

The effectiveness of a particular dry deposition process or pathway (series of processes) is governed by a number of factors which include the chemical and physical properties of the substances, ambient atmospheric conditions, and properties of the receiving surface. When the lower atmosphere is well mixed, material is transported effectively to the near-surface region; however, when stable conditions prevail, such as typically at night, vertical mixing is inhibited and deposition reduced. A layer of quasi-laminar flow over smooth surfaces also frequently inhibits deposition, particularly for small particles (e.g., the vast majority of sulfate-containing particles). Microscale surface roughness promotes particle deposition, while wet, alkaline and physiologically active surfaces promote the deposition of  $\text{SO}_2$ . Clearly, the importance of dry deposition will be a function of both time (time of day, season), stability and location (surface type).

The effectiveness of wet deposition depends on the ease with which materials are incorporated into precipitation elements, and on what might be termed the precipitation regime.  $\text{HNO}_3$ ,  $\text{NH}_3$  and  $\text{SO}_2$  are soluble enough to be readily taken up by cloud and rain drops (although for  $\text{NH}_3$  and  $\text{SO}_2$  this is a function of pH), and  $\text{SO}_4^{2-}$  particles are efficient cloud condensation nuclei. The main wet deposition pathways for sulfur are through  $\text{SO}_4^{2-}$  particles serving as condensation nuclei for cloud droplets, and  $\text{SO}_2$  being taken up into cloud and rain drops and subsequently oxidized to  $\text{SO}_4^{2-}$ .