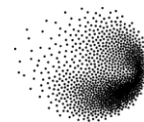


Zgorevanje lesa in onesnaženje zraka

Griša Močnik et al.

grisa.mocnik@ung.si



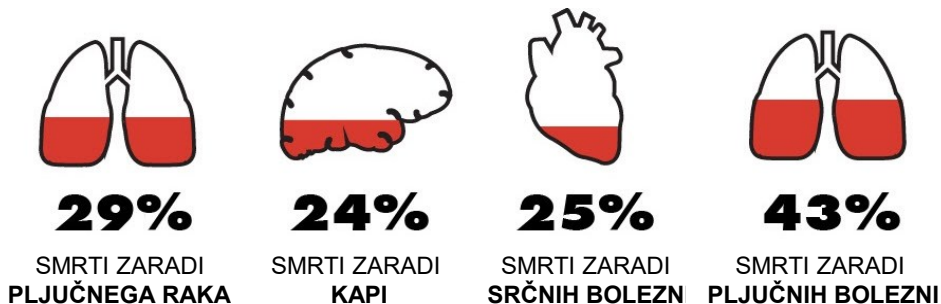
PSI

Hvala!

- OŠ Deskle (Kanal ob Soči).
- Občina Kanal ob Soči
- Paul Scherrer Institut (PSI), Laboratory of Atmospheric Chemistry (Villingen, Švica).
- Institut des Géosciences de l'Environnement, Univerza v Grenoblu in CNRS (Grenoble, Francija).
- Agencija za okolje RS



Onesnažen zrak: največja okoljska grožnja zdravju.



Source: WHO.

- Največji negativni učinki zaradi delcev. → Št. prezgodnjih smrti:

SVET **3,5> M**

EVROPA **240.000**

SLOVENIJA **~1.300**



**13-krat > letno
št. smrti v prometu**

Dve strani kovanca

primarni delci

- črni ogljik, kovine
- viri
- fini



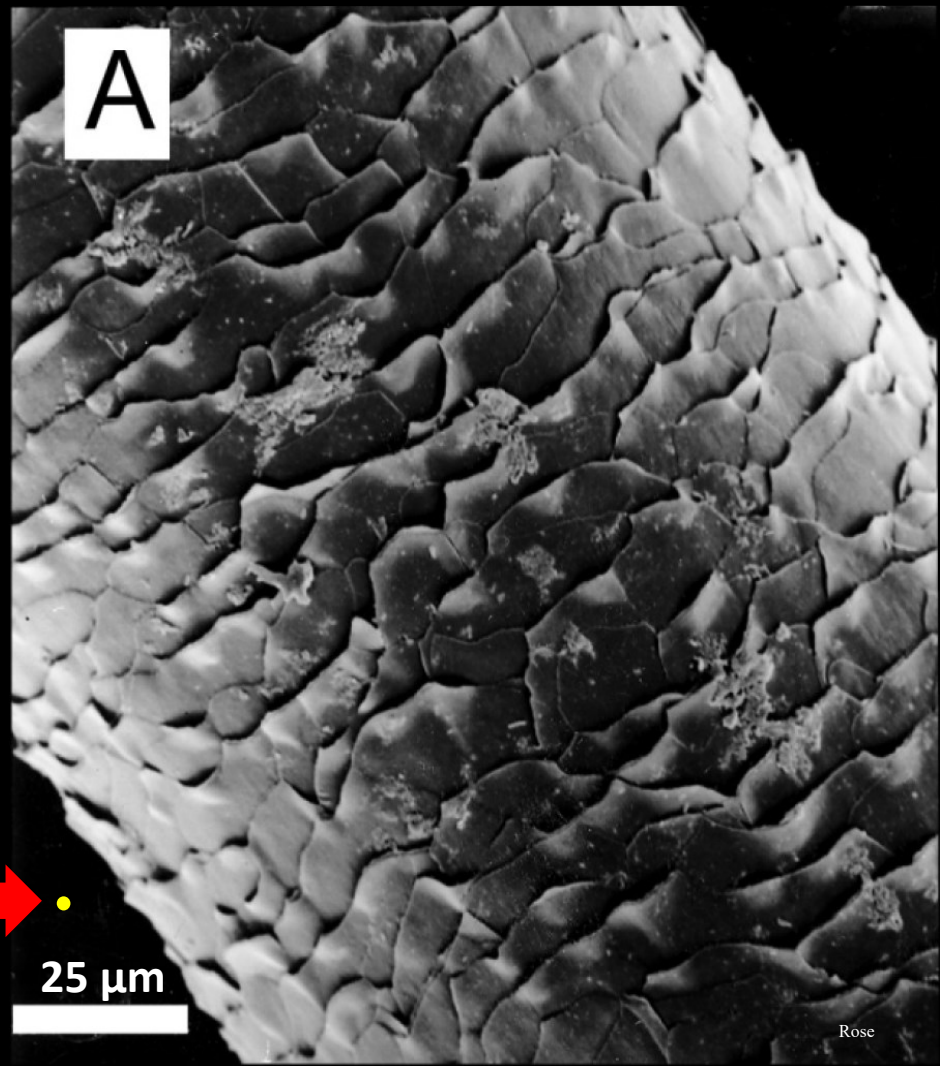
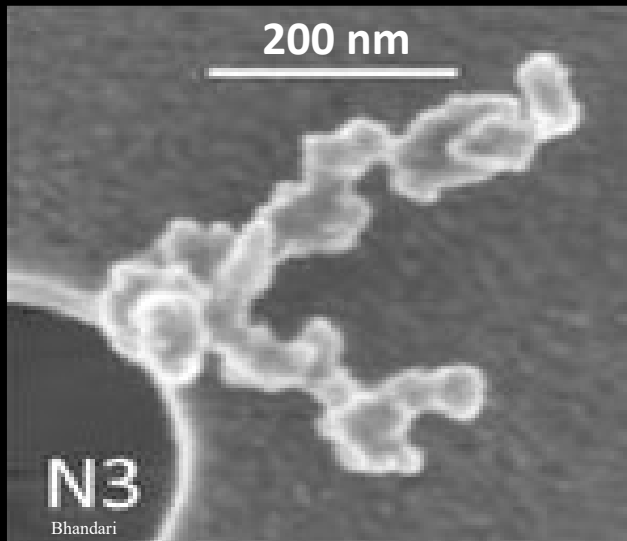
PM10

- ogljični delci + anorganski
- **primarni in sekundarni delci**
- veliki



Črni ogljik – kaj so viri – detektivka!





