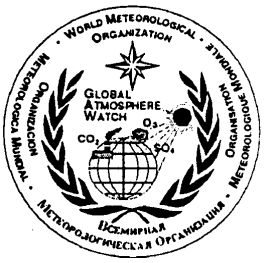
Environment Canada Environnement Canada

Guide to the WMO/GAW World Ozone Data Centre

Version 2.0



Meteorological Service of Canada
Environment Canada

December 2000

Canada

Guide to the WMO/GAW World Ozone Data Centre

Meteorological Service of Canada
Environment Canada*

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Version 1 – September 1999
Version 2 November 2000

Foreword

This document describes the World Ozone Data Centre (WODC) and is intended as a guide for data originators and clients. The World Wide Web (WWW) will be used to update information and serve as a bulletin board. As the WODC is further developed, this guide will be enhanced and updated accordingly.

The use of terminology throughout this text will interchange between the World Ozone and Ultraviolet Radiation Data Centre (WOUDC) and the acronym WODC. Issues that refer to the general aspects of the Data Centre such as data reception or access, will use the acronym WOUDC. Issues specific to ozone such as form and content will use the WODC acronym.

E.W. Hare*, E.J. Carty ++ and D.I. Wardle*

* Meteorological Service of Canada, Toronto, Ontario, Canada
++ Computer Solutions, Guelph, Ontario, Canada

Guide to the WMO/GAW World Ozone Data Centre

1. Introduction

The World Ozone Data Centre (WODC) began receiving data in 1961. The WODC has posted data in printed form in the publication *Ozone Data for the World* Red-book [1] beginning in 1964. The WODC continues to be funded and operated by the Canadian Government (Environment Canada) and has been since its inception. In 1992,Environment Canada agreed to accept ultraviolet radiation data as part of the data centre and the WODC changed its name to the World Ozone and Ultraviolet Radiation Data Centre (WOUDC). For the purposes of this guide book the acronym WODC will be used with the understanding that it represents the ozone portion of the WOUDC. When referencing issues pertinent to both ozone and UV, such as data file formats, then the acronym WOUDC will be used.

Although the WOUDC is operated by Environment Canada, it works under the auspices of the Global Atmosphere Watch (GAW) programme of the World Meteorological Organization (WMO). The WOUDC is part of the WMO Science Advisory Groups (SAGs) for both UV (WUDC) and Ozone (WODC).

The last WODC Guidebook (No. 2) was published in 1981 and explained the use of the ASCII text, 80 column, fixed format for data submission which has been in use for over thirty years. Although this format has proven to be an effective method for submission of simple data sets, the need for higher spatial and temporal resolution required a re-evaluation of the data format.

1.1 Rationale for Upgrading the Data File Formats

With advancements in technology, namely the extensive use of electronic data storage and the Internet, two changes were undertaken to update the method of data submission and retrieval. One was the cancellation of the printed form of the *Ozone Data for the World* "red book"as a data retrieval method, and the second was the revision of the data formats for data submission to provide data originators with options for higher spatial and temporal resolution. The latter change also brings together six independent formats into one common form.

The WOUDC will continue to accept and process data that is submitted in the traditional methods of paper forms or files in the 80-column format. Section 3 provides information about retrieving programs that have been created to assist data originators and users of the data with file format conversion.

[1] The *Ozone Data for the World* red book is published by the Meteorological Service of Canada of Environment Canada in conjunction with the World Meteorological Organization, Global Atmosphere Watch programme.

1.2 How to Use this Guide

This guidebook is intended for data originators who wish to submit data sets to the WOUDC. The guidebook will also prove useful to users of the data who want to understand more about the data format and content. The WOUDC uses the Internet as its main data dissemination tool, and so any updates to data products or changes occurring to the data centre as a whole will be posted on the WOUDC web site. Although this guide is intended to be used as a stand-alone document, changes are inevitable and the web site should be consulted for the most current version.

This guidebook is divided into three main sections: the application process for data submission, the new data file format used for data submission (which includes definitions for data category such as total column ozone, ozonesonde etc.) and data dissemination which includes data file security issues. Thus, this guide provides the information and structures of this new method of data submission and retrieval using a step by step method.

2. The New Method of Data Submission - Procedures

2.1 Application Process

If you are a first time data originator or you currently submit data to the WOUDC and would like to apply for a personal ftp account, follow the instructions listed below. Data originators are asked to follow the five steps below for arranging data submissions to the WOUDC for ozone and/or UV data sets.

2.1.1 Five Easy Steps

Step 1: Write a Scientific Sponsorship Statement (SSS) or "data passport" using the model given here (if appropriate). Contact the WOUDC for assistance or clarification if needed. Also refer to the WOUDC UV Guide [1]. Ozone data submissions do not presently use an SSS, however, a description of the instrument calibration history is considered valuable metadata and originators of ozone data are encouraged to submit an SSS. The SSS is intended to provide detailed description of the data quality including calibration, quality control and measurement accuracy. It can also stipulate conditions under which the data may be used. Refer to the Data Set Security Issues section for details. This file is an ASCII text file.

Step 2: Submit to the WOUDC a completed SSS along with an Agency (data originator) Profile. An Agency Form is available from the WOUDC web site. Refer to Section 2.2.

Step 3: Once the WOUDC has created an Agency Profile, a data submission agreement will be established between the data originator and the WOUDC. If special agreements, provisos, or security restrictions are required, they will be established at this point. Refer to the Data Set Security Issues section of this document. Refer also to Step 5.

Step 4: The WOUDC will assign an FTP account (with a personal username/password) to be used exclusively for data submission. Data may also be submitted on computer media such as CD-ROM or diskettes. The WOUDC will continue to accept data submitted on paper forms, but encourages data originators to submit data in electronic form.

Step 5: The frequency of data submission is suggested to be monthly, however, the WOUDC is capable of receiving data on a daily basis.

2.2 Application Forms

The WOUDC web site also has an automated application form submission page available. Refer to ***http://www.msc-smc.ec.gc.ca/woudc/data/submit_e.html*** and the subheading: Application Forms: Agency Statement. If you do not have access to the Internet, contact the WOUDC and arrangements will be made to forward the application forms by fax or mail.

