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# Solar influences on aerosol processes

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Aeorosols and their influence on cloud formation is the greatest uncertainty in our current understanding of climate forcings. About half of all aerosols acting as seeds for cloud droplets - cloud condensation nuclei (CCN) - are secondary aerosols, formed as molecular clusters in the gas-phase. Solar activity affects aerosol processes by regulating the amount of galactic cosmic rays that enter Earth's atmosphere on timescales from days to tens and hundreds of years. These cosmic rays are the main cause of atmospheric ionization and ions have been shown to have several effects on aerosol processes.

Both experiments, theory, and observations have proven that ionization can enhance the formation of secondary aerosols by stabilizing sub-critical clusters. This was thought to be insignificant for CCN formation as an increase in aerosol production would lead to slower growth rates and thus enhanced losses through scavenging by larger aerosols, leading to no increase in the amount of CCN despite the increase in small aerosol production. But a new physical mechanism was recently discovered showing that ionization can also enhance the growth of the aerosols as charged molecules interact more often than neutrals and typically are more massive as well. This mechanism negates the decreased growth rate caused by the formation of more small aerosols and therefore the production of CCN is modulated by changes in Solar activity, through its effect on ionization.

In this presentation I will give an overview of the physical mechanisms whereby Solar activity, through ionization, can affect aerosol processes along with the experimental evidence for these mechanisms. Finally the atmospheric conditions that favor these mechanisms will be discussed.