

***Interactive comment on “A middle latitude  
Rayleigh-scatter lidar temperature climatology  
determined using an optimal estimation method”  
by Ali Jalali et al.***

**Anonymous Referee #1**

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The paper presents a comprehensive investigation on a new and improved approach (Optimal Estimation Method) to analyze Rayleigh lidar signal so that the traditional Rayleigh lidar range can be extended to mesopause region. The author also quantifies the temperature uncertainty from each of the potential source and compares them with the traditional results. Based on the comparison work between the new Rayleigh climatology and those in the literature, including the traditional Rayleigh climatology and Na lidar climatology, this new algorithm demonstrates better performance than the traditional one by Hauchecorne and Chanin (1980). More importantly, it enables the Rayleigh lidar measurement into mesopause region. This paper is a high quality, well written scientific work and will have big impact on Rayleigh lidar community. I

C1

am confused by the statement on the value of Au 0.9 and 0.8, such as “. . . the height above which the temperature profile is more than 90% (0.9) and 80% (0.8) due to the measurements”, which appears in several figure captions. This seems to contradict to the statement on “a priori” on page 8 line 14-16, “the choice of a priori has little effect” below the cut off height “on retrieved temperature. . .”. I can understand the latter statement, but the former one, seems to me, would be other way around. So, I would appreciate if the author could clarify either one of the statement in the revision. The author argues the large “geophysical variability” in January, peaked at 41 km, is related to SSW (page 9 line 18-19). However January has the least amount of measurements based on Table 1. Could the lack of measurement contribute to this large “geophysical variability”? In addition, SSW would have impact all the way up to the middle latitude upper mesosphere (Yuan et al., 2012), but the variability is small between 70 km and 80 km in Figure 4 and the author contributes the large variability between 60 km and 70 km to MILs . So, I am not convinced the “geophysical” nature of these large variability as the author states.

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C2