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Case studies for assessment of the CALIOP system products in the Brazilian territory for application in air quality of megacities

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Aerosol and clouds play an important role in the Earth's climate process through their direct and indirect contributions to the radiation budget. The largest difficulty in predicting the climate change processes is associated with uncertainties in the distribution and properties of aerosols and clouds, as well as their interactions on a global scale. The CALIPSO mission was developed as part of the NASA program, in collaboration with the French space agency-CNES, with the main goal to develop studies that will help to quantify the uncertainties about aerosols and clouds. The CALIPSO satellite carries a Lidar system on board, named CALIOP, as a primary instrument, able to measure aerosol and cloud vertical profiles and distributions, and thus learn more about their interactions. Once the optical properties measured by CALIOP are retrieved, using a complex set of algorithms, it is necessary to develop methodologies in order to assess the accuracy of the CALIOP products. Within this context a validation methodology was developed in order to verify the assumed values of the Lidar Ratio (LR) selected by the CALIOP algorithms, using two ground-based remote sensing instruments, an elastic backscatter Lidar system (MSP-Lidar) installed at IPEN in São Paulo and the AERONET sunphotometers operating at 5 different locations in Brazil including São Paulo. The selected events days when the CALIOP system and ground-based instruments spatially coincided, were those selected and analyzed under cloud-free conditions, as well as when modeled air mass trajectories indicated the transport of air parcels from the CALIOP track area towards the ground-based sensors. The proposed Lidar Ratio values from the AERONET/CALIOP model (A/C Model) were determined and showed good consistency with those initially assumed by the CALIOP Algorithm. Based on quantitative comparisons, a mean difference of $-1.74 \pm 26\%$ was determined. The Lidar Ratio retrieved by the MSP-Lidar system at IPEN provided a mean difference of $-1.91 \pm 14\%$, confirming that the accuracy in the Lidar Ratio assumed a priori by the CALIOP algorithms is within the uncertainty range of 30%. This study focus in some case studies assessing the performance of the A/C Model as well as the CALIOP system products. The LR's values retrieved by A/C Model, the CALIOP system and MSP-Lidar were compared and this assisted in the validation and assessment process of the CALIOP products. It is the first step to start to implement those products in forecasting, transporting models and studies of air quality in megacities such as São Paulo.