Optimización de la búsqueda de parámetros atmosféricos en modelos de transferencia radiativa

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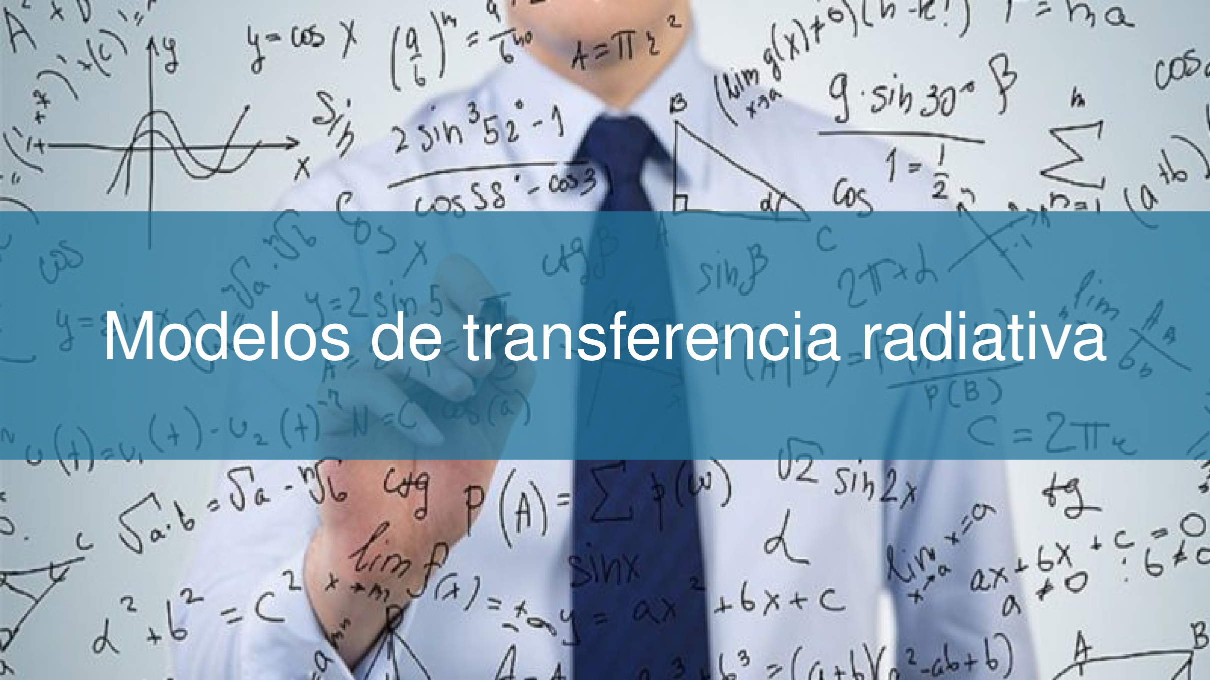


Modelos de transferencia radiativa

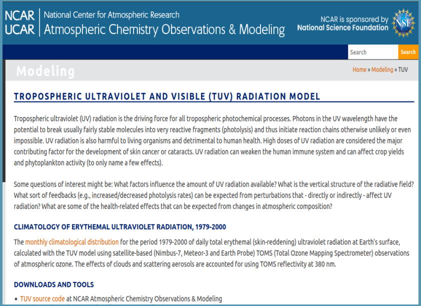


Figure 1: Tropospheric Ultraviolet and Visible (TUV) radiation model. [1]

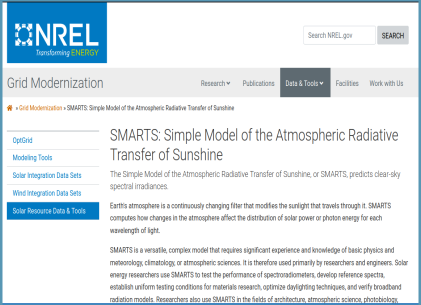


Figure 2: Simple Model of the Atmospheric Radiative Transfer of Sunshine. [2]

¿Qué hacen estos modelos?

$$\frac{dE}{dAdt} = I_\nu(\hat{k}, \vec{r}, t)\vec{k} \cdot \vec{n} d\Omega d\nu \qquad [3]$$

```
'AOD=0.041 '
2
25.750 0.476 0
1
'USSA'
1
0
1 0.2740
0
3
390
0
'S&F_URBAN'
5
0.041 2
18
1
51 37.0 180.0
285 2800 1 1366.1
2
285 2800 1
1
4
1
0 2.9 0
0
0
1
3
2015 1 11 8.2167 25.75 -100.255 -6
```

