



# MISURE PER LA VALIDAZIONE DEL MODELLO DI QUALITÀ DELL'ARIA: CARATTERIZZAZIONE DEL SITO TRISAIA MISURE GIORNALIERE DI PARTICOLATO AL SUOLO

*Antonella Malaguti, Massimo Berico, Teresa La Torretta, Roberto Nuzzi, Chiara Telloli,  
Milena Stracquadanio, Mihaela Mircea*

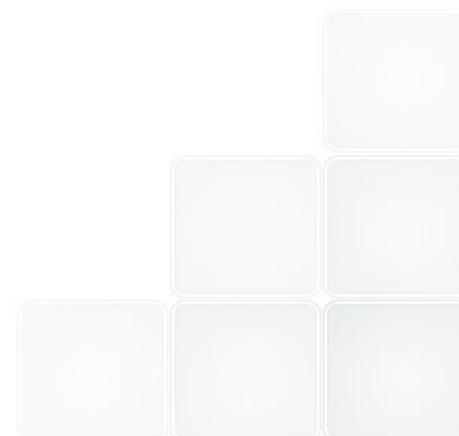
ENEA UTVALAMB AIR



# Sommario



- Obiettivi della campagna
- Descrizione del sito
- Organizzazione postazione misura
- Caratterizzazione chimica e serie temporali
- Stima del contributo marino
- Stima del contributo polveri sahariane
- Bilancio di massa



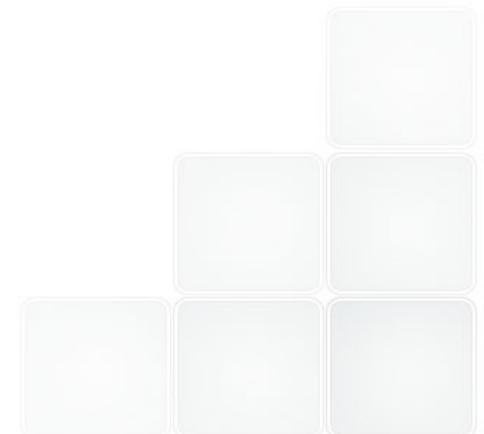


# Obiettivi della campagna



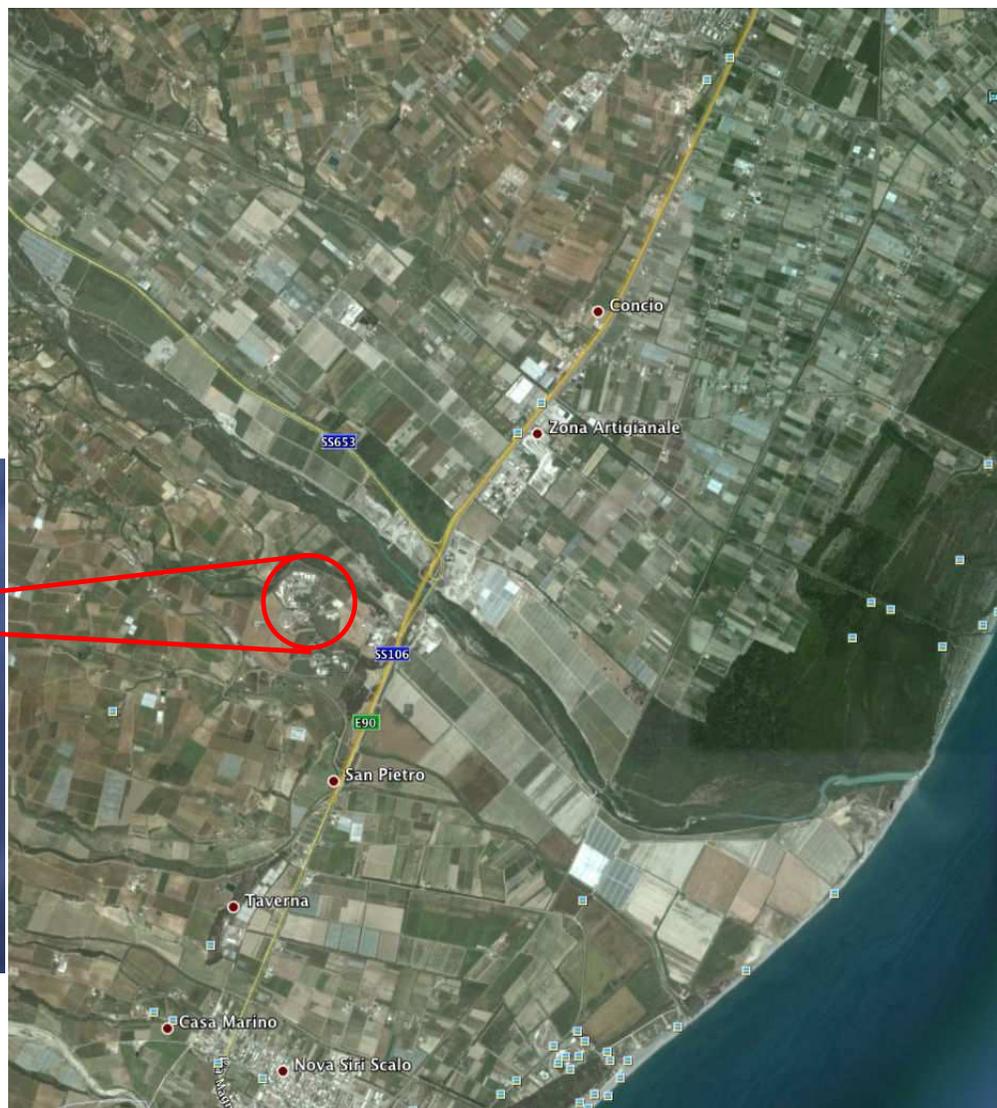
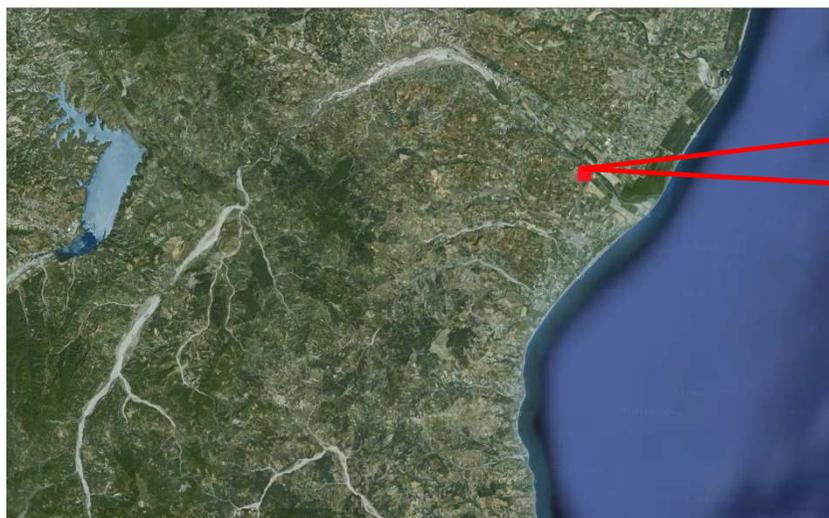
Verifica della efficacia dei nuovi moduli del modello:

- Aerosol marino
- Trasporto polveri desertiche e loro influenza sulle concentrazioni di particolato al suolo
- Incendi





# Sito di campionamento



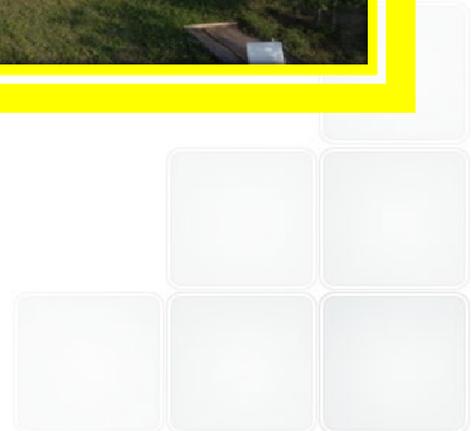


# Sito di campionamento



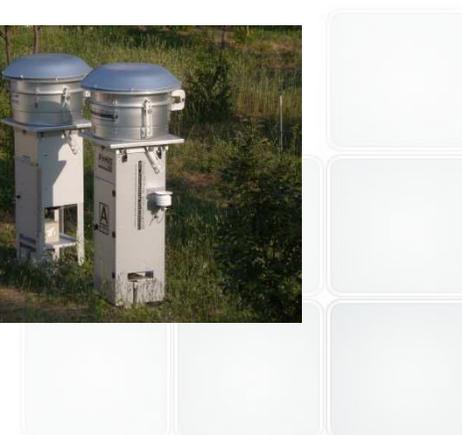
Centro ENEA della Trisaia

Campagna di misure: 3 maggio-2 luglio 2010





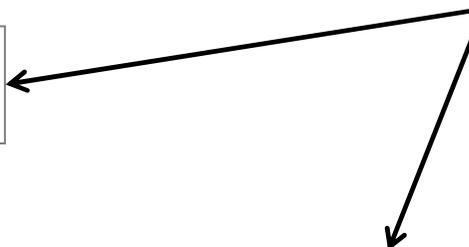
# Organizzazione della postazione





**LVS - FAI SWAM monocanale**  
PM10, PM2.5 - campionamenti 24h,  $2.3\text{m}^3\text{h}^{-1}$   
supporti fibra di quarzo  
Pall 2500-QUAT-UP  $\text{Ø}47\text{mm}$

**frazione inorganica idrosolubile**  
Cromatografia ionica

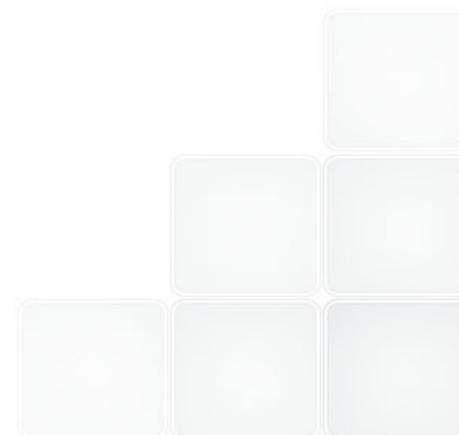


**concentrazione di massa PM10, PM2.5**  
misura automatica  
metodo attenuazione beta



- umidità relativa
- temperatura
- pressione atmosferica
- direzione ed intensità del vento
- intensità e durata della pioggia

**Stazione meteorologica  
VAISALA MAWS100**





**LVS-FAI HYDRA Dual Sampler**  
 PM10, PM2.5 - campionamenti 24h, 2.3m<sup>3</sup>h<sup>-1</sup>  
 supporti in polytetrafluoroethylene (PTFE)  
 Pall TEFLO W/RING Ø47mm  
 Velocità facciale 60cms<sup>-1</sup>

**HVS - Graseby Andersen / Tisch-Analitica**  
 PM10, PM2.5 - campionamenti 24h, 68m<sup>3</sup>h<sup>-1</sup>  
 supporti fibra di quarzo  
 Pall 2500-QAT-UP 7204, 203mmx254mm  
 Velocità facciale 76cms<sup>-1</sup>

Direttiva 2008/50/CE  
 D.Lgs n.155/2010

EN 12341  
 EN 14907

**concentrazione in massa PM10, PM2.5**  
 metodo gravimetrico

**Composizione elementare**  
 ICP-MS

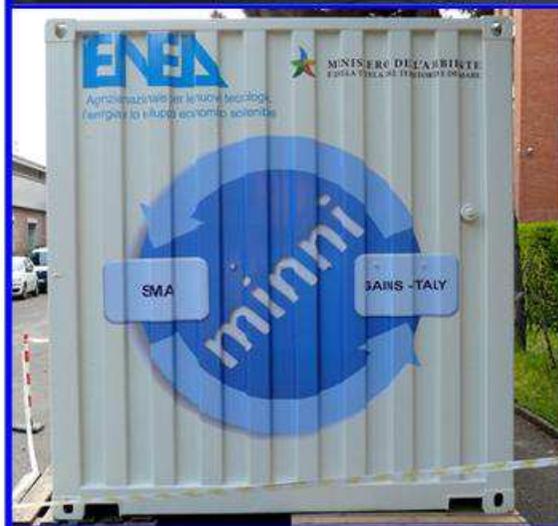
**Levogluosano**  
 Cromatografia a scambio anioionico  
 detector amperometrico (HPAEC-PAD)

