

STRATOSPHERIC PROCESSES
AND THEIR ROLE IN CLIMATE

SPARC

A PROJECT OF THE WMO/ICSU/IOC
World Climate Research Programme



20 Years of SPARC

Recollections of the First Two
Decades (1992-2012)

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Stratospheric Processes And their Role in Climate

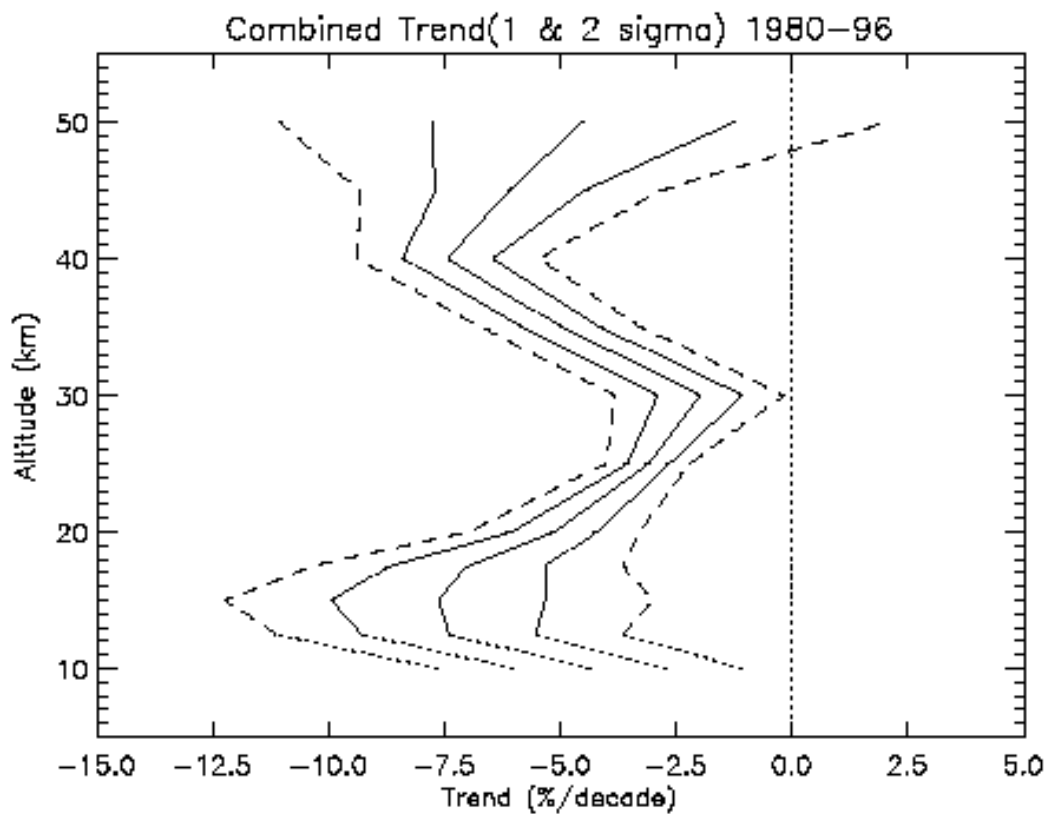
20 Years of SPARC



Recollections of the First Two Decades

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This figure helped putting SPARC on the map! Estimate of the mean trend in the vertical distribution of ozone that has occurred over northern mid-latitudes from 1980-1996 (heavy solid line) calculated using the trends derived from SAGE I/II, ozonesondes, SBUV and Umkehr measurements. Combined uncertainties are shown as 1σ (light solid lines) and 2σ (dashed lines). This is Figure 2 from SPARC Report No. 1. WMO Ozone Research and Monitoring Project Report No. 43 (1998).



Foreword

The twentieth anniversary of SPARC

Yes, it's very hard to believe that the WCRP core project "Stratospheric Processes And their Role in Climate" (SPARC) is already twenty years old! To mark this anniversary, to present some of the highlights of what has been achieved since the establishment of SPARC in 1992, and to look forward to the development of the project and some of the challenges to be faced in coming years, we have compiled in this small booklet the perspectives and thoughts of some of those who have played or are playing

key roles in SPARC. Included are contributions from the co-chairs of the SPARC Scientific Steering Group (SSG) since 1992 and the Directors of the SPARC Office, variously located at different times in Paris, Toronto and now Zürich. We think the texts make exciting reading!

The overwhelming conclusion is that SPARC was the right project at the right time. Up to the early 1990s, from the climate point of view, the main concern with the stratosphere was the conse-



quences of ozone depletion. The numerous interactions between the stratosphere and the troposphere and the role that the stratosphere played in relation to climate were not fully realised or not thought to be of fundamental importance. SPARC has changed all this by organising studies of observed changes in the stratosphere and atmospheric processes relevant to those changes, modelling those processes as well as investigating stratosphere-troposphere coupling. SPARC comprehensive (and peer-reviewed) assessments include the Vertical Distribution of Ozone, Stratospheric Temperature Trends, Upper Tropospheric and Stratospheric Water Vapour, Intercomparison of Middle Atmosphere Climatologies, Stratospheric Aerosol Properties, and Chemistry-Climate Model Validation. The key to the success of SPARC has been its way of working, setting a unique agenda with well-defined challenges, bringing together groups of scientists to focus on multidisciplinary emerging issues and to venture into new areas. SPARC is definitely not “science

by diktat” but is guided by input from all active scientists in our field on what initiatives are needed or would be valuable and in return offers new scenarios for developing research – also providing good opportunities for younger scientists. Thus, in the time since its inception, SPARC has become fully recognised and accepted as the focal point and beacon by the whole stratospheric scientific research community – atmospheric chemists, physicists and dynamicists – and is regarded as the place to meet and join forces in analyzing and tackling cross-cutting issues. The foresight, inspiration and dedication of Marie-Lise Chanin and Marv Geller who devoted so much effort to have the concept of SPARC originally accepted in the WCRP and our community as a whole, and who piloted the initial development of the project and its *modus operandi*, must be vigorously applauded.

Based on this SPARC approach, one can confidently look forward to continuing success in the future. In fact, SPARC has now been given an expanded man-



date in the WCRP, namely to develop a stronger focus on the interface of the stratosphere and the troposphere and stratosphere-troposphere coupling. Thus, as well as ongoing SPARC themes, scientific activities will be extended towards the troposphere including studies of relevant tropospheric processes and chemistry. This will obviously offer many new challenges in the next twenty years and require strengthened and broadened support from the scientific community.

As is also clear from the contributions to this booklet, the success of SPARC owes an enormous amount to its Project Office, hosted successively by France, Canada, and now Switzerland. Having always had exceptionally competent scientific and administrative staffing, this Office has had a crucial role and undertaken in an impressive way the practical planning, organisation and direction of SPARC activities and meetings, including notably the production of the outstanding semi-annual Newsletter and SPARC Reports, and preparation

of the landmark SPARC General Assemblies. The essential support of the hosting nations for the SPARC Office is gratefully acknowledged, although it has not always been easy to obtain all the resources necessary. We have to already note that maintaining the SPARC Office in Switzerland may only be possible for a relatively short time. We have to face again soon the challenge of exploring whether the Office may be able to continue in Switzerland or whether the Office will have to look for a new home.

Another very important factor in the success of SPARC has been the constant strong backing and interest of our parent programme, the WCRP. This has given much extra credibility and weight to our efforts underlining the significance of the stratosphere in the Earth's climate system, and the benefits of interactions with other WCRP core projects. But the traffic has certainly not all been one way: we believe that SPARC has been an extraordinarily successful project of the WCRP, bringing credit to the Programme and expanding its



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scientific scope and capability (for example, inclusion of aspects of atmospheric chemistry). And we hope furthermore that the special approach of SPARC sets an example for the WCRP as a whole.

Finally, we must acknowledge all of the resources and facilities provided for SPARC research and activities by so many different agencies and institutions, national and international, as well as their giving the time of their staff for participation in SPARC – without which SPARC would not have been possible at all.

Thanks are due to the SPARC Office in Zürich for the technical production of this booklet.

The SPARC Team *

* Past and present Co-Chairs and Directors of SPARC, and liaison persons at WCRP.



**Thoughts on SPARC by past and present
Co-Chairs, Directors and
WCRP Liaison Staff**



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Members of the first SPARC SSG, SPARC Office and other attendees in Corpus Christi College, Cambridge, UK, September 1993. From left to right: I. Isaksen, J. Pyle, J. Gille, G. Reid, J. Kaye, S. Chandra, R. Newson, M. Geller, M.-C. Torre, J. Mahlman, D. Ehhalt, V. Khatattov, E. D. Fabo, M.-L. Chanin, P. Simon, Y. Matsuno, H. Tanaka, S. Solomon



Marie-Lise Chanin

SPARC Co-Chair from 1992 to 2000

and Director of the SPARC Office from 1992 to 2004

Souvenir of the first decade of SPARC

My involvement with “stratospheric processes and their role in climate” started at least a decade before the name of SPARC had been thought of and the establishment of the project. To create such a new project requires many years of effort before it emerges from dream to reality! The main problem was to have the stratosphere and its importance in the Earth’s system recognised in the two principal climate and global change-

related programmes which existed at the end of the 1980s: the World Climate Research Programme (WCRP), established in 1980 to investigate the *physical* processes important in the climate system; and the International Geosphere-Biosphere Programme (IGBP), created in 1986 to study the interactive *physical, chemical and biological* processes that regulate the total Earth system. But the stratosphere was not mentioned in either of them!



The issue of ozone depletion had raised enormous interest in the stratospheric research community from the middle of the 1970s, and even more so after the discovery of the ozone hole in 1984. Many important national programmes had been successfully set up and the feeling was that there was no need to create new ones. What had to be demonstrated to the climate community was the existence of the numerous interactions between the stratosphere and the troposphere and the essential role that the stratosphere played in relation to climate, not just the consequences of ozone depletion.

I have already documented the difficulties we encountered to have SPARC accepted as a WCRP core project in an account published in SPARC Newsletter No 22 in January 2004, "A short history of the beginning of SPARC and its early development", so I won't spell out again the long process through which a group of scientists led by Marvin Geller and myself had to go in order to succeed. Now, when an interdisciplinary approach is re-

garded as fundamental in studying all issues related to global and climate change, it is difficult to imagine that the introduction of chemistry in the physical fortress of WCRP was such a revolution! But it is definitely worth recalling the enthusiasm that greeted SPARC in our community when it was finally formally established as a WCRP project. This is so apparent in the photo of the first session of the SPARC Scientific Steering Group (SSG) in Corpus Christi College, Cambridge in 1993 with all participants wearing a SPARC tee-shirt!

From the beginning, the first two co-chairs of SPARC, Marvin Geller and myself, our successors and SSG members, have been careful not to include in SPARC topics which were well taken care of by other existing programmes. Our approach was to establish strong links and good relationships with the national "ozone depletion" programmes, but without interfering. This worked well, thanks to a few key people who recognised that SPARC was not a threat but a complement and support to their



activities. SPARC duly focussed on understanding stratospheric changes, which are caused either by human activities or by natural variations, and how such changes can affect the climate. SPARC organised its studies around particular themes concerned with observed changes in the stratosphere, atmospheric processes relevant to those changes, and modelling those processes.

It would be overly ambitious to try and summarise here the first ten years in the life of SPARC. As the project established itself, became increasingly well known and recognised as a beacon in stratospheric science, the number of activities and scientists involved increased rapidly. A striking example of this is how the size of the always widely-distributed and popular SPARC Newsletter increased during this period - the number of pages multiplied by a factor of five!

