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Proposed standardized definitions and approaches for vertical resolution and uncertainty in the NDACC ozone DIAL algorithms

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Standardized definitions of vertical resolution and a standardized approach for the definition, propagation and reporting of uncertainty in the ozone lidar profiles contributing to the Network for the Detection for Atmospheric Composition Change (NDACC) database were recently developed.

Two standardized definitions that describe homogeneously and unequivocally the impact of vertical filtering were recommended. The first definition is based on the width of the response to a Finite Impulse-type perturbation. The second definition relates to the cut-off frequency of a digital filter. Both definitions yield approximately the same values. Numerical tools (routines written in several programming languages) were developed and distributed to lidar investigators in order to implement these standardized definitions within the entire network NDACC, as well as across the tropospheric ozone network TOLNet.

The proposed approach for the introduction and propagation of uncertainty in the NDACC ozone DIAL algorithms relies on the careful selection of independent uncertainty components propagated in parallel through the data processing chain before being combined together into an ozone combined standard uncertainty. The uncertainty sources contributing to the uncertainty budget include detection noise, saturation correction, background noise extraction, the absorption cross-sections of ozone, NO₂, SO₂, and O₂, the molecular extinction cross-sections, and the number densities of the air, NO₂, and SO₂.

The network-wide implementation of the proposed standardized definitions and approaches now allows a clear interpretation of the effective vertical resolution of lidar profiles when compared to profiles measured by other instruments/techniques, and allows a clear understanding and interpretation of the quality and limitations of the lidar measurements within NDACC and TOLNet. A review of these definitions and approaches and the implication for future data intercomparisons will be presented at the Symposium.