

BIBLIOGRAPHY

J. P. BURROWS

1. INTRODUCTION TO THE RESEARCH PUBLICATIONS OF J. P. BURROWS

My research has been in the area of atmospheric chemistry, atmospheric physics, kinetics, spectroscopy and the related aspects of physical chemistry and chemical physics. In particular I focussed on the study of reactions of atmospheric importance and the development of in situ and remote sensing measurement techniques. My research has significantly contributed towards our current understanding of solar interactions with the upper atmosphere, the behaviour of the stratospheric ozone layer and its response to anthropogenic modification of its composition, tropospheric air pollution and quality and climate change. I have developed

- a) a series of measurement techniques for laboratory studies of free radical spectroscopy, their reaction rate coefficients and product distributions,
- b) free radical and trace gas in situ measurement techniques.

I initiated and led scientifically the European remote sensing of atmospheric trace gases from space using the differential optical absorption spectroscopy and related retrieval techniques. In this area I pioneered the measurement of atmospheric trace constituents in particular in the troposphere, the holy grail for

2. SUMMARY OF PUBLISHED MANUSCRIPTS

Up to August 2010, Professor Burrows and his co-workers have approximately 433 co-authored publications in peer reviewed journals, of which 389 are found by the ISI Web of Knowledge. The ISI sum of cited references is 8195, the average citations per year is 21.23 and my h-index is currently 44. The following list contains the 10 most cited manuscripts as of 01.06.2010:

- 1) Burrows J. P., Weber M., Buchwitz M., Rozanov V., Ladstätter-Weissenmayer A., Richter A., DeBeek R., Hoogen R., Bramstedt K., Eichmann K.-U., and Eisinger M., 1999, "The global ozone monitoring experiment (GOME): Mission concept and first scientific results", Source: JOURNAL OF THE ATMOSPHERIC SCIENCES Volume: 56 Issue: 2 Pages: 151-175 Published: JAN 15 1999 Times Cited: 470
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 - 8) Richter A., Wittrock F., Eisinger M., and Burrows J. P., 1998 "GOME observations of tropospheric BrO in northern hemispheric spring and summer 1997", Source: GEOPHYSICAL RESEARCH LETTERS Volume: 25 Issue: 14 Pages: 2683-2686 Published: JUL 15 1998 Times Cited: 130
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- 41) J. P. Burrows "GOME: Total O₃ and NO₂ during 1996 and 1997 in the Arctic and Antarctic", *The 4th European Symposium on Stratospheric Ozone 22-26th September 1997.*
- 42) J. P. Burrows "Spurengasmessungen im arktischen Winter/Frühjahr: GOME Beobachtungen 1996-1998", *8 Statusseminar des OFP am 23/24 Juni 1998 DFG Bonn.*
- 43) J. P. Burrows "GOME und SCIAMACHY: Fernerkundung von Weltraum aus", *Deutsche Physikalische Gesellschaft – Frühjahrstagung – Symposium Physik für die Umwelt, Regensburg, 24. März 1998.*

- 44) J. P. Burrows "Measurement of minor atmospheric constituents from the global ozone monitoring experiment (GOME) 1995-1998", 32nd COSPAR Scientific Assembly 12-19th July 1998, Nagoya Japan
- 45) J. P. Burrows "Remote sensing of the atmosphere using GOME", *Joint International Symposium on Global Atmospheric Chemistry Fifth Scientific Conference of the International Global Atmospheric Chemistry Project (IGAC) and Ninth Symposium of the IAMAS Commission on Atmospheric Chemistry and Global Pollution (CACGP)IGAC 19-25th August 1998.*
- 46) J. P. Burrows "Remote Sensing of atmospheric constituents using UV visible and NIR spectroscopy", *Distinguished Scientist Invited Lecture September 1997 German American Distinguished Scientist Exchange Programme 1st September 1998 University of Maryland USA.*
- 47) J. P. Burrows "Satellite Sensing of Emissions from Indonesian Forest Fires", *Distinguished Scientist Invited Lecture September 1997 German American Distinguished Scientist Exchange Programme 3rd September 1998 University of Maryland USA*
- 48) J. P. Burrows "Remote Sensing of atmospheric constituents", *Distinguished Scientist Invited Lecture September 1997 German American Distinguished Scientist Exchange Programme 1st September*
- 49) J. P. Burrows "Spectrometers for Atmospheric Chemistry", 32nd ESLAB Symposium 17th September 1998.
- 50) J. P. Burrows "Einige Ergebnisse des Global Ozone Monitoring Experiment und Ausblick auf SCIAMCHY", *DGPF/DLR/DFD gemeinsame Tagung 14 Oktober 1998.*
- 51) J. P. Burrows "Passive remote sensing of the atmosphere from space", 60th Birthday Colloquium, Professor R. P. Wayne, University of Oxford 7th January 1999.
- 52) J. P. Burrows "SCIAMACHY: Mission objectives", *European Symposium on Atmospheric Measurements from Space 18-22nd January 1999.*
- 53) J. P. Burrows, "Satellite observations of ozone" *NATO ADVANCED STUDY INSTITUTE "Chemistry and Radiation Changes in the Ozone Layer" 15 - 24 May 1999, Crete, Greece.*
- 54) J. P. Burrows, "Satellites observations of chemical compounds in the atmosphere", *EC Advanced study course 1999 under the Environment and Climate Programme, ASTAIRE 1999 "Atmospheric effects of aircraft emissions in the upper troposphere and lower stratosphere" 22 - 31 August 1999, Bergen, Norway*

