Paris 2024 Research Demonstration Project

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National Meteorological Institutes & laboratories from:

Canada, USA, China, Australia, Sweden,
UK, Japan, Germany, France

April 2021

The 2024 Paris Olympic Games

Olympic Games will be mostly in dense urban areas of Paris and suburbs

The Olympics village

Scientific Goal and Objectives

To advance research on the "future Meteorological Forecasting systems at 100m (or finer) resolution for urban areas".

Scientific questions

1. Nowcasting & Numerical Weather Prediction
2. To improve knowledge on summer extreme events (Urban heat islands, air quality, thunderstorms in cities)
3. As 2., but for coastal cities
4. Big data, non-conventional data, and their uses
5. How to deliver tailored infra-urban services

RDP overview

2021

- High-resolution Modelling exercices

2022

- Experimental campaign: IOP June-July-August 2022
- Real-time simulations during the campaign

2023

- Cross analysis (exp/models) of the results of the campaign
- collaborations with forecasters and users

2024 Olympic Games

- Real-time simulations during the summer

RDP overview

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Experimental Campaign for summer 2022

To document the several aspects of urban climate :

Boundary Layer Dynamics, Surface variability, Effects of Aerosols,…

Operational networks

Two existing permanent academic super-sites

- In Paris center & suburbs

} Long-term

Many projects planned experimental campaigns :

- over Paris area in summer 2022
- with or without knowledge of the RDP

} 1 year or 1-2 Months

Coordination of the campaigns

Will of the several actors and scientific project managers

to coordinate the experimental effort of summer 2022

Several national or European projects contribute to experiments, mainly:

→ Heat and Health in Cities	Aude Lemonsu	CNRM (Toulouse, F)
→ ACROSS	Chris Cantrell	IPSL/LISA (Créteil, Paris, F)
→ STREET	Juliette Leymarie	Ecology & Env. Sci. Inst. (Paris)
→ Urbisphere	Andreas Christen	univ. Freiburg (Freiburg, G)
	Sue Grimmond	Reading univ. (Reading, UK)