I will just mention a few other highlights of this first decade. One of the most important and successful initiatives undertaken

initially was the assessment of our current knowledge of key stratospheric quantities (temperature, ozone, water vapour and aerosols) and to establish a climatology of the stratosphere. Most of the results and findings have been published as SPARC Reports. This activity has been the key to giving SPARC an important role in the successive WMO-UNEP Ozone Assessments and later in IPCC Assessments.

Also important was the organisation of many SPARC-related scientific meetings, including several very successful NATO workshops, providing the latest knowledge and ideas for the development of the project. The souvenirs of three exciting landmark SPARC General Assemblies (Melbourne, 1996; Mar del Plata, 2000; Victoria, 2004) are all alive in my memory, including their non-scientific aspects, for example, learning how to dance the tango...

With hindsight, I am happy to note that we didn't miss many topics which later came to the



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forefront; for example, “solar forcing of climate”, a sulphurous question at the time, is now the subject of much research by our community. The dynamical coupling of the stratosphere and troposphere and the linkage with the Arctic and North Atlantic Oscillations are now realised to be important for the predictability of changes in the troposphere. I also remember the strong pressure we put on IGBP to cooperate in joint SPARC/IGAC studies of chemistry-climate interactions, an issue now vital for the future of both programmes.

I often think of all the scientists who gave so much of their time and talent to make SPARC successful and I feel very grateful to

all of them. SPARC owes them its successes and its excellent reputation in the WCRP and climate/global change community, and I wish to express my sincere thanks. As Director of the SPARC Office for 12 years, I virtually had no experience of scientists refusing to support and participate in SPARC activities, whether writing articles or organising meetings, even from the busiest. For me, the most important and satisfying memory from all this period is the wonderful feeling of forming a large family enjoying to work together. This is the best reward that one can have when devoting one's energy to and working hard over many years for the success of a project!!





Marv Geller

SPARC Co-Chair from 1992 to 2002

SPARC forever!

I have been privileged to serve the longest term (1992-2002) of any individual as co-chair of the SPARC Scientific Steering Group (SSG) (with Marie-Lise Chanin, 1992-2000 and Alan O'Neill, 2001-2002) and I have attended every one of the sessions of the SSG in one capacity or another. Marie-Lise has referred to the difficulties that we initially encountered in having SPARC accepted as a WCRP core project (see "Souvenir of the first decade of SPARC"). I believe the SPARC

community and the WCRP were very forward-looking in starting a project with the name "Stratospheric Processes And their Role in Climate" at a time when a relatively small number of atmospheric scientists were saying that the stratosphere did play a significant role in affecting surface climate. One needs only to read the most recent WMO/ UNEP Ozone Assessment report to see how that situation has changed. The importance of the numerous interactions between the strato-



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sphere and troposphere in the Earth's climate system, originally emphasised by relatively few of us, is now universally accepted.

I have also been privileged to work, interact and associate with some of the most talented atmospheric scientists and some of the most personable people that one could wish for during the period of SPARC's existence (and before). One needs only to examine the original membership of the SPARC SSG, as well as all those that have served in this capacity since, to see this. The list of charter SSG members read as a Who's Who in our field. They were as follows: Marie-Lise Chanin and Marvin Geller (co-chairs), Dieter Ehhalt, Ivar Isaksen, Vyacheslav Khattatov, Jerry Mahlman, Taroh Matsuno, John Pyle, Susan Solomon, Hiroshi Tanaka and Richard Turco. The outstanding quality of the scientists serving on the SPARC SSG, and just as importantly those leading and participating in its working groups undertaking all the wide-ranging initiatives, was the key to the success of the project from the beginning. And

SPARC has been able to continue to attract the best scientists in our field, as is clear when you look at the individuals who now are now active in the project - this will guarantee ongoing progress and achievements.

SPARC has also been fortunate to have the strong support of the WCRP Joint Scientific Committee and the Joint Planning Staff from the beginning. I'm sure that Marie-Lise Chanin will agree with me how important Roger Newson was in providing not only basic staff support and WCRP liaison, but also valuable advice on relationships with other WCRP projects, international science programmes and organizations, helping us avoid several difficult situations. It was a very great pleasure for me to work with Roger, especially since I was familiar with his name from his pioneering work on modelling stratospheric warmings in the 1970s. Since Roger's retirement in 2002, excellent continuing support has been provided by Vladimir Ryabinin.



Several research ideas from SPARC have been very important to me. One of the best examples of this was the use of high-resolution radiosonde soundings, exploited originally in the SPARC Gravity Wave initiative. In 1995, Simon Allen and Bob Vincent published a paper illustrating how valuable information on atmospheric gravity waves could be derived using the inherent basic resolution of radiosonde soundings. Most meteorologists are familiar with the mandatory and significant radiosonde levels at which data are transmitted to operational centres around the world, but in fact these data are recorded much more frequently (at 6 second intervals for US soundings, which correspond to 30 m altitude resolution, and even higher in the last few years). SPARC duly instigated an effort to compile this information worldwide and enlisted interested scientists in their own countries to implement this effort. I was supported by the US National Science Foundation in buying the US data, as well as performing research using these. A further benefit was that the NASA

funding for the SPARC Data Centre (which I am pleased to say was established at the State University of New York at Stony Brook) enabled the high resolution radiosonde data to be made freely available from the Centre, with NOAA approving this arrangement. It is gratifying that there have been many students around the world whose research theses have taken advantage of these data, including two PhD and one MSc students of my own. A particularly clever use was by Thomas Birner, and his work has led to a great deal of the current interest on the sharpness of the extratropical tropopause and stimulated important new studies of the upper troposphere-lower stratosphere within SPARC (see contribution by Norman McFarlane on the work of the Toronto SPARC Office).

SPARC also began some activities about which I was originally a bit cautious. I remember well when Dieter Ehhalt suggested that, despite the huge effort on stratospheric chemistry that was ongoing in support of the Mont-



real Protocol and Ozone Assessments on one hand and on tropospheric chemistry by the IGAC community on the other, SPARC should take up certain specialised topics to support research in these areas. I was surprised since one of the reasons why many in the atmospheric chemistry community were at that time sceptical about the need for SPARC was the enormous amount of research into ozone depletion that had begun in the 1970s. But, of course, Dieter was correct, and SPARC's efforts on upper troposphere-lower stratosphere chemistry have turned out to be very valuable.

It was part of the initial plan for SPARC to support research on topics that could enhance the scientific basis of the WMO/UNEP Ozone Assessments. Again, it is a tribute to SPARC how knowledge of key stratospheric quantities such as temperature and ozone and information on trends were assembled and continue to be so, providing fundamental input to the WMO/UNEP Assessments. Moreover,

SPARC has contributed research on stratospheric water vapour and aerosols, coupled chemistry-climate models and on dynamical interactions between the stratosphere and the troposphere.

The big splash that SPARC made with a publication that resulted from perhaps its first workshop, in Cambridge, UK, September, 1993, on the subject of Stratosphere-Troposphere Exchange (STE), is also exciting and well worth mentioning. The paper on STE that ensued (Holton et al., 1995) had been cited 1005 times when I last checked, and that by Mote et al. (1995), which resulted, I believe, from a suggestion by Michael McIntyre at that workshop, 317 times! Much of the late Jim Holton's work has been widely cited, but this 1995 review paper has been referenced even more than the classic papers he wrote with Dick Lindzen on the mechanism for the QBO.

Earlier in this write-up, I acknowledged that SPARC's success would not have been possible without the participation and

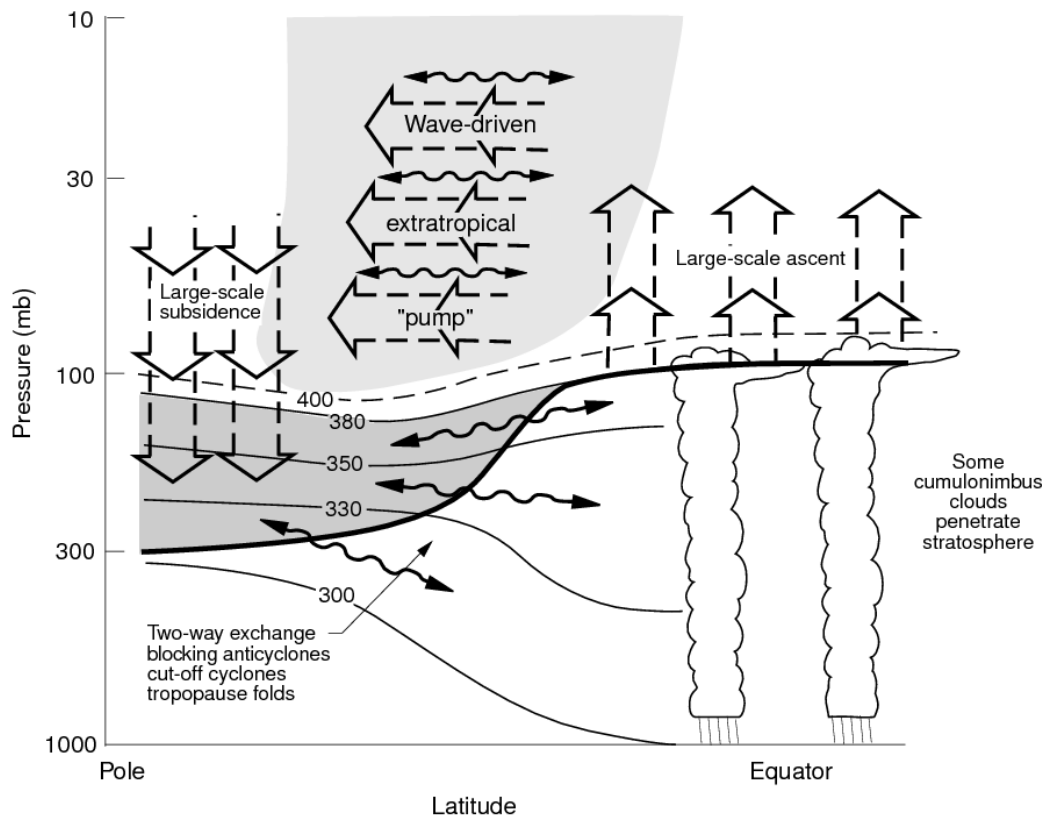


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support of the best atmospheric scientists in the world, but I would be remiss if I didn't also refer to the outstanding backing for SPARC from so many national and international agencies and institutions. The Centre National de Recherche Scientifique hosted and funded the SPARC Office in France (1993-2003), while Environment Canada, the Canadian Space Agency, the University of Toronto and the Canadian Foundation for Climate and Atmospheric Sciences provided the resources for the SPARC Office in Toronto (2004-2011). The SPARC Office, now in Zürich, is being supported by the Swiss Federal Institute of Technology in Zürich, (Eidgenössische Technische Hochschule Zürich, ETH), the Swiss Federal Office for Meteorology and Cli-

matology, and the Swiss Federal Office for the Environment. Compared to the total amount of funding or grants made for research related to SPARC undertaken by scientific groups and individual scientists, SPARC Office costs are small but are absolutely vital for the essential coordination of SPARC, organization of SPARC meetings and preparing SPARC scientific reports, which would otherwise not be possible.

I would also mention the particular interest and support of NASA and ESA for SPARC, manifested by the participation of programme managers from both agencies in almost all SSG meetings. Specifically, NASA has supported the SPARC Data Centre since its beginning in 1999.



