

Caratterizzazione chimica di particolato in dodici diverse classi dimensionali

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Overview

1. Caratterizzazione particolato 12 classi dimensionali
 - Campionamento
 - Analisi di metalli totali, ioni, specie carboniose
2. Source apportionment



Come varia il contributo delle sorgenti di particolato passando dalle particelle grossolane alle nanoparticelle?

Campionamento

Micro-Orifice Uniform Deposition Impactors
(MOUDI™)

Flusso: 30 L/min

Stadi: 10

Dimensioni particelle (µm):



Inlet	> 18
Stadio 1	18 – 10
Stadio 2	10 - 5.6
Stadio 3	5.6 - 3.2
Stadio 4	3.2 – 1.8
Stadio 5	1.8 – 1.0
Stadio 6	1.0 – 0.56
Stadio 7	0.56 – 0.32
Stadio 8	0.32 – 0.18
Stadio 9	0.18 – 0.10
Stadio 10	0.10 – 0.056
Back	< 0.056

PM_{10}

PM_1

nanoparticelle



Sito: Sacca Fisola (Venezia)

Periodo: 2/08/2018 – 27/11/2018

Frequenza: settimanale

Numero campioni: 16

Volume medio totale: 201 m³

Distribuzione dimensionale

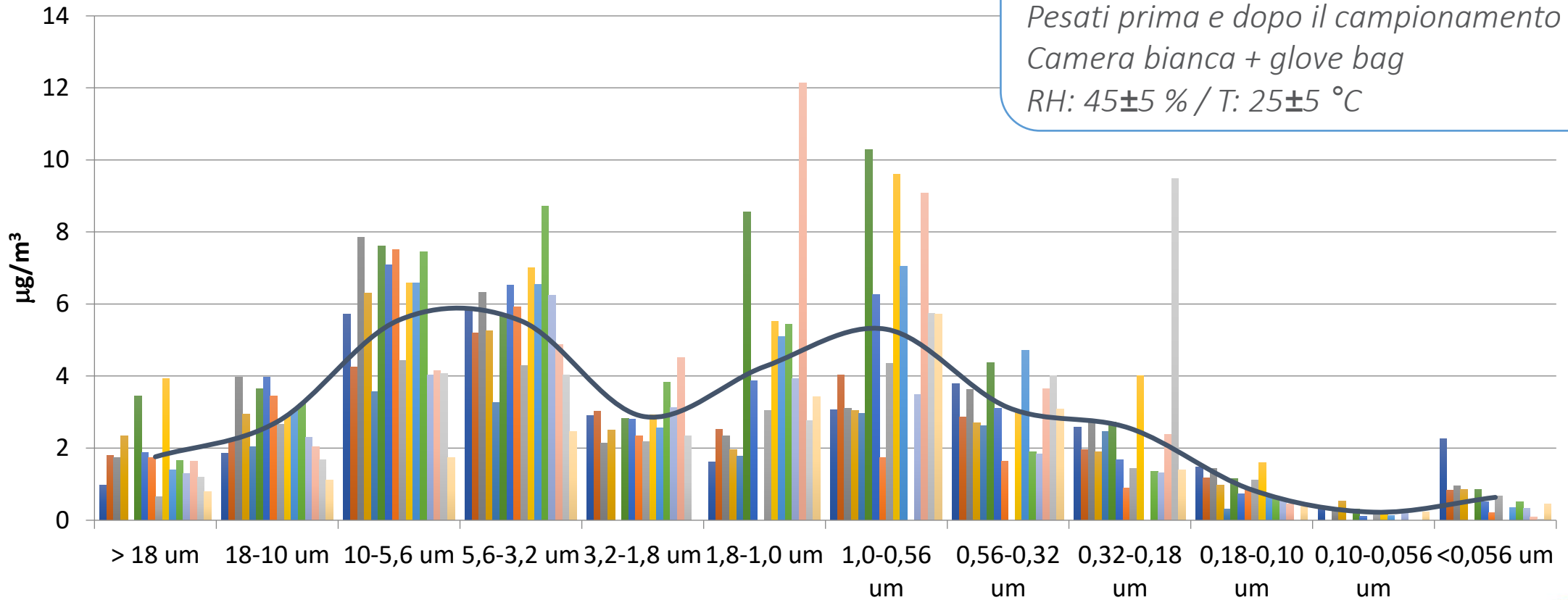
Pesata fitri

Filtri in fibra di quarzo

Pesati prima e dopo il campionamento

Camera bianca + glove bag

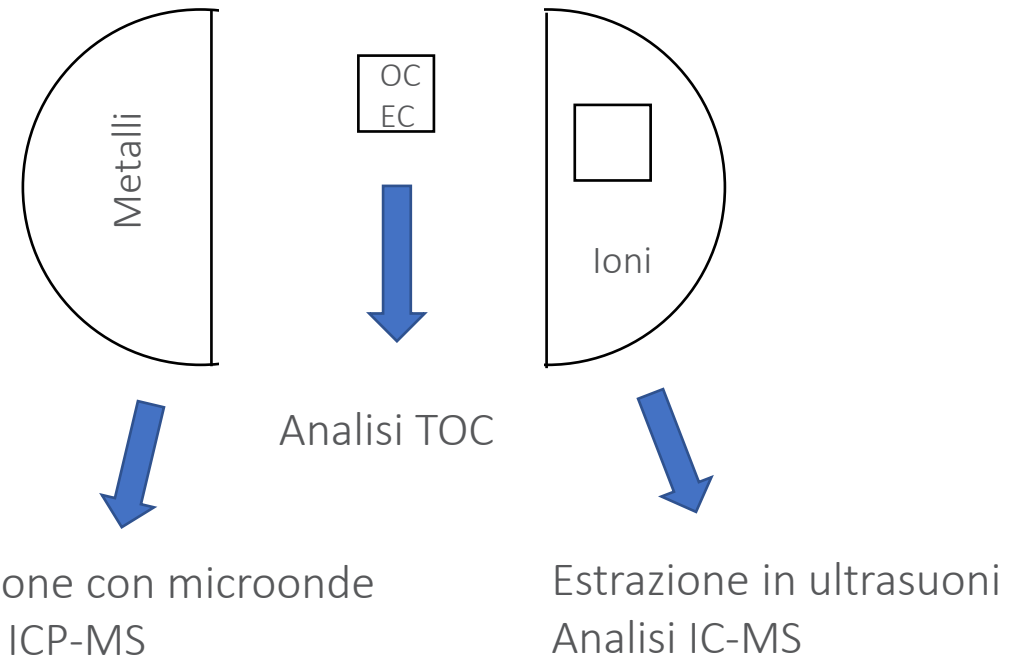
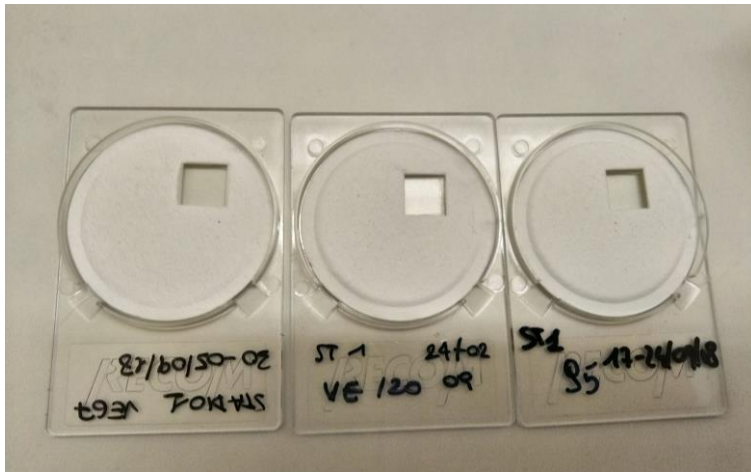
RH: 45 ± 5 % / T: 25 ± 5 °C



