В заключение можно сделать вывод, что информация, содержащаяся в "Объединенной базе магнитных полей солнечных пятен", несет в себе большой потенциал для дальнейших исследований в области физики Солнца и солнечно-земных связей.

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are examined. Finally, there is a conclusion about the reaction of aerosol layer on solar activity changes.

**Analysis and results of experimental data**

For more comprehensive analysis, the short- and the long- time intervals of the data are selected separately. The multispectral aerosol optical depth is considered for the long time period. The measurements of optical depth are obtained by a multipurpose photometer installed at the Rattlesnake Mountain Observatory (46.4 degrees N, 119.6 degrees W) at elevation of 1088m above mean sea. The daily variations of aerosol optical depth from 1979 till 1994 year are presented in Figure 1.

![Figure 1. The long-time variations of aerosol optical depth for the different wavelengths](image)

The analysis of these data show us that there are not only the yearly fluctuations of aerosol optical depth, but also there is the periodicity equal 11 years at this time period. From the one side it is well known that flux of galactic cosmic rays and the variation of solar activity have stability 11-year cycle. The galactic cosmic rays have enough energy to penetrate up to low atmosphere and to influence on physical and chemical processes of atmosphere. From the other side there are two big volcanoes, with the volcanic explosively index more then 5, at this time interval. One of them are volcano El.Chichon in Mexico. It is tracked 32 days in March and April of 1982 year. The second one is Mt.Penatubo in Philippines. The Pinatubo eruption is largest seen by TOMS data, which is traced 60 days in summer of 1991 year. As we can see at Figure 1 the eruptions of these volcanoes are one year before the big maximums in the optical depth for this period of time. According to the dynamic of the atmosphere in stratosphere numbers of aerosol particles increase after the volcanic eruptions, that led to change of optical characteristics of atmosphere. In stratosphere these changes are stable during one or two years after eruptions. In our case it can be means that these two big maximums of variations of aerosol optical depth, which could be correspond 11-year cycle, are reason by the two volcanoes. However in the paper [5], the author analyse the variations of the aerosol concentration, which not have the volcanic particles. The investigated period of time corresponds two 11-year cycles and one of the cycles is the time interval from 1979 till 1994. As a conclusion the author notice that there are the reaction of the concentration aerosol on changes of SA. In order to explain what really happens with aerosol when a proton flux from the sun changes, we consider the aerosol backscatter profiles for the short-time period. The integral of aerosol extinction (or aerosol backscatter - from lidar ratio) along the altitude characterize the optical depth. So if we could find some variations of the aerosol backscatter coefficient after solar proton flux changes, we would be able to do a conclusion about the ability influence of solar activity on aerosol optical properties.

The daily lidar data of aerosol backscatter profiles are from the stations, which have been included in the EARLINET project from 2000 till beginning 2003 year. These data are analysed according to the daily changes of solar activity. For our analysis we have selected the data for the days where there are not influence of the Sahara dust, volcanic eruptions, fires, and cirrus clouds. One of the altitude profiles of the aerosol backscatter before and after the special solar proton events are presented in Figure 2. From this figure it is seen that the aerosol backscatter profile has the aerosol peak after solar proton event at altitude layer between 10 and 12 kilometres. It can be explained by an increase of the proton flux ionising of the lower atmosphere and then increased concentration of small cloud condensation nuclei. At the next step there is the decrease in precipitation, then low soil moisture and at the end formation high dust layer.

**Conclusions**

Sahara dust, flares, volcanic eruptions or anthropogenic factors are some of the main sources of atmospheric aerosol. The data presented above show that one of sources of the variations of the atmospheric aerosol can be also solar activity. It is possible that aerosol optical properties react to the solar activity changes. After the investigations which have been done it is allowed to say that flux of galactic cosmic rays decrease or sunspot numbers increase and solar proton events lead to increase of aerosol backscatter profile and accordingly to increase of aerosol optical depth.

However, it has to be noted that the conclusions above are obtained from the analysis of rather scarce data and are quite preliminary. The problem needs an additional and detailed investigation.
Figure 2. The aerosol backscatter profiles at wavelength 532nm before and after the solar proton event.

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References


Abstract

It is demonstrated by means of the phase wavelet analysis on the base of the combined data that in the last millennium the moments of all Grand minima and maxima, such as the Maunder and the Sporer minima, the Late Medieval and the Modern maxima, etc., agree with high precision in the solar activity and in the global temperature. To make an outline of prognosis of variations of these parameters in the future a method is proposed, which is based upon wavelet transform and conditionally called “method of multiple-scale cloning”. The main idea of the method is construction of typical time profiles of the wavelet components by precedents and subsequent inverse wavelet transform. It is shown that one can expect the next Grand minimum in 2070-2090 and the next maximum in the end of the 22nd century.

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