

Seguimiento de la Calidad del Aire en la Red de Parques Nacionales  
Valsain (Segovia) 24-26 septiembre 2018

# Cuantificación de la deposición de aerosoles atmosféricos en Sierra Nevada: Influencias locales y globales. ¿Es posible la automatización?

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Credit: NASA

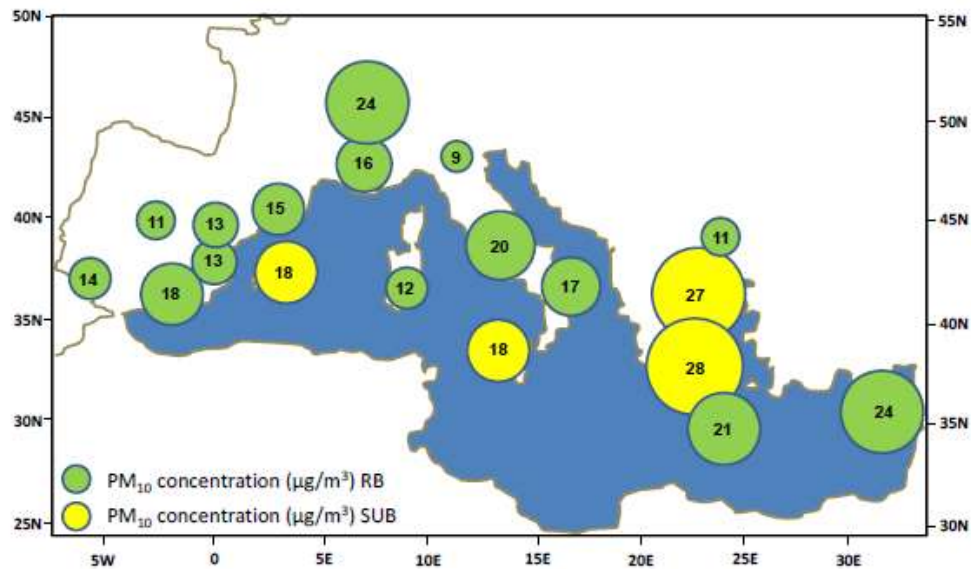
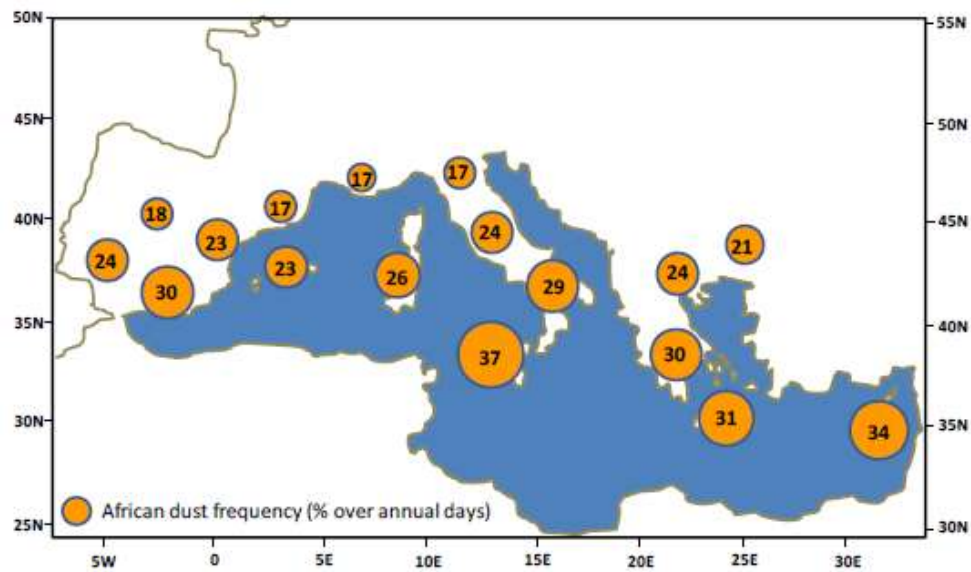
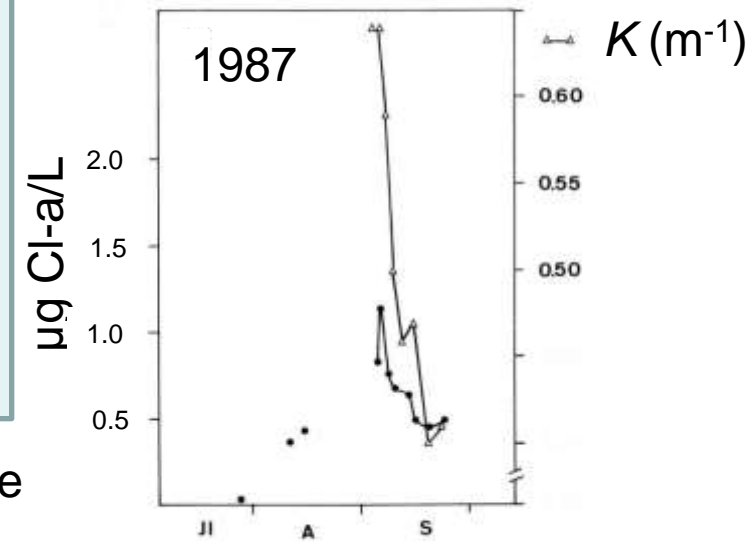
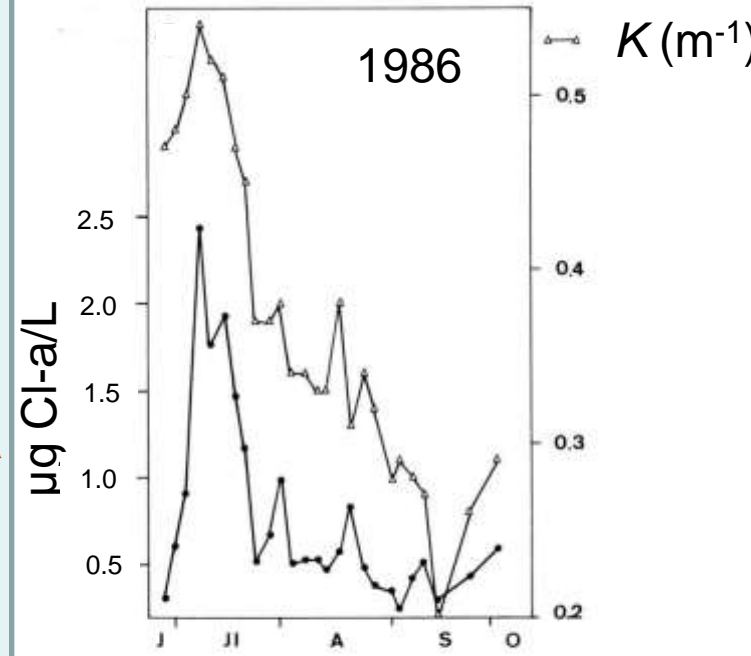
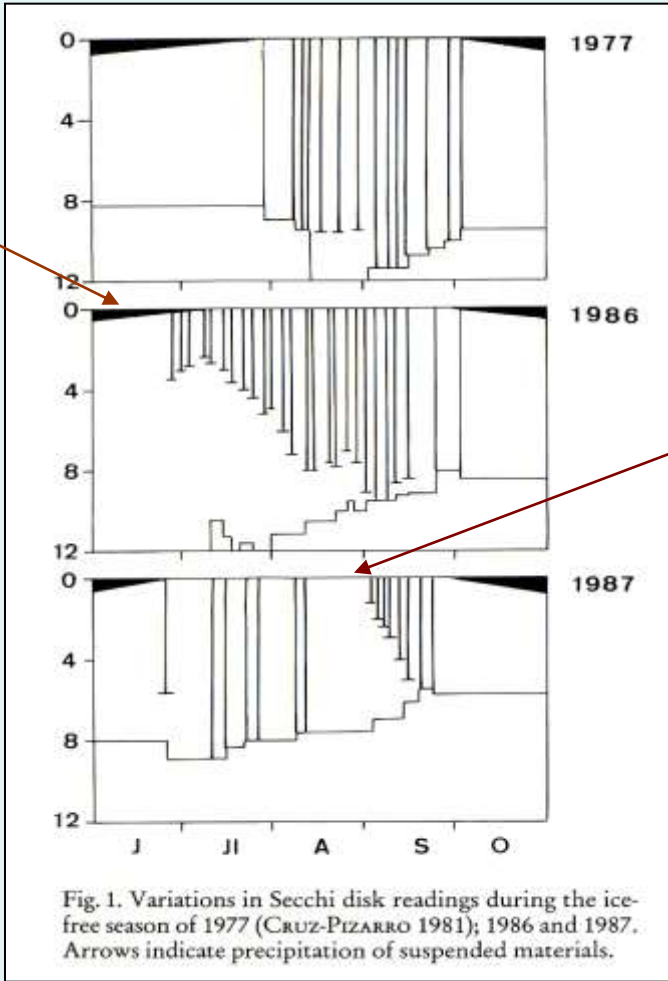


Fig. 2. Annual  $PM_{10}$  levels ( $\mu\text{g}/\text{m}^3$ ) at regional (RB) and suburban (SUB) background sites across the Mediterranean for the period 2001–2011.



La Caldera

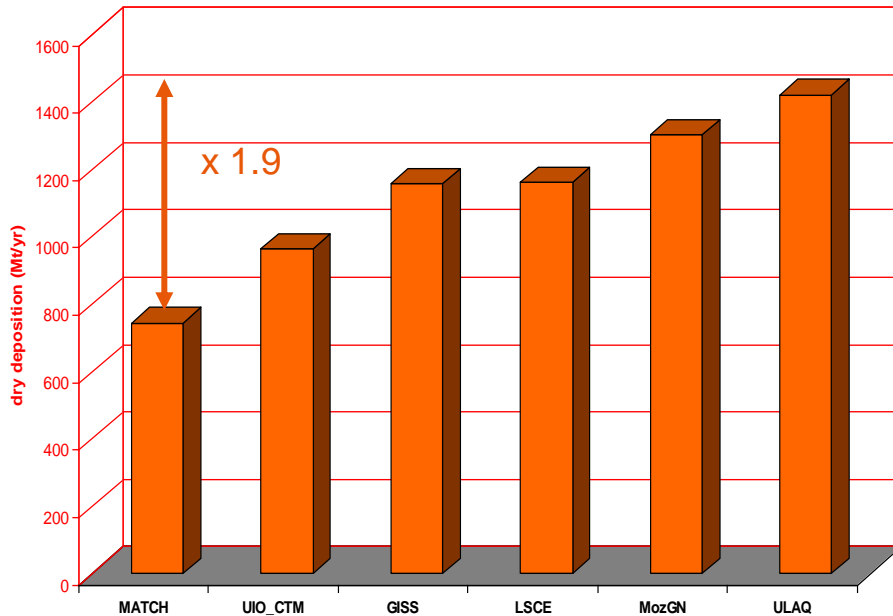
Lluvia roja



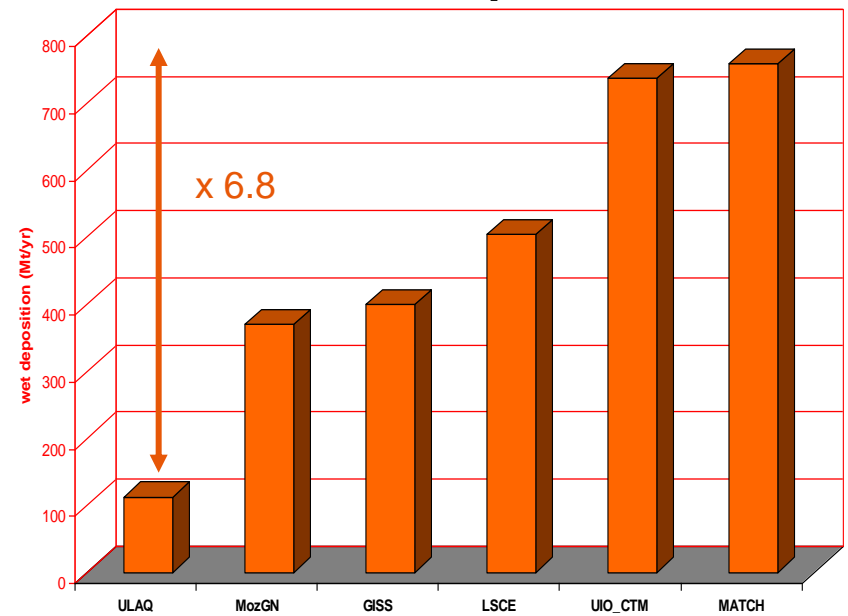
Transparencia de La Caldera durante dos eventos de precipitaciones sahariana (Carrillo *et al.* 1990. Verh. Internat. Verein Limnol 24: 97-101)