This figure has become an icon for SPARC research: dynamical aspects of stratosphere-troposphere exchange, from Holton et al. [Revs. Geophys., 1995].

The tropopause is shown by the thick line. Thin lines are isentropic surfaces. Heavily shaded region is the “lowermost stratosphere”, where isentropic surfaces span the tropopause and isentropic exchange by tropopause folding occurs. The region above the 380 K surface is the “overworld”, in which isentropes lie entirely in the stratosphere. Light shading in the overworld denotes wave-induced forcing (the extratropical “pump”). The wiggly double headed arrows denote meridional transport by eddy motions, which include tropical upper-tropospheric troughs and their cutoff cyclones as well as their midlatitude counterparts including folds. The broad arrows show transport by the global-scale circulation, which is driven by the extratropical pump. This global-scale circulation is the primary contribution to exchange across isentropic surfaces that are entirely in the overworld.



Alan O'Neill

SPARC Co-Chair from 2001 to 2004

SPARC: reminiscences of a former co-chair

What first comes to mind when I think about SPARC? The answer is: a great international community of people who ensured that SPARC was very science focused and delivered things of scientific value; excellent co-chairs who preceded me in that role; a similarly excellent co-chair who shared that role with me and made the partnership a real pleasure; very supportive colleagues in the SPARC Office;

and stimulating scientific meetings, which were also great fun.

I had been involved in stratospheric research (large-scale dynamics) for some time when SPARC was founded, and I eventually found myself on the SPARC Scientific Steering Group (SSG). The co-chairs at that time were the founders of SPARC, Marie-Lise Chanin and Marvin Geller. They set the tone for the project from its inception to this



day, ensuring an excellent response in providing the scientific input needed for international assessments, that it identified manageable initiatives where co-ordination at international level could make a difference, and that there were clear deliverables for each activity, such as scientific assessments and reviews. They spurred many enthusiastic scientists to become involved, and encouraged wide international involvement, especially where there was an opportunity to promote stratospheric research in a country.

It was a lesson to me to see how they operated as co-chairs on the SSG. I've tried to be a "Marie-Lise Geller" ever since! Marvin tended to dress casually and seemed to approach meetings quite informally, notwithstanding a structured agenda. This, together with his affability, made him "dangerous" (as I once told him with, I hope, personal warmth), in that he was very easy to underestimate. He had a real sense of the big picture and of the international framework in which science operated. Marie-

Lise complemented him superbly at SSG meetings – not least because she dressed much better than he did! Equally knowledgeable about the science and the international scene, she tended to let Marvin introduce agenda items and get the discussion going, while she deftly helped steer the debates, paid attention to the details and made sure that things got done.

The SSG meetings were great because they were science focused and great fun. I learned a lot, including, quite unintentionally, what the male members of the group looked like in the nude! After an SSG meeting in Japan, we all trooped off to a monastery in the mountains for some bonding with our local hosts. Our stay involved sleeping on tatami mats, six to a room, taking rice from a big bucket at breakfast – and washing in a very large, communal bath (single sex, of course). I took a certain amount of wicked pleasure from teasing the then representative of the World Climate Research Programme (WCRP), Roger Newson, innocently asking if he was badly



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missing the comforts of life in Geneva. Actually, we all thoroughly enjoyed our stay, including Roger, and were very grateful to our hosts for the arrangements.

SPARC owes a great deal to Roger for his support. He took a very active interest in stratospheric research (he had built the first global, general circulation model to simulate a stratospheric sudden warming spontaneously). He helped ensure that SPARC was a key component of the WCRP and that it received constant strong backing, attention and support. When Roger retired in 2002, Vladimir Ryabinin very ably picked up the baton and it was a pleasure to work with him during my term as co-chair. We also benefited greatly from the advice and encouragement of David Carson, the Director of the WCRP, from 2000-2005.

Every four years, SPARC held its big showcase meeting: a General Assembly. I had the privilege of chairing the scientific committee charged with organizing the second SPARC General Assembly

(November, 2000) held in Mar del Plata, a beach resort in Argentina. Pablo Canziani, then at the University of Buenos Aires, chaired the local organizing committee and did much of the hard work. Pablo's plan was to hold the meeting in a large tent near the beach. I must say that this raised eyebrows on the SSG. Blessed with a vivid imagination, the SSG imagined wild spring-time weather and strong winds blowing off the sea, while more than 200 people cowered in a tent trying to make sense of Eliassen-Palm fluxes. Fortunately, the skill of the SSG at long-range weather forecasting was much less than in studying stratospheric processes, and the weather was generally benign during the Assembly. Lunch breaks saw attendees talking science and eating in the sunshine as the surf rolled in (at least that is how I remember it!). Another very fond memory from the meeting was of Jim Holton, a towering figure in our field, now sadly deceased, thoroughly enjoying himself on the dance floor at an evening social event. The Assembly arrived at a number of



important scientific conclusions, which were reported both by Argentine and international media.

Eventually (2001), it fell to me to take on the mantle of co-chair of SPARC. Marie-Lise stepped down to allow me to overlap with Marvin for a year to learn the ropes. In turn, Marvin passed his mantle and A.R. Ravishankara (Ravi) joined me as co-chair. Working with Ravi was a delight. He was incredibly perceptive and would ask “dumb” questions that got right to the heart of the matter – the kind of questions that were so “dumb” that no one took the trouble to ask or to think about. He didn’t do it to discomfort people, but because he genuinely wanted to know the answer. I really used to enjoy it when he did that, because the question was invariably thought-provoking and I seldom knew the answer myself.

Ravi broadened the scope of SPARC in a number of important ways, especially in the area of coupled chemistry-climate interactions, a challenging subject in which there are still large gaps in

knowledge and modelling abilities. He established very important collaboration in this area with the International Geosphere Biosphere Programme (IGBP), a real step in the wider integration of joint activities between the WCRP and the IGBP that the complex problems of climate and environmental change demand.

Our very special thanks must go to our colleagues in the SPARC Office, which moved smoothly from Paris to Toronto during our tenure. They have all been absolutely central in making SPARC a success and for helping to maintain a vibrant, friendly and welcoming community. Though I cannot adequately acknowledge them all here, perhaps I might mention that Norm McFarlane undertook what must have been one of the world’s longest commutes (from Victoria, BC to Toronto, Canada) to fulfil his role as Director of the SPARC Office.

My involvement with SPARC and its community has been a highlight of my professional life. To have been a co-chair of the SPARC SSG was a real privi-



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lege. It is a pleasure to see that SPARC continues to thrive, stimulated by the increasing evidence that the stratosphere is a key component of the climate

system. But there is still an enormous amount to learn and understand about the role of the stratosphere in and crucial influence on that system.



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Alan Brewer, Kirill Semeniuk, and Michael McIntyre discussing the Brewer Spectrophotometer. From the report on the Brewer-Dobson Workshop, 13-15 December 1999, Oxford, UK, by Warwick Norton and Emily Shuckburgh. See SPARC Newsletter No. 15, July 2000 (<http://www.sparc-climate.org/publications/newsletter/>).



Norm McFarlane

Director of the SPARC Office from 2004 to 2011

The Toronto SPARC Office (2004-2011)

The first SPARC Office was hosted in France by the Service d'Aéronomie, Centre National de Recherche Scientifique. In 2003, following discussions with Marie-Lise Chanin, regarding the possibility of hosting the SPARC Office in Canada, Ted Shepherd and I undertook to explore Canadian funding and sponsorship opportunities. Fortunately, we were able to assemble the resources needed and relocation of the SPARC Office to Canada began in April 2004 and was com-

pleted in August 2004, following the SPARC General Assembly and SSG meeting in Victoria, Canada. The Department of Physics at the University of Toronto hosted the SPARC Office free of charge during its entire period in Toronto (up to 2011). Environment Canada provided start-up funding, office equipment and computers, and ongoing support for me to act as the Director. Major sustained cash funding was provided by the Canadian Foundation for Climate and Atmos-



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pheric Sciences (CFCAS) and the Canadian Space Agency (CSA). Regrettably, the support provided by CFCAS came to an end with its demise as an agency to fund climate science in Canada at the end of 2011. This support could not be replaced from other sources, with the consequence that the SPARC Office has now moved from Toronto to the Swiss Federal Institute of Technology in Zürich (Eidgenössische Technische Hochschule Zürich, ETH).

The Paris SPARC Office set a very high standard in the many years of service it provided to the SPARC Project and the challenge of matching that performance was somewhat daunting. In order to carry out the tasks of being the Director of the SPARC Office, I retired from my position as a research scientist at the Canadian Centre for Climate Modelling and Analysis in Victoria, BC in late 2004, but was immediately reappointed as a scientist emeritus and retained my office space there. While Director of the SPARC Office, I maintained my home in Victoria, but spent con-

tinuous periods of several weeks a few times per year at the SPARC Office in Toronto, where I also have an appointment as an Adjunct Professor in the Physics Department.

Diane Pendlebury started work as the SPARC staff scientist in May, 2004 and Victoria DeLuca joined as the SPARC Office manager in July, 2004. Our first major responsibility was hosting the 2004 SPARC General Assembly in Victoria, followed immediately by the twelfth session of the SPARC Scientific Steering Group (SSG). I am pleased to acknowledge the unstinting help we received from the Paris SPARC Office during the first year of operation. Catherine Michaut came to Victoria two weeks prior to the General Assembly and stayed on for the SSG meeting, which is where I took over formally from Marie-Lise Chanin as the Director of the SPARC Office. Catherine also came to Toronto later that year to help with compiling the January 2005 SPARC Newsletter, the first that was produced by the Toronto Office.



Alan O'Neill and A. Ravishankara (Ravi) were the co-chairs of SPARC in 2004 and remained so until 2007 when Tom Peter and Ted Shepherd succeeded to this role. During the entire period of the tenure of the SPARC Office in Toronto, Vladimir Ryabinin has been the liaison scientist for SPARC within the WCRP JPS in Geneva. It has been very easy, and pleasant to work with all the co-chairs, Vladimir and the JPS staff during the tenure of the SPARC Office in Toronto. We have had equally constructive and congenial interactions with SSG members, SPARC Activity leaders, and in fact the whole SPARC community. All of these interactions have been critical for the success of our efforts in organizing SPARC meetings and workshops (including hosting several in Canada), facilitating the 2008 SPARC General Assembly in Bologna and, most recently, coordinating the SPARC involvement in and contribution to the WCRP Open Science Conference in October 2011.

I was certainly well aware of SPARC from its earliest stages

because of my role in the development of the Canadian Middle Atmosphere Model (CMAM) as well as in other related research. This had led to my participation in SPARC activities such as the "GCM Reality Intercomparison Project for SPARC" (GRIPS) and the Gravity Wave initiative. However, becoming Director of the SPARC Office gave me a much broader perspective on SPARC, both as to the scope and strength of its science and the importance of its role within the WCRP. It has been very exciting to be involved in the evolution of SPARC over the last decade. Building on the solid foundations that were laid in the first decade of SPARC, it is gratifying that the SPARC Office in Toronto has in turn had the opportunity to play a role in facilitating the SPARC activities and achievements that have marked the second decade. Of course it is, fundamentally, the outstanding skill and commitment of the scientists within the SPARC Community that have produced these achievements. Although my tenure as Director was longer by a couple of years than I first expected, the oppor-



tunity it provided for interaction with these scientists, many of them at early stages in their careers, has made this a memorable and rewarding period in my life.