Črni ogljik – absorpcija in segrevanje ozračja

1 gram = 10 črnih dežnikov

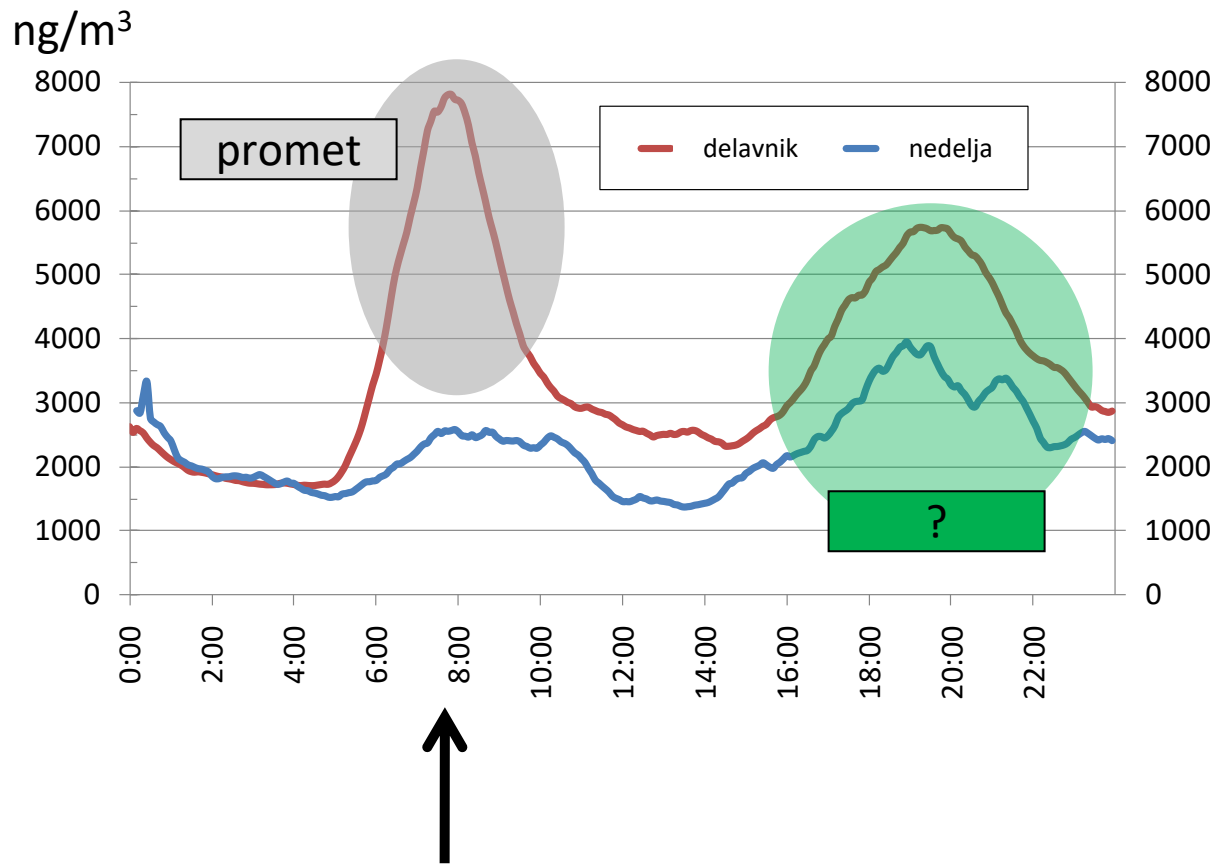
Bond, 2012



1 črni dežnik / 1 km



Črni ogljik v Novi Gorici



Biomasa - gorivo

- biomasa je **obnovljivo gorivo** – drevesa pač reciklirajo CO₂
- zgorevanje biomase je **globalno zelo pomemben vir energije**
- različni načini zgorevanja: visoko-učinkoviti sistemi daljinskega ogrevanja – individualne peči na drva
- mogoči so **ekstremni izpusti** delcev ali pa nastanek v atmosferi
- lokalni in regionalni problem – v EU ~**40% delcev = lesni dim**
- **lesni dim vsebuje delce, ki absorbirajo svetlobo**



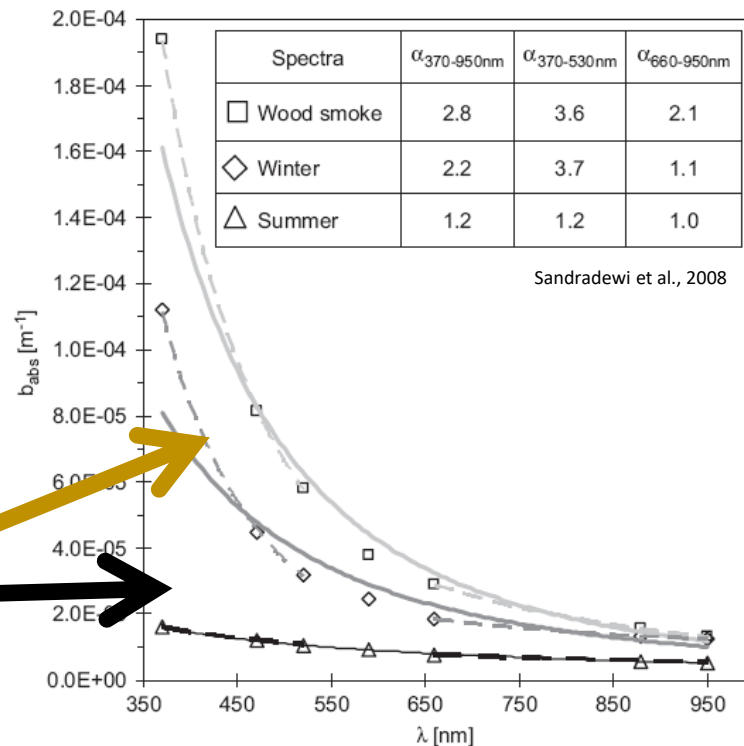
Lesni dim in dizelski izpuh

- določimo absorpcijski koeficient- b_{abs}
- za črni ogljik: $b_{abs} \sim \frac{1}{\lambda}$
- splošno Ångströmov exponent:

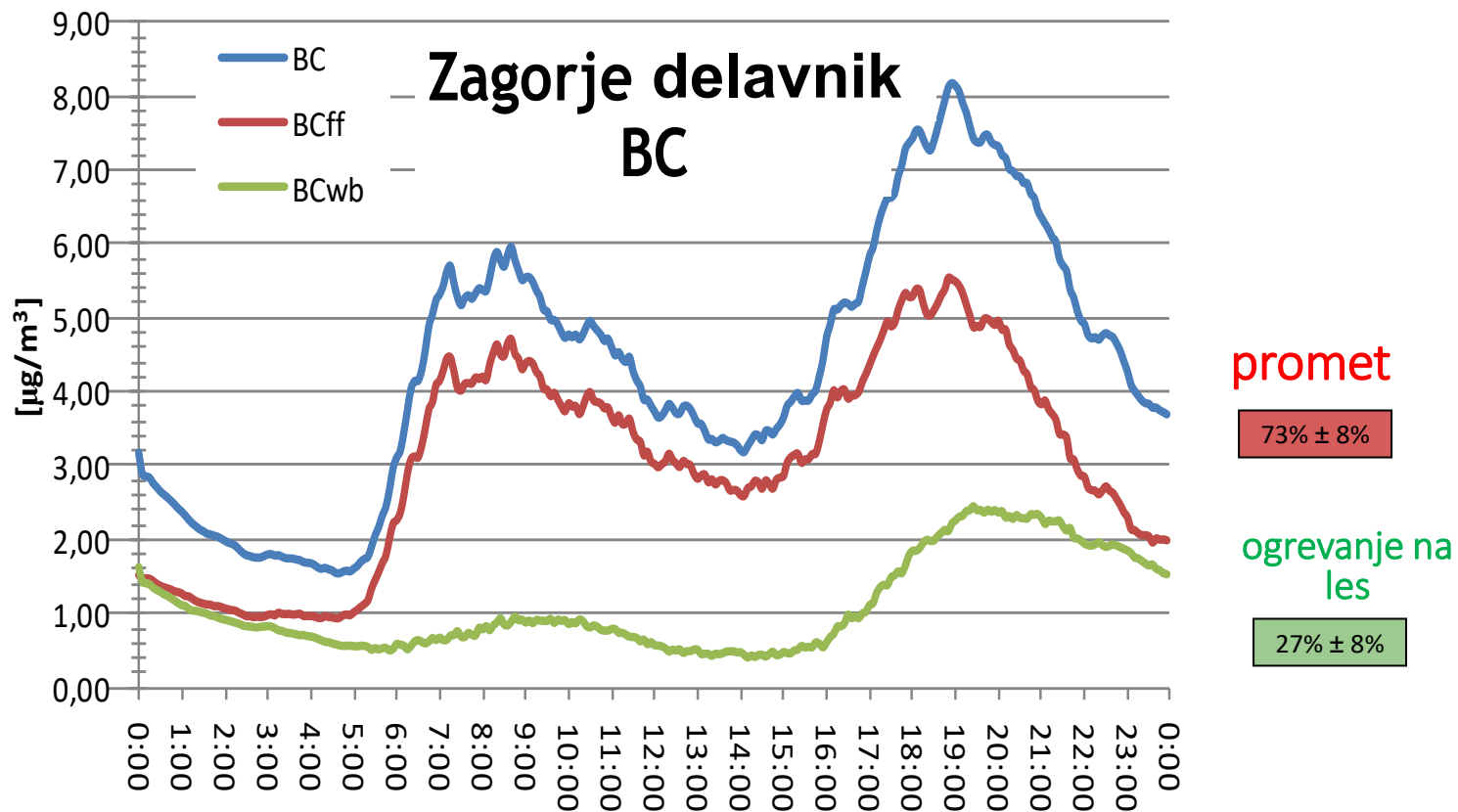
$$b_{abs} \sim \frac{1}{\lambda^\alpha}$$

