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Improved uncertainty estimates in the SWOOSH merged data set and implications for understanding long-term water vapor variability

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The Stratospheric Water Vapor and OzOne Satellite Homogenized (SWOOSH) data set is a vertically-resolved monthly-mean gridded data record that merges data from a number of limb sounding and solar occultation satellite instruments, including the SAGE instruments, UARS MLS, UARS HALOE, and Aura MLS. SWOOSH includes both individual satellite source records as well as a merged data product. A key aspect of the merged product is that the source records are homogenized to account for inter-satellite biases and to minimize artificial jumps in the record, which involves adjusting the satellite data records to a "reference" satellite using coincident observations taken during time periods of instrument overlap.
Previously, SWOOSH uncertainty estimates for the merged timeseries included terms related to the homogenization adjustment, instrument precision, and a rough estimate of sampling uncertainty which only included the number of samples in a bin.

In this presentation, we discuss progress towards improved SWOOSH uncertainty estimates, including efforts to quantify uncertainties associated with spatial and temporal sampling inhomogeneities. Overall, these sampling uncertainties are small during the Aura MLS period, but are substantial in the early part of the record. The impact of accounting for sampling uncertainty is discussed in the context of understanding long term variability and change in stratospheric water vapor, with a focus on comparisons with the Boulder frostpoint hygrometer balloon record.