Tropospheric and UTLS trace gases and aerosol observations by lidar at Maïdo Observatory (La Réunion, 21°S, 55°E): systems, datasets and case studies overview

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Water vapor, ozone, and aerosol are essential climate variables that need to be observed at a global scale to monitor the evolution of the atmospheric composition and potential climate changes. They can also give precious insights in key processes impacting the vertical layering of the Earth's atmosphere and the resulting radiative forcing.

La Réunion (21°S, 55°E) is a tropical island located in the south-west Indian Ocean, affected by southeasterly trade winds near the ground, and westerlies in the free troposphere. La Réunion is seasonally impacted by biomass burning plumes transported from southern Africa, South America, Australia and south-eastern Asia which can significantly affect the free tropospheric concentrations of trace gases and aerosols. Moreover, it is affected by stratospheric intrusions associated with the dynamical influence of the subtropical jet stream and the tropical cyclone deep convection.

The Atmospheric Physics Observatory of La Réunion (OPAR) is a permanent station for long term atmospheric observations: dynamic and chemistry of the low and middle atmospheres in the context of climate change in the Southern Hemisphere. It is a French Instrumented Site and provides data for: international monitoring networks (e.g. NDACC, GAW, AERONET, ICOS), scientific research and satellite validation. The Maïdo Observatory is one of the three sites of OPAR. The facility is located on the Maïdo mount (2160 m asl, lee side on the tropical island). Its situation allows to get interesting observing conditions both night (clear skies for teledetection, free tropospheric in-situ measurements) and day (marine boundary layer perturbed by local emissions).

Taking advantage of this unique tropical location in a sparsely documented area, tropospheric and UTLS water vapor (NDACC affiliated), ozone (NDACC affiliated) and aerosol observations are performed routinely at Maïdo Observatory since 2013 thanks to two lidar systems: the LIO3T and the Lidar1200. We will briefly describe these two lidar systems with their performances and limitations along with their water vapor, ozone and aerosol datasets. We will illustrate their particular interests in this remote part of the world with volcanic and biomass burning plumes case studies: the 2015 Calbuco volcanic plume, the 2017 Southern African River of Smoke, and the 2020 Australian wildfires plume.