dizel: $\alpha \approx 1$

lesni dim: $\alpha \approx 2$ in več



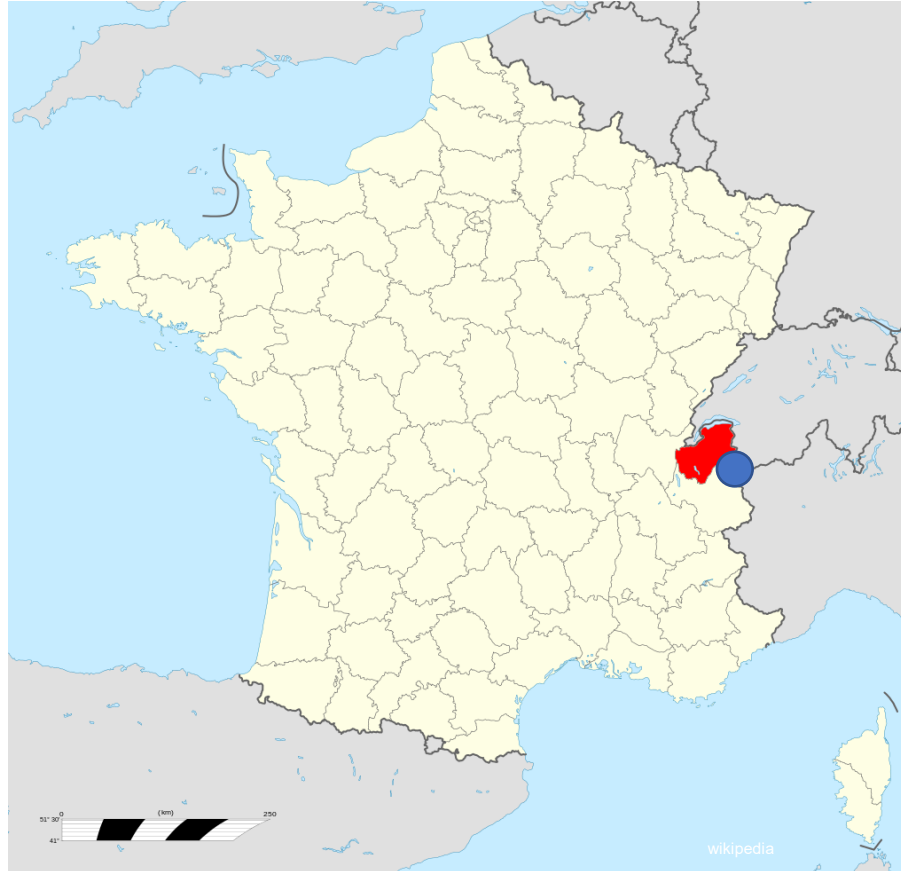
Določanje virov črnega ogljika



Lekcija št. 1

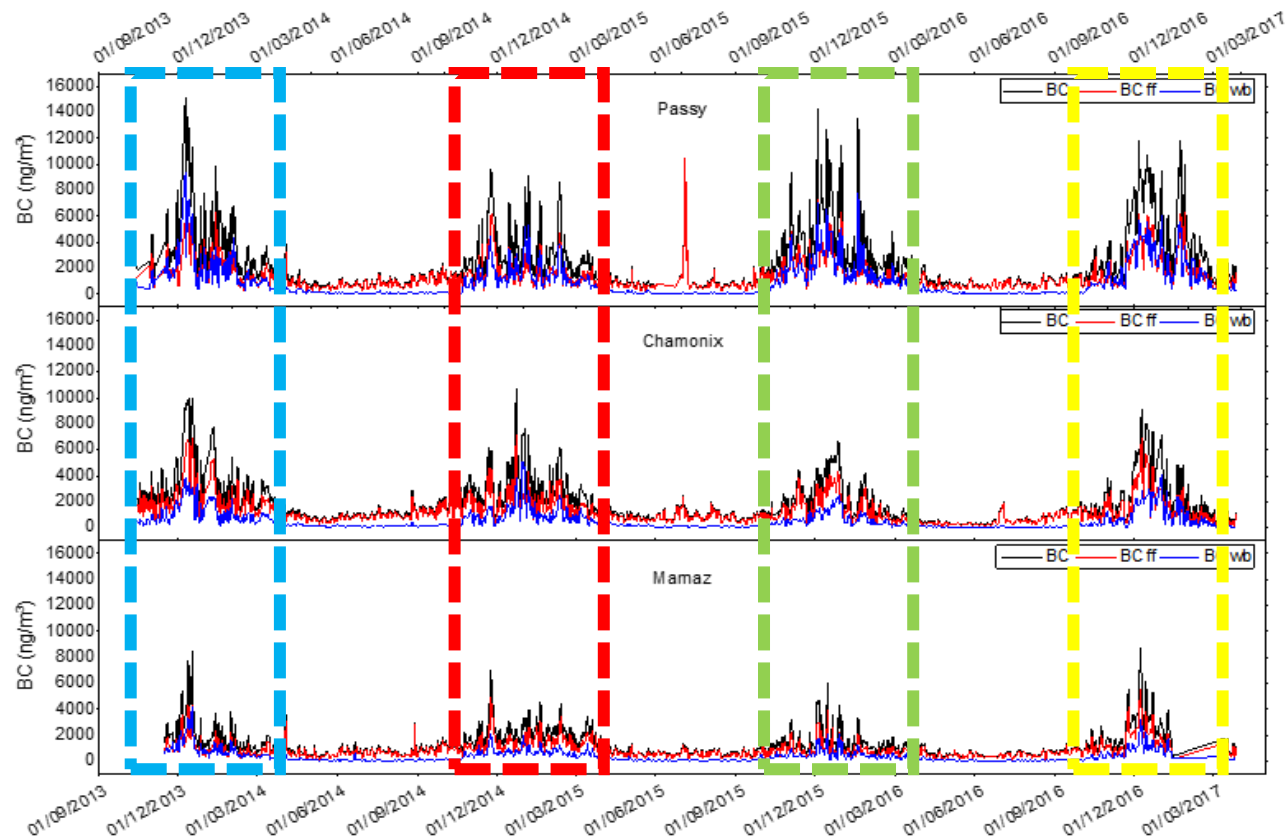
Če ničesar ne narediš, se nič ne spremeni.

Vallée d'Arve, France – 7000 stoves!

