

Study Cases of Cirrus Cloud Radiative Effect in Manaus Region during August – October 2014.

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Abstract: Cirrus clouds radiative effect on shortwave radiation (CRE) has been studied combining lidar measurements with a state of the art radiative transfer code and solar radiation measurements at ground during September – October 2014. For this purpose, two days with persistent cirrus clouds over two Lidar sites, near Manaus - Brazil, were selected during this time (September 3 – 5, 2014). The UV Raman Lidar operates at 355 nm with 10 Hz and 95 mJ per pulse and the detection efficiency is high enough to give good signal to noise ratio at the cirrus altitudes even during daytime. The VIS Raman lidar operates at 532 nm with 20 Hz and 200 mJ per pulse. The UV Raman Lidar (UVRL) is located at T0e (2.89 °S 59.97 °W) and the VISRaman lidar in T2 (3.21 °S 60.60 °W). The radiative transfer code was adapted to the local conditions at the sites, using water vapor and temperature profiles from the operational radiosondes (~30 km) as well as locally measured surface albedo. Runs of the atmospheric radiative transfer code were conducted both under the presence of cirrus clouds and in clear sky conditions. The diurnal behavior of the CRE profile is analyzed and the presence of cirrus clouds is proved with instruments onboard Calipso and MODIS measurements.

The calculated shortwave broadband cloud radiative effect values have negative sign, the mean daily cloud radiative effect ranging from -0.5 W/m² to -52 W/m², at the top of atmosphere and lower effect at the surface. A close correlation between the negative cirrus radiative effect and optical depth (anticorrelation) was found at the top of the atmosphere and at the surface when broadband solar irradiances calculations are analyzed. Also some calculations with different ice crystal sizes were conducted in order to evaluate the change in the CRE. Using these two lidar systems around the city of Manaus, the behavior of the cirrus clouds in the region was shown, during the second GoAmazon 2014, Intensive Operating Period (IOP2), from August 15 to October 15.

Keywords: Cirrus Clouds; Cloud Radiative Effect; GoAmazon.

IXWLMLA Topic: Lidar applications in environmental sciences.