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

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First *in situ* measurements using LOAC

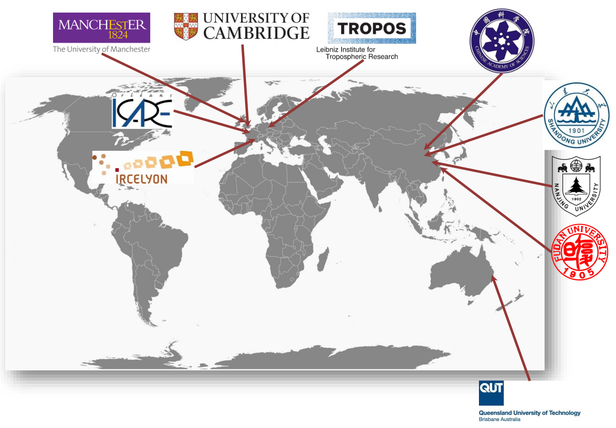
Yangtze River Campaign 2015 + Fudan University monitoring

J. Léglise, A. Mellouki, V. Daële, J. Chen, Team LPC2E,
ICARE-CNRS / LPC2E, Orléans (France), Fudan University

Introduction

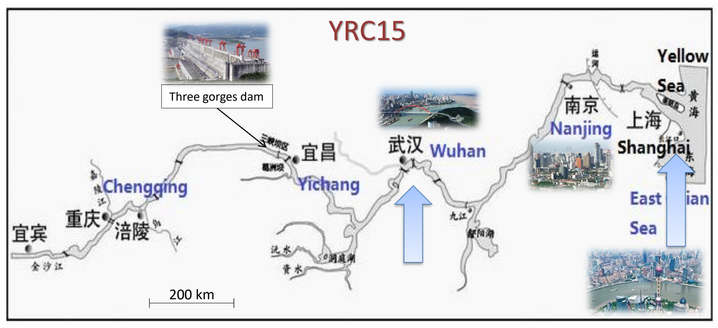
Collaborators

An **international** consortium :



Objectives

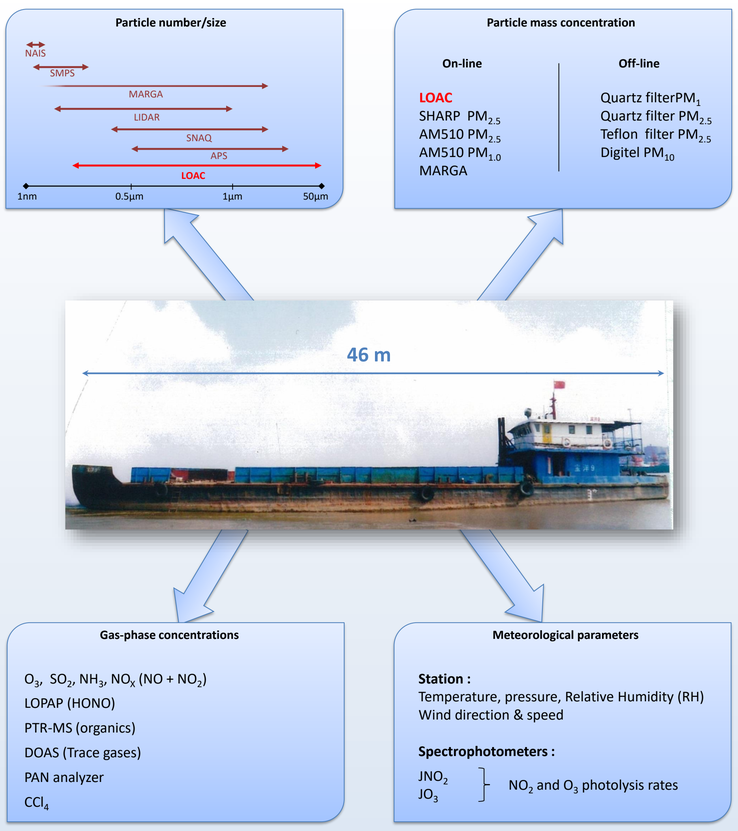
- Ships emissions
- **Yangtze river air pollution during heating season**
- Aerosol chemical and optical properties
- Photochemistry over Yangtze river
- Fog chemistry
- Dry/wet deposition of nutrient into the river



