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Simulating Xe-13xx concentrations at IMS noble-gas-stations, using STAX data from the medical isotope production facility of Fleurus

Andy Delcloo^{1,2}, Pieter De Meutter^{1,3}, Anas Hamdouchi⁴ and Benoît Deconninck⁴

1 Royal Meteorological Institute of Belgium

2 Ghent University

3 Belgian Nuclear Research Centre

4 Institute for RadioElements

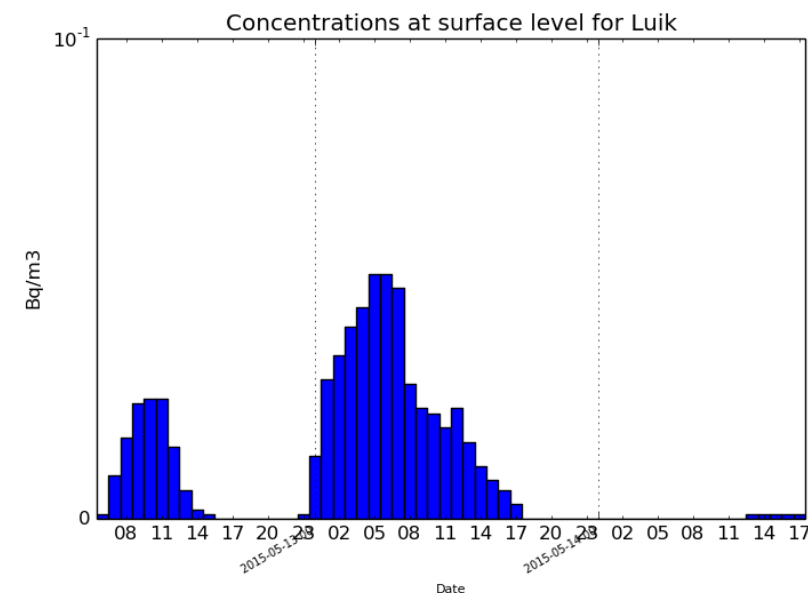
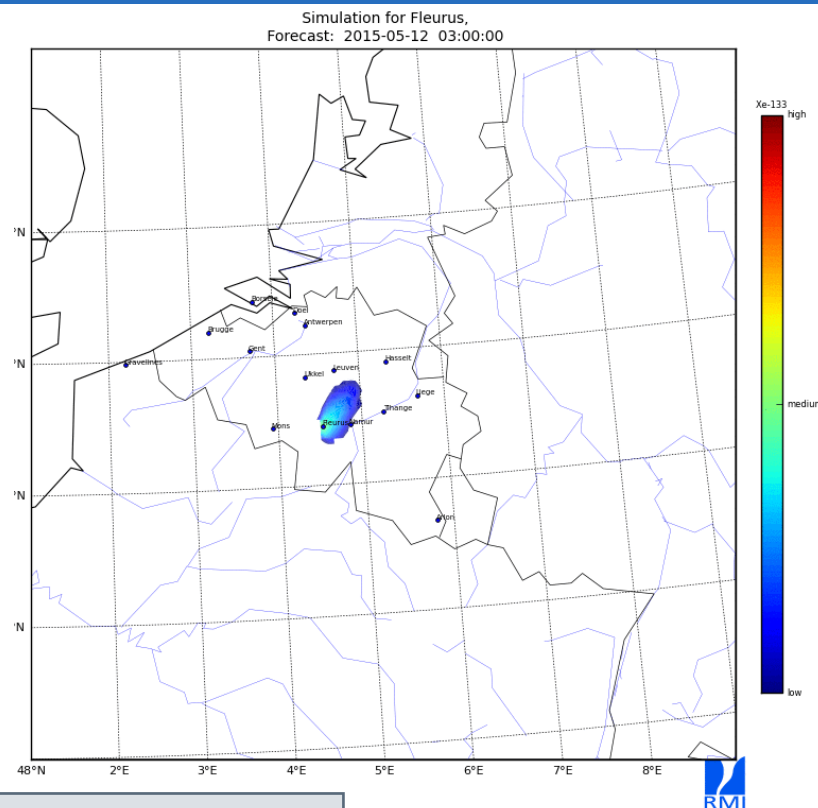
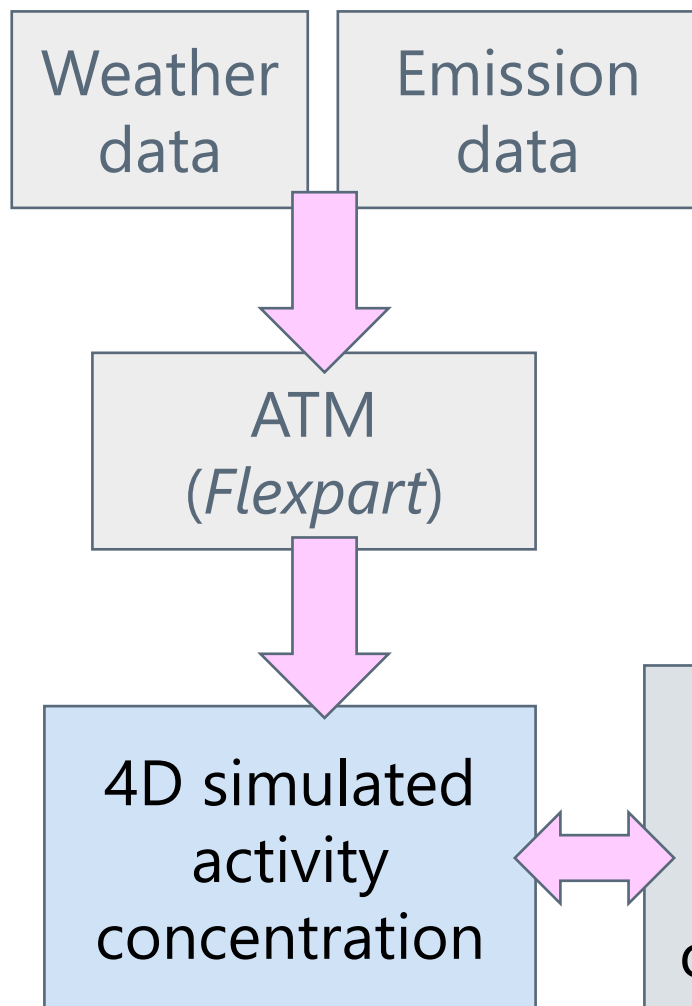


