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TITLE: Simultaneous and Common-Volume Lidar Observations of Mesospheric Fe and Na Layers at Boulder: Main Layers, Sporadic Layers, and Meteor Trails

PRESENTATION TYPE: Assigned by Committee (Oral or Poster)

CURRENT SECTION/FOCUS GROUP: SPA-Aeronomy (SA)

CURRENT SESSION: SA03. Chemistry and Temperatures in the Upper Mesosphere/Lower Thermosphere

AUTHORS (FIRST NAME, LAST NAME): Wentao Huang[1], Xinzhao Chu[1], Zhangjun Wang[1], Weichun Fong[1], Zhibin Yu[1], John A. Smith[1], Brendan Roberts[1]

INSTITUTIONS (ALL): 1. CIRES, Univ. of Colorado at Boulder, Boulder, CO, United States.

Title of Team:

SPONSOR NAME: Wentao Huang

ABSTRACT BODY: The rich features of the mesospheric metal layers are produced by the complicated chemical and dynamical processes in the Upper Mesosphere/Lower Thermosphere region. Current chemical models with parameterized inputs are able to reproduce some large-scale structures but challenged in small-scale features. Simultaneous and common-volume observations of multiple species provide crucial data to help reveal the determining mechanisms in small scales and validate the models. Such simultaneous observations of Fe and Na layers are still rare, despite several reports based on one or a few nights of data, and one extensive study at Wuhan (30°N), China. In summer and fall 2010, we made over 16 nights of simultaneous Fe and Na observations at Boulder (40°N, 105°W) with two resonance lidars: an Fe Boltzmann temperature lidar and a 3-frequency Na Doppler lidar. The data show the primary characteristics of Fe vs. Na layers, e.g., higher Fe density and column abundance, lower Fe peak and centroid altitude, larger density gradient at the bottom of Fe layer, similar to previous reports at mid-latitude. The altitudes of lower boundaries for both species are similar and closely follow each other, while the upper boundary of Na layer normally extends to higher altitude. Moreover, we introduce a method of using the relative density perturbations to analyze the simultaneous measurements, which is powerful to reveal the correlated density variations for both species in the main and sporadic layers. Differences in the amplitude and phase are noticed in a few cases. On 11 August 2010, two lidars caught meteor trails of Perseids meteor shower, which may have increased the column abundance of both Fe and Na layers. At last, the temperature profiles obtained simultaneously by the lidars for most of the nights will provide unique and critical information for future modeling efforts.

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