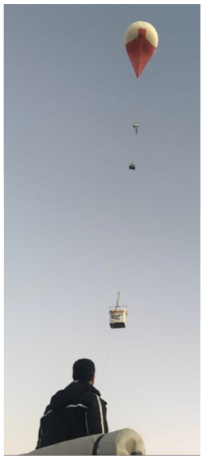
WMO

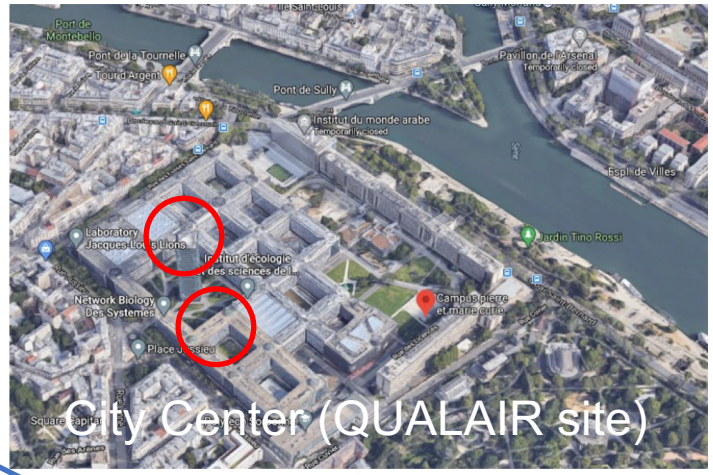
MAKE OUR PLANET GREAT AGAIN

ANR

erc European Research Council

Experimental Campaign for summer 2022

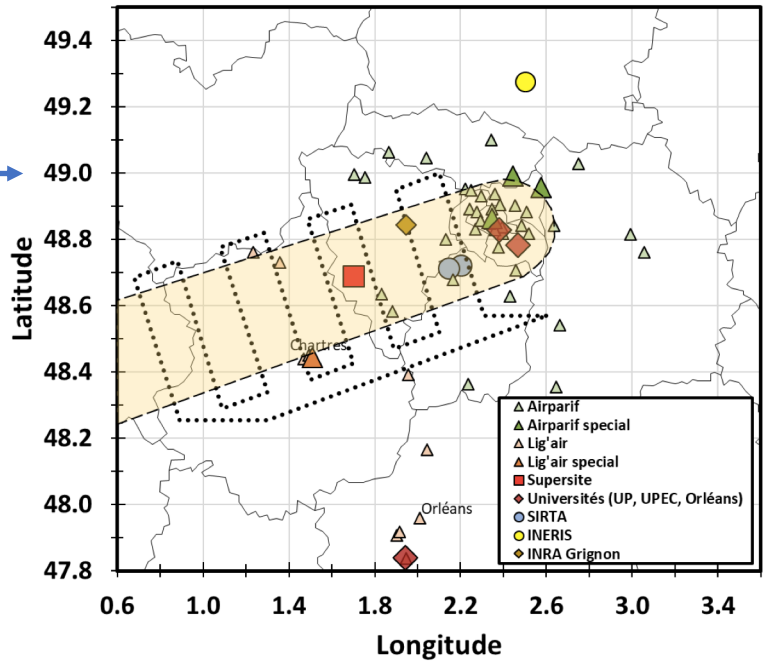




- Surface Energy Balance (EC, scintillometers)
- Urban Boundary Layer Dynamics
  - Profilers (aerosols, wind, *temp.*, *hum*.)
  - Scanning lidars
  - Aircraft on far suburbs and rural areas
- Radiation & aerosols
  - AQ, ballon, aircraft