In this short retrospective, I cannot possibly list the large range of SPARC activities that have been undertaken and the progress made during the time that the SPARC Office was in Toronto. A comprehensive view can be obtained by visiting the new SPARC web site¹, noting the excellent SPARC reports that have been produced and the large number of significant papers that have been published in the scientific journals. Looking back through the articles that have appeared in the SPARC Newsletters I have learned much from having the inside view that has come with being Director of the SPARC Office.

I would like to mention just a few SPARC activities that have been particularly interesting to me, from the perspective of my mod-

elling background, and having had the privilege of working with some of the scientists playing leading roles in SPARC. Among these has been the success of GRIPS which laid a sound basis for the SPARC evaluation of Chemistry-Climate Models (CCMVal), the studies on Modelling the Dynamics and Variability of the Stratosphere-Troposphere System (DynVar) and modelling solar influence on climate (as part of the SOLAR Influence for SPARC investigations (SOLARIS)). These have emerged as important ground-breaking initiatives in their own right, including innovative approaches such as the process-oriented diagnostics in model validation pioneered in CCMVal and, recently, the elaboration and use of new metrics. These seminal ideas have resonated with chemistry-climate modellers both in SPARC and the wider community and have resulted in rapid progress in the development and use of global climate models with comprehensive treatments of stratospheric chemistry, led to the key role of CCMVal in providing a strengthened scientific foundation for the

¹ <http://www.sparc-climate.org/>



WMO/UNEP Ozone and IPCC Assessments, and, indeed, have influenced modelling and analysis activities within the WCRP as a whole. In a parallel and complementary development, DynVar is emerging as the SPARC activity making fundamental contributions to understanding stratosphere-troposphere dynamical coupling and its role in weather and climate prediction. Building on these modelling achievements, the SPARC Data Assimilation Working Group has been able to demonstrate the feasibility and value of stratospheric dynamical and chemical data assimilation and succeeded in engaging the major weather prediction and analysis centres in stratospheric data assimilation. The SPARC Gravity Wave initiative has also reemerged as an important activity adding to both DynVar and CCMVal.

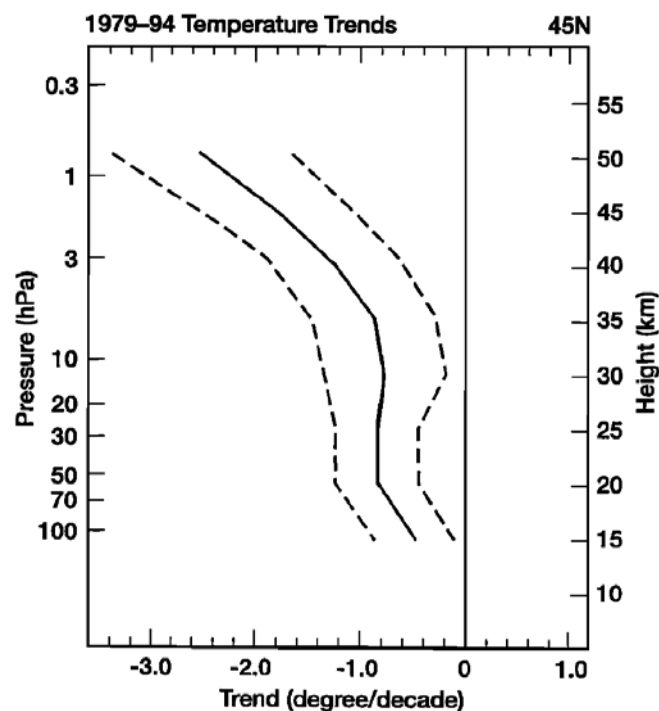
The upper troposphere-lower stratosphere region (UTLS) has been another ongoing focus of SPARC. My own general interest in this area stems from my years working in model development and parameterization, especially

in regard to the role of deep convection in the tropical tropopause layer (TTL) and how (if possible) to represent these effects in general circulation models. Notable presentations at the 2004 SPARC General Assembly, particularly by Thomas Birner, with whom I subsequently had the pleasure of working at the University of Toronto, provided the stimulus for organizing a joint SPARC-GEWEX-IGAC workshop in 2006 in Victoria (hosted by the SPARC Office), bringing together expertise in stratospheric processes, large-scale dynamics and transport and modelling of deep convection and chemistry in the tropics (see SPARC Newsletter No. 28, January 2007). The workshop was very successful and resulted in an improved understanding of the role of deep convection in determining the structure and composition of the TTL, but revealed that there were many outstanding observational and modelling challenges in further elucidating this role. This resulted in the profile of TTL research within the WCRP being raised and, for example, the design of deep convection model-



ling case studies by the Global Energy and Water Cycle Experiment (GEWEX) modelling group, as well as within the IGAC project of IGBP, were considerably influenced. Progress has been made in addressing these challenges in the subsequent years although many remain. Given the importance of the tropopause re-

gion in the general circulation of the atmosphere and climate, understanding the role of deep convection in the UTLS continues to be important and the time is probably ripe for another SPARC workshop to evaluate current understanding and how further advances can be made.



Mean vertical profile of temperature trend over the 1979-1994 period in the stratosphere at 45°N, as compiled using radiosonde, satellite, and analyzed data sets. The solid curve indicates the weighted trend estimate, while the dashed curves denote the uncertainty at the 2- σ level. From Ramaswamy et al., "Stratospheric temperature trends: Observations and model simulations" (Revs. Geophys., 2001). Data courtesy of SPARC Stratospheric Temperature Trends Assessment Project.



A.R. Ravishankara

SPARC Co-Chair from 2002 to 2007

What does SPARC mean to me?

Although SPARC was formally established in 1992, I was not aware of the project until Marie-Lise Chanin mentioned it at a meeting in Boulder in 1995. I was intrigued but felt that it was too far from my interests. It seemed to me as if “SPARC” was a lot of dynamicists talking in a language that I could hardly understand. As an experimental atmospheric (stratospheric) chemist, I was familiar with IGAC. But, IGAC had little “stratosphere” and SPARC had little “chemistry”! I

wasn’t sure whether SPARC could ever be a home for a stratospheric chemist.

My conversion came when I was invited to speak at the SPARC General Assembly in Melbourne in 1996, and had to talk about chemistry to the “SPARCies”! There I was surrounded by dynamicists with the task of trying to tell them about chemistry! I was greatly relieved that nobody threw tomatoes at me after my presentation. And then I found I



could ask them my naïve questions about dynamics and, often, was given understandable answers. This interaction with the dynamicists was very stimulating. It really changed how I was viewing stratospheric chemistry, caused me to look at chemistry issues in a different light and helped me better evaluate which chemical processes were more important - without necessarily even talking to a modeller.

Consequently, guided by Marv Geller, Marie-Lise Chanin and the SPARC Scientific Steering Group (SSG), chemistry was introduced as a mainstream topic in SPARC. The leadership of WCRP must have been supportive of this change. This was, in my opinion, a bold step forward and a major development of SPARC (the name wasn't changed but nevertheless chemistry incorporated into it!). I, an atmospheric chemist, even became a co-chair of SPARC. I really appreciated the interactions with the other co-chair, Alan O'Neill, and engaging the SSG in discussions of chemistry issues. SPARC has come a long way

since that critical step of including chemistry in a major way and this has naturally led the WCRP to look to SPARC for the expertise on all atmospheric chemistry questions. Clearly, this is a factor which must be kept in mind when considering the future of SPARC and its role in the WCRP as a whole.

I certainly recognise that organizing meetings and workshops is an essential for a project like SPARC and it actually does an excellent job of it. For me, a shining example is the SPARC General Assembly with no parallel sessions! - I hope it stays that way. But SPARC has been much, much more than an organization that provides opportunities and venues for people to meet. In my view, SPARC sets a unique agenda with well-defined challenges, bringing groups of scientists together to focus on multi-disciplinary emerging issues and to venture into new areas. These workshops have real concrete results in the form of reports, papers or assessments that are produced and frequently fundamentally change or influ-



ence the research of the scientists involved. The insistence on generating a peer-reviewed publication from these ventures is another of the important reasons for the success of SPARC and why scientists are eager and willing to work in and be associated with SPARC. Nowhere is the contribution of SPARC more visible to me than the tangible, focused input it provides to the WMO/UNEP Ozone Assessment. Not only does the SPARC community supply the brainpower for the Assessment but also key data, analyses, and the scientific backing from its projects.

I think the foregoing paragraphs demonstrate why SPARC has been so successful. Firstly, it has established the tradition of bringing scientists together, not just the like-minded, but from diverse areas with diverse approaches, as the evolution of the project over the past two decades clearly shows. Secondly, SPARC takes up manageable “bite-sized” focused initiatives that are important and delivers specific output – be it a report, an assessment, or a data set. Thirdly, SPARC’s de-

liberate, carefully considered approach and the intellectually stimulating environment of the multi-disciplinary interactions within the project have led to real conceptual changes in how we view the role of the stratosphere in the Earth system. Fourthly, the SPARC Office, staffed by high calibre scientists, has been a really strong force in piloting and organizing SPARC. The importance of this approach cannot be sufficiently stressed.

Thus it can be seen that SPARC is a very successful project of the WCRP. As I said earlier, it not only encompasses what is now fully recognised to be a vital part of the overall climate system that is not covered elsewhere in WCRP (or for that matter in IGBP and its projects), but it has also become the home for the key chemistry component of the climate system.

The future of SPARC, necessarily, depends on the people who are in it. Judicious choices and including giving opportunities to younger and perhaps less well-known scientists have always

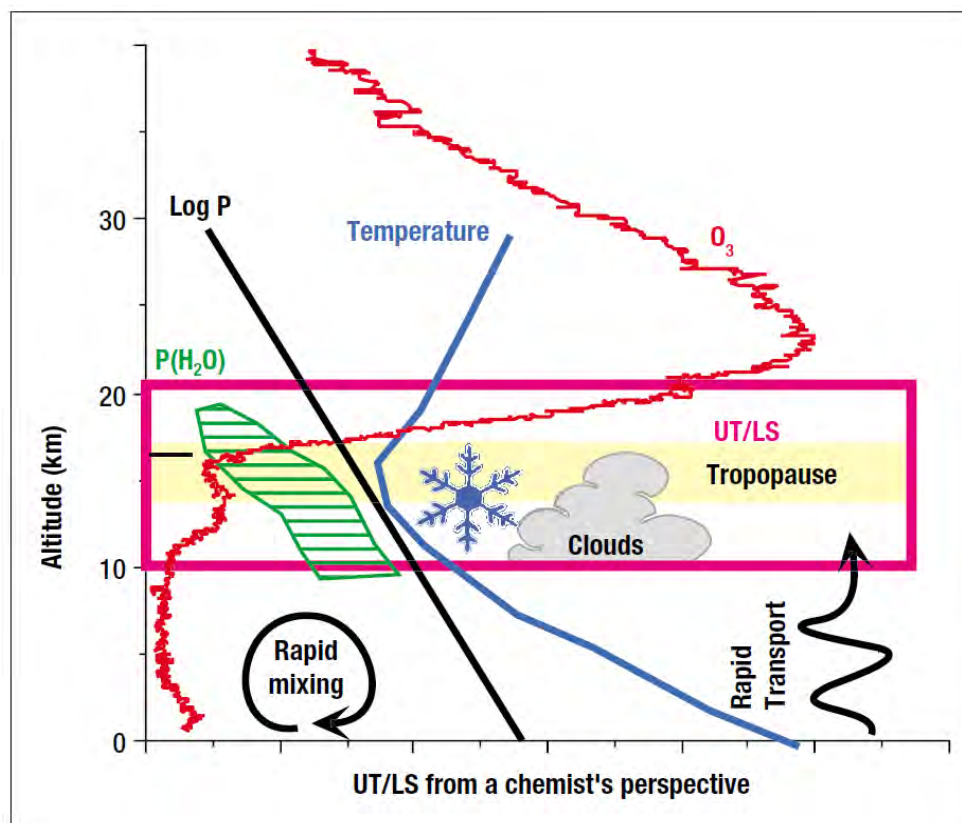


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been the way with SPARC. I see no change in this and can confidently predict a bright future for SPARC.

