



Koninklijk Meteorologisch Instituut

Institut Royal Météorologique

Königliche Meteorologische Institut

Royal Meteorological Institute

# Evaluation of SILAM and CHIMERE Airborne Birch Pollen Levels over Belgium

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and Nicolas Bruffaerts<sup>3</sup>

1. KMI, Belgium
2. Ghent University
3. Sciensano, Belgium



$\geq 10\%$

# Warnings for birch and grass pollen

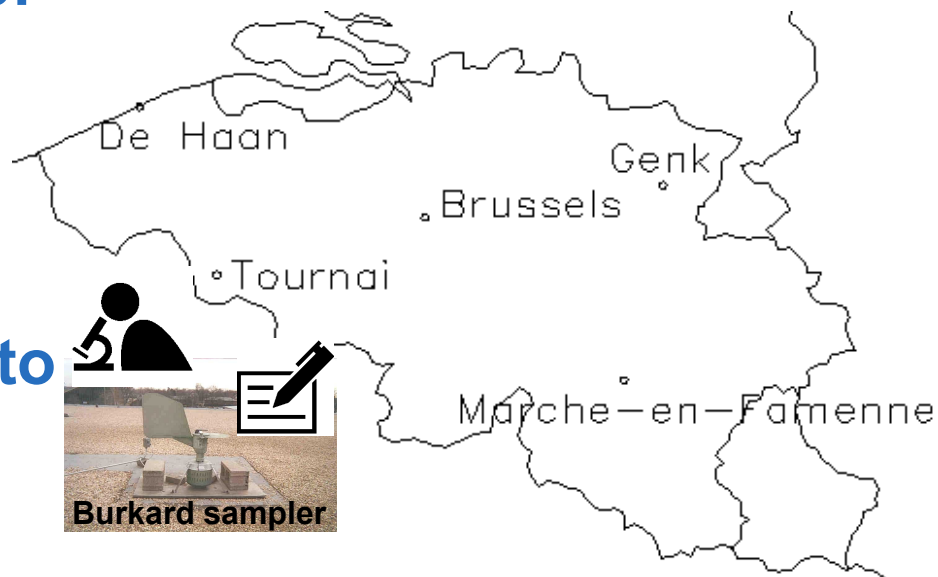
Medication, but not always very effective!

Avoidance!!!

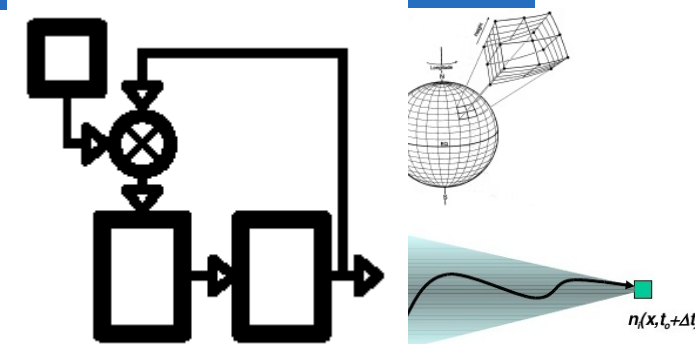
But which locations to avoid and at what times?

Warning system?

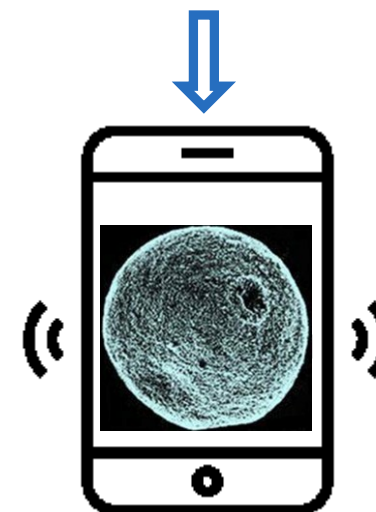
**ISSUE:**



Lack of real-time and detailed spatial information on pollen levels



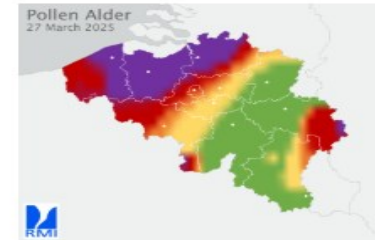
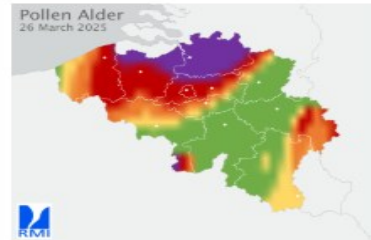
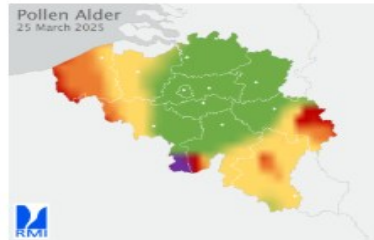
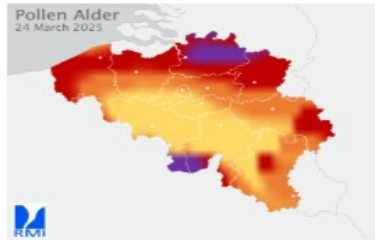
**CTM SILAM** configured for birch, grass, alder, hazel and mugwort pollen





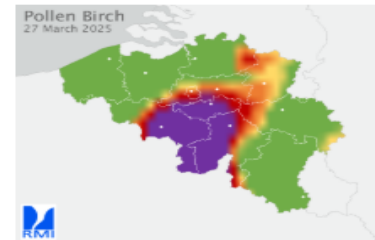
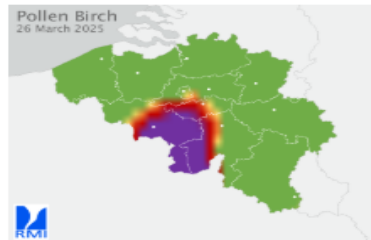
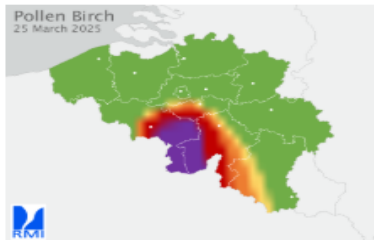
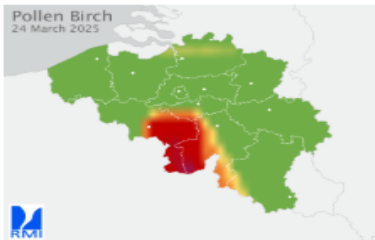
# RMI pollen forecasts

## Alder

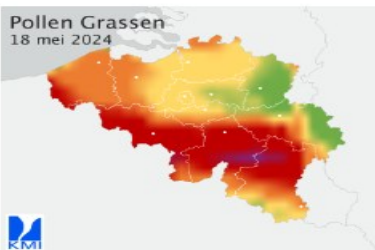
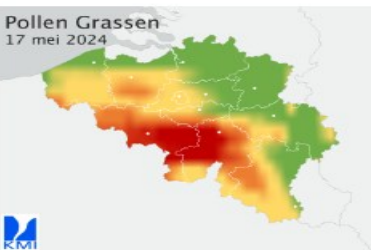
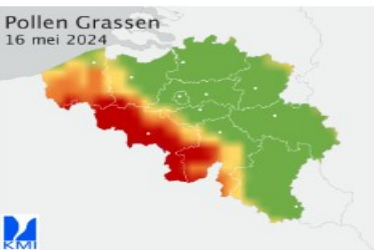
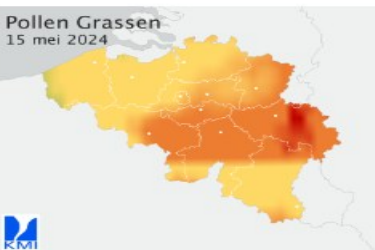


| Color  | Level     | Risk                                                                                                                                                                                                |
|--------|-----------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Green  | Null      | No pollen grains are expected in the air. The risk of symptoms is theoretically absent, although very local exposure can trigger allergies.                                                         |
| Yellow | Low       | Low concentrations of pollen in the air are expected. For very sensitive people, these few pollen could induce allergy symptoms. The usual avoidance measures are already recommended.              |
| Orange | Moderate  | Moderate concentrations of pollen in the air are expected, causing symptoms for people with pollen allergies. The usual avoidance measures are recommended.                                         |
| Red    | High      | High concentrations of pollen in the air are expected. Many people who are allergic to this pollen are likely to develop symptoms. The usual avoidance measures are recommended.                    |
| Purple | Very high | Very high concentrations of pollen in the air are expected. Most people who are allergic to this pollen are likely to develop symptoms. It is strongly recommended to avoid all outdoor activities. |