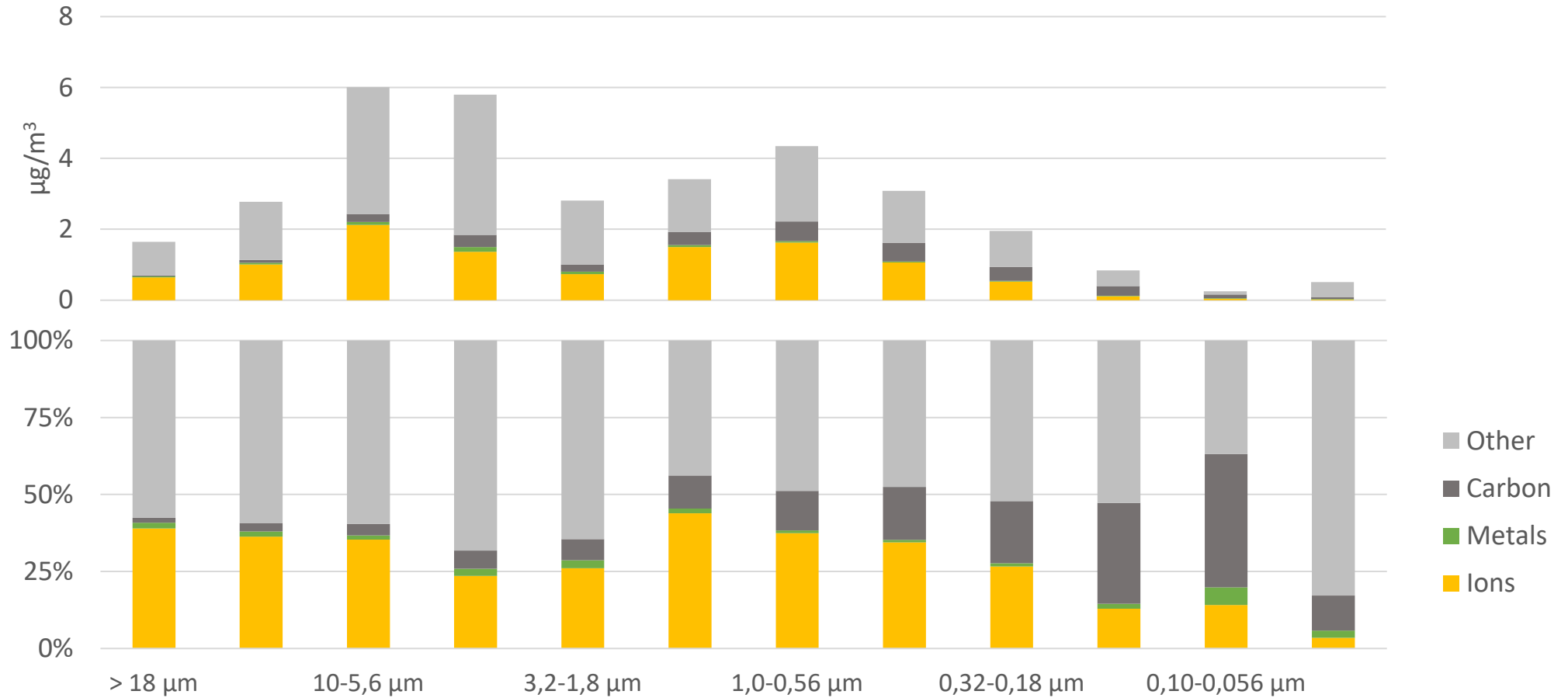
Analisi chimica

Classi analizzate

- Metalli
- Ioni maggiori e anioni acidi carbossilici
- Carbonio organico ed elementare (OC and EC)