sck cen



- The Stax project
- High resolution modelling @RMI

Using stack emission data from MIPF for Treaty verification: principle



Results for the lowest model layer 0-100 m



STAX data from IRE

Data:

- STAX data at IRE: January 2020 – December 2020
- IMS noble gas observations (^{131m}Xe , ^{133}Xe , ^{133m}Xe , ^{135}Xe) @ RN33 and RN63

Model:

- Flexpart coupled to ECMWF to calculate the activity concentrations originating from IRE at IMS stations

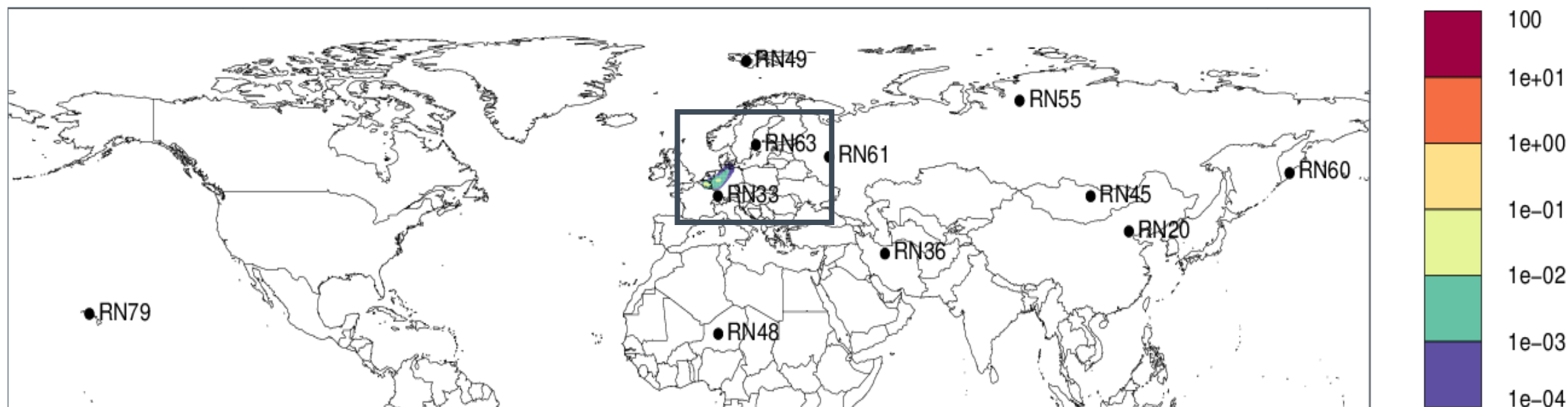
Purpose:

- Comparison between simulated and observed ^{13xx}Xe activity concentrations
- Comparison between simulations using STAX data



^{133}Xe activity concentration from IRE for the period of study

FLEXPART activity (Bq/m^3) 2018-08-27 12:00UTC





STAX data, what can we do with it?

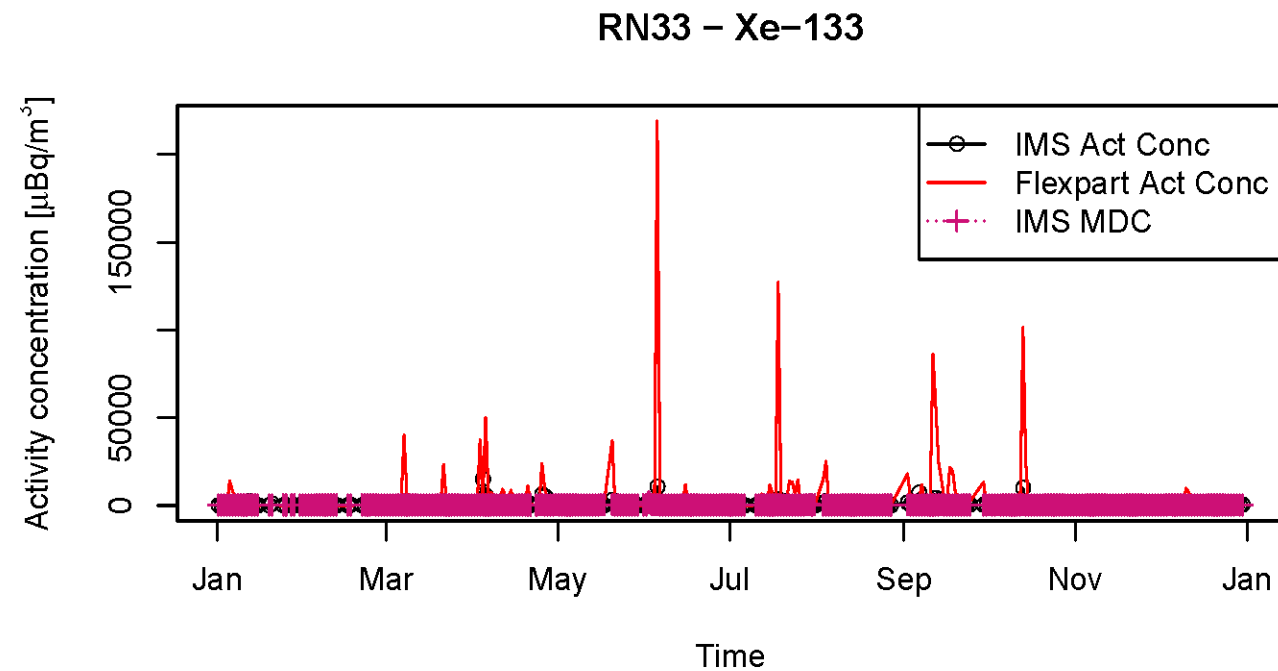
STAX data are available every 15 minutes

