COST
Domain Committee " ESSEM "

COST Action
726

Long term changes and climatology of UV radiation over Europe

MONITORING PROGRESS REPORT

Period: *March 2004 to March 2008*

This Report is presented to the relevant Domain Committee and contains two parts:

I. ***Management Report*** *prepared by the COST Office and Annual Grant Holder*

II. ***Scientific Report*** *prepared by the Chair of the Management Committee of the Action*

The report is a “cumulative” report, i.e. it is updated annually and covers the entire period of the Action.

Confidentiality: the documents will be made available to the public via the COST Action web page except for chapter *II.C. Self evaluation*.

Based on the monitoring results, the COST Office will decide on the following year’s budget allocation.

I. Management Report prepared by the COST Office

I.A. COST Action Fact Sheet

COST Action *726 - Long term changes and climatology of UV radiation over Europe*

- **Domain** *ESSEM*

- **Action details:**

CSO Approval: *(03/10/2004)* **End date:** *(28/03/2009)*
Entry into force: *(08/01/2004)* **Extension:** *(day/month/year)*

- **Objectives** The main objective of the Action is to advance the understanding of UV radiation distribution under various meteorological conditions in Europe in order to determine UV radiation climatology and assess UV changes over Europe.
- **Signatories:** *list of countries and date of signature*

Austria *(02/02/2004)*	Greece *(04/06/2004)*	Poland *(08/01/2004)*
Belgium *(08/01/2004)*	Hungary *(12/01/2004)*	Portugal *(27/06/2004)*
Bulgaria	Iceland	Romania *(16/03/2004)*
Croatia	Ireland	Republic of Serbia
Cyprus *(08/01/2004)*	Israel	Slovakia *(11/06/2004)*
Czech Rep. *(20/04/2004)*	Italy *(22/06/2004)*	Slovenia
Denmark *(18/10/2004)*	Latvia	Spain *(25/02/2004)*
Estonia *(08/01/2004)*	Lithuania	Sweden *(08/01/2004)*
Finland *(08/01/2004)*	Luxembourg	Switzerland *(18/03/2004)*
FYR of Macedonia	Malta	Turkey
France *(07/05/2004)*	Netherlands *(14/01/2004)*	United Kingdom *(22/04/2005)*
Germany *(29/01/2004)*	Norway *(02/03/2004)*	

- **Intentions to sign:**
- **Participating Institutes of non-COST countries:** EC Joint Research Centre (JRC), Ispra, Italy; World Radiation Data Center (WRDC), St. Petersburg, RU; Moscow State University, Moscow, RU (Near Neighbor member).

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- **Action Web site:** *http://www.cost726.org*

Working Groups
WG1 – Data collection (Leader, Dr. Hugo de Backer)
WG2 – UV modeling (Leader: Dr. Peter Köpke)
WG3 – Requirements for biological UV effects (Leader: Dr. Alois Schmalwieser)
WG4 – Quality Control (Leader: Dr. Julian Gröbner)

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I.B. Management Committee member list

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Mr. Anatoly TSVETKOV	***WMO WRDC***	tsvetkov@main.mgo.rssi.ru

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I.C. Overview activities and expenditures

Budget period: March 2004 - March 2008

Total Action Budget:
Remaining Action Commitment:

Meetings

Meeting Type	Date	Place	Participants	Total
MCM1	29.03.04	Brussels, Belgium	22	**13 255,00**
MCM2	8-9.06.2004	Kos, Greece	19	**21 161,00**
MCM3 + WGs Meetings	21-22.10.2004	Warsaw, Poland	48	**33 501,00**
MCM4	18-19.03.2005	Spindleruv-Mlyn, Czech Republic	43	**30 326,00**
MCM5 + Core group meeting + Internal Workshop	5-7.09.2005	Garmisch-Pertenkirchen, Germany	31	**29 894,07**
WG4 Meeting	21-22.10.2005	Davos, Switzerland	15	**6 076,11**
MCM6 +WG2 Meeting	6-7.04.2006	Larnaca, Cyprus	34	**26 002.62**
WG3 Meeting	8-9.06.2006	Warsaw, Poland	9	**3 835,56**
MCM7 + WG2 Meeting	11-13.09.2006	Stockholm, Sweden	39	**30 637,89**
Wg1&2 core group meeting	29-30.01 2007	Brussels, Belgium	12	**4 006,69**
MCM8 + WGs meeting	29-30.03.2007	Budapest, Hungary	32	**21 831,08**
WG3 meeting + Symposium	03-04.09.2007	Bath, United Kingdom	11	**9 411,13**
MCM9 meeting and internal Workshop + UV Conference	17-20.09.2007	Davos, Switzerland	36	**32 779,93**
WG1/2/3 Core Group meeting	11-12.01.2008	Munich, Germany	8	**3 416,59**