2.3 Data File Formats

The WOUDC is prepared to accept three data file formats. One is the original, 80 column format, the second is the new Extended Comma Separated Values or extCSV format (refer to the next section) and the last is the NASA-Ames 2160 ozonesonde and lidar formats.

Data files rendered in other formatting conventions will be accepted, but will not be included in the main data archive until such time as the files can be re-formatted to the extCSV.

Utility programs are available to format 80-column files to extCSV and from extCSV back to 80-column format. Refer to Section 3.3.

3. The New Data File Format Description with Examples

Comma separated values or CSV files are an accepted file format standard that can be directly imported into a database, spreadsheet or analysis applications. As these files are written in ASCII, they are portable to different computer platforms. The WOUDC has extended standard CSV syntax rules to support comments and multiple data content within individual files. This "extended CSV" or extCSV is now in use as the WOUDC standard file format for data submission and data file retrieval.

The extCSV file submission format provides the data originator the option to submit data at much higher temporal or spatial resolution than the traditional, 80-column WODC file format. The extCSV is also used for file output products. ExtCSV files are divided into two main parts: a metadata section and a data content section. The metadata section can be considered a data file “header” as this portion is common to all files within the WOUDC in terms of table format and content. The data portion will be unique to the individual data categories (or types) such as total

ozone or ozonesonde. Section 3.1 presents the metadata format and Section 3.2 the content section. The data content section presents each data category (type) with the unique set of table definitions. Presently, the following data categories are defined: Lidar, Ozonesonde, Surface Ozone, Total Ozone and Umkehr.

3.1 The WOUDC extCSV Data File Definitions - Metadata

The WOUDC header presents a set of variables that uniquely describes the data to follow in that particular file, and that are common to all data sets independent of the specific WOUDC data category such as total ozone or ozonesonde. The uniqueness of each field within the header is required such that if a duplicate data file is received, one or more of the header variables would have to have changed in order for this file to be accepted in to the data archive. Table 2.1 outlines the table names and the field (column) names for the metadata portion of the file format.

Static Metadata	**(*Only one occurrence or instance per file.*)**	
Table Name	**Condition**	**Field (Column) Names**
CONTENT	***Required***	<Class,Category,Level,Form>
DATA_GENERATION	***Required***	<Date,Agency,Version,ScientificAuthority>
PLATFORM	***Required***	<Type,ID,Name,Country,GAW_ID>
INSTRUMENT	***Required***	<Name,Model,Number >
Dynamic Metadata	**(*At least one required per file,* m*ultiple occurrences are permitted.*)**	
LOCATION	***Required***	<Latitude,Longitude,Height >
TIMESTAMP	***Required***	<UTCOffset,Date,Time>

Table 3.1. The WOUDC Metadata Format Model

3.1.1 Metadata Format Rules

1. The order of the static metadata tables is fixed.
2. A table name is in UPPERCASE and denoted by the pound symbol (#) as the first character.
3. A table is comprised of three sections: a table name, field (column) names and one or more data records. Refer to Example 1.
4. Columns are delimited by commas within each record which includes each field (column) name and datum.
5. Comments may appear anywhere within the file and are denoted by an asterisk (*) as the first character.

```
*Example 1
#TABLENAME
Field1,Field 2,Field3
Datum1,Datum2,Datum3
```

3.1.2 Metadata Content Rules

1. Only ONE instrument may be represented in a file.
2. To report changes in time and space, more than one #LOCATION and #TIMESTAMP table is permitted. Since most data submitted are considered from a stationary source, a single #LOCATION table is typically all that is required.
3. Further information about site conditions, meteorology, sky images etc. may be included as comments or by other tables generated at the discretion of the data originator. For example, if a data originator wishes to indicate an occurrence of a special note ("instrument was bumped while sampling") than a comment is probably reasonable. Dynamic variations occurring instantaneously such as meteorology (eg. sky or wind conditions) or the reporting of calibration data; would be represented in a table.

```
*Example 2
#SITE_METEOROLOGY
Date,Time,Temperature,Pressure,Wind Direction,Wind Speed
```

Table 2.2 provides a definition for each field (column) giving the required name for each field and a description, which includes physical units.

TABLE	***Column***	**Description**
CONTENT	*Class*	The general type of data to follow. WOUDC would be used here.
	Category	Sub group of data submitted. For example: OzoneSonde or TotalOzone.
	Level	Data level. The level refers to the data product. Raw data would be Level 0, processed data Level 1 etc..
	Form	The version of the data format to follow. The specification for the *Form* (initial value=1) refers to the table descriptions for that index value. If a data table is already defined (form=1) with a specific number of columns, then the addition of one or more columns to that table would require the *Form* value to be incremented by 1 for every change. The form index is intended as a file format reader indicator of the type of data tables to follow. Changes to this index will be made through the WOUDC only.
DATA_ GENERATION	*Date*	Date the file was processed or generated. Date is represented in the **ISO 8160** format standard, i.e. **yyyy-mm-dd**. Example 1998-09-21.
	Agency	The acronym of the submitting agency. This is typically agreed upon by the data originator and the WOUDC during the Agency registration.
	Version	Data version specified by the submitting agency. These versions have the form ***major.minor*** (eg. 3.2) where major values are incremented with changes to the processing algorithm and minor values are incremented when the characterisation or calibration values have changed.. Note, minor values are