For this purpose we integrate the emissions every hour

Operational forecast models can use this data on a daily basis

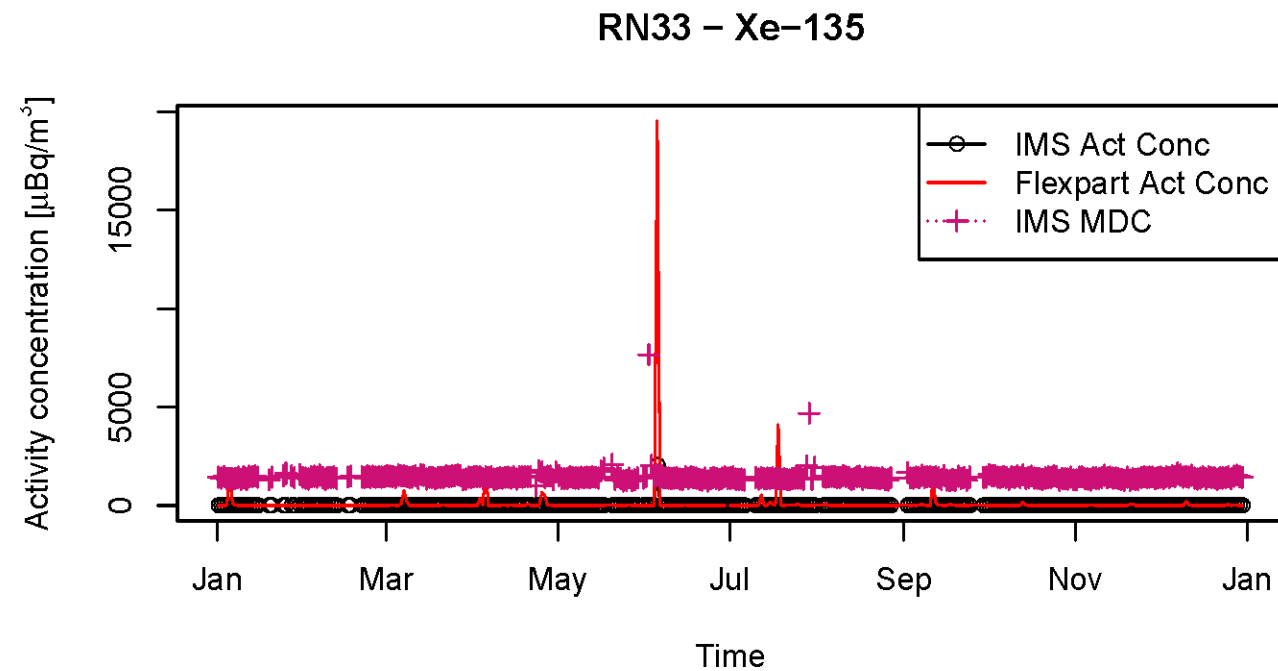
→ providing information on the Xenon background for the two
stations under consideration

