Selection bias of quasi-fixed-point observations in the ExUTLS and its impact on the seasonal record

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Fixed-point observations are essential for long-term monitoring of the atmospheric environment. However, some attention might be paid to the interpretation of seasonal variations appearing in the observational record, particularly for regions with large seasonal variations. In the extra-tropical upper troposphere/lower stratosphere (ExUTLS), the climatological tropopause height changes with season. This leads to a seasonal dependence of whether individual fixed-point observations are included in the stratosphere or the troposphere. In this study, using the reanalysis fields, quasi-fixed-point observations in the ExUTLS are simulated and categorized as being in the troposphere or stratosphere based on their position relative to the dynamic tropopause, to investigate seasonal tendencies of the categorization. The influence of these tendencies on seasonal variations of atmospheric composition in the categorized data is estimated. The seasonal cycles of CH_4, N_2O and SF_6 mixing ratios are found to change with the categorization method. In particular, the minimum values for these tropospheric tracers in observations categorized as stratospheric occur 1–2 months later than in uncategorized observations. This delay in stratospheric record is interpreted as the selection bias, that is, the air mass categorized as the stratospheric atmosphere biased to some specific meteorological situation due to the seasonal variation of ExUTLS meteorological field.

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