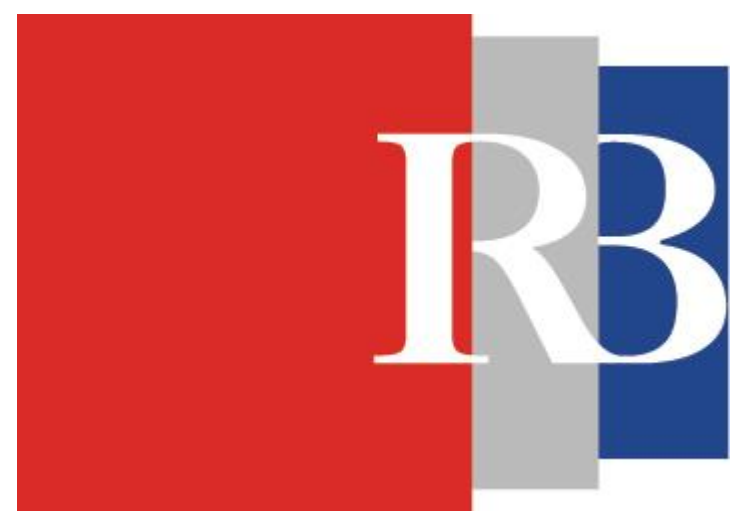


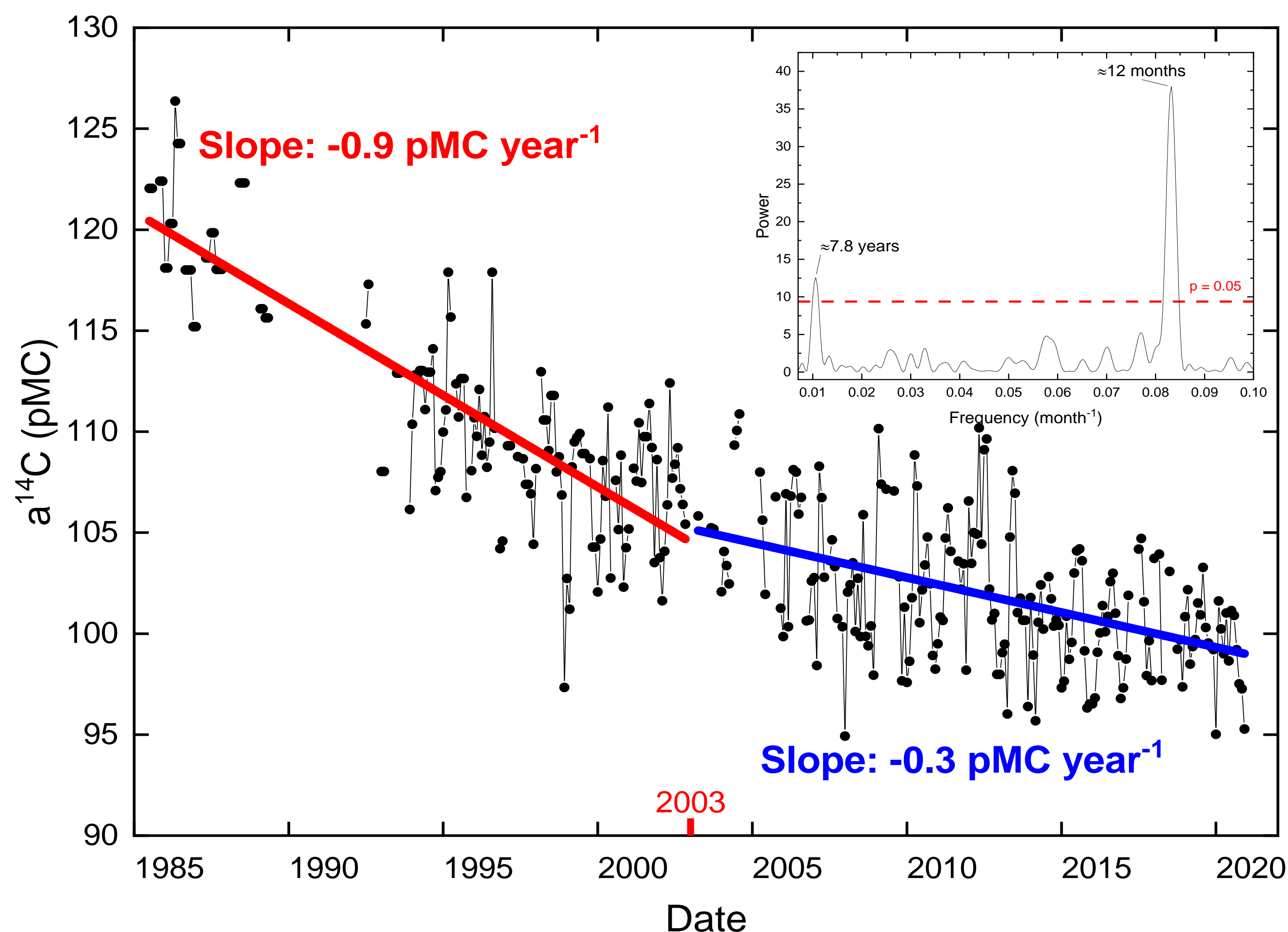


Comparison of sampling and measurement methods for atmospheric ^{14}C activity



D. Borković, I. Krajcar Bronić, A. Sironić, J. Barešić

Department of Experimental Physics, Ruđer Bošković Institute, HR-10000 Zagreb, Croatia



