Tarea:

¿Qué es la transferencia radiativa?

Es el fenómeno de propagación de las ondas electromagnéticas con su debida energía asociada y cómo cambia esta al atravesar un medio.

¿Qué dice la ecuación general de la transferencia radiativa?

La ecuación general de la transferencia radiativa da cuenta cómo cambia la irradiancia al tener en cuenta los 3 fenómenos principales de la interacción radiación-materia, por ello, este cambio se denota como la diferencia entre la irradiancia entrante y la función total de la fuente, que tiene en cuenta la emisión de la fuente y la forma en la que esta esparce la radiación en un nuevo ángulo sólido.

¿Qué es SBDART?

SBDART es un programa informático diseñado para el cálculo rápido y preciso de la transferencia radiativa atmosférica, el modelo físico-matemático del SBDART integra efectos como la absorción y el esparcimiento de la radiación por gases, nubes y aerosoles, así como la reflexión y emisión de la superficie terrestre y las nubes.

¿Qué recibe SBDART y qué entrega?

SBDART recibe datos de propiedades atmosféricas como pueden ser perfiles de temperatura, presión, humedad y concentraciones de gases. Recibe la distribución vertical de los aerosoles y nubes (tamaño de partículas, distribución del tamaño de las partículas, effective cloud droplets radius, etc.)

Este modelo también recibe propiedades de la superficie, incluyendo el albedo, la temperatura y la emisividad, tiene en cuenta la geometría solar y se define de la fecha, hora, latitud y longitud.

Las salidas incluyen flujos radiativos, índice UV, índice de fotosíntesis activa y otros índices relevantes, diagramas polares de radiancia.

IDATM: 0, user specified and 1, Tropical (Tentative) (output atmospheric profile will reflect any modifications by UW, UO3, O3TRP, PBAR, RHCLD and KRHCLR.

IDATM = 1 takes default water vapor (g/cm2) as 4.117 and ozone (atm-cm) total below 10 km 0.253 – 0.0216

ATMOSPHERIC PROFILE (Required)

Atms.dat:

* Amix: Percentage of mixing between atms.dat and standard internal profiles by IDATM. (Values between 0-1)
* UW: Integrated water vapor amount (g/cm2)
* UO3: Integrated ozone concentration above ZTRP (atm-cm); if ZTRP = 0 UO3 usually specifies the total ozone column.
* ZTRP: Altitude of tropopause. If default (0) UO3 and UO3TRP sets the total column ozone in the stratosphere.
* XN2: Volume mixing ratio of N2 (PPM, default = 781000.00)
* XO2: Volume mixing ratio of O2 (PPM, default = 209000.00)
* XCO2: Volume mixing ratio of CO2 (PPM, default = 360.00)
* XCH4: Volume mixing ratio of CH4 (PPM, default = 1.74)
* XN2O: Volume mixing ratio of N2O (PPM, default = 0.32)
* XCO: Volume mixing ratio of CO (PPM, default = 0.15)
* XNH3: Volume mixing ratio of NH3 (PPM, default = 5.0e-4)
* XSO2: Volume mixing ratio of SO2 (PPM, default = 3.0e-4)
* XNO: Volume mixing ratio of NO (PPM, default = 3.0e-4)
* XHNO3: Volume mixing ratio of HNO3 (PPM, default = 5.0e-5)
* XNO2: Volume mixing ratio of NO2 (PPM, default = 2.3e-5)
* XRSC: Sensitivity of Rayleigh scattering (default = 1). Efficiency scattering factor in terms of altitude (pressure and temperature)
* PBAR: Surface pressure in millibars.

PBAR > 0: causes each pressure to be multiplied by the factor (PBAR/P0) where P0 is the surface pressure of the original atmosphere. Absorption due to mixed gases is affected except UW and UO3. The Rayleigh scattering optical depth is proportional to the PBAR/P0 factor.

PBAR = 0: disables Rayleigh scattering and all atmospheric absorptions. Scattering by aerosols or clouds is not affected.

PBAR < 0: Default and causes the original pressure profile to be used.

* ZPRES: Surface altitude in kilometers. Alternative way of setting the surface pressure.
* SCLH2O: Water vapor scale height in km.

If SCLH2O.gt. 0, then water vapor is vertically distributed as exp(-z/SCLH2O)

If SCLH2O.le. 0, the original vertical profile is used. No effects on the total water vapor amount.

CLOUD PARAMETERS --- BUSCAR

* ZCLOUD: Altitude of cloud layers in km (up to 5 values)
* TCLOUD: Optical thickness of cloud layers (up to 5 values)

Specifies the cloud depth at a wl of 0.55 microns. Is computed using the relation, tau = TCLOUD\*Q(wl)/Q(0.55um), where Q is the extinction efficiency and is a function of effective radius and wavelength. IMPORTANT

* NRE: Cloud drop effective radius (microns) (up to 5 values) (NRE < 0 is for ice particles)

NRE > 0 selects Mie scattering parameters for droplets

* RHCLD: Relative Humidity within a cloud layer (floating point value between 0.0 and 1.0)
* IMOMC: Controls the phase function model used in cloud layers:

1, isotropic scattering.

2, Rayleigh scattering phase function.