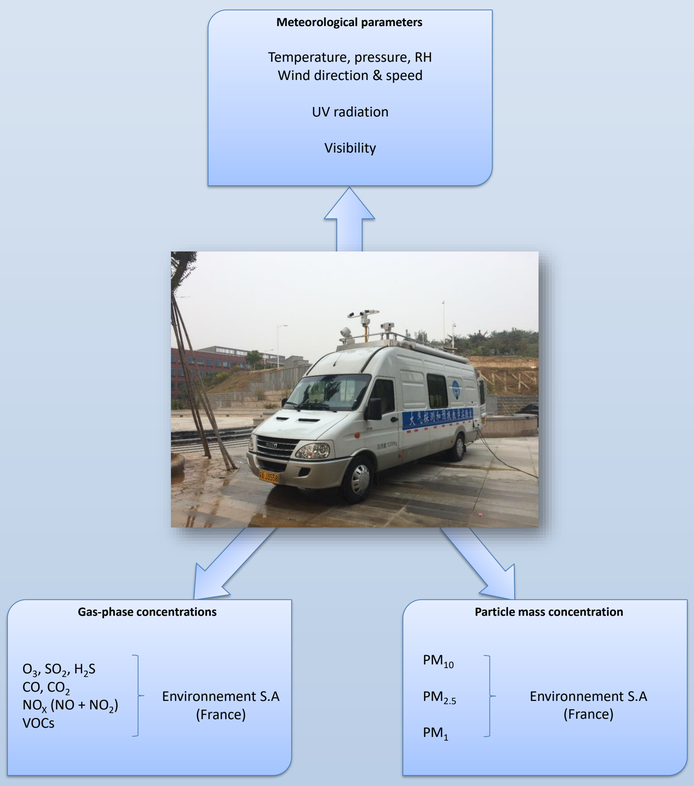
Dates: 20th november – 4th december 2015 (Day 324 → Day 338)
Route: Round trip between Shanghai and Wuhan (2150 km)

Materials & Methods

Ship



Monitoring van



LOAC

LOAC = Light Optical Aerosol Counter

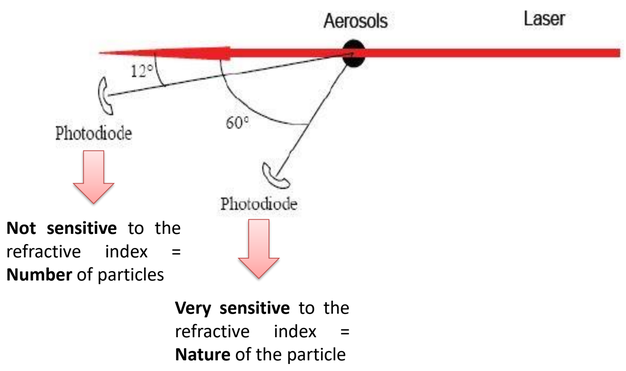
- Developed by **LPC2E**, MeteoMODEM, Environnement S.A.
- **Light** instrument (approx. 300 g, pump included)
- **Optical** measurement (λ = 650 nm) based on **Mie** scattering theory
- **Size range** : 0.2 – 50 µm within 19 size **classes** →

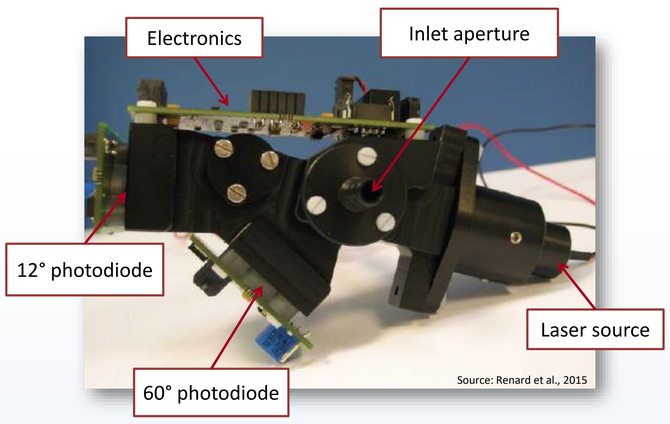
Class	Diameter (µm)
1	0.2 – 0.3
2	0.4 – 0.5
3	0.5 – 0.6
4	0.6 – 0.7
5	0.7 – 0.9
6	0.9 – 1.1
7	1.1 – 1.3
8	1.3 – 3
9	3 – 5
10	5 – 7.5
11	7.5 – 10
12	10 – 12.5
13	12.5 – 15
14	15 – 17.5
15	17.5 – 20
16	20 – 22
17	22 – 30
18	30 – 40
19	40 – 50

