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Trends in atmospheric ozone from long-term ozone climatology

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Ozone is an important trace gas in the atmosphere, playing a significant role in atmospheric chemical, dynamical, and radiative processes. It is also a major pollutant. In this presentation, a three-dimensional (latitude, longitude, altitude) climatology of tropospheric and stratospheric ozone is presented. This ozone climatology is derived from the global ozonesonde sounding record comprising 51 898 profiles at 116 stations over 44 yr (1965-2008), by a domain-filling trajectory mapping method. The trajectory technique provides a powerful tool to integrate sparse ozonesonde measurements, by filling in the spatial domain. This physically-based trajectory mapping method offers evident advantages over typical statistical interpolation methods.

This ozone climatology is latitudinally, longitudinally, and vertically resolved and it offers more complete high latitude coverage as well as a much longer record than current satellite data. As the climatology depends on neither a priori data nor photochemical modeling, it provides independent information and insight that can supplement satellite data and model simulations of stratospheric ozone.

One of the objectives to create this ozone climatology is for trend analysis. The climatology clearly shows the depletion of ozone from the 1970s to the mid 1990s and ozone increases until the middle of the 2000s in the lower stratosphere. The ozone trends over the globe, the Arctic, and the Antarctic are analyzed by season. All regions show ozone depletion from the 1970s to the 1990s and ozone increases until the middle of the 2000s. The decadal variation is larger in the winter season than in the summer season in both hemispheres, presumably because of chemical ozone loss in polar winter. Ozone trends in the troposphere over North America will also be discussed.

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