		reset to zero with changes to the processing algorithm.
	ScientificAuthority	The ScientificAuthority is the person(s) responsible for the data quality.
PLATFORM	*Type*	Type of observing platform Stationary (STN) or Moving (Examples: Airborne (FLT), Ship borne (SHP) etc.). The default is STN. This field, for example, will accommodate the future inclusion of an onboard GPS on sonde flights which records exact location throughout a flight. Thus, FLT would be selected instead of STN.
	ID	Unique station or flight ID assigned by the WOUDC. The station number is a pointer to other information about the station such as the observation programs, the different instruments in operation and related site information like the proximity to an urban centre and other background effects.
	Name	Station Name
	Country	The country where the station is located. *Country* is the 3-letter **ISO-3166** code. For example, Finland is FIN, Switzerland is CHE etc. Refer to the WOUDC web site for a listing.
	GAW_ID	Applicable only to stations with the 5-digit WMO number.
INSTRUMENT	*Name*	Common name of instrument. For example, the Brewer spectrophotometer is called the "Brewer" whereas the Brewer-Mast ozonesonde is called the "Brewer-Mast". Refer to the WOUDC web site for a listing.
	Model	Model ID where applicable. For the Brewer, a typical corresponding *model* is MKIII and a Dobson would be Beck or Japanese.
	Number	Serial number of the instrument.
LOCATION	*Latitude*	Benchmark *latitude* of the instrument. Typically an instrument is located at a fixed station location and shares the station latitude. The format is decimal degrees (deg.) with North positive and South negative.
	Longitude	Benchmark *longitude* of the instrument. Typically an instrument is located at a fixed station location and shares the station longitude. The format is decimal degrees (deg.) with East positive and West negative.
	Height	Benchmark *height* of the instrument. Typically an instrument is located at a fixed station location and shares the station elevation. The format is metres above sea level (m.a.s.l.)
TIMESTAMP	*UTCOffset*	The UTCOffset is the amount of time SUBTRACTED from the local time in order to obtain UTC time (where East is positive and Local Time as defined by the data originator). This is equivalent to UTC=time-UTCOffset. *UTCOffset* is represented in the **ISO-8601** standard of **hh:mm:ss.** The default is to report time in UTC, thus UTCOffset=+00:00:00.
	Date	The Date corresponding to the time code represented in the **ISO-8160** standard.
	Time	Time is represented in the **ISO-8601** standard of **hh:mm:ss.**

Table 3.2 The WOUDC extCSV Data File Description of the Tables and Fields - Metadata

3.1.3 An Example of an extCSV File Format Header

```
*SOFTWARE: SNDPRO 1.3
*TROPOPAUSE IN MB 320
*M.S.C.-O3 T1200

#CONTENT
Class,Category,Level,Form
WOUDC,OzoneSonde,1.0,1

#DATA_GENERATION
Date,Agency,Version,ScientificAuthority
1999-05-07,MSC,1.0,Jonathan Davies

#PLATFORM
Type,ID,Name,Country,GAW_ID
STN,315,Eureka,CAN

#INSTRUMENT
Name,Model,Number
ECC,6a,6a2355

#LOCATION
Latitude,Longitude,Height
79.99,-85.94,10

#TIMESTAMP
UTCOffset,Date,Time
+00:00:00,1999-04-28,23:15:00
```

3.2 The WODC extCSV Data File Definitions – Data Content

Table 3.3 summarises the current data types or "categories" presently defined by the WODC. Each extCSV file requires **one** of these categories to be included in the CONTENT table under the field (column) heading "Category". Note the temporal range specifies the required amount of data within each file.

Category	**Usage**	**Temporal Range per file**
Lidar	Data submission and retrieval.	Duration of one observation period (usually one local day)
OzoneSonde	Data submission and retrieval.	Duration of sonde flight (One flight)
SurfaceOzone	Data submission and retrieval.	One month of daily summaries
TotalOzoneObs	Data submission and retrieval.	Usually within one local day
TotalOzone	Data submission and retrieval.	One month of daily summaries
UmkehrN14	At present: data retrieval only.	One month of daily summaries

Table 3.3 WODC Data Categories

Each category has a set of defined tables which includes the fields (columns) names, the order of the fields and the required units (where applicable)..

3.2.1 Category: Lidar

TABLENAME	Field Names (in order)
#WAVELENGTHS	**WAVELENGTH,DESCRIPTION**
#AEROSOL_SUMMARY	ProfileIntBackscatter,IntOpticalDepth,AeroExtBackscatterRatio
#PROFILE_SUMMARY	Begin_time,End_time,EA_Code,R_trop,Npulses,
#PROFILE	Range,AirDensity,Temperature,PTemperature,[O3],O3ese,R,Rese,AEC, AECese,ABSC,ABSCese

Table: WAVELENGTHS

Field Name	Definition
Wavelength	Laser wavelength in nanometres (nm) used to generate a profile or retrieved from profile.
Description	Type of constituent targeted or retrieved. Example: Extinction from Raman means that the extinction coefficient profile has been calculated by (default technique) using the Raman 385 nm signal.

Table: AEROSOL_SUMMARY

Note: *that this table is used primarily to store data from the traditional WODC formatted Lidar profiles.*

Field Name	Definition
ProfileIntBackscatter,	Profile Integrated Backscatter
IntOpticalDepth	Integrated Optical Depth (Thickness)
AeroExtBackScatterRatio	Aerosol Extinction to Backscatter Ratio

Table: PROFILE_SUMMARY

Field Name	Definition
Begin_time	Time the observations began. ISO 8601format for time hh:mm:ss is used.
End_time	Time the observations ended. ISO 8601format for time hh:mm:ss is used.
EA_Code	Code for the Extinction Algorithm used to process the profile. *Refer to the Extinction Algorithm Code Table.*
R_trop	The range or altitude of the tropopause in kilometres.
Npulses	Number of laser pulses averaged to obtain daily profile.

Table: PROFILE

Field Name	Definition
Range	Laser range in metres (m)
AirDensity	Density of the air (molecules*cm^{-3})
Temperature	Temperature (Kelvin)
PTemperature	Potential temperature (Kelvin)
[O3]	Ozone concentration (molecules*cm^{-3})
O3ese	Ozone concentration estimated standard error (molecules*cm^{-3})
R	Scattering Ratio: used to characterize the aerosol loading at a specific wavelength and is the ratio between the total backscattering (aerosol plus molecular) and the pure molecular backscattering. (Rayleigh+Mie)/Rayleigh.
Rese	Scattering ratio estimated standard error
AEC	The aerosol extinction coefficient is the fraction of energy scattered out of the light in all directions, by aerosols, per path length (km^{-1}).
AECese	Aerosol extinction coefficient estimated standard error (km^{-1}).
ABSC	The aerosol back scattering coefficient is the fraction of output laser light that is scattered back to the receiver, by aerosols, per steradian per path length (km^{-1} str^{-1}).
ABSCese	Aerosol back scattering coefficient estimated standard error (km^{-1} str^{-1}).