- 55) J. P. Burrows, GOME: "Stratospheric and tropospheric observations of trace constituents from space." *Atmospheric Chemistry Workshop – Telluride Colorado August 2000.*
- 56) J. P. Burrows, "Atmospheric Remote Sensing from Space", *NOAA AL Seminar August 2000*
- 57) J. P. Burrows, "GOME and SCIAMACHY", *IAMAS 2001 Innsbruck July 2001 –.*
- 58) J. P. Burrows "Remote Sensing of the Troposphere", *DACH – German Austrian and Swiss Meteorological Society Meeting in Vienna September 2001*
- 59) J. P. Burrows, "ENVISAT / SCIAMACHY", *Stand und Perspektiven der Atmosphärenforschung in Deutschland vor dem Hintergrund internationaler Entwicklungen 2. Nationaler SPARC Workshop, Johann Wolfgang Goethe Universität, Frankfurt am Main, 8. – 9. April 2002*
- 60) J. P. Burrows, "New satellite observations/Chemical data assimilation and remote sensing". *Session ST6 EGS 2002, 22-26th April 2002, Nice, France.*
- 61) J. P. Burrows, "Observations of the Chemical Environment from Space", *Royal Meteorological Society 15th of May, 2002.*
- 62) J. P. Burrows, Limb Observations of the Atmosphere using SCIAMACHY: Retrieval of vertical profiles of atmospheric constituents "" *AGU Washington 2002 Spring Meeting Washington Convention Center, Washington, DC, 28 - 31 May 2002*
- 63) J. P. Burrows, "Observations of the Chemical Environment from Space", *Telluride Atmospheric Chemistry Workshop August 4-9, 2002.*
- 64) J. P. Burrows, "GOME, SCIAMACHY and GeoTROPE: the Remote Sensing of Atmosphere from Space an update", *12th August 2002 - Atmospheric Chemistry Division, National Center (Centre) for Atmospheric Chemistry, Boulder CO, USA.*
- 65) J. P. Burrows, "Remote sensing of atmospheric composition from space: GOME and SCIAMACHY", *13th September 2002, Met Office, Bracknell UK*
- 66) J. P. Burrows "The Determination of Tropospheric Trace Constituents from Space: GOME, SCIAMACHY and GeoTROPE(GeoSCIA+GeoFiS)???" *10th Symposium of CACGP/7th Scientific Conference of IGAC, 18-25th September 2002, Creta Maris, Hersonissos, Heraklion, Crete, Greece.*
- 67) J. P. Burrows, "Passive Remote Sensing of Aerosols (and Cloud) from Space: an incomplete overview", *the Joint SPARC-IGAC workshop on Climate-Chemistry Interactions, Giens, France from April 2-6 2003.*