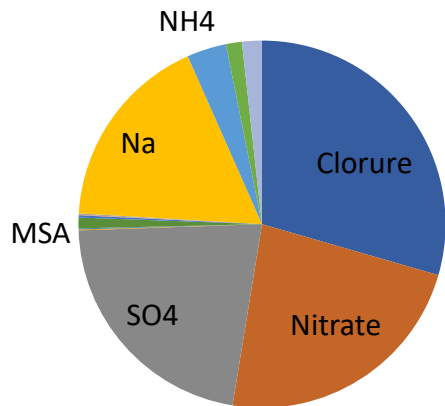


Composizione chimica aerosol

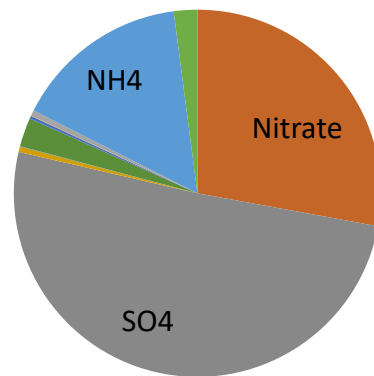


Analisi di ioni

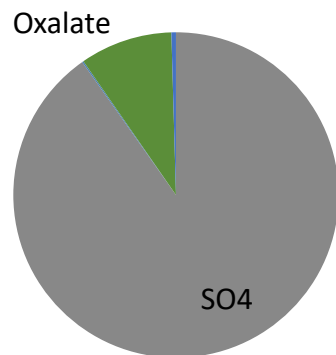
Coarse



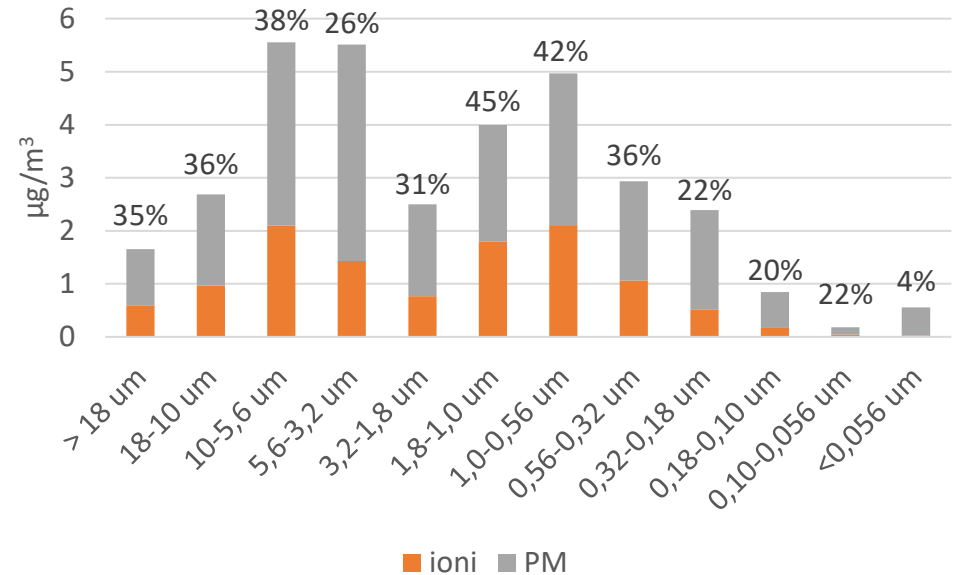
Fine



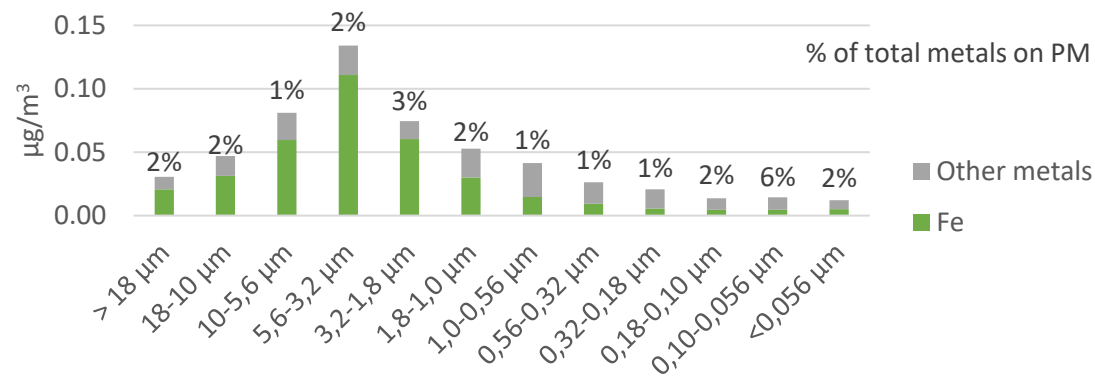
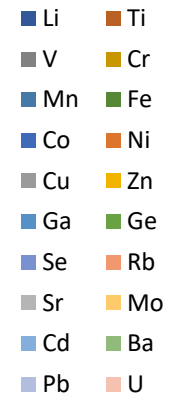
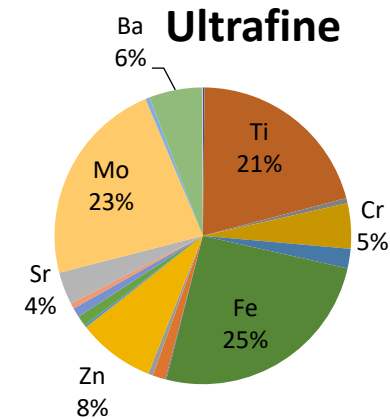
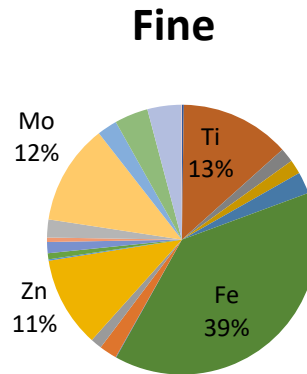
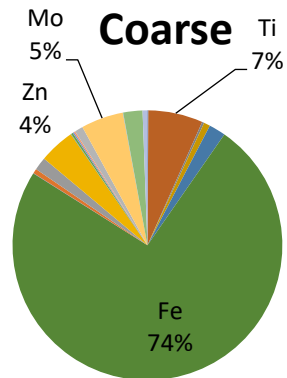
Ultrafine



