InSARで捉えたスポラディックE層の非分散性成分の解釈

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An interpretation on the non-dispersive phase during the Es detected by InSAR

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Maeda et al. (2016, GRL) first succeeded in demonstrating an Es episode in Japan, using both GNSS TEC and an InSAR image derived from the Advanced Land Observation Satellite/Phased Array L-band Synthetic Aperture Radar (ALOS/PALSAR); ALOS was launched in 2006 by Japan Aerospace Exploration Agency (JAXA). Maeda et al. (2016) could attribute the phase anomalies in the InSAR image to the Es episode, given the nearly identical location of the phase anomalies in InSAR data to those derived from GNSS TEC data.

We should note, however, that GNSS TEC is physically distinct from what InSAR phase anomaly indicates, because InSAR phase includes not only dispersive signal due to TEC but also non-dispersive phase delay that has been mostly attributed to polar molecules in the troposphere. In contrast to the dual frequency measurement by GNSS, SAR imaging has been performed with a single carrier frequency, and no-operational corrections for ionosphere have been done so far. However, it has been demonstrated that split-spectrum method (SSM) could virtually perform dual frequency imaging, thereby allowing for possibly operational correction of dispersive effects (Gomba et al. 2016, IEEE TGRS).

Applying the SSM InSAR to two Es episodes in Japan, we observe that small-scale dispersive signals due to the Total Electron Content (TEC) anomalies are accompanied with non-dispersive signals with similar scale at the same locations. We interpret that the latter non-dispersive signals would indicate the emergence of nitric oxide (NO) generated by the reaction of metals, Mg and Fe, with nitric oxide ion (NO^+) during the Es. We discuss the implications for the observed Es signals.