

lower latitudes, at middle and higher latitudes the ratio of summer-winter noontime and average diurnal photochemical rates can be large: for example, at 35°N, summer noontime and average diurnal rates are 4 to 5 times greater than the corresponding winter values. At 55°N, the summertime values are 16 to 20 times greater. In fact, Altshuller finds that during the winter months, homogeneous oxidation reactions cannot account for any significant conversion of SO<sub>2</sub> to sulfate at latitudes greater than 45°N. Bottenheim et al. (1977), in their study of seasonal effects on photochemical air pollution at 60°N, have come to similar conclusions. These results are largely due to changes in available ultraviolet solar intensity (Nieboer et al., 1976; Bottenheim et al., 1977; Altshuller, 1979), although temperature effects may also play a role (Carter et al., 1979). Table 4, taken from Altshuller (1979), illustrates the expected effects of season and latitude on noontime sulfur dioxide homogeneous oxidation rates in clean air. In polluted air, the corresponding rates be a factor-of-two or so higher (Calvert et al., 1978; Altshuller, 1979).

Heterogeneous sulfur dioxide oxidation processes are less well-understood than their homogeneous counterparts. Oxidation can take place in droplets, liquid films surrounding particles at high relative humidity, or on dry particle surfaces (Paper 1, this report). At present, the most important heterogeneous reactions which take place in the aqueous phase are thought to be (Beilke and Gravenhurst, 1978): (1) SO<sub>2</sub> oxidation by O<sub>2</sub> in the presence of catalysts (e.g., dissolved transition metals); and (2) SO<sub>2</sub> oxidation by strongly oxidizing agents (e.g., ozone and hydrogen peroxide). The reaction with hydrogen peroxide in particular has recently excited the interest of the scientific community, due to its potential atmospheric importance (see, for example, Penkett et al., 1979; Dasgupta, 1980; Martin and Damschen, 1981). To date, there has been no clear demonstration that SO<sub>2</sub>--dry particle reactions are of atmospheric significance, except possibly in smokestack plumes close to the chimney (where concentrations are relatively high). For example, Britton and Clark (1980) have recently reviewed past work on heterogeneous SO<sub>2</sub> reactions on dry particles and have presented the results of some of their own studies with soot and SO<sub>2</sub>/NO<sub>2</sub> mixtures. In their conclusions, they state: "From the point of view of the overall SO<sub>2</sub> oxidation process in the atmosphere, the heterogeneous reactions on soot or other particles play a