Working Group 3

Requirements for biological UV effects

A.W. Schmalwieser
Unit of Medical Physics and Biostatistics
Univ. of Veterinary Medicine, Vienna, Austria
Tasks following the MoU:

1. Collection of action spectra for photobiological effects induced by UV radiation and selection of representative action spectra.

2. Derivation of requirements for ancillary data collection, reconstruction, climatology and trend analysis.

3. Recommendation of biological action spectra, time resolution and other requirements for UV modelling.

4. Dissemination of information on the biological importance of effective UV radiation and gained results to a broader audience.
1. Collection of Action spectra:

1.1 Collection:
>400 AS collected

1.2 Questionnaire: Which Action spectra are applied?
Austria, Cyprus, Estonia, Germany, IT, Poland, Slovakia, Spain, Sweden, Switzerland,..

-> 15 different AS
### 1.2 Which Action spectra are applied?

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<tr>
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<tbody>
<tr>
<td>Photoconjunctivitis,</td>
<td>CIE 1986a</td>
<td>Licor 1800 Macam spectroradiometer</td>
<td></td>
<td>Spain1</td>
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<tr>
<td>Photokeratitis</td>
<td>CIE1986b</td>
<td></td>
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<td>Spain1</td>
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<tr>
<td>Skin Lipid peroxidation</td>
<td>Morliere et al. 1995</td>
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<td>Spain1</td>
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<td>Skin elastosis</td>
<td>Wulf et al, 1989</td>
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<td>Spain1</td>
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<tr>
<td>Photoisomerization</td>
<td>Gibbs et al. 1993</td>
<td></td>
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<td>Spain1</td>
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<td>Photoinmunosupression de Fabo</td>
<td>Morliere et al. 1995</td>
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<td>Spain1</td>
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<tr>
<td>Erythema</td>
<td>CIE 1987</td>
<td>SpectrAIR Portable UV-VIS, Spectroradiometer</td>
<td>STAR model</td>
<td>Italy1</td>
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<td></td>
<td></td>
<td>Brewer MKIV</td>
<td></td>
<td>Italy2</td>
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<td></td>
<td></td>
<td>Brewer MK III, UV-MFR-4, MFR-7, TSI-440 RT,</td>
<td>discrete ordinate Meloni et al. 2003.</td>
<td>Italy3</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Yankee Model UVB-1</td>
<td>TUV, Madoonich 1993</td>
<td>Cyprus1</td>
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<tr>
<td></td>
<td></td>
<td>Kipp &amp; Zonen , CUVB1</td>
<td></td>
<td>Cyprus2</td>
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<tr>
<td></td>
<td></td>
<td>Solar Light Model 501</td>
<td>libRadtran</td>
<td>Austria1</td>
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<tr>
<td></td>
<td></td>
<td>Solar Light Model 501, Eldonetmeter</td>
<td>Improved Diffey, Schmalwieser et al 2002</td>
<td>Austria2</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Solar Light Model 501, Brewer +other rad. Instr.</td>
<td>STRÅNG-system Landelius et al. 2001</td>
<td>Nor.1</td>
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<tr>
<td></td>
<td></td>
<td>UV-B 306nm,UV-A 320 320 nm,UV-B 280-315 nm</td>
<td></td>
<td>Est.1</td>
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<td></td>
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<td>Yankee UVB-1, Bentham DMC150</td>
<td>Schothorst model Vishvakarman et al. (2003)</td>
<td>CH1</td>
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<td></td>
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<td>Neural Network P+P in press</td>
<td>Spain2</td>
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<tr>
<td>Human skin cancer</td>
<td>de Grujil et al. 2003</td>
<td>Schothorst model Vishvakarman et al. (2003)</td>
<td></td>
<td>CH1</td>
</tr>
<tr>
<td>Photosynthesis</td>
<td>Caldwell 1971 IL1400 SED 240/UV-B1/W</td>
<td>UV-B&lt;sub&gt;B&lt;/sub&gt;E according to Caldwell 1971</td>
<td></td>
<td>Poland2</td>
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<td></td>
<td></td>
<td>Induction of flavonoid synthesis in higher plants Caldwell MM et al. 1983 Kipp &amp; Zonen broad band sensors (UV-A and UV-B)</td>
<td></td>
<td>Germ1</td>
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<tr>
<td>Vitamin D3</td>
<td>VioSpor device Presentation on the Conference, Copenhagen, June 2004</td>
<td></td>
<td></td>
<td>Poland1</td>
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<tr>
<td>Vitamin D3</td>
<td>McLaughin et al,</td>
<td>improved Difffey, Schmalwieser et al. 2002</td>
<td></td>
<td>Austria2</td>
</tr>
<tr>
<td>Microbicidal</td>
<td>Önorm M5873-2</td>
<td>IL1700 + several SED240</td>
<td></td>
<td>Austria2</td>
</tr>
</tbody>
</table>
1.2 Which Action spectra are applied?
2. Derivation of requirements