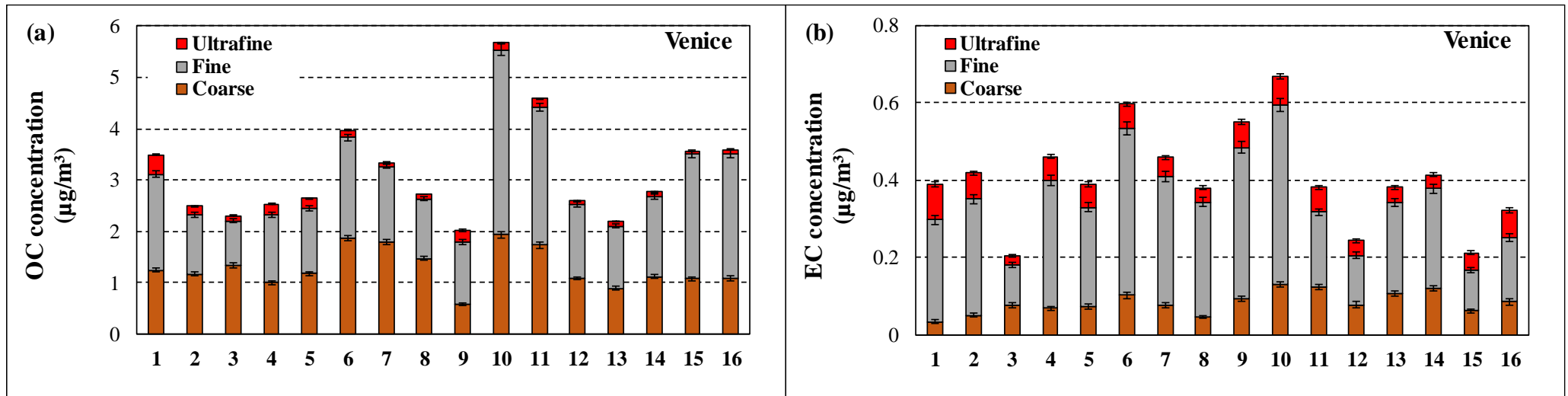
- Clorure
- SO4
- Br
- Malonate
- Malate
- NH4
- Mg
- Nitrate
- MSA
- Oxalate
- Succinate
- Na
- K



Analisi di metalli



Analisi di specie carboniose



Cesari et al., Atmospheric Pollut. Res. 11 (2020) 1705

Source apportionment

POSITIVE MATRIX FACTORIZATION (PMF)

LATI POSITIVI

- Quantificazione contributo sorgenti con modello a recettore

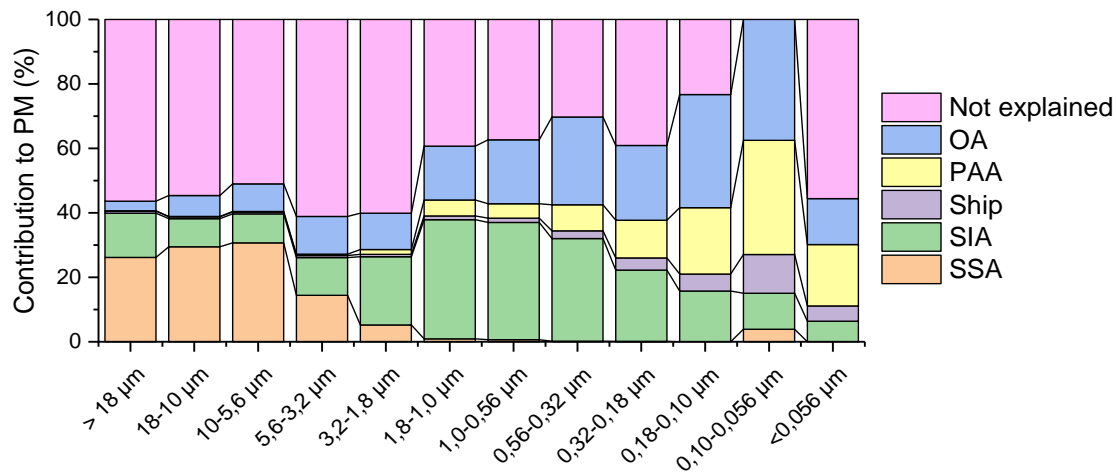
DIFFICOLTA'