Lastly, I am very proud to be a part of SPARC, and I am grateful

for the opportunity it has given me for my own scientific growth and enlarging in such a stimulating way my scientific perspectives.



Chemist's view of UT/LS. From SPARC Newsletter No. 19, July 2002
(<http://www.sparc-climate.org/publications/newsletter/>).

Courtesy A.R. Ravishankara.



Vladimir Ryabinin

Joint Planning Staff for the WCRP since 2001

SPARC: School of Professionalism, Ambition, Rigour and Curiosity

When I joined the Joint Planning Staff (JPS) for the World Climate Research Programme (WCRP)² in November 2001, I took the place of Victor Savtchenko, a Russian-Ukrainian expert in polar

² WCRP, the World Climate Research Programme, jointly sponsored by the World Meteorological Organisation, the International Council for Science and the Intergovernmental Oceanographic Commission of UNESCO, with the objective of improving climate predictions and understanding human influence on climate.

research. My primary area of responsibility was the study of polar regions and the cryosphere in the WCRP which was then evolving rapidly. A new WCRP core project, Climate and Cryosphere (CliC), initiated in 2000, was building on and generalising the scope of the original Arctic Climate System Study (which formally ended in 2004). Initially, I was mainly looking after this one area of WCRP activity. It was Roger Newson who at that time



was responsible for SPARC in WCRP and had been so since its inception in 1992. Roger also had other responsibilities including climate modelling projects, overall programme planning and budget and supporting the work of the Joint Scientific Committee (JSC)³ for the WCRP. But he always had a special interest in SPARC and was strongly in favour of the inclusion of stratospheric studies in the WCRP. Together with Marie-Lise Chanin and Marvin Geller, he encouraged the initiation of SPARC as a WCRP core project and played a considerable role in the early development of project activities.

Roger retired in 2002 and the then Director of WCRP, David Carson, gently requested me to take over the responsibility for SPARC in the WCRP. David said, "Vladimir, I promise you will never regret it; it's a wonderful project and you will meet great

people there". I couldn't say "No" to David, and although I was not sure that my scientific background was appropriate for me to judge SPARC scientific/technical issues, I duly became the JPS contact for SPARC. Soon after, in November 2002, I was participating in the tenth session of the SPARC Scientific Steering Group (SSG) in Kyoto, Japan - my very first SPARC meeting.

David was right. From the first moments of the meeting in Kyoto I felt at home. My conclusion was that the stratosphere was indeed "above" the troposphere. There are many "stars" in the SPARC community and the group has always been rich in talent. It is, I believe, the greatest recognition of the success of SPARC that almost all leading figures in stratospheric science have been or are involved in the Project - and have always wished to be so. In SPARC, the stars feel "at home" and appreciate the potential for advancing their scientific interests. Discussions in SPARC scientific meetings are invariably interesting, aimed at identifying the outstanding questions and

³ JSC, the Joint Scientific Committee responsible for the overall organisation, guidance and monitoring progress of the WCRP, comprising eighteen scientists appointed by the three sponsoring bodies.



the possible means of studying them. SPARC is thus a major focus of scientific research in the stratosphere.

Since 2001, I have attended many dozens of climate research coordinating meetings, including those of ACSYS, CliC, GEWEX⁴, the JSC and many conferences as well as sessions of WCRP, WMO, IOC and ICSU working bodies – and this is not a complete list. SPARC meetings are special in the following sense. The SPARC community is really able to determine “bite-size” chunks of a scientific problem and to crack them. This ability is remarkable. When a coordinating group of scientists embarks on something too big to swallow, very often not much happens (and I’m afraid there are many examples of this at the international level!). Real talent is required to take a holistic look at important science problems, determine and put under the microscope the most important ques-

tions, assess possible solutions and move ahead on addressing the whole. I hope that this school of thought and exemplary approach to achieving progress in science will continue to be the model in the future SPARC.

Among my many interesting and noteworthy experiences associated with SPARC, I would like to describe here one in particular. In March 2007, the annual session of the JSC was convened in Zanzibar. I was assigned to prepare the report. This JSC meeting was the first to be attended by Thomas Peter and Ted Shepherd, the new SPARC co-chairs, who were just starting their first terms of service in that capacity. At that time, WCRP was under strong pressure to change its course and mode of work and perhaps even its sponsorship. New ideas were being put forward in what I thought was quite an aggressive way and I believe the atmosphere at that JSC meeting must have taken Ted and Tom by surprise. They saw that WCRP meetings could become an arena for sharply conflicting opinions, with the guid-

⁴ GEWEX, the WCRP core project, Global Energy and Water Cycle Experiment.



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ance to be given to and coordination of international climate science activities being at stake. I was delighted to see how Ted and Tom faced the challenge, how intelligent and honest their input to the Zanzibar meeting and to subsequent discussions has been and how important their participation and input to discussions have been on the way WCRP as a whole should move forward. The SPARC community has effectively shared its values and approach with the overall WCRP, and has helped the Programme to follow a sound course and rise to the challenges that face climate science. When I think what I would associate with the word “community”, I cannot help thinking about SPARC.

In conclusion, I would really like to thank the SPARC community for the pleasure and satisfaction of working with you, not just as the WCRP secretariat point of

contact, but also personally: I have much appreciated the friendly interactions and the care for and interest in the Project by all those involved. My contacts with the past and present members of the SPARC International Project Office: Catherine Michaut, Victoria de Luca, Diane Pendlebury and, of course, Norm McFarlane, have turned into real friendship. And the same has been true working with A.R. Ravishankara, Alan O'Neill, Ted Shepherd, and Tom Peter. Sorry for being unable to list here names of many other wonderful colleagues that I have met in the course of my service to SPARC.

The domain of SPARC is now extending “down”, to the troposphere - but I am sure that the talents of SPARC scientists and the special way of working will continue at stratospheric heights! And don't let's forget about the mesosphere.





Tom Peter

SPARC Co-Chair from 2007 to 2011

Interdisciplinary science at its best!

In 1996, I had been working for six years on the microphysics of polar stratospheric clouds with a group of about ten scientists at the Max Planck Institute for Chemistry in Mainz, Germany when A. Ravishankara (Ravi) and Ted Shepherd encouraged me to become involved in SPARC. Although I didn't know much about the project at that time, I readily agreed, thinking that it certainly wouldn't do any harm to gain a "somewhat wider perspective" of the world, and, in

1997, I duly accepted the invitation to become a member of the SPARC Scientific Steering Group (SSG).

I realised very rapidly, even as I participated for the first time in the SSG in 1997, that SPARC brings together atmospheric chemists, physicists and dynamists and really makes them join forces in analyzing and tackling cross-cutting issues. This is one of the most important and exceptional characteristics of SPARC



and certainly helped me look further than one interesting but highly specialised topic to a much broader interdisciplinary view, not only of the stratosphere, but of the entire atmosphere and beyond. Although I continued to discount the “C” in SPARC for some time, this also changed radically by virtue of discussions at SSG meetings and numerous SPARC workshops, and most notably by participating in the exceptionally stimulating multi-disciplinary General Assemblies in Mar del Plata, Argentina (2000), in Victoria, Canada (2004) and in Bologna, Italy (2008). In short, SPARC provides the ideal setting for considering and investigating the intriguing links between chemical and microphysical processes on the one hand and atmospheric dynamics on the other, all as interacting components of the overall climate system.

It was then a question of expressing the approach of SPARC and its objectives in practice. I remember with pleasure the vigorous discussions during the

session of the SSG in Kyoto in November 2002⁵ on updating and refocusing the SPARC Implementation Plan. Three overarching SPARC Themes were established:

- Climate-Chemistry Interactions
- Detection, Attribution and Prediction of Stratospheric Changes
- Stratosphere-Troposphere Coupling.

The Themes were devised to cover fundamental questions such as: How well can we explain past changes in terms of natural and anthropogenic effects and how do we expect the stratosphere to evolve in the future? How will changes in stratospheric composition affect climate? And what is the role of the stratosphere in tropospheric weather and climate?

⁵ See Report of the tenth session of the SPARC Scientific Steering Group, Kyoto, Japan, 18-21 November 2002 by Marie-Lise Chanin and Vladimir Ryabinin, SPARC Newsletter No. 20 (<http://www.sparc-climate.org/publications/newsletter/>).



I remember also the subsequent lively discussions about how best to display our master scheme to scientists within and outside SPARC, and to provide a convincing demonstration of the importance and relevance of SPARC to the stake holders, e.g., the Parties to the Montreal Protocol. The diagram below shows the result: the Themes, supported by Methods, and a pearl necklace of the various Activities, within which scientists work on the essence of the Themes. This layout has varied over time, and Activities have been adapted to changing requirements, but the overarching Themes of SPARC have remained the same.

It can certainly be argued that these basic SPARC Themes are still topical. In particular, the importance of the stratosphere's role in the climate system has been recognised more and more and considerable significance is now attached to the stratosphere in forecasting tropospheric weather for more than a few days ahead. The greatly improved knowledge of the chemical and

dynamical interactions affecting ozone in the stratosphere has led to appreciation of the Montreal Protocol as a potent and progressive instrument for climate protection in support of the Kyoto process.

However, SPARC is currently wrestling with the question whether it should change its name to reflect the project's evolution and the intention and capability of tackling complex atmospheric and climate problems in a comprehensive, interdisciplinary manner. This naturally involves including the troposphere and the representation of relevant tropospheric processes and chemistry much more fully in SPARC work. The WCRP has recently given SPARC the mandate to explore these possibilities. I find the "blog"⁶ on the question whether or not SPARC should change its name extremely interesting and it certainly indicates the high degree of self-awareness and forward-looking approach of SPARC sci-

