Overview of WG1 activities on input data for UV maps

Hugo De Backer & WG1
Memorandum of Understanding

WG1 – Data collection

• Inventory of available high quality UV-measurements

  Inventory of high quality UV measurements to validate the results of the reconstruction models

• Inventory and collection of measured ancillary data

  Determination of the ancillary data that are necessary to run the models, considering variable spatial and temporal resolution
Survey of available observations in Europe

• High quality spectral UV data for model validation
• Ozone (column, profile)
• Albedo (including also snow depth/age data)
• Aerosol optical properties (AOD, Angstrom coefficient in different wavelength bands)
• Cloud properties (type, altitude)
• Visibility
• Global irradiation (total, diffuse, different wavelengths)
• Sunshine duration
Results of the survey:
Data are different in
• quality
• time and space resolution
• formats and way to access

Need for a data exchange tool:
Through we could use a safe password protected system with dataproto-col
UV and ancillary data for model validation and model comparison (collaboration with WG2 on modelling)

Selection based on availability and latitude range over Europe

Four stations:

- Bergen (Norway)
- Potsdam (Germany)
- Davos (Switzerland)
- Thessaloniki (Greece)

Three years:

Result of model intercomparison (collaboration with WG2 on modelling)

COST publication *EUR 23338 COST Action 726* – Modelling solar UV radiation in the past: Comparison of algorithms and input data.

The best scoring models use global irradiation as proxy input parameter for cloud/aerosol effects

More: Presentations of WG2
Input data series needed for the reconstruction of the UV maps:

• Ozone column
• Global irradiation
• Aerosol climatology
• Albedo (special attention for the alpine region)

Requirements:

• Homogeneous
• Regular grid
To produce maps:

Spatial and temporal interpolation necessary on the input parameters

However:

Each input parameter has different scales in variability

Different approach for each parameter
Ozone data:

COST726 daily total ozone data set has been created (1950-present):

Before 1979:

Based on a two step statistical regression model for each grid point and four seasons (*explanatory variables selected from a set of meteorological variables and teleconnection indices by multivariate adaptive regression splines*)

Regression coefficients determined against the “NIWA” total ozone set (combined satellite data)

After 1979:

The “NIWA” data set
Ozone data (continued):

Validated by long term observations at selected stations

(Arosa, Belsk, Longyearbyen, Oxford, Lerwick and Upsala)

Details: presentation by Janusz Krzyścin

Arctic summer seasons: Total ozone trend Arosa Cold-Period

Normalized Difference (Dobson - Cost)/Cost *100%

AROSA: Cold-Period

-25 -20 -15 -10 -5 0 5 10 15 20 25 30


Mean = -0.4% ± 5.9% (1σ)

Arctic summer seasons: Total ozone trend Arosa Warm-Period

Normalized Difference (Dobson - Cost)/Cost *100%

AROSA: Warm-Period

-25 -20 -15 -10 -5 0 5 10 15 20 25 30


Mean = -1.1% ± 3.6% (1σ)
Global solar irradiation:

Used to derive Cloud Modification Factors (CMFs)

Can be extracted from ERA-40 (ECMWF) re-analysis but contains systematic deviations

Corrected with data from observations (different sources)

Converted to CMFs for the UV

Details: presentation of Henning Staiger
Global irradiation (continued):

Data sources:
- World radiation Center (very strict quality checks)
- National Renewable Energy Laboratory
- National Meteorological Services
- Other networks (Environmental Agencies, Universities, …)

Average UV-CMFs for July
**Aerosol climatology:**

Optical parameters needed:
- aerosol optical thickness ($\tau_{\lambda}$)
- Angstrom parameter ($\alpha$)
- single scattering albedo ($\omega_{\lambda}$)
- the asymmetry factor ($g_{\lambda}$)

Spatial distribution $\tau_{308}$ derived from MODIS (satellite) $\tau_{550}$ with $\alpha_{440-870}$ from AERONET (groundbased)+Kriging interpolation

Other parameters estimated constant at $\omega \sim 0.94$ and $g \sim 0.75$ in UV region

Details: presentation by Natalie Chubarova
Aerosol climatology (continued):

Spatial distribution of $\tau_{308}$ according to MODIS/AERONET datasets

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Albedo:

Albedo in snow-free conditions low and constant (<10%)
Snow has large impact on the albedo
Multiple reflections → consider the effective albedo for a region

COST726 albedo determined from ERA-40 snowdepth (low spatial resolution, long time series) and JRC derived METEOSAT surface albedo (high spatial resolution, shorter period) and cloud optical thickness in the UV
Long term changes and Climatology of UV radiation over Europe

Albedo (continued):

COST 726 Albedo validation against Swiss method based on observed snow cover fraction:
• Correlation not high but significant
• COST726 albedo generally lower than Swiss albedo

COST726 maybe more relevant for UV because of darkening effects from cities and forests (increasing with snow age)

Differences most important in difficult situations (mountains, presence of snow); uncertainties smaller during summer when UV radiation is highest

Details: presentations by Laurent Vuilleumier and Jean Verdebout
Conclusion

✓ WG1 set up a tool for data exchange between the different partners (observers and modellers)

✓ WG1 prepared input data set for the reconstruction of UV fields over Europe for the COST 726 action (ozone column, global radiation/CMFs, aerosol, albedo)

✓ WG1 prepared UV data for the validation of the models used for the reconstruction (4 stations, three years)

Many thanks to all the active contributions of the different participants of WG1