Appendix III – Microwave Instruments

The following covers the validation process for new microwave instruments, and the criteria for maintaining existing instruments in the NDACC. The NDACC-designated species measured by the microwave spectrometers are chlorine monoxide (ClO), water vapor (H_2O), and ozone (O_3). This description is intended to apply to the determination of their vertical profiles.

Quality Criteria for the Evaluation of New Instruments and Instrument Teams

The measurement responsibilities of Instrument Teams applying for NDACC affiliation are detailed in the NDACC Measurements Protocol as is the application process itself. Data archiving responsibilities for all investigators can be found in the NDACC Protocol for Data Providers and Data Users. The details below are in specific reference to microwave spectrometers.

Independent Evaluation of the Instrument Design and Data Analysis

The Investigator should supply documentation to the NDACC Microwave Working Group (MWWG) or its designated representative addressing the following points. Investigators are encouraged to supply as much of this documentation as possible in the form of published research paper reprints.

- Given that NDACC has a focus on long-term, high-quality measurements, it is preferable that the instrument has been taking measurements for a period of at least one year. Instruments that are operated on a campaign basis may be considered for NDACC affiliation if the campaigns take place on a regular basis, e.g., during polar winter, or address specific atmospheric phenomena.
- As described in the NDACC Measurements Protocol a complete description of the instrument and data acquisition procedures must be provided. For microwave instruments in particular, calibration procedures using well-established reference loads should be documented.
- The Investigator also should provide an algorithm-description document containing information on the forward model, retrieval model, and method of error analysis. It also should show that the spectroscopic database that is used is current.

Instrument and Data Analysis Intercomparison

The following intercomparison procedures must be pursued to meet full approval as an NDACC instrument:

- The Investigator should demonstrate the existence (and document the results) of a continuing data-validation effort to establish that the measurement error bars are approximately correct. A detailed error analysis similar to those given in Rodgers (*JGR*, 5587-5595, 1990) or Nedoluha (*JGR*, 2927-2939, 1995) shall be provided.

- While the preferred method of validation is a side-by-side campaign with another NDACC microwave instrument, the MWWG recognizes that this is often not possible. Comparisons against other NDACC ground-based instruments or against well-established satellite instruments also are considered acceptable if these instruments provide measurements over similar altitude ranges.

Quality Criteria for the Evaluation of NDACC-Affiliated Instruments and Instrument Teams

The following guidelines must be followed to maintain NDACC affiliation:

- The Investigator must submit data to the NDACC archive on a regular basis.
- The experiment documentation files in the NDACC archive should be kept up-to-date.
- The Investigator should participate in any ongoing NDACC MWWG forward-model and retrieval-algorithm intercomparisons in order to ensure that the algorithms and the spectroscopic databases are kept current.
- The Investigator should participate in regular data validation activities in order to demonstrate continuing data quality and a good understanding of measurement errors. Potential measurement biases should be flagged, and efforts to correct them described.
- Each Investigator should submit a yearly report to the NDACC Steering Committee. This report should give the current instrument status and also should certify and describe the ways in which each of the above requirements has been met.

Changes in Instruments and Data Analysis

Since one of the major goals of the NDACC is the detection of long-term trends, care should be used with any modifications of the instrument or data analysis that may affect the results. Once the regular operation of an instrument has begun, such changes should not be undertaken lightly; consultation with the MWWG is recommended. The Investigator should retain primary data (interferograms or spectra) indefinitely (although not deposited in the NDACC archive), so that improved data-retrieval processes, including improved spectral line parameters, can be applied retrospectively to the earlier data. In such cases, the entire dataset should be reprocessed and archived, along with (at least) reference to earlier versions.

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