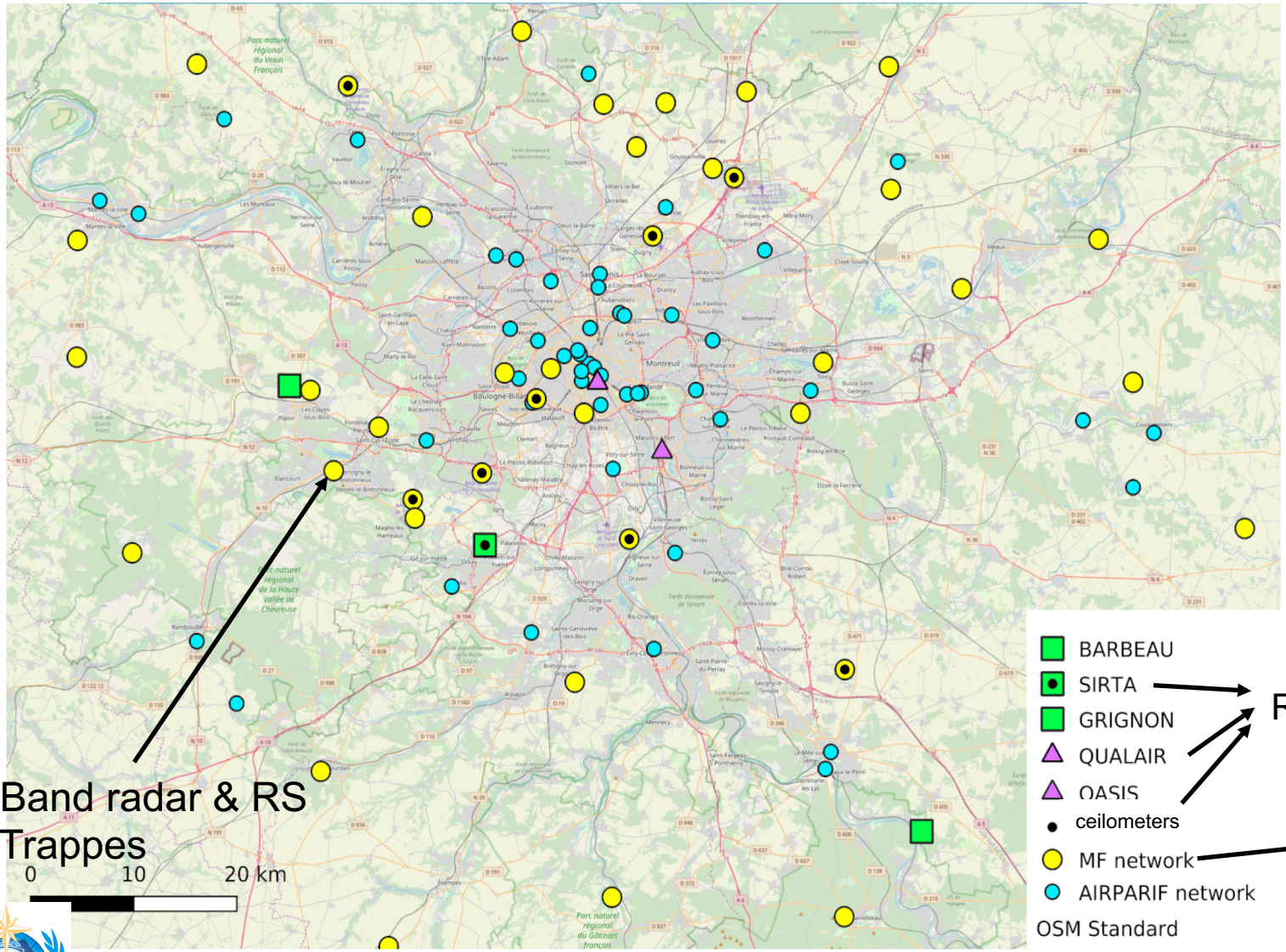
Urban sites

Chemistry measurements



WMO

Experimental Campaign for summer 2022



High-resolution modelling

2 cases studies have been identified; Urban & meteorological data provided

3 steps methodology agreed for model setup during first year:

→ Each group runs 'as usual' with its model on Paris area (mostly done)

→ Convergence on high-resolution modelling with similar setup *(we are here)*

→ Use of high-resolution urban data (at urban block scale)

Working on the **Heat-Wave case**:

CNRM, NCAR, BoM, CMA (IUM)

Modelling of the **Thunderstorm case**:

CNRM, ECCC, Met Office, JMA (MRI)

→ First intercomparison shows large variability → need of Ensembles

Thunderstorm : 9 to 10 July, 2017

Simulations with the canadian model GEM (courtesy: Arnaud Foster)

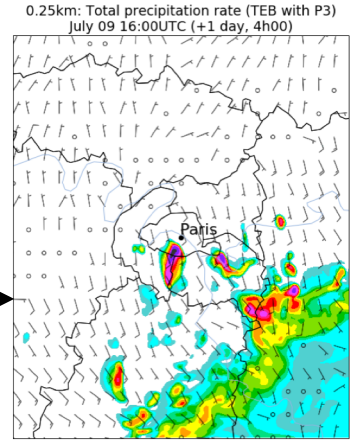
Environment Canada

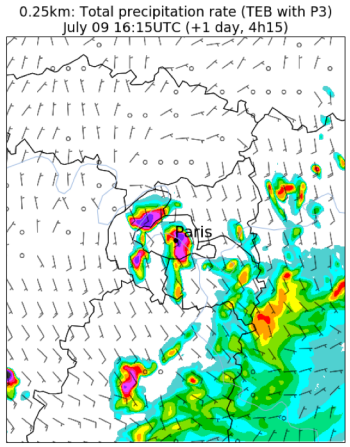
Rainfall (at 15min intervals)

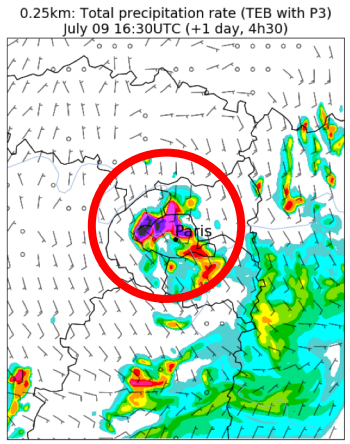
Model with the agglomeration of Paris

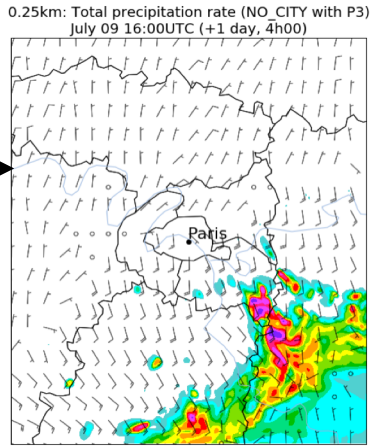
The thunderstorm seems to be created by Paris

