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The impact of atmospheric aerosol interactions with the solar radiation field on the radiation absorption efficiency of a forest canopy

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Aerosols (small atmospheric particulate matter originating from different source types) attract a growing interest from atmospheric scientists with regard to their impact on pollution as well as the global climate. A hypothesis, less investigated, is whether atmospheric aerosol interactions in the solar radiation field affect the amount of radiation absorbed by vegetation canopies and hence agricultural productivity. Typically, aerosols may affect vegetation canopy radiation absorption efficiency by altering the physical characteristics of solar radiation impinging on for example a forest canopy. It has been well illustrated, that increasing mixing ratio's of atmospheric particulate matter lead to more diffuse sunlight. It can be demonstrated, based on the application of atmospheric (MODTRAN) and canopy radiative transfer models (5-Scale), that radiation absorption efficiency (and hence productivity) of forests increases with increasing levels of diffuse radiation. It can be documented - on a theoretical basis - that increasing aerosols loads in the atmosphere, enhance canopy photosynthesis. From our study it can even be suggested, that aerosol interactions in the atmosphere have to be taken into account when estimating vegetation gross primary productivity responses to actual and future aerosol climatology.
Modelling results indicate that atmospheric aerosol load has a significant impact on photosynthetically active radiation absorbed by for example a forest canopy. This suggests that forest CO2 sink magnitude may increase with increasing atmospheric aerosol loads