**OC/EC**  
 analisi termo-ottica  
 EUSAAR2

**WSOC**  
 Combustion/NDIR GAS analysis  
 TOC-analyzer

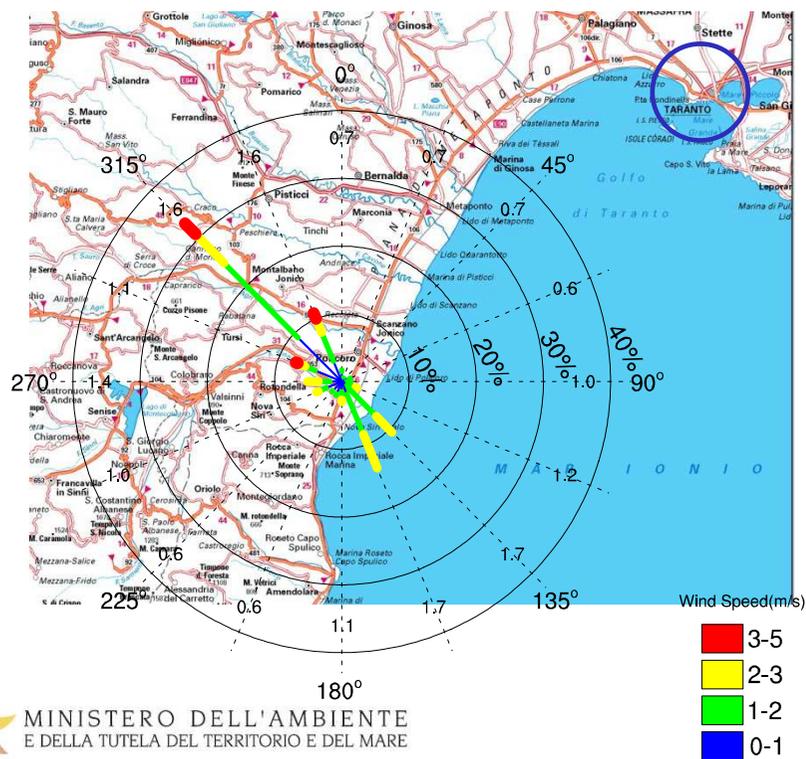
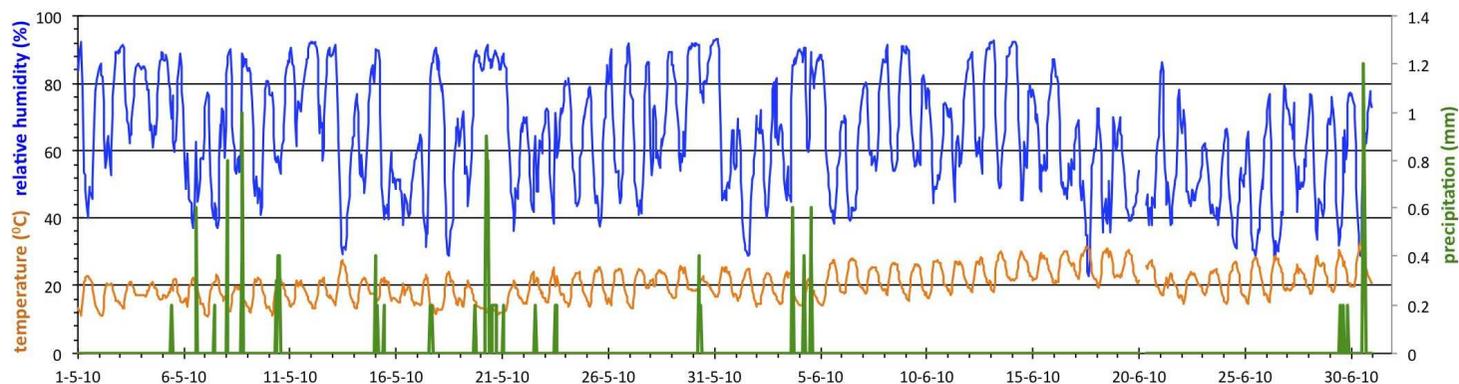