- 68) J. P. Burrows, "SCIAMACHY in Orbit: an Overview of its objectives, the first year and some results", *IGARSS 2003, Centre de Congrès, Toulouse, France 21-25 th July 2003*
- 69) J. P. Burrows, "Remote Sensing of Atmospheric Constituents from Space", *Royal Meteorological Society Conference 2003, UEA Norwich, UK 3rd September 2003.*
- 70) J. P. Burrows, "A View from the Top: Atmospheric Chemistry using space-borne Instruments: GOME and SCIAMACHY from LEO, and the potential from GEO", *Gordon Research Conference on Atmospheric Chemistry, Big Sky, U.S.A. 10th September 2003*
- 71) J. P. Burrows, "Viewing the Earth's Environment from Space: the Challenges, the Progress and the Future" Royal Society of Chemistry Environmental Chemistry Group: Distinguished Guest Lecture and Symposium – 3rd March 2004.
- 72) J. P. Burrows, "Remote sensing of atmospheric trace constituents from Space: Results from GOME and SCIAMACHY. O3-Quadrenniel Symposium Kos Greece, 30.05-10.6.2004
- 73) J. P. Burrows, International Summer School on Atmospheric and Oceanic Sciences - ISSAOS 2004 Observing systems for Atmospheric Composition, 20-24 September 2004 University of L'Aquila, Italy
- 74) J. P. Burrows, Overview of the Session Extra tropical UT/LS, SPARC (Stratospheric Processes and their Role in Climate) general Assembly Victoria British Columbia 1-6th August 2004.
- 75) J. P. Burrows GOME, SCIAMACHY and GeoSCIA: Remote sensing of Atmospheric Constituents from Space, 13th EPS 2005, 12th July, Bern, Switzerland.
- 76) J. P. Burrows, ISSI Solar Observations using SCIAMACHY and related climate gas observations, Workshop on Solar Variability and Planetary Climates, ISSI, Bern, Switzerland June 6-10, 2005.
- 77) J. P. Burrows, Scientific Highlights from SCIAMACHY 2002 to 2006. Atmospheric Chemistry Conference 8-12th of May 2006.
- 78) J. P. Burrows, IGAC Conference September 2006
- 79) J. P. Burrows Remote Sensing of Trace Atmospheric Constituents using GOME and SCIAMACHY: Focus on some tropospheric chemistry issues. Georgia Tech - 6^h October 2006,
- 80) J. P. Burrows, British Council Erforschung der Atmosphäre vom Weltraum aus: Luftverschmutzung, Stratosphärisches Ozon und Klimaänderung Umwelt Tage Bremen 2006 - ÖkoStadt Bremen e.V., Eröffnung der Ausstellung NorthSouthEastWest vom British Council

81) J. P. Burrows, Remote Sensing of Atmospheric Constituents and Surface Properties from Space using GOME and SCIAMACHY: Focus on some tropospheric chemistry issues. Zentrum für Marine und Atmosphärenwissenschaften, Universität Hamburg, 11 January 2007.

83) J. P. Burrows, Remote Sensing of Atmospheric Constituents and Surface Properties from Space using GOME and SCIAMACHY: Focus on some tropospheric chemistry issues; Department of Physics & Atmospheric Science, Dalhousie University, 2nd April 2007.

84) J. P. Burrows "Advances in Atmospheric Science resulting from the Envisat/ERS-2 Missions" ESA ENVISAT Symposium, Montreux Switzerland 23rd-27th April 2007.

85) J. P. Burrows Measurements of Air Quality and Climate Gases from Space, IUGG (International Union of Geodesy and Geophysics) Symposium Perugia Italy Session JMS003 on the 2nd – 5th July 2007.

87) J. P. Burrows, Changing Atmospheric Composition: Fact or Fiction (as observed from space), IUGG Symposium Perugia Italy Session MS019 on the 2nd - 5th July 2007.

88) J. P. Burrows – ARCNESS 1st Winter School and Lecture 12-25th August 2007.

89) J. P. Burrows – ACCENT ESF Summer School and ACCENT Summer School, 14th September 2007, Ile d'Oléron, France.

Session A11F - AGU Fall Meeting, San Francisco 10th December 2007 "The retrieval of dry columns of Greenhouse Gases using SCIAMACHY".