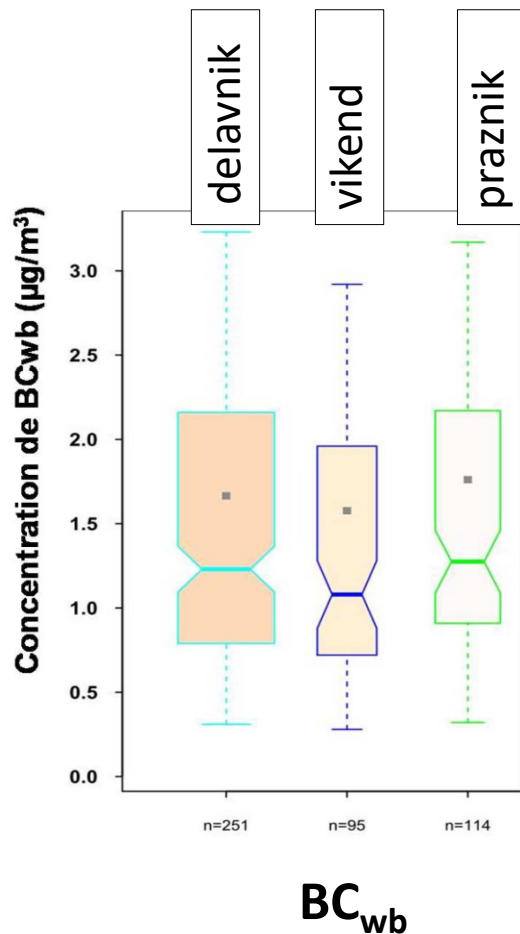
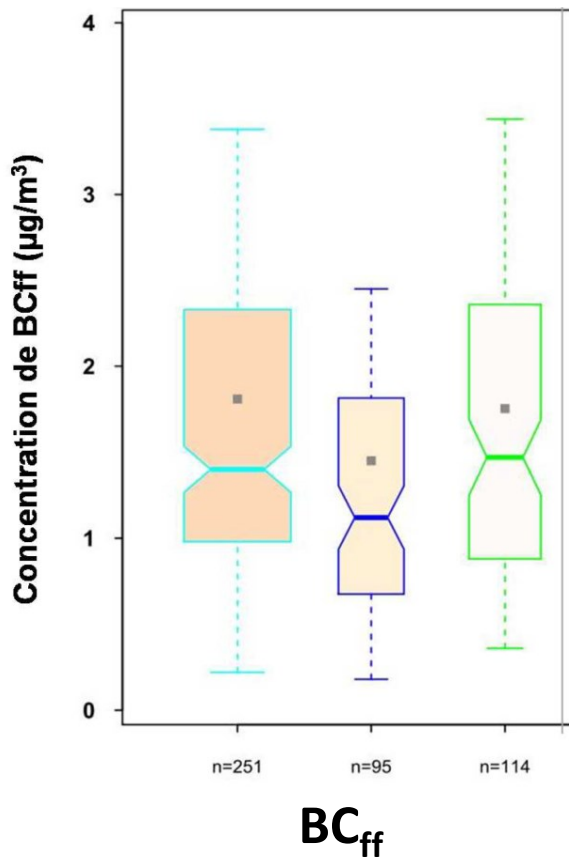


