Acidity of atmospheric aerosol and its importance

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Atmospheric aerosols drive a cascade of effects on climate, ecosystems and human health. They affect climate by modulating the Earth's energy balance, clouds and precipitation; they contain toxic compounds which upon inhalation cause millions of premature deaths every year. The same particles also contain substances that act as nutrients when deposited in ecosystems, which in turn can affect primary productivity, the carbon cycle and biogeochemistry. Knowledge of the levels and drivers of atmospheric aerosol acidity (pH) is critical for understanding the diverse aerosol processes that drive all the impacts mentioned above – yet only recently we are obtaining reliable estimates of it.

This talk will focus on a number of topics related to aerosol pH. We will first present advances in constraining *in-situ* particle pH from the thermodynamic analysis of aerosol and gas-phase composition. Using this approach, we show that strong acidity (pH of 0 to 3) is ubiquitous in global aerosol, caused by the large difference in volatility between acidic compounds (primarily sulfate), and bases (primarily ammonia). We then discuss under which conditions substantial changes in aerosol acidity changes occur with a focus on its impact on the solubilization of trace metals and its impacts on health (oxidative potential) and trace nutrient availability. Acidity is then used to show how it controls the dry deposition of reactive nitrogen, and responses of particulate matter to aerosol precursors (especially those conditions that can lead to intense haze episodes). We present many case studies and research projects from Switzerland, E.Mediterranean, and other locations – and conclude on outlooks for the future and emphasizing the importance of using aerosol pH as a fundamental aerosol property for knowledge and policy.