# Laboratorio trasportabile





# Dati meteorologici locali



	T°C	RH%
MIN	10.8	22.6
MAX	32.6	93.2
AVG	20.4	63.9

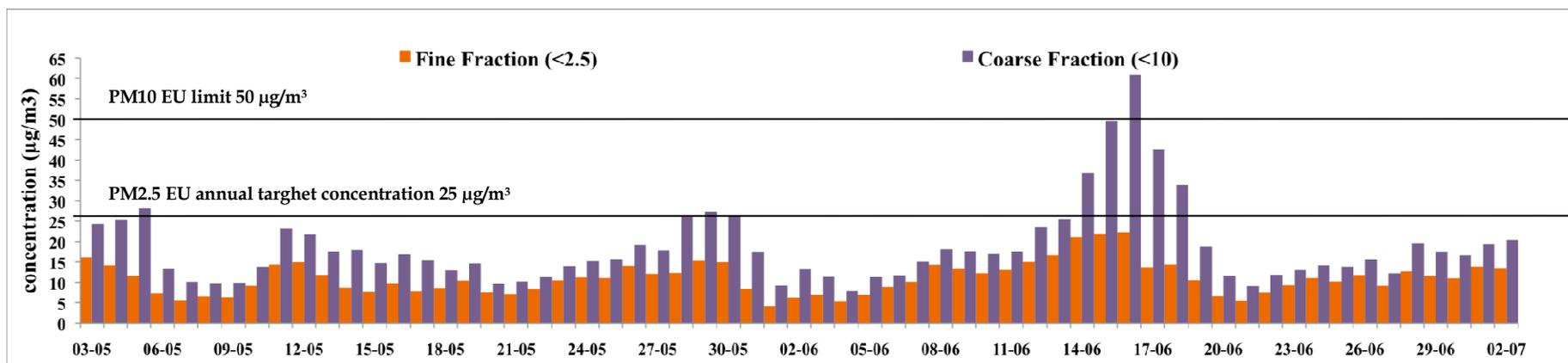


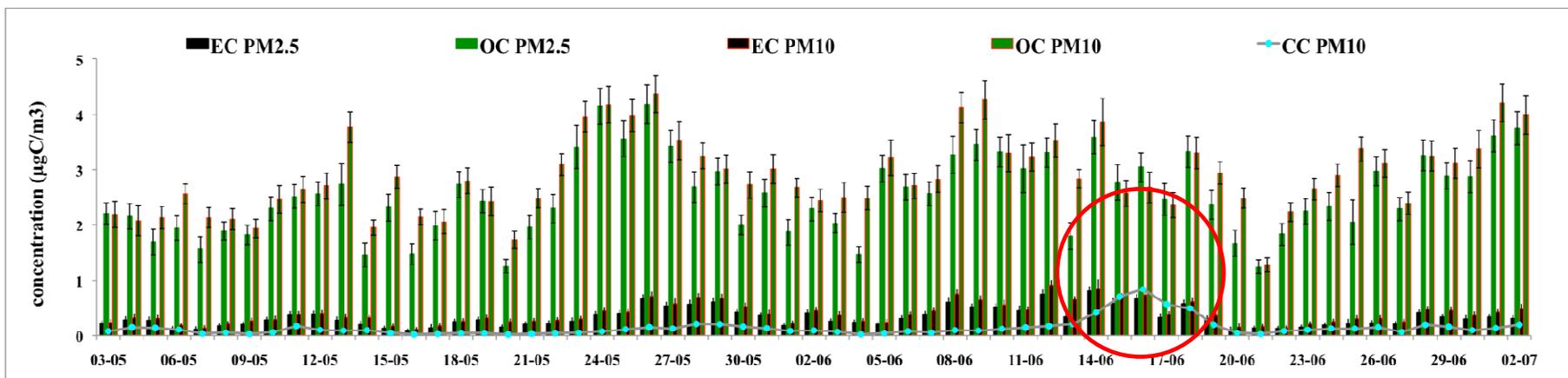
# Concentrazioni particolato



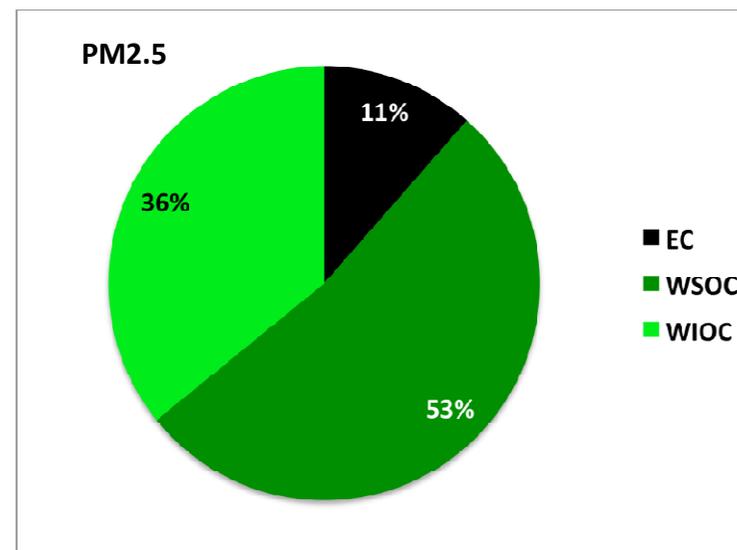
## Dati gravimetrici

	PM2.5	PM10
MIN	4.20	8.03
MAX	22.34	60.88
AVG	11.07	18.65
DV.ST	3.95	9.73



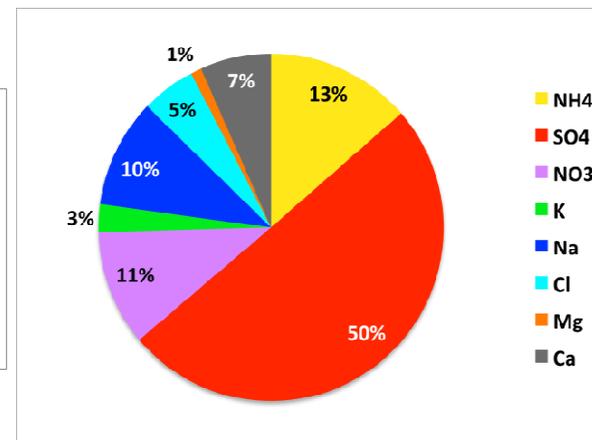
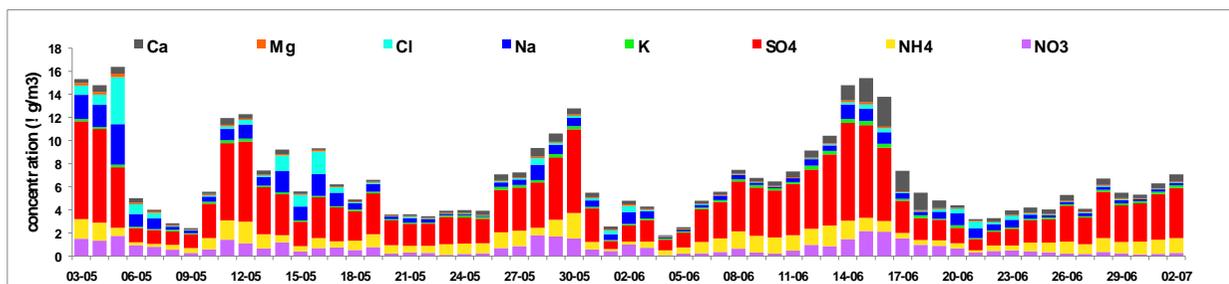


Wood smoke OC =  $[Levoglucosano-C] \times 6.1 = 3\%$  OC totale.

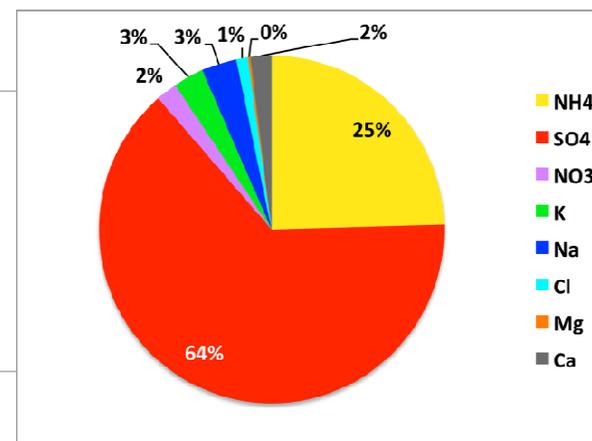
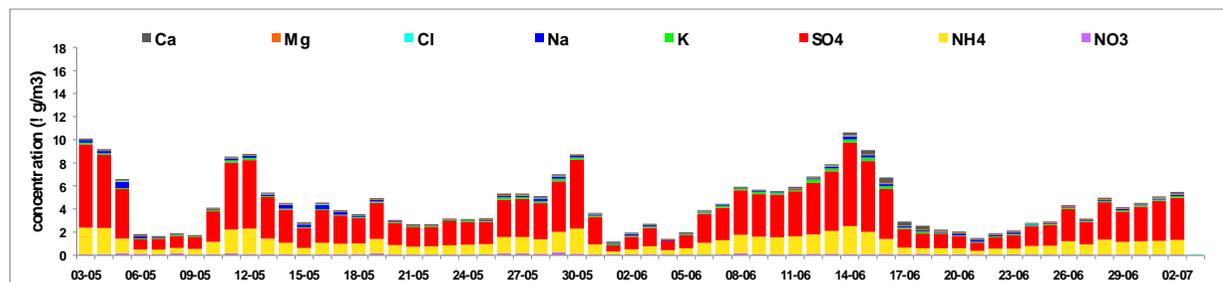


-Caseiro et al., 2009, *Atmospheric Environment*, 43, 2186-2195

## PM10



## PM2.5





# Stima del contributo marino



## Stima frazione marina

$$ssSO_4^{2-} = Na^+ (SO_4^{2-}/Na^+)_{seawater}$$

$$ssCl^- = Na^+ (Cl^-/Na^+)_{seawater}$$

$$ssCa^{2+} = Na^+ (Ca^{2+}/Na^+)_{seawater}$$

$$ssMg^{2+} = Na^+ (Mg^{2+}/Na^+)_{seawater}$$

$$ssK^+ = Na^+ (K^+/Na^+)_{seawater}$$

$$(SO_4^{2-}/Na^+)_{seawater} = 0.252 \text{ w/w}$$

$$(Cl^-/Na^+)_{seawater} = 1.798 \text{ w/w}$$

$$(Ca^{2+}/Na^+)_{seawater} = 0.038 \text{ w/w}$$

$$(Mg^{2+}/Na^+)_{seawater} = 0.120 \text{ w/w}$$

$$(K^+/Na^+)_{seawater} = 0.037 \text{ w/w}$$

$$\text{Sea Salt Aerosol} = [Na^+] + [ssSO_4^{2-}] + [Cl^-] + [ssCa^{2+}] + [ssMg^{2+}] + [ssK^+]$$

$$SSA = [ssNa^+] + [ssSO_4^{2-}] + [ssCl^-] + [ssCa^{2+}] + [ssMg^{2+}] - \text{(Kishcha et al., 2011)}$$

-Perrino et al., 2009, *Atmospheric Environment*, 43, 4766-4779  
311-321.