STSM

Beneficiary	Date	Place	Total
Julita Biszczuk	11-17.09.2004	European Reference Centre for Ultraviolet Radiation Measurements, JRC, Ispra	**1 500.00**
Jose Manuel Vilaplana	13-17.12.2005	European Reference Centre for Ultraviolet Radiation Measurements, JRC, Ispra	**1 205.00**
Chrysanthi Topaloglou	16.05-03.06.2005	Norwegian Radiation Protection Authority, Oslo, Norway	**1 200,00**
Grzegorz Zablocki	16.05-03.06.2005	Norwegian Radiation Protection Authority, Oslo, Norway	**1 100,00**

Anna Pribullova	22.05-2.06.2006	Meteorological Institute University of Munich, Germany	**1 952,00**
Janusz Krzyscin	31.05-09.06.2006	Meteorological Institute University of Munich, Germany	**1 900,00**
Mario Blumthaler	6-19.08.2006	PMOD / WRC, Davos, Switzerland	**1 900,00**
Jose Manuel Vilaplana	31.0 –11.08. 2006	PMOD / WRC, Davos, Switzerland	**1 950,00**
Iolanda Ialongo	03.09-05.10.2007	Universite des Sciences et Technologies de Lille, France	**2500,00**
Gregor Hülsen	01-16.09.2007	INTA, El Arenosillo, Spain	**2000,00**
Grzegorz Zabłocki	28.08-14.09.2007	INTA, El Arenosillo, Spain	**2000,00**
Anders Lindfors	24.01-07.02.2008	WRDC, Sankt Petersburg, Russia	**1625,00**

Workshops

Title	Date		Place	Total
	From	To		
Joined SPIE2006 and COST-726 Session 7: "UV Ground-based Measurements" and Session 8: "UV Modeling and Data Analysis"	13.09.2006	13.09.2006	Stockholm, Sweden	**1 659,39**
Joint Symposium of the European Society of Photobiology and COST Action 726: "A reconstruction of the past UV climatology over Europe for photobiological studies"	04.09.2007	04.09.2007	Bath, United Kingdom	**3 000,00**
Conference 'One Century of UV Radiation Research'	18.09.2007	20.09.2007	Davos, Switzerland	**3000,00**

General Support Grants

Beneficiary	Date								Cost	Total
										0

Schools

Title	Date	Place							Cost	Total
										0

Others

Subsidy to MCM2	**1 500,00**
Subsidy to MCM4	**2 000,00**
Subsidy to web page management	**1 500,00**

Annual Grant Holder (June 2005 – June 2007)- secretariat	**20 658,85**
Subsidy to MCM8	**1 260,00**
Subsidy to WG3 Meeting	**2 000,00**
Subsidy to MCM9	**2 000,00**
Participation of Mrs Natalia Chubarova of Near Neighbour Country (RU) in MCM9 and UV Conference in Davos, Switzerland in days 17-20.09.2007.	**934,00**
Participation of Mrs Natalia Chubarova of Near Neighbour Country (RU) in WG1/2/3 Core Group Meeting in Munich, Germany in days 11-12.01.2008.	**828,00**
Annual Grant Secretariat (June 2007- March 2008)	**7 143,03**

Action 726	
Total :	**333 349,55**

II. Scientific Report prepared by the Chair of the Management Committee of the Action

II.A. Results achieved during the period March 2004 to March 2008

The up-to-date status of the Action is consistent with the time-table and objectives. The following stages have been completed:

- The available data for UV reconstruction have been recognised;
- Action's data base have been implemented and it is operated by Finish Meteorological Institute;
- The BSCW package (provided by DWD) is used for data and results access and exchange;
- The data Protocol has been agreed and has to be signed by all data-base and BSCW users;
- The data from selected six stations were made available to UV reconstruction models;
- The works concerning the UV reconstruction methodology have been started;
- The works on the construction of the Action's web page have been started. The web page would be operated by the Institute of Medical Physics, University of Veterinary Medicine in Vienna;
- The Data Protocol has been approved and sent out to all Action members;
- Update of the list of potential available data sets.
- The BSCW tool is now operational.
- Quality check of different algorithms and of input data for the UV reconstruction was completed.
- Models suited for building a European climatological dataset of UV radiation were identified.
- The Action's web page project was accepted by MC and the web page is now available at the site: http://i115srv.vu-wien.ac.at/uv/COST726/ Cost726.htm
- The COST726 contribution to WMO Standard Operating Procedures was discussed and accepted by WG4 members.
- The modeling exercise has been performed, using well defined input data prepared by WG1. Thirteen WG2 members with sixteen models and algorithms took part in the exercises and the results were presented at MCM6. The modeling exercise was very successful. Models that are suitable to perform the COST action have been identified. Moreover, a large body of data is available which can be used for many scientific questions, like practical aspects of cloud, aerosol or albedo effects on UV and model improvement. As an outcome, the paper describing the modeling exercises was prepared and submitted for SPIE 2006 Conference;
- The draft of the report from the modeling exercise was prepared.

- The calibration/comparison campaign of the broadband UV radiometers was held at PMOD/WRC Davos from 1 to 26 August 2006. It consisted of 2 weeks of laboratory characterizations of all participating radiometers and two weeks of outdoor measurements for the absolute calibration based on the QASUME spectroradiometer.
- Following the decision of MC made during MCM6, the Standard Operating Procedures for broadband instrument were prepared separately by COST-726 in the cooperation with the contributors to UV SAG of WMO. The draft has been sent out to the national delegates for consideration and acceptance.
- The COST-726 reconstructed ozone dataset was created.
- The suitability of different ozone data bases (ERA-40, NIWA,COST-726) for UV reconstruction was analyzed. On the base of the obtained results, the decisions concerning the usage of those ozone datasets in UV reconstruction were made.
- The possible sources of information about clouds (ERA-40, NCEP) that can be used in the UV reconstruction models were considered. It was decided that global radiation data would be used.
- The arrangements for the exercise aiming at comparing different methods for UV maps creation were made.
- The report on the results of the extensive UV reconstruction models intercomparison was prepared for publishing by OPOCE.
- The general ideas for Electronical Climatological Atlas (e-atlas) were defined and the decisions about its content were made.
- The content of the COST Action 726 Booklet that would provide the information about the UV climatology was decided.
- The results from PMOD/WRC calibration/comparison campaign were analysed. Calculated UV Index values with original calibration were collected from nearly all operators. PMOD/WRC delivered 34 calibration certificates and 2 performance records. Both, radiometer comparison and the laboratory characterisation comparison were also made.
- Campaign data and documentation were made available to the Action members.
- Draft campaign report has been circulated within WG4 members.
- Following the MC decision, the first stages of organizing the PMOD/WRC 'UV Conference', supported by COST Action-726, were completed. The conference program was decided and the key speakers were invited. The conference will be held on 17-20 September 2007 in Davos, Switzerland along with the MCM9 meeting.
- In September 2006, the address of the Action's web site http://i115srv.vu-wien.ac.at/uv/COST726/Cost726.htm was changed to the following one: http://www.cost726.org

---------- NEW!!!