An Example of Lidar Data in extCSV File Format

```
*Example of data average values from two different months
*One Event per file

#CONTENT
Class,Category,Level,Form
WOUDC,Lidar,1.0,1

#DATA_GENERATION
Date,Agency,Version,Scientific Authority
1999-06-19,CRESTech,1.0,J.Bird

#PLATFORM
Type,ID,Name,Country,GAW_ID
STN,315,Eureka,CAN

#INSTRUMENT
Name,Model,Number
DIAL,Lotard,1

#LOCATION
Latitude,Longitude,Height
80.00,-85.93,607

#TIMESTAMP
UTCOffset,Date,Time
+00:00:00,1998-11-08,02:28:42

#WAVELENGTHS
Wavelength,Description
308,Rayleigh on
353,Rayleigh off
332,Raman on
385,Raman off

#PROFILE_SUMMARY
Begin_Time, End_Time, EA_Code, R_Trop, N_pulses
2:28:42,11:06:51,ExtRaman,8.2200

#PROFILE
Range,AirDensity,Temperature,PTemperature,[O3],O3ese,R,Rese,AEC,AECese,ABSC,
ABSCese
0.15,2.57E+19,259.14,265.43,7.14E+12,,0.459,,0.174,,0.00E+00,
0.45,2.48E+19,257.98,267.32,7.31E+12,,0.021,,0.021,,-8.00E-03,
0.75,2.39E+19,256.83,269.2,7.48E+12,,0.124,,0.125,,-6.91E-03,
1.05,2.32E+19,254.65,269.97,7.64E+12,,1.257,,1.258,,1.97E-03,
1.35,2.24E+19,253.64,272,2.74E+13,,2.123,,2.125,,8.29E-03,
1.64,2.16E+19,252.37,273.66,7.78E+11,,1.816,,1.817,,5.83E-03,
1.94,2.09E+19,250.49,274.76,-2.95E+12,,1.426,,1.427,,2.95E-03,
2.24,2.02E+19,248.66,275.97,-2.68E+12,,1.204,,1.205,,1.37E-03,
2.54,1.96E+19,246.65,276.98,-2.81E+12,,1.102,,1.103,,6.66E-04,
```

3.2.2 Category: OzoneSonde

TABLENAME	Field Names (in order)
#FLIGHT_SUMMARY	IntegratedO3,CorrectionCode,SondeTotalO3,CorrectionFactor,TotalO3, WLcode,ObsType,Instrument,Number
#PROFILE	Pressure,O3PartialPressure,Temperature,WindSpeed,WindDirection,LevelCode, Duration,GPHeight,RelativeHumidity,SampleTemperature
#AUXILIARY_DATA	MeteoSonde,ib1,ib2,PumpRate,BackgroundCorr,SampleTemperatureType, MinutesgroundO3
#PUMP_CORRECTION	Pressure,Correction

Table: FLIGHT_SUMMARY

Field Name	Definition
IntegratedO3	Integrated ozone amount to burst altitude.
CorrectionCode	Code for the algorithm used to estimate remaining ozone above burst height to the top of atmosphere. (*Refer to the Residual Ozone (Correction) Algorithm Code Table*).
SondeTotalO3	Integrated + calculated residual.
CorrectionFactor	The quantity by which the SondeTotal ozone determined from the sounding measurements has been multiplied in order to achieve agreement with the total column ozone measured by ground-based or satellite instruments.
TotalO3	Total amount of column ozone (from observation - ground-based or satellite). (*This value may be calculated as well*).
WLCode	Code for wavelengths or wavelength pair(s) used in the total ozone measurement.
ObsType	Type of total ozone measurement (maybe in the form of a code).
Instrument	Instrument used to provide observed column ozone data. (Refer to the Instruments list on the WOUDC web site). Include the model in brackets. Ex: Dobson (Beck).
Number	The serial number of the instrument used to provide observed column ozone data.

Table: PROFILE

Field Name	Definition
Pressure	Atmospheric pressure in hecto-Pascals (hPa)
O3PartialPressure	Layer partial pressure of ozone in milli-Pascals (mPa)
Temperature	Level Temperature in degrees Celsius (C)
WindSpeed	Wind speed in meters per second (m/s)
WindDirection	Wind direction in degrees
LevelCode	Code for the level type (*Refer to Level Codes Table*)
Duration	Time (in seconds) from launch
GPHeight	Geopotential height in meters (m)
RelativeHumidity	Relative Humidity in percent (%)
SampleTemperature	Temperature where sample is measured in degrees Celsius (C)

Table: AUXILIARY_DATA

Field Name	Definition
MeteoSonde	Radiosonde model flown with ozonesonde.
ib1	Background current before sonde is exposed to ozone in microamps (μA).
ib2	Background current measured just prior to launch. microamps (μA).
PumpRate	Pump rate measured at ground level. (s/100ml)
BackgroundCorr	Correction used. Selection: No correction, Pressure_ib1, Pressure_ib2 or Constant_ib1, Constant_ib2. If blank, the field is considered to be unknown or assumed to be not measured.
SampleTemperatureType	Thermistor position (Box, pump, Tube, Calculated or Constant)
MinutesGroundO3	The number of minutes at ground ozone

Table: PUMP_CORRECTION

Field Name	Definition
Pressure	Level Pressure in hecto-Pascals (hPa)
Correction	Correction applied to corresponding pressure level(s).

Code Tables for OzoneSonde

Residual Ozone (Correction) Algorithm Code Table

CorrectionCode	Algorithm
None (blank)	Unknown
0	None
1	Satellite derived climatology from SBUV. (after (McPeters, R.D., Labow, G.J., and Johnson, B.J. 1997 in JGR)
2	Constant mixing ratio extrapolated from value at burst height. The residual ozone (D.U.) = 7.892 * ozone partial pressure [mPa] at burst level.
3	Constant mixing ratio extrapolated from average of last 3 significant levels above 17 mbar (MSC method). Residual Ozone (D.U.) = 7.892 * Total atmospheric pressure * (Average mixing ratio of last 3 levels) [mPa]
4	Extrapolated from final ozone partial pressure and temperature at burst (NOAA method?) Residual ozone (D.U.) = 5.923*(273.15/(Temperature at burst+273.15))*(ozone partial pressure [mPa] at burst)
5-98	To be defined by WOUDC
99	Other (not yet defined) Supplied by data originator.