- Separazione sorgenti miste
- Convergenza del modello

FORMULE APPROSSIMATE

- Spray marino
- Aerosol secondario inorganico
- Contributo primario del traffico navale
- Aerosol antropico primario
- Aerosol organico

Risultati da formule approssimate



$$SSA = 1.176 (Cl^- (w/v) + Na^+ (w/v))$$

$$SIA = nns-SO_4^{2-} (w/v) + NO_3^- (w/v) + NH_4^+ (w/v)$$

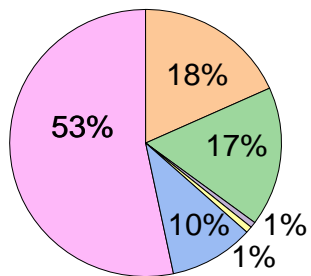
$$Ship = (R \cdot V) / F_{v,HFO}$$

$$PPA = EC + OM_{prim} = EC + 1.8 OC_{prim}$$

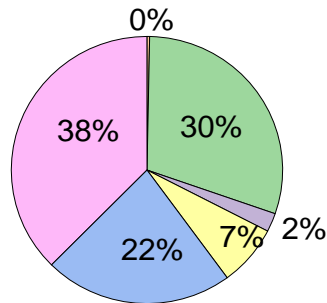
$$OA = 1.8 (OC - OC_{prim})$$

$$OC_{prim} = 1.1 EC$$

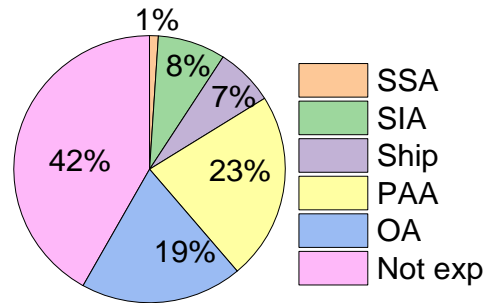
Coarse fraction



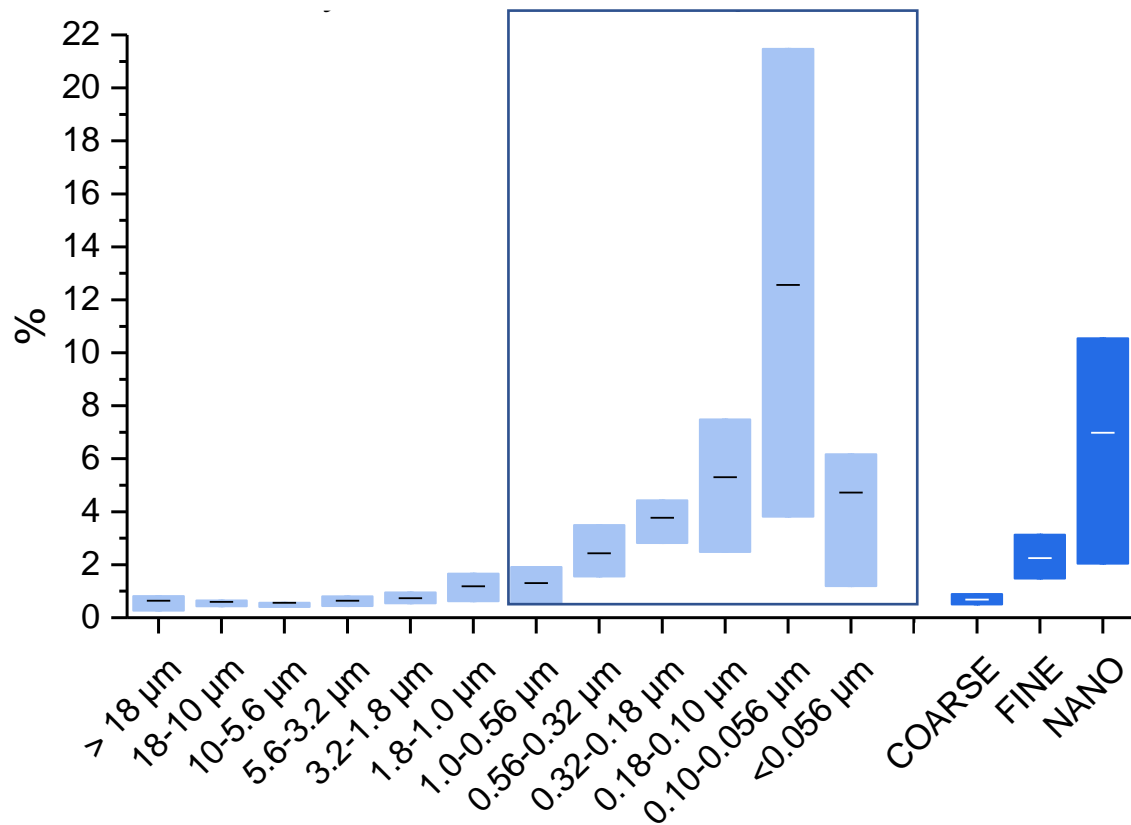
Fine fraction



Ultrafine fraction

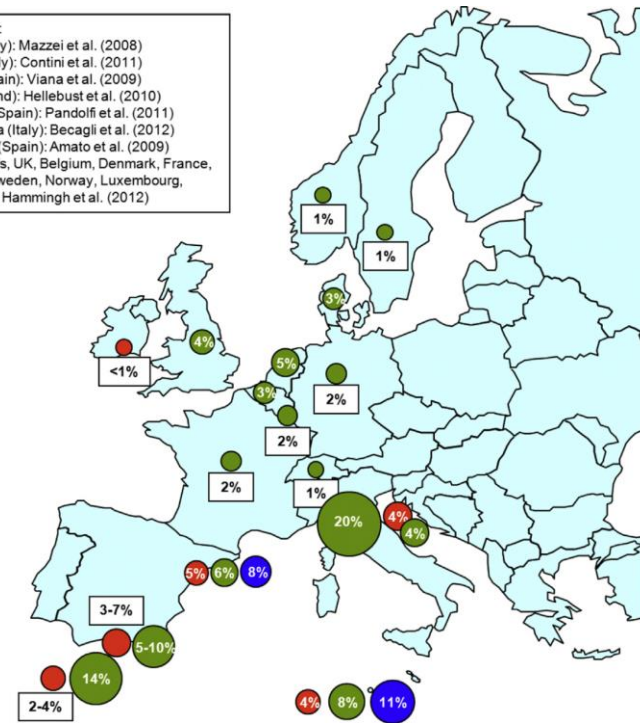


Contributo traffico navale



- References:**
- Genoa (Italy): Mazzei et al. (2008)
 - Venice (Italy): Contini et al. (2011)
 - Melilla (Spain): Viana et al. (2009)
 - Cork (Ireland): Hellebust et al. (2010)
 - Algeciras (Spain): Pandolfi et al. (2011)
 - Lampedusa (Italy): Becagli et al. (2012)
 - Barcelona (Spain): Amato et al. (2009)
 - Netherlands, UK, Belgium, Denmark, France, Germany, Sweden, Norway, Luxembourg, Switzerland: Hammingh et al. (2012)

- PM₁₀
- PM_{2.5}
- PM₁



Further work should be carried out to characterize the particle size distribution of particles (primary and secondary) derived from ship emissions, as these reach coastal areas. Viana et al., Atmos Environ 90 (2014) 96

Conclusioni

Caratterizzazione + quantificazione sorgenti di particolato size-segregated



- Distribuzione dimensionale componenti aerosol a Venezia
- Contributo sorgenti in base alla dimensione delle particelle
 - ✓ SSA contribuisce su grossolane
 - ✓ SIA maggiore nella frazione fine
 - ✓ OA aumenta al diminuire delle dimensioni fino a $0.056 \mu\text{m}$
 - ✓ PPA e Ship maggiore nelle nanoparticelle → contributo antropico
 - ✓ Contributo traffico navale sotto PM_{10}

Grazie per l'attenzione

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WORKING GROUP

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