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Remote-sensing of aerosol atmospheric rivers over the southwest Indian Ocean in September 2017: origins, evolution and impacts

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In the southern hemisphere, the dry season from June to October coincides with the occurrence of significant fires especially located along the tropical belt in Africa and South America. This fire activity is an important source of aerosols in the tropical troposphere and results in smoke plumes transported across long distances toward area generally aerosol-free. The atmospheric composition over the Indian Ocean is often influenced by biomass burning plumes shaped by the synoptic atmospheric circulation with high pressure over southern Africa and the movement of westerly waves that may embedded cut-off lows. The propagation over the Indian Ocean is then dependent on the position of the Mascarene High. The meandering shape of the plumes is then associated with an aerosol atmospheric river (AAR). Such a phenomenon has been sampled by spaceborne lidars and spectro-radiometers, and even observed above La Réunion (21.1°S, 55.3°E) during September 2017 by a ground-based lidar and a sun-photometer. The Li1200, an operational lidar in the frame of the Atmospheric Physics Reunion Observatory (OPAR), recorded the passage of an AAR during two nights. These measurements allow us to derive both the vertical structures of the plume and some vertically resolved aerosol optical properties. This information was used to constrain Lagrangian modelling tools to identify the pathways and origins of the biomass burning plume. These results have been corroborated by the spaceborne observations of CALIOP and CATS, and the passive sensor MODIS. Reanalysis of ECMWF with atmospheric composition outputs from the Copernicus Atmosphere Monitoring Service (CAMS) supports the understanding of the synoptic conditions leading to the formation of this aerosol plume configuration. We will present our scientific approach and discuss the environmental impact of these AARs in the southwest Indian Ocean.