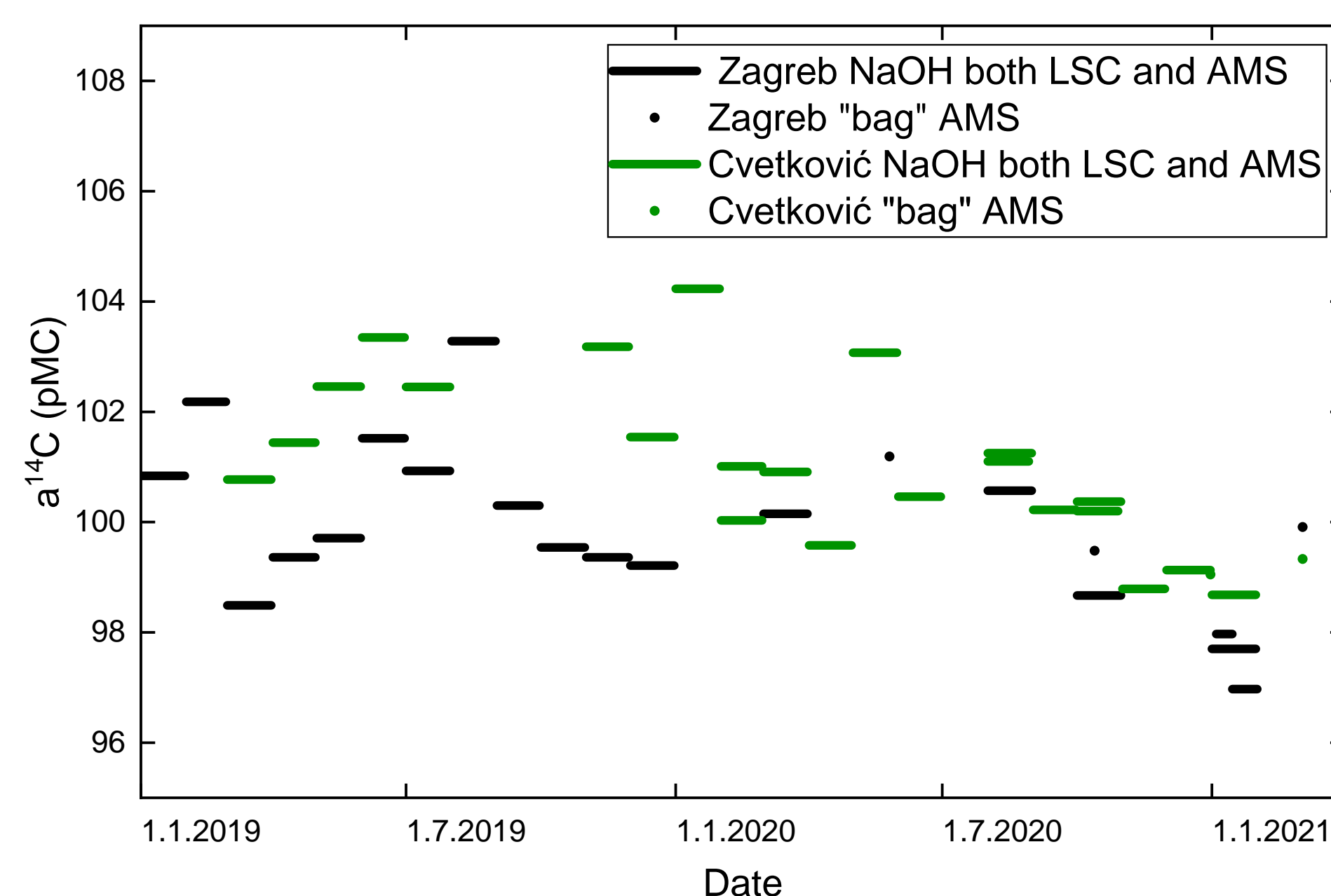
^{14}C activity measured in Zagreb (Croatia) since 1985 revealed slopes of $-0.9 \text{ pMC year}^{-1}$ and $-0.3 \text{ pMC year}^{-1}$ for period until and after 2003, respectively. Frequency analysis revealed a dominant periodicity of one year and secondary statistically significant periodicity of 7.8 years.