92) J. P. Burrows University of California, School of Chemistry and Department Earth and Planetary Atmospheres 2007 – 2008 Harold S. Johnston Lecturer - 4th March 2008. 2 two hours lectures:

- i) Exploring Atmospheric Chemistry from Space: The Challenges and the Potential
- ii) Global Observations of Greenhouse Gases and related air pollutants using SCIAMACHY

93) J. P. Burrows Exploring Atmospheric Chemistry from Space: Contributions from SCIAMACHY and GOME 4th DOAS International Workshop, Hefei China 30th March - 3rd April 2008

94) J. P. Burrows, EGU Session AS 3.12 Vienna Conference Center, 14th April 2008 Satellite Remote Sensing of Trace Gases and Air Pollution using SCIAMACHY on board ENVISAT,

95) J.P. Burrows EPS/SPF Conference Energy : a challenge for the 21st century physics, EPS /SPF Conference, École de Physique, Les Houches 02-05.06.2008, Observations of Climate.

96) J. P. Burrows 4th SPARC General Assembly, 31st August - 5th September 2008 Bologna, Italy ; Observation of the Upper Atmosphere from Satellite Platforms: *Sensing and Sensibility* .

97) J. P. Burrows IGAC 08 Conference Annecy France, 8-12th September 2008 Measurements of Relevance for Air Pollution and Greenhouse Gases from Space using GOME, SCIAMACHY and GOME-2 from 1995 to present

98) J.P. Burrows MOCA-09, 19th-29th July 2009 Montreal Canada - Joint Assembly of IAMAS (The International Association of Meteorology and Atmospheric Sciences) , IAPSO (and International Association for the Physical Sciences of the Oceans) and IACS (International Association of Cryospheric Sciences). **J13 Biogeochemistry and Climate**

Invited Talk: Carbon Dioxide and Methane Column averaged mixing ratios from SCIAMACHY: Work in Progress

99) J. P. Burrows Earth Observation: Sensing & Sensibility, NERC Directors Meeting 15th December 2009 University of Reading UK.

100) J. P. Burrows WMO – BIPM Meeting Measurement Challenges for Global Observation Systems for Climate Change Monitoring: Traceability, Stability and Uncertainty, 29th March to 1st April 2010, Invited talk Global observations of Greenhouse Gases using SCIAMACHY

101) J. P. Burrows SPARC/IGAC SSG meeting - Regional and Local Workshop - 25-26th October 2009 Kyoto Japan : Tropospheric remote sensing of trace gases and aerosols

102) J.P. Burrows SPARC SSG 26th-31st October Kyoto Japan, “ Report on the 5th International Atmospheric Limb Conference and Workshop, Helsinki, November 16 - 19, 2009”

103) C. Von Savigny and J. P. Burrows SCOSTEP Symposium, 11-116th July 2010, Berlin, Germany Measurements of solar and atmospheric phenomena using SCIAMACHY on board Envisat 2002 – present

104) J. P. Burrows Session A11 COSPAR 38 in Bremen Germany, “SCIAMACHY on board Envisat: an update of stratospheric and mesospheric results 2002 – 2010“,

5. INTERNATIONAL AND NATIONAL CONFERENCE AND WORKSHOP ORGANISATION

- 1) Optical Methods in Atmospheric Chemistry - Programme Committee 1992

- 2) Conference on Lasers and Electro-Optics/International Quantum Electronics Conference CLEO/IQEC - Programme Committee 1993, 1994
- 3) European Symposium on Atmospheric Measurements from Space 18-22nd January 1998, Conference Committee.
- 4) GOME and SCIAMACHY Scientific Workshops 1989-present
- 5) EUROTRAC TROPOSAT Workshops 2000- present
- 6) COSPAR 32 1998 Session A1.2. Remote Sensing of Trace Constituents in the Lower Stratosphere, Troposphere and the Earth's Surface: Global Observations, Air Pollution and the Atmospheric Correction: MSO: Hilsenrath E.; DO: Takeuchi, N.; Editor: Burrows J.P., Kawata T., Takeuchi, Nagoa N., Japan 12-19th July 1998.
- 7) COSPAR 33 2000 Session A1.2. Remote Sensing of Trace Constituents in the Lower Stratosphere, Troposphere and the Earth's Surface: Global Observations, Air Pollution and the Atmospheric Correction: MSO: Burrows, J.P.; DO: Takeuchi, N.; Editor: Burrows, J.P., Kawata, T., Takeuchi, N. Warsaw Poland 16th -23rd July 2000.
- 8) COSPAR 34 2002 Session A1.2. Remote Sensing of Trace Constituents in the Lower Stratosphere and Troposphere and the Earth's Surface: MSO: Burrows, J.P.; DO: J Remedios; Editor: Burrows, J.P. 10-19th October 2002
- 9) COSPAR 35 2004 Session A1.1 Atmospheric Remote Sensing: Earth's Surface, Troposphere, Stratosphere and Mesosphere, MSO: J. P. Burrows 18-25th July 2004, Paris, France.
- 10) SPARC (Stratospheric Processes and their Role in Climate) general Assembly Victoria British Columbia 1-6th August 2004.
- 11) 1st ACCENT Symposium 2005, 12th- 16th September 2005 University of Urbino, Italy.
- 12) COSPAR 36, 2006 Session **A1.1** Atmospheric Remote Sensing: Surface Layer, Troposphere, Stratosphere and Mesosphere, DO: J. P. Burrows 16-23th July 2006 Paris, France.
- 13) 2nd ACCENT Symposium 2007, 21st- 28th July 2007 University of Urbino, Italy.
- 14) ACCENT Emission Workshop Remote Sensing and Inventories of Anthropogenic Emissions IIASA , Laxenburg Austria, 4-5th December 2007
- 15) 4th DOAS International Workshop, Hefei China 30th March - 3rd April 2008