# The huge model variability on deposition is a critical problem

## Dry deposition



## Wet deposition



Global dust aerosol model intercomparison with prescribed mass fluxes, injection height and emitted particle size

Adapted from AEROCOM (Aerosol Model Comparison; <http://dataipsl.ipsl.jussieu.fr/cgi-bin/AEROCOM/>; Textor et al., Atmos. Chem. Phys., 2006 and 2007)



# Localización de los colectores

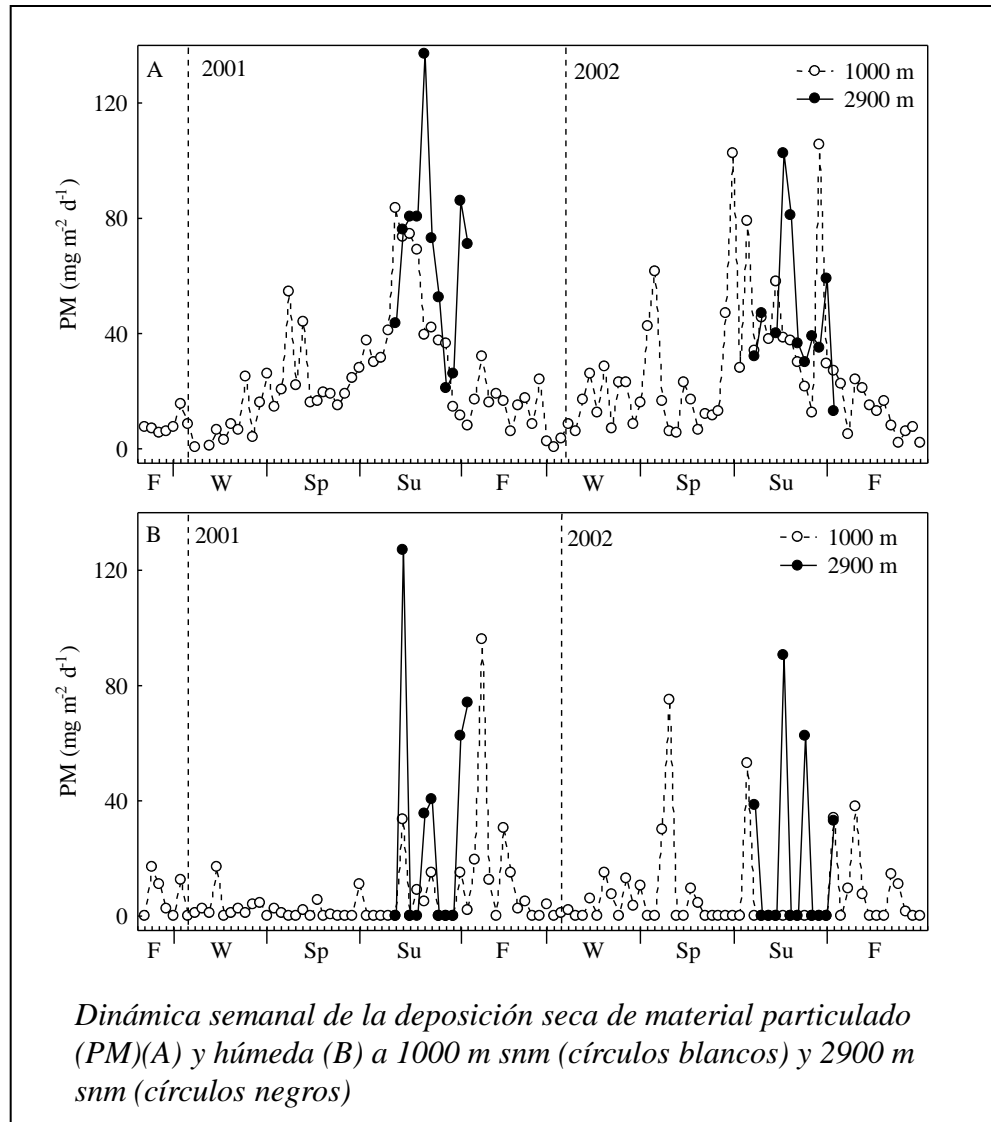






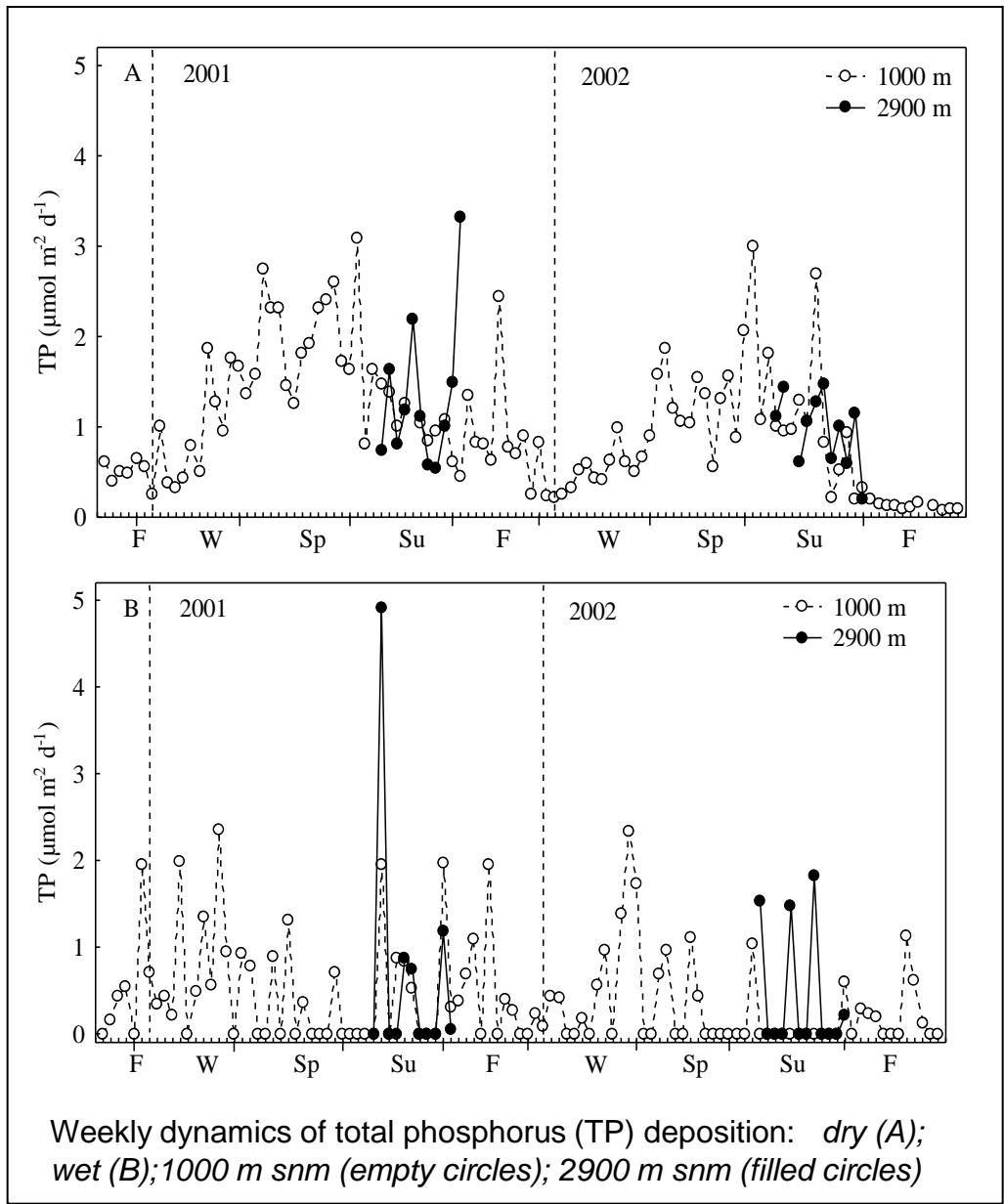
Colector a 1000 m snm  
(recogida semanal Nov.2000-Dic.2002)



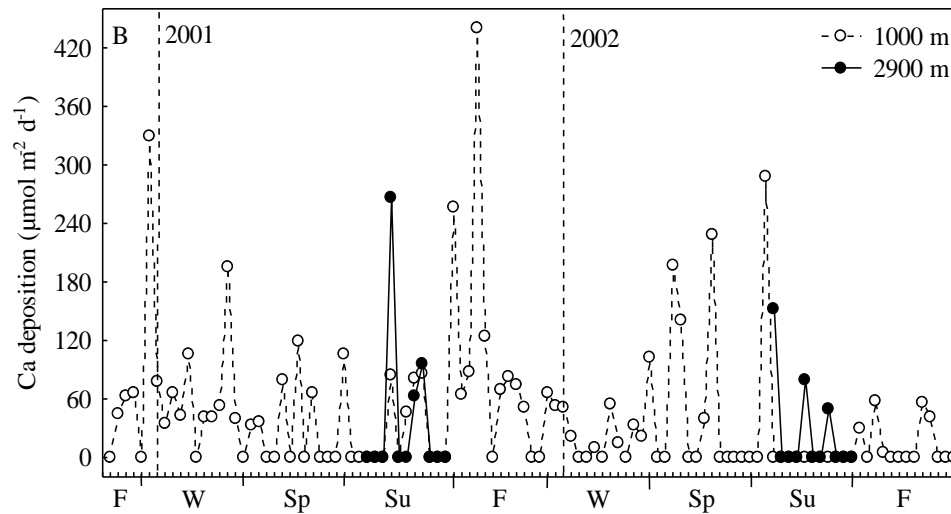
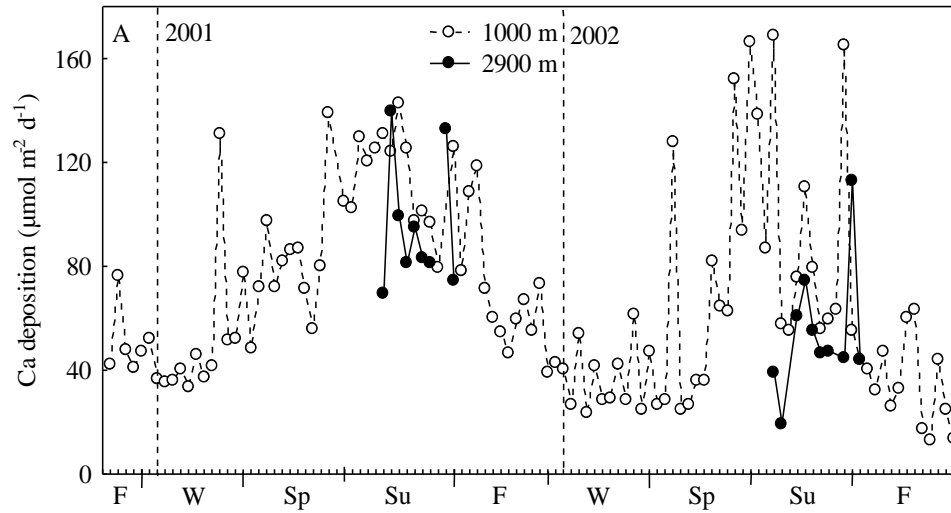


