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► To cite this version:

Denis Quelo, Arnaud Querel, Anne Mathieu, Yelva Roustan. Scientific lessons learned from the understanding of the Fukushima deposit to be implemented in operational atmospheric transport models.. EGU General Assembly, EGU, Apr 2019, VIENNE, Austria. 2019. hal-02635632

HAL Id: hal-02635632

<https://hal.science/hal-02635632v1>

Submitted on 27 May 2020

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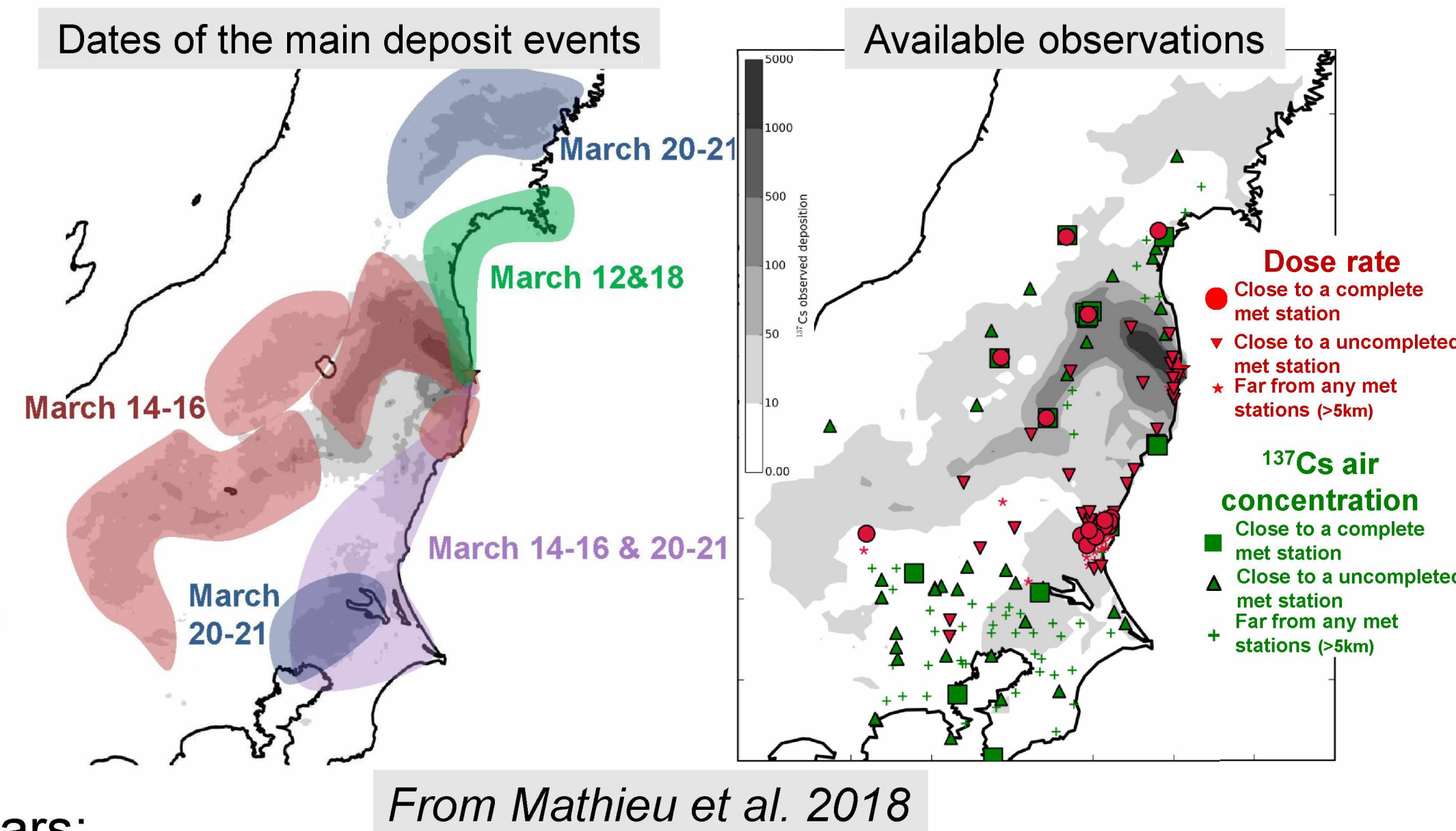