- Global solar irradiance dataset for UV maps have been obtained from WRDC in Sankt Petersburg (RU) and prepared for the use.
- High resolution ERA-40 CMF and snow data have been obtained for COST-726 research.
- COST726 ozone data set has been updated and validated against ground ozone measurements. The data set has been made available for all COST726 members. ‘
- The report Modelling solar UV radiation in the past: Comparison of algorithms and effects of the selected input data’ have been prepared and submitted for publication.
- The UV irradiance time series have been reconstructed for the selected stations with long time series of global irradiance data.
- Test versions of UV maps in the past over Europe have been created using several different interpolation methods as well as input data: reconstructed UV, ERA-40, etc. Preliminary estimation of their quality has been done.
- The ozone impact study using 3 input data sets have been performed and the preliminary results presented.
- The method for interpolation of AERONET aerosol optical depth data has been proposed.
- The usefulness of MODIS aerosol data for UV maps has been analysed.
- The method for aerosol single scattering albedo retrieval in UV range from OMI data has been worked out and validated for Rome measurements.
- Decisions concerning the way the influence of clouds, aerosols, surface albedo and altitude will be taken into account in UV climatology construction have been made.
- The Decisions on the Action’s products (quantity, temporal, spectral, and spatial resolution) have been made.
- Different methods for trend analysis have been studied in order to select the one to be used for analyzing the UV changes for selected stations.
- ‘Report of the PMOD/WRC-COST Calibration and Intercomparison of Erythemal radiometers Davos, Switzerland 28 July – 23 August 2006’ have been prepared and sent for publishing
- COST726 experts took part in the national Spanish broadband campaign held in El Arenosillo, on 15.08-21.09.2007, what allowed for calibration and checking the quality and stability of UV broadband instruments working in COST-726 countries.
- The content of the Final Report and Booklet have been discussed and preliminarily accepted. People responsible for different Chapters were selected.
- The first version of e-atlas software has been created.

- The choice of action spectra for e-atlas and Final Report has been discussed and preliminarily approved.

II.B. Non-COST participations' contributions ***NEW!!!***

Non-COST participants, Mr. J. Verdebout (JRC, Ispra, IT), Mr. A. Tsvetkov (WRDC, Sankt Petersburg, RU) and Mrs. N. Chubarova (Moscow State University, Moscow, RU) actively take part in the works undertake in the frame of COST-726, what resulted in significant achievements and benefits.
Due to participation of EC JRC, Ispra, Italy, the following results have been achieved:

- The method for UV irradiance interpolation using 20 year METEOSAT climatology have been applied for COST-726 data;
- The analysis of influence different input data on the resulted UV maps has been performed, what gave the basis for the discussion about the future activities and tasks.
- Data from COST-726 data base are to be used for validation of METEOSAT based UV maps.

Due to participation of WRDC in Sankt Petersburg, Russian Federation the following results have been achieved:

- COST726 members were informed about the content of the WRDC database, what allowed for consideration of possible methods for UV climatology creation. Global irradiance data are the main source of information about cloudiness in the past that can be used in UV reconstruction models.
- The COST726 members have learnt about the quality check mechanism applied for WRDC data sets.
- The data set of best quality, homogenous global irradiance data from European stations has been prepared and made available for COST726 activities through STSM hosted in WRDC in Sankt Petersburg.
- WRDC will be informed if doubts concerning data quality appears during the analysis performed in the frame of COST726 activities;

Due to participation of Moscow State University, Moscow, Russian Federation, the following results have been achieved:

- Maps over Europe on the base of AERONET as well as AERONET including MODIS data have been created and analyzed. This as well as an experience of Mrs. N. Chubarova in UV researches, allowed for making decisions about the method for taking into account aerosol influence in UV reconstruction.
- The long time series of global solar irradiance data for Moscow have been made available for Action activities.

- An access to COST726 results will enable Mrs. N. Chubarowa to compare the results from MSU UV reconstruction model with the results obtained by different algorithms developed within the frame of COST-726.

II.C. Dissemination of results

- *Action related Publications and Reports*

Papers

P. Koepke, et. al, "UV exposure in Europe during the past", in Proceedings of the 17th International Congress of Biometeorology, ICB 2005 Annale der Meteorologie, 41, 2, 659-662;

Eerme K., "Variation of total solar radiation and estimated erythemal UV doses in Estonia during 1953-2004", in Proceedings of the 17th International Congress of Biometeorology, ICB 2005 Annale der Meteorologie, 41, 2, 663-666;

P.Koepke, et. al, "Modeling solar UV radiation in the past: comparison of algorithms and input data", in Proceedings of SPIE, Remote Sensing of Clouds and the Atmosphere XI, Vol. 6362, 636215-1 – 636215-1, 2006.