-Kishcha et al., 2011, *Atmospheric Research*, 100, 28-35  
*Environment*, 44, 5269-5278

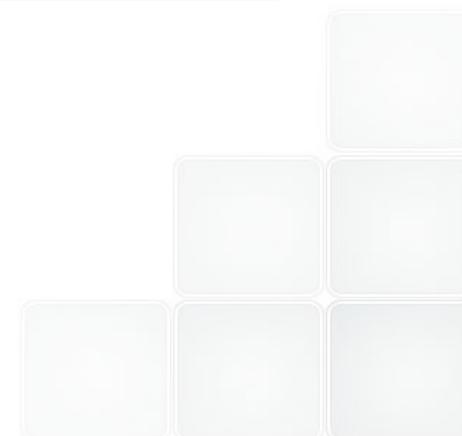
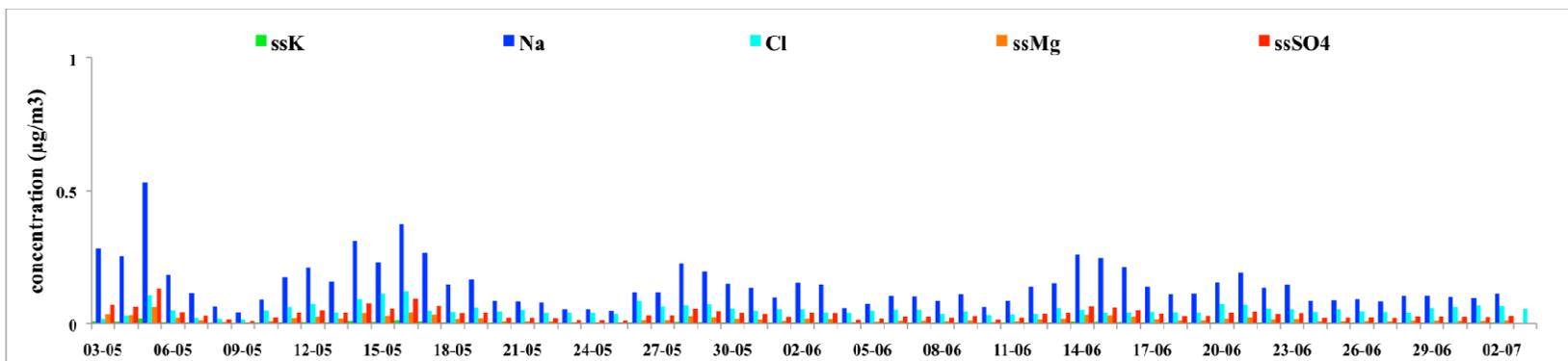
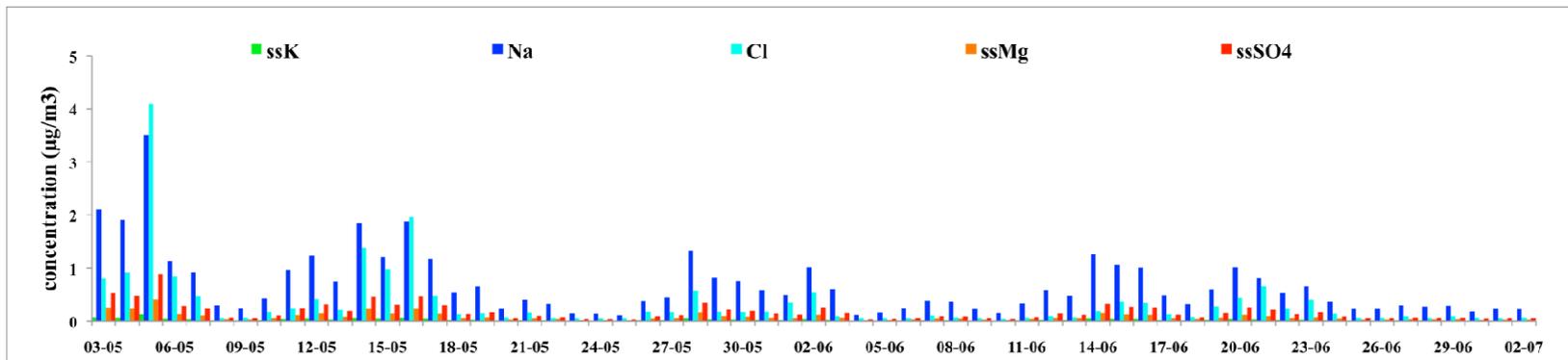
-Rinaldi et al., 2007, *Water Air Soil Pollution Environment*, 185,  
3519-3528

