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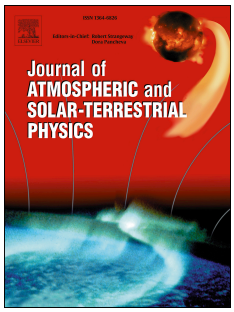

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PII: S1364-6826(17)30650-8

DOI: 10.1016/j.jastp.2018.08.013

Reference: ATP 4908

To appear in: *Journal of Atmospheric and Solar-Terrestrial Physics*

Received Date: 16 November 2017

Revised Date: 7 August 2018

Accepted Date: 20 August 2018

Please cite this article as: Motty, G.S., Satyanarayana, M., Jayeshlal, G.S., Krishnakumar, V., Mahadevan Pillai, V.P., Lidar observed structural characteristics of higher altitude cirrus clouds over a tropical site in Indian subcontinent region, *Journal of Atmospheric and Solar-Terrestrial Physics* (2018), doi: 10.1016/j.jastp.2018.08.013.

Lidar observed structural characteristics of higher altitude cirrus clouds over a tropical site in Indian subcontinent region

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Abstract

In this study, the structure and dynamics of tropical cirrus clouds were characterized based on their microphysical properties. The altitude and temperature dependence of the microphysical properties, their interdependence and the most probable shape of the crystals in cirrus clouds were investigated. Studies on the effective size distribution of ice particles, which decides the lifetime of the cirrus clouds is important to understand the radiative properties of the clouds. The small sized crystals having low fall velocities undergo homogeneous nucleation processes resulting in cirrus with longer life time. The microphysical properties of these tropical cirrus, and the role of fall velocity in radiative transfer are discussed from the data obtained using the ground based lidar system over the tropical site Gadanki [13.5° N, 79.2°E], India over a period of 5 years from 2006 to 2010. The CALIPSO satellite based CALIOP lidar observations are used to fortify the ground based observation. It is noted that the life time of the cirrus is enhanced due to the decrease in cloud temperature.

Keywords: Cirrus clouds; Lidar; CALIPSO; extinction coefficient; optical depth; mid cloud temperature; lidar ratio; depolarization ratio; crystal shape; fall velocity.

1. Introduction

High altitude cirrus clouds in the range between 8 to 20 km, have an important place in sustaining the energy budget (Liou, 1986; McFarquhar et al., 2000) of the earth atmospheric system by interacting with the solar radiation (Stephens et al., 1990).Ice clouds reflect solar radiation effectively back to space, which is called the albedo effect and absorb thermal emission from the ground and lower atmosphere, through the greenhouse effect (Stephens et al., 1990).The microphysical conditions of these clouds have primary responsibility in radiative