In this paper we report the first lidar observations of polar middle and upper atmosphere at McMurdo, Antarctica, and present the newest science discoveries. These include the first-ever observations of neutral Fe layers with gravity wave signatures in the thermosphere from 110-155 km. Frequent occurrence of sporadic Fe layers and extremely active variations of main Fe layers are also unique among other lidar observations of metal species. These results of neutral Fe atoms challenge our understanding of the upper atmosphere composition, chemistry, dynamics and thermal structure. Furthermore, PMC data in the first summer season of 2010-2011 confirm previous reports of the inter-hemispheric difference in PMC mean centroid altitude. By combining the McMurdo observations with those obtained at the South Pole and Rothera, we find that the latitudinal dependence of mean PMC altitude is statistically significant with a slope of $40 \pm 3$ m/deg. Lidar observations provide direct evidence that the cold phase of wave-induced temperature oscillations facilitates PMC formation and Fe depletion.

http://cires.colorado.edu/science/groups/chu/projects/mcmurdo.html

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