^{133}Xe activity concentration time series: RN33

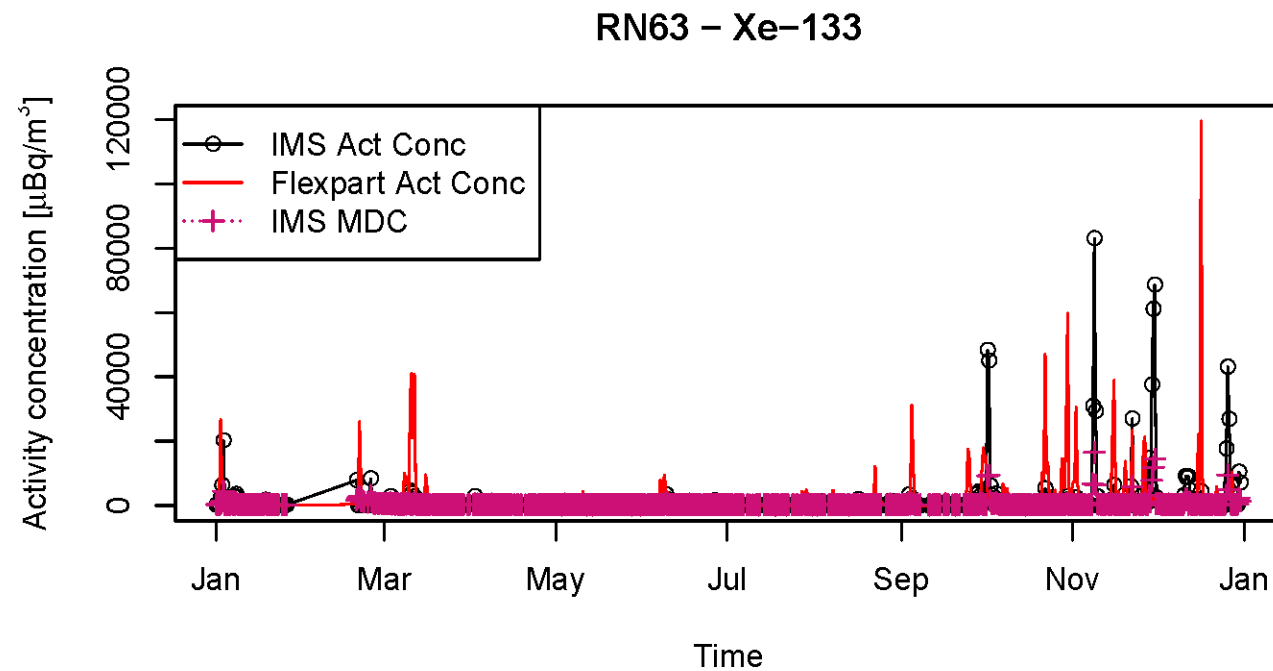




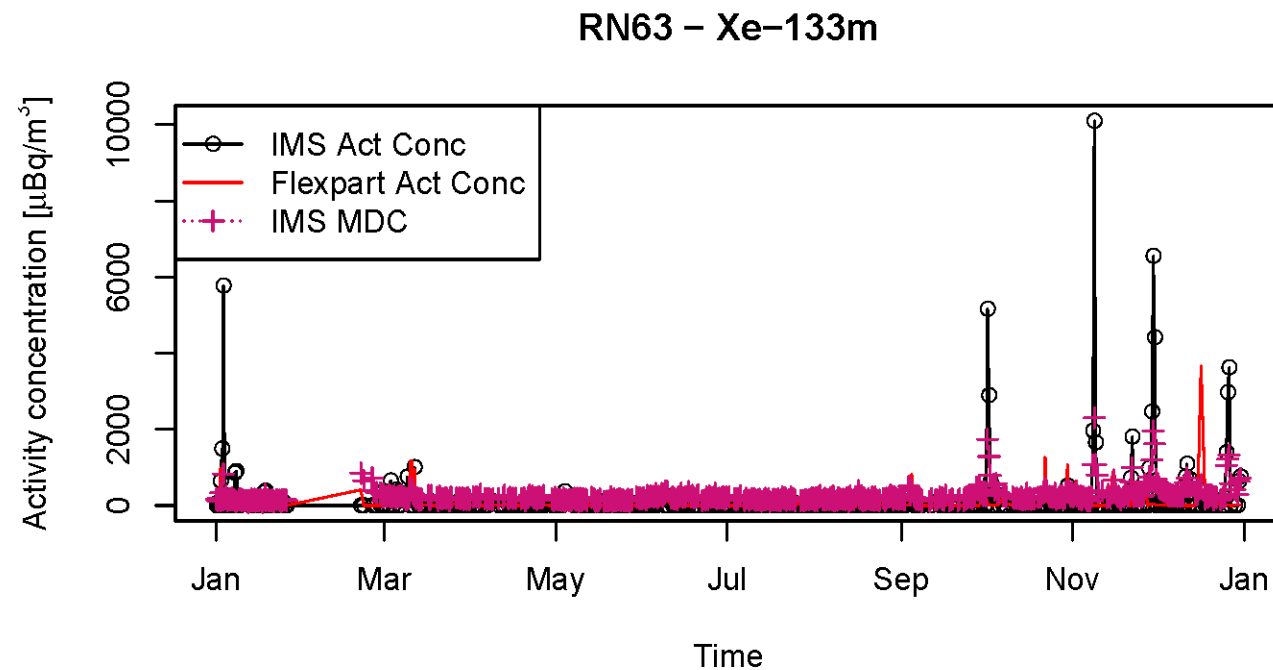
^{135}Xe activity concentration time series: RN33