## Birch



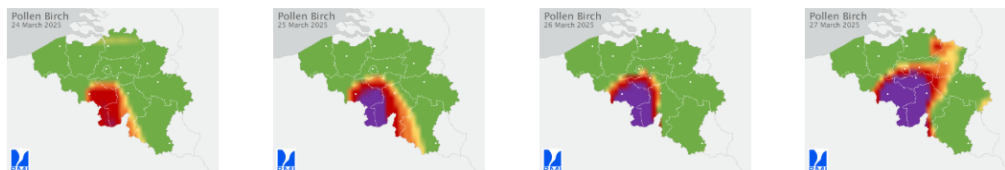
## Grasses



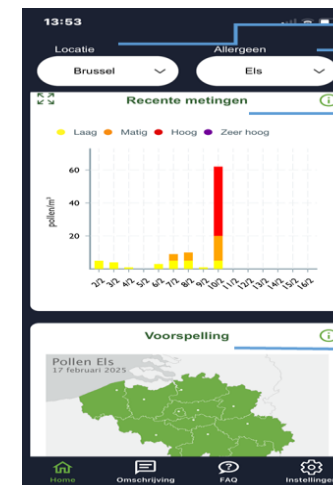
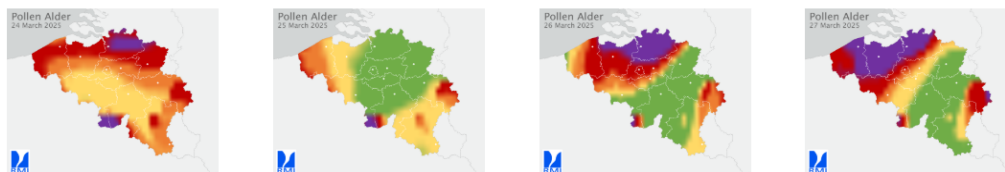


# RMI pollen forecasts

## Birch



## Alder

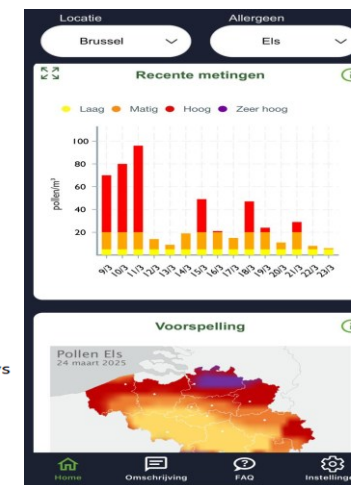


Brussels

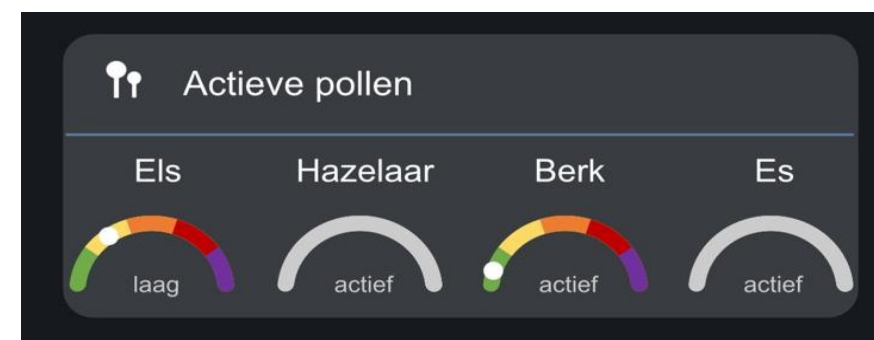
Alder pollen

Recent observations

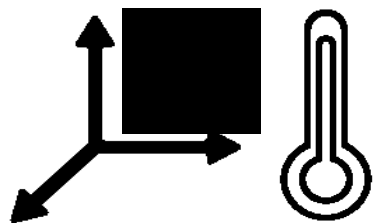
Forecast of today and three consecutive days



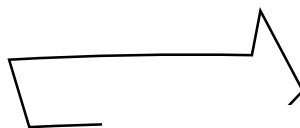
| Color  | Level     | Risk                                                                                                                                                                                                |
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# Pollen on the run

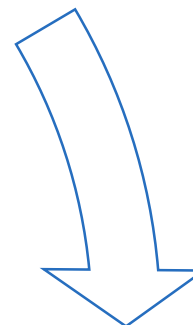


Pollen



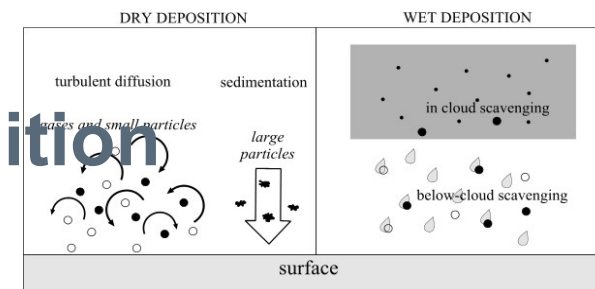
nsport

Non-domestic  
pollen

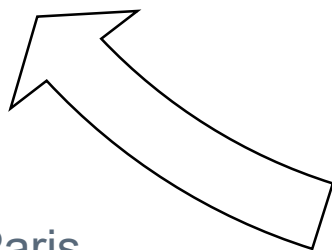
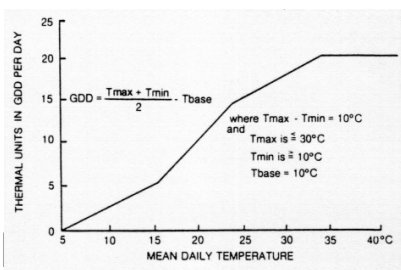


Emissions

Deposition



Dry & wet deposition



Resuspension

# Pollen transport modelling: the principles

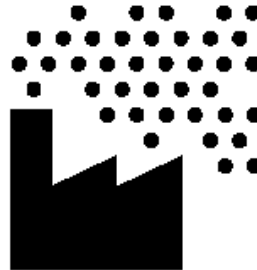
Chemistry Transport Model (CTM)

Particles move due to 4D wind fields

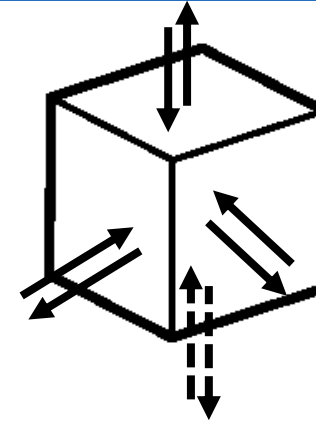
Aerosols



Growing Degree days for plants



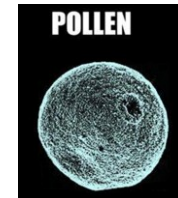
Airborne pollen levels near the surface



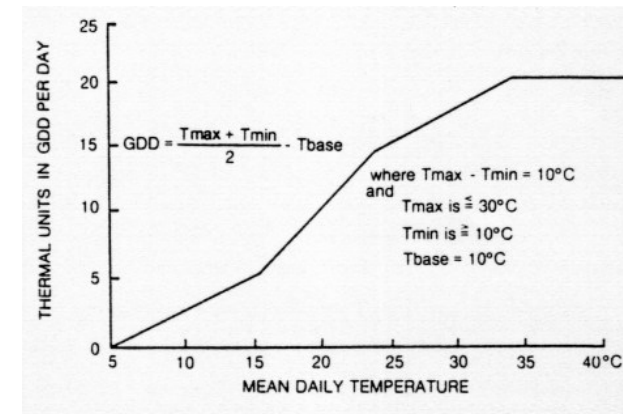
Troposphere

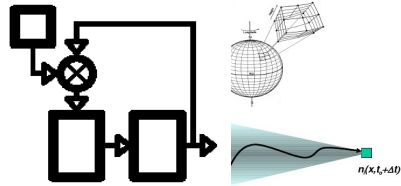
7 km

PM10, PM2.5



PM22

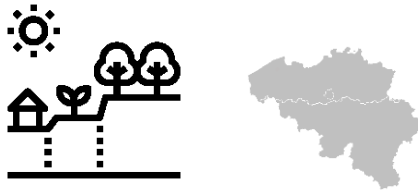




SILAM (System for Integrated modeLling of Atmospheric coMposition) => requires timely spatio-temporal inputs

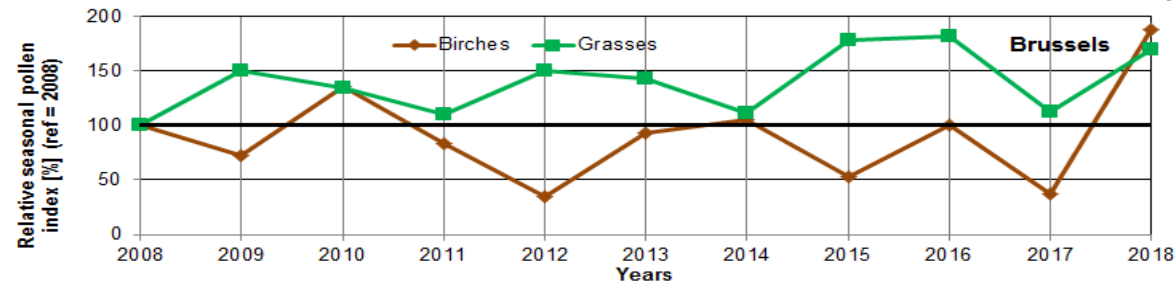


Meteorological data input => ECMWF! Start with **Forecast** meteo, compared with **ERA-5** meteo data