Level Codes Table

Level Code	Description
None (blank)	Unknown
0	Regular level (point value/datum)
1	Standard level The 15 standard WODC levels are: 1000, 700, 500, 300, 200, 150, 100, 70, 50, 30, 20, 10, 7, 5, 3, 2 and 1 (hPa).
2	Significant level Surface, tropopause or other significant inflection point for ozone, temperature etc.
3	Standard and Significant Level.
4	Level average
Other codes	Further codes will be generated as required using the following simple model: Level Code Description 8 significant for temperature 16 significant for ozone 32 significant for RH E.g.. a standard level which is significant for temperature and ozone would be 1+2+8+16 = 27

An Example of Ozonesonde Data in extCSV File Format

```
*SOFTWARE: SNDPRO 1.3
*TROPOPAUSE IN MB 320
*A.E.S.-O3 T1200

*One flight per file

#CONTENT
Class,Category,Level,Form
WOUDC,OzoneSonde,1.0,1

#DATA_GENERATION
Date,Agency,Version,ScientificAuthority
1999-05-07,MSC,1.0,Jonathan Davies

#PLATFORM
Type,ID,Name,Country,GAW_ID
STN,315,Eureka,CAN

#INSTRUMENT
Name,Model,Number
ECC,6a,6a2355

#LOCATION
Latitude,Longitude,Height
79.99,-85.94,10

#TIMESTAMP
UTCOffset,Date,Time
+00:00:00,1999-04-28,23:15:00

#FLIGHT_SUMMARY
IntegratedO3,CorrectionCode,SondeTotalO3,CorrectionFactor,TotalO3,WLCode,ObsType
,Instrument,Number
379.9,2,390

#AUXILIARY_DATA
MeteoSonde,ib1,ib2,PumpRate,BackgroundCorr,SampleTemperatureType,MinutesGroundO3
RS80-RSA11,,0.069,26.67,Pressure_ib2,Box

#PROFILE
Pressure,O3PartialPressure,Temperature,WindSpeed,WindDirection,LevelCode,Duratio
n,GPHeight,RelativeHumidity,SampleTemperature
1023.92,0,-18.6,1,20,2,0,10,66,
1017.2,0,-18.7,,,0,10,59,65,
1011.01,0,-18.8,,,0,20,105,71,
1004.61,0,-18.9,,,0,30,152,75
1000,0.2,-18.9,,,1,37,186,76
998.01,0.2,-18.9,,,0,40,201,77
…
3.48,1.3,-23.4,,,0,7900,38330,1
3.46,1.3,-23,,,0,7910,38380,1
3.44,1.1,-22.8,,,0,7920,38429,1
3.42,0.7,-22.5,,,0,7930,38475,1
3.4,0.7,-22.2,,,2,7940,38517,1
```

3.2.3 Category: SurfaceOzone

TABLENAME	Field Names (in order)
#DAILY_SUMMARY	Date,HH,Mean,Min,Max,Duration

Table: DAILY_SUMMARY

Field Name	Definition
Date	yyyy-mm-dd
HH	Hour (to nearest hour) UTC, of maximum surface ozone for the day.
Mean	Partial pressure of surface ozone in whole nanobars. Represents the daily mean based upon observed hourly mean values for the day.
Min	Daily minimum of surface ozone in whole nanobars
Max	Daily maximum of surface ozone in whole nanobars
Duration	Code figure for duration of an ozone value in excess of 100 nanobars. *

***** Refer to the Surface Ozone Duration Codes Table.

Surface Ozone Duration Codes Table

Code	Description
01-90	Duration in tens of minutes.
91	Duration over 15 hours but not more than 16 hours.
92	Duration over 16 hours but not more than 17 hours.
93	Duration over 17 hours but not more than 18 hours.
94	Duration over 18 hours but not more than 19 hours.
95	Duration over 19 hours but not more than 20 hours.
96	Duration over 20 hours but not more than 21 hours.
97	Duration over 21 hours but not more than 22 hours.
98	Duration over 22 hours but not more than 23 hours.
99	Duration over 23 hours and up to and including 24 hours.

An Example of Surface Ozone Data in extCSV File Format

```
*Example of daily data for Category: SurfaceOzone
*One month per file

#CONTENT
Class,Category,Level,Form
WOUDC,SurfaceOzone,1.0,1

#DATA_GENERATION
Date,Agency,Version,ScientificAuthority
1999-06-07,NOAA-CMDL,1.0,

#PLATFORM
Type,ID,Name,Country,GAW_ID
STN,031,Mauna Loa,USA,71638

#INSTRUMENT
Name,Model,Number
Dasibi,Unknown

#LOCATION
Latitude,Longitude,Height
19.53,-155.58,3397

* NOTE: the date defaults to the first day of the month.

#TIMESTAMP
UTCOffset,Date,Time
+00:00:00,1986-12-01

*PRIMARY_COMMENT “EQUIPMENT DASIBI     UV PHOTOMETER”

#DAILY_SUMMARY
Date,HH,Mean,Min,Max,Duration
1986-12-01,11,28,24,31
1986-12-02,06,28,25,33
1986-12-03,09,27,25,29
…
1986-12-31,15,28,22,30

#TIMESTAMP
UTCOffset,Date,Time
+00:00:00,1986-12-31
```

3.2.4 Category: TotalOzoneObs (Individual Daily Observations)

TABLENAME	Field Names (in order)
#OBSERVATIONS	Time,WLCode,ObsCode,Airmass,ColumnO3,StdDevO3,ColumnSO2,StdDevSO2

Table: OBSERVATIONS

Field	Definition
Time	hh:mm:ss
WLCode	Code to designate the wavelength pair(s) used for total ozone measurement. (Code 0-7 are used for Dobson instruments only, 8 for Filter instruments only and 9 for Brewer instruments only.)
ObsCode	Code to designate the type of total ozone measurement.
Airmass	Relative slant plant through atmosphere.
ColumnO3	Discrete total column ozone (O3) amount (in Dobson units, i.e., m atm-cm) measured at the time of observation.
StdDevO3	Standard Deviation of total column ozone measurement.
ColumnSO2	Discrete total column sulphur dioxide (SO2) amount (in Dobson units, i.e., m atm-cm) measured at the time of observation.
StdDevSO2	Standard Deviation of total column SO2 measurement.

