Characterizing Sampling and Screening Biases in Solar Occultation and Limb Sounders

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We will show the effect of sampling and quality screening on satellite measurements of temperature and several trace gases in terms of biases and the induced changes in trends and their detectability. We calculate these sampling/screening induced artifacts by interpolating CMAM30-SD model fields (used as a proxy for the real atmosphere) to real sampling patterns of four satellite instruments: Aura MLS, MIPAS, HALOE, and ACE-FTS. First, the contrast between using a dense and relatively uniform sampling pattern (such as the ones provided by MIPAS or MLS) versus a coarse non-uniform sampling pattern (such as provided by ACE-FTS or HALOE) is discussed. Then, the impact of screening biases is studied by comparing MIPAS and MLS sampling and screening patterns. Both these instruments have dense uniform sampling patterns typical of limb emission sounders, producing almost identical sampling biases. However, there is a substantial difference between the number of locations discarded. MIPAS, as a mid-infrared instrument, is very sensitive to clouds, and measurements affected by them are thus rejected from the analysis. For example, in the tropics, the MIPAS yield is strongly affected by clouds, leading to screening biases, while MLS is mostly unaffected (although its penetration is limited to the upper troposphere, while MIPAS can observe well into the mid troposphere in cloud-free scenarios).

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