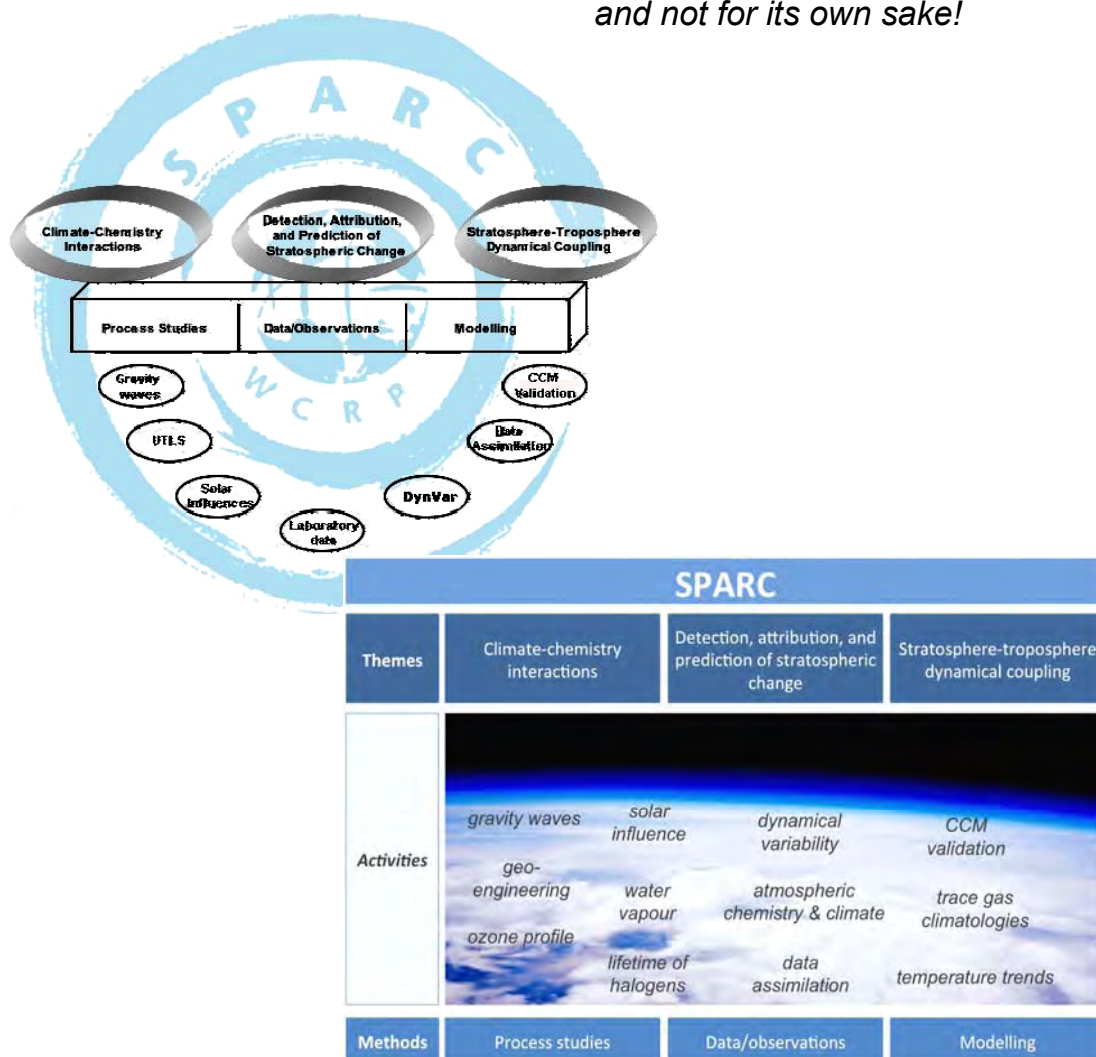
⁶ http://blogs.ethz.ch/sparc_namechange/2011/08/23/should-sparc-change-its-name/



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entists. Whatever is decided, it is clear that there are exciting developments ahead of us, which, amongst other things, will certainly strengthen SPARC collaboration with the troposphere-oriented International Global At-

mospheric Chemistry (IGAC) project of IGBP. My term as co-chair of the SPARC SSG ended at the conclusion of 2011, but I continue to be very excited about this further development: *inter-disciplinary science at its best, and not for its own sake!*



SPARC Themes and Activities: Upper left: The original “pearl” diagram from the SPARC Office in Toronto, showing “Themes” in the big ovals, “Methods” in the horizontal bar, and “Activities” in the small pearls. Lower right: Updated analogue from the SPARC Office in Zürich.



Ted Shepherd

SPARC Co-Chair since 2007

My thoughts on SPARC

The litmus test of the value of an activity is the extent to which it affects what people do. In my own case, it is impossible for me to imagine my professional career without SPARC as the two have been so closely intertwined. The WCRP core project SPARC was established in 1992, shortly after I was hired at the University of Toronto. I was immediately drawn to the project and was thrilled when I was asked to join the SPARC Scientific Steering Group (SSG) in 1994. Since then

I have been continuously involved in SPARC in many different capacities.

I remember that when I became a member of the SPARC SSG, Jim Holton, an important mentor of mine, said “I see you have joined the world of ‘science by committee’”. This was clearly not intended as a compliment! But years later, he told me that SPARC had surprised him, really making a difference to the field and taking useful initiatives. And I



think that has been the hallmark of SPARC from the beginning and the key to its success. Its approach has been described as focusing on 'bite-sized' elements of problems or issues and delivering in a timely manner tangible specific results, clearly reported and rapidly made widely available to the community in the well-known SPARC Reports and in influential journal publications. The reputation of SPARC amongst scientists and agencies has been established by concentrating on providing real added value in areas where international coordination makes a concrete difference.

An important and remarkable product of SPARC has been its Newsletter. Typically, these sorts of communications have a very short shelf life. But despite being a 'grey literature' publication, the SPARC Newsletter attracts high quality articles from leading scientists in our field to the extent that these are regularly cited in the peer-reviewed literature. Many, many people outside SPARC have commented to me on the excellent standard of the Newsletter, and that it is a 'must

read' publication. The Newsletter's ability to attract such creditable contributions is itself an indication of the outstanding reputation of SPARC.

Another praiseworthy characteristic of SPARC, which I believe is also a significant factor in its success, is to include and give opportunities to young and perhaps less well-known scientists. Too often, 'science by committee' can become an old boys club, but from the very beginning, SPARC has been proactive in putting young scientists into leadership positions. I myself am an example of this. When I was appointed to the SSG, I wasn't very experienced and was quite intimidated by all the famous scientists around me. But I was very quickly given responsibility for organizing a workshop on stratosphere-troposphere exchange, and the part I played in SPARC resulted in my being given a leadership role in the 1998 WMO/UNEP Ozone Assessment. There are many other cases of young scientists who were given responsibilities in SPARC, which have helped them develop their



own careers. This can certainly be regarded as being an important form of capacity building. Also it is often the case that younger scientists are able to dedicate more effort to SPARC than their more senior (and frequently overburdened) colleagues, so SPARC gains a double benefit.

Through its General Assemblies, community products (Reports, Newsletters and community journal publications), and open approach to participation, there is no question that SPARC has attracted, built up and now represents a strong scientific constituency, which is truly a community. Many young scientists identify themselves with SPARC in a way that I used to think would be natural but which I now realise is unique in the world of internationally coordinated science. An eye-opening experience for me was the 'SPARC, quo vadis?' talk I gave at the Bologna General Assembly in 2008. Many will recall that I related the idea of the WCRP at the time for a considerable reorganization of the Programme with 'sunsets' for the ex-

isting core projects, including SPARC. The reaction was one of shock and there were literally tears in the room from some of the younger scientists who identified strongly with and saw so many opportunities in all the highly motivated and productive SPARC-related activities and research. The overwhelming response from the community was, thankfully, instrumental in convincing the WCRP to change course on the proposed restructuring.

The final outstanding feature of SPARC I must mention is its continuous push on the scientific boundaries and looking beyond these boundaries. SPARC activities are always dynamic: nothing remains static or becomes stagnant. This is, of course, a consequence of the focus on added value, rapid updating of our scientific knowledge and preparation of current assessments, which characterises SPARC. SPARC is thus always looking at gaps in our understanding that are ripe to be filled and expanding the frontiers. Linked to this is the interdisciplinary spirit that has



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permeated SPARC from the beginning: between observations and modelling, and between chemistry and dynamics. This sort of interdisciplinary approach is now becoming the 'modern' model, but it has been an essential part of the SPARC ethos in the 20 years since its inception.

Going back to my litmus test, the value of SPARC is demonstrated by how it has affected what so many scientists working in its scientific domain have chosen to do as part of their career. SPARC is now at something of a turning point as it adopts a new

WCRP mandate to develop a stronger focus on the upper troposphere and stratosphere-troposphere coupling. Scientific activities will be extended towards the troposphere including studies of relevant tropospheric processes and chemistry. There are concerns that this could change the unique culture of SPARC and its strong sense of community. My own feeling is that if we do things right, we need not be concerned, and in fact we can bring the SPARC culture to bear on an even wider range of problems in climate science for the benefit of all.



*SPARC co-chairs – on (too) high chairs?
From SPARC Newsletter No. 30, Jan. 2008.*



Johannes Staehelin

Director of the SPARC Office since 2011

The establishment of the SPARC Office in Zürich

Support of the activities of SPARC by a project office is of vital importance, as it is for other WCRP core projects and other similar international initiatives such as those of the International Geosphere-Biosphere Programme (IGBP). The SPARC office was hosted by the University of Toronto, Canada, from 2004-2011, depending on funding and facilities provided by the Canadian Foundation for Climate and

Atmospheric Sciences (CFCAS), the Canadian Space Agency, Environment Canada and the Physics Department of the University of Toronto.

However, the support provided by CFCAS came to an end with its demise as an agency to fund climate science in Canada at the end of 2011. This support could not be replaced from other sources and the SPARC Office



could no longer be maintained in Toronto (see also contribution “The Toronto SPARC Office (2004-2011)” by Norman McFarlane).

Thomas Peter, co-chair of the SPARC Scientific Steering Group (SSG), duly explored the possibility of Switzerland’s taking over the responsibility of hosting the SPARC Office, specifically at the Institute for Atmospheric and Climate Science of the Swiss Federal Institute of Technology in Zürich (Eidgenössische Technische Hochschule Zürich, ETH). It was necessary to overcome quite a number of problems to secure the necessary resources. In this regard, it has to be noted that the policy of the International Group of Funding Agencies for Global Change Research (IGFA)⁷ is that project offices (such as the SPARC Office) should not be directly supported by international

programmes or projects. IGFA holds that the hosting of a project office should be perceived as an “honour” for the country concerned. Notwithstanding, our experience of setting up the SPARC Office in Zürich has illustrated that in practice it is quite difficult to convince national funding bodies to support such international offices and that the “honour” for the country is not automatically converted to the resources required!

My own involvement began in the autumn of 2009 when Thomas Peter asked me whether I would be interested to take on the responsibility of Director of the SPARC Office. I was glad to agree to Tom's suggestion, anticipating that this position would offer me an interesting new perspective for the last few years of my career as atmospheric scientist at ETH. I was engaged in the Ozone Scientific Advisory Group (SAG) of the World Meteorological Organization (WMO) Global Atmosphere Watch (GAW). This is complementary to and very relevant to SPARC's activities, the priority of the GAW ozone

⁷ IGFA is responsible for the four International Global Change Research Programs (WCRP, IGBP, IHDP and DIVERSITAS) and the Earth System Science Partnership (ESSP) under the aegis of ICSU, see <http://www.igfagcr.org/index.php/about-igfa>.



programme being reliable ground-based long-term ozone measurements, and now including coordination with satellite and regular aircraft measurements following the concept of the Integrated Global Atmospheric Chemistry Observations (IGACO) strategy. In view of the role of WMO directly in GAW and indirectly in SPARC by virtue of its co-sponsorship of the WCRP, there appeared to be advantages to be involved in both activities and to foster co-operation and appropriate combined actions more efficiently.

In order to establish the SPARC Office in Zürich, the objective was to obtain resources equivalent to those available to the Office during its time in Toronto and, at first, it appeared that this would be comparatively easy. Tom generously offered that I could spend 50% of my paid ETH working hours for SPARC, and the Institute and ETH kindly offered the necessary infrastructure (rooms, etc.). The plan was then that the necessary operational funding would be provided (in equal amounts) by ETH, the

Swiss Federal Office for Meteorology and Climate, and the Swiss Federal Office for the Environment (FOEN). However, Tom had to overcome many obstacles in 2010 to secure the major part of the required budget. Problems arose because of budget cuts in the sponsoring institutions and negotiations and discussions were very time consuming, lasting for more than one year. It finally became evident that, although we would obtain a large fraction of the requested support, we would have to face significant cuts compared to the budget of the SPARC Office in Toronto. Since a large part of the expenditure such as production of Newsletters and SPARC reports is fixed, the shortfall would limit the money available for the supporting staff in the Office. It was near the end of 2010 when Tom asked me whether I would still be willing to take the responsibility of the SPARC office given the budget constraints. Given the level of funding that had been obtained, I certainly felt that there was no real option but to continue. Nevertheless, the prospect of running the SPARC Office with consid-



erably less resources than in the previous years worried me and I was concerned that it would be difficult to match the high standards of the Toronto SPARC office and of the earlier Paris Office.