Vallée d'Arve, France

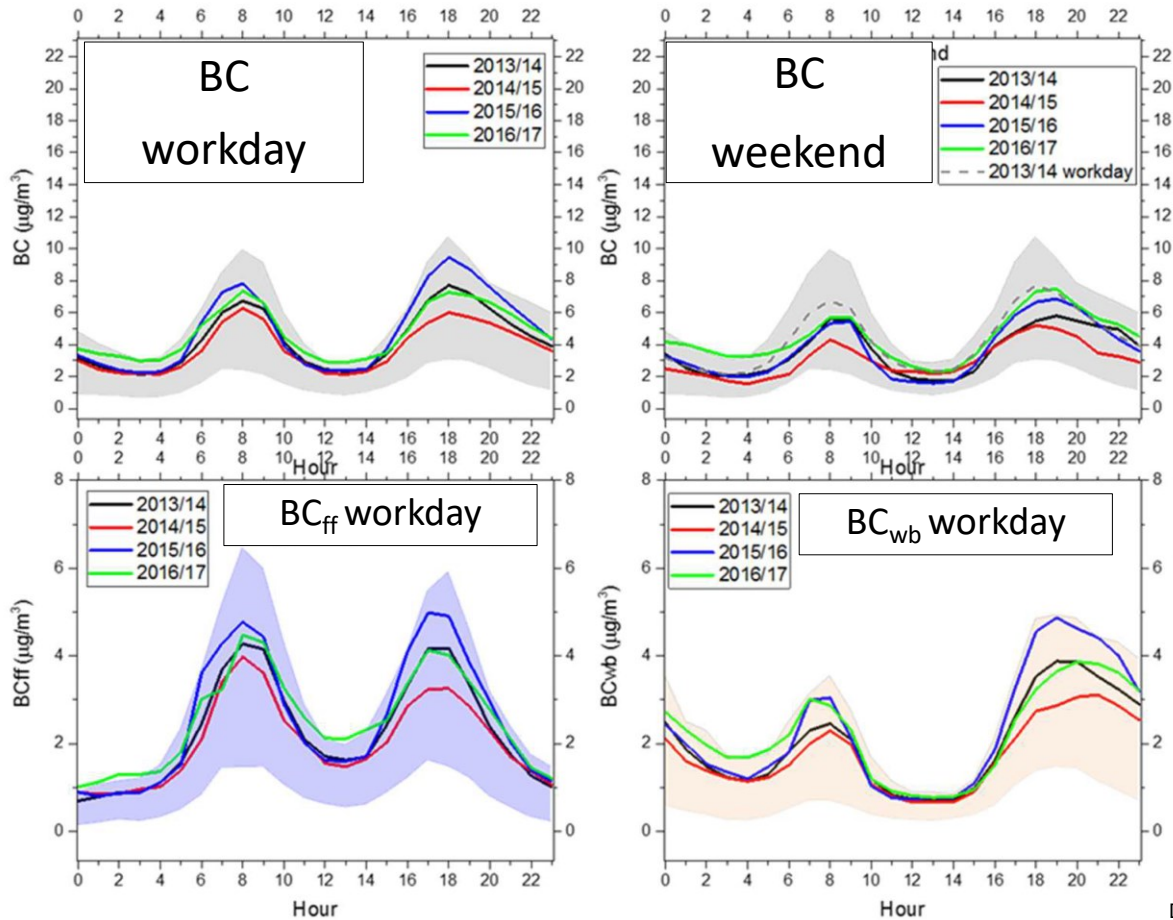
Nov – Mar



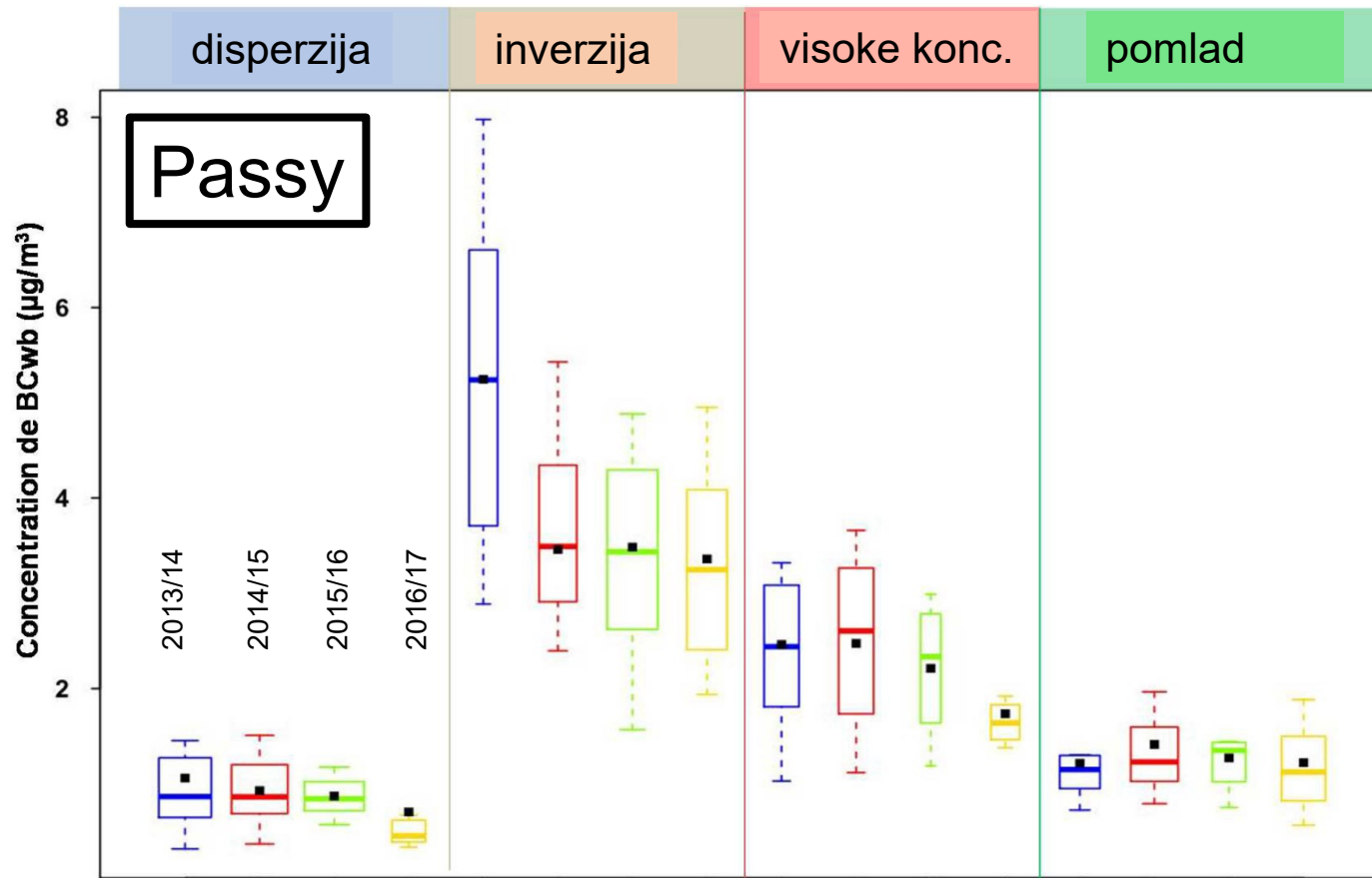
Vallée d'Arve, France - Passy



Vallée d'Arve, France - Passy



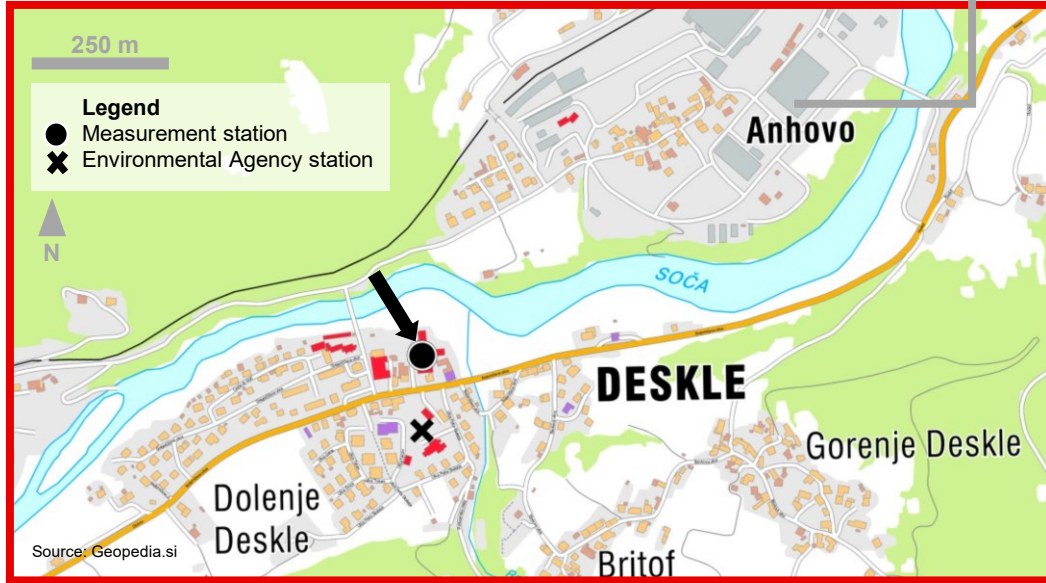
BC_{wb} Nov – Mar



Lekcija št. 2

Tudi če kaj narediš, je spremembe težko izmeriti.