Wavelength and Observation Codes Table

WLCode	Description
0	AD wavelengths, ordinary setting
1	BD wavelengths, ordinary setting
2	CD wavelengths, ordinary setting
3	CC' wavelengths, ordinary setting
4	AD wavelengths, focused image
5	BD wavelengths, focused image
6	CD wavelengths, focused image
7	CC' wavelengths, focused image
8	Used to denote filter ozonemeter instruments
9	Used to denote Brewer spectrophotometer instruments
10-N	To be defined
ObsCode	**Description**
0 or DS	Direct Sun
1 or FM	Focused Moon
2 or ZB	Zenith Blue Sky
3 or ZS	Zenith Cloud (uniform stratified layer of small opacity)

4 or ZS	Zenith Cloud (uniform or moderately variable layer of medium opacity)
5 or ZS	Zenith Cloud (uniform or moderately variable layer of large opacity)
6 or ZS	Zenith Cloud (highly variable layer with or without precipitation)
7 or ZS	Zenith Cloud (fog)
8-N	To be assigned by the WOUDC. Data originators are encouraged to contact the WOUDC to register a new code when required.

An Example of Total Ozone Observation Data in extCSV File Format

```
*Example of a single day of observations
*One observation day per file

#CONTENT
Class,Category,Level,Form
WOUDC,TotalOzoneObs,1.0,1

#DATA_GENERATION
Date,Agency,Version,ScientificAuthority
1999-05-07,MSC,1.0,J. Kerr

#PLATFORM
Type,ID,Name,Country,GAW_ID
STN,065,Toronto,CAN,71638

#INSTRUMENT
Name,Model,Number
Brewer,MKII,014

#LOCATION
Latitude,Longitude,Height
43.78,-79.47,198

#TIMESTAMP
UTCOffset,Date,Time
+00:00:00,1999-04-10

#OBSERVATIONS
Time,WLcode,ObsCode,Airmass,ColumnO3,StdDevO3,ColumnSO2,StdDevSO2
10:03:01,9,DS,2.39,350.0,2.0,1.13,0.02
10:25:11,9,DS,2.35,351.2,1.9,0.98,0.02
11:13:01,9,DS,2.21,348.4,1.5
…
17:03:23,9,DS,2.89,350.0,2.0,1.13,0.08
17:25:01,9,DS,2.99,350.8,2.2
17:50:01,9,DS,3.09,355.0,2.3
18:09:51,9,DS,3.29,351.4,2.7,2.13,0.6
```

3.2.5 Category: TotalOzone

TABLENAME	Field Names (in order)
#DAILY	Date,WLCode,ObsCode,ColumnO3,StdDevO3,UTC_Begin,UTC_End,UTC_Mean, nObs,mMu,ColumnSO2
#MONTHLY	Date,ColumnO3,StdDevO3,Npts

Table: DAILY

Field	Definition
Date	yyyy-mm-dd
WLCode	Code to designate the wavelength pair(s) used for total ozone measurement.
ObsCode	Code to designate the type of total ozone measurement.
ColumnO3	Daily value of total column ozone amount (in Dobson units, i.e., m atm-cm) defined as the "best representative value" in order of DS, ZS and FM.
StdDevO3	Is the estimated population standard deviation of the total column ozone measurements used for the daily value.
UTC_Begin	The starting time of observations (in decimal hours, UTC).
UTC_End	The ending time of observations (in decimal hours, UTC).
UTC_Mean	The mean time of observations (in decimal hours, UTC).
nObs	Number of observations used to calculate the total column ozone value.
mMu	The harmonic mean of the relative slant path at 22Km ($\mu 1$) for each of the observations used to compute the daily value. It is a useful statistic in relation to the effects of uncertainties in the zero airmasss extrapolations and in the generation of simulated data from independent data. $mMu=NN/\Sigma(1/\mu_i)$
ColumnSO2	The daily total column sulphur dioxide (SO2) amount calculated as the mean of the individual SO2 amounts from the same observation used for the O3 amount.

Table: MONTHY

Field	Definition
Date	yyyy-mm-dd
ColumnO3	Daily value of total column ozone amount (in Dobson units, i.e., m atm-cm) defined as the "best representative value" in order of DS, ZS and FM.
StdDevO3	Standard Deviation of daily total column ozone measurement
Npts	The number of points (typically this is the number of daily averages) used to determine the monthly mean ozone value.

An Example of Total Ozone Data in extCSV File Format

```
*Example of daily ozone values
*One month per file

#CONTENT
Class,Category,Level,Form
WOUDC,TotalOzone,1.0,1

#DATA_GENERATION
Date,Agency,Version,ScientificAuthority
1999-06-07,MSC,1.0,J. Kerr

#PLATFORM
Type,ID,Name,Country,GAW_ID
STN,065,Toronto,CAN,71638

#INSTRUMENT
Name,Model,Number
Brewer,MKII,014

#LOCATION
Latitude,Longitude,Height
43.78,-79.47,198

* NOTE: the date defaults to the first day of the month.
#TIMESTAMP
UTCOffset,Date,Time
+00:00:00,1999-04-01

* Precipitation on April 2, 28, 29

#DAILY
Date,WLCode,ObsCode,ColumnO3,StdDevO3,UTC_Begin,UTC_End,UTC_Mean,nObs,mMu,Column
SO2
1999-04-01,9,0,350.0,5.0,,,13.75,27,1.28,5.13
1999-04-03,9,0,341.1,4.1,,,12.75,19,1.12
1999-04-04,9,0,353.8,3.0,,,13.01,35,1.2
…
1999-04-26,9,0,355.0,5.0,,,13.05,37,1.21,3.33
1999-04-27,9,0,355.0,5.0,,,12.66,37,1.19
1999-04-30,9,0,369.0,5.0,,,13.7,25,1.3

#TIMESTAMP
UTCOffset,Date,Time
+00:00:00,1999-04-30

* NOTE: the date of the MONTHLY table defaults to the first day of the month.

#MONTHLYY
Date,ColumnO3,StdDevO3,Npts
1999-04-01,350.0,5.0,13
```