70%  
Contribución  
deposición seca



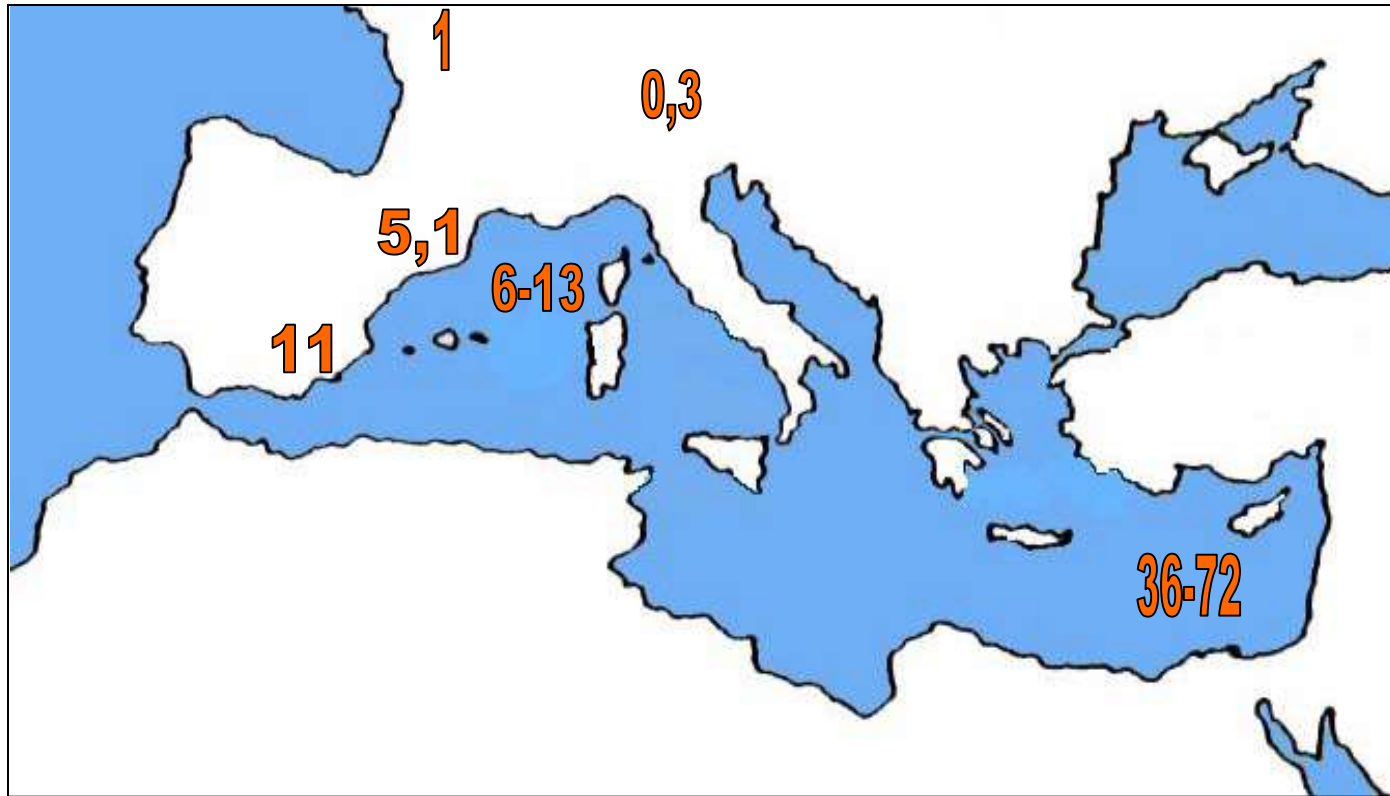


Morales-Baquero *et al.* 2006.  
*Limnol. Oceanogr.* 51(2):830-837



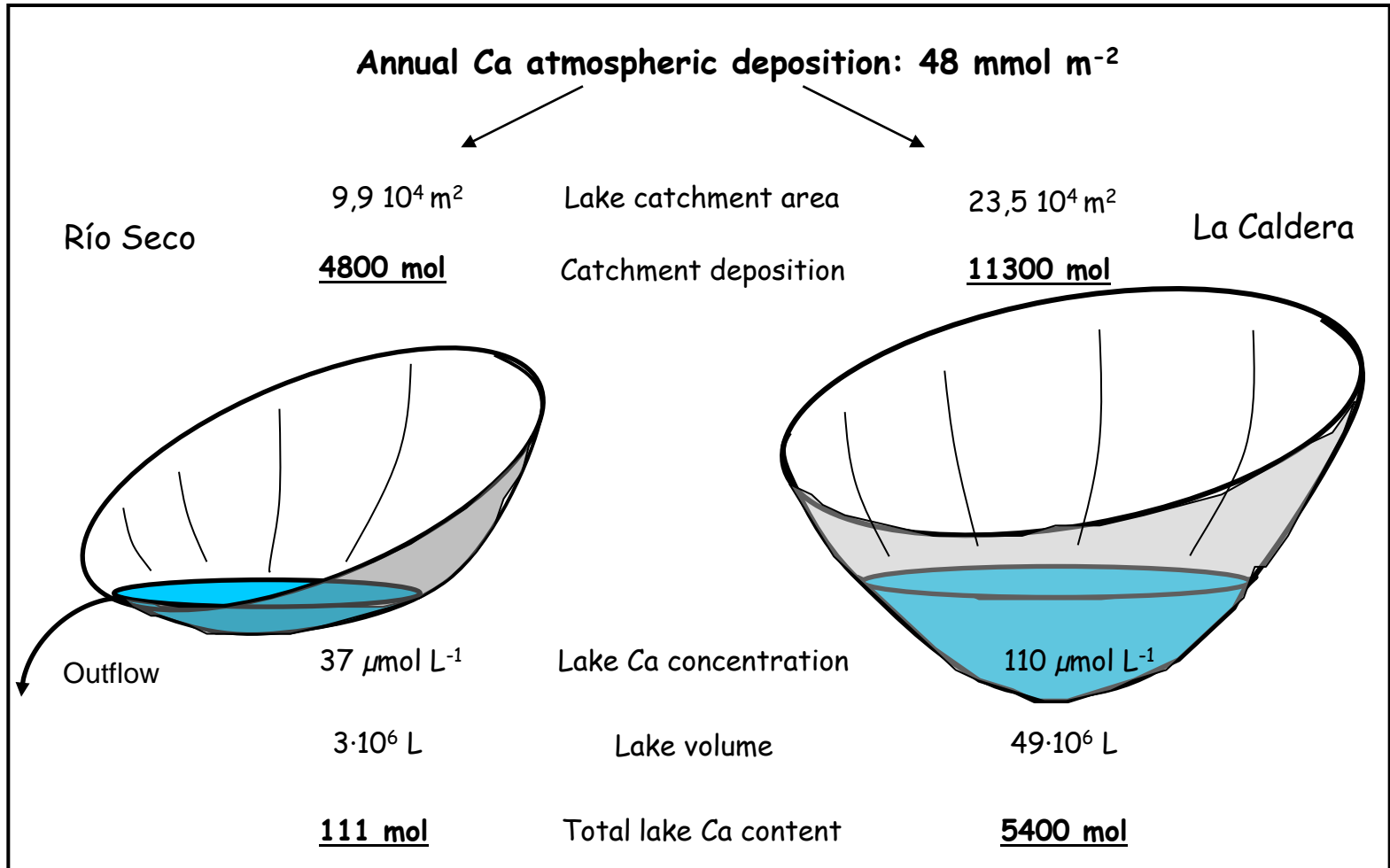
Weekly dynamics of Ca deposition: dry (A); wet (B); 1000 m snm (empty circles); 2900 m snm (filled circles)