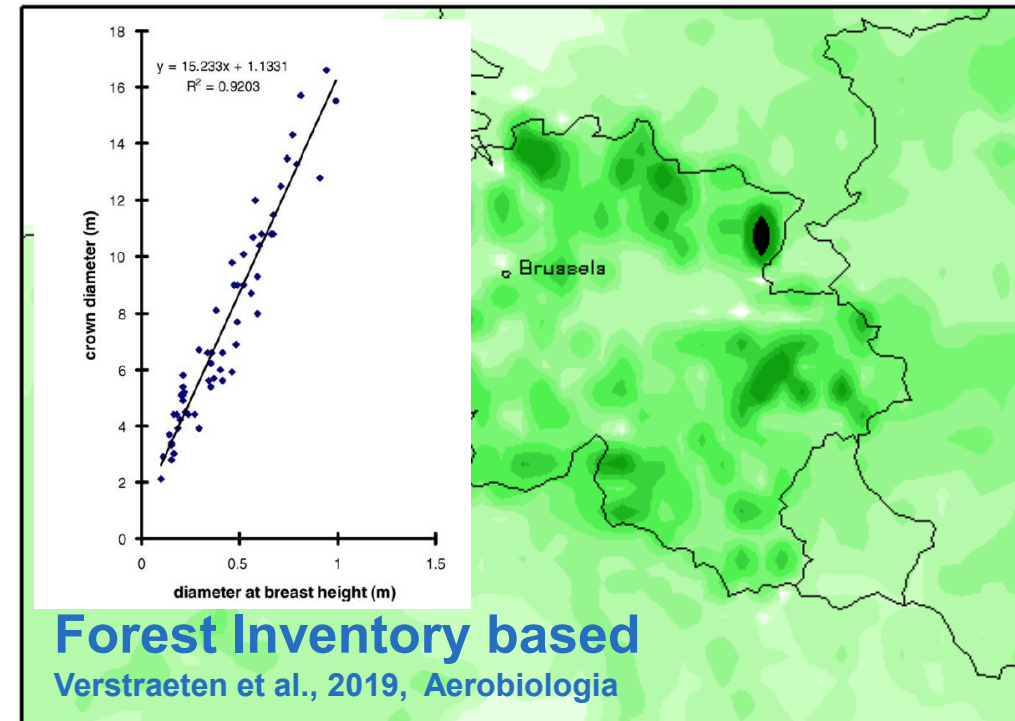
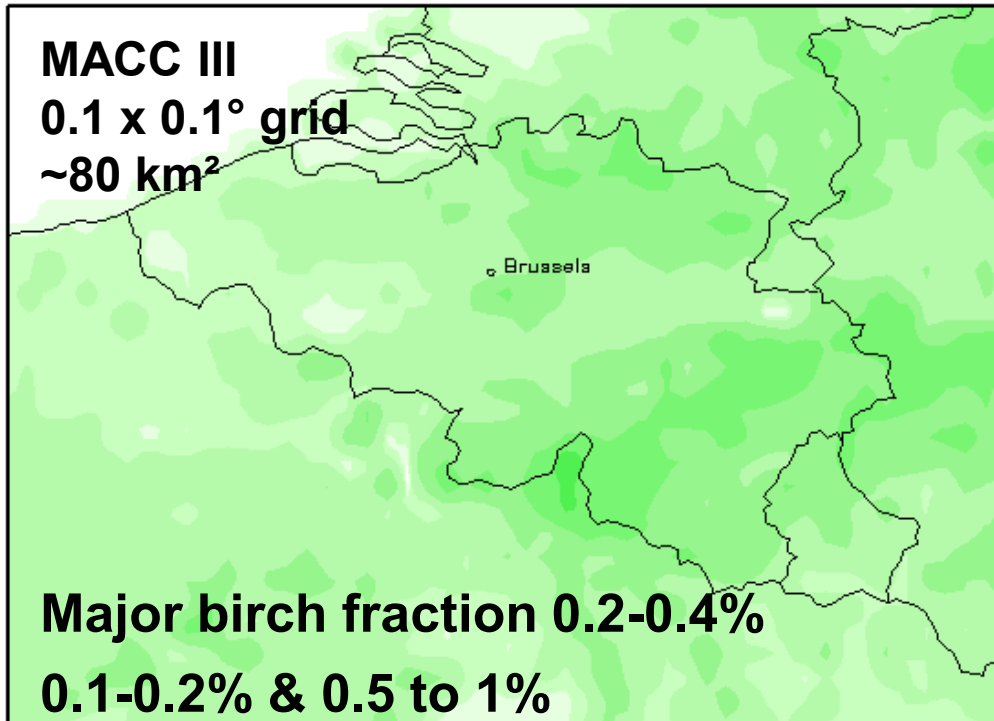
Emission maps: spatial distribution of pollen sources, **but ...**  
Large seasonal variations in pollen emissions (SPIn):

Relative amount of pollen observed at Elsene, Brussels  
Source: Sciensano





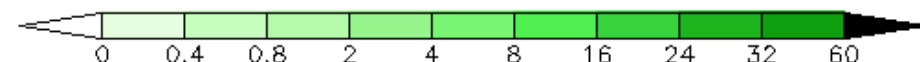
# Bottom-up approach: mapping of birch pollen emission sources

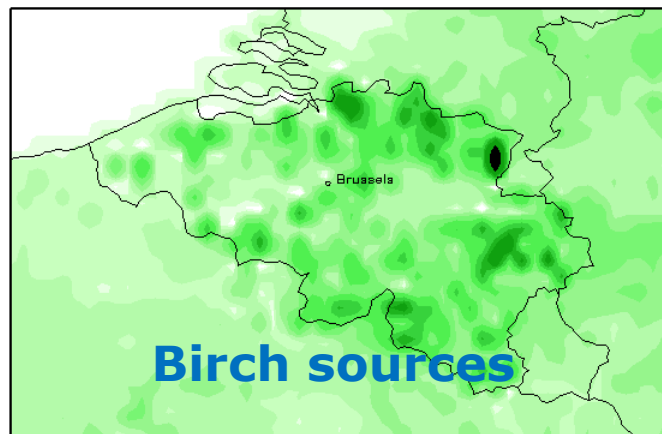


Birch fraction [%]



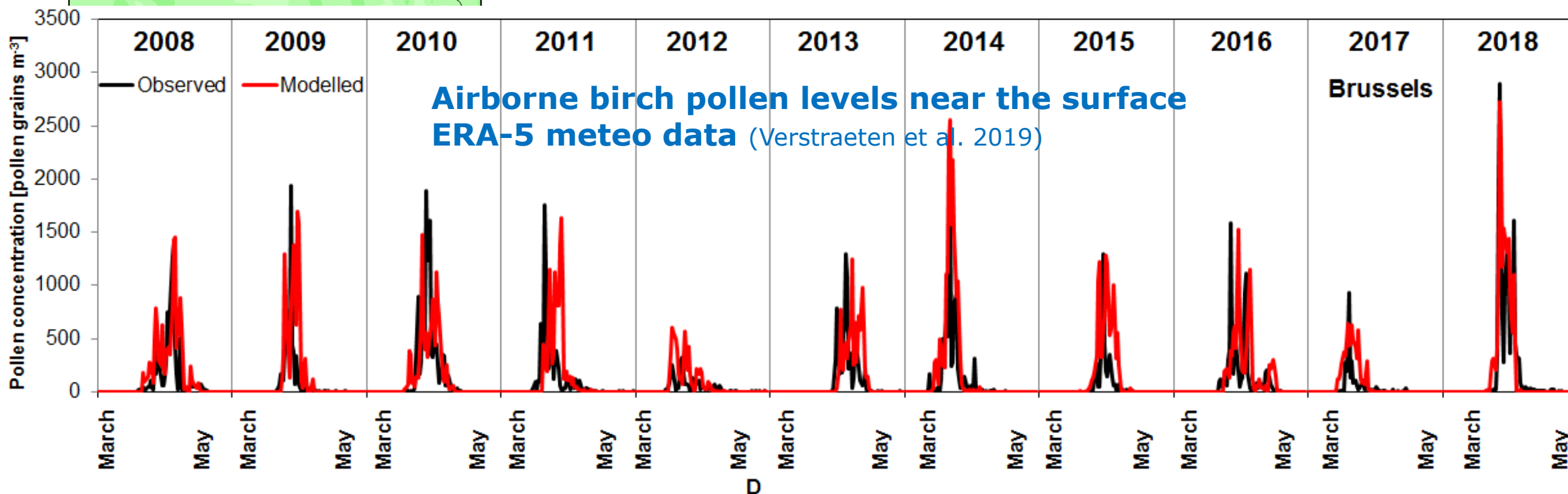
Birch fraction [%]