Three sampling methods were used:

- Static absorption of CO_2 on NaOH ;
- Dynamic absorption of CO_2 , pumping air through NaOH solution, constant temperature and air flow maintained;
- Point CO_2 measurement with air collected in a sampling bag.

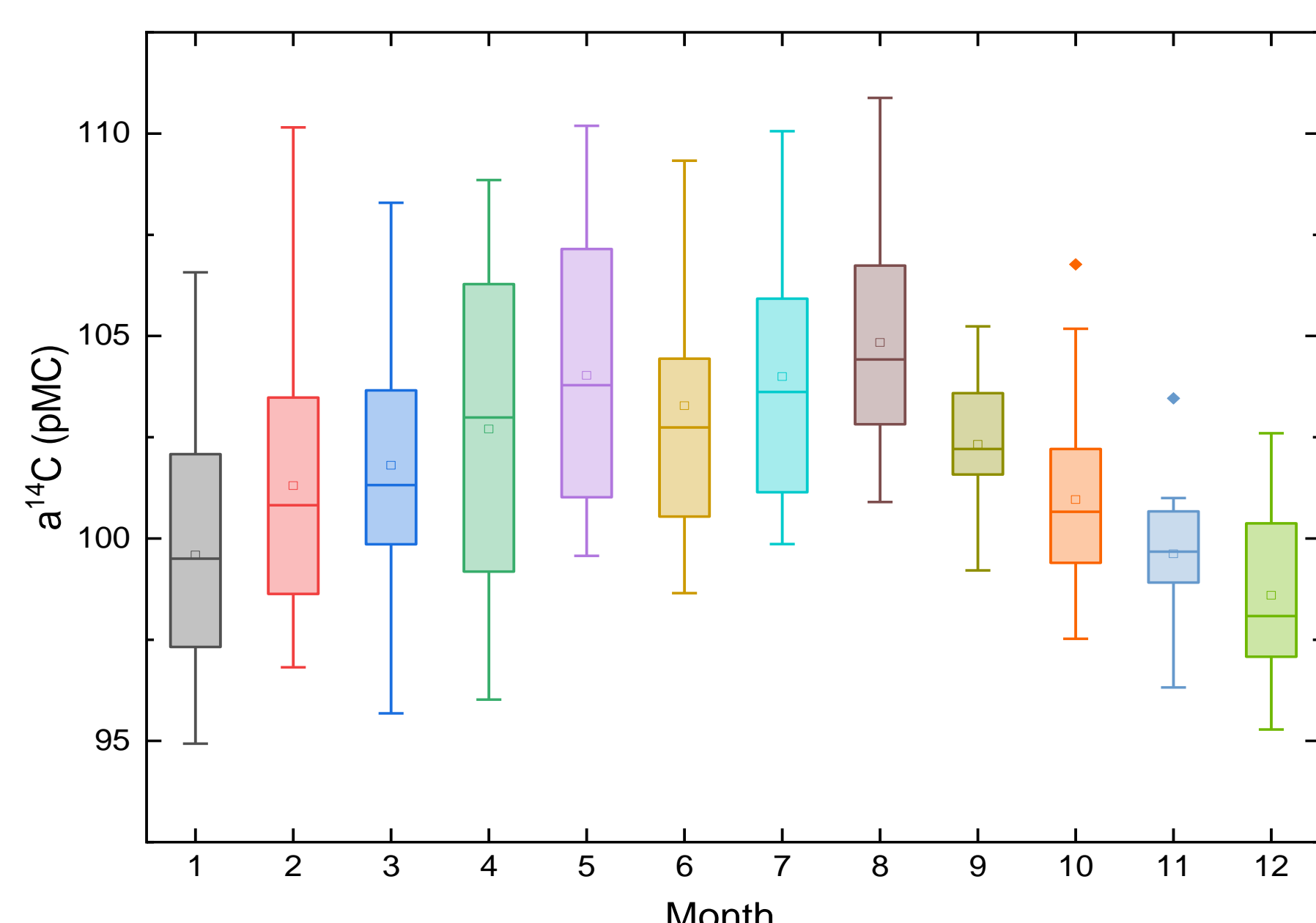
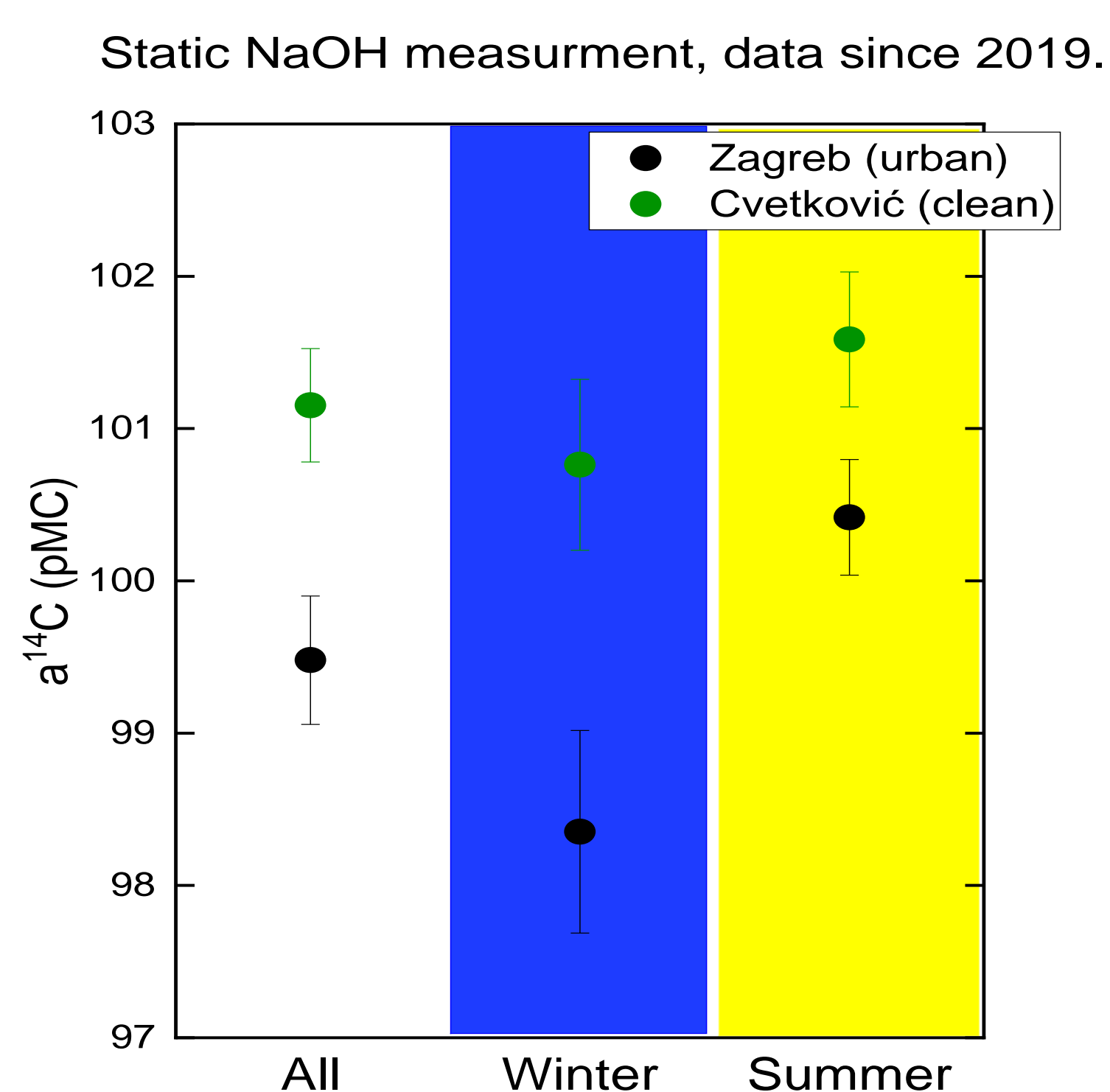
Measured $a^{14}\text{C}$ values at clean (Cvetković) and urban location (Zagreb)

