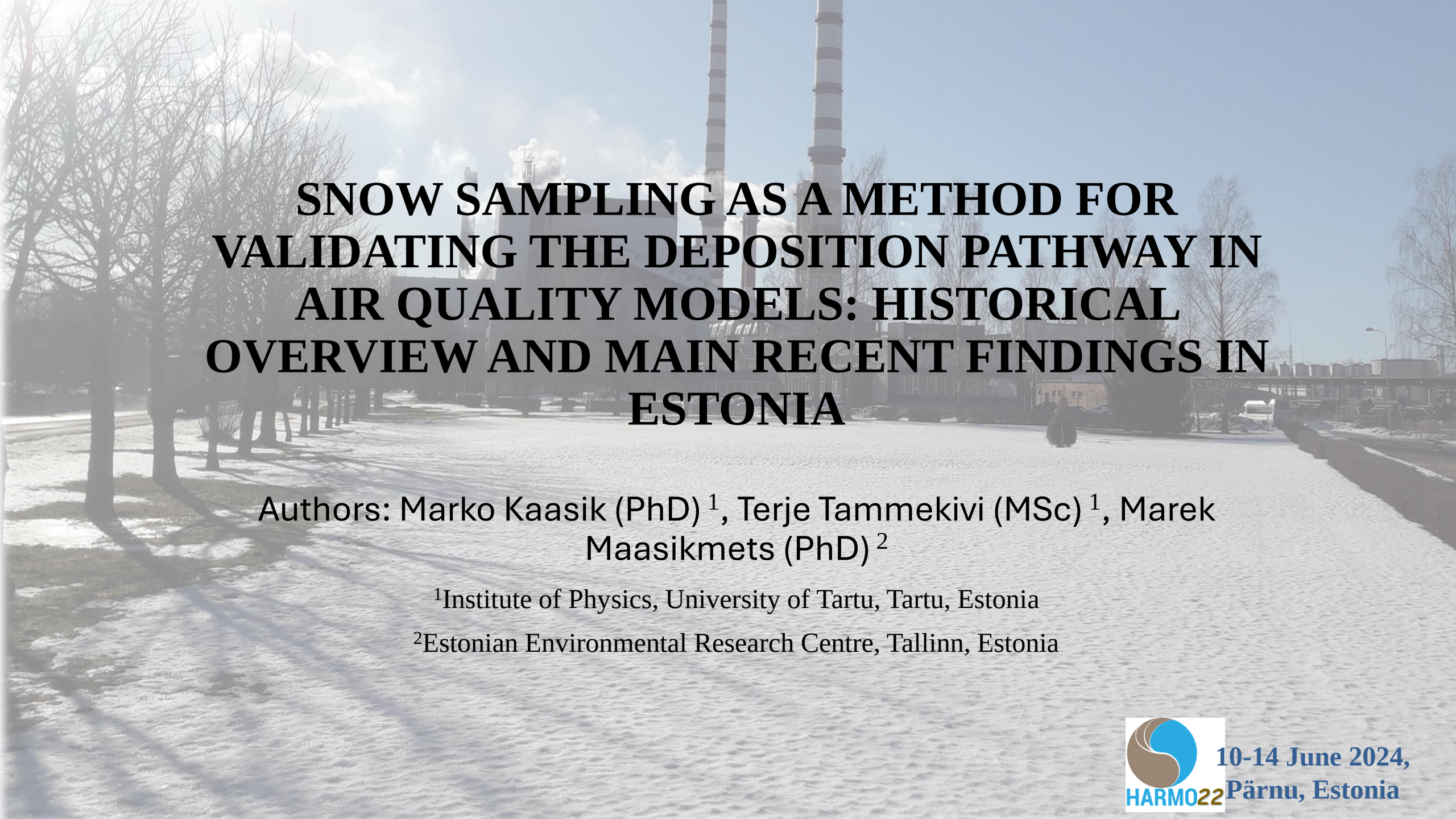

SNOW SAMPLING AS A METHOD FOR VALIDATING THE DEPOSITION PATHWAY IN AIR QUALITY MODELS: HISTORICAL OVERVIEW AND MAIN RECENT FINDINGS IN ESTONIA

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Snow layers

- First snow melts
- Ground temp <0°C then its stay on ground
- Weather episodes

Sampling in Estonia

* chemically analysed since 1985
* **Permamently**:Basic anions and cations
* **Occasionally**: Chemical composition of solid deposit, trace metals, black carbon, fly ash particles of specific shape

Stable snow cover is a natural collector of ingredients deposited from the air

Area

- **Northern Estonia**: industrial area
- **Southern Estonia**: small towns as and rural areas

