TC–NCA–083

HIRDLS

HIGH RESOLUTION DYNAMICS LIMB SOUNDER

Originator: Chris M. Halvorson Date: 2001–01–30

Subject / Title: Curtis-Godson Transmittance Tables

Contents / Description / Summary:

This document describes the nature and structure of versions 1 and 2 of the Curtis-Godson transmittance tables, which have been created for general use within the HIRDLS program.

Key Words: Curtis-Godson transmittance

Purpose (20 characters maximum): specify absorption

Approved / Reviewed By:

Date (yyyy–mm–dd):

National Center for Atmospheric Research
Atmospheric Chemistry Division
3300 Mitchell Lane, Suite 2300
Boulder, Colorado 80301–2272
United States of America

EOS

File Names and Location

The latest versions of the Curtis-Godson transmittance tables are always located in the directory `/hir1t/HIRDLS/HIRRAD/TRANSMITTANCE` of the HIRDLS Science Computer Facility (SCF). There are two versions available, located in the subdirectories `VERSION_0102` and `VERSION_0202`. The general form of the file names is

`transtab_c`*`CC`*`_g`*`GGGGGG`*`_v`*`VVVV`*`.bin`,

where *CC* is the two-digit channel number of the specific channel, *GGGGGG* is the six-character species code of the specific gas, and *VVVV* is the four-digit version number of the specific table version. The possible values of the species code are: `H2O---`, `CO2---`, `O3----`, `N2O---`, `CH4---`, `O2----`, `SO2---`, `NO2---`, `HNO3--`, `CFC11-`, `CFC12-`, `CF4---`, `CLONO2`, and `N2O5--`. The channel numbers are `01` to `21`, and the version numbers are `0102` and `0202`. The last two digits of the version number indicate which version of the spectral response data (see TC–NCA–082) was used to create the transmittance table; the first two digits indicate the actual version of the table. Version 1 was calculated from version 4 of the amount absorption coefficient data files (see TC–NCA–081), and version 2 is a reformatted presentation of the Curtis-Godson transmittance data that was calculated by Steven T. Massie at NCAR.

File Format

The transmittance tables are sequential, ANSI-IEEE binary files. The specific structure of the tables is illustrated by the following Fortran 95 input code sample:

```
implicit none

! Integer Parameters
! ------------------
! lnxi_unit = input unit number for the Curtis-Godson transmittance
!             table with the values of the natural logarithm of the
!             optical depth

integer(kind=4), parameter :: lnxi_unit = 1

! Integer Variables
! -----------------
! compression = data compression indicator, currently set to "0",
!               indicating no compression
!     N_sigma = number of wave number grid points
!         N_p = number of pressure grid points
!         N_T = number of temperature grid points
!       N_eta = number of column amount grid points

integer(kind=4) :: compression,N_sigma,N_p,N_T,N_eta
```

```
! Character Variables
! -------------------
! header_1 = first header of the Curtis-Godson transmittance table
! header_2 = second header of the Curtis-Godson transmittance table
! header_3 = third header of the Curtis-Godson transmittance table
! header_4 = fourth header of the Curtis-Godson transmittance table

character(len=80) :: header_1,header_2,header_3,header_4

! Real Variables
! --------------
! DELTAsigma = wave number grid size [cm-1]
!    lnp_max = maximum value of the natural logarithm of the pressure
!              grid (pressure "p" in hPa = mbar)
!   DELTAlnp = ln(p) grid size
!      T_min = minimum value of the temperature grid [K]
!     DELTAT = temperature grid size [K]
!  lneta_min = minimum value of the natural logarithm of the column
!              amount grid (column amount "eta" in mol / m2)
! DELTAlneta = ln(eta) grid size
!    sigma_l = wave number [cm-1] of the lower passband boundary
!       lnxi = natural logarithm of the gridded optical depth

real(kind=4) :: DELTAsigma,lnp_max,DELTAlnp,T_min,DELTAT,lneta_min,&
   DELTAlneta
real(kind=8) :: sigma_l
real(kind=4), allocatable :: lnxi(:,:,:)

open(unit=lnxi_unit,file='/hir1t/HIRDLS/HIRRAD/TRANSMITTANCE/&
   &VERSION_0102/transtab_c18_gH2O---_v0102.bin',status='old',&
   form='unformatted',action='read')
read(unit=lnxi_unit) header_1
read(unit=lnxi_unit) header_2
read(unit=lnxi_unit) header_3
read(unit=lnxi_unit) header_4
read(unit=lnxi_unit) compression,N_sigma,sigma_l,DELTAsigma,N_p,&
   lnp_max,DELTAlnp,N_T,T_min,DELTAT,N_eta,lneta_min,DELTAlneta
allocate (lnxi(N_p,N_T,N_eta))
read(unit=lnxi_unit) lnxi
close(unit=lnxi_unit,status='keep')
```

Data Parameters

For version 2 of the spectral response data, $\Delta\sigma = 0.002$ cm^{-1}; and for version 1 of the transmittance tables, the pressure and temperature grids are specified by:

$$N_p = 15, \quad (\ln p)_{\max} = 3 / \lg e, \quad \Delta(\ln p) = -0.5 / \lg e$$

and

$$N_T = 21, \quad T_{\min} = 100 \text{ K}, \quad \Delta T = 15 \text{ K};$$

where lg e is the common (decadic) logarithm of the natural base of logarithms. The minimum value and grid size of the column amount grid depend on the specific gas, but for all gases:

$$N_\eta = 60.$$

The version 1 tables also have three dummy files for those gases that are not in a particular channel but are part of a joint retrieval in a set of channels, namely, CCl_2F_2 in channel 7, CCl_3F in channel 9, and N_2O_5 in channel 17. For these dummy files:

$$N_p = 3, \quad (\ln p)_{\max} = 3 / \lg e, \quad \Delta(\ln p) = -3 / \lg e;$$

$$N_T = 3, \quad T_{\min} = 100 \text{ K}, \quad \Delta T = 150 \text{ K};$$

and

$$N_\eta = 3, \quad (\ln \eta)_{\min} = -100, \quad \Delta(\ln \eta) = 75.$$

The optical depths in the dummy files are all set to a constant negligible value.

For version 2 of the transmittance tables:

$$N_p = 21, \quad (\ln p)_{\max} = \ln 500, \quad \Delta(\ln p) = (\ln 2.54 \times 10^{-5} - \ln 500) / 20;$$

$$N_T = 22, \quad T_{\min} = 150 \text{ K}, \quad \Delta T = 10 \text{ K};$$

and

$$N_\eta = 61.$$

The version 2 tables do not have dummy files, per se; the relevant gas-channel combinations simply have the optical depths set to a constant negligible value.