Monitoring tropospheric and stratospheric aerosol events over South America using a ground-based lidar system.

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January and February 2022 were marked by two critical atmospheric events in South America. The first is the volcanic plume transported from the Hunga-Tonga Hunga Ha'apai (HTHH) volcano, a submarine volcano in the South Pacific. The second one is the intense episodes of fires in Paraguay and Argentina. Both events were detected at different altitudes in the atmosphere and can impact the Earth's radiative process in different ways.
Preliminary results show that HTHH volcanic plume in its initial blast reached above 50 km into the mesosphere, while the biomass burning was confined into the troposphere.

In this context, a ground-based lidar is an essential tool since it can monitor different layers of the atmosphere with high temporal and spatial resolution. As part of Latin-America LIdar NETwork (LALINET), the SPU-Lidar station, a Raman lidar system installed at the Nuclear and Energy Research Institute - IPEN, in the megacity of São Paulo-Brazil, was employed to measure profiles of the particle extinction and backscatter coefficients. The system is set up as a commercial Nd:YAG laser operating at 1064, 532, and 355 nm. The laser energy per pulse is about 600, 400, and 230 mJ at 1064, 532, and 355 nm, respectively, using a repetition rate of 10 Hz and pulse duration of approximately 5 ns.

Since the 23rd of January 2022, we have carried out an intensive measurement campaign to monitor the development of the HTHH plume layer. However, several episodes of aerosol transport from biomass burning (BB) aerosol were also detected during this period. The HTHH plume mainly was detected between 24 to 25 km (a.g.l.) and 18 km (a.g.l.). At the same time, the BB aerosol layers were detected in several altitudes between 1 to 6 km (a.g.l.). We will show the results of aerosol optical properties such as aerosol optical depth (AOD) and lidar ratio (LR) for each different aerosol layer in the troposphere and stratosphere. For layers in the tropospheric region, we applied the Raman analysis. The transmittance method was used to volcanic layers at the stratosphere.