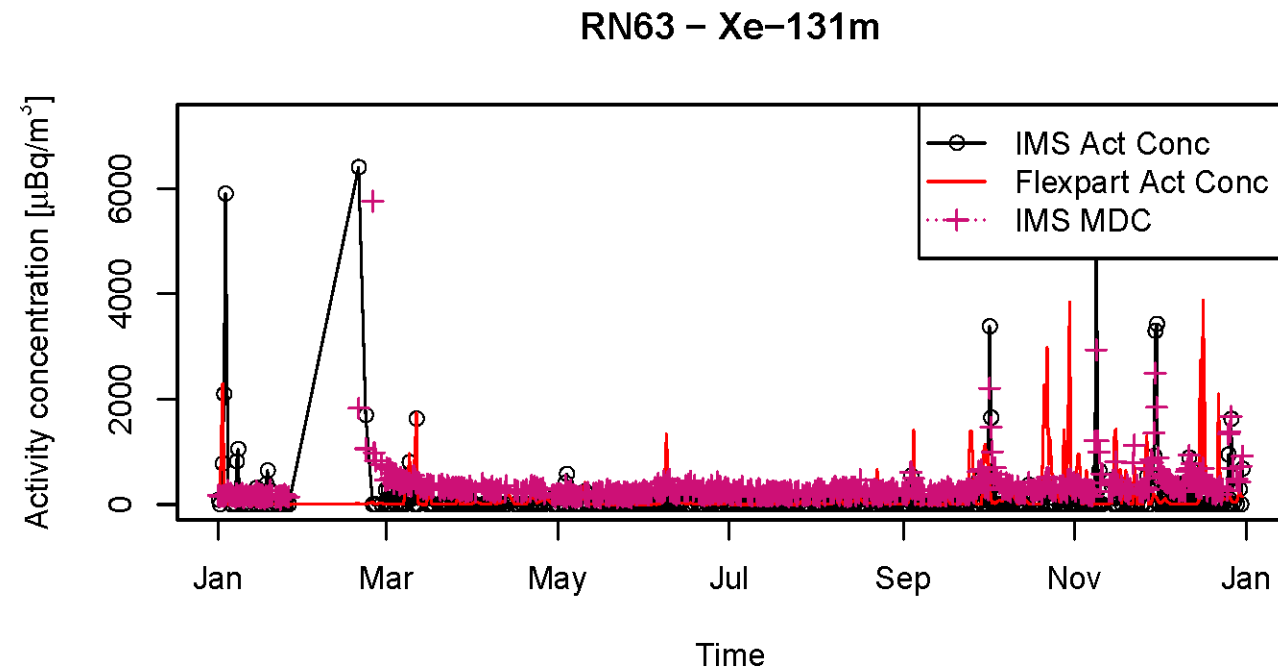
^{133}Xe activity concentration time series: RN63



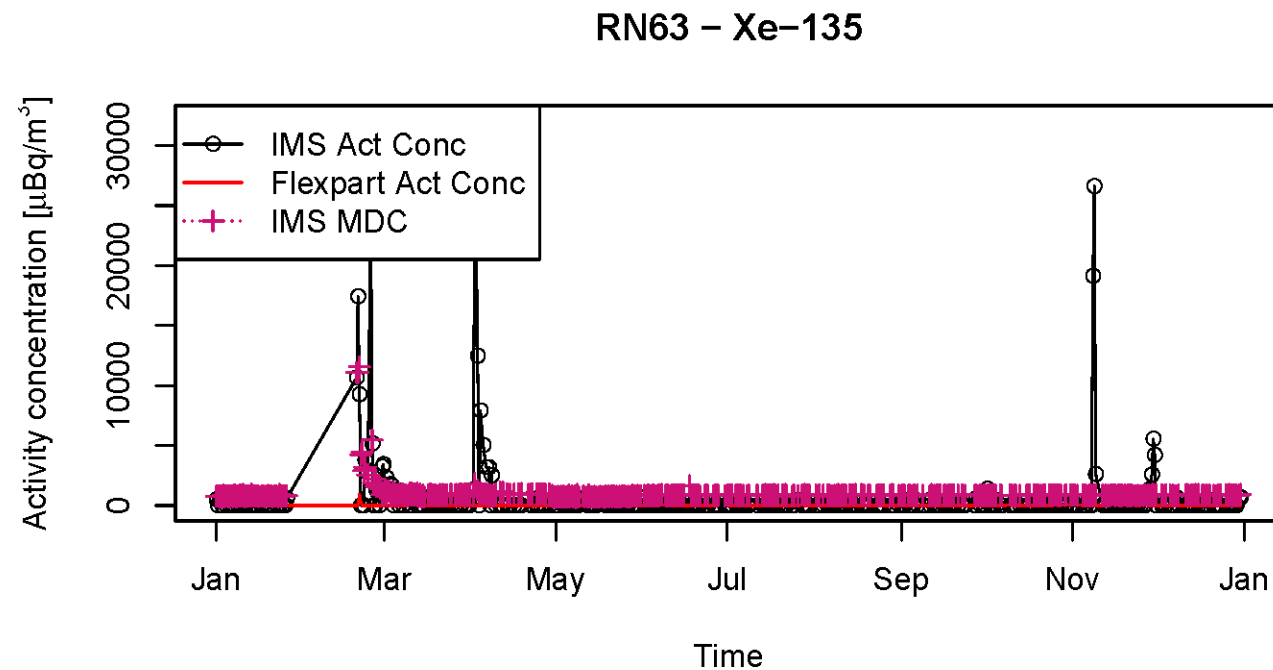
^{133}mXe activity concentration time series: RN63



