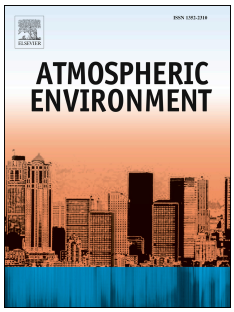
Accepted Manuscript



Hygroscopic properties of atmospheric particles emitted during wintertime biomass burning episodes in Athens

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PII: S1352-2310(18)30010-4

DOI: 10.1016/j.atmosenv.2018.01.004

Reference: AEA 15763

To appear in: *Atmospheric Environment*

Received Date: 29 August 2017

Revised Date: 23 December 2017

Accepted Date: 3 January 2018

Please cite this article as: Psichoudaki, M., Nenes, A., Florou, K., Kaltsonoudis, C., Pandis, S.N., Hygroscopic properties of atmospheric particles emitted during wintertime biomass burning episodes in Athens, *Atmospheric Environment* (2018), doi: 10.1016/j.atmosenv.2018.01.004.

Hygroscopic properties of atmospheric particles emitted during wintertime biomass burning episodes in Athens

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Abstract

This study explores the Cloud Condensation Nuclei (CCN) activity of atmospheric particles during intense biomass burning periods in an urban environment. During a one-month campaign in the center of Athens, Greece, a CCN counter coupled with a Scanning Mobility Particle Sizer (SMPS) and a high resolution Aerosol Mass Spectrometer (HR-AMS) were used to measure the size-resolved CCN activity and composition of the atmospheric aerosols.

During the day, the organic fraction of the particles was more than 50%, reaching almost 80% at night, when the fireplaces were used. Positive Matrix Factorization (PMF) analysis revealed 4 factors with biomass burning being the dominant source after 18:00 until the early morning. The CCN-based overall hygroscopicity parameter κ ranged from 0.15 to 0.25. During the night, when the biomass burning organic aerosol (bbOA) dominated, the hygroscopicity parameter for the mixed organic/inorganic particles was on average 0.16. The hygroscopicity of the biomass-burning organic particles was 0.09, while the corresponding average value for all organic particulate matter during the campaign was 0.12.

Keywords: Organic aerosol; fireplace emissions; urban air quality; CCN.

1. Introduction

Atmospheric aerosols play an important role in the Earth's atmosphere, affecting the local and global climate (Vestin et al., 2007). Aerosol particles can affect the global radiation budget by scattering and absorbing solar radiation and thus have a direct effect on climate. In addition, depending on their physical and chemical properties, aerosols can serve as Cloud Condensation Nuclei (CCN) thereby indirectly affecting climate by