SNOW-BASED QUANTIFICATION OF DEPOSITION FLUXES

- *Tube sampler (S)
- *Time interval (t)

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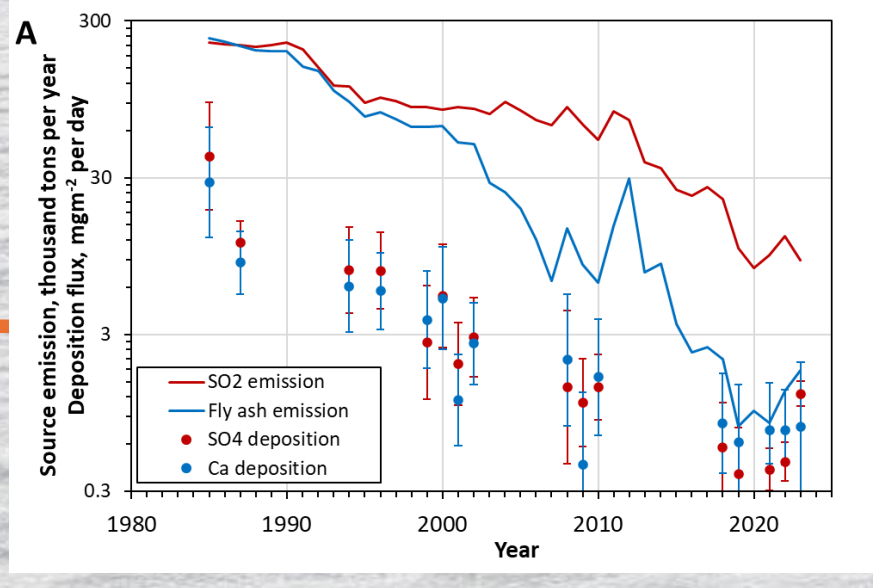
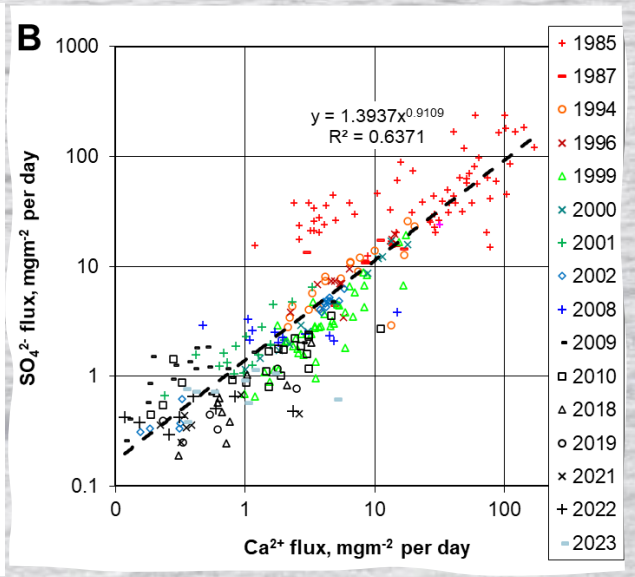
Industrial pollution: an historical overview

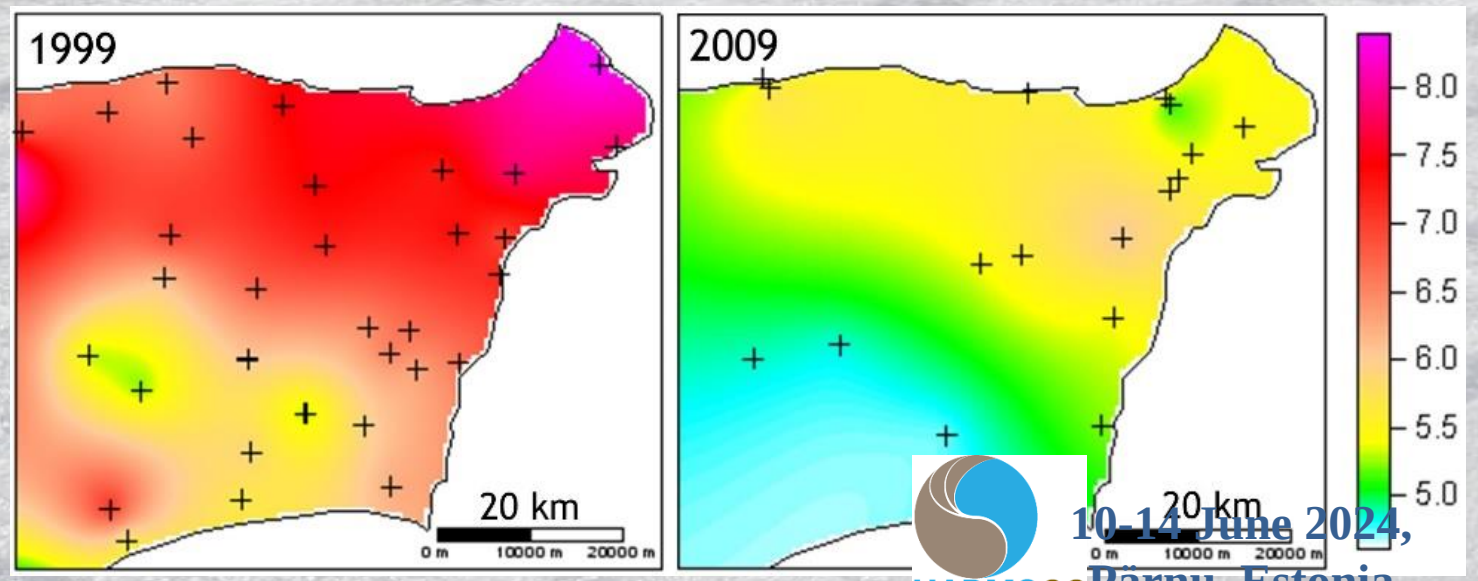
Kukersite oil shale as a solid fossil fuel of unique composition