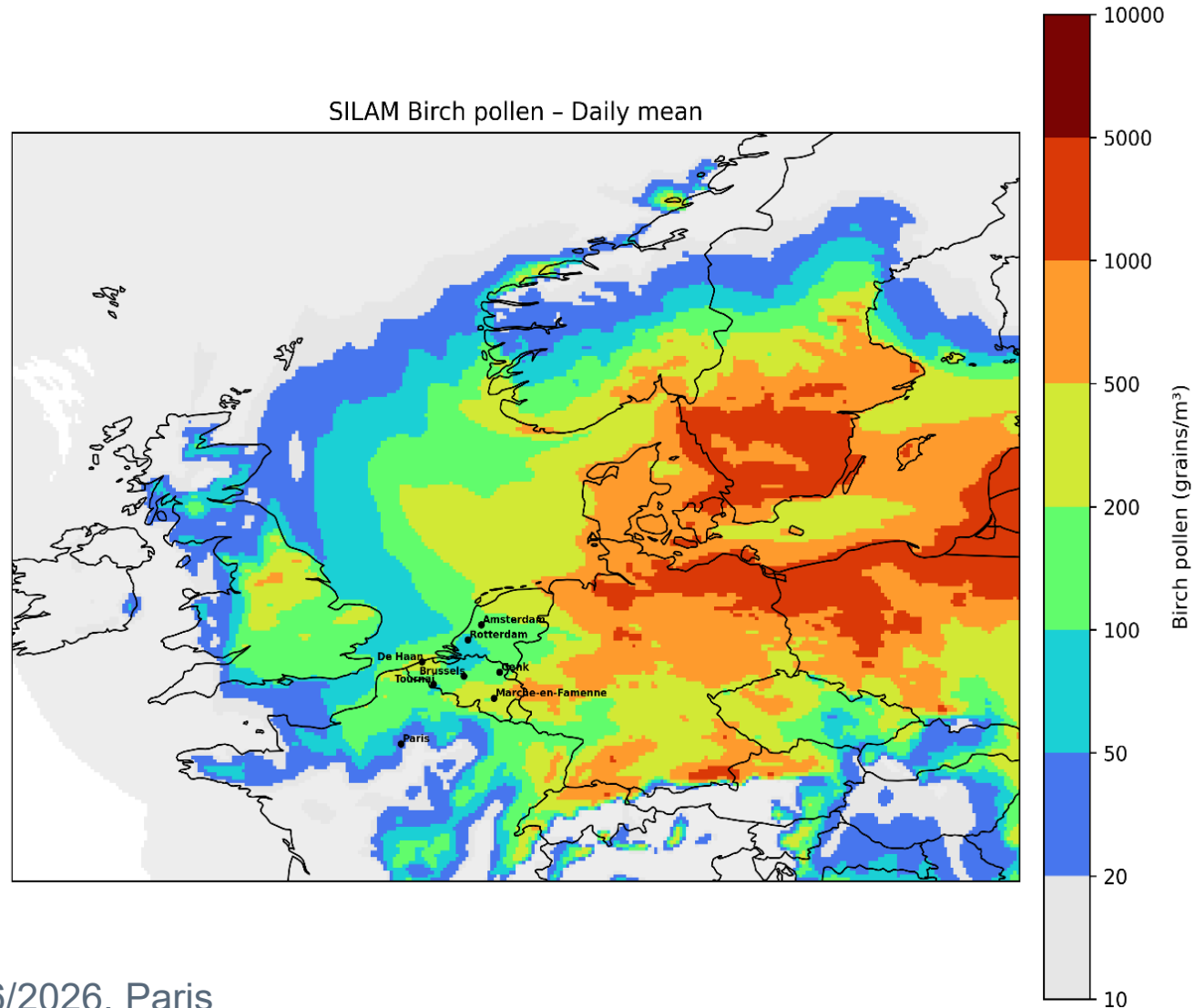


New birch pollen emission source map  
 $R^2$  increased with  $\sim 50\%$ ;

For daily values and sites in Belgium  
 $R^2 = 0.30-0.59$ ; For Brussels  $R^2 = 0.40$