2.3.6 Category: UmkehrN14 (Data retrieval ONLY)

TABLENAME	Field Names (in order)
#N14_VALUES	Date,H,L,WLCode,ObsCode,ColumnO3,N600,N650,N700,N740,N750,N770,N800,N830,N840,N850,N865,N880,N890,N900
#C_PROFILE	Date,H,L,ColumnO3Obs,ColumnO3Retr,Layer10,Layer9,Layer8,Layer7,Layer6Layer5,Layer4,Layer3,Layer2,Layer1,ITER,SX,SZA_1,nSZA,DFMRS,FEPS,RMSRES

Table: N14_VALUES

Field	Definition
Date	yyyy-mm-dd
H	Code for time of observation: 0=unkown, 1=AM and 2=PM.
L	Code for wavelength pair used for observation: 1=A wavelength pair 2=B wavelength pair 3=C wavelength pair 4=D wavelength pair 5=non sunobservation adjusted to DS observation
WLCode	Code to designate the wavelength pair(s) used for total ozone measurement. *
ObsCode	Code to designate the type of total ozone measurement. *
ColumnO3	Total amount of column ozone (in Dobson units, i.e., m atm-cm) applicable to the Umkehr observation.
N600 to N900	Log(I'/I + constant) to three decimal places (NNN) for the Solar Zenith Angle (_###)**. The SZA is given to the nearest tenth of a degree with the decimal point omitted. When Log(I'/I + constant) exceeds unity, the integer is omitted. For example: if Log(I'/I + constant)=1.231 then NNN is coded as 231. Missing data are indicated as -1.

* Refer to Wavelength and Observation Codes Table.

** The Log(I'/I) + constant} mantissa only to 3 decimal places. The characteristic of the logarithm is inferred. The N values are given for the corresponding Solar Zenith Angles: 60, 65,70,74,75,77,80,83,84,86.5,88,89 and 90 degrees.

An Example of Umkehr N-value Data in extCSV File Format

```
*NOAA-CMDL is the Agency acronym for the National Oceanographic and
*Atmospheric Administration-Climate Monitoring and Diagnostics Laboratory

*One month per file

#CONTENT
Class,Category,Level,Form
WOUDC,UmkehrN14,1.0,1

#DATA_GENERATION
Date,Agency,Version,ScientificAuthority
1996-07-02,NOAA_CMDL,1.0, Gloria Koenig

#PLATFORM
Type,ID,Name,Country,GAW_ID
STN,067,Boulder,USA

#INSTRUMENT
Name,Model,Number
Dobson,Beck,082

#LOCATION
Latitude,Longitude,Height
40.03,-105.25,832

#TIMESTAMP
UTCOffset,Date,Time
+07:00:00,1992-10-07

#N14_VALUES
Date,H,L,WLCode,ObsCode,ColumnO3,N600,N650,N700,N740,N750,N770,N800,N830,N840,N850
,N865,N880,N890,N900
1992-10-07,1,1,0,0,268,-1,145,356,572,627,746,913,957,942,916,844,763,705,630
1992-10-07,1,3,0,0,268,467,538,645,768,800,877,44,231,295,343,363,344,316,271
1992-10-07,1,4,0,0,268,208,244,292,254,371,416,504,629,681,734,817,893,920,917
1992-10-07,2,1,0,0,244,-1,145,356,572,627,746,913,957,942,916,844,763,705,630
1992-10-07,2,3,0,0,244,467,538,645,768,800,877,044,231,295,343,363,344,316,271
…
1992-10-28,1,1,0,0,268,-1,145,356,572,627,746,913,957,942,916,844,763,705,630
1992-10-28,1,3,0,0,268,467,538,645,768,800,877,44,231,295,343,363,344,316,271
1992-10-28,1,4,0,0,268,208,244,292,254,371,416,504,629,681,734,817,893,920,917
1992-10-28,2,1,0,0,244,-1,145,356,572,627,746,913,957,942,916,844,763,705,630
1992-10-28,2,3,0,0,244,467,538,645,768,800,877,044,231,295,343,363,344,316,271

#TIMESTAMP
UTCOffset,Date,Time
+07:00:00,1992-10-28

#METEOROLOGY
Temperature,Pressure,Relative Humidity
,1642
```

Table: C_PROFILE

Field	Definition
Date	yyyy-mm-dd
H	Code for time of observation: 1=AM and 2=PM.
L	Clear zenith=3, Cloudy zenith=5 (used at Station 035, Arosa only)
ColumnO3Obs	Observed total column ozone analogous to TotalOzone (where Dobson unit is milli-atm-cm)
ColumnO3Retr	Retrieved value for total ozone in Dobson units. (Sum of retrieved individual layer amounts)
Layer10 - Layer1	Computed layer ozone amount in Dobson units. The sum of Layers 10-1 = ColumnO3Retr value.
ITER	Number of iterations (2, 3, 4 or 5).
SX	A priori profile error covariance matrix used for processing. Where: U = Uniform covariance matrix C = Climatological covariance matrix.
SZA_1	Code used to indicate the first SZA where: 1=60, 2=65 and 3=70 degrees.
NSZA	Number of solar zenith angles: 9, 10, 11 or 12.
DFMRS	RMS fractional retrieval change from last iteration.
FEPS	RMS change in forcing vector from last iteration.
RMSRES	RMS fit residual