- Extremely calcium-rich fuel
- Its fly ash is strongly alkaline

Fly ash influx is alkalization of naturally acidic soils







Model validation efforts

AEROPOL model: First comparison of air pollution transport and deposition model

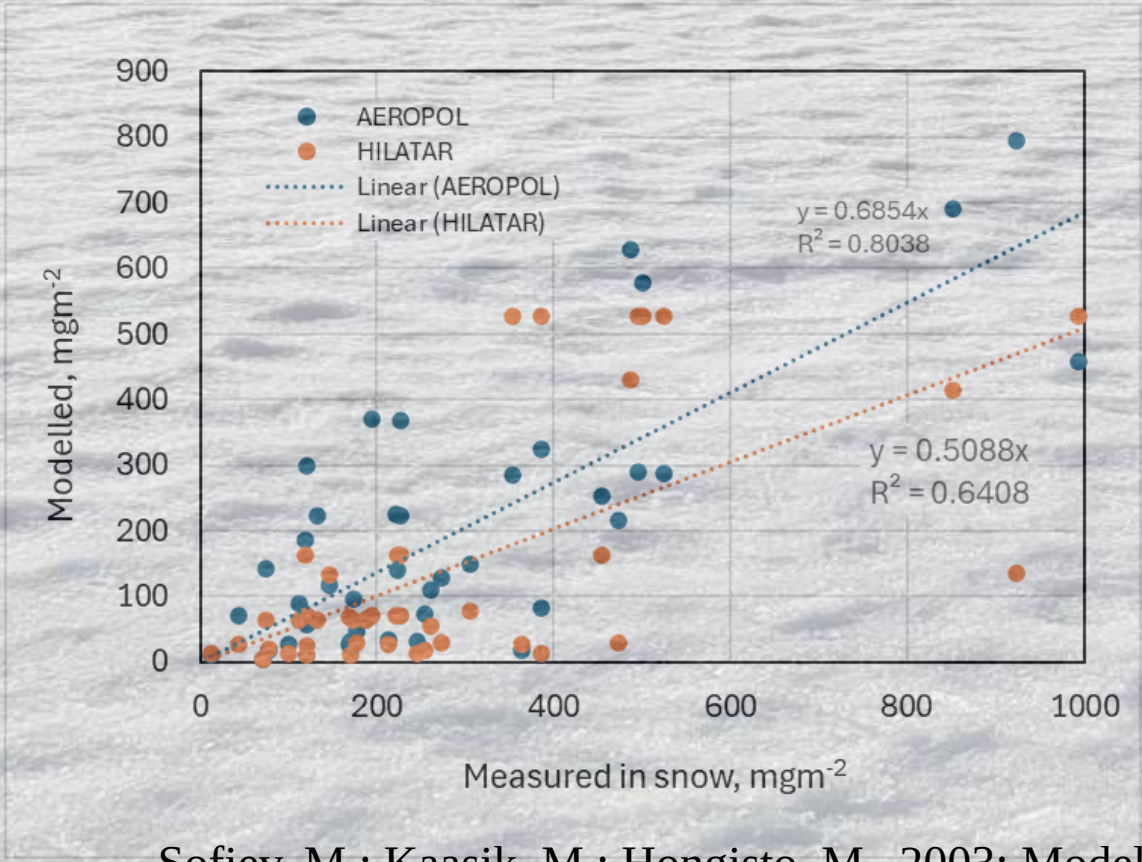
- 1990's in Tartu Observatory: based on extensive snow sampling campaign in 1985
- Measurement: calcium and sulphate deposition

Snow- based deposition data were Input for **HILATAR model (2003)**

- Slight underestimation
- rather high linear correlation (0.67)

Model validation efforts

- Comparison of modelled and measured calcium deposition in Estonia for the winter 1998–1999.
- Snow samples were collected during the period of stable snow cover (50–70 days for different sites since January 7, 1999).