-Carbone et al., 2010, *Atmospheric*





# Ioni inorganici di origine marina

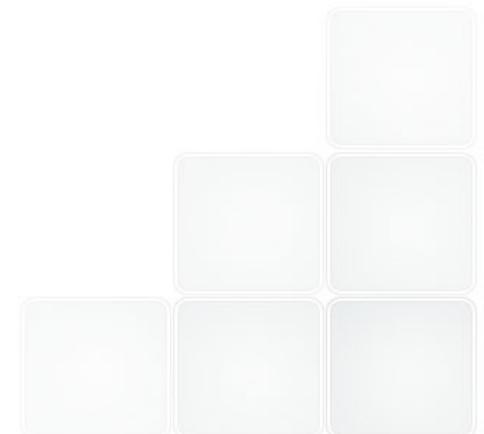




**schema meccanismo fotochimico SAPRC99 in FARM**

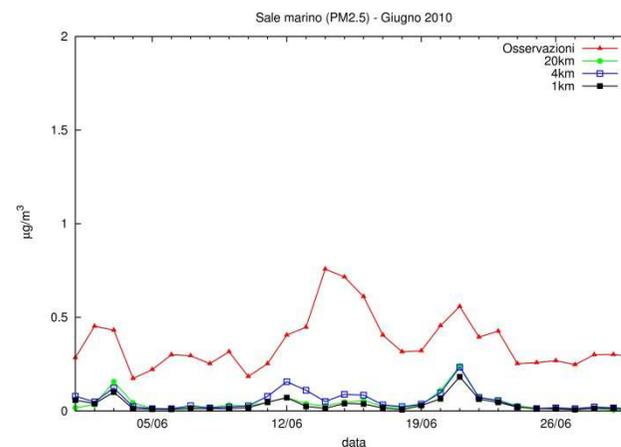
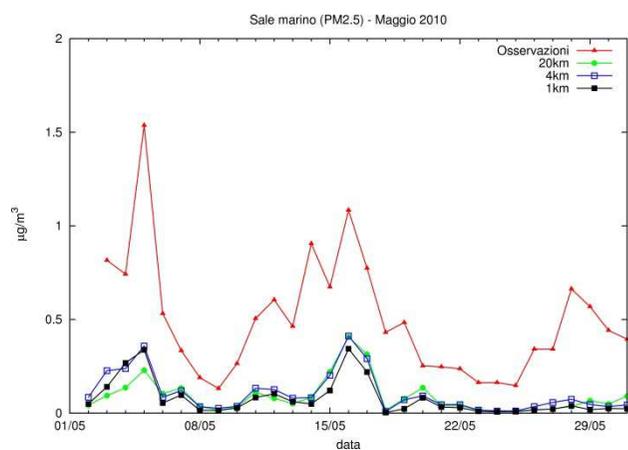
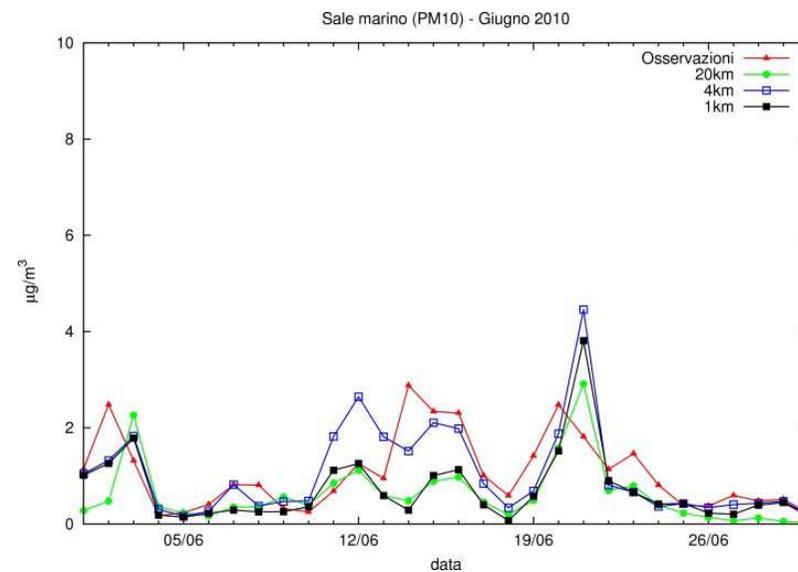
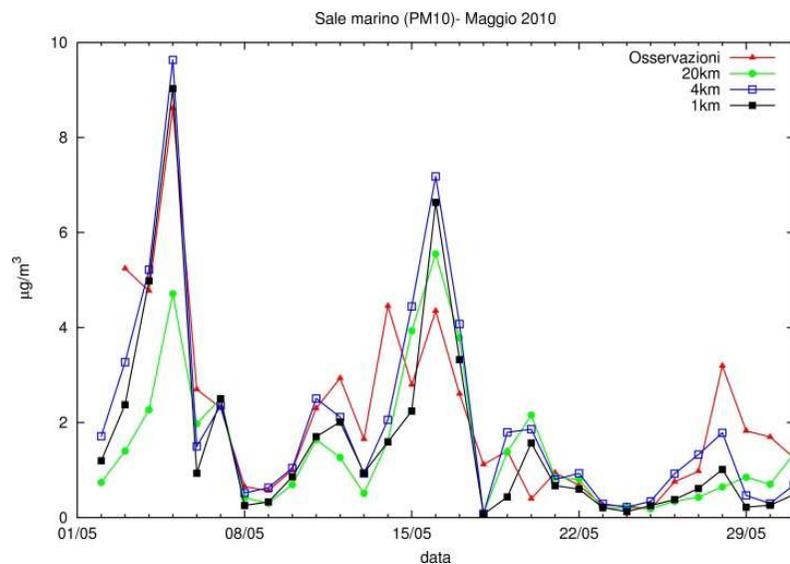
**parametrizzazione emissioni sali marini descritta in Zhang et al. (2005)**

**condizioni meteorologiche (velocità del vento, l'umidità relativa) e  
d'inquinamento simulate con risoluzioni spaziali di 20km, 4 km,  
1km**





# Marino: confronto modello-dati sperimentali





# Stima del contributo di polveri sahariane



## Identificazione trasporto DUST

Principali componenti **Ca, Si, Al, Fe, Ti**

$Al > 1 \mu\text{g}/\text{m}^3$  + air mass back trajectories

Ca/Al ratio <2-3

(Kocak et al., 2012)

## Stima del contributo in massa

Determinazione indiretta  $\text{Al}_2\text{O}_3$ ,  $\text{SiO}_2$ ,  $\text{CO}_3^{2-}$

$$1.89[\text{Al}] = \text{Al}_2\text{O}_3$$

$$2\text{Al}_2\text{O}_3 = \text{SiO}_2$$

$$1.5\text{nssCa} + 2\text{nssMg} = \text{CO}_3^{2-}$$

$$\text{Dust mass} = \text{Al}_2\text{O}_3 + \text{SiO}_2 + \text{CO}_3^{2-} + 1.42[\text{Fe}] + 1.94[\text{Ti}] + \text{nssMg}^{2+} + \text{nssCa}^{2+} + 1.2\text{nssK}^+$$

(Guinot et al., 2007; Perrino et al., 2009; Querol et al., 2001; Pettijohn, 1975)

**mineral dust** =  $5.6\text{xnssCa}^{2+}$  (non saharan dust period) (Putaud et al., 2004)

**mineral dust** =  $15.0\text{xnssCa}^{2+}$  (saharan dust period)

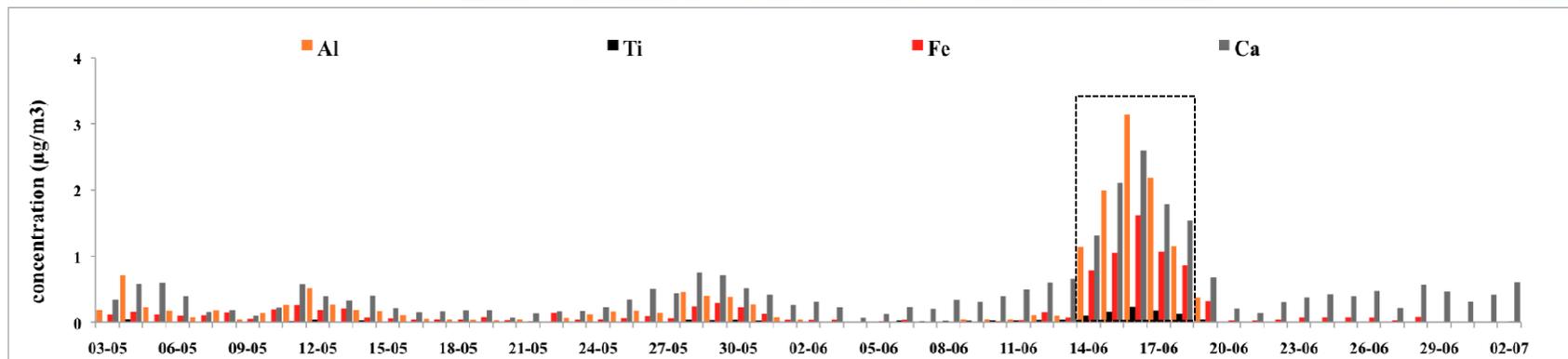
**mineral dust** =  $\text{Ca}^{2+}/f$  (f coeff. regressione lineare tra  $\text{Ca}^{2+}$  e la massa non identificata) (Guinot et al., 2007)

