

## 4. ATMOSPHERIC CHEMISTRY

### 4.1 Introduction

Increases in atmospheric acidification result from the oxidation of sulfur, nitrogen, and carbon compounds to form the strong mineral acids  $H_2SO_4$  and  $HNO_3$  and weak organic acids. Therefore, the oxidation of  $SO_2$ ,  $NO$ , and  $NO_2$  must be among the processes appearing in the long range transport LRT models if they are to predict meaningful wet and dry deposition patterns for individual species such as  $SO_2$ ,  $NO_2$ ,  $HNO_3$ , and  $H_2SO_4$ . That is because the rates for wet and dry removal of  $SO_2$  and  $NO_2$  are vastly different from  $H_2SO_4$  and  $HNO_3$ , respectively. The chemical forms significantly influence the residence time and transport distances of these sulfur and nitrogen compounds. Also, the extent of the adverse ecological effects may be strongly dependent upon the chemical forms.

### 4.2 Linearity vs. Non-Linearity

The LRT models described in Chapter 7 attempt to account for the formation of  $H_2SO_4$  through a simple, linear rate law, which is:

$$\begin{aligned} d[H_2SO_4]/dt &= d[SO_4^{2-}]/dt && (4-1) \\ &= k_S[SO_2] \end{aligned}$$

In words, equation 4-1 states that the overall formation rate in the atmosphere of  $H_2SO_4$  is equal to the rate for  $SO_4^{2-}$  formation, which is in turn equal to a constant ( $k_S$ ) times the  $SO_2$  concentration. The constant  $k_S$  includes the combined rate of  $SO_2$