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Skyrad.pack\_V5.0 : A package for sky radiance analyses Ver.5.0

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1. History

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2024.01.17 Version 5.0 is organized by M.Hashimoto

2. List of contents

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In this package there are the following eight directories, a Mie-kernel

file 'MIEKER' and this document 'ReadMe\_skyrad\_V5.doc'.

(1) cal\_f0/ ... Calculation of calibration constants for instrument

(2) dtform/ ... Format conversion of data files for analyses

(3) examples/ ... Examples for PREDE data processing

(4) parafiles/ ... Examples for observation conditions files

(5) solid/ ... Calculation of solid view angles for instrument

(6) sproc5/ ... Analysis Ver.5.0

(7) tkrnl/ ... Making of a Mie-kernel file

There is a ReadMe document in each directory.

In the directory parafiles/ there are examples for 'METEO.DAT'

(meteorological conditions), 'ins.para'(information on instrument)

and 'obs.para'(information on observation) files.

In the directory examples/ there are two examples for typical

processing of PREDE data.

In the other directories there are the following-type files for

processing.

proc the main part of source program file for processing

proc.f full source program file for use (execution)

proc.par parameters/options file for process control

3. Genaral information

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3-1. Uses

This package has been developed for analyses of observation data

measured on ground or on ship by sky radiometers made of PREDE

Co.,Ltd. At present pitching and rolling of ship leaves out of

consideration in analyses of ship-born data.

Sky radiance data got by other instruments also can be analyzed,

if they include all the information necessary for analyses and are

converted by yourself into input data files for analyses.

3-2. Compiling of source files

First of all, it is necessary to prepare on your machine the

environment that FORTRAN77 operates and to compile source files

('proc.f') for execution by yourself.

The following compile options are used.

f77 (gfortran/ifort etc.) -r8 -O -g -o proc.e proc.f

In this case an executable file 'proc.e' is made.

The double precision option for all variables and constants(-r8)

is indispensable for suitable analyses with enough accuracy.

4. General procedure for PREDE sky radiometers measurements

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4-1. Measurements

Sky radiance measurement data are stored in the following data files.

yymmdd.DAT

or yyyymmdd.dat

or yymmddnn.dat

Here 'yy' or 'yyyy' gives year, 'mm' - month, 'dd' - day

and 'nn' gives a serial number.

4-2. Setting of observation conditions files ... parafiles/

The following three parameter files are set. Their examples are in

the directory parafiles/.

METEO.DAT: the atmospheric pressure and the ozone amount

ins.para : wavelengths, solid view angles(SVA) and calibration

constants(F0) for the instrument

obs.para : longitude, latitude, altitude of the observation site

and scattering angles for measurement

4-3. Format conversion of measurement data files ... dtform/

Measurement data files are converted into some input files for analyses

according to the analysis version.

For Ver.5.0 analysis, the following data files(\*.DT5) are made:

DAT/yymmdd.DAT -> DT5/yymmdd.DT5

yyyymmdd.dat -> yyyymmdd.DT5

yymmddnn.dat -> yymmddnn.DT5

At the same time 'tag' files(\*.tag) are also made. They are tables

of information on measurements (date, time, longitude, latitude,

solar height and the maximum scattering angle for measurement).

DAT/yymmdd.DAT -> Tag/yymmdd.tag

yyyymmdd.dat -> yyyymmdd.tag

yymmddnn.dat -> yymmddnn.tag

4-4. The level-1 analysis by Ver.5.0 ... sproc5/

Aerosol optical properties (optical thickness, size distribution,

complex refractive index) are retrieved from sky radiance data by

an inversion method. In analysis with Ver.5.0, refractive indices

are retrieved for the respective wavelengths.

Parameters/options for process control are set in the 'sproc.par'

file. A Mie-kernel file 'MIEKER' is necessary for this process.

Inputs: DT5/\*.DT5 ... measured sky radiance

Tag/\*.tag ... information on measurement

Outputs: Par/\*.par ... optical thickness, refractive index,

single scattering albedo

Vol/\*.vol ... volume spectrum (dV/dlnr[cm3/cm2])

Aur/\*.aur ... measured and retrieved sky radiance

Phs/\*.phs ... phase function

All results are output to one file Out/\*.out, if it is chosen.