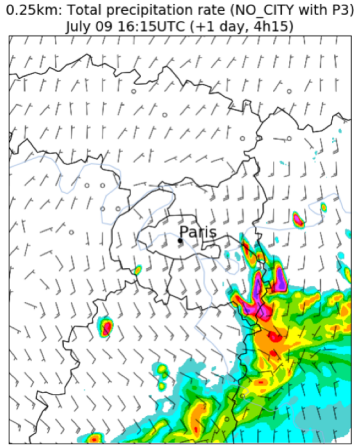
Model with crops instead of agglomeration: no storm

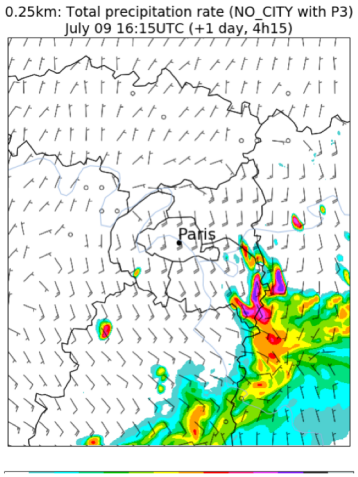


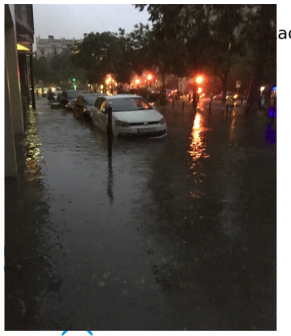


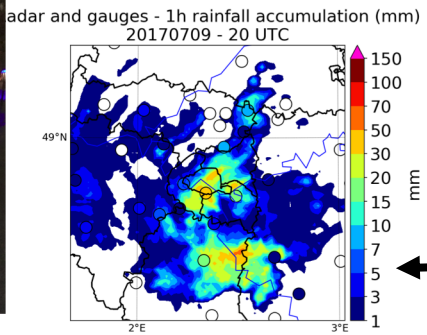










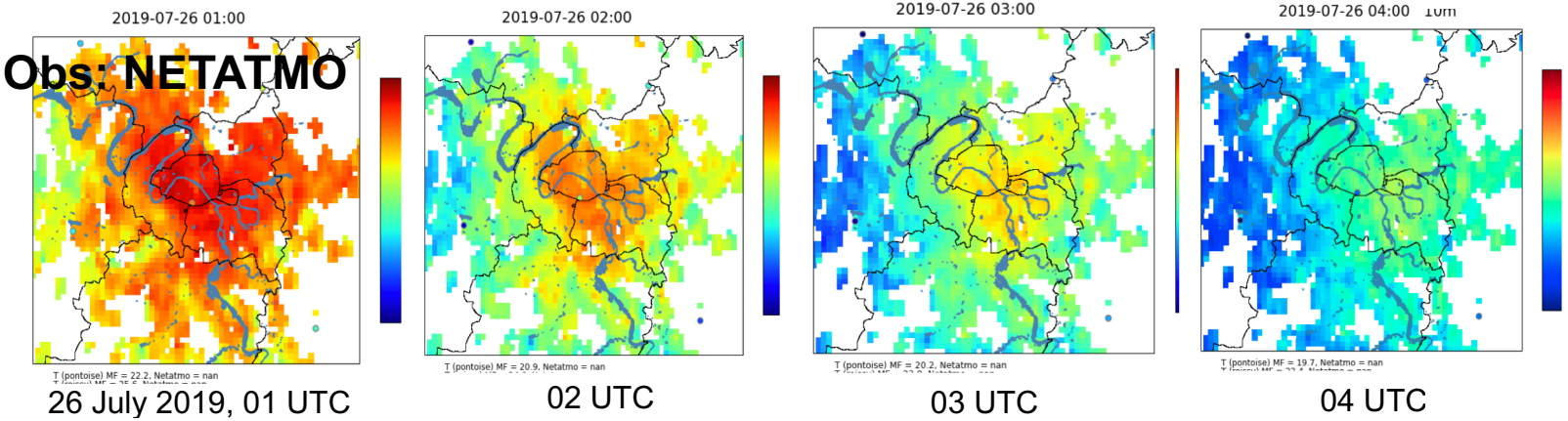


Observation at the same stage of the thunderstorm development

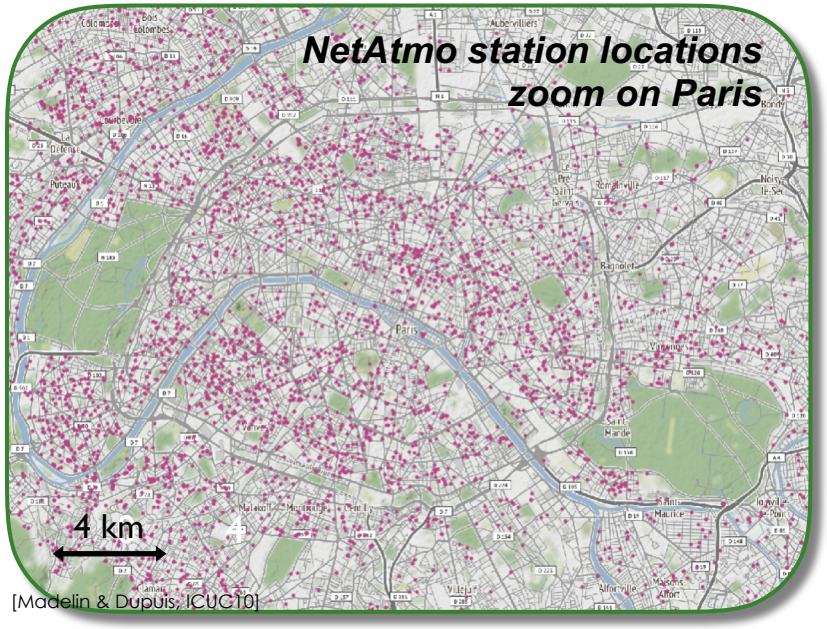
Heat Wave from 22nd to 26th of July 2019

Observation with personal met stations (netatmo)

Source: Marine Claeys



26 July 2019, 01 UTC | 02 UTC | 03 UTC | 04 UTC