- **Aerosol nature identification**
  - Mineral
  - Carbonaceous particles
  - Inorganic
  - Droplets
- Limitations: Very sensitive to the **background electronic noise**

Principle

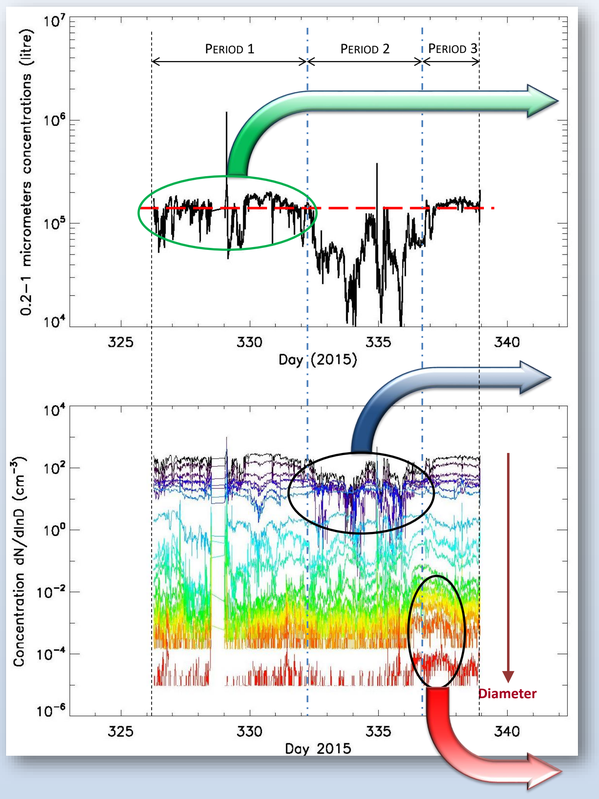
- 2 scattering angles : **12° and 60°**





Results

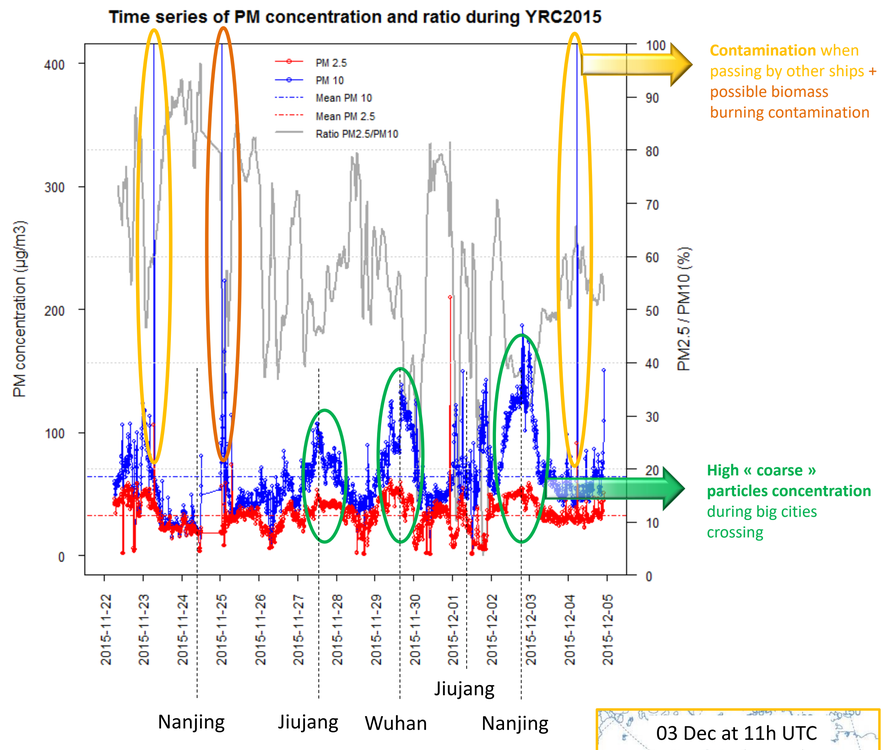
1) Output data given by the LOAC during YRC15:

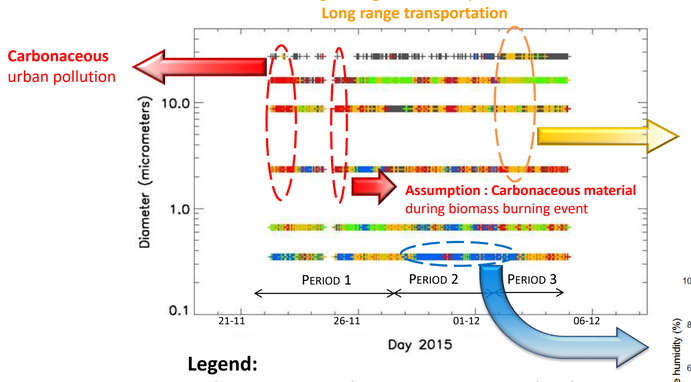


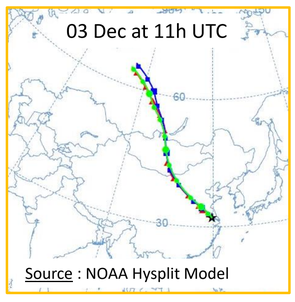
Period 1: Relatively stable PM_1 concentration

Period 2: Drop of lowest particles diameter concentrations

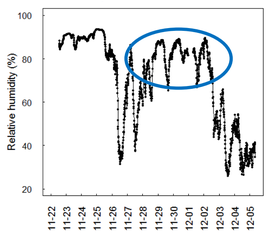
Period 3: Rise of largest particles diameter concentrations





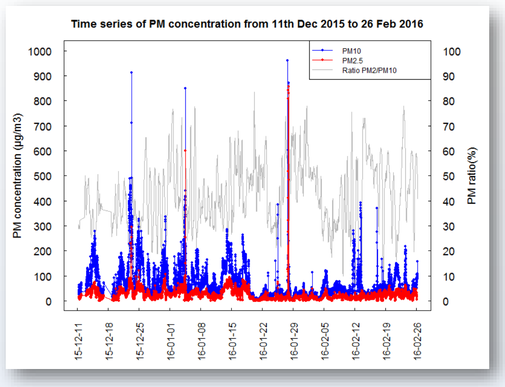


Period 2: **Liquid particles** during small particles depletion event = **high humidity conditions**

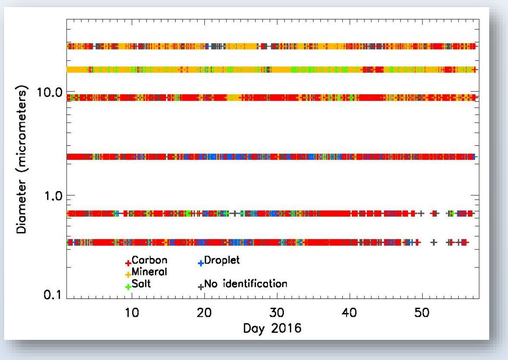


2) Fudan University monitoring (December 2015 → May 2016)

LOAC localisation : 31.298504 °N - 121.501412 °E



- Heavy pollution events
- PM_{10} concentration often higher than **200 µg/m³**
- Approx **40%** of the particulate matter has a Dp < 2.5 µm
- 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)
  - SMPS/APS → Validation for : Concentration + composition in the same size range → **LOAC precision**
  - MARGA → Validation for : Composition → **aerosol sources**
  - PM sample heads → Validation for : Concentration → **LOAC precision**
- 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

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

Contact Information

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