- 16) COSPAR 37, 2006 Session **A1.1** Atmospheric Remote Sensing: Surface Layer, Troposphere, Stratosphere and Mesosphere, DO: J. P. Burrows 12-20th July 2008 Montreal, Canada.
- 17) IGBP-IGAC 10th IGAC 2008 Conference Bridging the Scales in Atmospheric Chemistry: Local to Global 7th to 12th September 2008 in Annecy-le-Vieux, France, Member of the Scientific Programme Committee for the Symposium.
- 18) WCRP-SPARC SPARC 4th GENERAL ASSEMBLY SEPTEMBER 1-5, 2008 Bologna, Italy CNR Congress Centre
- 19) MOCA-09, 19th-29th July 2009 Montreal Canada -
http://www.moca-09.org/e/documents/Fast-facs-sheet-for-web-ENGLISH_head_000.pdf
Joint Assembly of IAMAS (The International Association of Meteorology and Atmospheric Sciences) , IAPSO (and International Association for the Physical Sciences of the Oceans) IACS (International Association of Cryospheric Sciences), their Joint Assembly, held in Montréal, Québec, Canada. Convener of Session J13 Biogeochemistry and Climate
Convener of Session M15 Atmospheric Composition Change: Air Pollution in the Global Environment.
- 20) 12th Symposium of the International Commission on Atmospheric Chemistry and Global Pollution (CACGP) 11th Science Conference of the International Global Atmosphere Chemistry (IGAC) Project Atmospheric Chemistry: Challenging the future, Halifax, Canada, July 11-16, 2010 Scientific Programme Committee
- 21) COSPAR 2010 38th Scientific Assembly of COSPAR Bremen 18th to 25th July Bremen DSO and Scientific Programme Committee for Session A11

German Physical Society: Environmental Physics Section

I am a founding member of the section of the German Physical Society, dedicated to Environmental Physics. I assisted the organising of the annual spring meeting, since their inception in 1997.

TROPOSAT-1 and TROPOSAT-2

Together with Professor U. Platt (University of Heidelberg) and Dr. Peter Borrell (P&P Consultants), I initiated the TROPOSAT project, which aims to exploit remote sensing for tropospheric research. TROPOSAT ran within the context of and had two annual meetings.

TROPOSAT has now been succeeded by the ACCENT – Remote Sensing TROPOSAT-2 Project, which is running within the framework of the EU Network of Excellence ACCENT.

I am co-ordinator of AT-2 project within ACCENT, supported by Dr. Peter Borrell, who is executive secretary of AT-2 and Professor Ulrich Platt, who is a member of the steering committee.

5 EXTERNAL RESEARCH CONTRACTS

Throughout my career spanning some 35 years of research, I have been involved in Contract research of different types. My department within the Institute of Remote Sensing which is part the Institute of Environmental Physics has been on average 2-3 M€ per annum for the past 15 years. In the following are examples of the research contracts undertaken by my research team.

EEC COST 61a projects

Reactions of N_2O_5 and NO_3 of relevance to atmospheric chemistry. J. P. Burrows and G. S. Tyndall
1984-1986

Chemical Manufacturers' Association Contracts:

1) Investigation of the product formation in the association reaction of ClO with NO_2 , using diode laser spectroscopy. R. A. Cox and J. P. Burrows, C. M. A. project FC-80-334.