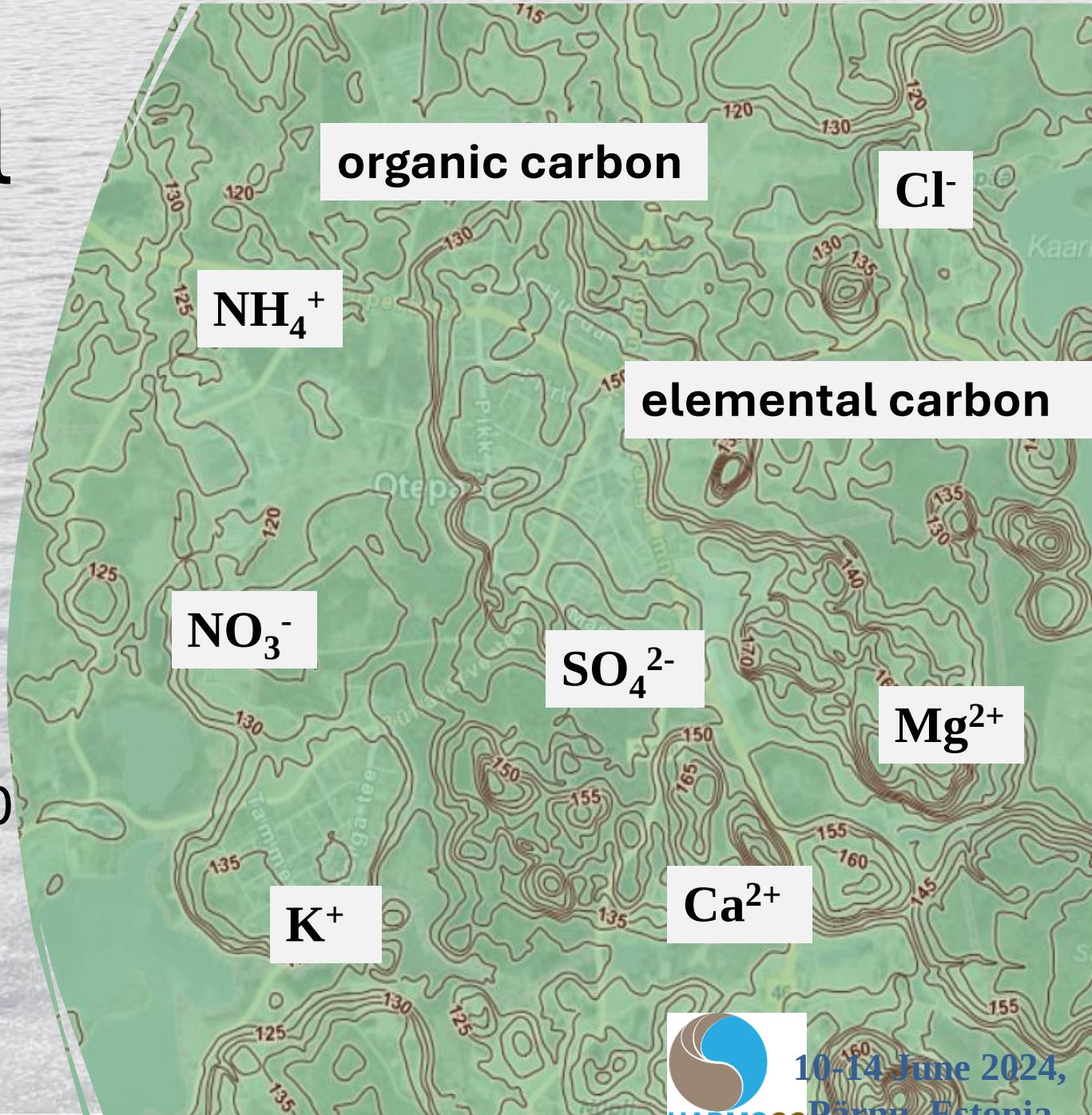
Sofiev, M.; Kaasik, M.; Hongisto, M., 2003: Model simulations of the alkaline dust distribution from Estonian sources over the Baltic Sea basin. *Water Air & Soil Pollution*