2.1 Uncertainties from measurements, spatial and temporal variability of total ozone to erythemally effective irradiance at noon and daily dose (50°, 30°, 0°)

Presented: SPIE Conference Stockholm 2006, MCM 7

Published:
• Schmalwieser et al. 2007 Sensitivity of Erythemally Effective UV Irradiance and Daily Exposure to Uncertainties in Measured Total Ozone, Photochem. Photobiol. 83
• Schmalwieser et al. 2008 Sensitivity of UV Erythemally Effective Irradiance and Daily Dose to Spatial Variability in Total Ozone, Photochem. Photobiol. 84, 1149-63
• Schmalwieser et al. 2009 Sensitivity of Erythemally Effective UV Irradiance and Daily Exposure to Temporal Variability in Total Ozone, Photochem. Photobiol. 85
50°N (Hradec Kralove):

**Measurements uncertainties**

**Temporal resolution**

**Latitude**
2.1 Uncertainties $O_3$

Measurements uncertainties $O_3$:
- independent of geograph. Position:
  $\pm 0.75$ UVI, $\pm 5$ UVIh, SPF $\pm 2$ (ST 1,2) -> SPF+2

Spatial resolution (Lat./Long.) $O_3$:
- independent of geograph. Position:
  p95(200km) $\pm 0.5$ UVI
  p95(700km) $\pm 1.0$ UVI, $\pm 7.5$ UVIh, $\pm 3$ SPF$_{12}$
  Altitude cor. (<0.1 UVI und <1.0 UVIh)

Temporal resolution $O_3$:
- p95(1d $\pm 0.5$ UVI
- p95(2-3d) $\pm 1.0$ UVI, $\pm 7.5$ UVIh, $\pm 3$ SPF$_{12}$
2.2 Influence of spectral resolution to biol. eff. irradiance, …

Exercise: G. Zipoli et al. : GPD, keratitis, erythema, …
3. Recommendation of biological action spectra, and other requirements for UV modelling

3.1 Selection of AS: 16 (Questionnaire)

3.2 Preparation of Action Spectra for modelling
   High Spectral resolution -> Interpolation
   -> Logarithmic spline interpolation
WG3 - Requirements for biological UV effects

3.2 Preparation of Action Spectra for Modelling

Spectral range? -> Extrapolation
Used as published: accepting 0 (Vitamin D)
Extrapolation: Expanding the last slope
Effective Dose? (MED, …)

~30% Spr./Aut.
4. Dissemination of information on the biological importance of effective UV radiation and gained results to a broader audience

4.1 Web-page: www.cost726.org

4.2 Symposium at the Conference of the European Society of Phtobiology (Bath UK 2007)
4.3 Training School (Vienna, Oct. 2008)
4.4 Booklet
4.5 Electronic Atlas
4.1 Web-page

THE CHALLENGE
Goals of COST 726, UV-Radiation, UV and Climatology

MEETING THE CHALLENGE
WG 1 (Data Collection): General, Activities, Members
WG2 (UV-Modelling): General, Accomp.Publications, Activities, Members
WG3 (Biol.Effectiveness): General, Accompanying Information, Activities, Members
WG4 (Quality Control): General, Activities, Members

PARTICIPANTS: Secretary and Chair, National Delegates, Experts

MEETINGS
S.T. SCIENTIFIC MISSIONS
WG3 - Requirements for biological UV effects

4.1 Web-page:

OUTCOME

Minutes
Progress Reports
Publications
Public Information
Theses
Total Ozone Climatology over Europe
Training School
Broadband UV Monitoring in Europe
Action Spectra for Modelling
UV CMF Climatology over Europe

