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The influence of the Brewer-Dobson circulation on the seasonal cycle of total ozone

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The effect of the winter Brewer-Dobson circulation on the seasonal evolution of total ozone in both hemispheres is investigated using total ozone data from GOME, SCIAMACHY, and GOME2 (1995-present). Combining data from both hemispheres a linear relationship between the cumulative extratropical 100 hPa eddy heat flux derived from different re-analyses (ERA-40, ERA Interim, NCEP) and the ozone ratio with respect to fall ozone levels is found and being statistically significant for tropical as well as polar ozone. The high correlation at high latitudes persists well into the summer months until the onset of the next winter season. The anti-correlation of the cumulative eddy heat flux with tropical ozone ratios, however, breaks down in spring as the polar vortex erodes and changes to a weak positive correlation similar to that observed at high latitudes. The seasonal and inter-annual variability of ozone in all seasons is driven by the cumulative effect of the previous winter's meridional circulation as expressed by the cumulative extra-tropical eddy heat flux. This compact linear relationship is also found in two different global climate models (FUB-CMAM, DLR-ECHAM E39C-A) indicating that current models realistically describe the variability in stratospheric circulation and its climate effect on total ozone.