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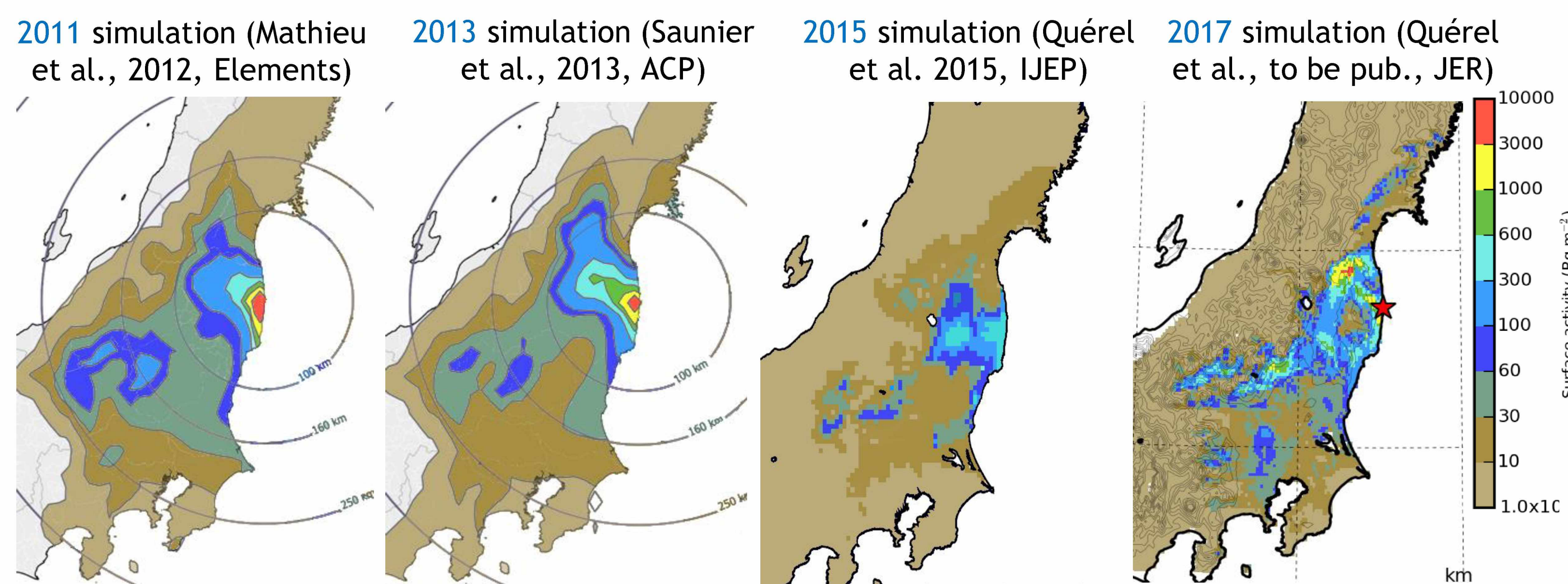
The Fukushima Daiichi Nuclear Power Plant accident led to a significant release of radionuclides in the environment. Numerous radiological measurements enabled the scientists to substantially reconstruct the main sequences of release and identify the probable trajectories of the radioactive plumes and their deposit. Scientific lessons were learned about the wet deposition process. Some of them were implemented in the operational atmospheric transport model of IRSN in order to improve the responses to future emergencies.