# 2025 birch pollen forecast for CAMS-SILAM

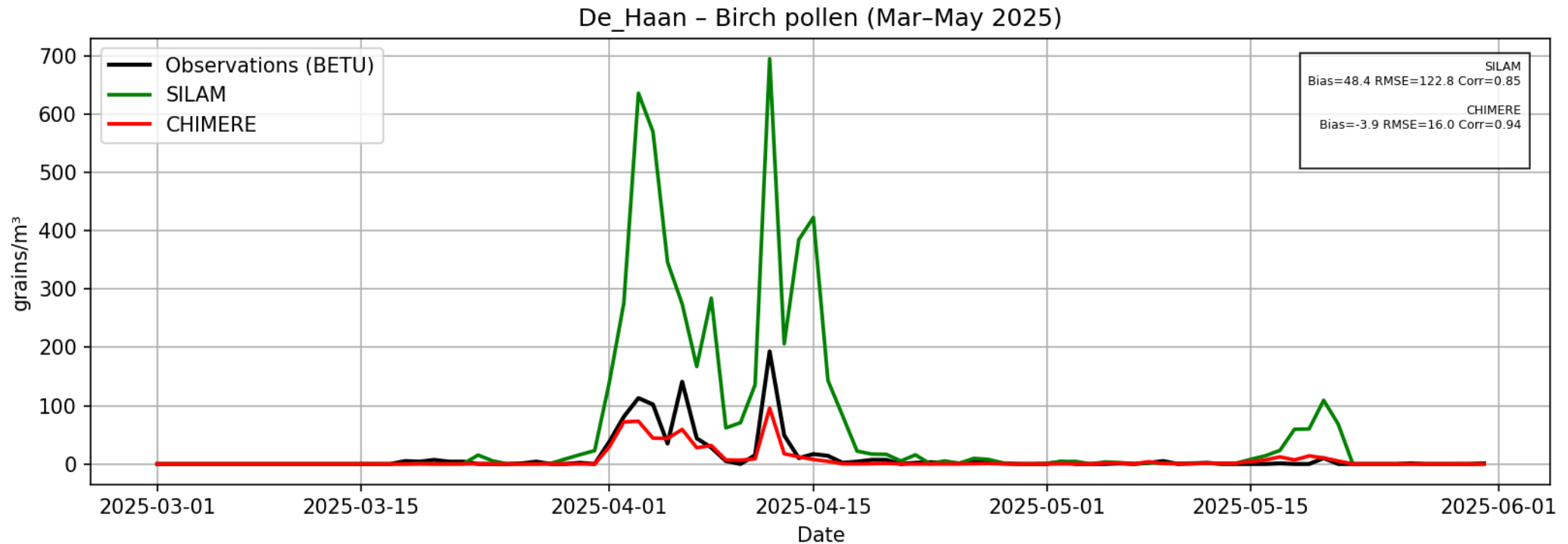




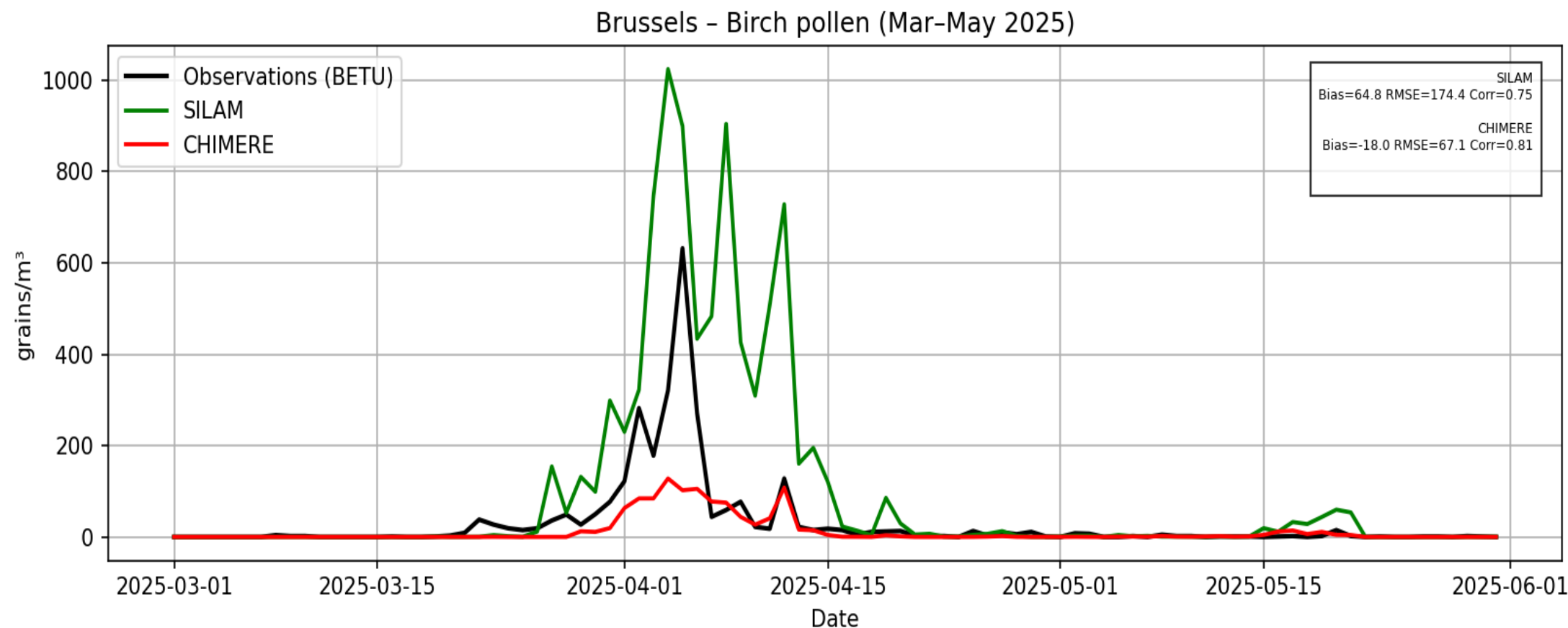
## 2025 birch pollen season CAMS vs OBS

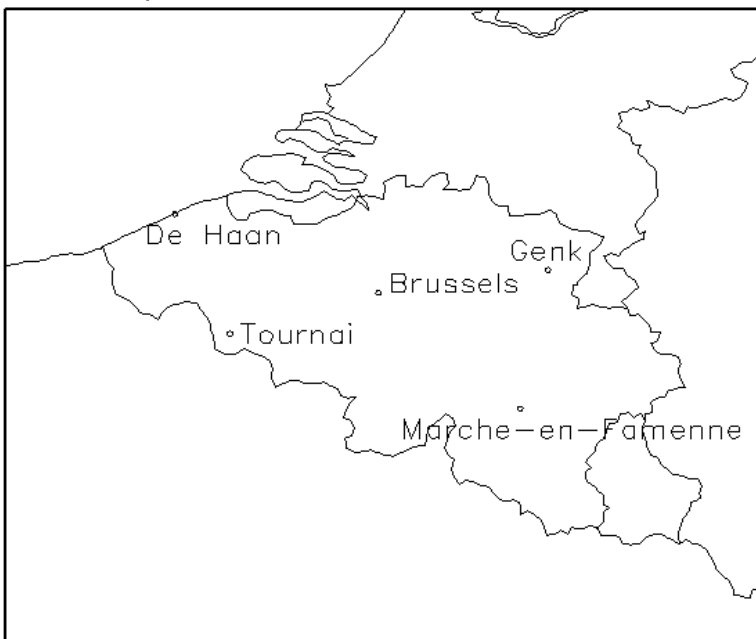
| Station                  | Model    | COR  | RMSE   | BIAS   |
|--------------------------|----------|------|--------|--------|
| <b>Brussels</b>          | CHIMERE  | 0.81 | 67.07  | -18.01 |
|                          | SILAM    | 0.75 | 174.42 | 64.8   |
|                          | SILAM-BE | 0.65 | 89.28  | 29.28  |
| <b>De Haan</b>           | CHIMERE  | 0.94 | 16.01  | -3.95  |
|                          | SILAM    | 0.85 | 122.81 | 48.41  |
|                          | SILAM-BE | 0.70 | 31.95  | 10.45  |
| <b>Genk</b>              | CHIMERE  | 0.78 | 66.17  | -13.64 |
|                          | SILAM    | 0.76 | 202.18 | 82.1   |
|                          | SILAM-BE | 0.63 | 94.99  | 28.82  |
| <b>Marche-en-Famenne</b> | CHIMERE  | 0.83 | 54.31  | -12.84 |
|                          | SILAM    | 0.7  | 304.84 | 122.78 |
|                          | SILAM-BE | 0.57 | 63.71  | 17.76  |

# CAMS 2025 birch pollen forecast for De Haan

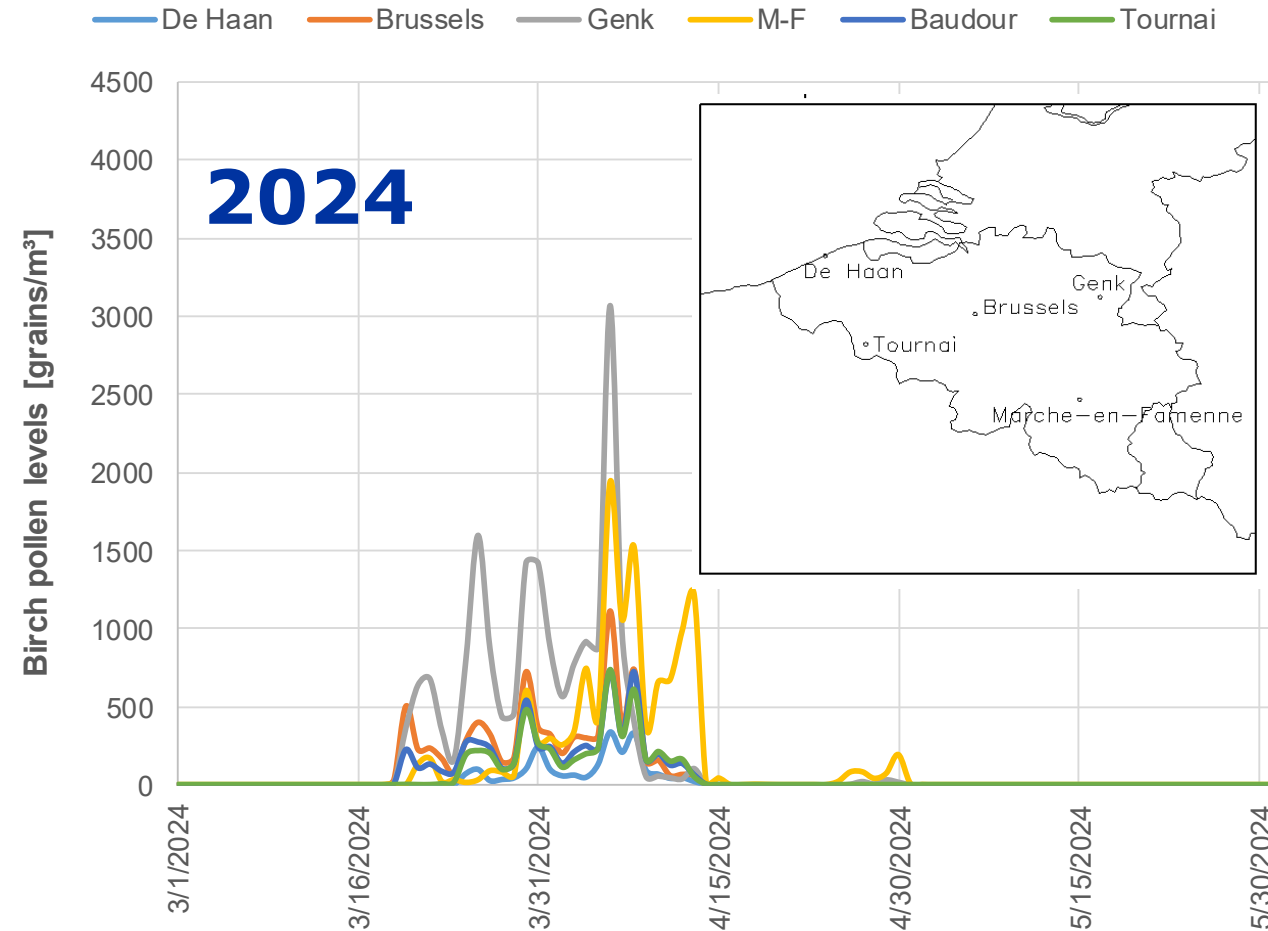
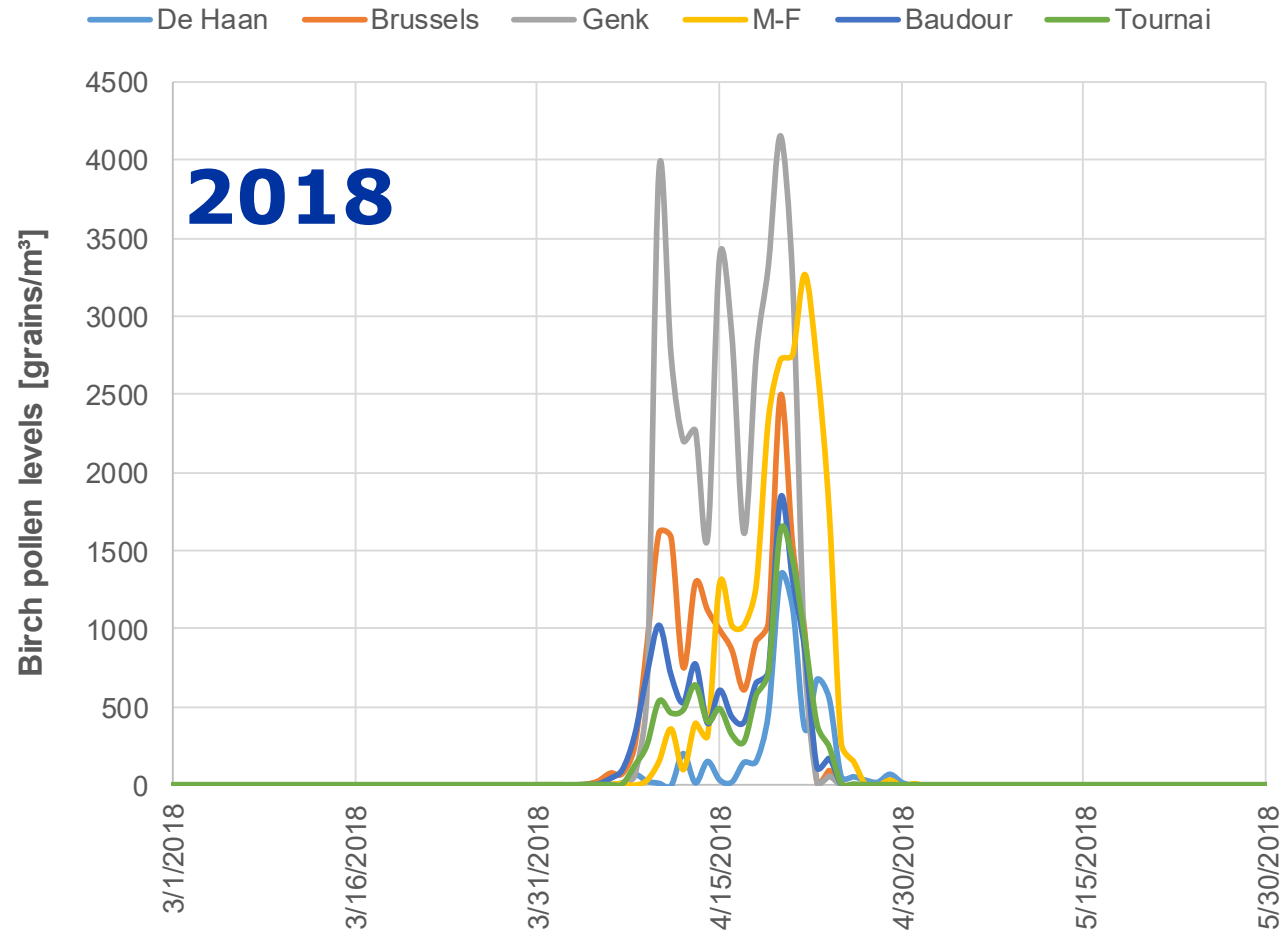


