



Possible relationship of meteor disintegration in the mesosphere and enhancement of sodium atoms: A case study on July 05, 2013

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Abstract

Our observations show that on some occasions an influx of meteor ablation possibly contributes to appearance of a sudden enhancement in mesospheric sodium density. On July 05, 2013, all-sky images with a narrow sodium filter in the 589 nm emission, operating at Cachoeira Paulista (22.7° S, 45° W) and lidar observations of the mesospheric sodium layer, operating at São José dos Campos (23.1° S, 45.9° W), both observatories in Brazil, show a possible relationship of meteor disintegration and appearance of sodium enhancements on the background layer. After the meteor impact, the all-sky images showed a sodium cloud that was seen for about 10 min through the images in the NaD 589 nm emission, with initial dimensions of approximately 36 km × 9 km and initial speed of about 90 m/s southward. In addition, our observations show that the movement of sodium cloud in the horizontal plane around 90 km is relatively anisotropic and change the dimensions with time.

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Keywords: Sodium Lidar; All-sky images; Sodium cloud

1. Introduction

The novelty of the present study is the rarely reported observation of meteor ablation detected by all-sky system, showing the increase in the NaD 589 nm emission in the region of meteor explosion, that indirectly, represents an increase of sodium density. The increase in the sodium density around the meteor explosion, reported in the present study, has similar characteristics to the sporadic sodium layers N_{as} reported in the literature. However, it differs in relation to N_{as} layer width.

It is well established in the literature that the width of the N_{as} has a range of 1 km to 2 km full-width at half maximum (FWHM). The event reported in this study has a range of 3 km to 7 km FWHM and consequently we are not treating it as a N_{as} . Since the early report of a sporadic sodium layer by Clemesha et al. (1978), also called Sudden Sodium Layer by von Zahn et al. (1987), many experiments have been conducted in order to study the origin and the behavior of N_{as} . The sporadic layer is a narrow layer in which a sudden increase of sodium is observed. The thicknesses of the layer are on the order of 1 km to 2 km (FWHM). They are often observed to appear in a matter of minutes, but can persist for as long as a few hours, and then disappear rapidly. Occur at altitudes between 90 km and 110 km with peak around 93 km and the ratio of the N_{as} density to the Na background layer have concentrations between 2 and 20 times (Batista et al., 1989; Kane

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