aerosols have a size increasing with time, until they fall on the ground.

From the theoretical calculations of the extinction law (van der Hulst, 1952), we derive an increase of the typical aerosol radius from 0.4 to 0.7 μm from HJD 2445170 to 2446030 (El Chichon), and from 0.5 to 0.8 μm from HJD 2448670 to 2449260 (the Pinatubo). Thus, the typical radius was a little larger for the Pinatubo aerosols, and, in the case of both volcanoes, we note *an increase of the typical aerosol radius with time*. These conclusions are in agreement with the results obtained by Hofmann & Rosen (1983, 1987), Knollenberg & Huffman (1983), Oberbeck et al. (1983) in the case of El Chichon and Valero & Pilewskie (1952) in the case of the Pinatubo.

2.2 The annual variation of the extinction

The annual variation of the extinction is mainly due to the variation of the meteorological aerosol content in the atmosphere above the observing site. This variation can be examined by removing the minimum mean extinction values and the extinction due to volcanic aerosols (Section 2.1) to the global data. In addition, for the purpose of this Section, the data from the periods of two years following the eruptions of the two volcanoes have been excluded. The resulting extinction values in *V* have been plotted in Figure 2 versus the date in the year. We see that: (i) the minimum value of the extinction is relatively stable throughout the year; (ii) the maximum values are reached during the first part of the year, i.e. during the southern summer.

The extinction law for these meteorological aerosols has been determined in Paper II (the effect from the volcanoes having been removed): $k_p(\lambda) = b_p \lambda^{-1.39}$. The value $\alpha_p = -1.39$ (the Ångström factor) is remarkably stable and well defined at La Silla. It is known (e.g. Wempe, 1947; Ångström, 1961) that α_p varies within a small range and that, under global, average conditions, at a large variety of locations on the Earth, it has a value close to -1.3 ± 0.2, being seldom above -0.5 or below -1.6. The values of α_p larger than -0.5 are encountered under conditions when the atmosphere is, for instance, polluted by volcanic outbreaks or forest fires. When estimations concern specifically the meteorological haze, the values for α_p are less dispersed, between -1.25 and -1.45, and are independent of the haze density.

The component of the extinction analysed in this Section is related only to the haze present during the nights of very good and stable, *photometric*, atmospheric transparency. This is an indication that the distribution of the radii of the particles forming the haze (mainly constituted of water droplets) is quite stable during these nights and has its mode near the value 0.3 μm.

2.3 Short-term variations of the extinction

Is there any typical period of several days, or weeks, during which the extinction does not vary considerably? Or, in other words, is the extinction in a given night correlated to the extinction of the previous and/or the following night(s)?

Based on our large material, it is possible to give a clear answer to this question, for the La Silla site, since the extinction has been determined during almost all the photometric nights during a period of about 17 years. The best mathematical method to analyse these data is to use an autocorrelation technique. The results, presented on Figure 3, are based on the k(V) values obtained during the years 1985 to 1990 only (HJD 2446066–2448257), in order not to be affected by the effects from the volcanoes. An important autocorrelation appears for a time $T \leq 5$ days, shown up by a decrease of the function from 0 to 5 days: the autocorrelation is very high (0.90) for $T = 1$ day, and decreases until $T \simeq 5$ days. Consequently, *the global tendency is to have series of a few* ($n \leq 5$) nights with similar extinction values.

3. Conclusion

The variation of the atmospheric extinction is essentially due to the meteorological and/or volcanic aerosols. The characteristic time for these variations, *restricted to the nights of photometric quality*, varies from 2–3 hours to several years. The amplitude of these variations is large: during the 4400 nights of our photometric activity, the proportion of the light diffused or absorbed by the Earth atmosphere has varied, in the *V* band, from 9% (minimum extinction) to 33% (beginning of the period affected by the aerosols from the Pinatubo).

In the case of ground-based measurements, the correct estimation of the fluxes “outside the atmosphere” must absolutely be done by using the atmospheric extinction value for the site and at the time the measure has been performed. In the cases of stable photometric nights, the mean value for the night can be used. An estimation based on the extinction values of other nights will give correct results only by chance.

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G. Burki
e-mail: OBS.UNIGE.CH