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Search for evidence of trend slow-down in the long-term TOMS/SBUV total ozone data record: the importance of instrument drift uncertainty

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Abstract. We have developed a merged ozone data set (MOD) for the period October 1978 through June 2006 combining total ozone measurements (Version 8 retrieval) from the TOMS (Nimbus 7, Earth Probe) and SBUV/SBUV2 (Nimbus 7, NOAA 9/11/16) series of satellite instruments. We use the MOD data set to search for evidence of ozone recovery in response to the observed leveling off of chlorine and bromine compounds in the stratosphere. A crucial step in any time series analysis is the evaluation of uncertainties. In addition to the standard statistical time series uncertainties, we evaluate the possible instrument drift uncertainty for the MOD data set. We combine these two sources of uncertainty and apply them to a cumulative sum of residuals (CUSUM) analysis for trend slow-down. For the extra-polar mean between 60° S and 60° N, the apparent slow-down in trend is found to be clearly significant if instrument uncertainties are ignored. When instrument uncertainties are added, the slow-down becomes marginally significant at the 2 σ level. For the mid-latitudes of the northern hemisphere (30° to 60° N) the trend slow-down is highly significant at the 2 σ level, while in the southern hemisphere the trend slow-down has yet to meet the 2 σ significance criterion. The rate of change of chlorine/bromine compounds is similar in both hemispheres, and we expect the ozone response to be similar in both hemispheres as well. The asymmetry in the trend slow-down between hemispheres likely reflects the influence of dynamical variability, and thus a clearly statistically significant response of total ozone to the leveling off of chlorine and bromine in the stratosphere is not yet indicated.

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