Figure 3: Archivo de inputs del modelo SMARTS

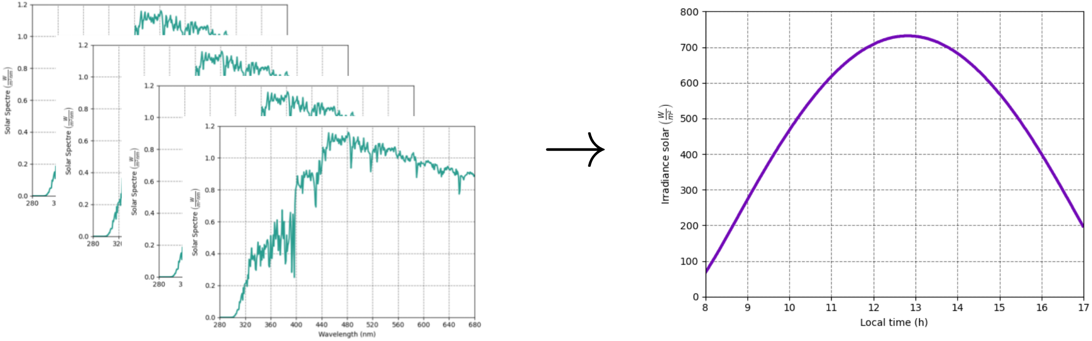
```
TUV inputs:
==================================================================
inpfil =        CDMX  outfil =         cdmx  nstr =            -2
lat =         19.420  lon =         -99.145  tmzone =        -6.0
iyear =         2016  imonth =            1  iday =             9
zstart =       2.245  zstop =        80.000  nz =              81
wstart =     280.000  wstop =       400.000  nwint =          120
tstart =      10.000  tstop =        15.000  nt =              61
lzenit =           F  alsurf =        0.080  psurf =       -999.0
o3col =      228.380  so2col =        0.000  no2col =       0.100
taucld =       0.000  zbase =         4.000  ztop =         5.000
tauaer =       0.061  ssaaer =        0.800  alpha =        1.000
dirsun =       1.000  difdn =         1.000  difup =        0.000
zout =         2.245  zaird =    -9.990E+02  ztemp =     -999.000
lirrad =           T  laflux =            F  lmmech =           F
lrates =           T  isfix =             0  nms =              2
ljvals =           F  ijfix =             0  nmj =              0
iwfix =            0  itfix =             0  izfix =            0
==================================================================
```

Figure 4: Archivo de inputs del modelo TUV

$$I(t) = \int_{\lambda_0}^{\lambda_i} E(\lambda, t)\, d\lambda \tag{1}$$

```
# Calculo de la irradiancia solar a partir de los resultados del
modelo SMARTS
size = np.size(irradiance)
integral = irradiance[0]
for i in range(1, size):
    integral += irradiance[i]*(wavelength[i]-wavelength[i-1])
```

Figure 5: Implementación de la ecuación 1.


Solar Spectre $\left(\frac{W}{m^2 \cdot nm}\right)$
0.0
0.2
0.4
0.6
0.8
1.0
1.2
280 320 360 400 440 480 520 560 600 640 680
Wavelength (nm)
Irradiance solar $\left(\frac{W}{m^2}\right)$
0
100
200
300
400
500
600
700
800
8 9 10 11 12 13 14 15 16 17
Local time (h)

Recolección de datos

Mediciones in situ

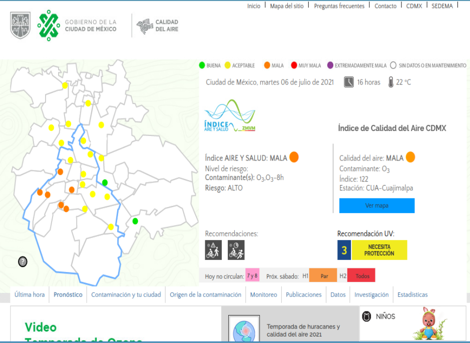


Figure 6: Página web de la SEDEMA. [4]

Figure 7: Página web del SIMA. [5]

$$\text{UVB} \rightarrow [280nm, 320nm]$$
$$\text{UVA} \rightarrow [320nm, 400nm]$$
$$\text{UVB+UVA} \rightarrow [280nm, 400nm]$$

