The power of global measurements of aerosol composition

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The PALMS single particle mass spectrometer recently completed a set of global flights on the NASA DC8 during the Atmospheric Tomography (ATom) mission. By combining the single particle data with optical size distributions we can create quantitative maps of all of the major aerosol components: dust, sea salt, smoke, organic-sulfate particles, and other types. This talk will focus on processes revealed by two types: sea salt and sulfuric acid particles in the stratosphere. These are the first extensive measurements of sea-salt particles above the boundary layer. The measured concentrations put stringent limits on reactions of nitrate and bromine with salt particles in the upper troposphere. Sea salt also turns out to be an excellent test of wet removal processes – this is very important because there are more studies about aerosol sources than aerosol sinks. Global transport models range from fairly good to extremely poor in reproducing the sea-salt measurements. The DC8 was in the stratosphere often enough to measure the composition of particles in the lower stratosphere. PALMS can differentiate particles that formed in the stratosphere from particles that formed in the troposphere. The two groups of particles not only have distinct composition but also distinct size distributions. Their compositions provide information on the condensation and oxidation of organics in the tropopause region. I will also show brief results on other types of particles such as smoke.