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Ground-based observations of stratospheric NO_2 increase over Europe associated with the October 2003 solar proton events

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Data of spectrometric ground-based measurements of stratospheric column NO_2 contents (SC NO_2) within Network for the Detection of Atmospheric Composition Change (NDACC) are analyzed. Episodes of a significant increase in SC NO_2 were detected at European NDACC stations of Zvenigorod (55.7°N, 36.7°E) and Harestua (60.2°N, 10.8°E) in the middle latitudes, and Sodankyla (67.4°N, 26.6°E), and Kiruna (67.8°N, 20.4°E) in the high latitudes. The NO_2 increase is associated with the air transport from the polar stratosphere region with significantly enhanced NO_x produced by the strong solar proton events at the end of October 2003, and the amplitude of the observed SC NO_2 increase diminishes toward the lower latitudes. The NO_2 vertical profiles derived from NO_2 measurements at Zvenigorod show an increase in the NO_2 concentration in the upper stratosphere in the end of October by 52%, and one third of the increase may be related to the effect of the October proton event.