

**R005-P40**

ポスター 3 : 11/25 PM1/PM2 (13:15-18:15)

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## **Modelling of three-dimensional structure and dynamics of the large-scale sporadic E layers over East Asia**

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Sporadic E (Es) layers are thin layers of concentrated metallic ions in the mesosphere and lower thermosphere (MLT) region. Their formation and evolution are deeply modulated by atmospheric dynamics, indicating that they can serve as indicators of atmosphere-ionosphere coupling processes. Currently, the three-dimensional (3-D) Es layer structure and evolution process have not yet been fully understood. In this study, we investigated the structural and dynamic characteristics of the large-scale Es layers over East Asia by using a 3-D Es layer numerical model driven by neutral winds from the Whole Atmosphere Community Climate Model with thermosphere and ionosphere eXtension model (WACCM-X). The simulation results show that the Es layer is a tilted structure rather than a narrow flat blanket. In addition, the Es layers mainly occur in the 3-D spatial position of the convergent vertical wind shear. The apparent velocity (~300-400 m/s) of Es layers is mostly westward and northward, which is different from the ion drift velocity (~100 m/s). This indicates that Es layer can develop rapidly over a large area rather than drifting gradually. This study systematically analyzed the physics of the 3-D Es layer, which can be helpful for understanding the observations recorded by different instruments, such as satellites and ground-based receiver networks.