The next step was that ETH wanted to have a formal contract regarding the establishment of and support to SPARC office between all the sponsors. Since I am an employee of ETH, the contract, based on our input, was drafted by a very capable lawyer of ETH. However, Tom had again to spend much time and patience until the contract was finally accepted by the lawyers of the four institutions involved (one, WCRP/WMO, being an international organization).

The annual session of the SPARC SSG in 2011 took place in Pune, India, in late January and, in early February 2011, very shortly after finalization of the contract for the SPARC office, I was formally named as the new Director of the Office - but there had not been time fully to establish and appoint the staff of the

Office in Zürich. Fortunately, there were resources to continue the operation of the Office in Toronto in 2011, which, for a while, was a “virtual” office consisting of the co-workers in Toronto and the Director in Zürich! I acknowledge with gratitude the roles of the former Director (Norm McFarlane) and the excellent supporting staff of the SPARC office in Canada (Diane Pendlebury and Victoria De Luca) which allowed the work to carry on without major problems, whilst we have gradually built the new team in Zürich. This team will, as well as myself as Director, comprise: Anke Witten, Office Manager; Carolin Arndt Foppa, Communication Manager; Fiona Tummon, Project Scientist; Shubha Pandey, Assistant Project Scientist.

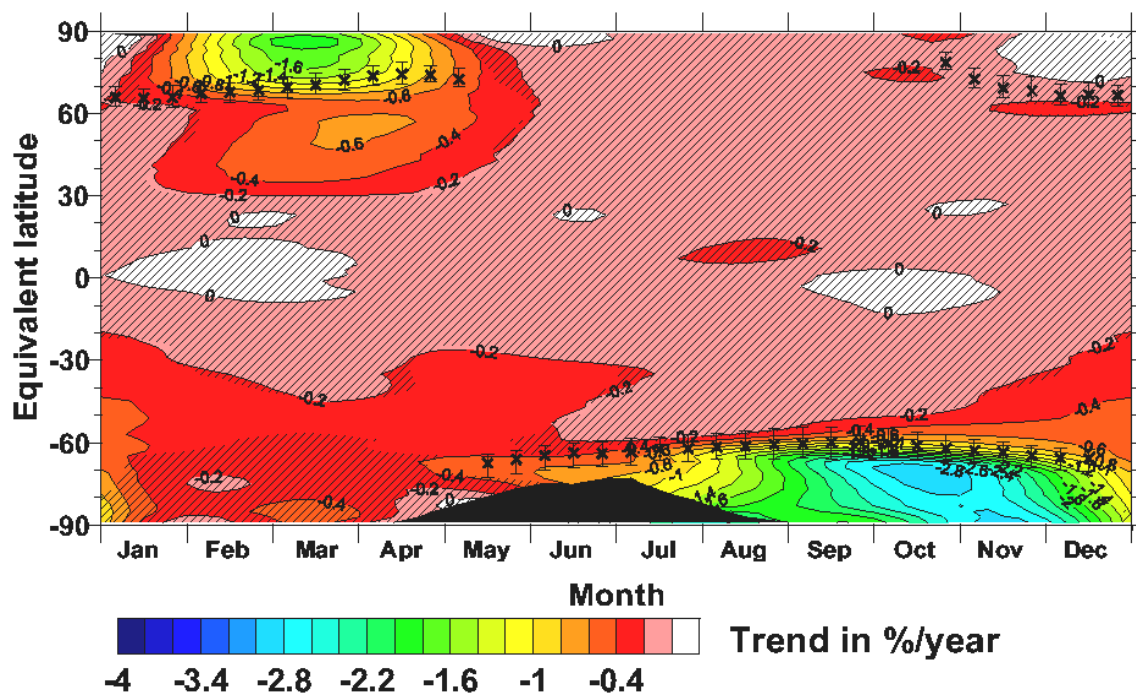
In respect to the staffing of the Office, we were aware that the Swiss National Science Foundation (SNF) is formally obliged to take requests for support of international project offices. However, the main aim of SNF is to foster basic research and providing for such offices is very con-



troversial within the SNF committees responsible for deciding on the allocation of resources. Because of the shortfall in our funding (as mentioned above), we decided to write a proposal to SNF which was submitted at the end of March 2011. The preparation of such a proposal is always time-consuming and I am not sure whether the investment of time turned out to be justified. The formal decision of SNF was delayed because of internal controversy and it was only at the beginning of November that we were informed that the Foundation would support one position at the SPARC office - with the condition that this support would end when I step down as SPARC Office Director, which will be in four years at the latest. Unfortunately, it therefore appears that the time of the SPARC Office in Zürich is probably going to be comparatively short.

Nonetheless, the next few years are expected to be a crucial pe-

riod for SPARC as it adopts a new WCRP mandate (by 2013) to develop a stronger focus on the interface of the stratosphere and the troposphere and stratosphere-troposphere coupling. SPARC duly plans to extend scientific activities towards the troposphere, in particular by organization of numerical simulations building on its previous experience in, for example, the SPARC evaluation of Chemistry-Climate Models (CCMVal). I look forward to the challenge of contributing in a fundamental way to the development of SPARC. I believe my knowledge of tropospheric chemistry from my earlier career will be helpful for these new initiatives, which will also involve contacts with the atmospheric chemistry community in the International Global Atmospheric Chemistry project of IGBP as a partner institution in the planned modeling experiments.



Total column ozone trends as a function of equivalent latitude and season. Shaded region indicate where trends are statistically insignificant. The crosses show the mean position of the vortex edge over the time period for which the trend was calculated. From Bodeker et al., J. Geophys. Res., 2001.



Greg Bodeker

SPARC Co-Chair since 2012

My experience with SPARC

My memory, being what it is, left me flat-footed when I was asked to cast my mind back to recall my most important experiences with SPARC. It felt that I had always been engaged with SPARC in some way, shape or form. Looking through my emails, I found 5354 that had something to do with SPARC. Clearly, SPARC has been a large part of my career as a scientist. I first became aware of SPARC in 1996 at the time of the first SPARC General Assembly held in Melbourne. Un-

fortunately, I was not able to attend that meeting as I was travelling at the time. But reports back from the Assembly by work colleagues gave me the impression that SPARC was the place to be.

The first SPARC project I became involved in was the assessment of trends in the vertical distribution of ozone. The interest of the scientific community in this initiative (undertaken by SPARC jointly with the International Ozone Commission and the



WMO Global Atmosphere Watch) was outstanding and altogether over 100 scientists contributed to the study. In 1997 I started working on getting the Lauder ozone-sonde database into the best possible shape for the assessment and I was highly encouraged to see that this ozonesonde record featured prominently in the report. Being involved in this assessment showed me how, by bringing together and motivating the right group of people, SPARC could accomplish a lot. This assessment is an excellent example of how progress can be made given the wide support and interest of the research community – and, particularly, good leadership and organisation of the activity.

Three years later, I attended the SPARC General Assembly in Mar del Plata and this meeting convinced me that SPARC was the home for my research. This was one of the most interesting scientific conferences I had ever attended and the breadth of the different activities being undertaken by SPARC was both overwhelming and very stimulating. I came away from the meeting

fired up about the work that we were doing in our group at Lauder and with a clear vision of where the work needed to go in the future. This is one of the defining features of SPARC and the SPARC General Assemblies – if you're not sure which research avenues to follow, attend a SPARC General Assembly.

Unfortunately I was not able to attend the third SPARC General Assembly in Victoria in 2004, but around this time I did play a part in the SPARC assessment of stratospheric aerosol properties. Another hook on the SPARC line which caught me was the establishment of the evaluation of Chemistry-Climate Models (CCMVal). This is probably the SPARC activity in which I have been most involved and which has played a huge role in shaping my research career and determining specific lines of research I have followed. CCMVal spun up just around the time that we started our chemistry-climate modelling group at Lauder and it provided the perfect forum for sharing research ideas.



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In July 2007, I was invited to become a member of the SPARC Scientific Steering Group (SSG). It took me about 5 seconds to decide to say “yes”. By this time I could see very clearly the essential role that SPARC was playing by coordinating stratospheric research activities across the international community.

The fourth SPARC General Assembly in Bologna in 2008 is another clear milestone along the road of my SPARC journey. I was on the scientific organising committee for the conference and was again overwhelmed by the breadth and depth of the research being undertaken within the various SPARC activities. It was an exhausting week and I came away from the meeting with my head so full of new research ideas that I didn't know where to begin. Now, as the members of the local organising committee and I propose to host the next SPARC General Assembly, I am very aware of the vital role that these gatherings play in creating that sense of community that underlies and is essential to SPARC's success.

For me, much of the enjoyment of being involved in SPARC is because of the wonderful people that comprise the SPARC community. Being a good scientist and being a good human share many common attributes. I am eternally grateful that my career does not require me to belong to a community of military dictators.

In recognition of the support and value that WCRP provides as SPARC's parent, we delayed the 2012 General Assembly in favour of encouraging attendance at the WCRP Open Science Conference (OSC) in October 2011. My attendance at the OSC was again a highlight of my involvement in SPARC and reassured me how strong our community is and that we are ready and able to adapt to the needs of the users of our research and to meet the grand challenges which face the climate research community today.

I am now beginning my term as co-chair of the SPARC SSG. I am both excited and daunted by this challenge; SPARC is such an important community to me. I



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am also quite sure that this is going to be my most important experience with SPARC and, no matter how unreliable my memory becomes, I am certain that I won't be needing to scroll back through my emails to recollect

this part of my journey with SPARC. The next 20 years of SPARC are going to be amazing and I am honoured to be in a position to be able to contribute to that success.



SPARC General Assemblies are a truly unique opportunity for in-depth science discussions, with all oral sessions being plenary and poster sessions being the Assemblies' highlights.



Big thanks –

SPARC's success depended and continues to depend crucially on the enthusiasm and skills of the following colleagues

French International Project Office, Paris

- Catherine Michaut, Office Manager
- Sushil Chandra, Project Scientist
- Yuri P. Koshelkov, Project Scientist
- Marie-Cécile Torre, Assistant
- Céline Phillips, Assistant Scientist
- Marie-Christine Gaucher, Secretary
- Emmanouil K. Oikonomou, Project Scientist

Canadian International Project Office, Toronto

- Victoria De Luca, Office Manager
- Diane Pendlebury, Project Scientist
- Ellie Farahani, SPARC-IPY Project Coordinator
- Denise Mah, Administrative Assistant (2005)
- Michelle Rosen, Administrative Assistant (2010-11)

Swiss International Project Office, Zürich

- Anke Witten, Office Manager
- Fiona Tummon, Project Scientist
- Carolin Arndt, Communication Manager
- Shubha Pandey, Assistant Project Scientist

Liaison with WCRP Joint Planning Staff

- Roger Newson⁸, as predecessor of Vladimir Ryabinin

as well as David J. Carson and Ghassem R. Asrar as WCRP Directors.

⁸ Special thanks to Roger for drafting the foreword and editing all contributions!