Kanal ob Soči



Vzorčene in meritve

Winter 2020/21 Spring 2021 Summer 2021 Autumn 2021

DHA-80 + AE33

Xact 625i

PM₁₀

Digitel DHA-80



24h filters



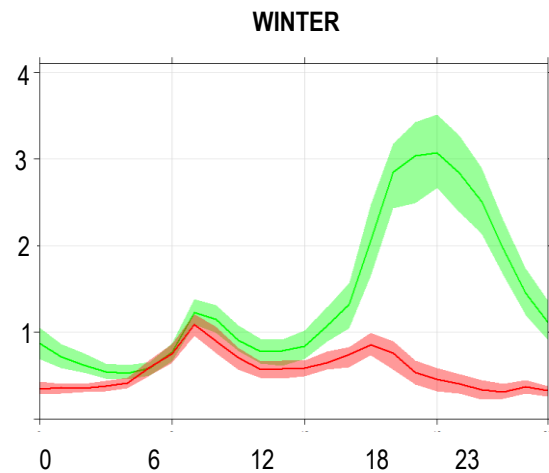
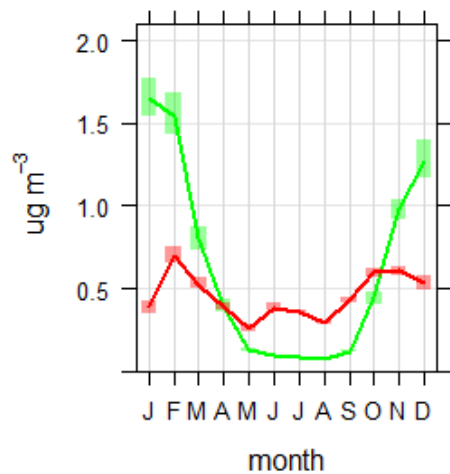
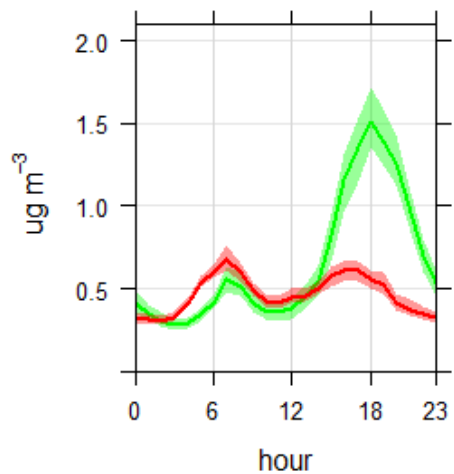
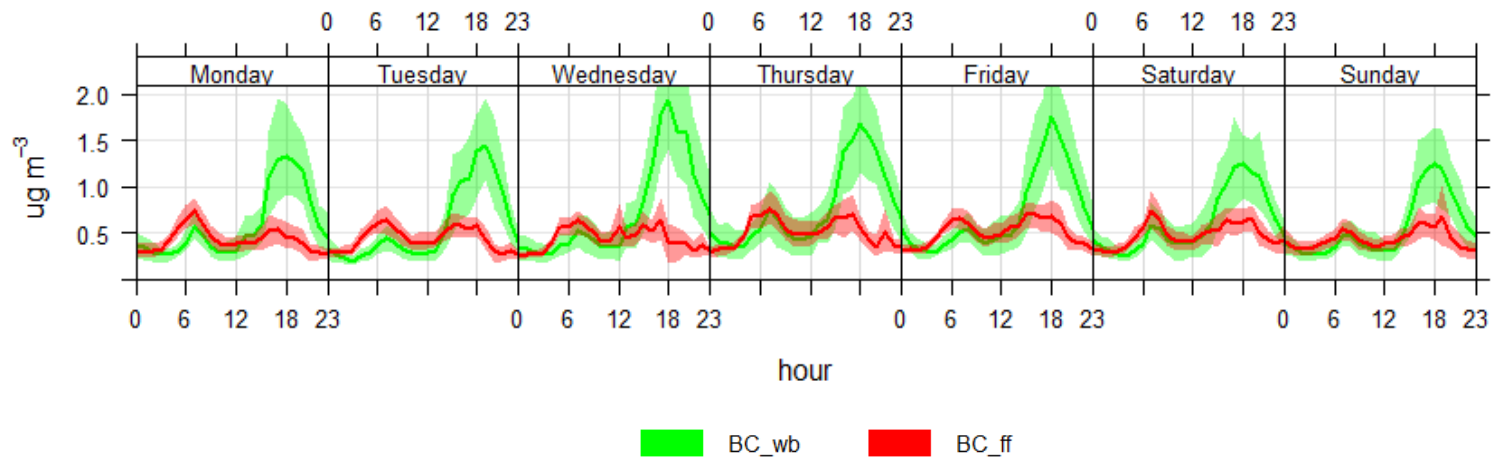
eBC

