

## APPENDIX IV – 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<sub>2</sub>O), and ozone (O<sub>3</sub>). This description is intended to apply to the determination of their vertical profiles.

### Quality Criteria for the Evaluation of New Instruments and Instrument Teams

#### Independent Evaluation of the Instrument Design and Data Analysis

The Investigator should supply documentation addressing the points below to the NDACC Microwave Working Group (MWWG) or designated representative. In order to simplify the application process, investigators are encouraged to supply this documentation in the form of published research paper reprints.

- The Investigator must agree to submit data on a regular basis to the NDACC data archive, and to abide by the NDACC Data Protocol. The Investigator also must demonstrate a commitment to make long-term, high-quality measurements with support from his/her home institute. Before being endorsed by the NDACC, the instrument must have acquired measurements for a period of at least one year. Instruments that are operated on a campaign basis are generally not suited for NDACC unless the campaigns take place on a regular basis, e.g., during polar winter.
- A document completely describing the instrument and data acquisition procedures should be provided for review. In particular, this document should emphasize calibration procedures. Instruments must be calibrated against well-established reference loads.
- The Investigator also should submit 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 is current.

#### Instrument and Data Analysis Intercomparison

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

- The MWWG has an ongoing forward- and retrieval-model intercomparison activity. The Investigator should participate in this activity to help ensure that the analysis algorithms are of acceptable quality.
- 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 the ongoing 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.

Version: April 14, 2009