ATMOSPHERIC WATER SURFACES

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Surface active (surfactant) components have been identified in atmospheric aerosol particles from a wide range of environments. Many of these surfactants can significantly reduce aqueous surface tension, but their effects on submicron aerosol properties and cloud microphysics are yet to be fully constrained. Droplet surface tension is a key parameter in Köhler theory governing cloud formation, but size-dependent variations in microscopic droplet surface tension can introduce large variations in predictions of cloud-climate effects, which are currently not included in most atmospheric models [1,2,3].

We have studied the surfaces of aqueous solutions comprising atmospherically relevant surface active components as model systems of atmospheric cloud droplets, using synchrotron radiation excited spectroscopy [4,5,6]. Based on insights from these experiments, we presented a new surface monolayer model for predicting size-dependent surface tension of water droplets [7]. Recently, we made the first direct measurements of surface tension for microscopic surfactant-containing droplets suspended in air, showing that droplet surface tension is elevated compared to macroscopic solutions of identical composition and confirming predictions with the monolayer model [8]. Ongoing experiments focus on adopting sample delivery systems and environments to enable direct studies of water droplets and aerosol particles using synchrotron radiation [9].

References

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