Temporal evolutions of N_2^+ Meinel (1,2) band near 1.5 µm associated with aurora breakup and their effects on mesopause temperature estimations from OH Meinel (3,1) band

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We have carried out ground-based NIRAS (Near-InfraRed Aurora and airglow Spectrograph) observations at Syowa station, Antarctic (69.0°S, 39.6°E) and Kiruna (67.8°N, 20.4°E), Sweden for continuous measurements of hydroxyl (OH) rotational temperatures and a precise evaluation of aurora contaminations to OH Meinel (3,1) band. A total of 368-nights observations succeeded for two winter seasons, and three cases in which N_2^+ Meinel (1,2) band around 1.5 µm was significant were identified. Focusing on two specific cases, detailed spectral characteristics with high temporal resolutions of 30 seconds are presented. Intensities of N_2^+ band were estimated to be 228 kR and 217 kR just at the moment of the aurora breakup and arc intensification during pseudo breakup, respectively. At a wavelength of $P_1(2)$ line (~ 1523 nm), N_2^+ emissions were almost equal to or greater than the OH line intensity. On the other hand, at a wavelength of $P_1(4)$ line (~ 1542 nm), the OH line was not seriously contaminated and still dominant to N_2^+ emissions. Furthermore, we evaluated N_2^+ (1,2) band effects on OH rotational temperature estimations quantitatively for the first time. Aurora contaminations from N_2^+ (1,2) band basically lead negative bias in OH rotational temperature estimated by line-pair-ratio method with $P_1(2)$ and $P_1(4)$ lines in OH (3,1) band. They possibly cause underestimations of OH rotational temperatures up to 40 K. In addition, N_2^+ (1,2) band contaminations were temporally limited to a moment around aurora breakup. This is consistent with proceeding studies reporting that enhancements of N_2^+ (1,2) band were observed to be associated with International Brightness Coefficient 2-3 auroras. It is also suggested that the contaminations would be neglected in the polar cap and sub-aurora zone, where strong aurora intensification are less observed. Further spectroscopic investigations at these wavelengths are needed especially for more precise evaluations of N_2^+ (1,2) band contaminations. For example, simultaneous 2-D imaging observation and spectroscopic measurement with high spectral resolutions for airglow in OH (3,1) band will make great advances in more robust temperature estimations.