2) Measurement of the UV absorption cross section of HO_2NO_2 at 298 K and its temperature dependence. J. P. Burrows, G. K. Moortgat and P. J. Crutzen, C. M. A. project FC-85-574.
EEC Contracts

A) Stimulation Action Programme:

"The study of the $HO_2 + CH_3CHO$ reaction in the photolysis of CH_3CHO and its consequences for atmospheric chemistry." J. P. Burrows, G. K. Moortgat, R. A. Cox and P. J. Crutzen.
1984-1986

B) Environmental Research Programme: 1st to 3rd Framework Programmes or Equivalent

1) Study of the oxidation of naturally emitted hydrocarbons by NO_3 .
1988-1990

2) Laboratory studies of nitrate radical reactions of tropospheric importance.
1988-1990

3) Halogen Oxide Reactions of Importance for the Lower Stratosphere
1990-1992

4) Chemistry of Halogen Oxides in the Stratosphere - CHAOS

1992-1993

5) Stratospheric Climatology by using UV-visible Spectroscopy - SCUVS
1992-1994

6) Field studies on the tropospheric degradation mechanism of Biogenic VOC's: Isoprene and DMS - FIELDVOC
1992-1995

7) Stratospheric Climatology by using UV-visible Spectroscopy - SCUVS-2
1994-1995

8) CABRIS: Chlorine and Bromine Reservoirs in the stratosphere
1994-1995

9) HODAS: Hemispheric Models and data within the SESAME Campaign
1994-1995

10) Stratospheric Climatology by using UV-visible Spectroscopy - SCUVS-3
1995-1998

11) Peroxy Radical Intercomparison Exercise -PRICE 2
1995-1998

4th Framework Programme

12) THESEO - Third European Stratospheric Experiment on Ozone – Stratospheric Ozone Destruction by Bromine (CEE ENV4-CT97 0521) 1997-2000

13) PRIME - Peroxy Radical initiative for measurement in the environment (ENV4-CT97-404).

14) GODIVA - GOME Data Interpretation, Validation and Application (ENV4-CT97-0419).

15) COSE - Compilation of Observations of the Stratosphere above Europe (ENV4-CT98-0750).
1998 - 2000.

5th Framework Programme

16) POET - Precursors of Ozone and their Effects in the Troposphere (EVK2-1999-00011) 2000-2003.

17) FORMAT Formaldehyde as a Tracer of Oxidation on the Troposphere EVK2-CT-2001-00120. 2001-2004.

- 18) THALOS - Tropospheric Halogens – Effect on Ozone EVK2-2001-00022. 2002-2005.
- 19) RETRO REanalysis of the TROspheric chemical composition over the past 40 years (EVK2-2001-00370) 2002-2005.
- 20) EVERGREEN - EnVisat for Environmental Regulation of GREENhouse gases. Contract in negotiation 2002 –2005.
- 21) GMES-GATO – Global Monitoring of Environment and Security: Global ATmospheric Observations. Contract in negotiation 2002 –2005.

6th Framework Programme

- 22) ACCENT: Atmospheric Composition Change: A European Network 2004-2009: Co-ordinator: S. Fuzzi CNR Bologna EU Network of Excellence 01.03.2004 - 28.02.2009.
- 23) SCOUT-03: Stratosphere-climate links with emphasis on the UTLS 01.05.2004 - 30.04.2009.
- 24) GMES-GEMS: Global and regional Earth-system (Atmosphere) Monitoring using Satellite and in-situ data (GEMS) 2005 – 2010.
- 25) African Monsoon Multidisciplinary Analyses 01.03.2005 – 01.03.2009. QUANTIFY Quantifying the Climate impact of Global and European Transport Systems 01.03.2005 – 28.03.2010.
- 27) GEOMON- Global Earth Observation and Monitoring of the atmosphere Partner 01.01.2007 – 31.12.2011.