Aethalometer AE33:
1min resolution

Metals

Xacts 625i: PM₁₀ & PM_{2.5}
1h resolution

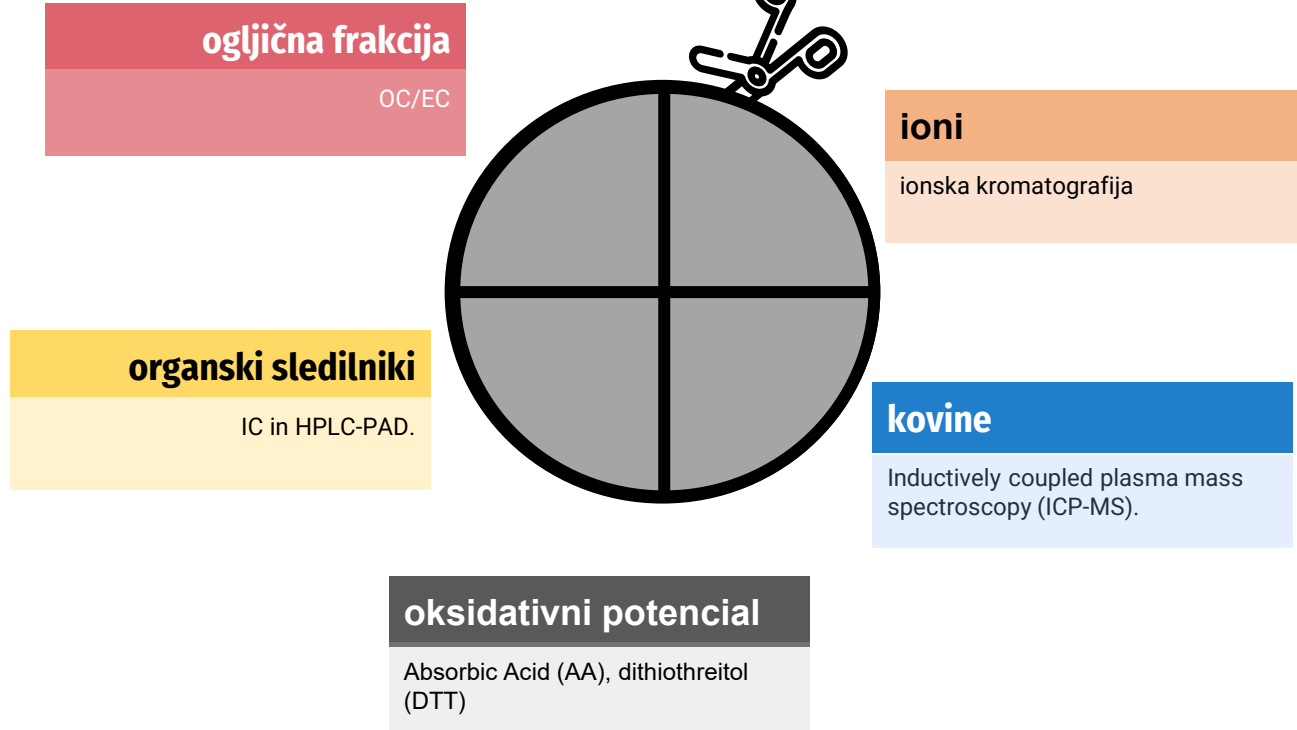




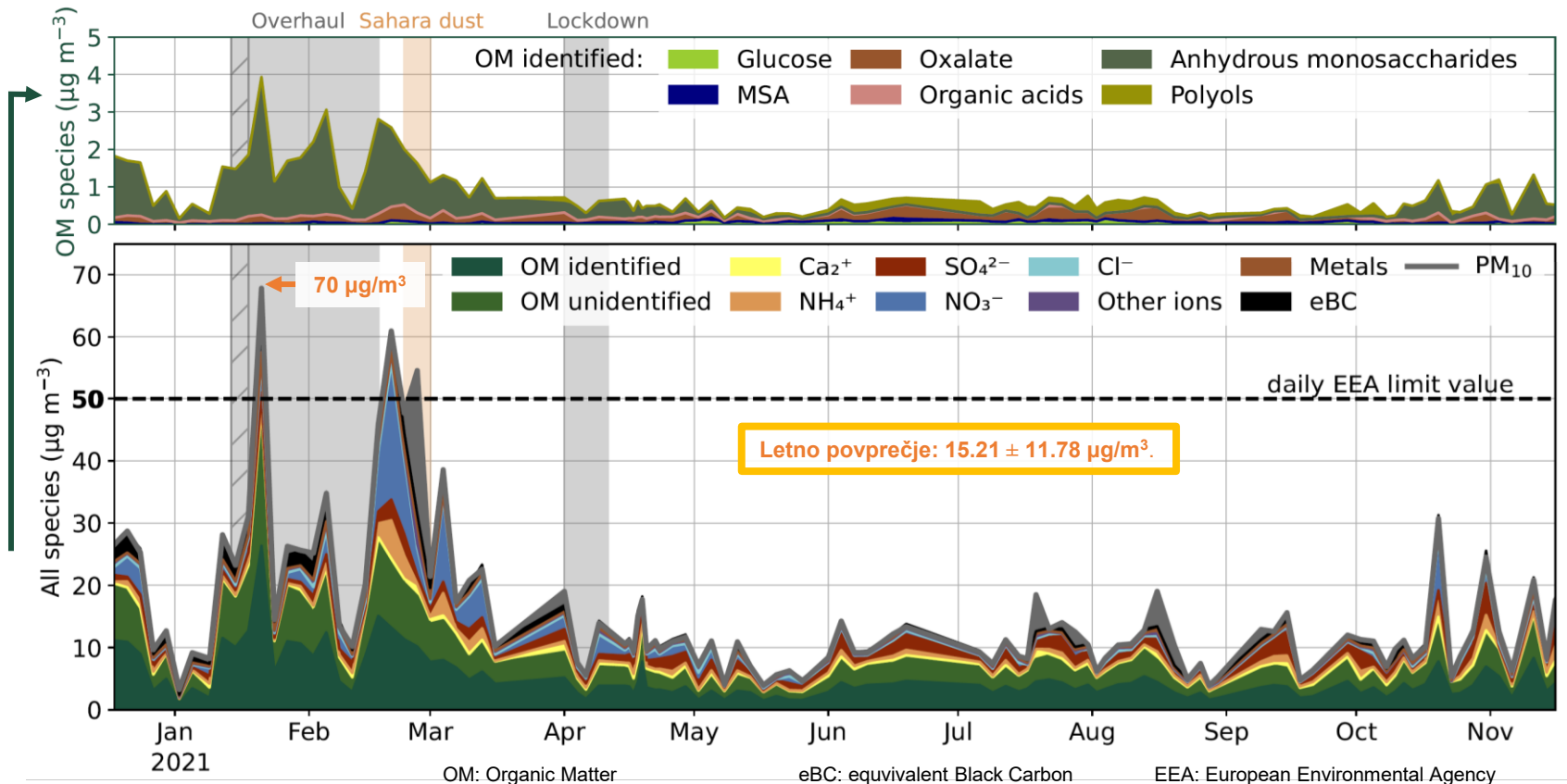
Kemijska analiza



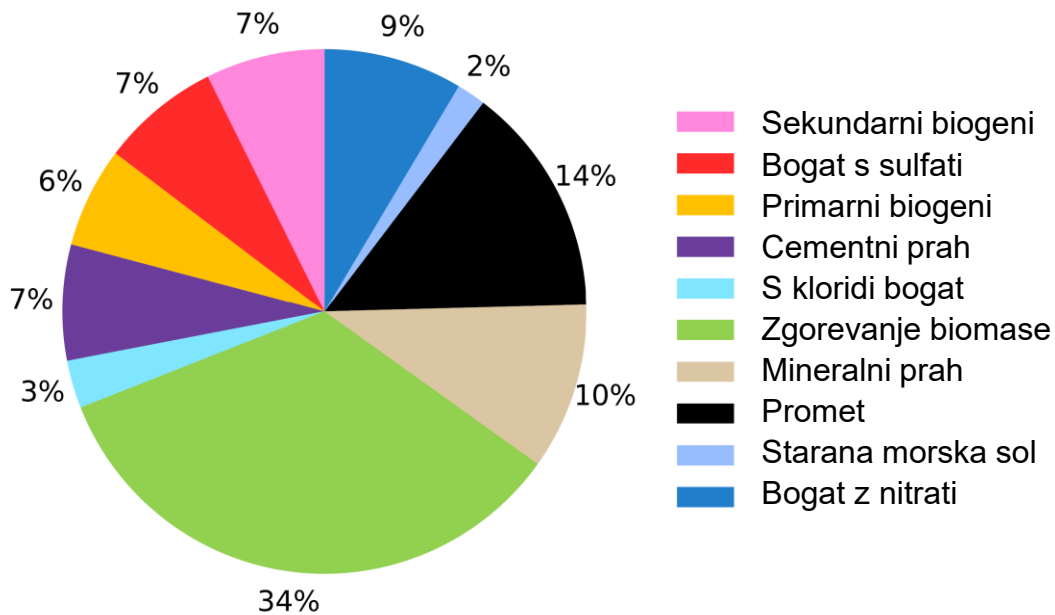
vsak 3-tji filter, 120 skupaj



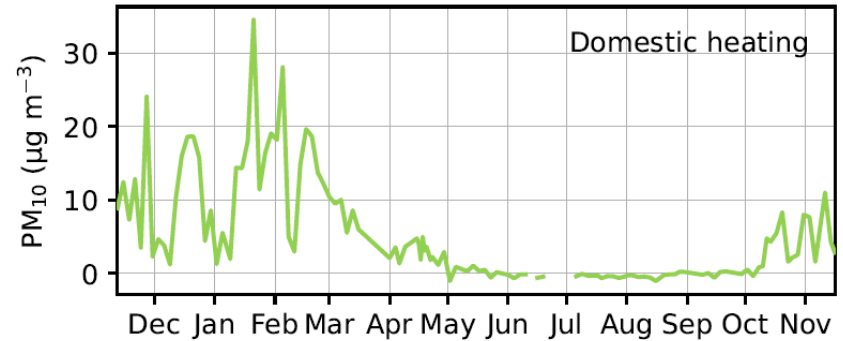
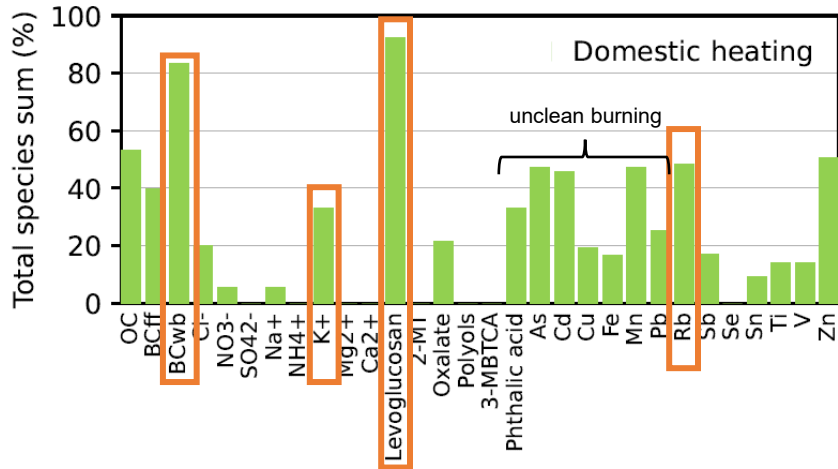
Rezultati: PM₁₀ in kemijska setsava



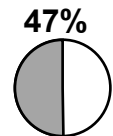
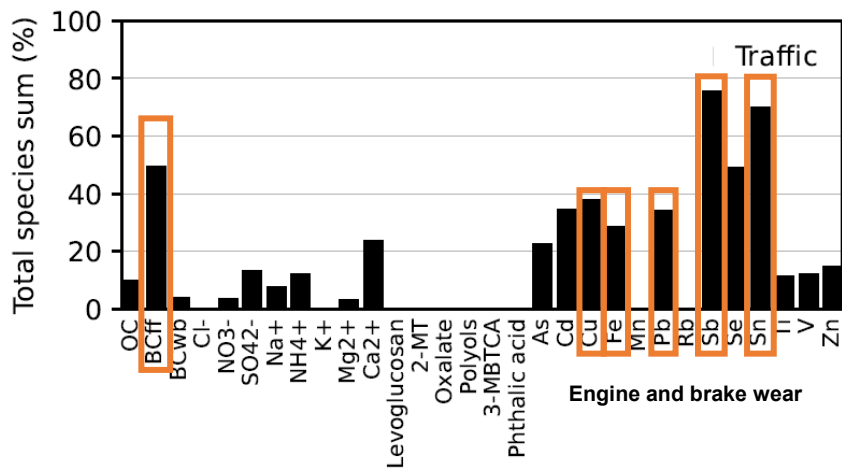
Viri PM₁₀



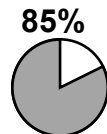
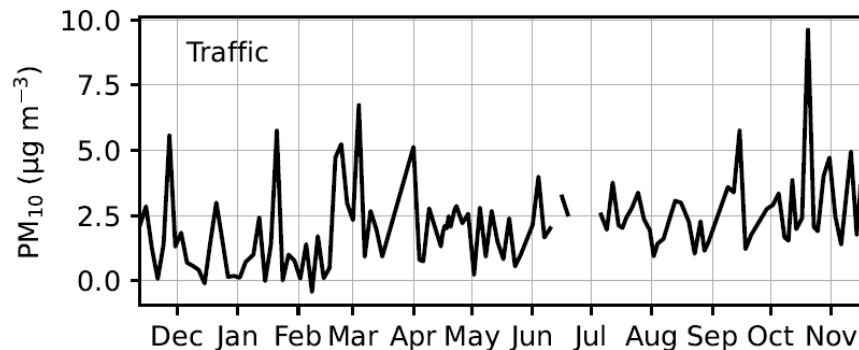
Zgorevanje biomase