TOTAL CONTENT:
>2 GB: +190 htm, +440 pdf, +550 others, COST726 O₃-database
4.2 Symposium at the Conference of the European Society of Phhtobiology Sept. 2007, Bath, UK

A reconstruction of the past UV climatology over Europe for photobiological Studies - Joint with the EU Programme COST 726

Chair: Gaetano Zipoli (Firenze, ITA)

9:45 (IL316): COST 726: Long term changes and climatology of UV radiation over Europe
Alois W. Schmalwieser (Vienna, AUT)

10:15 (IL317): Quality of UV measurements
Mario Blumthaler (Innsbruck, AUT)

10:45 (IL318): Modeling UV radiation in the past: achievements and limitations
Peter Koepke1, Jean Verdebout2 (1Munich, GER; 2Ispra, ITA)

11:15 (IL319): The role of action spectra in determining the biologically effective UV radiation
Gaetano Zipoli, Daniele Grifoni (Firenze, ITA)

11:45 (OC320): Exploring the details of UV irradiances, human exposure and dosimetry
Richard Kift, Liam McNulty, Lucy Bunhill, Marie Durkin, Donald Allan, Jacqueline Berry, Lesley E. Rhodes, Ann R. Webb (Manchester, GBR)

12:00 (OC321): Reconstructed long-term erythemal irradiance over Europe from measurements of solar irradiance and total ozone
Andreas Kazantzidis1, Alkiviadis Bais1, Peter Den Outer2, Harry Slaper2, Tapani Koskela3, Uwe Feister4, M. Woldt4 (1Thessaloniki, GRE; 2Bilthoven, NED; 3Jokioinen, FIN; 4Lindenberg, GER)

12:15 (OC322): Photoprotection and skin cancer prevention in the Czech caucasion population
Michal Janouch, Karel Ettler (Hradec Kralove, CZE)

12:30 (OC323): UVBE maps for Poland – preliminary results for selected action spectra
Zenobia Litynska1, Aleksander Curylo1, Bozena Lapeta2, Julita Bischczuk1, Janusz Krzyscin3, Barbara Bogdanska3, Jakub Walawender2 (1Legionowo, 2Krakow, 3Warsaw, POL)

**Students:**
20 students from COST726 countries

**Teachers:**
Measurements: A. Webb, M. Blumthaler
Modelling: P. Koepke
Biol. Effects: G. Zipoli, A. Schmalwieser, H. Maier*, G. Schauburger*, A. Cabaj*

**Summer School:**
Theory + Exercises

All materials, lectures,…. via web-page and *.zip from www.cost726.org
4.4 Booklet: “UV RADIATION AND LIFE”

1. Introduction (Z. Litynska, A.W. Schmalwieser)
2. Solar UV radiation (Z. Litynska)
2.1. Factors influencing UV radiation (J. Krzyścin)
2.2. UV measurements (J. Gröbner)
2.3. UV modelling (P. Köpke)
2.4. Geographical distribution and temporal variability of UV radiation in Europe (J. Verdebout, P. den Outer, J. Krzyścin)
3. Biologically effective UV radiation (A.W. Schmalwieser)
3.1. Biological effects of UV radiation on human body (K. Ettler)
3.2. UV radiation and Animals (A.W. Schmalwieser)
3.3. Micro-organisms and UV radiation (A.W. Schmalwieser)
3.4. UV radiation and Plants (G. Zipoli)
3.5. UV and aquatic systems (A.W. Schmalwieser)
4. Expectations for the future (Z. Litynska, A.Bais)
Appendix A: Reference Institutions in the COST726 Countries (J. Biszczuk-Jakubowska)
Appendix B: List of www pages with UV information (J. Biszczuk-J.)
4.5 Electronic Atlas

Electronic version of UV climatology
Data + Action Spectra + Easy2Use Interface
(M.Janouch et al.: ascii output+graphics)

640 GB (Apr.09) -> 8 GB (2DVD)
-> 1x1°, 1nm, ascii

4.6 Advertising/promoting !!!COST726!!! Results

-> + MCs + Experts

THANKS