7th Framework Programme

- 27) CITYZEN UB PI and Partner in proposals of Cityzen, which is a 4-year research project focusing on megacities and emission hot spots. It is funded by the European Commission through Framework Programme 7. <http://cityzen-project.eu/>
- 28) MACC, UB is PI and partner of Monitoring Atmospheric Composition and Climate - MACC, which is the current pre-operational atmospheric service of the European GMES programme. MACC provides data records on atmospheric composition for recent years, data for monitoring present conditions and forecasts of the distribution of key constituents for a few days ahead. MACC combines state-of-the-art atmospheric modelling with Earth observation data to provide information services covering European Air Quality, Global Atmospheric Composition, Climate, and UV and Solar Energy. <http://www.gmes-atmosphere>

BMFT (German Ministry of Science and Technology) Contracts

- 1) Troposphärische Spurengas Messungen mittels Dioden-Laser-Spektroskopie.,(Project Nr. 0744112) 1986-1990
- 2) Ein Flugtaugliches Dioden-Laser-Absorptionsspektrometer für atmosphärische Spurengasmessungen mit hoher Nachweisempfindlichkeit bei simultaner Messung von vier Spezies 1988-1991
- 3) Interpretation von Ozon-Vertikalenprofilen und höhenabhängigen Photolysenratenvariation in der nördlichen Hemisphäre unter Benutzung von GOME Satellitendaten,1996-1999. 01LO 9607/1
- 4) Studie zur Bestimmung solarer UV-B Strahlung aus GOME-Satellitendaten 1997-2000. 01LU97042.
- 5) Messung der stratosphärischen H₂O und CH₄ Konzentration mit Hilfe von NIR Diodenlasern, zusammen mit der Universität Heidelberg ab 1997 – 2000. 01LA98353.
- 6) Indirekte Bestimmung der Single Scattering Albedo und des komplexen Brechungsindex des atmosphärischen Aerosols aus kombinierten spektralen Sonne- und Himmelsstrahlung, sowie spektralen Flußmessungen und der Ermittlungsantriebs. 07 AF 227/0.

Space Based Remote Sensing Projects:**A) SCIAMACHY : a European proposal for atmospheric remote sensing from the Polar Platform**

Principal Investigator: J. P. Burrows

Submitted July 1988.

Recommended by ESA for flight on the first ESA polar platform - March 1989.

Phase A study July 1989 - April 1990.

Phase B study July 1990 - December 1992

Phase C/D study January 1993 –2002

Phase E 2002-present.

SCIAMACHY is part of the ESA satellite ENVISAT, which was successfully launched into a sun-synchronous descending Low Earth Orbit (LEO), having an equator crossing time of 10.00 a.m. SCIAMACHY makes near simultaneous observations of solar radiation upwelling from the atmosphere in limb/nadir viewing geometry. In addition it makes sun rise and moon rise occultation measurements. SCIAMACHY is a passive remote sensing instrument, having eight spectral channels enabling it to observe the backscattered reflected and absorbed electromagnetic radiation between 220 and 2380 nm. Inversion of these measurements enables the amounts and distributions of atmospheric constituents to be determined. The scientific objective of the measurements SCIAMACHY is to improve our understanding and knowledge of the atmosphere and in particular the physics and chemistry of the stratosphere and troposphere.

Scientific Studies supported by BMFT/DLR/BMBF/GSF 1992-present

Wissenschaftliche Begleitstudie zur Entwicklung von Sciamachy im Rahmen des Atmos-Projektes 07 UFE12/8.

B) GOME - Global Ozone Monitoring Experiment

Lead Scientist: J. P. Burrows

Proposed - December 1988

Phase A study July 1989 - April 1990

Phase B study July 1990 - April 1991

Phases C/D study July 1991 - July 1994

GOME is a small scale version of SCIAMACHY, which could be rapidly developed. GOME was launched on the ESA satellite ERS-2 on the 20th of April 1995 and has been successfully making measurements for 2 years. GOME observes simultaneously the back scattered up welling radiation from the top of the atmosphere in four spectral

channels between 240 and 790 nm. ERS-2 like ENVISAT flies in a descending LEO having an equator crossing time of 10:30 a.m. the swath of GOME yields global coverage in three days at the equator.

GOME-2 is an improved version of GOME-1, which will fly on the EUMETSAT Metop series of operational meteorological sun synchronous platforms from 2005-2020. It has higher spatial resolution and global coverage in one day.

Scientific Studies supported by ESA 1989-1997

- 1) GOME Scientific Support. 9997/92/NL/CN.
- 2) Scientific Support for GOME during ERS-2 operational life 1994-1996.11149/94/NL/CN

Scientific studies supported by DARA/DLR/BMBF 1995- present

- 1) Wissenschaftliche Datenprodukte und Prozeßstudien für das Global Ozone Monitoring Experiment GOME auf ERS-2. 50 EE 9440.
- 2) Studie zur Kalibration und Validation von Daten des Global Ozone Monitoring Experiment GOME auf ERS-2. 50EE 9439.