## Deposición atmosférica en el área mediterránea

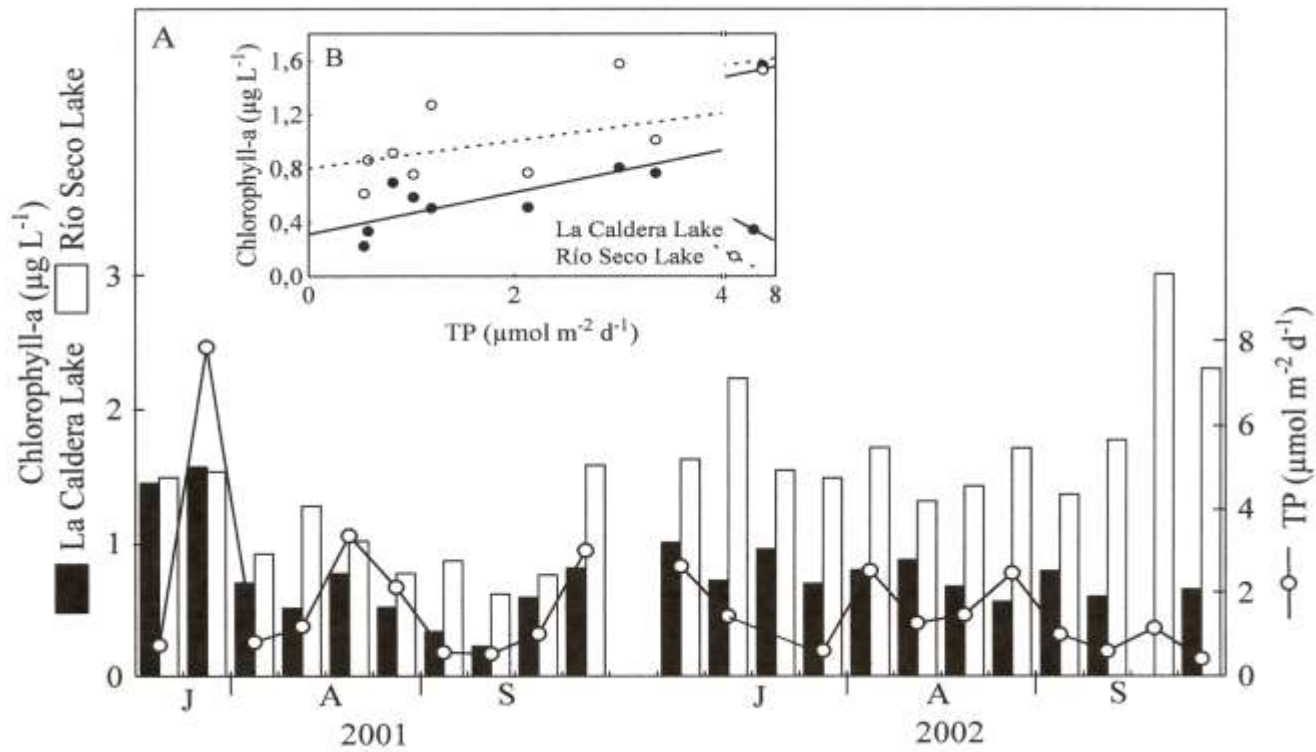


Deposición material particulado  $\text{g m}^{-2} \text{año}^{-1}$

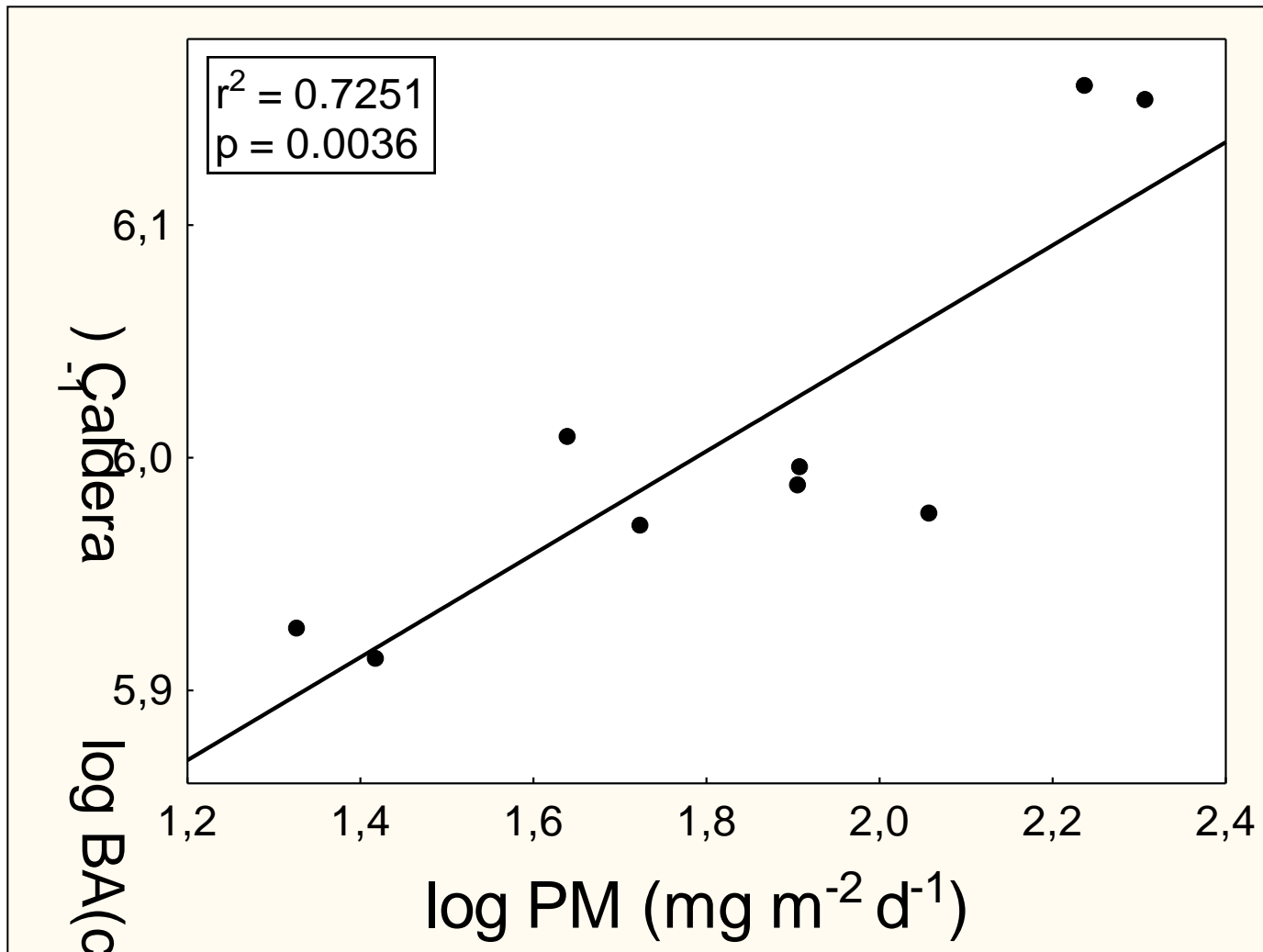




*Balance de Ca en las cuencas de La Caldera y Río Seco basado en las entradas atmosféricas anuales y en las concentraciones observadas en las lagunas. (Adaptado de Pulido-Villena et al. 2006. **Global Biogeochem. Cycles**. 20, GB2012, doi:10.1029/2005GB002662 )*

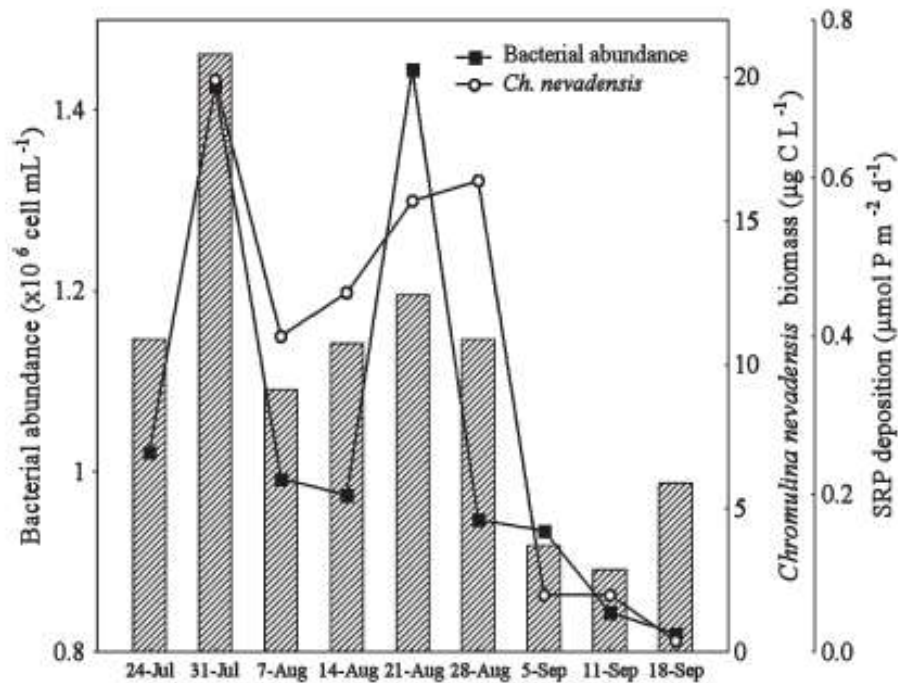


A) Weekly dynamic of atmospheric phosphorus precipitation (TP) (dry+wet) and chlorophyll-a in two lakes. B) Regressions lines between these variables in 2001.



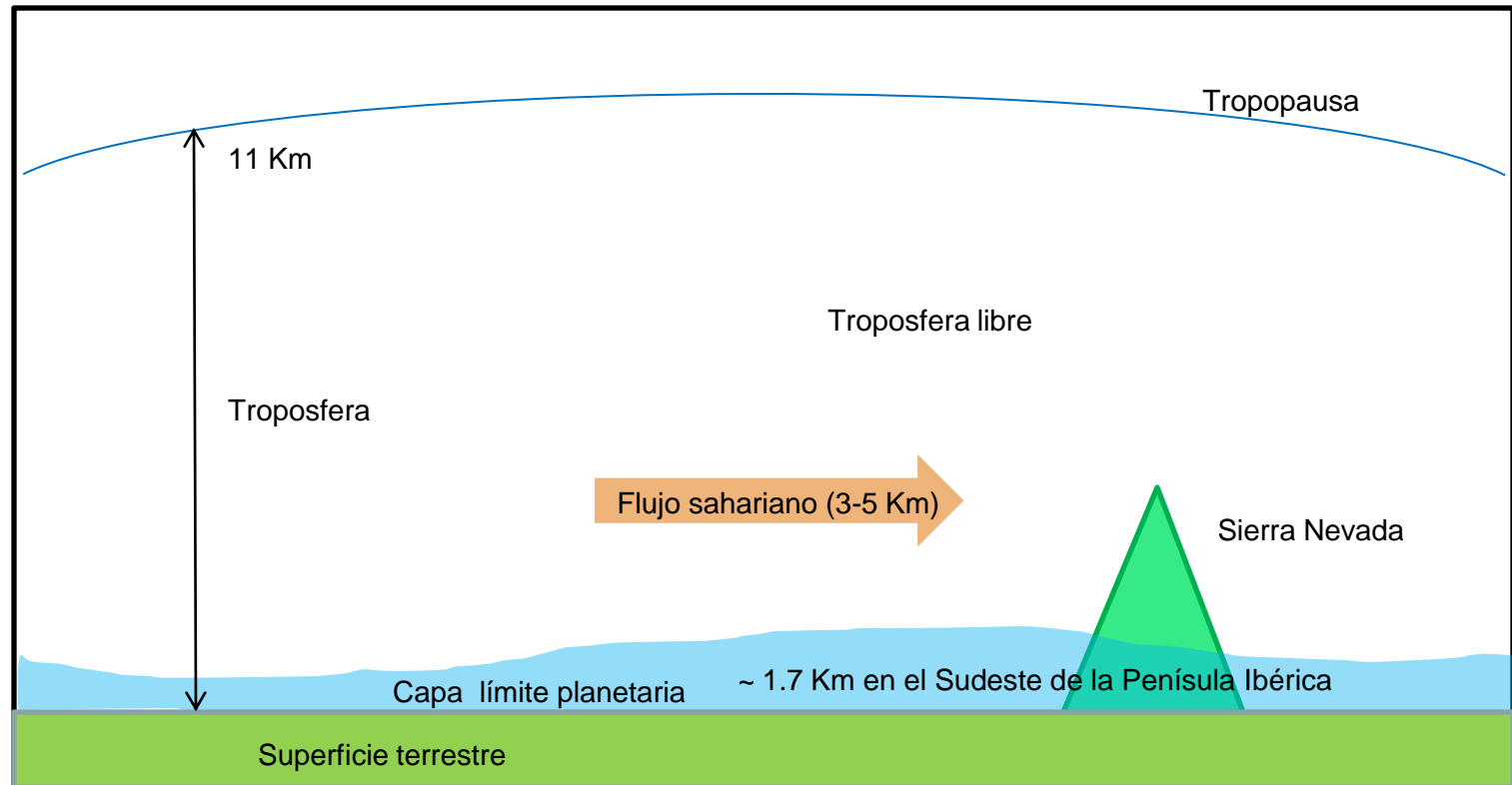
Relación entre la deposición semanal de material particulado (PM) y la abundancia bacteriana (BA) en La Caldera (Reche *et al.* 2009. L&O)





**Figure 4.** Temporal dynamics of total (dry + wet) atmospheric deposition of soluble reactive phosphorus (SRP;  $\mu\text{mol m}^{-2} \text{d}^{-1}$ ; filled bars), bacterial abundance (BA;  $\times 10^6 \text{ cell mL}^{-1}$ ) and *Chromulina nevadensis* biomass ( $\mu\text{g C L}^{-1}$ ) in La Caldera Lake during the ice-free period of 2001. Result of the Pearson's correlation analysis between BA and *Ch. nevadensis* biomass:  $n = 8$ ;  $r = 0.76$ ;  $p < 0.05$ .

