An updated version of a gap-free monthly mean zonal mean ozone database

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An updated and improved version of a global, vertically resolved, monthly mean zonal mean ozone database has been calculated – hereafter referred to as the BSVertOzone database. Like its predecessor, it combines measurements from several satellite-based instruments and ozone profile measurements from the global ozonesonde network. Monthly mean zonal mean ozone concentrations in mixing ratio and number density are provided in 5° latitude zones spanning 70 altitude levels (1 to 70 km), or 70 pressure levels that are approximately 1 km apart (878.4 hPa to 0.046 hPa). Different "Tiers" of data are provided: "Tier 0" is based only on the available measurements and therefore does not completely cover the whole globe or the full vertical range; the "Tier 0.5" monthly mean zonal means are calculated from a filled version of the Tier 0 database where missing monthly mean zonal mean values are estimated from correlations at level 20 against a total column ozone database and then at levels above and below on correlations with lower and upper levels respectively. The Tier 0.5 database includes the full range of measurement variability and is created as an intermediate step for the calculation of the "Tier 1" data where a least squares regression model is used to attribute variability to various known forcing factors for ozone. Four different combinations of contributions from selected regression model basis functions result in four different Tier 1 data sets that can be used for comparisons with chemistry-climate model simulations that do not exhibit the same unforced variability as reality (unless they are nudged towards reanalyses).

Compared to previous versions of the database, this update includes additional satellite data sources and ozonesonde measurements to extend the database period to 2016. Additional improvements over the previous version of the database include: (i) adjustments of measurements to account for biases and drifts between different data sources (using the TOMCAT/SLIMCAT chemistry-transport model simulation as a transfer standard), (ii) a more objective way to determine the optimum number of Fourier and Legendre expansions for the basis function fit coefficients, and (iii) the derivation of uncertainties on each database value are traced through all data modification steps. Comparisons with another measurement-based ozone database show excellent agreements in many regions of the globe, and minor differences caused by different bias adjustment procedures for the two databases.

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