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Mechanisms for the formation and growth of nanometer-sized particles in the Amazon: New insights from GoAmazon2014 and the Tapajos Upwind Forest Flux Study (TUFFS).

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Abstract:

The Amazon rainforest is a unique and important place for studying aerosol formation and its impacts on atmospheric chemistry and climate. In remote areas, the atmosphere is characterized by low particle number concentrations and high humidity; perturbations in the particle number concentrations and climate-relevant physical and chemical properties could therefore have a great impact on cloud formation and thus on regional climate and precipitation. While it was previously believed that new particle formation occurs rarely in the Amazon, observations in the Amazon of a sustained steady-state particle number concentration, along with an abundance of dry and wet surfaces upon which particles may deposit, imply that sources of new particles must exist in this region.

We present observations from two studies, GOAmazon2014 and Tapajos Upwind Forest Flux Study (TUFFS), which seek to identify and quantify the sources of aerosol particles in the Amazon. Measurements of the chemical composition of 20 – 100 nm

diameter aerosol particles at the T3 measurement site during the wet and dry season campaigns of GOAmazon2014 show the presence of inorganic ions such as potassium ion and sulfate, as well as organic ion such as oxalate, in ambient nanoparticles. These observations, combined with 1.5 – 300 nm diameter particle number size distributions and trace gas measurements of organic compounds and sulfuric acid, are used to determine the relative importance of sulfuric acid, organic compounds, and primary biological particle emissions to nanoparticle formation and growth. Observations of 3 – 100 nm diameter particle number size distributions at the KM67 tower site during TUFFS show frequent new particle formation events during the wet season in April, transitioning to a scenario of less frequent events in July at the onset of the dry season. These observations highlight the regional nature of new particle formation in the Amazon, and suggest that additional observations at a variety of locales are needed to fully understand the roles of new particle formation in this region.