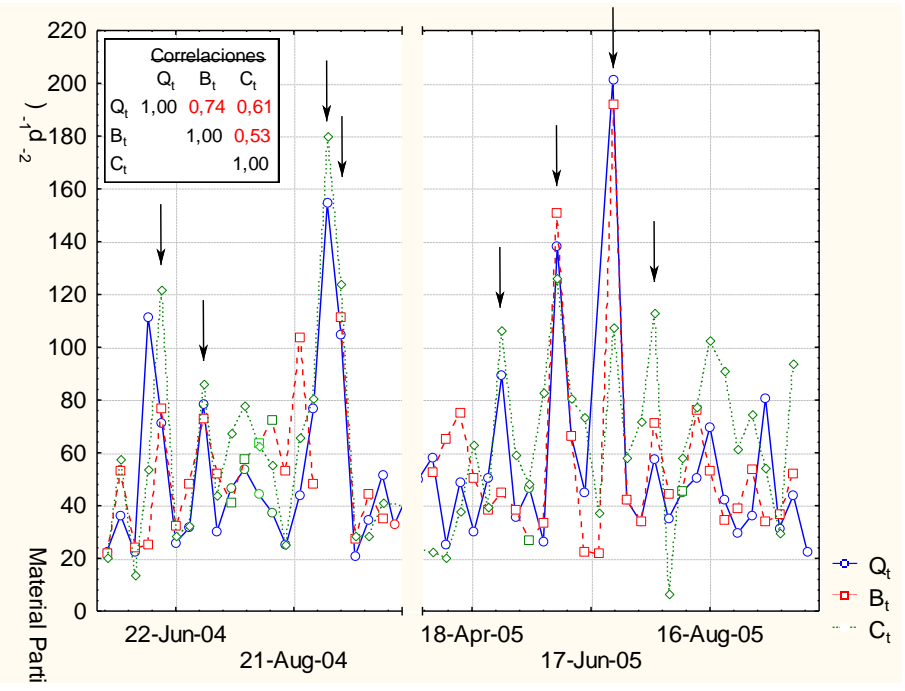
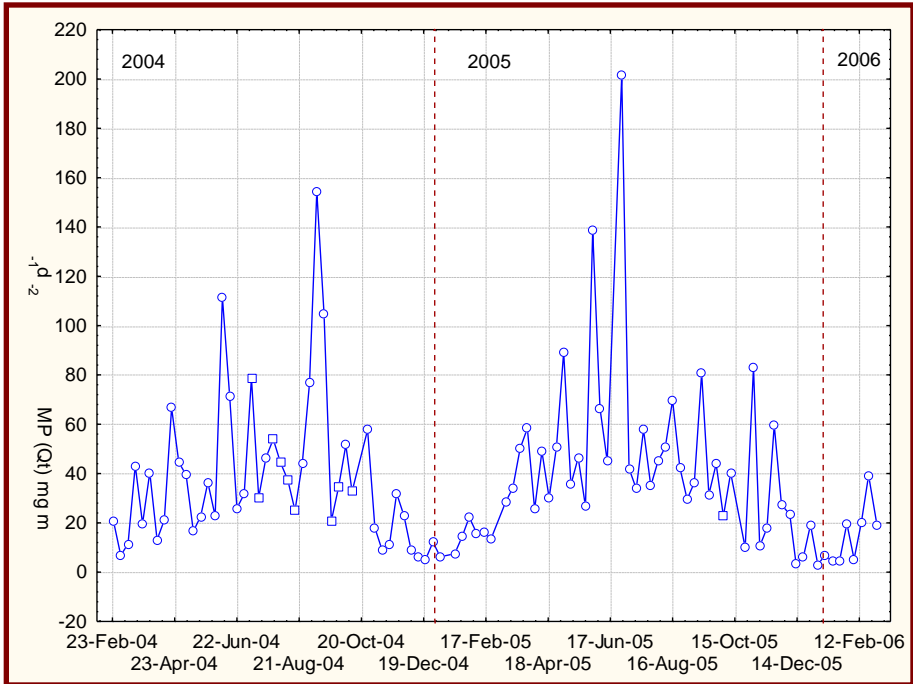
## Evidence of an atmospheric forcing on bacterioplankton and phytoplankton dynamics in a high mountain lake

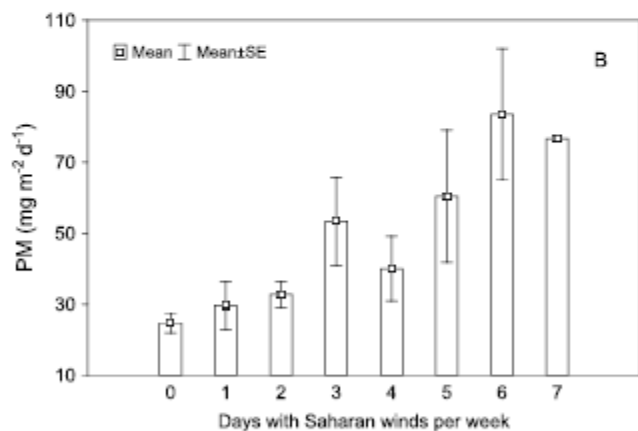
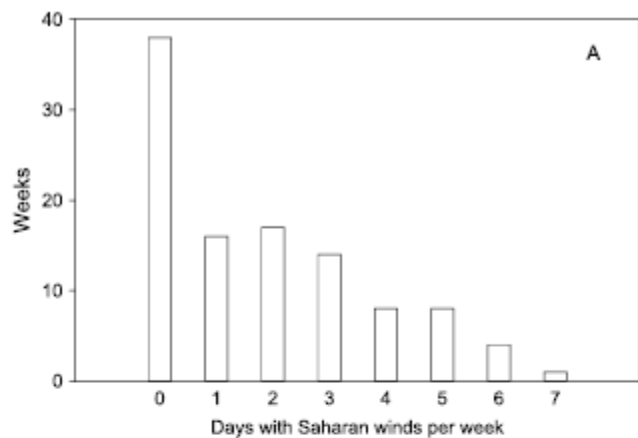


# Lugares seleccionados



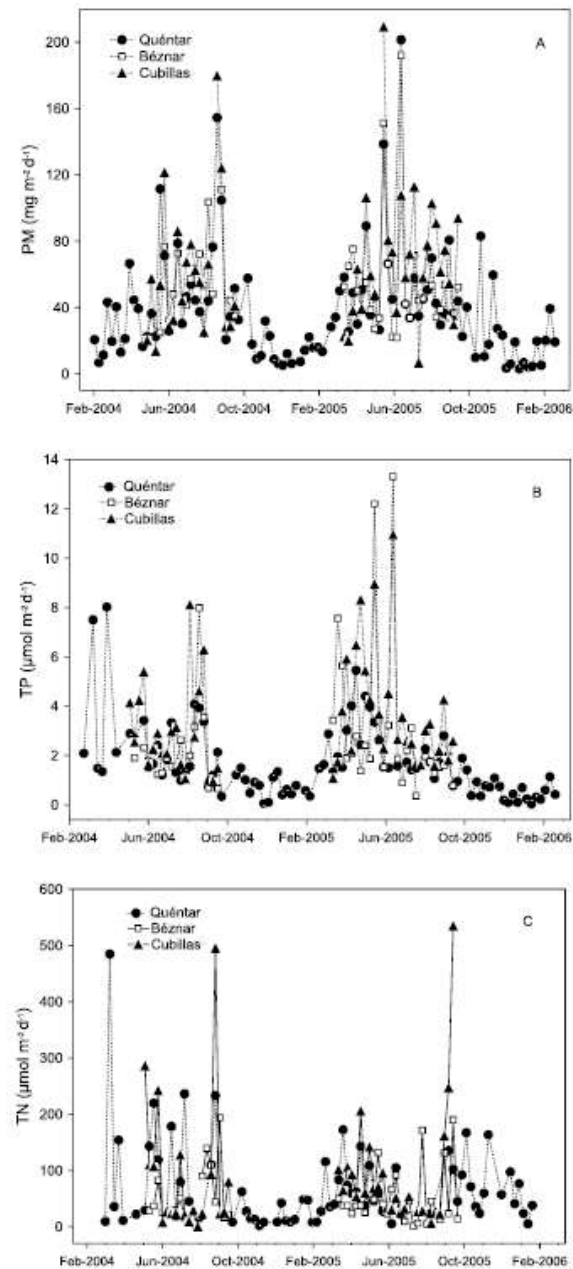




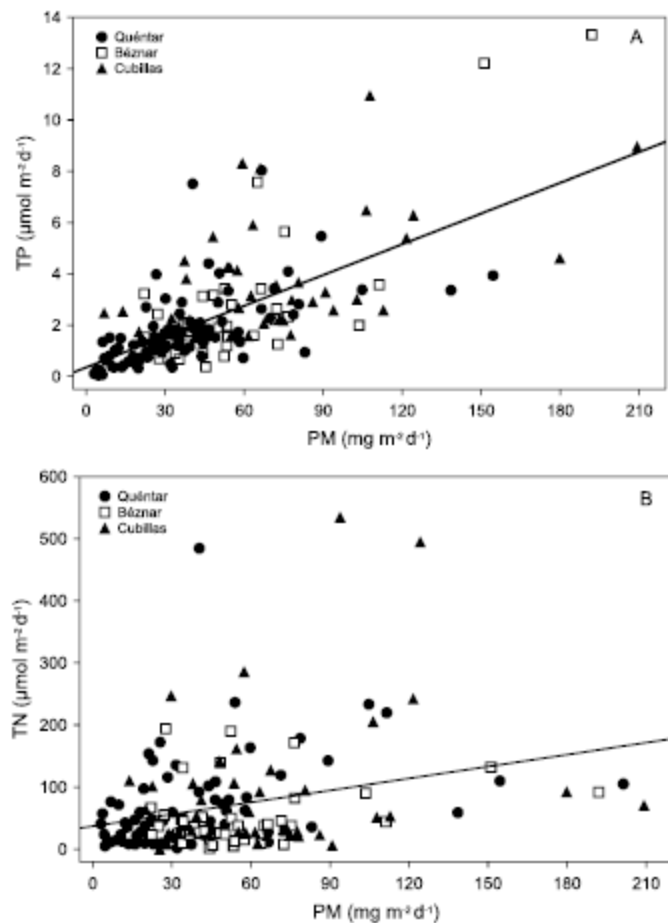


**Figure 3.** (a) Number of weeks with 0–7 days of winds from the Sahara per week during the 2 years in which atmospheric deposition was measured at the Quéntar site. The presence of Sahara winds was determined by daily back trajectory analysis using the HYSPLIT model. (b) Mean and standard errors of dry + wet particulate matter (PM) collected during these weeks at the Quéntar site.