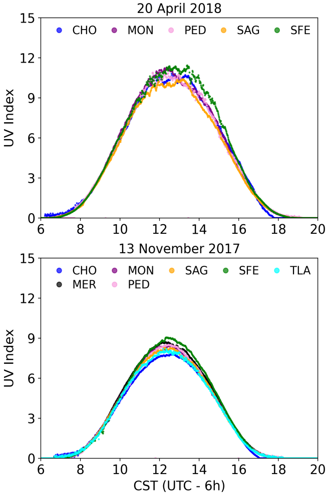


Figure 8: Mediciones de indice UV en las diferentes estaciones de monitoreo de la SEDEMA. [4]

Mediciones satelitales

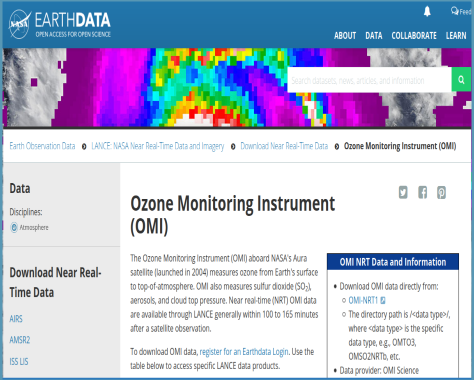


Figure 9: Página web del proyecto OMI. [6]

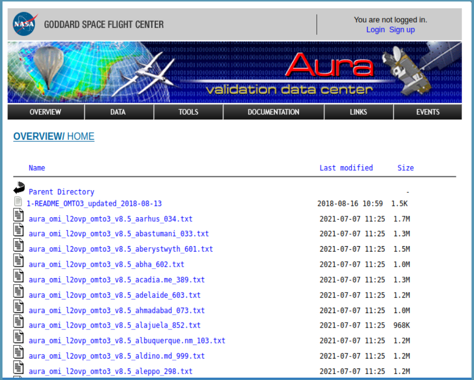


Figure 10: Página web de los datos OMI. [7]

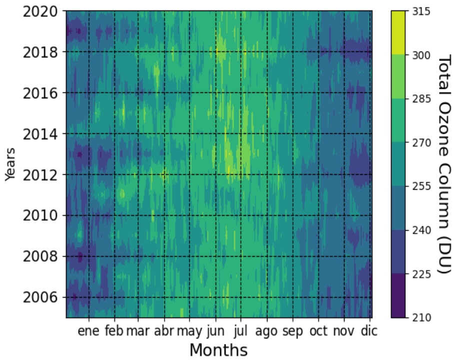


Figure 11: Datos de columnas de Ozono en CDMX.

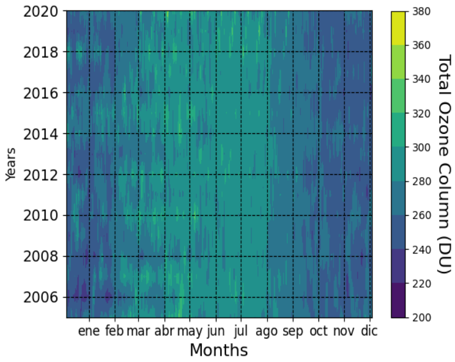


Figure 12: Datos de columnas de Ozono en Monterrey.


THANK YOU

[1] NCAR, "Atmospheric chemistry observations & modeling." https://www2.acom.ucar.edu/modeling/tropospheric-ultraviolet-and-visible-tuv-radiation-model, 7 2021.

[2] NREL, "Smarts: Simple model of the atmospheric radiative transfer of sunshine." https://www.nrel.gov/grid/solar-resource/smarts.html, 7 2021.

[3] A. Carramiñana, *Transferencia radiativa*, ch. 2, pp. 1–24. INAOE, 8 2020. https://www.inaoep.mx/~alberto/cursos/radiacion/cap2.pdf.

[4] SEDEMA, "Sistema de Monitoreo Atmosférico,Ciudad de México." http://www.aire.cdmx.gob.mx/default.php?opc=%27aKBhnmI=%27&opcion=bQ==.

[5] SIMA, "Sistema integral de monitoreo ambiental." http://aire.nl.gob.mx/.

[6] EarthData, "Ozone Monitoring Instrument (OMI)." https://earthdata.nasa.gov/earth-observation-data/near-real-time/download-nrt-data/omi-nrt.

[7] Goddard Space Flight Center, "Aura Validation Data Center." https://avdc.gstfc.nasa.gov/pub/data/satellite/Aura/OMI/V03/L2OVP/OMTO3/.