3.3 Summary

The above experimental results make it difficult to draw any firm conclusions on the seasonal variation of SO_2 oxidation rate. Perhaps this much can be said: during the summer months, photochemical processes are important, and both point source and urban plume data indicate daytime "dry" rates of several percent per hour (a summertime diurnal average of 1 to 2% h^{-1} might be suitable for long-range transport modelling, although some of the urban plume data suggest rates several times greater than this). In the winter, it is not clear what one should expect. The chimney plume data, most of which may be of questionable relevance to long-range transport modelling because of high pollutant concentrations, indicate oxidation rates generally considerably less than 0.5% h^{-1} at latitudes where photochemical reactions should not be contributing appreciably. On the other hand, the limited urban plume data suggest a greater role of heterogeneous processes, and therefore appreciable oxidation rates, but at the same time they have been derived with more assumptions about the history of the air parcel, and are therefore more open to criticism (see, for example, Forrest et al., 1979b). It must be concluded that at present the available plume data is too conflicting to draw any firm conclusions about the seasonal dependence of the SO_2 oxidation rate. The potential role of clouds in converting SO_2 to sulfates further complicates matters. If current work shows that clouds are indeed as important as suspected, then expected seasonal variations in SO_2 transformation could increase considerably, especially in areas where clouds consist largely of dry ice crystals in the winter (and hence have very low chemical transformation potential, as compared to summertime conditions).

4. Nitrogen Oxides Deposition and Chemistry

The atmospheric chemistry and deposition of sulfur oxides has in the past received considerably more attention than that of nitrogen oxides. However, the recognition that the latter are important precursors of acid deposition, and that emissions of nitrogen oxides will grow considerably more than those of sulfur oxides in the coming two decades (U.S.-Canada Research Consultation Group on LRTAP, 1979), has recently led to a substantial increase