3, Henyey\_greenstein (a function of asymmetry factor, g(re)) (default) (average of the cosine of the scattering angle, values between 1, -1)

* LWP: The liquid water path of a cloud (g/cm2). Another way to specify cloud optical depth.

tau = (3\*Q(wl)\*LWP) / (4\*RHO\*NRE)

STRATOSPHERIC AEROSOLS (LOWTRAN 7 model)

* JAER: 5 element array of stratospheric aerosol types

0 – no aerosol

1 – background stratospheric

BOUNDARY LAYER AEROSOLS (BLA)

* IAER: Boundary layer aerosol type selector: (tentative 1, 2, 4)

-1, read aerosol optical depth and scattering parameters from aerosol.dat

0, no boundary layer aerosols

1, rural

2, urban

4, tropospheric

5, user specified

If user specified, input parameters wlbaer, tbaer, wbaer and gbaer.

* WLBAER: Wavelength points (microns) for user defined aerosol spectral dependence. (qbaer not need to be specified if a single spectral point is set)
* WBAER: Single Scattering Albedo
* GBAER: Asymmetry Factor
* PMAER: Legendre moments of scattering phase function of boundary layer aerosols (Only active if IAER = 5)

No disponible

* RHAER: Spectral dependence of the boundary layer aerosol scattering parameters are sensitive to RH.

-1, use ambient surface RH computed from temperature and water vapor density of the current model atmosphere. (default)

* ZBAER: Altitude grid for custom aerosol vertical profile (km)
* DBAER: Aerosol density at ZBAER altitude grid points. Check the SBDART user manual.
* TBAER: Vertical optical depth of boundary layer aerosols nominally at 0.55 microns.
* QBAER: Extinction efficiency. (Only active when IAER = 5)
* ABAER: Wavelength (Angstrom model) exponent used to extrapolate BLA extinction efficiency (Active when IAER = 5, default = 0)
* IMOMA: Controls phase function used for boundary layer aerosol. (if heyney\_greenstein (default = 3) asymmetry factor must be specified)
* NOTHRM: Thermal emission

-1, Thermal emission turned on only for wl > 2.0 microns (default)

0, Thermal emission turned on for all wl

1, No thermal emission.

WAVELENGTH LIMIT AND FILTER SPECIFICATION

* Solar spectrum selector: tentative

-1 = read from file solar.dat (user supplied) reads wlsun and sun.

wlsun: wavelength sample points

sun: direct normal solar irradiance at the top of atmosphere (W/m2/micron)

0 = spectrally uniform

1 = 5s solar spectrum

0.005 microns resolution, 0.25 to 4 microns

2 = LOWTRAN\_7 solar spectrum (default)

20 cm-1 resolution, 0. to 28780 cm-1

10 cm-1 resolution, 28780. to 57490 cm-1

3 = MODTRAN\_3 solar spectrum

20 cm-1 resolution, 100 – 49960 cm-1

* ISAT: values (-4, -3, -2, -1, 0)

0 is default and treatment is WLINF to WLSUP and is read from filter.dat (wlfilt, filt)

WLFILT: wavelength sample points (microns)

FILT: filter response values (unitless)

* WLINF: Lower wl limit if ISAT = 0
* WLSUP: Upper wl limit if ISAT = 0
* WLINC: Specifies the spectral resolution of the SBDART run.

SOLAR GEOMETRY (Required)

* SZA: Solar zenith angle (degrees, default = 0)
* CSZA: Cosine of SZA (default = -1)
* SAZA: Solar azimuth angle (degrees, default = 0.)
* IDAY: Number of days into a standard “year”

If IDAY > 0, the solar illumination angles (SZA, SAZA) are computed from the specified time and geographic coordinates.

* TIME: UTC TIME in decimal hours.
* ALAT: Latitude of point on earth´s surface.
* ALON: East longitude of point earth´s surface.
* SOLFACT: Solar distance factor.

SOLFACT is set internally when the solar geometry is set through IDAY, TIME, ALAT, ALON.

* NOSCT: Aerosol scattering mode used for boundary layer aerosols: (tentative)

0, normal scattering and absorption treatment.

3, set ssa=0

SURFACE REFLECTANCE PROPERTIES

* ISALB: Surface Albedo Feature

-1, spectral surface albedo read from albedo.dat

0, user specified, spectrally uniform set with ALBCON

6, vegetation (data range 0.4 – 2.6 microns)

* ALBCON: Spectrally uniform albedo

Range values between (0-1) Buscar valores nominales de albedo urbano, bosque, pasto

Urban Albedo is around 0.1 <https://escholarship.org/content/qt0pz748p6/qt0pz748p6_noSplash_416c923a269d142bd9fc7a265feb8bca.pdf>

Forest Albedo is around 0.13 and for trees 0.15 - 0.18

<https://thundersaidenergy.com/downloads/albedo-of-different-landscapes-a-challenge-for-reforestation/#:~:text=However%2C%20some%20commentators%20have%20criticized,Thus%20they%20absorb%20more%20heat>.

Landscape is around 0.2

<https://thundersaidenergy.com/downloads/albedo-of-different-landscapes-a-challenge-for-reforestation/#:~:text=However%2C%20some%20commentators%20have%20criticized,Thus%20they%20absorb%20more%20heat>.

Grass albedo isa round = 0.25 – 0.3

<https://www.researchgate.net/publication/275956502_Investigating_the_Impact_of_Ground_Albedo_on_the_Performance_of_PV_Systems>

EXAMPLE CODE: Modified

# Description: Example 2

# Spectral Flux for different albedo values and different UW amounts

UW=0;0.2312;0.7098;1.701;3.752;8

ALBCON=0;0.2;0.4;0.6;0.8;1

WLINF=6

WLSUP=14

WLINC=20

IOUT=1

ZGRID1=0.2