Lindfors A., L. Vuilleumier, 'Erythemal UV at Davos (Switzerland), 1926-2003, estimated using total ozone, sunshine duration, and snow depth', *J.Geophys.Res*., **Vol. 110** (D2), D02104, doi:10.1029/2004JD005231, 2005

M. Glandorf, A. Arola, A. Bais, and G. Seckmeyer, 'Possibilities to detect trends in spectral UV irradiance', *Theor. Appl. Climatol*. **81**, 33–44, DOI 10.1007/s00704-004-0109-9, 2005

P. N. den Outer, H. Slaper, and R. B. Tax (2005), 'UV radiation in the Netherlands: Assessing long-term variability and trends in relation to ozone and clouds', *J.Geophys.Res*, **110**, D02203, doi: 10.1029/2004JD004824

Schmalwieser A.W., Schauberger G., Erbertseder Th., Janouch M., Coetzee G.J.R. and Weihs Ph., 'Sensitivity of Erythemally Effective UV Irradiance and Daily Exposure to Uncertainties in Measured Total Ozone', *Photochemistry and Photobiology*,. **83**, 433–443, 2007.

Junk J., Feister U., Helbig A., 'Reconstruction of daily solar UV irradiation from 1893 to 2002 in Potsdam, Germany', *Int. J. Biometeorol*., **51**, 505-512, 2007 doi 10.1007(s00484-007-0089-4

Staiger H., den Outer P.N., 'Hourly Resolved Cloud Modification Factors in the Ultraviolet.', Proceedings of the UV Conference "One Century of UV Radiation Research", 18-20 September 2007, Davos, Switzerland, pp. 203-204, 2007.

Lindfors, A., J. Kaurola, A. Arola, T. Koskela, K. Lakkala, W. Josefsson, J. A. Olseth, and B. Johnsen (2007), 'A method for reconstruction of past UV radiation based on radiative transfer modeling: Applied to four stations in northern Europe', *J.Geophys.Res.*, **112**, D23201, doi: 10.1029/2007JD008454.

Hülsen, G. and Gröbner, J. (2007), 'Characterization and calibration of ultraviolet broadband radiometers measuring erythemally weighted irradiance', *Appl. Optics*, **46**, 5877-5886.

Lindfors Anders and Antti Arola (2008), 'On the wavelength-dependent attenuation of UV radiation by clouds' *Geophys. Res. Lett.*, in press

Alois W. Schmalwieser, Thilo Erbertseder, Günther Schauberger and Philipp Weihs (2008), 'Sensitivity of UV Erythemally Effective Irradiance and Daily Dose to Spatial Variability in Total Ozone Photochemistry and Photobiology', Published article online: 31-Jan-2008, doi: 10.1111/j.1751-1097.2007.00285.x

Reports

'Practical Guide to Operating Broadband Instruments Measuring Erythemally Weighted Irradiance'', A.Webb, J.Gröbner, M.Blumthaler, (Produced by the joint efforts of WMO SAG UV and Working Group 4 of COST-726 Action "Long Term Changes and Climatology of UV Radiation over Europe"), EUR 22595, ISBN 92-898-0032-1, COST Office, 2006, Belgium.

'Modelling solar UV radiation in the past: Comparison of algorithms and effects of the selected input data'. Peter Koepke, Hugo De Backer, Alkiviadis Bais, Aleksander Curylo, Kalju Eerme, Uwe Feister, Bjorn Johnsen, Juergen Junk, Andreas Kazantzidis, Janusz Krzyscin, Anders Lindfors, Jan Asle Olseth, Peter den Outer, Anna Pribullova, Alois Schmalwieser, Harry Slaper, Henning Staiger, Jean Verdebout, Laurent Vuilleumier, Philipp Weihs, in press (OPOCE);

'Report of the PMOD/WRC-COST Calibration and Intercomparison of Erythemal radiometers Davos, Switzerland 28 July – 23 August 2006'.
J. Gröbner, G. Hülsen, L. Vuilleumier, M. Blumthaler, J. M. Vilaplana, D. Walker, and J. E. Gil, in press (OPOCE);

---------- NEW!!!

Thesis

Brynhild Berge Sjølingstad (2007): 'Reconstruction of UV radiation: UV exposure of the Arcto-Norwegian cod egg population 1957-2005'
Master thesis in Meteorology at Geophysical Institute, University of Bergen, Norway.
Thesis supervisor: Jan Asle Olseth and Joachim Reuder.

Iselin Medhaug (2007): 'Reconstruction of UV-radiation and its potential implications on development of skin cancer'
Master thesis in Meteorology at Geophysical Institute, University of Bergen, Norway.
Thesis supervisor: Jan Asle Olseth and Joachim Reuder.

