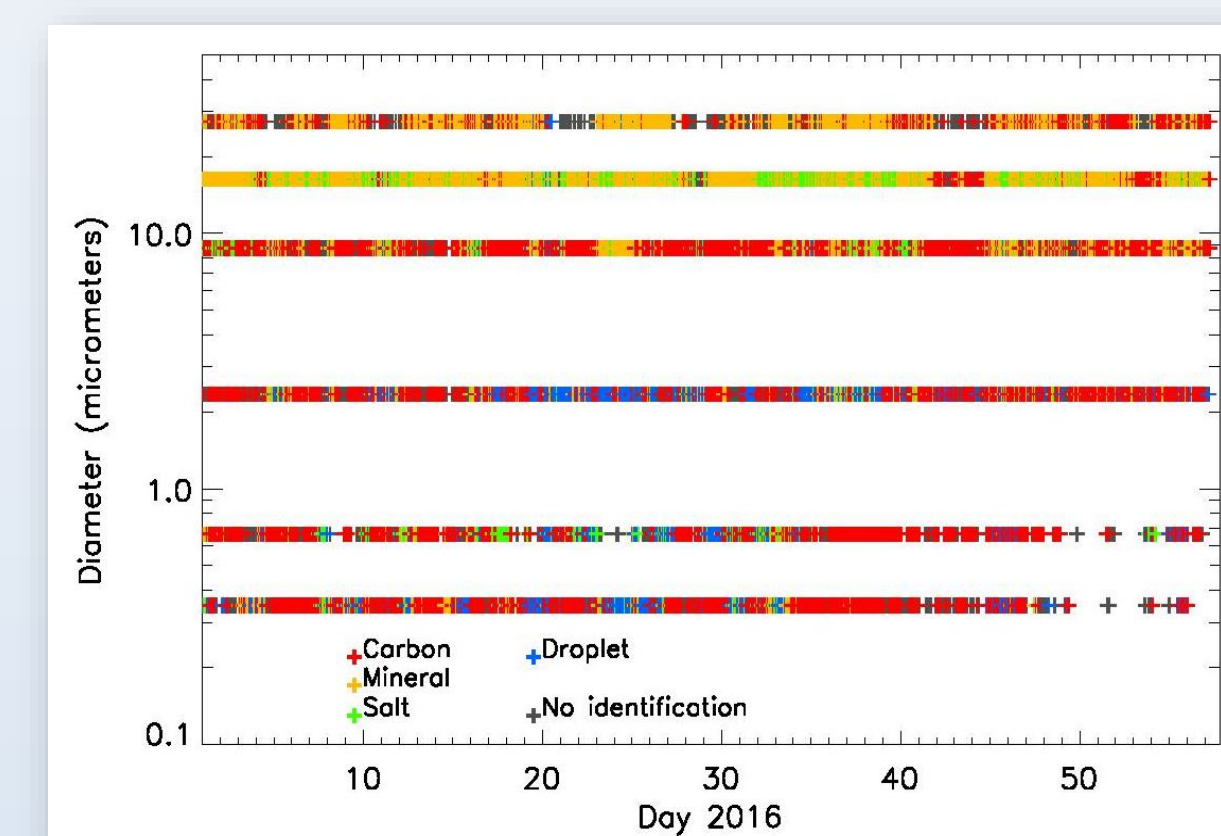


#### 2) Fudan University monitoring (December 2015 → May 2016)

LOAC localisation : 31.298504 °N - 121.501412 °E



- Heavy pollution events
- $\text{PM}_{10}$  concentration often higher than 200  $\mu\text{g}/\text{m}^3$
- Approx 40% of the particulate matter has a  $D_p < 2.5 \mu\text{m}$
- $\text{PM}_{10}$  essentially consist in carbonaceous material = typical of urban pollution from combustion, vehicle exhausts and industries



### Conclusion and future work

LOAC measurements allow to:

- Identify pollution events
- Pinpoint contamination peaks
- Roughly retrieve the particles nature

But very sensitive to the electronic noise → Be cautious in interpreting the data

#### Future work:

- Comparison with other instruments data (YRC15)
- Matching these results with transport/emission aerosol sources
- Collect/interpretation of new data from the LOAC set in Fudan University, and cross-comparison with other *in situ* measurements

#### Contact Information

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