$^{131\text{m}}\text{Xe}$ activity concentration time series: RN63

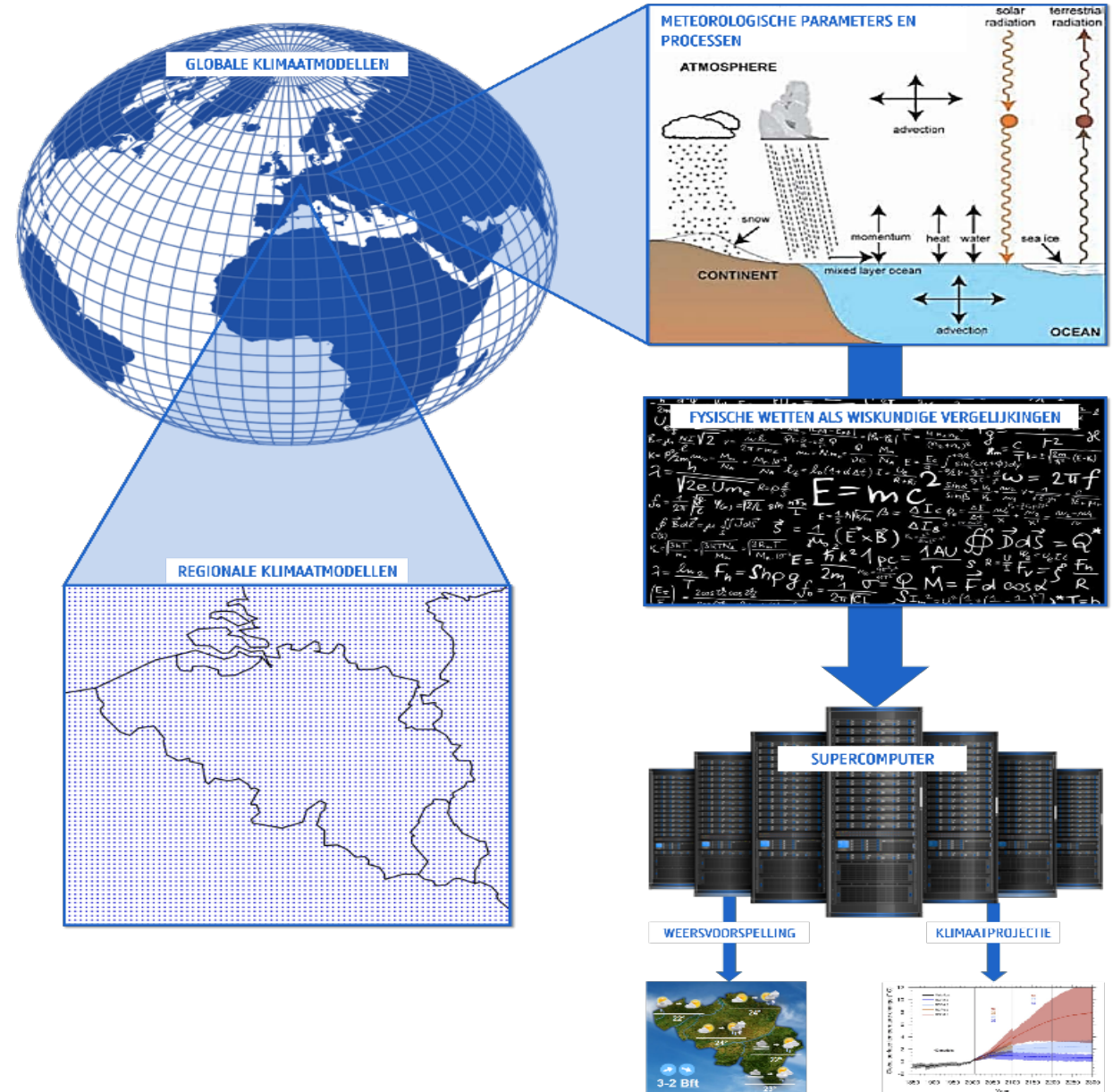


^{135}Xe activity concentration time series: RN63



Conclusions

- Simulating the radioxenon contribution at IMS noble gas stations from civilian nuclear facilities is important for Treaty verification
- Validation for the year 2020
- It is clear that the STAX data is an added value to this research
- The interpretation of the results for RN63 is more complex due to the nearby NPPs (Ringbom et al, 2020)

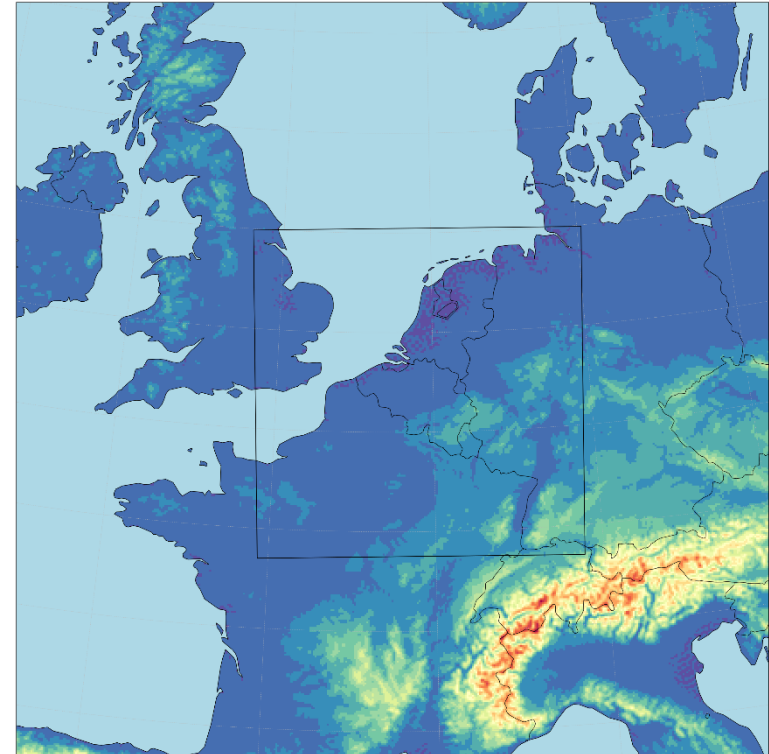


- Creating a continuous xenon background forecast for any place in the world
- Approach: global stack monitoring coupled with ATM
 - there are discrepancies between modelling and observations
 - reasons can be manifold
- One approach to (potentially) improve ATM is to look at higher resolutions (since ATM is coupled to NWP)
 - better resolve the atmospheric flow
 - but high resolution is computationally too expensive to perform globally
 - we need an intermediate step: RMI is planning to launch an operationally regional high resolution *xenon background system*, using LAM NWP.

- Use high resolution models for specific case studies to improve our understanding of *unexplainable* observations.
- steps:
 1. apply this for special events
 2. make operational for Western Europe and compare with the current system at ('low') resolution
 3. make available for other locations for ad hoc events (eg nuclear explosions, OSI) → is a plan for the far future?

Operational models @ RMI

- RMI contributes to the ACCORD consortium for high resolution limited area models, containing the models ALARO/**AROME**/ARPEGE.
- A square grid over the domain.
- Numerically solve the discretised equations in time steps of 1-5 minutes.
- 87 levels
- Two domains:
 - 4km and 1.3km resolution
 - Range: +60h and +36(48)h resp.
 - 4 runs/day



THANK YOU

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