UV-radiation model intercomparison and selection

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Content

- Model quality- type of model, modelled parameter, incorporation of aerosols and snow
- Model requirements/inputs
- Model outputs – daily dose, hourly dose, spectral irradiance
- Model results

Model principle

- Regression or combination of analytical, statistical and regression methods (SR)

auth, dwdk, dwdk_acc, gsas, igfp, imwm, rivm, tobs, uvwm

- Models based on neural networks (statistical) (NN)

dwdf, mim_cn4, mim_cn1, mim_wgt

- Models based on look-up tables (analytical?) (LUT)

fmi, jrc

- Analytical models (A)

boku

Modeled parameter

•cloud modification factor (CMF) of erythemal UV radiation

- spectral irradiance CMF igfp, jrc, mim_cn4 (?), mim_cn1 (?), mim_wgt (?)

-daily CMF auth, dwdk, gsas, imwm, rivm, tobs, uvwm

- integral hourly CMF or integral irradiance CMF dwdk_acc, fmi (spectral?)

•erythemal UV radiation

-daily dose dwdf ?
- hourly sum boku
- spectral irradiance mim_cn1,mim_wgt, mim_cn4

General or local models

local models dwdf, imwm, tobs (derivation of local seasonal averages of different UV radiation proxies and differences form the average)

Possibility to model UV radiation spectrally weighted by different action spectra

-directly igfp, jrc, (min_cn4, mim_cn1, mim_wgt ?), boku

- needed corrections

-construction of new LUT tables for differently weighted / spectral UV irradiances fmi?

-construction of new regression relations between spectral CMF or spectral irradiances and its proxy parameters for regression models of daily CMF (auth, dwdk, dwdk_acc, rivm, gsas, uvwm, imwm)

-dwdf (change the NN model of broadband UV radiation to model spectral irradiances, new neural network training)

- tobs (based on climatological? data)

Modeling of albedo variability effect on UV radiation

- no albedo effect uvwm
- snow effect from Schwander et all. (1999) auth, dwdk, dwd_acc, min_cn1,min_cn4, mim_wgt
- satellite data jrc (METEOSAT - albedo of global irradiance)
-incorporation of snow effect without detailed specification dwdk, fmi, gsas, igfp, rivm, boku
- determination of UV radiation albedo optimizing the RT model inputs imwm
- deviations of surface albedo from climatological values tobs

Modelling of aerosol variability effect on UV radiation

no aerosol variability – constant AOD and its quality during a year – auth, jrc, uvwm, rivm, boku

aerosol quantity derived from visibility dwdf, min_cn1, mim_cn4, mim_wgt, gsas (and boundary layer height)

aerosol climatology –imwm (EDUCE), fmi, dwdk, dwd_acc, tobs

Model inputs

model	inputs
auth	Clear-sky UV,and G, geographical, O3, snow, AOD average, SZA
dwdk	Clear-sky UV,and G, geographical, O3, snow, AOD average?, SZA
dwd_acc	Clear-sky UV,and G, geographical, O3, snow, AOD average?, SZA
dwd_f	O3, snow, vis, SD, Dif, G,SZA
fmi	Clear-sky UV, G,O3, geographical, column of water vapour, albedo(UV,G), annual course of AOD (climatology), SZA
gsas	Clear-sky UV,and G, geographical, O3, snow, AOD average, vis, SZA
igfp	Clear-sky UV_{spec},and G, geographical, O3, snow, AOD average, vis, SZA, column of water vapour, winter and summer profiles of t and trace gases
imwm	Clear-sky UV,and G, geographical, O3, quarterly AOD and α, LOCAL (UV,G datasets for derivation of regression constants)
jrc	G,O3, column of water wapour, albedo(G), altitude, SZA, vis(?)
mim_cn4	Clear-sky UV and G, O3, snow, SZA, AOD from climatology,
rivm	Clear-sky UV,and G, G, geographical, O3, albedo, annual AOD average, cloudiness
tobs	Clear-sky UV, G, Dir, geographical, O3, snow , climatological O3, albedo, turbidity, cloudiness
boku	Clear-sky UV, SD, snow, AOD average
mim_cn1	Clear-sky UV, geographical, O3, snow, annual AOD average, cloudiness
mim_wgt	Clear-sky UV, geographical, O3, snow, annual AOD average, SD
uvwm	Clear-sky UV,and G, geographical, O3

Bias - measured/ modeled daily UV dose for year 1999 in %

model	Be	Da	Th	all
auth	-1.3	-2.3	-2.7	1.1
dwdk	-4.2	-0.4	-3.6	-1.3
dwd_acc	+1.1	-8.1	+0.5	-1.8
dwd_f	+2.8	-3.9	-	+1.2
fmi	+1.5	-3.1	-7.1	+0.5
gsas	+2.5	-4.6	-0.4	+1.3
igfp	-2.2	-7.2	-2.2	-2.6
imwm	-8.0	-5.1	-1.8	-4.6
jrc	-1.1	-20.0	-2.8	-4.7
mim_cn4	+19.4	-0.1	-5.8	+18.4
rivm	-3.8	-5.4	+2.8	-1.3
tobs	+1.2	-	-	-
boku	-4.7	+20.4	+2.0	-5.9
mim_cn1	+19.5	-9.7	19.6	+17.4
mim_wgt	+2.9	-13.7	5.9	+5.0
uvwm	-4.0	-2.0	-11.6	-10.6

Absolute or relative differences between measured and modelled data as criterion of quality?

model	AbsDev
fmi	0.22
imwm	0.22
dwdk_acc	0.23
auth	0.24
gsas	0.25
dwdk_day	0.26
rivm	0.27
dwdf	0.29
igfp	0.37
tobs	0.37
jrc	0.47
mim_cn4	0.56
uvwm	0.65
mim_wgt	0.66
boku	0.68
mim_cn1	0.85

model	RelDif
gsas	0.20
fmi	0.21
imwm	0.22
rivm	0.22
auth	0.27
jrc	0.29
dwdf	0.30
igfp	0.40
dwdk_acc	0.45
dwdk_day	0.49
tobs	0.49
mim_cn4	0.58
uvwm	0.59
mim_wgt	0.61
mim_cn1	0.75
boku	0.83

Absolute or relative differences ?

Computation-time requirements

Requirements on input parameters

Necessity to test the models on additional location/s with only available inputs for reconstruction of UV radiation over Europe

Different models for daily erythemal UV radiation and for estimation of long-term variability of differently weighted spectral UV radiation