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### STUDY ON GENERATION MECHANISMS OF A SPORADIC SODIUM LAYER ABOVE TROMSOE, NORWAY DURING A NIGHT OF THE HIGH AURORA ACTIVITY

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We have evaluated generation mechanisms for a sporadic sodium layer (SSL) by using data obtained with the sodium LIDAR, the EISCAT UHF radar, the meteor radar, and the photometer at Ramfjordmoen, Tromsø, Norway (69.6deg N, 19.2deg E). A SSL suddenly appeared at 2118 UT on 22 January 2012 and lasted for 22 min with the peak sodium density of  $1.7 \times 10^{10} \text{ m}^{-3}$  at about 94 km. The EISCAT UHF radar observed a sporadic E layer (Es layer) from 1940 to 2330 UT above 90 km for the same night. At 2000 UT, the Es layer appeared at about 105 km and moved down and reached to about 94 km at 2118 UT, and the Es layer stayed at the almost same altitude (about 94 km) with the SSL for 22 min. A number of previous studies suggested that SSLs were generated by converting sodium ions in Es layers into sodium atoms [cf., Cox and Plane, 1998]. We, however, have found that the Es layer were able to provide 40 % or less amounts of sodium atoms to the SSL in this event. Possible another candidate of generation mechanisms is transportation of sodium ions due to the strong electric field. The direction of the electric field measured with the EISCAT UHF radar was south-westward with the strength of between 17 and 33 mV/m, which could cause downward ion motion from 2040 to 2110 UT. We have investigated temporal development of the sodium atom density with consideration a combined process of chemical reactions and vertical motion of sodium ions due to the electric-magnetospheric (so-called ExB) force in the collisional system. This calculation has shown that this process would provide about 80% sodium atom density of the SSL.

We have derived temperature with a 15 second and 480 m resolution using the LIDAR data, and have found no remarkable temperature enhancements inside the SSL for 22 minutes after the appearance at 2118 UT. Furthermore, during the SSL event the background temperature was lower than that for other time intervals. The reaction rate between sodium ion and sodium atom becomes higher when the background temperature becomes lower. Therefore, we have concluded that (1) the SSL was generated by conversion of sodium ions into sodium atoms, and (2) sodium ions were supplied by combination of the Es layer and the ion concentration due to the electric field: the latter contribution was higher than the former.