C) GeoSCIA and GeoTROPE (Geostationary Tropospheric Explorer) initiatives and ESA EUMETSAT Sentinel 4 UVN Mission

GeoTROPE and GeoSCIA - Principal Investigator: J. P. Burrows

The GeoTROPE proposal has been submitted to ESA in response to the call for Earth Opportunity Missions. The GeoTROPE concept aims to make spectrally resolved measurements of the upwelling back scattered solar and thermal radiation at high spatial and temporal sampling from geostationary orbit. It comprises two instruments GeoSCIA and GeoFIS. The former builds on the heritage of GOME and SCIAMACHY, whilst the latter builds on the heritage of IASI. The combination of spectral absorption and scattering features from different spectral regions yields the optimal vertical resolution for trace constituents.

The GeoTROPE and GeoSCIA initiatives have been supported by the German Space Agency - DLR. The French space Agency CNES has supported the development of GeoFIS. Currently ESA are considering how to respond to the ESAC (Earth Sciences Advisory Committee) recommendation to investigate the GeoTROPE proposal.

A smaller version of GeoSCIA called GeiSCIA-Lite was also proposed for national funding by the DLR.

Following successful studies of GeoSCIA by ESA and the investigation of a UVN Instrument by EUMETSAT and the recommendation by the EU GMES working Group 4, The UE supported ESA in its Sentinel 4 and Sentinel 5 elements. Sentinel 4 is a UVN Instrument having heritage in GeoSCIA and flying as part of the MeteoSat Third generation platform.

D) CarbonSAT and related studies

MaMAP (Methane Mapper) IUP University of Bremen and GFZ Potsdam, 2005-2010
This study produces and aircraft prototype for a passive remote sensing instrument.

KlimaSaat Study together with OB Systems supported by the State of Bremen.
This study investigated options to measure

CarbonMon Study together OHB Systems, supported by German Aerospace (DLR).
This study, together those above developed the Carbon

E) Other ESA Studies

- 1) Tracegas 1 – A study of Method for the Retrieval of atmospheric constituents – ESA 9687/91/NL/BI
- 2) Tracegas 2 – Detailed Analysis of the Retrieval Algorithms selected for the Level 1-2 processing of GOME data. ESA 10728/94/NL/CN.
- 3) A Study of Cloud detection. ESA 10997/94/NL/CN
- 4) Study of the Ring Effect. ESA 10996/94/NL/CN.
- 5) Study on absorption cross-sections in the UV and visible. ESA 11340/95/NL/CN
- 6) Design, development and upgrading of prototype software tools for the use with ESRIN atmospheric reference processor. ESA 12030/96/I-HGE
- 7) Cloud and Aerosol Data products Algorithms Development (CADAPA). ESA 11572/95/NL/CN.
- 8) HARMONICS Harmonisation of GOME, SCIAMACHY, GOME-2 Ozone and Nitrogen Dioxide Cross-sections
- 9) Sentinel 4 UVN Scientific Support. In a series of studies supported by ESA the IUP Bremen team has provided scientific studies to support the development of the GMES Sentinel 4 UVN instrument.

10) ALANIS (Atmosphere-Land Interactions Study) IUP UB team one of the partners of this study 2009 to 2011.

11) ESA Climate Change Initiative
CCIs are currently in negotiation phase
UB team is leading the GHG CCI
UB is a partner in the Ozone CCI
UB is a partner in the Aerosol CCI
UB is a partner in the Cloud CCI.

F) EUMESAT

- 1) GOME-2 Error Analysis, EUM/CO/01/901/DK
- 2) GOME-2 Error Analysis Extension
- 3) UV-Vis Instrument Study Support

G) NATO

Forward Models and Retrieval Precision for Nadir Viewing Multi-channel Spectrometers. CRG 920173.

H) Environmental Programme Land Bremen

- 1) Der Einfluß der Peroxyradikalkonzentration auf die Höhe der Ozonproduktion – FV 058 – 1992-1995.
- 2) Bremen Ozon-Kurzzeit Prognose BROK. 1996- 1999.
- 3) Optimierung und Bau eines NO₂-Meßgerätes. 1996-1999.