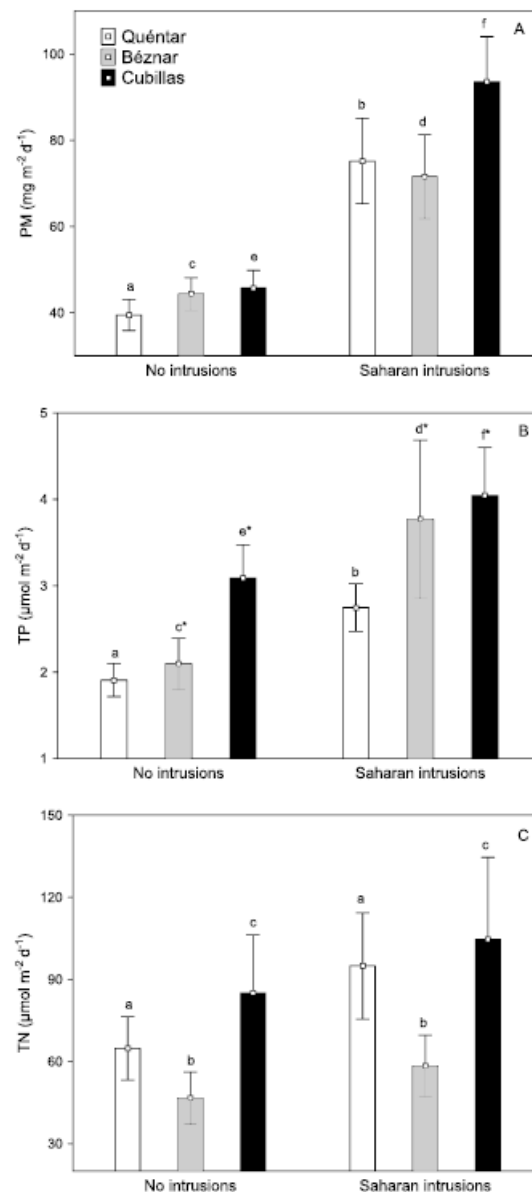
Morales-Baquero & Pérez Martínez. 2016. *Global Biogeochem. Cycles*. 30, doi:10.1002/2015GB005254



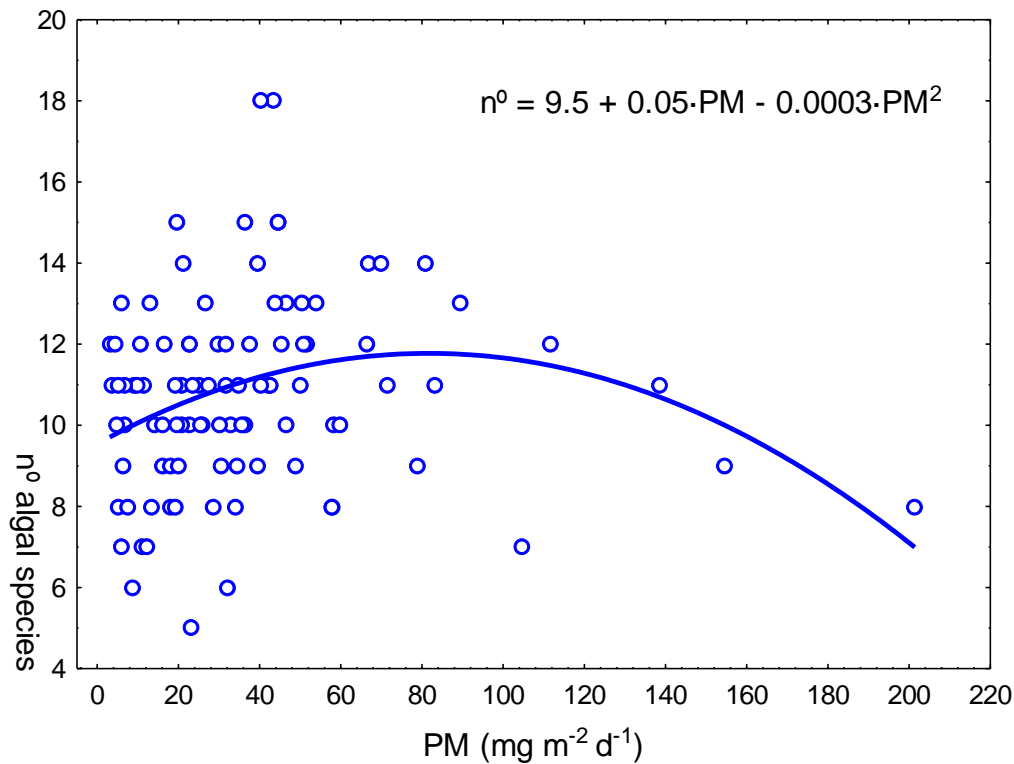
**Figure 4.** Seasonal dynamics of total (dry+wet) weekly atmospheric deposition of (a) particulate matter (PM), (b) total phosphorus (TP), and (c) total nitrogen (TN) at sites in Quéntar, Béznar, and Cubillas. Results of Pearson correlations between sites are shown in Table 2.



**Figure 5.** Linear regression between the weekly deposition of particulate matter (PM) and (a) total phosphorus (TP) and (b) total nitrogen (TN) in the three study sites. All samples collected at the three sites were considered in analyses. Linear regression results: (Figure 5a)  $\text{TP} = 0.35 + 0.04 \text{ PM}$ ,  $r^2 = 0.46$ ,  $p < 0.0000$  and (Figure 5b)  $\text{TN} = 37.01 + 0.64 \text{ PM}$ ,  $r^2 = 0.08$ ,  $p < 0.001$ .

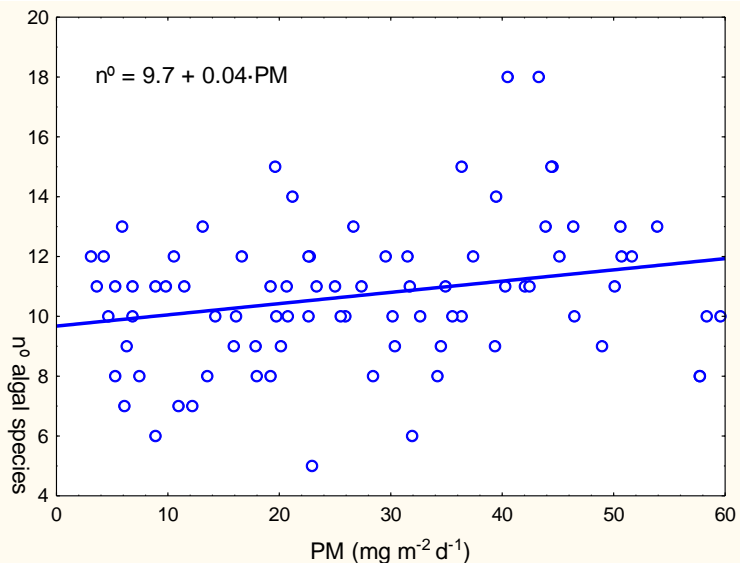


**Figure 6.** Mean daily deposition rates during weeks without Saharan intrusions and weeks with Saharan intrusions. Weeks without Saharan intrusions are defined as those with no winds from Sahara and weeks with Saharan intrusions as those with more than 2 days of winds from Sahara. Significant ( $p < 0.05$ ) or marginally significant ( $p < 0.08$ ) increases at each site (Mann-Whitney  $U$  test) are indicated by a different letter above each pair of columns of the same site (asterisk = marginally significant).

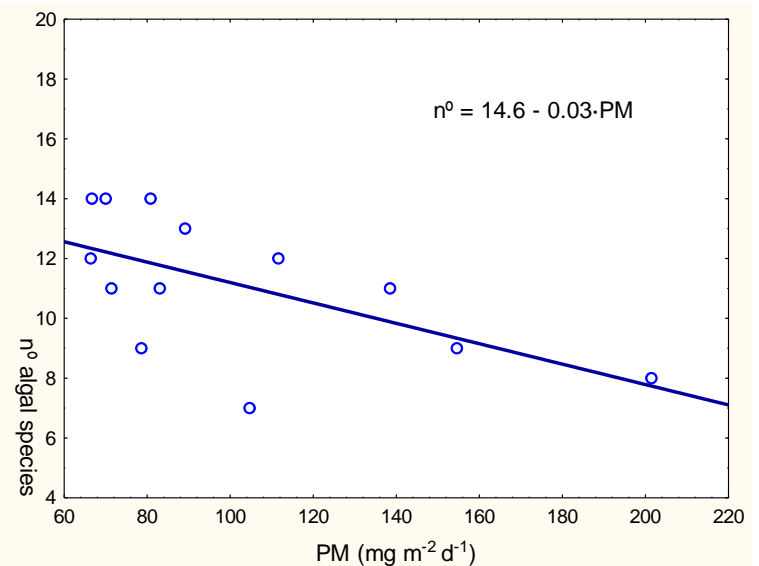


Relación entre la cantidad de material atmosférico particulado depositado y el número de especies de algas planctónicas en el embalse de Quentar (Granada)

Up to 60 mg m<sup>-2</sup> d<sup>-1</sup>



From 60 mg m<sup>-2</sup> d<sup>-1</sup>



¿Es posible la automatización en la recogida del material depositado?

