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Aerosol transport of biomass burning to the Bolivian Andean region from remote sensing measurements

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This work deals with the analysis of columnar aerosol optical and microphysical properties obtained by the AERONET network in the region of Bolivia and its border with Brazil. Through the long record AERONET measurements we focus in the transport of biomass-burning aerosol from the Amazon basin (stations at Rio Branco, Cuiba, Ji Parana and Santa Cruz) to the Andean Altiplano (altitude above 3000 m a.s.l. at the station in the city of La Paz). Also, measurements from the space-sensors MODIS and OMI are used to understand spatial distribution. The main results is the high impact in the aerosol load during the months of August, September and August with mean values of aerosol optical depth at 500 nm (AOD) at the low lands of $\approx$ 0.60 $\pm$ 0.60 and Angstrom exponent (α(440-870)) of $\approx$ 1.52 $\pm$ 0.38. Satellite measurements also follow very similar patterns. Also, that season is characterized by some extreme events that can reach AOD of up to 6.0. Those events are cloud-screened by MODIS but not by OMI sensor, which is attributed to different pixel resolutions. The biomass-burning is clearly transport to the Andean region where higher values of AOD ($\sim$ 0.12 $\pm$ 0.06 versus 0.09 $\pm$ 0.04 in the no biomass-burning season) and α(440-870) ($\sim$ 0.95 $\pm$ 0.30 versus 0.84 $\pm$ 0.3 in the no biomass-burning season). However, the intensity of the biomass-burning season varies between different years. Analysis of precipitation anomalies using TRNM satellites indicates a strong correlation with AOD, which suggest that on dry years there is less vegetation to burn and so less aerosol load. The opposite is found for positive anomalies of precipitation.

In the transport of biomass burning larger values of the effective radius (reff) are observed in La Paz (reff = 0.26 $\pm$ 0.10 μm) than in the low lands (reff = 0.63 $\pm$ 0.24 μm), which has been explained by aerosol aging processes. Moreover, although the spectral dependence is similar, single scattering albedo (SSA) is larger in the low lands ($\sim$0.89 $\pm$ 0.05 at 670 nm) than in the high lands ($\sim$0.84 $\pm$ 0.08 at 670 nm). The hypothesis to explain that change in SSA is that in the low lands the high humidity makes aerosol hygroscopic growth. At high land, the humidity is low and dries the particle.

The use of the HYSPLIT model has allowed the identification of the different air-masses backward-trajectories that reach the city of La Paz. Particularly, due to the abrupt changes in the terrain, an upgrade meteorological model has been used allowing a meteorological database of 1 km of horizontal resolution. The aerosol characteristics associated with each air-masses backward-trajectory is studied.