-Guinot et al., 2007, *Atmospheric Chemistry and Physics*, 7, 1657-1670

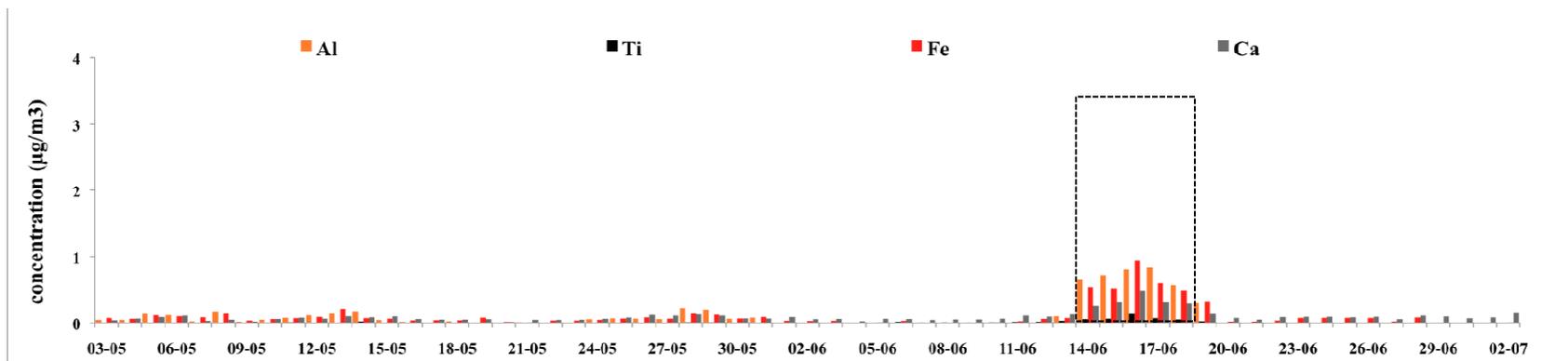
-Kocak et al., 2012, *Atmospheric Environment*, 57, 266-277

-Perrino et al., 2009, *Atmospheric Environment*, 43, 4766-4779

-Putaud et al., 2004, *Atmospheric Chemistry and Physics*, 4, 889-902

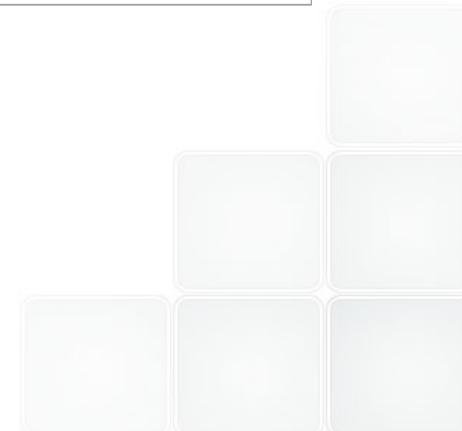


PM10



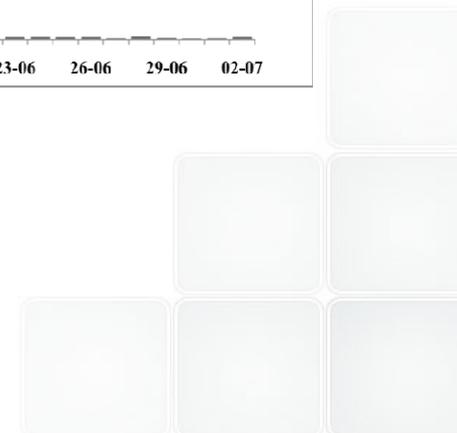
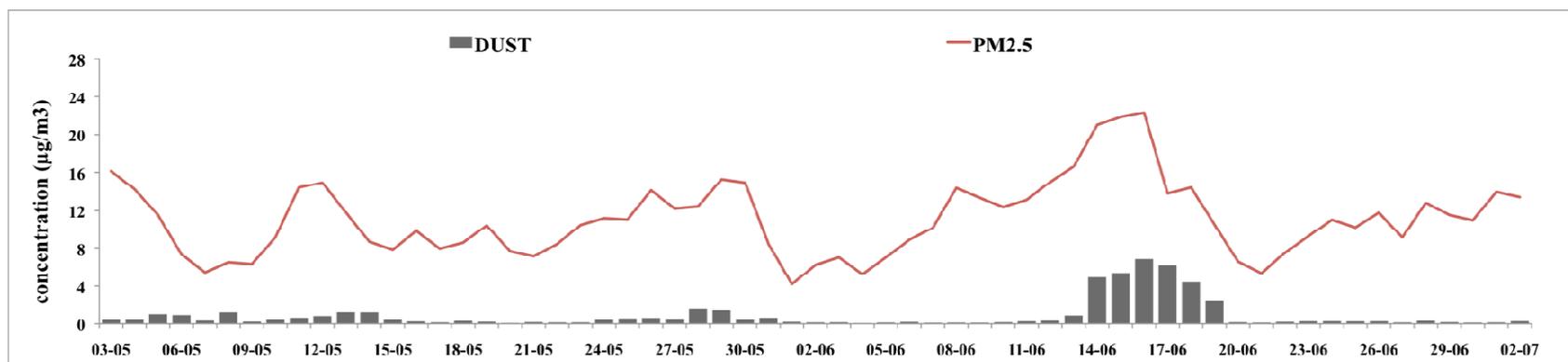
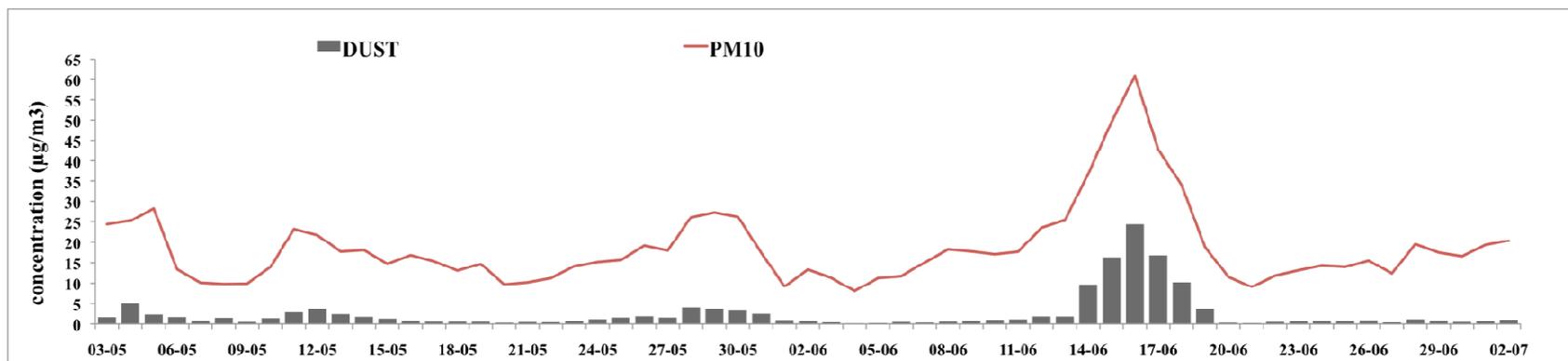
PM2.5