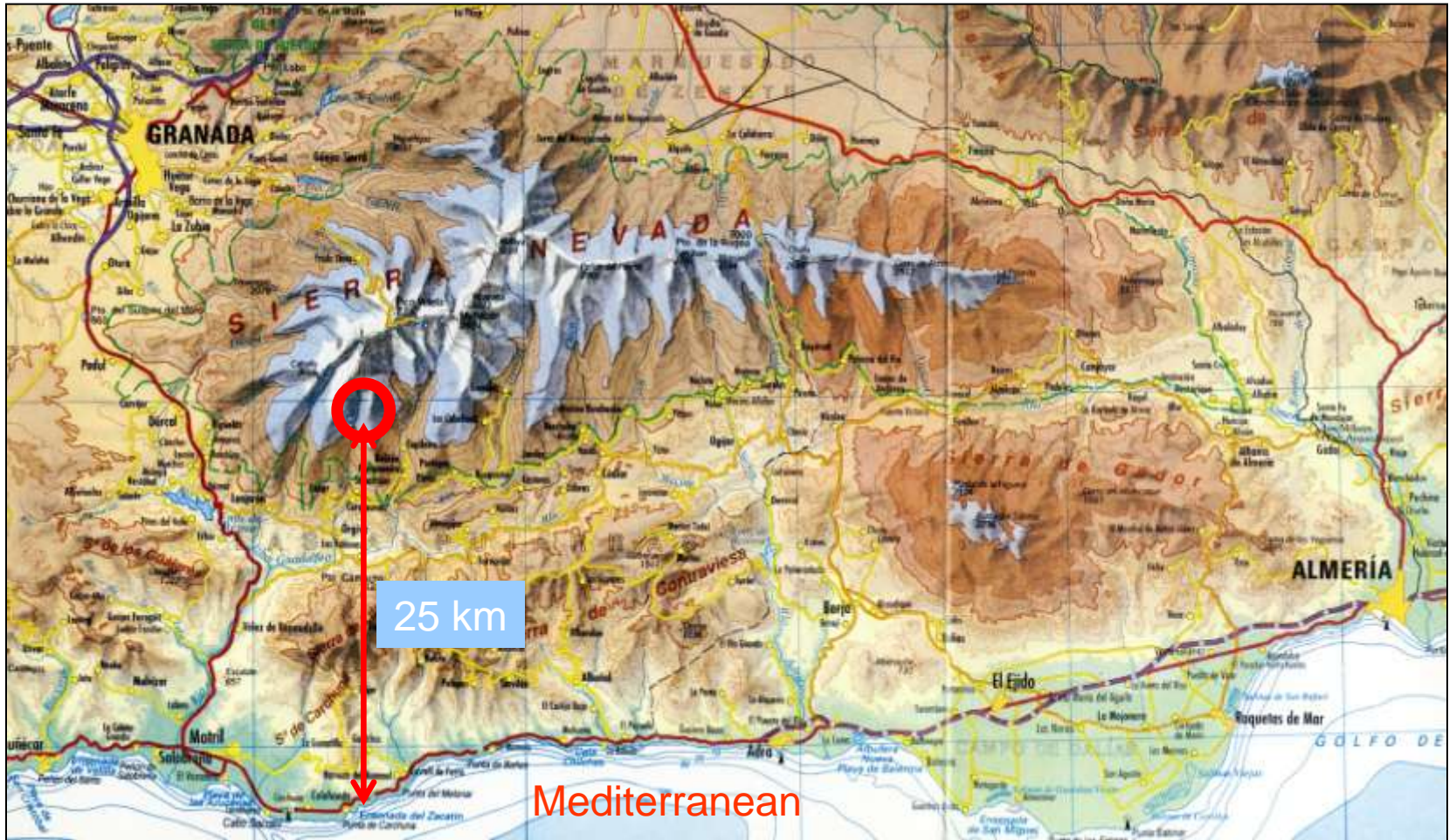


**Second ChArMEX International Workshop**

**26–28 May 2010**

**Universitat Politècnica de Catalunya, Barcelona, Spain**









  
**ESTACIÓN METEOROLÓGICA AUTOMÁTICA**  
**PROGRAMA DE SEGUIMIENTO DEL CAMBIO GLOBAL EN LA RED PARQUES NACIONALES**  
Las instalaciones de esta estación, según normativa específica para el estudio de la influencia del cambio global en los Parques Nacionales españoles.  
ACCIONES RELACIONADAS CON ESTAS ESTACIONES EN:  
<http://portal.parquesnacionales.es/programa/rta>  
EL DISEÑO Y CONSTRUCCIÓN DE ESTACIONES RELACIONADAS EN OTRAS ZONAS CONSTITUIDAS EN PARQUE NACIONAL POR LA LEY.

**RED DE SEGUIMIENTO DEL CAMBIO GLOBAL EN PARQUES NACIONALES**  
  
  
El mantenimiento de estas estaciones está financiado por FERROVIAL AGRÓNOMÍA y FUNDACIÓN BIODIVERSIDAD



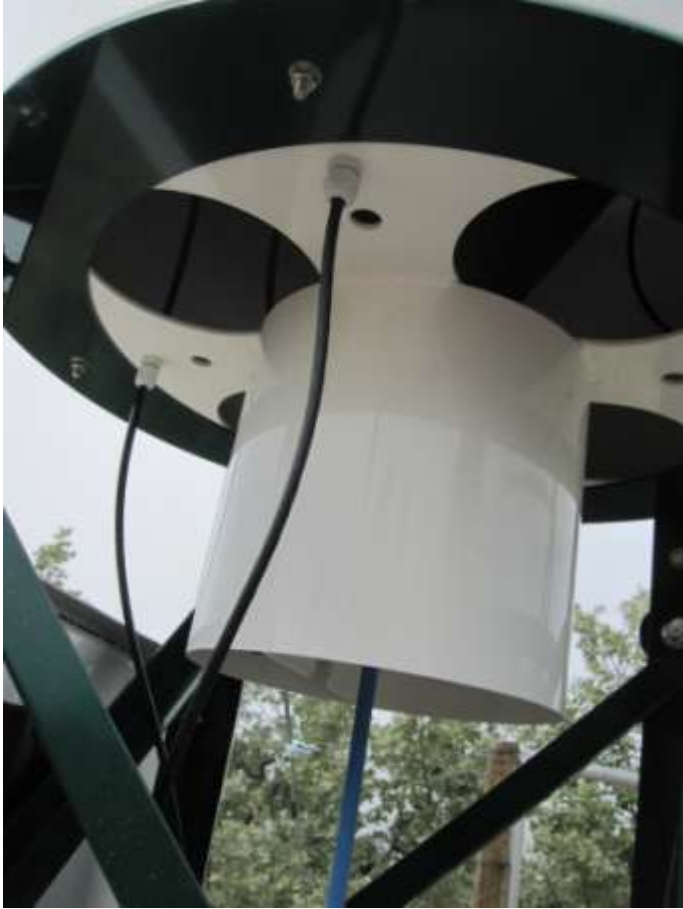
Laurent *et al.* 2015. An automatic collector to monitor insoluble atmospheric deposition: application for mineral dust deposition. *Atmos. Meas. Tech.*, 8: 2801-2811





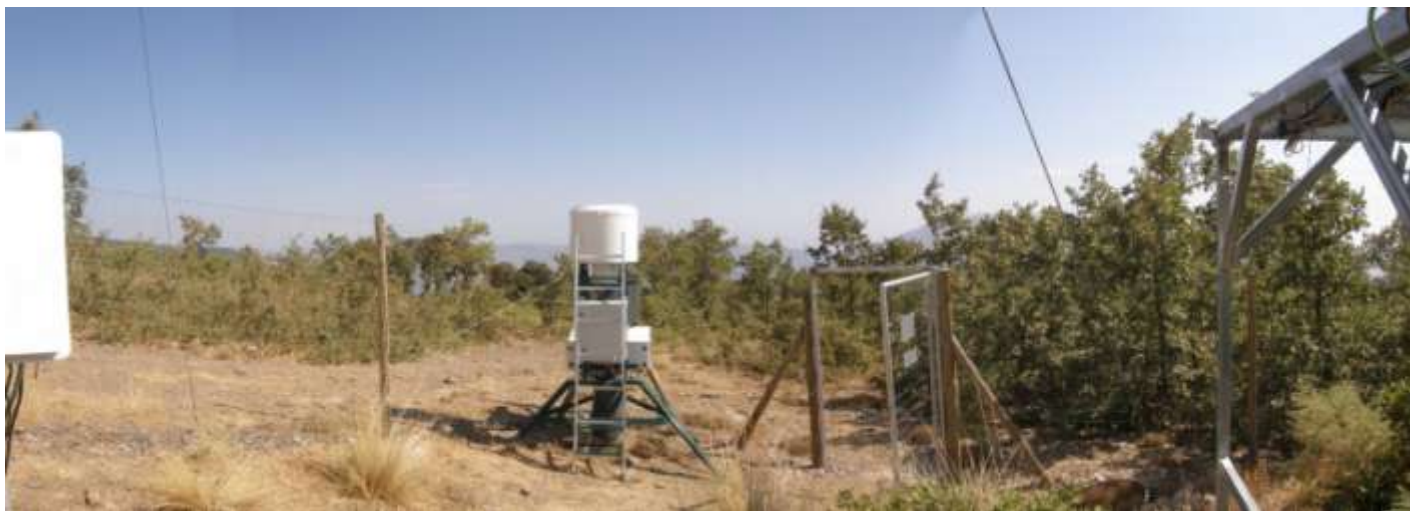




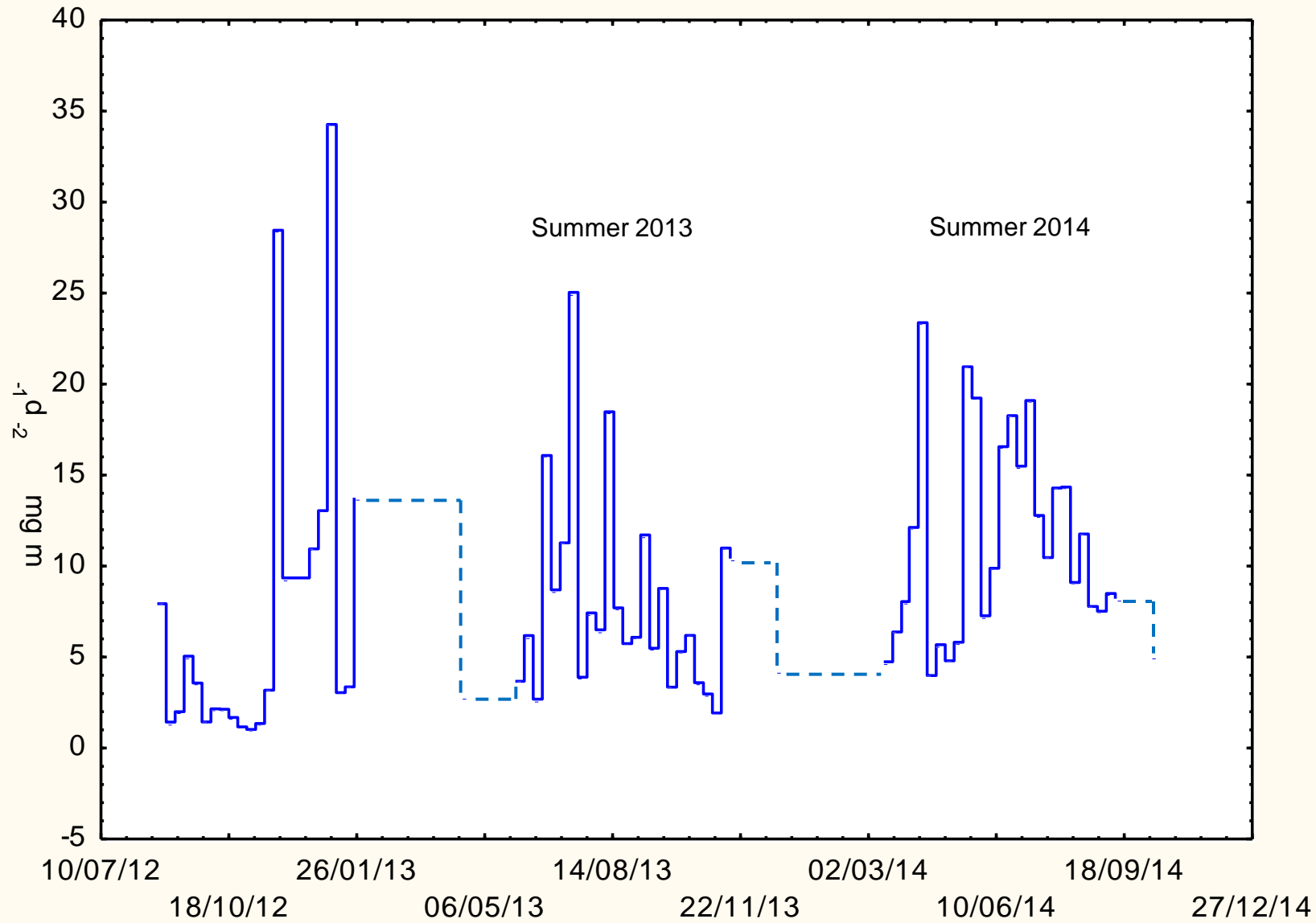




# CARAGA installation August 2012



PM deposition (CARAGA, Sierra Nevada)