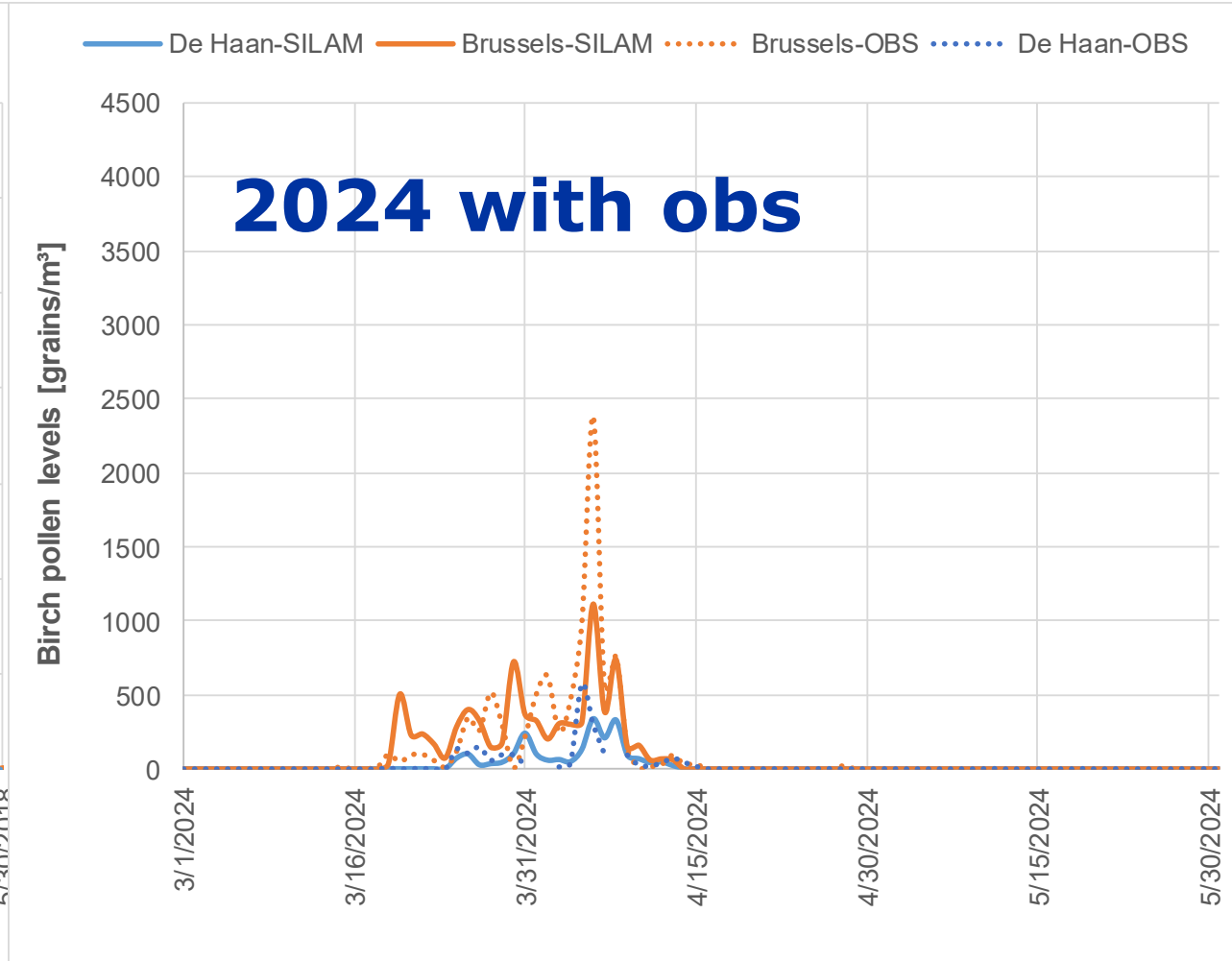
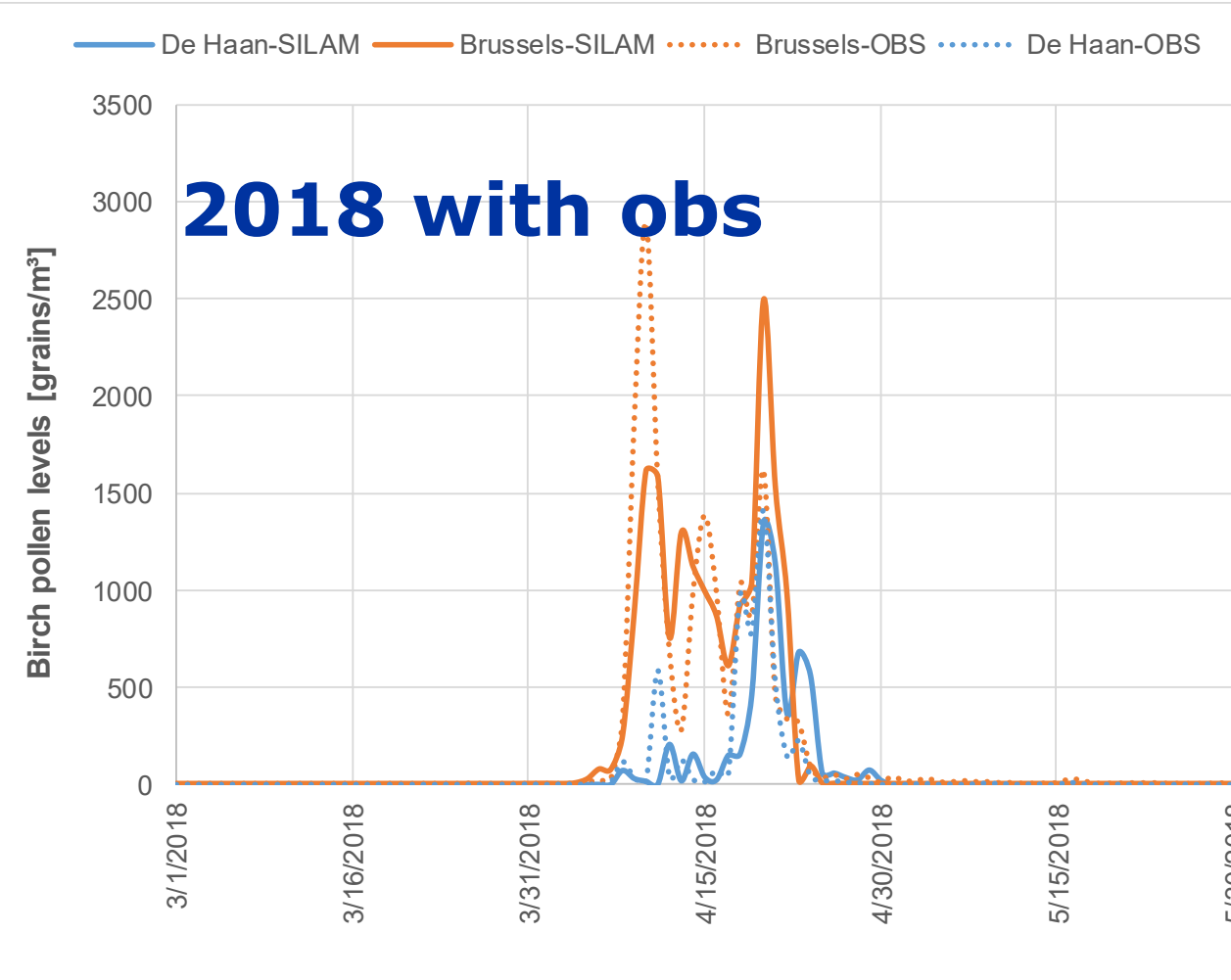
# CAMS 2025 birch pollen forecast for Brussels





