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Study of solar variability impact on nitrogen dioxide: 2004-2013

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Nitrogen dioxide (NO_2) locally plays an important role in the radiation budget by absorbing solar radiation at ultraviolet (UV) and visible wavelengths. The influence of solar variability on the inter-annual variability and trends in nitrogen dioxide is evaluated for a period of 10 years (2004-2013) using monthly mean tropospheric NO_2 measurements of the Ozone Monitoring Instrument (OMI) version 2.0. Possible signatures of solar variability on nitrogen dioxide time series of NO_2 over several cities were analyzed using various statistical methods. Various solar proxies were selected, in order to separate between possible links to solar irradiance and to solar wind. Several locations with different levels of pollution, located in different places of the world (Athens, Jungfraujoch, Lauder, Lisbon, Moscow, and Uccle), were selected. Observations show a clear 27 day period of the NO_2 tropospheric Vertical Column Density (VCD) or total Slant Column Density (SCD). NO_2 content decreases with increasing activity above polluted areas (e.g. Athens, Moscow) while for unpolluted areas there is no evident correlation (e.g. Lauder, Jungfraujoch). Possible effects of solar wind on NO_2 content are observed as well, but the relationship is less clear, since polluted areas seem to respond differently to solar wind variations. The mechanism by which NO_2 content can be affected by solar variations relate mainly to ozone production but other paths by which solar energy may be transferred to the lower atmosphere are investigated.