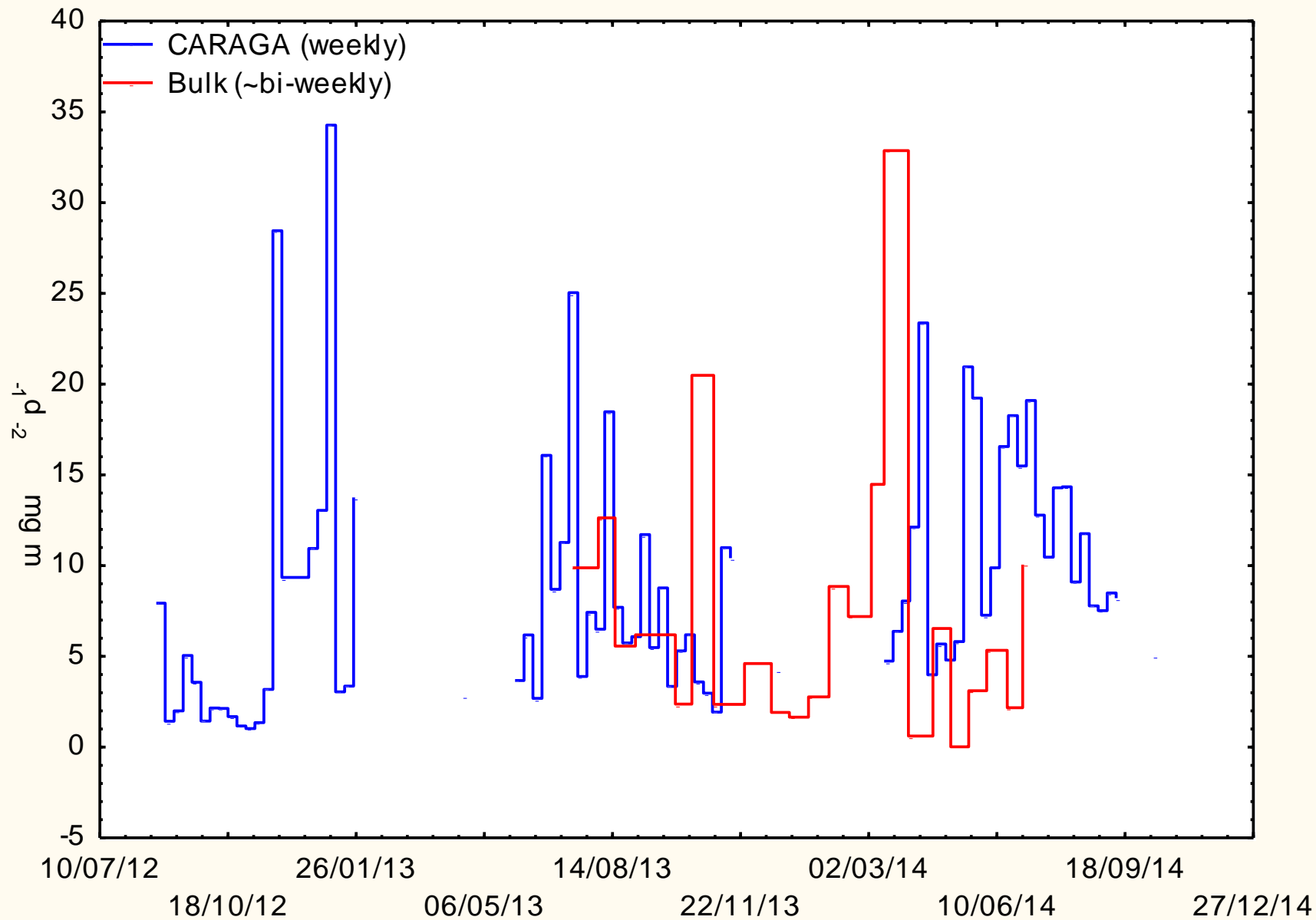






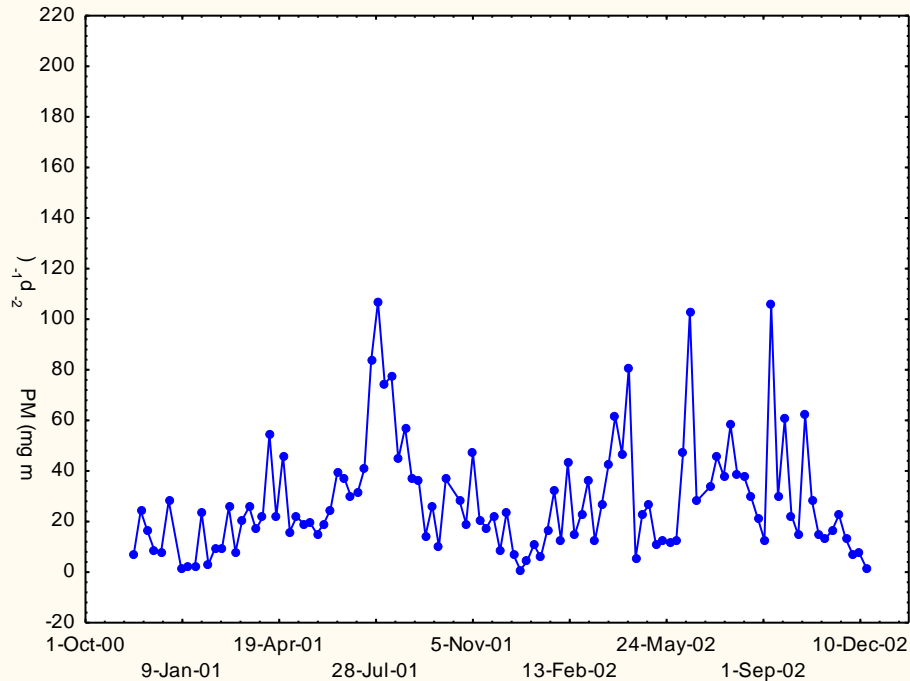


PM deposition (CARAGA + Bulk -Cañar, Sierra Nevada-)

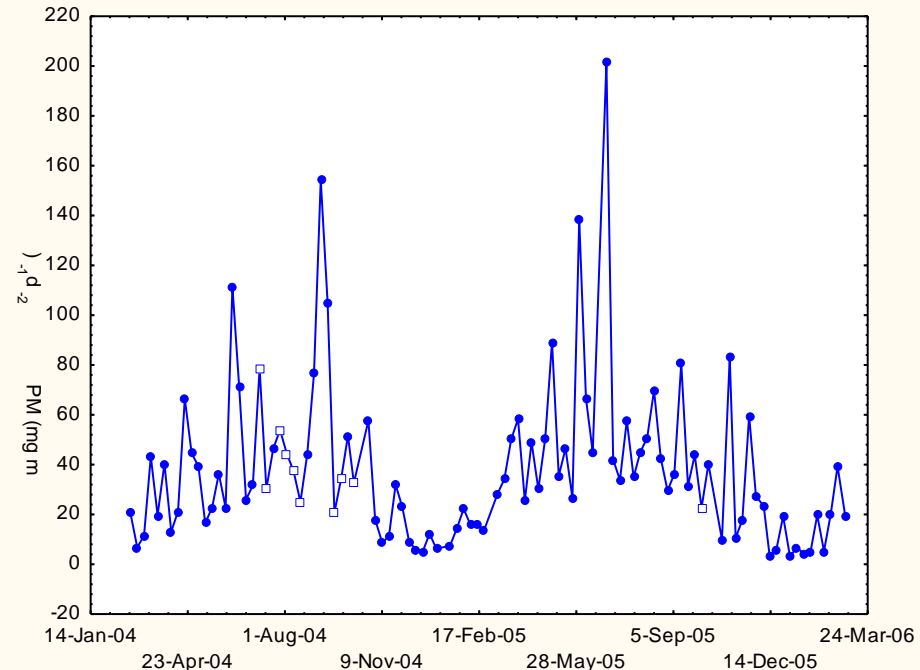


# Sierra Nevada

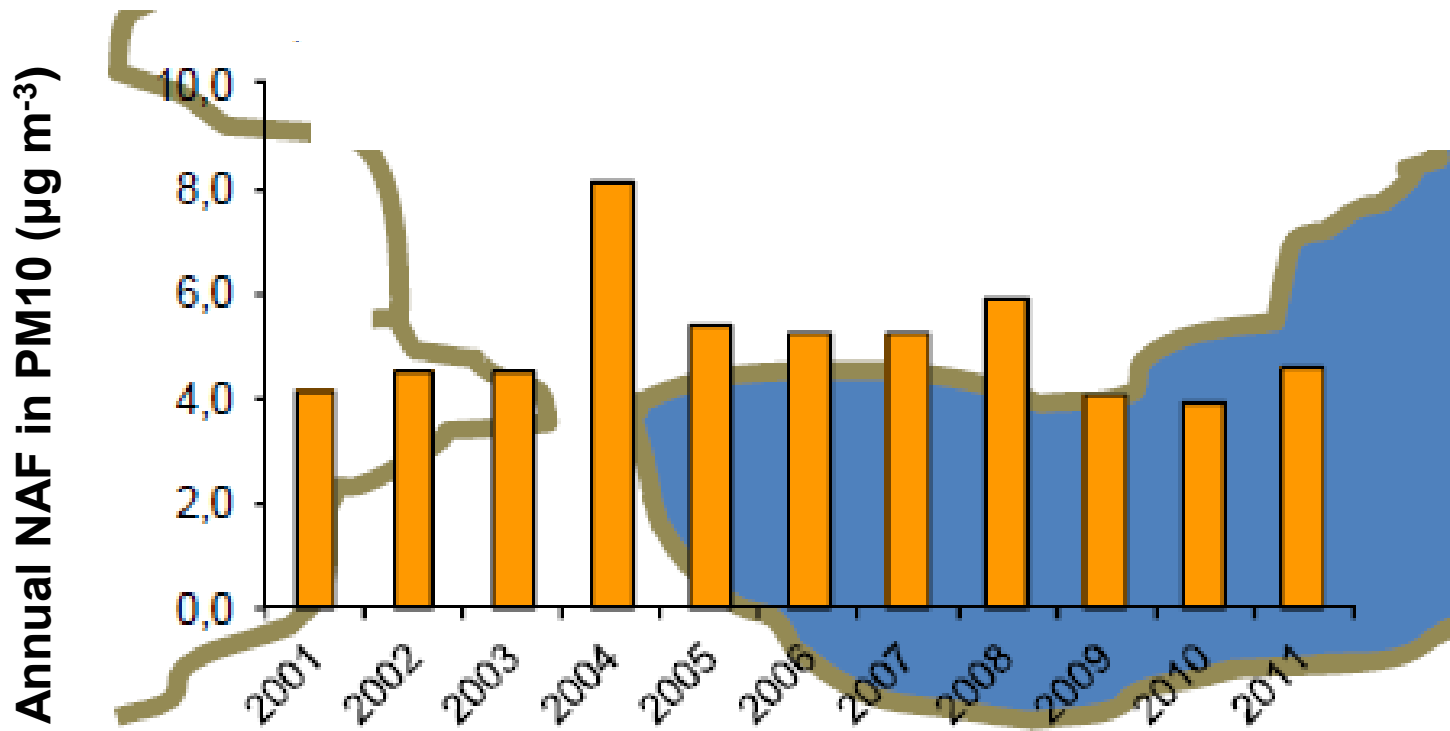
2001-2002



2004-2005



Deposition data from MTX instrument (dry + wet)



Mean annual African dust contributions to PM10 (in  $\mu\text{g m}^{-3}$ ) in South-East Iberian Peninsula from 2001 to 2011 (modified from Pey *et al.* 2013)

Muchas gracias por su atención