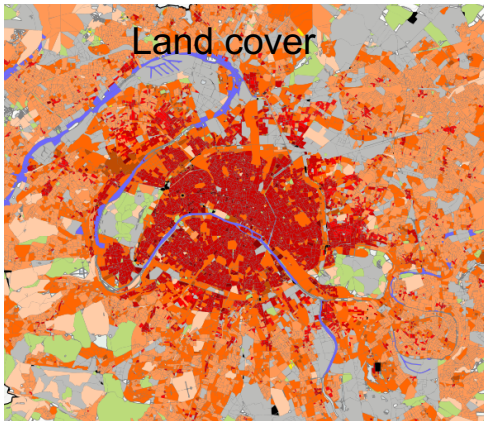
[Madelin & Dupuis, ICUC10]

Link between models & obs. in cities

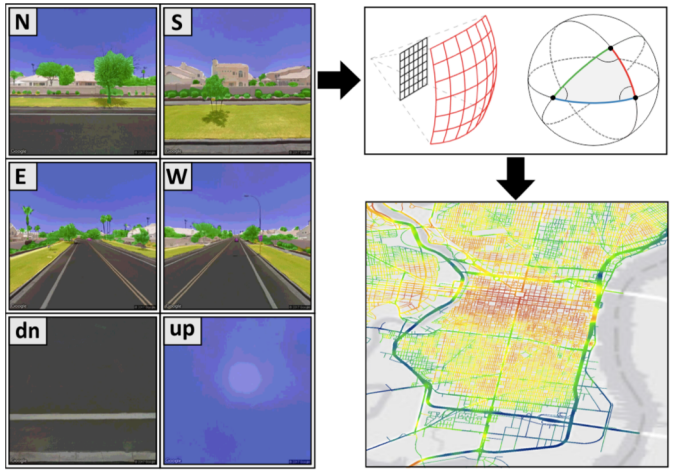
Observations are crucial, but at what scale?

- crowd-sourcing (netatmo, cars, cellular phones?, …)

- Urban data



Copernicus SLIM
Source: CNRM & LabSTICC



Source: A. Middel, Arizona SU

Methods:

- data fusion & AI, data assimilation

Conclusion

Paris Olympics RDP

→ A Research Project contributing to one of the priority of the WMO (WWRP)

→ This is the beginning. You are welcome to participate.

Thanks for your attention