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"Notes on the use of LOW & LOWTRAIN-6 codes"

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Please note: These are preliminary notes intended for internal distribution only.

Notes on the use of LOW and LOWTRAN-6 codes

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Preface

Some of the physics contained in program LOWTRAN-6 is described in the LOWTRAN-6 manual. LOWTRAN-6 allows to compute atmospheric transmittance and radiance in the shortwave and longwave spectrum of electromagnetic radiation. A new version of the code, called LOWTRAN-7, and the associated Technical Report (AFGL-TR 88-0177) is being distributed by:

National Climatic Data Center
NOAA
Environmental Data Service
Federal Building
Asheville, N.C., 28801
tel (704) 259 0682

LOWTRAN-6 INPUT and OUTPUT files and the LOW program.

LOWTRAN-6, as inplemented during this course, expects the input data, arranged according to the instruction given in the afore mentioned manual, to be in the INPUT file; accordingly the basic output file is named OUTPUT. A second output file, to be eventually used by a plotting routine, is named TAPE7.

In order to easy the preparation of the INPUT file a program can be used by typing: LOW <cr> (where <cr> stands for the Enter key).
This program does not exploit all the possibilities offered by LOWTRAN-6. It is however a valid help for beginners and allows to compute transmittance and radiance in most situations. It is not a fully tested program in the sense that sometimes the informations requested should not be required for the computation: in this case the information is asked but not used.

Preparing the INPUT file using LOW.

In the following an example is given of the use of LOW: it should be considered an example by no means exaustive of the possibilities offered by LOW since many choices depend on previous selections. Any answer to the Menus consist of the option selected (a real or integer number) and <cr>.
The parts within two continuous lines denote what is printed on the screen and, sometimes, possible answers.

To start the process type: LOW<cr> and you will see:

INPUT data file generator for LOWTRAN6

By L. Gumley, L. Fuchmayer, J. Waring
Curtin University of Technology
Version 1.0017 November 1988

Hit return to continue.....

=====> .... Hit return to continue

Option selection : Model

o	Tropical model atmosphere	return
o	Midlatitude summer	1
o	Midlatitude winter	2
o	Subarctic summer	3
o	Subarctic winter	4
o	1962 U.S. standard	5
o	Met.data specified (horiz. paths only)	6
o	User defined 7	

Enter your choice (1 - 7) :

Choose for example <cr> (Tropical model atmosphere) and you will go to the next Menu

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Option selection : Atmospheric path type

	return
o Vertical or slant path to space	1
o Vertical or slant path between H1, H2	2
o Horizontal (constant pressure)	

Enter your choice (1 - 2) :

Choose for example <cr> (Vertical or slant path to space) and you will go to the next Menu

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Option selection : Calculated parameters

	<return>
o Transmittance	1
o Atmospheric radiance	2
o Atmospheric, solar/lunar radiance	3
o Transmitted solar irradiance	

Enter your choice (1 - 3) : 1

Choose for example <1> (Atmospheric radiance) and you will go to the next Menu.
A series of questions will be asked and default answer is no:

Do you wish to supplement the temperature and pressure profile (y/n,n) : n
Do you wish to supplement the water vapour profile (y/n,n) : n
Do you wish to supplement the ozone profile (y/n,n) : n

Next Menu:

Option selection : Program output specification

o	Abbreviated output	<return>
o	Full output of profiles	1

Enter your choice : 1

The volume of data produced is usually quite large and may arrive easily to a hundred pages. You are invited to look at the data with an editor before printing the output file.

Next request concerns the ..

Surface albedo of earth (0.0-1.0) : 0.3

For computations in the visible the number to be typed in is the surface albedo; for transmittance or radiance calculations in the infrared the number is the surface emissivity!

Next Menu deals with the treatment of aerosols in the lowest 2 km of the troposphere:

Option selection : Extinction by aerosols

o	None	<return>
o	Rural (visibility 23 km)	1
o	Navy maritime (sets vis.)	2
o	Maritime (vis. 23 km)	3
o	Urban (vis. 5 km)	4
o	Tropospheric (vis. 50 km)	5
o	User defined (vis. 23 km)	6
o	Advection fog (vis. 0.2 km)	7
o	Radiation fog (vis. 0.5 km)	8

Enter your choice (1 - 8) : 1

Select 1 for example. Next Menu asks for season:

Option selection : Season

- o Set by Model <return>
- o Spring-summer 1
- o Fall-winter 2

Enter your choice (1 - 2) :

The first option uses the model selected in the first menu to define the appropriate season.

Next Menu asks to choose the aerosol profile in the upper troposphere and stratosphere:

Option selection : Aerosol profile, extinction

- o Background stratospheric (p and e) <return>
- o Background stratospheric (p and e) 1
- o Moderate volcanic p., aged volcanic e. 2
- o High volcanic p., fresh volcanic e. 3
- o High volcanic p., aged volcanic e. 4
- o Moderate volcanic p., fresh volcanic e. 5

Enter your choice (1 - 5) :

In case you want to compute the attenuation of shortwave radiation by cirrus clouds (see the LOWTRAN-6 manual for details) type 1 in the next Menu. A series of submenus will be shown which are not reported in this manual.

Option selection : Cirrus cloud

- o No cirrus attenuation <return>
- o Use cirrus profile 1

Enter your choice : <cr>

Next Menu:

Meteorological visibility range (km) (0:use default vis.) : 0
Rain rate (mm/hr) :0

Type 0 0 to use a visibility of 23 km (in this example the tropospheric aerosol RURAL 23 km was chosen) and no rain.

Next Menu asks for the observer altitude and solar zenith angle (which has a meaning only for shortwave transmittance or irradiance computations!)

Observer/sensor altitude (km, 0 < H1 < 100) : 0
Solar zenith angle from H1 (degrees) : 60

Next Menus are self explanatory:

Initial wavelength (microns) :0.5
Final wavelength (microns) :3.5

The code writes some information ans asks for the frequency interval:

Frequency range (cm-1) is 2857.143 to 33333.330
Frequency interval (cm-1, multiple of 5) : 20

Final Menu for repeated (eventually) computations:

```
        Option selection : Program repetition options

    o  Execute using this data only      <return>
    o  Read another data set                 1
    o  Read another geometry data set        2
    o  Read another wavelength data set      3

   Enter your choice  (1 - 3) :
```

The INPUT file is ready and LOWTRAN-6 is executed. Files OUTPUT and TAPE7 are produced.
When exiting the code the following note is printed in your consolle:

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        You should modify the default names for INPUT, OUTPUT
        and PLOT file used by LOWTRAN6

                          Type:     IOP n

        where n is an integer from 0 to 999. The files will be
        defined renamed as:

                      INPUT    ===> LOWI.n
                      OUTPUT   ===> LOWO.n
                      TAPE7    ===> LOWP.n

================================================================
```

Type, for example

```
 C:\USER\XXX>iop 1
```

if the n=1 was not previously selected; in case files LOWI.1, LOWO.1 and LOWP.1 exist an error is reported.

NOTA BENE

The length of the output file is strongly dependent on the choice of the frequency interval. Since the basic resolution of LOWTRAN-6 is 20 wavenumber the frequency interval should be greater than 20. The possibility of producing results at 1 wavenumber interval does not add much to the information content and produces easily hundreds of pages.