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Aerosol Optical Depth from MODIS satellite data above the Pierre Auger Observatory

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Aerosol optical depth can be retrieved from measurements performed by Moderate Resolution Imaging Spectroradiometer (MODIS) satellite instrument. The MODIS satellite system includes two polar satellites, Terra and Aqua. Each of them flies over the Pierre Auger Observatory once a day, providing two measurements of aerosols per day and covering the whole area of the Observatory. MODIS aerosol data products have been generated by three dedicated algorithms over bright and dark land and over ocean surface. We choose the Deep Blue algorithm data to investigate the distribution of aerosols over the Observatory, as this algorithm is the most appropriate one for semi-arid land of the Pierre Auger Observatory. This data algorithm allows us to obtain aerosol optical depth (AOD) values for the investigated region. Quality cuts were also applied to the data. As a result, cloud-free aerosol maps were prepared with the horizontal resolution $0.1° × 0.1°$. Since a sufficient number of measurements was obtained only for Loma Amarilla and Coihueco FD sites of the Pierre Auger Observatory, a more detailed analysis of aerosol distributions is provided for these sites, i.e. we prepared daily plots for the years 2004-2017. Aerosols over these FD sites are generally distributed in a similar way each year, but some anomalies are also observed. These anomalies in aerosol distributions appear mainly due to some transient events, such as volcanic ash clouds, fires etc. Some seasonal effects are also observed. We conclude that the Deep Blue MODIS algorithm provides more realistic aerosol optical depth values than other algorithms, although the uncertainties, both systematic and statistical, are still essential.

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