

The uniqueness of the beryllium-7 time series in Kista and Vienna over 1987–2014

ANA RAKOVIĆ

VIENNA UNIVERSITY OF ECONOMICS AND BUSINESS, VIENNA, AUSTRIA

MAJA KRČMAR

DEPARTMENT OF PHYSICS, GRAND VALLEY STATE UNIVERSITY, ALLENDALE, MI, USA

JELENA AJTIĆ

FACULTY OF VETERINARY MEDICINE, UNIVERSITY OF BELGRADE, BELGRADE, SERBIA

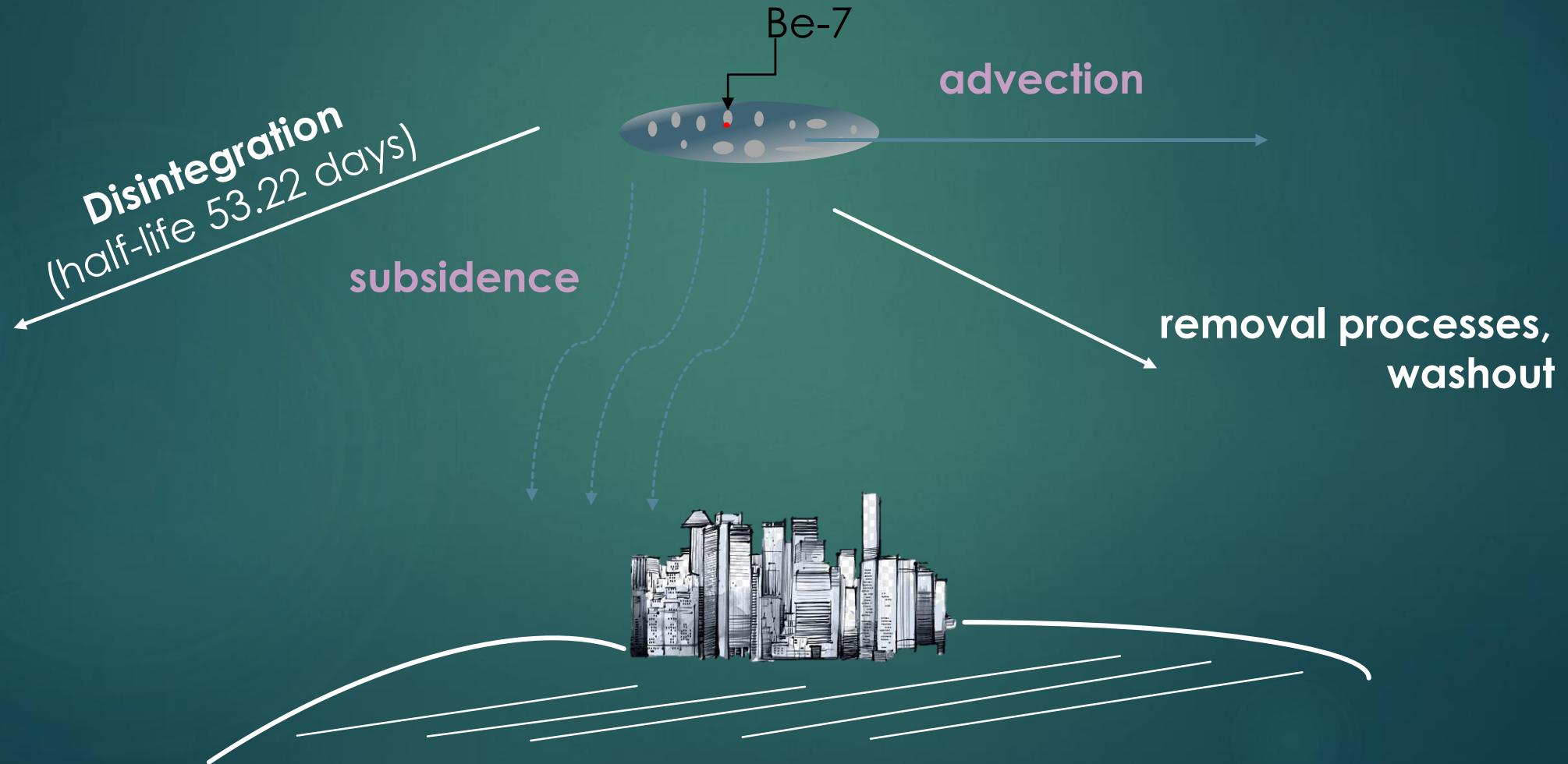
Background

- ▶ Concentration of beryllium-7 (Be-7) in the surface air is considered a good tracer of atmospheric processes.

