

Statistical study of Sporadic Sodium Layer (SSL) in the polar MLT region

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Based on about 3300 hours of sodium density data obtained with the Tromsø sodium LIDAR over 7-year winter seasons between October 2012 and February 2018, we have identified 36 events of Sporadic Sodium Layer (SSL) in the polar mesosphere and lower thermosphere (MLT) region. Averaged values of the maximum density, the strength factor, and the thickness are $1.3 \times 10^{10} \text{ m}^{-3}$, 11.1, and 1.3 km, respectively. We have investigated an occurrence rate of sporadic sodium layer (SSL) as well as necessary conditions for a SSL to form in the polar MLT region. SSLs appeared for shorter than 3 % of the overall observational time, indicating it is a rare event in polar winter during the observed interval. Auroral electron precipitation as well as existence of a sporadic E layer would be necessary conditions for SSL forming. We have investigated whether or not the sodium LIDAR observed a development of SSL or an advected SSL; we have found that 29 events of 36 events (80%) were probably advected: they moved from north in the meridional direction. This suggests a SSL is usually generated at higher latitude than 70 degrees N. Furthermore, we investigated roles of wind to generate a SSL, and then we have discussed necessary conditions for forming a SSL.