

Generation mechanism for temporary wintertime sporadic E layer intensification: Possible links with lower atmospheric variations

*安藤 慧^{1,2}、齊藤 昭則¹、品川 裕之²

*Satoshi Andoh^{1,2}, Akinori Saito¹, Hiroyuki Shinagawa²

1. 京都大学大学院理学研究科、2. 情報通信研究機構

1. Graduate School of Science, Kyoto University, 2. National Institute of Information and Communications Technology

We provide a mechanism for temporary wintertime sporadic E layer intensification (WESLI) in 2009. It is widely accepted that EsL intensity exhibits the minimum in winter partially because vertical wind shears that are crucial for EsL formations are weak in winter. Despite the wintertime minimum, it is known that temporary EsLI occurs for 10–30 days in the wintertime. A possible mechanism is considered to be abundant metal ions provided by the major meteor showers such as the Geminid meteor shower. However, temporary WESLI has occurred in 2009 not accompanied with the major meteor showers. Its cause has remained unclear. In this study, EsL simulations were conducted from 24 to 54 day of year in 2009, 2010, and 2011. The simulations exhibited that temporary WESLI occurred during the period in 2009, but not in 2010 and 2011, which reproduced successfully ionosonde observations at Kokubunji, Japan. We found that the temporary WESLI is attributed to vertical ion convergence (VIC) intensification at the altitudes of 100–120 km between 4 and 8 LT and especially after 15 LT. The VIC intensification is caused by intensified vertical wind shears of the SW2/DW1 tides. Drivers of the SW2/DW1 tidal amplifications in 2009 can be zonal mean zonal wind variations owing to a sudden stratospheric warming and tidal modulations by planetary waves.

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