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THE CHARACTERISTICS OF ACID PRECIPITATION IN SOUTHERN CHINA

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EXTENDED ABSTRACT

Research on acid rain started in 1979 in several cities of China. This paper presents the results of precipitation and gaseous pollutants monitored in Guangdong and Guangxi provinces during spring 1988 and spring 1989. Four mountain sites (380–2140 m altitude) and five city monitoring sites have been installed. An aircraft campaign at 500–4000 m altitude was also performed.

The precipitation in these areas was seriously acidified. The percentage of samples with pH less than 5.6 was 95, 87, 88 and 99.5% for upper air cloud, mountain rain, mountain cloud and rainwater collected at the city stations, respectively. The percentages of samples with pH less than 5.0 was 88, 84, 80 and 96% for the type of samples mentioned above, respectively [1]. The acidity was closely related to specific meterological conditions. With the northern cold air front, the percentage of samples with pH less than 5.0 was almost quantitative.

The average of total cation or total anion concentration is much higher as compared to Lijiang background site (Table 1). Sulphate and nitrate were the major contributors to acidity, with lower sulphate-to-nitrate ratio as compared to South-western area (Chongqing city, see also Table 1). The major acidic compound is sulphuric acid originating from sulphur dioxide. The sulphur dioxide average concentration in the cities ranged from 0.07 to 0.13 mg/m3 (1988).

The concentrations of secondary pollutants such as O_3, H_2O_2, HNO_3, aldehydes and fine particles were rather high, resulting in high photochemical activity and strong oxidising capacity of the atmosphere. The average O_3 and HNO_3 concentrations in the cities varied between 29–114 and 0.05–0.21 ppbv, respectively. The H_2O_2 concentration in precipitation collected at the city sites varied between 0.4–60 μmol/l, depending on the SO_2 concentration in air and S(IV) concentration in precipitation. High H_2O_2 concentrations are only found under low SO_2 atmospheric condition. This indicates that H_2O_2 is the principal oxidant for precipitation during spring. For the precipitation samples, high NH_4 concentrations were observed which were most likely caused by high NH_3 concentrations in air (ranging from 6–11 $\mu g/m^3$). Below-cloud scavenging modelling showed that ammonia was the most important compound impacting pH and total sulphur concentration of precipitation.

With respect to the sources of acid precipitation, coal with relatively high sulphur content, ash content and low caloric value was the major energy resource used in this area. In total about 0.87×10^9 kg SO_2 and 0.65×10^9 kg smoke dust was emitted in this area in 1988. These emissions were mainly responsible for the acid precipitation. The precipitation

collected on the mountain sites was acidified mostly during northern cold front passages. Therefore, long-range transportation of acidifying pollutants accumulated in the northern cold front also contributed to acid precipitation in the Southern provinces.

1. Wang Meirong, ACTA Scientiae Circumstantiae, 12 (1) (1992) 37.
2. Sheng Peixuan, Mao Jietai *et al.* ib, 12 (1) (1992) 16.

Table 1. Cat- and anion concentration (μeq/l) and corresponding ratios

site	Avg. H^+	sum (anion)	sum (cation)	NH_4^+/cation (%)	NO_3^-/anion (%)	SO_4^{2-}/anion (%)	SO_4^{2-}/NO_3^-
upper air	135	356	495	30.0	34.6	40.3	1.2
Mt. rain	81.0	177	250	29.5	26.0	56.5	2.5
Mt. cloud	98.4	531	595	50.9	19.5	70.4	3.9
ground rain	138	347	418	33.8	14.7	65.3	5.1
Chongqing	129	216	270	30.0	1.1	78.1	71.0
Lijiang	10.0	13.7	23.9	23.8	13.9	59.1	4.2