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Organic condensation onto atmospheric nanoparticles - recent developments and open questions

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Atmospheric aerosol particles influence global climate as well as impair air quality through their effects on atmospheric visibility and human health. Ultrafine (<100 nm) particles often dominate aerosol numbers, and nucleation of atmospheric vapors is an important source of these particles. To have climatic relevance, however, the freshly nucleated particles need to grow in size. The growth of the smallest atmospheric nanoparticles to sizes where they may act as seeds for cloud droplets is thus a key step linking aerosols to clouds and climate. Recent studies show that in many environments this growth is driven by uptake of organic compounds. Several different mechanisms may control this uptake, including 1) production of low-volatility vapours by gas-phase oxidation of organic precursors and the reversible condensation of these compounds; 2) formation of organic salts; 3) formation of organic oligomers and polymers; and 4) kinetic effects on the particulate phase transport due to solid or amorphous phase of the aerosol. Based on observational data and recent literature, we will discuss these mechanisms and their importance at different stages of atmospheric nanoparticle growth. There is evidence that each of the proposed mechanisms may play an important role, and that their relative importance is likely to vary with particle size, time, space and ambient conditions.