Case study: the Fukushima accident

Studied by IRSN (French Emergency response and preparedness centre) from 2011 to 2017, in collaboration with a Japanese team: Sakura Project (with MRI-JMA) ; Intercomparison of the Science Council of Japan (JAEA, Univ.). The deposit mainly occurred during the first three weeks (11th to 31st March 2011). Plenty of observations are available in order to understand and to model the atmospheric dispersion of the releases.



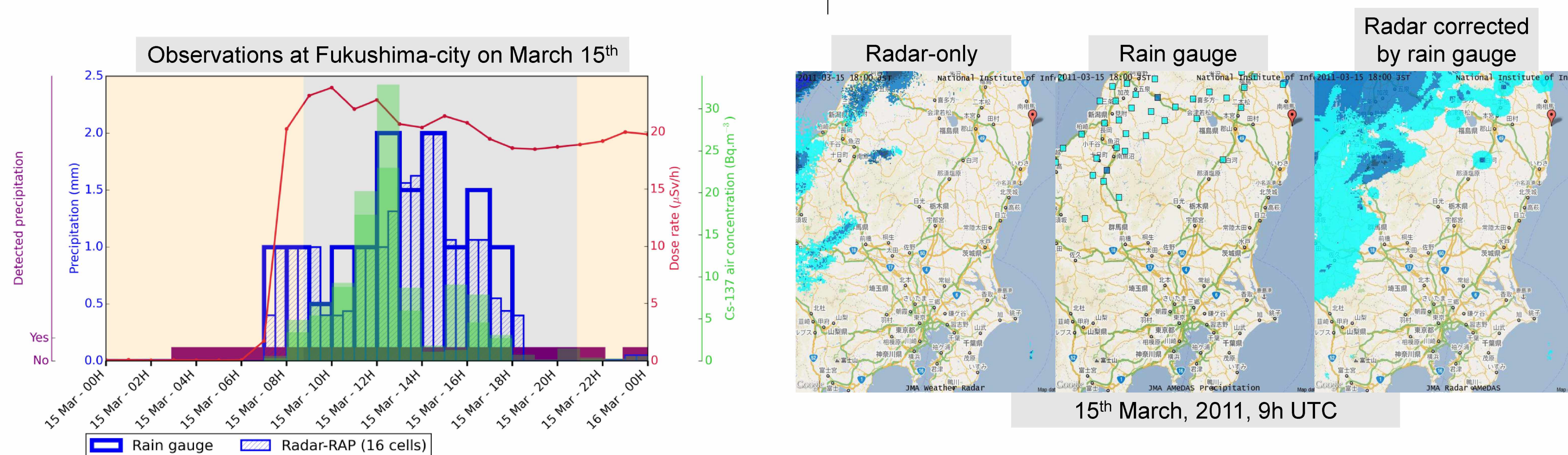
Modelling was improved constantly during the last 8 years:



Deposition events: some large deposits occurred within very short periods

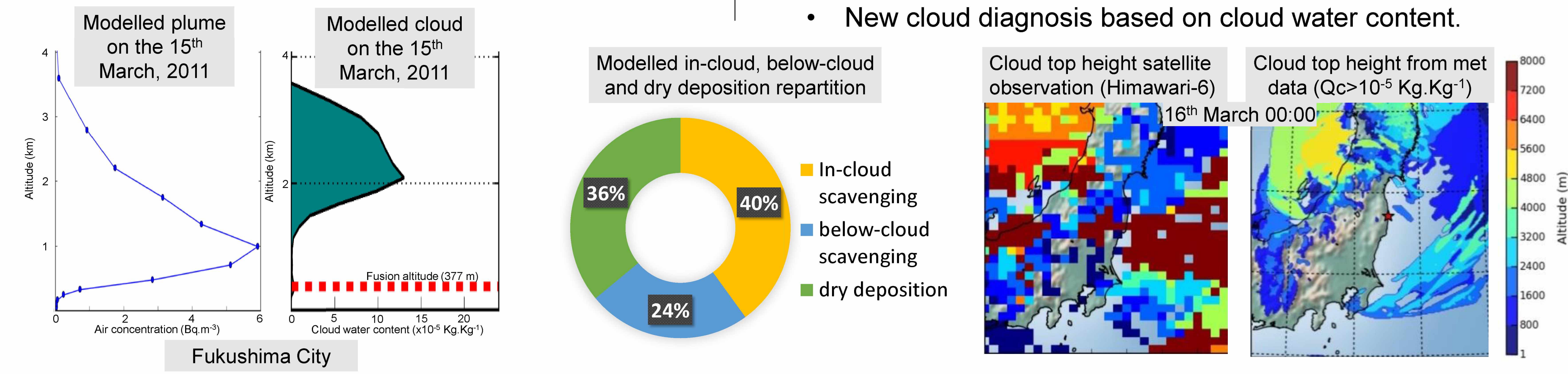
- Modelling is sensitive to small errors on the location or a delay when the plume crosses the precipitation
- Light rain could be responsible for large wet deposit, particularly at rainfall start

Use high resolution met data: radar observations, 1 km, 5 minutes, in France
Carefully, since they do not measure light rain.
How to determine the cloud above?