Deposition in rural areas (OTEPÄÄ)

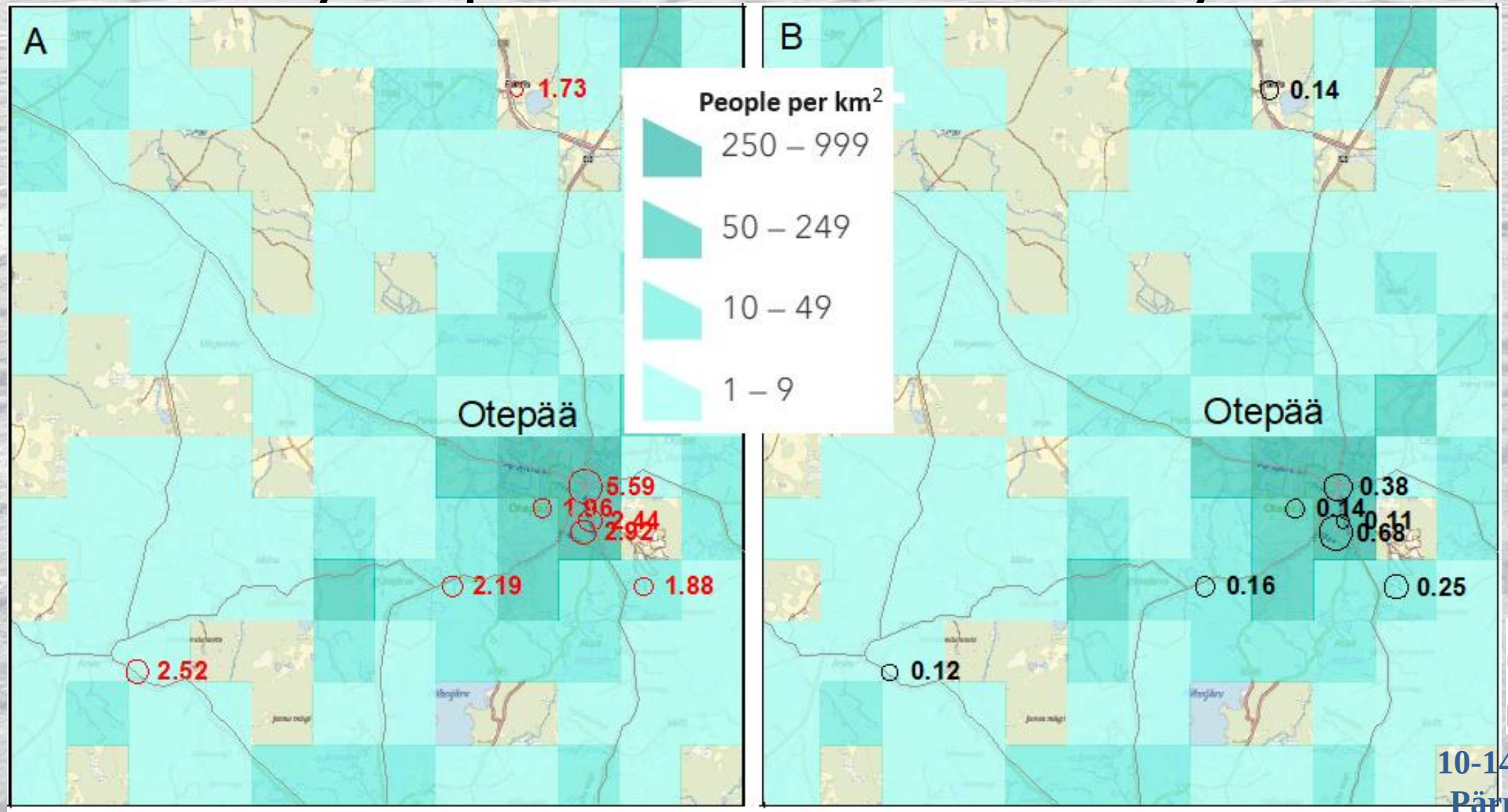
Local residential firewood heating

- 2200 inhabitants
- Sampling: 2022 (79 d), 2023 (41 d) and 2024 (53 d)
- 8 sampling sites located 110-180 m above sea level

Condition: snow cover is stable enough, last > 30 days



Summary: deposition fluxes of analyzed ions



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CONCLUSIONS

continuous and prominent decreasing trend in air pollution

- decrease of kukersite oil shale mining
- Decrease of smoke gas purification
- Decrease firewood-based heating in a rural area

The measurements of air pollution deposition based on snow samples works

Thank you!

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