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# Biomass burning and its effects on fine aerosol acidity, water content and nitrogen partitioning

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Aerosol acidity is an important property that drives the partitioning of semi-volatile species, the formation of secondary particulate matter and metal and nutrient solubility. Aerosol acidity varies considerably between aerosol types, RH, temperature, the degree of atmospheric chemical aging and may also change during transport. Among aerosol different sources, sea salt and dust have been well studied and their impact on aerosol acidity and water uptake is more or less understood. Biomass burning (BB) on the other hand, despite its significance as a source in a regional and global scale, is much less understood.
Currently, there is no practical and accurate enough method, to directly measure the pH of in-situ aerosol. The combination of thermodynamic models, with targeted experimental observations can provide reliable predictions of aerosol particle water and pH, using as input the concentration of gas/aerosol species, temperature (T), and relative humidity (RH). As such an example, ISORROPIA-II (Fountoukis and Nenes, 2007) has been used for the thermodynamic analysis of measurements conducted in downtown Athens during winter 2013, in order to evaluate the effect of BB on aerosol water and acidity.
Biomass burning, especially during night time, was found to contribute significantly to the increased organics concentrations, but as well to the BC component associated with wood burning, particulate nitrates, chloride, and potassium. These increased concentrations were found to impact on fine aerosol water, with Winorg having an average concentration of 11±14 $\mu$g m-3 and Worg 12±19 $\mu$g m-3 with the organic component constituting almost 38% of the total calculated submicron water. When investigating the fine aerosol acidity it was derived that aerosol was generally acidic, with average pH during strong BB influence of 2.8±0.5, value similar to the pH observed for regional aerosol influenced by important biomass burning episodes at the remote background site of Finokalia, Crete. During cleaner days submicron aerosol was found to be more acidic, regardless of the season (winter or summer).
This reduced acidity is attributed to the presence of non-volatile cations, such as non-sea salt potassium and the significant excess of ammonium compared to sulfates. The lower pH values leads to the partitioning of the majority of nitrate and chloride to the aerosol phase, which can explain the good correlation found in biomass burning influenced environments between BB tracers and both these species.
Finally, we show that these acidity effects of biomass burning can be also seen in regional and global scales, which can have important implications for public health, climate and ecosystems.