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Sporadic E layers in the polar region and their response to the geomagnetic storm in May 2024

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Sporadic E layers are thin regions of enhanced electron density appearing in the E-region of Earth's ionosphere. Due to their large vertical electron density gradients, the layer are strongly disturbing global communication and navigation signals. Their footprint appears as strong fluctuations in the Signal-to-Noise ratio profiles of GNSS radio occultation measurements.
In this study, we focused on the layers'appearance in the northern polar region with a special focus on the period in May 2024 when a series of geomagnetic storms occurred after the Sun produced multiple intense solar flares and coronal mass ejections. This period is considered as the most powerful storm affecting the Earth since March 1989.
We are using ionosonde and GNSS radio occultation measurements to observe the unusual behaviour of sporadic E layers during these days. A special type of sporadic E layers, the so-called auroral type or Esa type, usually forms during times of particle influx in the auroral region. During the storm, we could observe the Esa type in central Europe coinciding with polar light displays. The radio occultation SNR profiles recorded at similar regions showed an exceptional high background noise. Further, the sporadic E occurrence rate and intensity strongly increased during and slightly after the storm period especially in the auroral region.

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