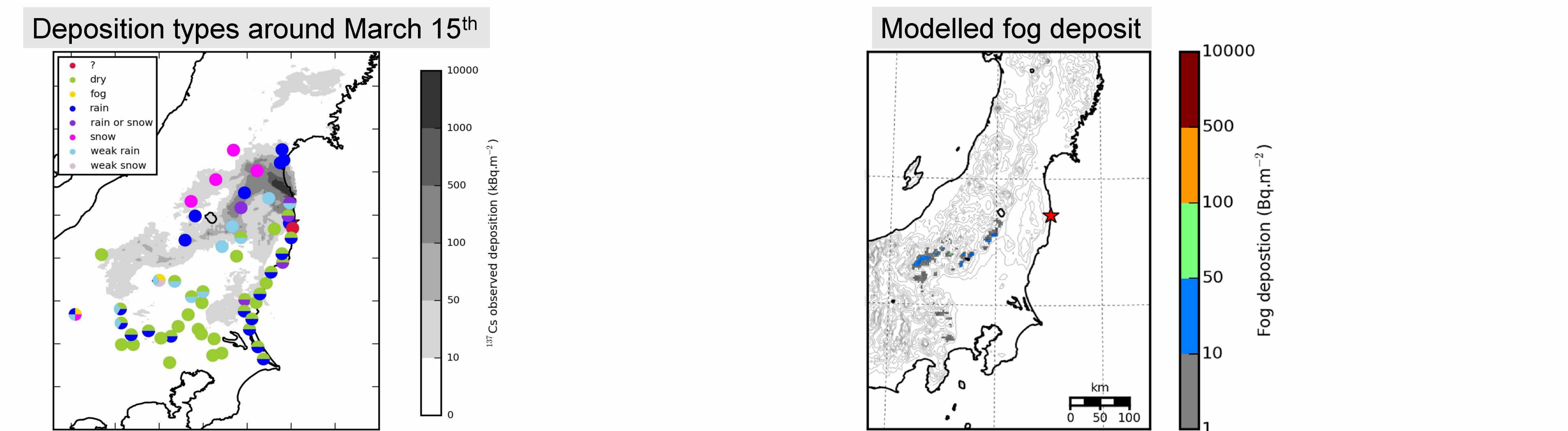
In-cloud scavenging made the largest contribution to the deposit

- Some plumes were scavenged in altitude leading to consequent deposits whereas atmospheric concentrations at ground were low.
- Improvements of what happened on the vertical:
 - Modification of the in-cloud scavenging scheme: $\Lambda = 5 \times 10^{-5} I \rightarrow \Lambda = 5 \times 10^{-4} I^{0.64}$
 - New cloud diagnosis based on cloud water content.



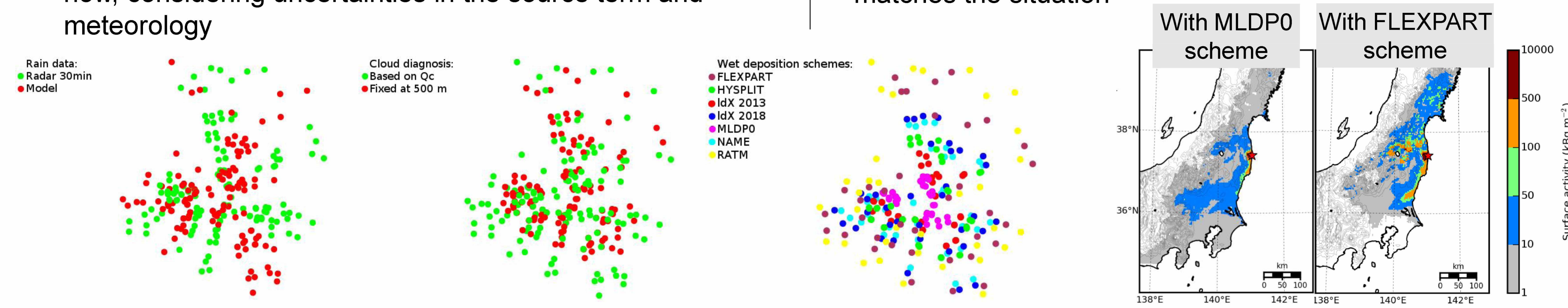
Several mechanisms of deposition contributed to the final map of deposit

- Analysis based on meteorological devices and radiological measurements showed that fog, snow, rain are involved in some deposit (partial evidence for snow and fog deposition)
- Implementation of a fog deposition modelling based on liquid water content at the ground.
 $Q_{\text{cloud}}(z=0) > 10^{-4} \text{ Kg.Kg}^{-1}$ then deposition x 20



Deposit modelling schemes: neither of them is better

- The ranking of several deposition schemes depends on the criteria, and the input data used (source term and meteo)
- Simple wet deposition parameterizations are enough for now, considering uncertainties in the source term and meteorology
- Implementation of 5 operational wet deposition schemes able to reproduce different patterns... ..with the possibility to switch to the one that seems to best matches the situation



Although the Fukushima case is complex, it is a comprehensive case study for atmospheric modelling that allowed scientific advances, especially for wet deposition. The challenge for modellers is to do the deposit at the right time, at the right place and implementing the right deposition process. These features are now implemented in the IRSN operational platform and should benefit to emergency responses. The next case study is atmospheric radon to check whether the lessons of the Fukushima case may be corroborated. See EGU2019-18762, Thu 11 Apr PICO spot 4.

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