

## 4.084 Revising concepts of methanesulfonic acid (MSA) formation in the remote tropical Pacific marine boundary layer using high-resolution measurements and a thermodynamic model of aerosol chemistry.

Early Career Scientist

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Abstract:

We report and interpret high-resolution methanesulfonic acid (MSA) and methanesulfonate ( $\text{MS}^-$ ) measurements collected during a field campaign in the tropical Pacific marine boundary layer (MBL). An earlier study noted vapor-phase MSA was twice as concentrated near the ocean surface as at the top of the mixed layer. We use aerosol composition measurements and the online Extended AIM Aerosol Thermodynamics Model (E-AIM; *Clegg et al.* [1998]) to demonstrate that this pattern is due to evaporation of particulate MSA from sulfuric acid-dominated particles. We cannot rule out the possibility of a small homogeneous production source. Up to 99% of the  $\text{MS}^-$  in aerosol forms in the aqueous phase after DMSO/MSIA vapor is wet-scavenged and oxidized to  $\text{MS}^-$  in aerosol water and cloud droplets. More alkaline coarse-mode aerosol generates  $\text{MS}^-$  by this mechanism and gathers MSA evading from fine particles. It is not clear which of these paths is more important. The lower FT is a source of MSA to the buffer layer (BuL) (entrainment flux:  $9.9 \times 10^{11}$  molecules/cm<sup>2</sup>/d), probably dissolving in cloud droplets and emerging below cloud as fine-mode  $\text{MS}^-$ . Most fine-mode  $\text{MS}^-$ , however, is formed in cloud from DMSO/MSIA, while coarse-mode  $\text{MS}^-$  is formed on sea salt particles that have greater alkalinity.