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CONTROL ID: 1199837

TITLE: Diurnal Variations of Meteoric Fe Layers in the Mesosphere and Lower Thermosphere at McMurdo (77.8°S, 166.7°E), Antarctica

PRESENTATION TYPE: Assigned by Committee (Oral or Poster)

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

CURRENT SESSION: SA02. Advances in Geospace Research From Antarctica

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ABSTRACT BODY: As one of the main metal species in the mesosphere and lower thermosphere, neutral Fe layers provide an excellent tracer for studying atmospheric dynamics and chemistry. Unfortunately, most Fe measurements were made in the night, except a few reports from the Antarctic and Arctic. So far studies of the diurnal variations of Fe layers are very rare. This situation poses interesting questions like how Fe layers vary through a diurnal cycle, whether such variations change with seasons, and what mechanisms contribute to the diurnal variations. To help address this issue, we report the diurnal variations of Fe densities, based on our lidar observations made at McMurdo, Antarctica. The data were collected with an Fe Boltzmann lidar since late December 2010 through austral autumn, winter and spring in 2011, covering the states of polar days under full sunlight, alternations between day and night, and polar nights under total darkness. By taking composite days, we obtain 24-h Fe coverage for every month, allowing relatively detailed study of the diurnal variations. Our preliminary analyses show an interesting phenomenon that the bottom boundary of Fe layers extends downward from ~80 km to ~75 km or lower when switching from night to day. This phenomenon is obvious in continuous (straight) 24-h data as well as in composite 24-h data during March and April when the sunlight conditions have day and night switches. The results indicate that photochemistry, rather than wave dynamics, may play an essential role in determining the Fe layer bottom. No obvious diurnal variations are observed in polar summer and mid-winter; however, the layer bottom altitude descends for several kilometers from polar day to polar night. These likely reflect the influences of temperatures, waves, mesospheric clouds and aurora activities.

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INDEX TERMS: [0340] ATMOSPHERIC COMPOSITION AND STRUCTURE / Middle atmosphere: composition and chemistry.

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