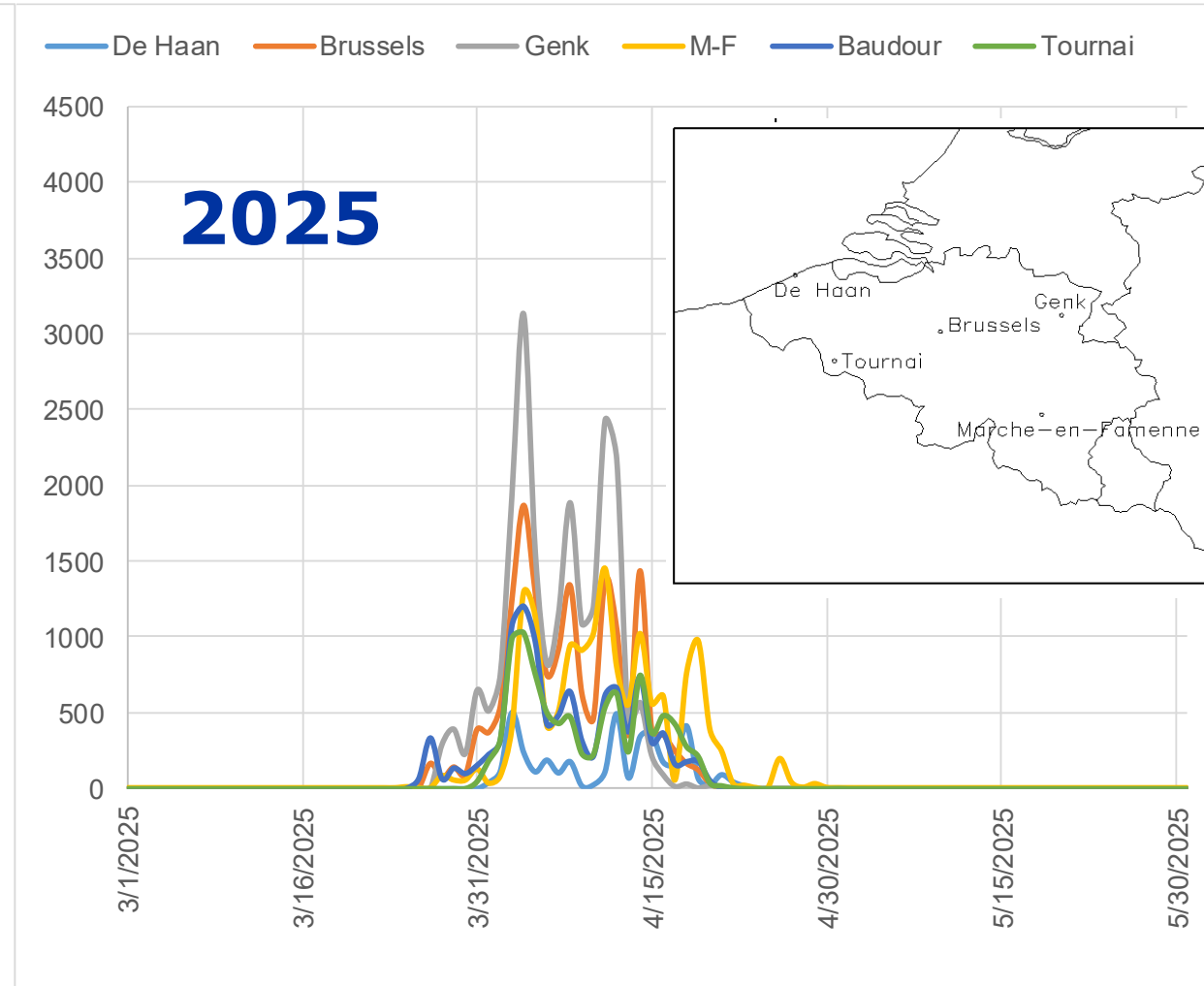
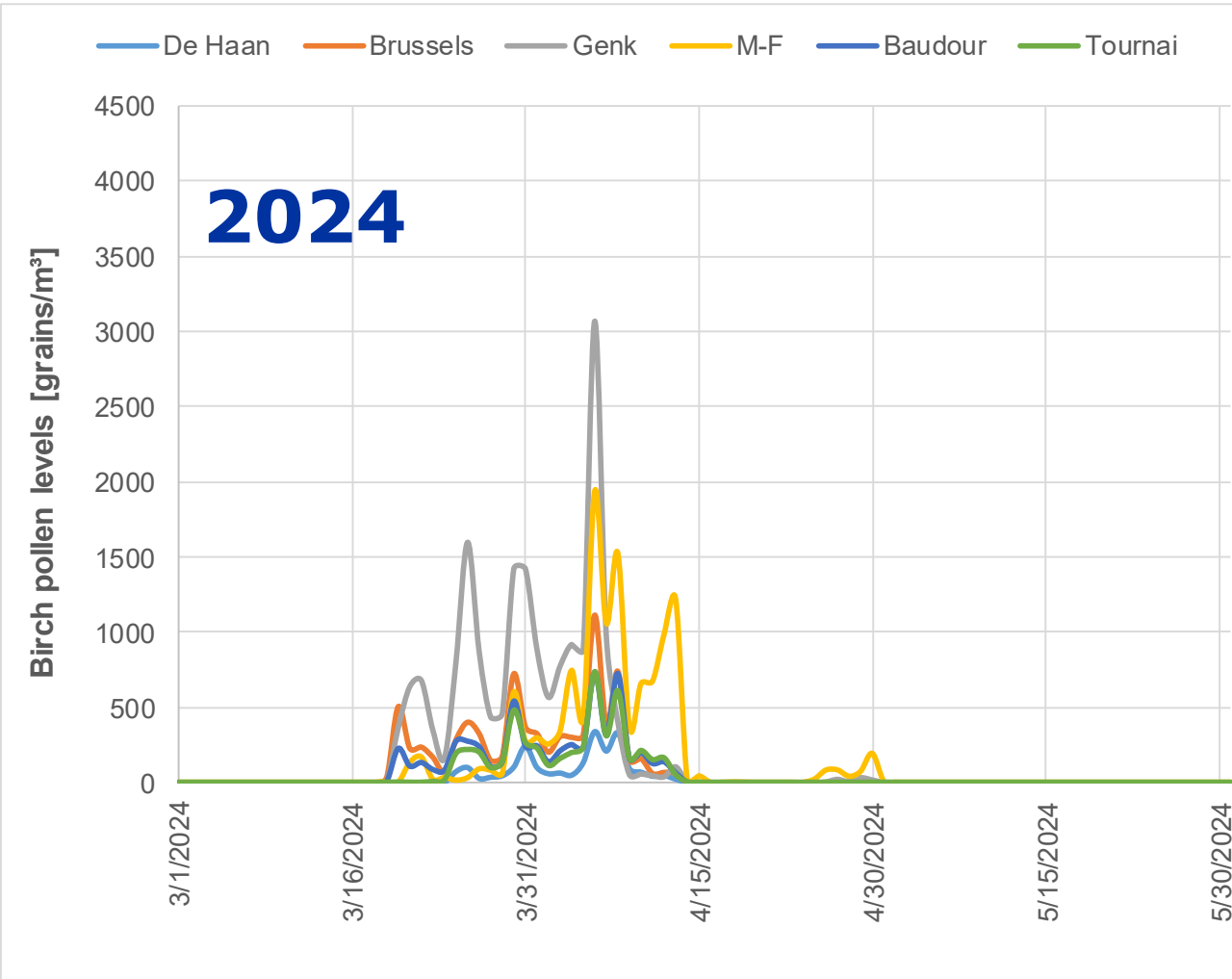
| COR, R          | 2018 | 2024 | 2025 |
|-----------------|------|------|------|
| <b>De Haan</b>  | 0.74 | 0.41 | 0.70 |
| <b>Brussels</b> | 0.84 | 0.63 | 0.65 |
| <b>Genk</b>     | 0.82 | 0.75 | 0.63 |
| <b>M-F</b>      | 0.67 | 0.58 | 0.57 |
| <b>Baudour</b>  | /    | 0.51 | 0.78 |
| <b>Tournai</b>  | 0.75 | /    | /    |