An Example of Umkehr Profile Data in extCSV File Format

```
*NOAA-CMDL is the Agency acronym for the National Oceanographic and
*Atmospheric Administration-Climate Monitoring and Diagnostics Laboratory

*Version 1 is approved 1995 C-Umkehr MK2V4CUM Program
*One month per file

#CONTENT
Class,Category,Level,Form
WOUDC,UmkehrN14,2.0,1

#DATA_GENERATION
Date,Agency,Version,ScientificAuthority
1996-07-02,NOAA_CMDL,1.0, Gloria Koenig

#PLATFORM
Type,ID,Name,Country,GAW_ID
STN,067,Boulder,USA

#INSTRUMENT
Name,Model,Number
Dobson,Beck,82

#LOCATION
Latitude,Longitude,Height
40.03,-105.25,832

#TIMESTAMP
UTCOffset,Date,Time
+07:00:00,1989-08-01

#C_PROFILE
Date,H,L,ColumnO3Obs,ColumnO3Retr,Layer10,Layer9,Layer8,Layer7,Layer6,Layer5,Lay
er4,Layer3,Layer2,Layer1
1989-08-01,1,3,292,291.4,1.22,2.7,8.56,24.5,47.7,66.3,64.8,34.6,18,23
1989-08-05,1,3,286,287.2,1.24,2.83,8.96,24.1,48.6,70.9,63.1,30.7,15.6,21.1
1989-08-05,2,3,286,287.1,1.23,2.75,8.53,23.8,50.4,71.6,61.7,30.2,15.6,21.2
1989-08-06,2,3,297,295.8,1.22,2.67,8.19,23.5,48.4,67.7,65.3,35.8,19.1,23.9
1989-08-08,1,3,296,294.7,1.24,2.84,9.15,25.7,47.1,64.9,64.8,35.9,19.2,24
1989-08-10,1,3,302,302,1.27,3.02,9.9,26.5,49.8,70.7,65.6,34.9,18.4,21.9
1989-08-14,1,3,296,295.3,1.26,2.95,9.39,25.3,46.4,66.8,66.4,35.4,18.5,23
1989-08-15,1,3,301,300.9,1.27,3.01,9.58,25.2,46.9,69.8,68.3,36,18.7,22.2
1989-08-24,1,3,299,297.6,1.28,3.03,9.51,25.7,45.7,64.6,66.7,37,19.9,24.3
1989-08-25,1,3,295,293.8,1.28,3.01,9.32,24.9,45.3,64.7,66.4,36,19.1,23.9
1989-08-28,2,3,293,290.3,1.27,2.92,8.78,23.4,42,61.8,65.8,37.3,20.5,26.4
1989-08-29,1,3,284,284.1,1.3,3.12,9.73,26,46.6,64,62.3,31.6,16.5,22.9
1989-08-31,1,3,281,280.8,1.29,3.04,9.24,24.9,46.2,63.9,62,30.9,16.1,23.2

#TIMESTAMP
UTCOffset,Date,Time
+07:00:00,1989-08-31

#METEOROLOGY
Temperature,Pressure,Relative Humidity
,1642
```

3.3 Additional Notes

3.3.1 Access to the WOUDC Web and ftp sites

The WOUDC web site is at: http://www.msc-smc.ec.gc.ca\woudc and the WOUDC ftp site can be accessed either directly from the WOUDC web site or by conventional means as follows:

Address: ftp.tor.ec.gc.ca
Username: woudc
Password: woudc*

3.3.2 Revisions

When submitting revised data sets, data originators are encouraged to indicate the revision details in the metadata table DATA_GENERATION. The date the data were processed and the version number are important indicators of these changes which are needed by the WOUDC for administration purposes and to users of the data to ensure that they have the latest version of the data. This information provides a useful and efficient method tracking of updated data sets.

3.3.3 Utility Programs and Additional Assistance

It is expected that the time for transition from the traditional 80-column to the new extCSV file format will take some time. The WOUDC is also aware that many users of the data have programs written to read the old formats. Therefore, two utility programs are provided to assist in the conversion from either the 80-column to extCSV format (csx_wodc.exe) or from the extCSV to the 80-column format (wodc_csx.exe). To obtain a copy of the converter programs, access the WOUDC ftp site and go to the directory ***\software\converters***. These programs also provide accompanying documentation. The WOUDC reserves the right to update these programs without notice.

4. Data Set Security Issues

The WOUDC data output is freely available for public use and all files are write protected with read only access. There are special circumstances, however, which require a single user or group of users to have the ability to freely exchange data at a level of security which permits both read and write access to that specified group.

In response to this need for a higher level of security, special "secure" directories and user access through a specified username/password will be made available to interested individuals or groups. The general procedure to access these new directories by means of the File Transfer Protocol (FTP) will remain the same, just the username and password will be different. Files and documentation may then be freely exchanged within this second level and be protected from "public" viewing. These options are available to data originators. Refer to the options in the

WOUDC Data Submission Agreement. The submission of data either to the "secure" or public directories is acceptable, the latter being preferred. Originators should note that users of public data are advised by the WOUDC to abide at all times by whatever stipulations the originator has requested. Refer to the Data User's Protocol Form.

To get special directory access, the user will have to complete the information and sign the Data User's Protocol Form before access is granted.

5. Contact Information

For futher information, contact the WOUDC at:

The World Ozone and Ultraviolet Radiation Data Centre
4905 Dufferin Street
Toronto, Ontario
M3H 5T4 CANADA

Email: woudc@ec.gc.ca
Phone: +1-416-739-4635
Fax: +1-416-739-4281

6. Acknowledgements

The authors and the WOUDC would like to thank the following persons for their assistance in reviewing the new extCSV file format and data content requirements.

D. Anderson, A. Bais, J. Bird, T. Coleman, J. Davies, H. DeBacker, J. Easson, R. Evans, V. Fioletov, T. Fujimoto, M. Ginsburg, D. Hlaing, J. Kerr, U. Köhler, J. Logan, P-A Mettraux, M. Miyauchi, M. Molyneux, S. Oltmans, M. Stanek, W. Sukloff, D. Tarasick and K. Vanicek.

7. References

[1] Wardle, D.I., E.W. Hare, E.J. Carty and V.E. Fioletov, The Guide to the WMO/GAW World Ultraviolet Radiation Data Centre (WUDC) Version 5.1, Atmospheric Environment Service, Environment Canada, 1998.