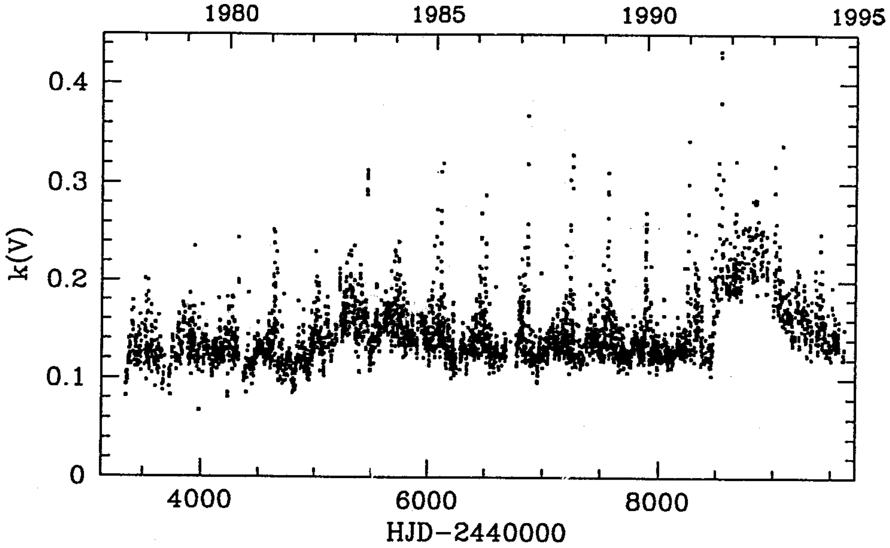

Figure 1: *Variations of the extinction coefficient in the V filter.*

volcanic aerosols injected in the Earth atmosphere by the eruption of the El Chichon volcano.

This problem has been revisited on the basis of the new photometric data (Burki et al., 1995, hereafter Paper II) because of: (i) the time period covered by the observations, which is now 17 years; (ii) the atmospheric extinction which has now been evaluated for all the photometric nights (and not only for the so-called MD nights (see Paper I) representing about only 20% of the photometric nights); (iii) the effect of another volcano eruption, that of the Pinatubo, which can be analysed.

2. The Variations of the Extinction

The general characteristics of the variations of the mean atmospheric extinction during the photometric nights of the past 17 years at La Silla are presented in Figure 1 for the filter *V*. The extinction variations can be decomposed into: long-term variations due to volcano aerosols, a mean annual variation and short-term variations due to meteorological aerosols.

2.1 Long-term extinction variations due to volcanoes

Two volcanoes are well known to have affected the Earth atmosphere's transparency, in particular at La Silla, during the past years:

El Chichon in Mexico (latitude +17°) had two eruptions, in March 23 and April 4, 1982 (HJD 2445051 and 2445064). The stratospheric loads due to El Chichon is estimated to reach about 8 megatons of sulphur dioxide SO_2, a radiatively very efficient absorbant when transformed into sulphuric acid by photochemical effect in the presence of water vapour (Mroz et al., 1983; McCormick & Swissler, 1983).

The Pinatubo in the Philippines (latitude +15°) had also two main eruptions: the first of four pre-paroxysmal vertical eruptions took place on June 12, 1991 (HJD 2448420), and the main eruption on June 15, 1991 (HJD 2448423). The estimation of the amount of SO_2 emitted to the atmosphere is about 20 megatons (Bluth et al., 1992; Pallister et al., 1992).

As shown by Figure 1: (i) these two volcanoes can be considered as the cause for the long-term variations of the extinction at La Silla during the past 17 years; (ii) the increase of the extinction at La Silla was very sudden, roughly 150 days (El Chichon) and 100 days (the Pinatubo) after the eruptions; (iii) the effect from the Pinatubo was much stronger than the one from El Chichon; (iv) the decantation of the volcanic aerosols in the atmosphere is very slow, lasting at least 1000 days, perhaps even 1300 days.

Our data permit to follow the evolution of the extinction law due to the volcano aerosols, during some hundreds of days following the eruptions. Adopting a law of the standard form $k(\lambda) \sim \lambda^{\alpha_p}$, we obtain that: (i) the aerosols from the two volcanoes were very different at their origin (or, more precisely, when they were detected from La Silla), the aerosols from the Pinatubo having produced a flater, or gray, extinction law; (ii) the "volcanic aerosols" produce very different extinction laws than the "meteorological aerosols" (see Section 2.2); (iii) the evolution towards an increase of α_p with time, observed in the cases of the two volcanoes, could mean that the volcano

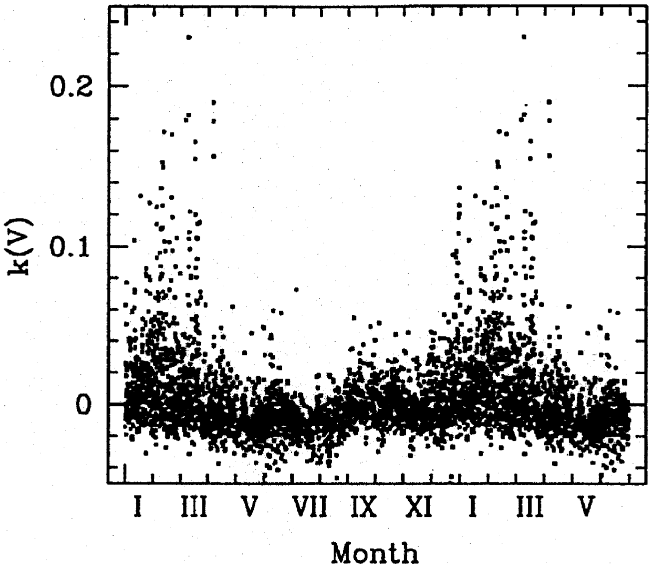

Figure 2: *The annual variation of the extinction coefficient in the V filter.*

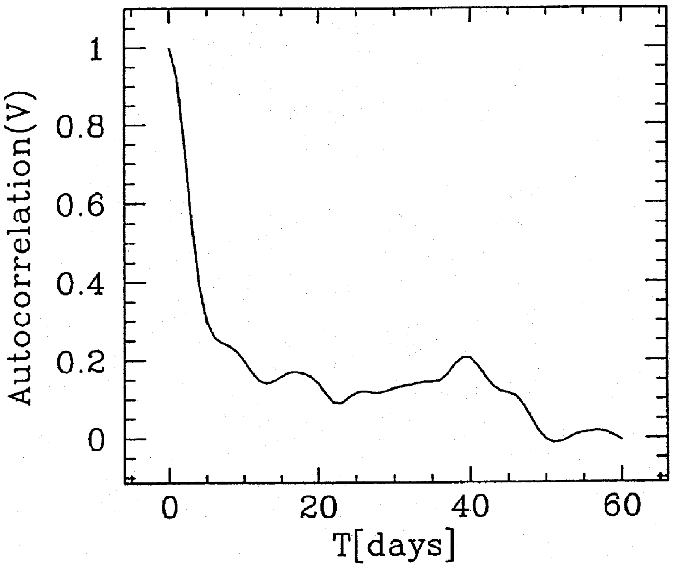

Figure 3: *Analysis of the series of the extinction coefficient determinations in the V filter by autocorrelation.*