Anders Lindfors (2008): 'Reconstruction of past UV radiation',
PhD thesis at Department of Physical Science, Faculty of Science, University of Helsinki, Finland.

- *Conferences and Workshops*
  - 17th International Congress of Biometeorology 2005, 5-9 September 2005, Garmisch-Partenkirchen, Germany; joint UV session.
  - COST-726 Internal Workshop, joined with ICB Symposium, 6-7 September 2005, Garmisch-Partenkirchen;
  - SPIE 2006 Conference, Stockholm, Sweden, 11-14 September 2006, joint session 'Remote Sensing of Clouds and the Atmosphere XI'.
  - Joint Symposium of the European Society of Photobiology and COST Action 726: "A reconstruction of the past UV climatology over Europe for photobiological studies", 04.09.2007, Bath, UK.
  - Conference 'One Century of UV Radiation Research', 18-20.09.2007

- *Web site*

  The Action's web site has been accepted by MC and is run by University of Veterinary Medicine, Vienna, Austria. The web page is available at the following site: http://i115srv.vu-wien.ac.at/uv/COST726/Cost726.htm

  The web page is divided into three parts: Challenge, Meeting the challenge, Outcomes "The Challenge" contains the information concerning the UV radiation, its climatology and the goals of COST-726 Action. In the chapter "Meeting the Challenge" information about the Action, its structure, members and activities is presented. "Outcome" chapter contains the Minutes from the meetings, the Progress Reports as well as the Public Information that includes any form of dissemination of COST-726 results on different forum.

  The web page includes the password-protected zone that contains all the documents and information that should be available only for Action's members. The decision concerning the content of this zone is made by the MC or by the individual authors. The last applies to the presentations.

  In September 2006, the address of the Action's web site http://i115srv.vu-wien.ac.at/uv/COST726/Cost726.htm was changed to the following one: http://www.cost726.org

  ---------- NEW!!!

The new items have been added to the 'Outcome' chapter: Publications, Thesis and Total Ozone Climatology over Europe. The first one consist the list of COST726 related papers, presentations and posters. In the second one the list of Master and PhD thesis prepared partially in the frame of COST-726 is presented. Finally, the third item includes the information about 'COST 726 Ozone Climatology over Europe (25°E to 35°W and 30°N to 80°N) from 1950 to 2004' .

- *Scientific and Technical Cooperation (the list does not include the organizations, projects etc directly involved in the Action, neither does it include cooperation and contacts at national, regional or local level)*

  The Head of the WMO World Radiation Data Centre (WRDC) in Petersburg, Russia, dr Anatoly Tsvetkov had a presentation on: The WMO World Radiation Data Centre - 30 years of its activity. He was asked to join the Action.

  The experts from the outside of UV community, dealing with influence of UV on environment, were invited to cooperate. Their remarks and suggestions are taken into account while preparing the COST-726 outcome.

  The cooperation with the European Society for Photobiology (ESP) was originated in order to popularize the COST Action 726 outcomes among the photo-biologists as well as to better identification of their needs and requirements. A special ESP - COST Action 726 symposium titled 'A reconstruction of the UV climatology over Europe for photobiological studies' will be organized in the frame of the 12th Congress of ESP that will be held on 1- 6 September 2007 in Bath, UK.

- *Transfer of results*

  SCOUT-O3 Project - Members of the Action's MC are involved in the project activities and the information as well as the results are being exchanged.

  COST Action 719 "The use of Geographic Information Systems in climatology and meteorology"

  At the MCM3 meeting in Warsaw, the Vice-chairwoman of COST Action 719, Mrs. Izabela Dyras presented the applications of GIS method to meteorology and climatology.

  Bozena Lapeta was hosted by COST Action 719 at their meeting in Budapest and she participated in the Conference on the Spatial Interpolation Techniques in the Climatology and Meteorology, 25-28 October 2004, Budapest, Hungary.

  The knowledge and experiences gained in the frame of the above cooperation is planned to be applied in the COST-726 activities, especially in the preparation of the final Action's products.

The cooperation and contacts were established with the UV SAG WMO group in order to prepare the ‘Standard Operating Procedure’ guide.

- *Contacts in the ERA*

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II.D. Self evaluation