

Chemical composition of PM₁₀ and PM₁ at a remote mountain site in NE of Spain

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Keywords: tropospheric aerosols, continental background, PM₁, chemical composition

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Chemical composition of particulate matter (PM) was determined at Montsec (MSC, NE of Spain, 42° 3' N; 0° 44' W) remote site, to investigate variability of tropospheric aerosols speciation and to quantify sources of aerosols in a continental background environment. This work summarizes results on partitioning and variability of major and trace components in PM₁₀ and PM₁.

24h PM₁₀ and PM₁ samples were collected at a ratio of 1 sample out of 4 days, on quartz fibre filters using high-volume samplers (MCV CAV-A/MSb).

Overall, 371 (Nov 2009-Dec 2012) and 221 (Mar 2011-Dec 2012) samples of PM₁₀ and PM₁, respectively, were collected. PM concentrations were determined by standard gravimetric procedures. Samples were treated following the methodology from Querol *et al* (2001) for the determination of the major and trace elements concentrations. In addition to the routine measurements, intensive campaigns were performed during Mar-Apr 2011, Jul-Aug 2011, Jan-Feb 2012, and Jun-Jul 2012.

Low average concentrations of PM, which are typical of remote sites, were recorded. The lowest PM concentrations were measured in winter (7.6 $\mu\text{g m}^{-3}$ and 6.5 $\mu\text{g m}^{-3}$ for PM₁₀ and PM₁ respectively) because during this season MSC is frequently above the planetary boundary layer (PBL) and is mainly influenced by long-range-transported particles. On the contrary, the highest concentrations were measured during summer (15.0 $\mu\text{g m}^{-3}$ for PM₁₀ and 10.2 $\mu\text{g m}^{-3}$ for PM₁) due to the recirculation processes that accumulate regional pollutants (Figure 1) and to the frequent impact of Saharan dust outbreaks.

The chemical components were grouped as:

- Mineral matter (MM: sum of components typically found in rock-forming minerals, including Al₂O₃, SiO₂, CO₃⁻², Ca, Fe, K and Mg)
- Sea Spray (SS: sum of Cl⁻ and Na⁺)
- Secondary inorganic species were treated individually (sulphate: SO₄, nitrate: NO₃, ammonium: NH₄)
- Organic matter (OM, calculated from the organic carbon (OC) as 2.2*OC) and elemental carbon (EC)
- Trace elements (TE: sum of Li, Be, V, Ni, Ti, Cu, Zn, As, Cr, Mn, Co, Ga, Se, Rb, Sr, Cd, Sn, Sb, Ba, La, Ce, Hf, Ta, Tl, Pb, P, Bi, Th, and U).

The percentage of each species with respect to the total mass was very similar in summer and in winter for both size fractions (Figure 1), except for SO₄ and NO₃. SO₄ concentrations were higher in summer and lower in winter, opposite to NO₃ concentrations, due their different sources and gas to particle equilibrium. Also, in summer, a higher contribution of coarse MM was

evidenced due to the frequent impact of Saharan dust events and to the wind-induced soil resuspension.

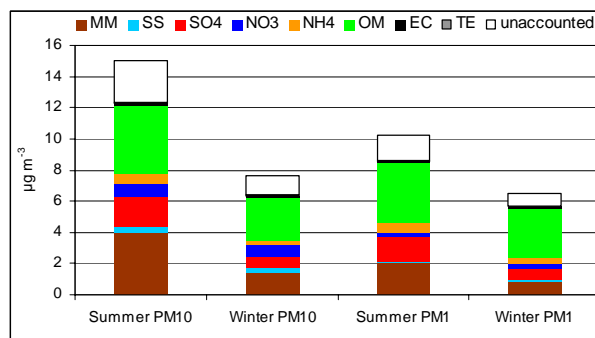


Figure 1. MM, SS, SO₄, NO₃, NH₄, OM, EC and TE summer and winter mean concentrations for PM₁₀ and PM₁ at MSC site.

MM, SS, NO₃, and TE were mainly in the coarse fraction, whereas SO₄, NH₄, OM and EC were principally fine (Figure 2).

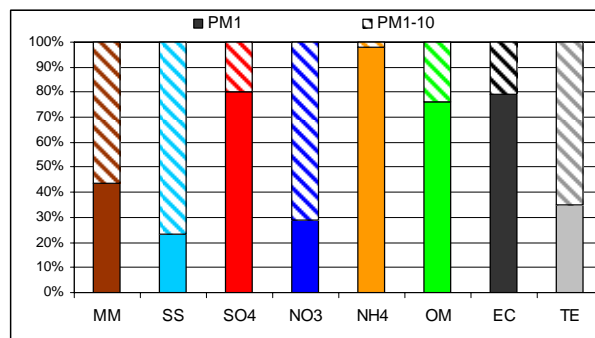


Figure 2. Mean PM₁ and PM₁₋₁₀ proportion (%) of PM₁₀.

Chemical composition of PM will be interpreted as a function of meteorological scenarios, and source apportionment will be estimated by receptor models.

This work was supported by the MICINN (Spanish Ministry of Science and Innovation) and FEDER funds under the project CARIATI (CGL2008-06294/CLI). M.C.M. was funded by JAE-Doc CSIC, co-funded by the European Social Fund (ESF).

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