# Study of generation of midlatitude field-aligned irregularities with 3-D simulation

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Observations of the midlatitude E-region field-aligned irregularities (FAI) with the MU radar show that distinctive quasi-periodic (QP) echoes frequently appear with more than 30 km height extent, which cannot be explained by horizontally stratified sporadic-E (Es) layers. We have developed a 3-D simulation to study structures of Es layers, and generation of the polarization electric field as a source of FAI. In our simulation space, fluid equations for ions and electrons are solved numerically. When rod-like enhancements of plasma density exist at the Es layer height, intense polarization electric fields can be generated by an ambient electric field or neutral wind. Even if the length of the plasma rod is finite, or, only a small spherical shape, the polarization electric fields can be sustained through the field-aligned current coupling between E- and F-region. The generated polarization electric fields map along the geomagnetic field and form plasma density structure. It is expected that such a large polarization electric field at the lower ¥E-region is not a special phenomenon but frequently generated through this mechanism. These results support the observational results of the QP echoes at more than 120 km altitude and the electric fields detected with the SEEK rocket experiment.