- Clean location, farther from fossil fuel consumption sources, shows higher $a^{14}\text{C}$



Comparison of average $a^{14}\text{C}$ values, clean and urban locations, static method, data since 2019

- All data shows statistically lower $a^{14}\text{C}$ values at the urban location in comparison with the clean one (1.7 pMC difference, $p=0.051$)
- Larger differences observed in Winter (2.4 pMC, $p=0.013$) than in Summer (1.2 pMC, $p=0.059$)



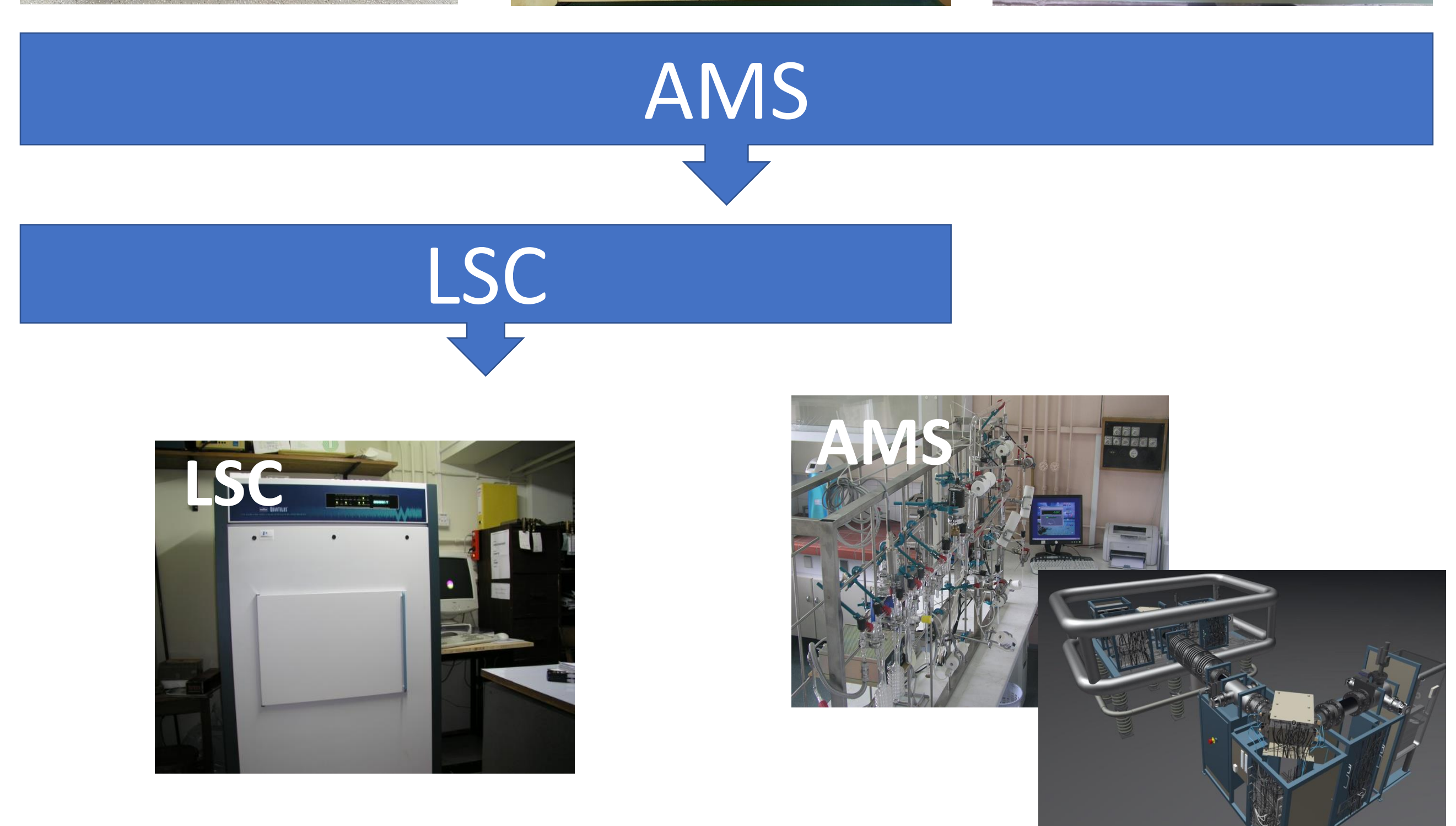
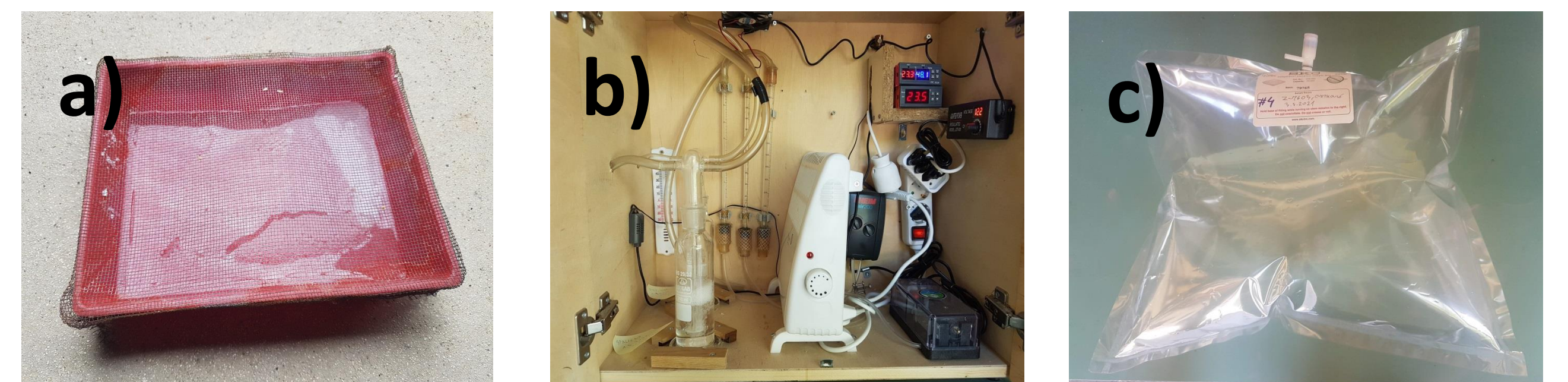
Seasonal fluctuations in $a^{14}\text{C}$, Zagreb, data since 2003

- Higher $a^{14}\text{C}$ values in summer months due to fossil fuel consumptions in winter

Two measuring techniques:

LSC – Liquid Scintillation Counting for a, b;

AMS – Accelerator Mass Spectrometry for a, b and c.



Sampling method	Sampling interval	Measuring method	$\delta^{13}\text{C}$	Comment
Static	Integral	LSC & AMS	No	Simple
Dynamic	Integral	LSC & AMS	Yes	Adjustable flow rate and temperature
„Bag“	Instant	AMS	Yes	Grab sample

CONCLUSIONS

- We showed no difference between sampling and measuring methods.
- The choice of the sampling method depends on the aim of sampling.
- ^{14}C activities are higher at a location farther from fossil fuel consumption.
- The difference is larger in winter due to larger fossil fuel consumption for heating.