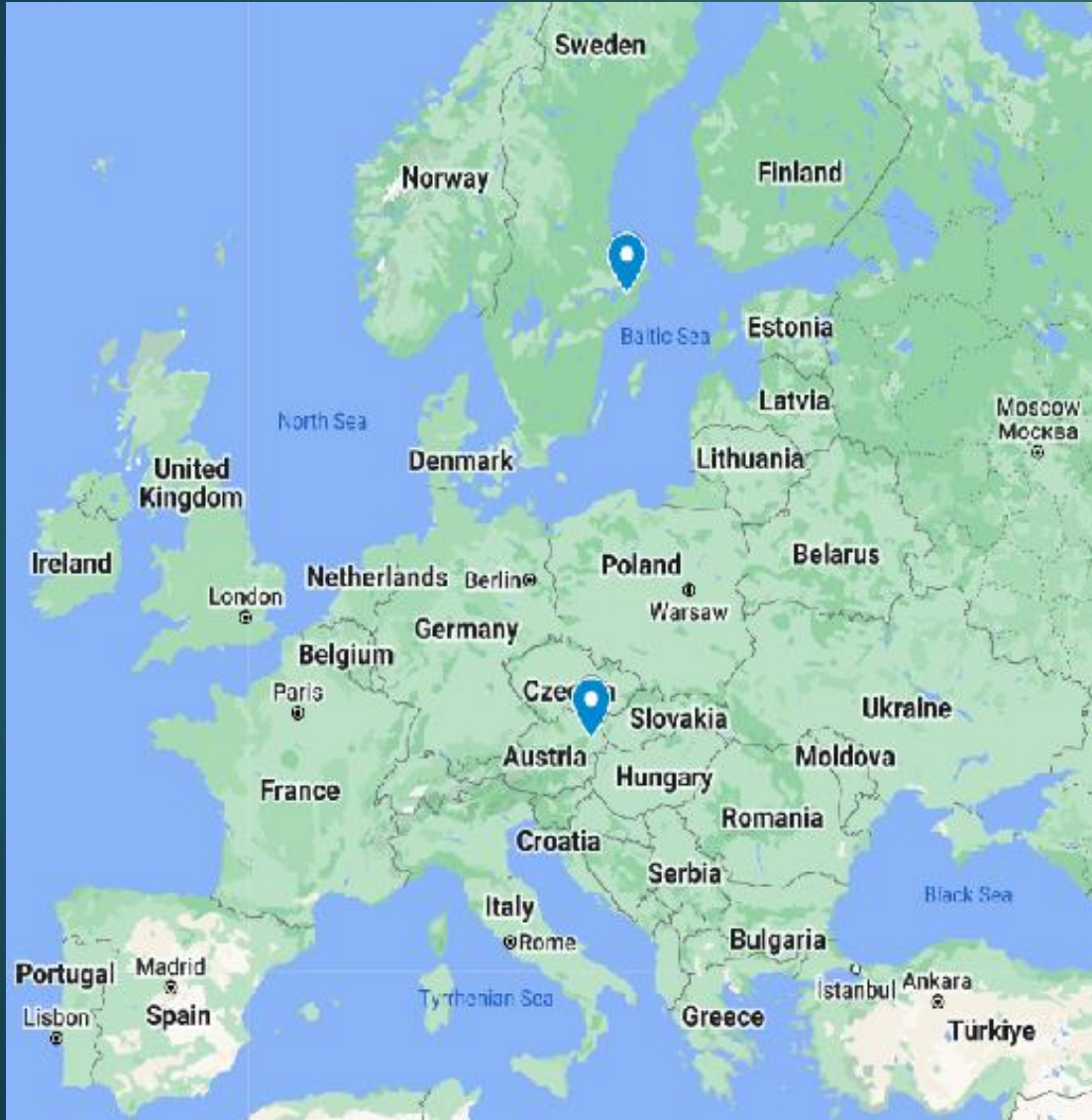
Aim

- ▶ Does a set of five variables: mean temperature, minimum temperature, maximum temperature, precipitation and atmospheric pressure account for the Be-7 concentration variability at the surface?

Be-7 in the atmosphere



Data



Kista (Sweden) and Vienna (Austria)
Radioactivity Environmental Monitoring data bank
Joint Research Centre, Ispra, Italy

1987-2014

air filters

gamma spectrometry

weekly data

~1400 data points

meteorological parameters from the
E-OBS gridded climatology, version 15

Factor analysis

- ▶ Assumption: a given set can be modelled as a linear combination of unobserved factors.
- ▶ Loadings are the contribution of each original variable to the factor; variables with high loadings are well explained by the factor.
- ▶ Total data variability has two terms: communality, which arises from the linear combinations of the factors, and **uniqueness** not explained by the factors.
- ▶ **The model is appropriate if the uniqueness is low.**
- ▶ Null hypothesis: the chosen number of factors is sufficient to explain the variability of the data; the hypothesis is rejected if the calculated p-value is less than 0.05.

One factor / Vienna



Observable	Loading <i>F1</i>	Uniqueness
Be-7	0.681	0.536
Temperature	0.998	0.005
Precipitation	0.119	0.986
Pressure	-0.316	0.900



F1 = temperature!

Two factors / Vienna



Observable	Loading <i>F1</i>	Loading <i>F2</i>	Uniqueness
Be-7	0.755	-0.157	0.406
Temperature	0.956	0.291	0.005
Precipitation	< 0.1	0.412	0.830
Pressure	-0.251	-0.266	0.866



F1 = temperature

F2 \approx precipitation

Three factors / Vienna

Observable	Loading <i>F1</i>	Loading <i>F2</i>	Loading <i>F3</i>	Uniqueness
Be-7	0.726	< 0.1	-0.269	0.399
Temperature	0.980	-0.124	0.152	0.005
Precipitation	< 0.1	-0.193	0.429	0.777
Pressure	-0.155	0.926	-0.336	0.005



F1 = temperature

F2 = pressure

F3 \approx precipitation

Results

- ▶ Be-7 concentration seems to be strongly correlated with temperature
- ▶ Uniqueness of the Be-7 concentration decreases with the increasing number of factors
- ▶ But, p-value ≈ 0 in all three models – variance cannot be captured by up to 3 factors

Conclusion

- ▶ Our chosen set of variables lacks an important observable that could help explain the behaviour of the Be-7 concentration at the surface