Promet



v industrijsko cono Anho



v industrijsko cono Anho

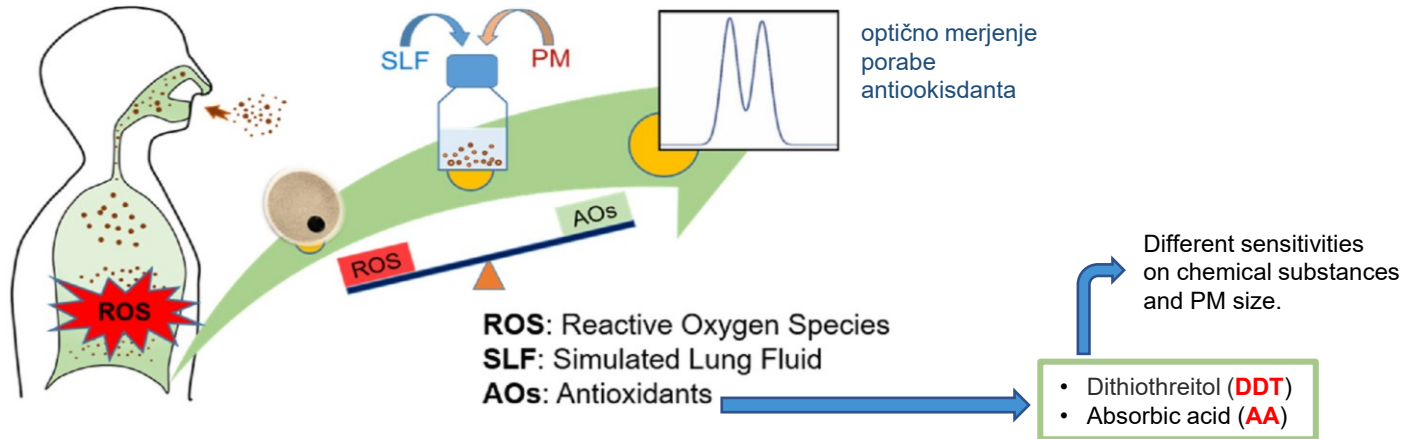


Zdravje: Oksidativni Potencial (OP)



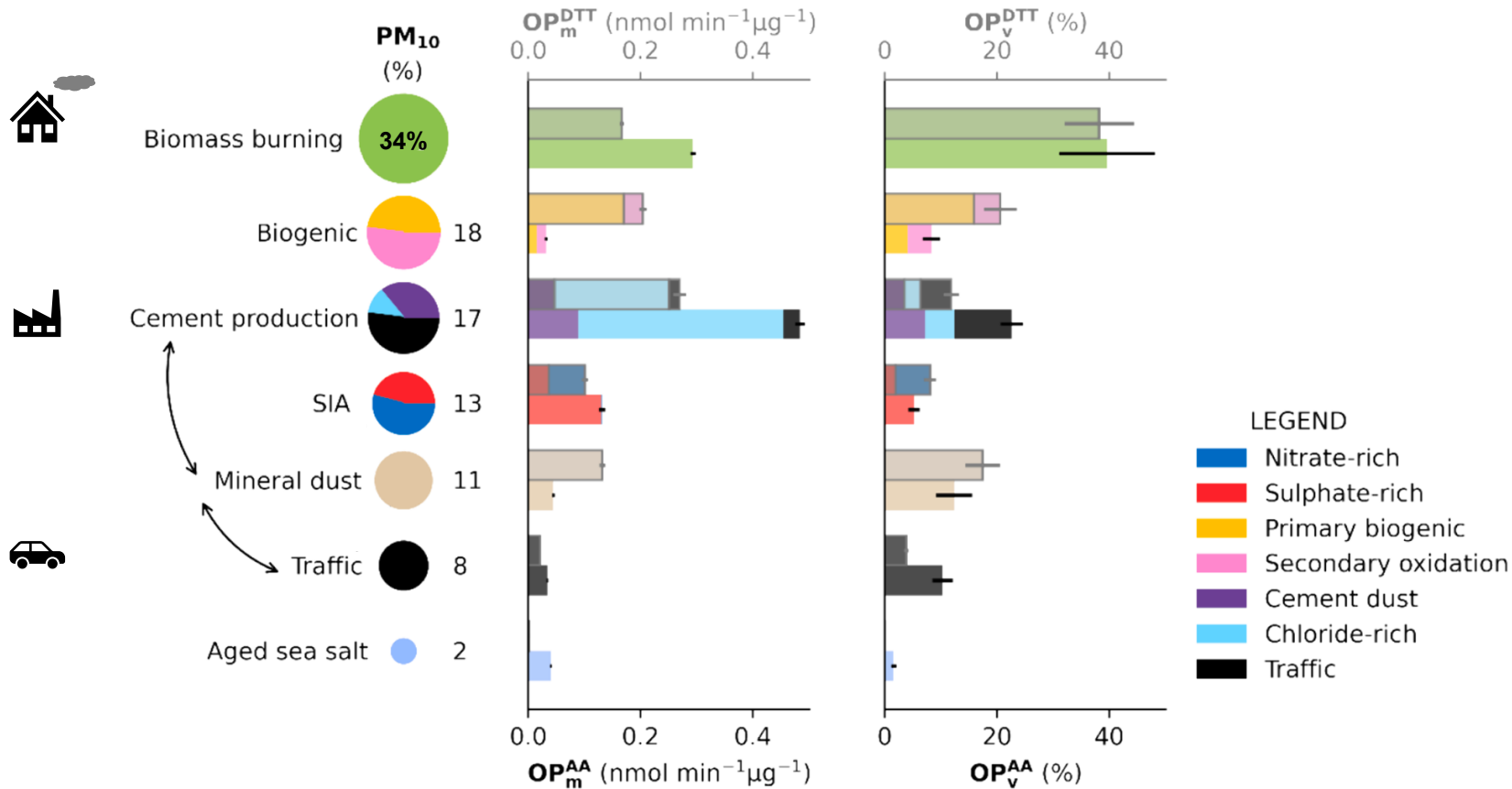
Zmožnost PM, da povzroči oksidativni stres v celicah (Weber et al, 2021).

Kvantifikacija OP :

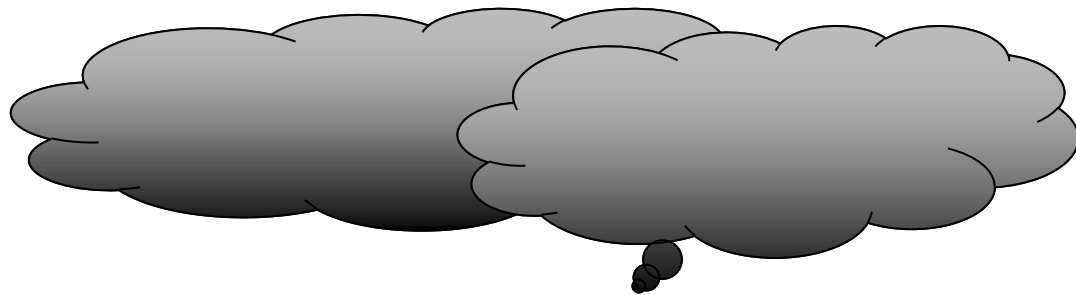


Source: Shahpoury et al., 2022.

Prispevki virov



Sklepi



- **PM₁₀ ≈ druge alpska področja.** (Herich et al., 2014)
- Najpomembnejši antropogeni viri PM₁₀:
- **OP ≈ med najvišjimi v Evropi.** (Daellenbach et al., 2020; Weber et al., 2021; Borlaza et al., 2021b)
- nenavaden s **kloridi bogat vir, visok OP_i.**
- Naprej:
 - primerjave online PMF;
 - resuspenzija.



Lekcija št. 3

Tudi če spremembe izmeriš, je lahko rešitev komplicirana.

Tudi iz plinskih izpustov nastanejo delci!