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SPARC

1993
newsletter n° 1
July

STRATOSPHERIC PROCESSES AND THEIR ROLE IN CLIMATE
A Project of the World Climate Research Programme

Processes affecting the troposphere-stratosphere system

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The front page of SPARC Newsletter No. 1, July 1993
(<http://www.sparc-climate.org/publications/newsletter/>).



More thanks –

to all past and present members of the SPARC Scientific Steering Committee (SSG) and activity leaders

Elected SSG Members⁹

- J. Alexander (USA)
- J. Arblaster (Australia)
- J.P. Burrows (Germany)
- P. Canziani (Argentina)
- H.-B. Chen (China)
- P.C.S. Devara (India)
- R. Diab (South Africa)
- D. Ehhalt (Germany)
- V. Eyring (Germany)
- D. Fahey (USA)
- C. Granier (France)
- K. Hamilton (USA)
- D. Hartmann (USA)
- P.H. Haynes (UK)
- S. Hayashida (Japan)
- I. Hirota (Japan)
- D. Hofmann (USA)
- I. Isaksen (Norway)
- D. Karoly (Australia)
- V. Khatatov (Russia)
- J. Mahlman (USA)
- E. Manzini (Italy)
- T. Matsuno (Japan)
- P. McCormick (USA)
- M. Pulido (Argentina)
- J. Pyle (UK)
- K. Rao (India)
- M. Santee (USA)
- A. Scaife (UK)
- U. Schmidt (Germany)
- M. Shiotani (Japan)
- S. Solomon (USA)
- H. Tanaka (Japan)
- A.M. Thompson (USA)
- R. Turco (USA)
- P. Wennberg (USA)
- S. Yoden (Japan)
- V. Yushkov (Russia)

Ex-Officio Members⁹

- *IGBP/JGOFS*: J. Priddle
- *IGBP/GCTE*: M.Caldwell, H. Mooney
- *GAW/UVB*: P. Simon

⁹ Without past and present Co-Chairs and Directors, who often serve(d) as SSG Members, Ex-Officio Members, and Activity Leaders.



Ex-Officio Members (cont'd)

- *WMO/GAW*: R. Bojkov, J. Miller, M. Proffitt, L. Barrie, G. O. Braathen
- *SCOSTEP*: R. Vincent, P. Simon
- *IAMAS*: K. Labitzke
- *SCOPE*: E. De Fabo
- *COSPAR*: J. Gille
- *ICTP*: S. Radicella
- *NDACC/NDSC*: M. Kurylo
- *IGAC*: S. Penkett, D. Parrish, K. Law, S. Doherty, M. Melamed

Activity Leaders^{9,10}

- *Understanding Ozone trends*
N. Harris (UK), J. Kaye (USA)
- *Gravity Waves*:
K. Hamilton (USA), R. Vincent (Australia), J. Alexander (USA)
- *Water Vapour Climatology*
J. Gille (USA), D. Hofmann (USA) †
- *Water vapour analysis (WAVAS)*:
D. Kley (Germany), C. Schiller (Germany), K. Rosenlof (USA)
- *Temperature Trend Analysis*:
V. Ramaswamy (USA), W. Randel (USA), D. Thompson (USA)
- *The Quasi-Biennial Oscillation and its role in the coupling between the stratosphere and troposphere*
I. Hirota (Japan), M. Baldwin (USA)
- *Middle atmosphere climatology*:
W. Randel (USA)
- *Data Assimilation*:
I. Stajner (USA), S. Polavarapu (Canada), D. Jackson (UK)
- *Intercomparison of Climate, Middle Atmospheric Models (GRIPS)*:
S. Pawson (Germany)

¹⁰ Activities are listed roughly in chronological order.



Activity Leaders (cont'd)

- *Lab Studies joint with IGAC:*
R. A. Cox (UK)
- *Solar Influences for SPARC (SOLARIS):*
K. Kodera (Japan), K. Matthes (Germany)
- *UTLS/SPARC Tropopause Initiative:*
P. H. Haynes (UK), A. Gettelman (USA), J. A. Añel (Spain)
- *CCM Validation Activity (CCMVal):*
V. Eyring (Germany), A. Gettelman (USA), S. Pawson (USA),
D. Waugh (USA)
- *Dynamical Variability Activity (DynVar):*
P. Kushner (Canada), E. Manzini (Italy)
- *Atmospheric Chemistry and Climate (AC&C):*
M. Chipperfield (UK), P. Rasch (USA), P. Hess (USA), M. Barth (USA),
C. Marie (France), J.-F. Lamarque (USA), D. Shindell (USA),
S. Doherty (USA)
- *Role of Halogen Chemistry in Polar Stratospheric Ozone Depletion:*
M.J. Kurylo (USA), B.-M. Sinnhuber (Germany)
- *SPARC Data Initiative:*
M. Hegglin (Canada), S. Tegtmeier (Germany)
- *Ozone Profile Initiative:*
N. Harris (UK), R. Stolarski (USA)
- *Lifetime of halogen source gases:*
M. Ko (USA), P. Newman (USA), S. Reimann (CH), S. Strahan (USA)
- *Geoengineering:*
A. Robock (USA)

Editors of SPARC Reports,

and on their behalf thanks to all chapter lead authors and co-authors:

- *SPARC Report No. 1:*
SPARC/IOC/GAW, Assessment of Trends in the Vertical Distribution of
Ozone, May 1998
N. Harris (UK), R. Hudson (USA) and C. Phillips (France)



Editors of SPARC Reports (cont'd)

- *SPARC Report No. 2:*
Upper Tropospheric and Stratospheric Water Vapour, Dec. 2000
D. Kley (Germany), J.M. Russell III (USA) and C. Phillips (France)
- *SPARC Report No. 3:*
Intercomparison of Middle Atmosphere Climatologies, Dec. 2002
W. Randel (USA), M.-L. Chanin (France) and C. Michaut (France)
- *SPARC Report No. 4:*
Assessment of Stratospheric Aerosol Properties (ASAP), Feb. 2006
L. W. Thomason (USA), Th. Peter (Switzerland)
- *SPARC Report No. 5:*
Evaluation of Chemistry-Climate Models (CCMVal), June 2010
V. Eyring (Germany), T. G. Shepherd, D. W. Waugh (USA)

Authors of SPARC Papers:

SPARC has led to *many* excellent scientific articles! Most notable might be the following seminal original papers and review articles:

CCM Validation:

Eyring, V., N. Butchart, D. W. Waugh, et al., Assessment of temperature, trace species and ozone in chemistry-climate model simulations of the recent past. *J. Geophys. Res.*, 111, D22308 (2006)

Gravity waves:

Alexander, M. J., M. Geller, C. McLandress, et al., Recent Developments on Gravity Wave Effects in Climate Models, and the Global Distribution of Gravity Wave Momentum Flux from Observations and Models. *Q. J. Roy. Meteorol. Soc.*, 136, 1103-1124 (2010)

Temperature trends:

Ramaswamy, V., M.L. Chanin, J. Angell, et al., Stratospheric temperature trends: Observations and model simulations. *Revs. Geophys.* 39, 71-122 (2001)



Authors of SPARC Papers (cont'd)

Water vapour:

Rosenlof, K.H., S.J. Oltmans, D. Kley, et al., Stratospheric water vapour increases over the past half-century, *Geophys. Res. Lett.* 28, 1195-1198 (2001)

GRIPS:

Pawson, S., K. Kodera, K. Hamilton, et al., The GCM-Reality Intercomparison Project for SPARC (GRIPS): Scientific Issues and Initial Results, *Bull. Am. Meteorol. Soc.*, 81, 781-796 (2000)

Middle atmosphere climatology:

Randel, W., P. Udelhofen, E. Fleming, et al., The SPARC Intercomparison of Middle Atmosphere Climatologies. *J. Climate* 17, 987-1003 (2004)

Laboratory data:

Tyndall, G. S., R. A. Cox, C. Granier, et al., Atmospheric chemistry of small organic peroxy radicals, *J. Geophys. Res.*, 106, 12157-12182, (2001)

Quasi-biennial oscillation:

Baldwin, M.P., L.J. Gray, T.J. Dunkerton, et al., The quasi-biennial oscillation, *Revs. Geophys.* 39, 179-229 (2001)

High-resolution radiosondes:

Birner, T., Fine-scale structure of the extratropical tropopause region, *J. Geophys. Res.*, 111, D04104 (2006)

Stratospheric aerosols:

Deshler, T., R. Anderson-Sprecher, H. Jäger, et al., Trends in the non-volcanic component of stratospheric aerosol over the period 1971–2004, *J. Geophys. Res.*, 111, D01201 (2006)

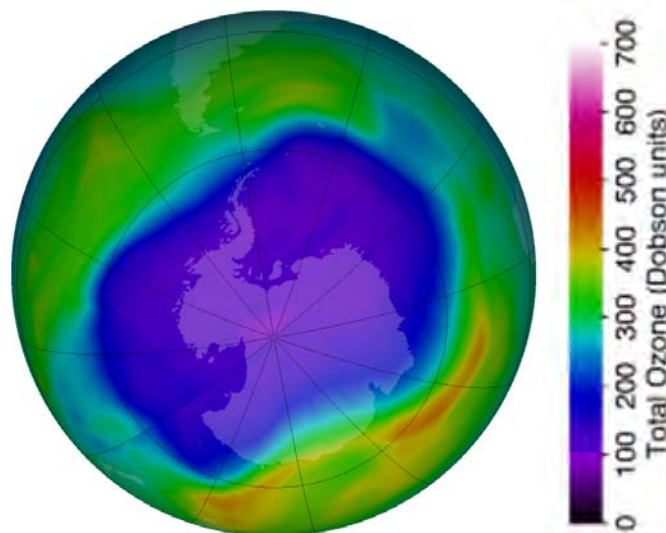


Last, but not least –

SPARC enjoys having a Data Centre

Since 1999 the SPARC Data Centre is located at the State University of New York at Stony Brook (<http://www.sparc.sunysb.edu>). Throughout this time it has been supported by the National Aeronautics and Space Administration (NASA), which we gratefully acknowledge. Our thanks go to the past and present SPARC Data Centre Scientist:

- Petra Udelhofen (1999-2002 †, unforgotten)
- Xuelong Zhou (2002-2004)
- Stefan Liess (2004-2009)
- Peter Love (2009-)



*The ozone hole on 24 September 2006, the largest on record.
From “NASA Ozone Watch” (<http://ozonewatch.gsfc.nasa.gov/>).*



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The SPARC Project and the whole scientific SPARC community gratefully acknowledge financial and logistic support as well as scientific guidance by:





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SPARC's International Project Offices acknowledge generous financial and logistic support by:

French International Project Office, Paris (1992-2004)



Canadian International Project Office, Toronto (2004-2011)





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Swiss International Project Office, Zürich (2011-)



Eidgenössische Technische Hochschule Zürich
Swiss Federal Institute of Technology Zurich



Schweizerische Eidgenossenschaft
Confédération suisse
Confederazione Svizzera
Confederaziun svizra

Bundesamt für Umwelt BAFU
Office fédéral de l'environnement OFEV
Ufficio federale dell'ambiente UFAM
Uffizi federal d'ambient UFAM



Schweizerische Eidgenossenschaft
Confédération suisse
Confederazione Svizzera
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Federal Department of Home Affairs FDHA
Federal Office of Meteorology and Climatology
MeteoSwiss

Finally, SPARC acknowledges support for its Data Centre:

SPARC Data Centre, Stony Brook, USA (1999-)





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