**Dati al suolo**  
**14-18 giugno**  
**Al >  $1\mu\text{g}/\text{m}^3$  val max 16 giugno  $3\mu\text{g}/\text{m}^3$**   
**Ca/Al ratio < 2**





# Contributo in massa di polveri

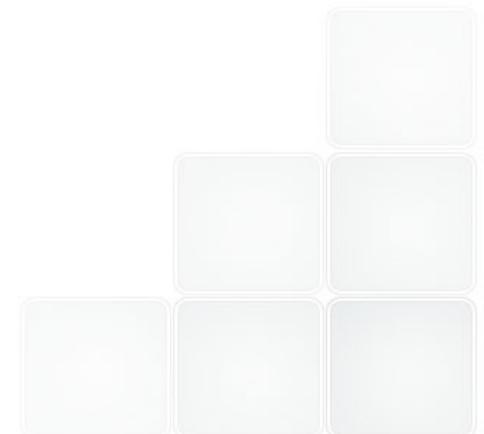


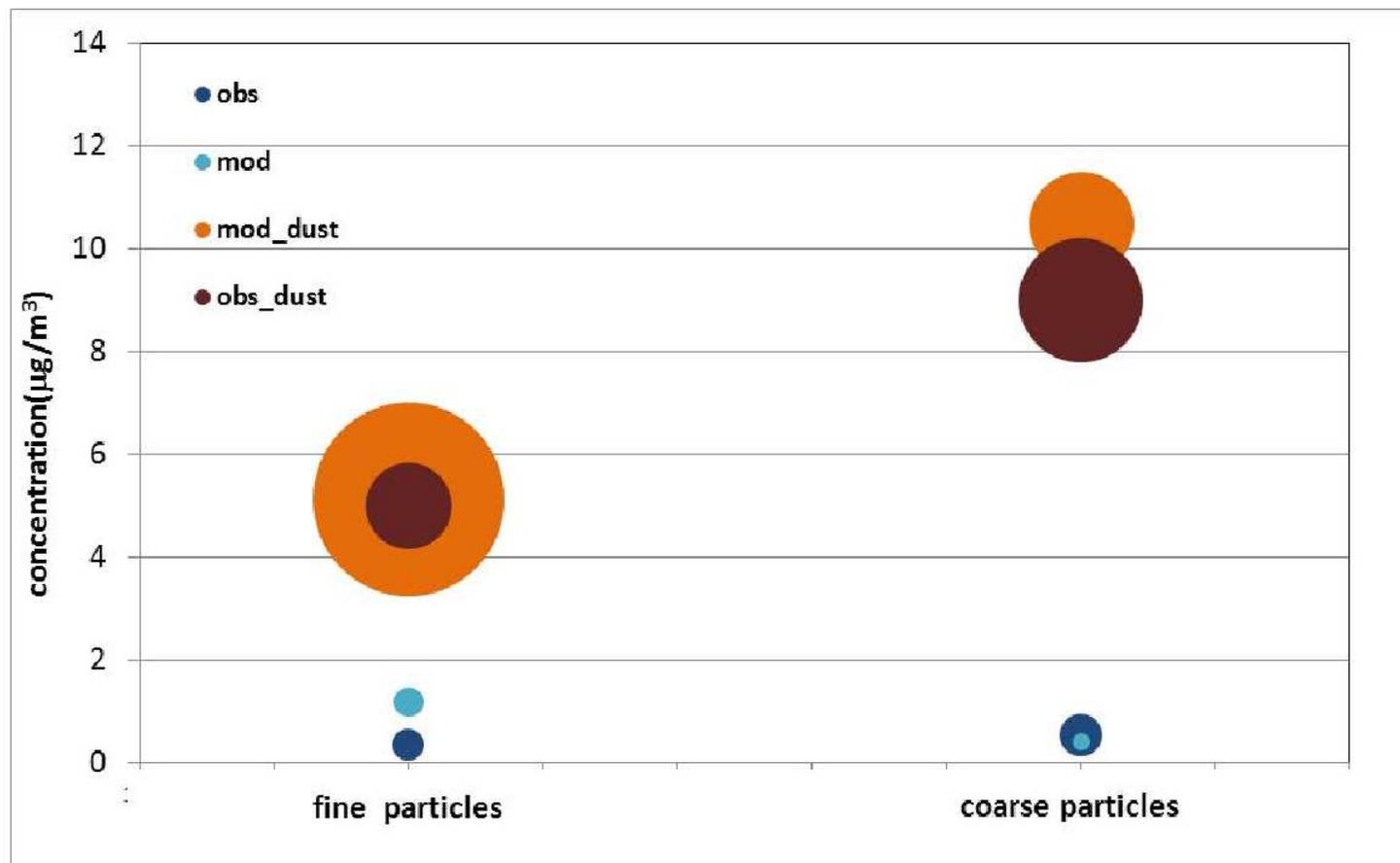


# DUST: confronto modello-dati sperimentali

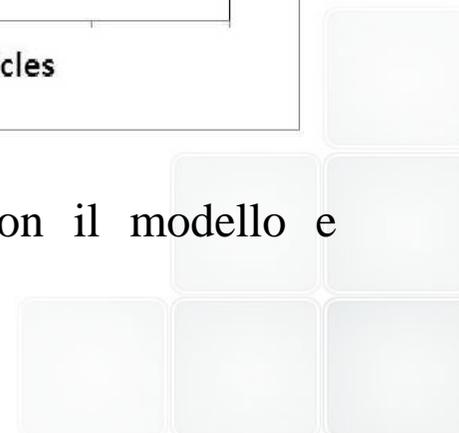


AMS-MINNI accoppiato con il modello Skiron riproduce le concentrazioni misurate di dust.





Concentrazioni del dust nelle frazioni fine e coarse ottenute con il modello e sperimentalmente durante e fuori dagli eventi di dust.





# Contributi percentuali da sorgenti naturali