5. General procedure for other instruments measurements

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5-1. Measurements

If direct solar irradiance and several diffused sky radiance data

are obtained, they can be analyzed by this package.

5-2. Setting of observation conditions files ... parafiles/

The following two parameter files are set. Their examples are in

the directory parafiles/.

METEO.DAT: the atmospheric pressure and the ozone amount

ins.para : wavelengths, solid view angles(SVA) and calibration

constants(F0) for the instrument

5-3. Format conversion of measurement data files ... dtform/

Instead of 'dtform' processing in case of PREDE data, measurement

data files must be converted by yourself into input data files

for analyses. For Ver.5.0 analysis, the following daily data files

must be made.

DT5/yymmdd.DT5 ... measured sky radiance data file

Tag/yymmdd.tag ... 'tag' file for measurement

Here 'yy' gives year, 'mm' - month and 'dd' - day.

'tag' files(\*.tag) are tables of information on measurements (date,

time, longitude, latitude, solar height and the maximum scattering

angle for measurement).

The formats of \*.DT5 and \*.tag files are given in ReadMe\_dtform.doc.

5-4. The level-1 analysis by Ver.5.0 ... sproc5/

Aerosol optical properties (optical thickness, size distribution,

complex refractive index) are retrieved from sky radiance data by

an inversion method. In analysis with Ver.5.0, refractive indices

are retrieved for the respective wavelengths.

Parameters/options for process control are set in the 'sproc.par'

file. A Mie-kernel file 'MIEKER' is necessary for this process.

Inputs: DT5/\*.DT5 ... measured sky radiance

Tag/\*.tag ... information on measurement

Outputs: Par/\*.par ... optical thickness, refractive index,

single scattering albedo

Vol/\*.vol ... volume spectrum (dV/dlnr[cm3/cm2])

Aur/\*.aur ... measured and retrieved sky radiance

Phs/\*.phs ... phase function

All results are output to one file Out/\*.out, if it is chosen.

6. Examples for PREDE data processing

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6-1. Example.1 ... example1/

An example for typical processing of measurements on GROUND is given

in the directory examples/example1/.

6-2. Example.2 ... example2/

An example for typical processing of measurements on SHIP is given

in the directory examples/example2/. At present pitching and rolling

of ship leaves out of consideration in analyses of ship-born data.

7. Other software

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7-1. Calculation of calibration constants for instrument ... cal\_f0/

Calibration constants (F0) for the instrument are determined from

sky radiance data by the Improved Langley method. Considerable data

are needed for this determination; data of a month at least, usually

of several months.

It is better to examine F0 constantly in parallel with observation.

7-2. Calculation of solid view angles for instrument ... solid/

Initial solid view angles (SVA) for the instrument are given

by PREDE Co.,Ltd. In long-term observation it is better to

examine SVA sometime regularly, for example, once every two weeks.

Disk scans data for SVA calibration are got by sky radiometer

measurements. Disk scans should be performed nearly at culmination

under good sky condition (clear sky without clouds).

SVA are calculated from disk scans data by 'solid' processing.

7-3. Making of a Mie-kernel file ... tkrnl/

'MIEKER' is a table of efficiency factors for extinction, scattering

and its angular distributions of a Mie particle (Mie kernel).

Complex refractive index and size parameter of a particle and its

scattering angles are set in the 'tkrnl.par' file.

Your custom-made 'MIEKER' can be made by changing parameters in

'tkrnl.par'.

8. Copyright and Contact Information

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Individuals and Institutions must identify themselves through

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Every researchers, scientists, engineers, teachers who will publish

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developer(s), with a sentence and publication lists suggested below.

If you got considerable supports from OpenCLASTR colleagues or package

developer(s), please contain individual name(s) as co-author(s).

[Acknowledgement]

“The author(s) are grateful to OpenCLASTR project for using

Skyradiometer analysis package (SKYRAD.pack) in this research.”

[Reference]

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