File Revision Date:
December 14, 2004

WHOLE DATA SET

DataSetName: Carbon monoxide and ozone vertical profiles over:
Thule, Greenland; January, February, and March, 2002
Thule, Greenland; January and February, 2003

DataSource: Stony Brook ground-based mm-wave spectrometer

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SourceCharacteristics: Strato-mesospheric CO (range 30-80 km) and O3 (range 15-79).

InvestigationObjectives: Measurement of the variations in the vertical profiles of carbon monoxide and ozone in the stratosphere and mesosphere over Thule, Greenland.

InstrumentAttributes: Ground-based mm-wave heterodyne receiver/spectrometer using a superconducting (SIS) niobium tunnel junction mixer. Pressure broadened emission spectra from molecular rotation lines are measured. Data are acquired alternately from the zenith (the reference) and from approximately ten degrees above the horizon (the signal). The difference spectrum, [signal-reference]/reference, is used to isolate stratospheric emissions. Data is recorded in fifteen minute scans which are combined into longer time bins for analysis, depending on signal strength and species characteristics. Time bins of one or two hour duration may be used for species where diurnal change is significant. See reference 1.

MeasuredParameters: Mixing ratio of carbon monoxide or ozone as a function of altitude. Resolution goes from approximately 6-7 km in the 20-40 km range, increasing at higher altitudes depending on species and signal strength to a maximum of 13 km.

DataSetQuality: Spectral line intensity calibrated against black-body sources of known temperature several times per day. Estimated calibration errors +/- 10%; estimated vertical profile retrieval errors given separately with data files.

DataProcessingOverview: Input data are pressure broadened emission spectra measured with two acousto-optical spectrometers (AOSs). The wideband AOS has a bandwidth of 512 MHz at 1 MHz resolution, whereas the narrowband AOS is tuned in frequency at the center of the wideband AOS with a bandwidth of 50 MHz at 65 KHz resolution.
Output data are mixing ratios as functions of altitude, extracted from the input lineshapes by numerical deconvolution. Vertical resolution is approximately 6-7 km in the 20-40 km range, increasing at higher altitudes depending on species and signal strength to a maximum of 13 km. Profiles are smoothly interpolated and mixing ratios are given at 1 or 2 km intervals.

DataUsage: Expected uses are to show seasonal and secular variations in the polar stratospheric ozone vertical profile, and diurnal variations in the mesospheric ozone content. Carbon monoxide can be used as a "tracer" to study stratospheric and mesospheric dynamics.

FileClassRelationships: File classes are for different molecular species, carbon monoxide and ozone.

LitReferences: 1) A. Parrish, R.L. de Zafra, P.M. Solomon, and J.W. Barrett, Radio Science, 23, 106-118, 1988.
2) S. Twomey, B. Herman, R. Rabinoff, Journal of the Atmospheric Sciences, 34, 1085-1090, 1977.
3) R.L. de Zafra, The Ground-Based Measurement of Stratospheric Trace Gases Using Quantitative Millimeter Wave Emission Spectroscopy, in "Diagnostic Tools in Atmospheric Physics", pages 23-54, Eds. G. Fiocco and G. Visconti, Proceedings of the International School of Physics 'Enrico Fermi', Course CXXIV, IOS Press, Amsterdam, 1995.
4) "Ground-Based Microwave Spectroscopy of the Earth's Stratosphere and Mesosphere", R. T. Clancy and D. O. Muhleman, Ch. 7 of Atmospheric Remote Sensing by Microwave Radiometry, M.A. Janssen, Editor. ISBN 0471-62891-3, John Wiley & Sons, Inc. New York, 1993.
5) "Microwave Limbsounding", J. W. Waters, Ch. 8 of Atmospheric Remote Sensing by Microwave Radiometry, M.A. Janssen, Editor. ISBN 0471-62891-3, John Wiley & Sons, Inc. New York, 1993.

FILE CLASS

FileClassName: Carbon monoxide
RecordTypeNames: Vertical profile
Algorithms: Reference 2
FileClassSyntax: Chronological
FileClassFieldRelationships: Data contain the field’s altitude, pressure, mixing ratio, and one nominal standard deviation in mixing ratio.

FileClassName: Ozone
RecordTypeNames: Vertical profile

Algorithms: Reference 2
FileClassSyntax: Chronological
FileClassFieldRelationships: Data contain the fields altitude, pressure, mixing ratio, and one nominal standard deviation in mixing ratio.

RECORD

RecordName: Vertical profile
RecordStructure: Variable
RecordLength: 51 data points (CO); 33 data points (O3)
RecordFieldNames: Altitude, pressure, mixing ratio, and one nominal standard deviation in mixing ratio.
RecordSyntax: Each line of data contains altitude, pressure, mixing ratio, and one nominal standard deviation in mixing ratio at that altitude. Altitude increases from beginning to end of file.

FIELDS

FieldName: Altitude
FieldMnemonic: Alt.
FieldSyntax: One-dimensional array
FieldUnits: Meters
FieldResolution: 1000 (CO); 2000 (O3)
FieldRange: 30000 to 80000 (CO), 15000 to 79000 (O3)
FieldDescription: Geopotential altitude
FieldRepresentation: Integer*4

FieldName: Pressure
FieldMnemonic: Pres.
FieldSyntax: One-dimensional array
FieldUnits: hPa
FieldResolution: .001
FieldRange: 15 to .005 (CO), 120 to .005 (O3)
FieldDescription: Atmospheric pressure
ieldRepresentation: integer*4

FieldName: Mixing ratio
FieldMnemonic: CO mr (CO), O3 mr (O3)
FieldSyntax: One-dimensional array
FieldUnits: Parts per million by volume (ppmv)
FieldResolution: .001
FieldRange: .001 to 20 (CO), .001 to 10 (O3)
FieldDescription: Average mixing ratio at each level from six retrievals
FieldRepresentation: integer*4

FieldName: One nominal standard deviation in mixing ratio

FieldMnemonic: MRsigma
FieldSyntax: One-dimensional array
FieldUnits: Part per million by volume (ppmv)
FieldResolution: .001
FieldRange: .001 to 2 (CO), .001 to 1 (O3)
Field Description: One standard deviation around average of six retrieved mixing ratios at each level. Systematic uncertainty estimate is not included
FieldRepresentation: integer*4