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The influence of the springtime total ozone on summer UV radiation in the Northern Hemisphere

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The link between stratospheric ozone decline and ultraviolet (UV) radiation increase at the Earth's surface is well established. In the Northern Hemisphere extratropics, stratospheric ozone is accumulated from autumn to spring due to transport from the Tropics where it is produced. The amount of accumulated ozone varies from year to year due to natural dynamical variability and chemical destruction by natural and anthropogenic substances. Observational and modeling studies show that these total ozone anomalies persist in the extratropics from spring to summer. In this study we analyze time series of ground-based and satellite measurements of UV radiation and total ozone and demonstrate a link between springtime total ozone and summer UV anomalies in the Northern Hemisphere extratropics. The interannual variability in springtime ozone abundance can explains up to 20–40% of the summer UV variability in some regions, which has implications for seasonal UV forecasts. According to chemistry transport model calculations, the massive Arctic ozone depletion 2011 increased the March–August cumulative erythemal clear-sky UV dose in the Northern Hemisphere extratropics (north of 35°N) by 3–4% compared to the climatology, with about 75% of the increase accumulated after the breakup of the polar vortex. This result strongly suggests that the effect of seasonal ozone anomaly persistence should be included in the assessment of the impacts of polar ozone losses. [Reference: Karpechko et al. The link between springtime total ozone and summer UV radiation in Northern Hemisphere extratropics, J. Geophys. Res. Atmos., 118, 8649–8661, doi:10.1002/jgrd.50601]