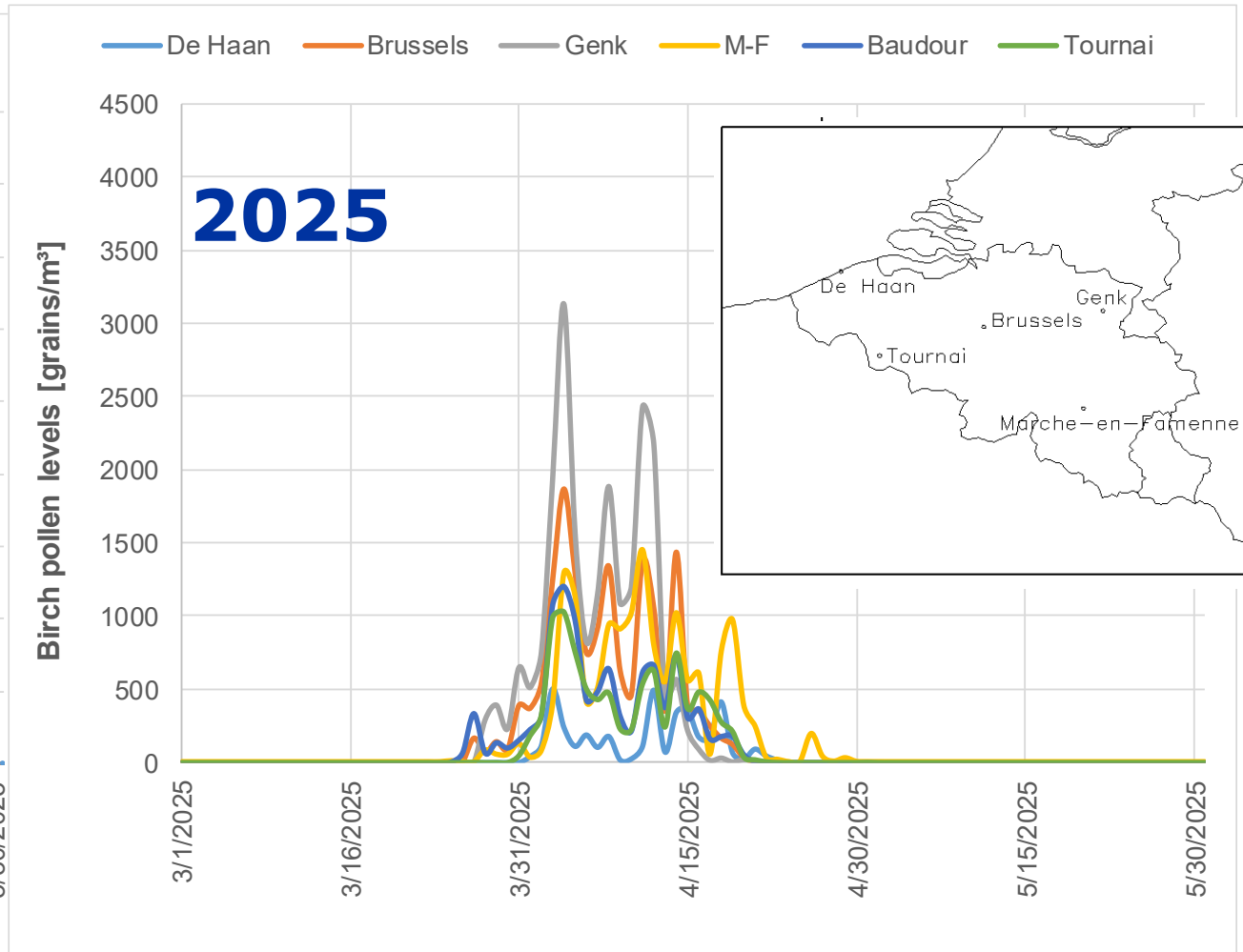
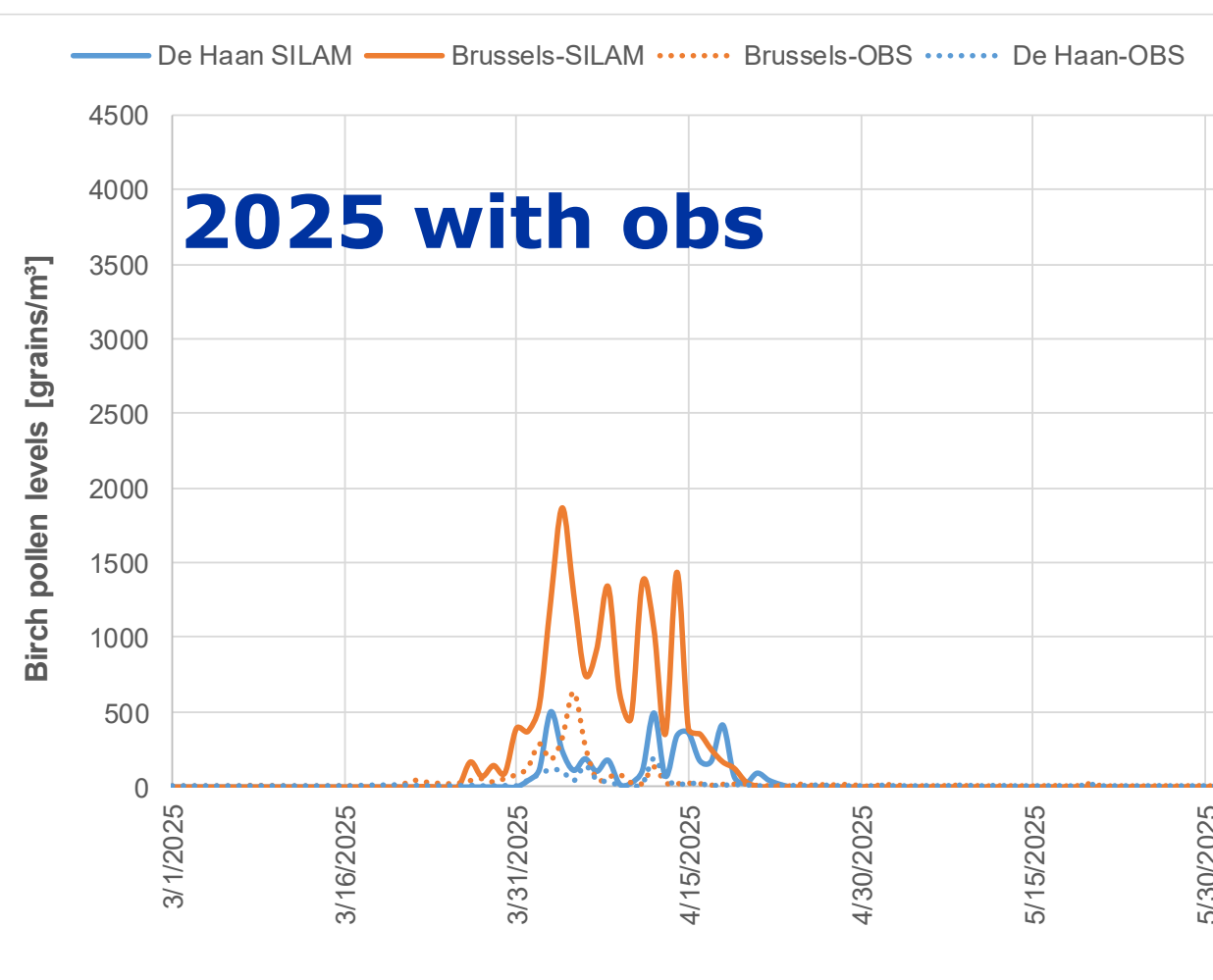






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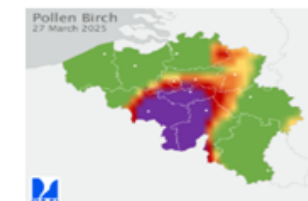
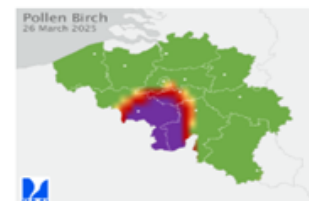
Work in progress ...

- Too high pollen levels by both CAMS-SILAM as SILAM-Belgium, better by CHIMERE, but its signal is rather flat
- But, 2025 is a very low pollen year (low SPIn)
- Scaling emissions prior to the start of the season by using environmental proxies such as June-July Temperature and others should be applied for copying with very high and low birch pollen seasons (Verstraeten, submitted)
- Need for more spatially detailed meteo and emission grids

We can model the amount of birch pollen in the air in Belgium with good performance for the past years

- For Belgium we have an operational 4-day birch pollen (among other pollen types) level forecast available for the public
- Correlations between model & observations are good
- Need for **more detailed** spatial information of the forecasts using **higher resolution meteo and emission data**

## Birch



**THANKS!**