As the SPARC SSG just followed the SPARC First General Assembly (see report in this issue), the session started by reviewing new scientific results and conclusions from the assembly that would need to be taken into account in the future development of SPARC. The SSG also reviewed progress in the various SPARC initiatives, in relationship with the issues raised above and to adjust the direction of these initiatives where appropriate, and/or to initiate new ones if needed. Another important task undertaken during this session was to refine the formulation of the SPARC implementation plan. An overview of each of the current SPARC Initiatives follows.

**Intercomparison of Troposphere-Stratosphere General Circulation models (GRIIPS)**

**Progress of GRIPS in 1996** and plans for 1997 and beyond were presented by S. Pawson and K. Kodera.

- The EuroGRIPS Project of the European Commission, a four-way partnership involving FUB, CNRM, UGAMP and UKMO, has started.
- The Victoria Workshop (cf. SPARC Newsletter # 7) was an excellent opportunity to better define the project, formulate plans for the next year or so, and form working groups.
- The contacts with AMIP were developed: G. Boer and P. Gleckler attended the Victoria meeting and gave an excellent presentation about AMIP and much useful advice. Both speakers stressed the likely problems as well as the benefits of model intercomparisons. S. Pawson visited PCMDI in November/December 1995 and gained a much more realistic impression of what was required for a successful project.
- Within SPARC there is excellent contact with the reference climatology group (W. Randel) and an intensifying relationship between GRIPS and the gravity wave initiative (K. Hamilton, R. Vincent); many of the GRIPS modelers were represented at the Santa Fe meeting.
The GRIPS Web site is finally operating; this will be updated in the near future to include all relevant reports and links to many members and related topics.

Many models have already submitted their data to the FUB. A limiting factor has been the time available to process it and the storage space available. The second of these should be solved by now.

Future plans for GRIPS:

- Completion of the «Phase 1» topics «documentation», basic should be performed, and the data collected and evaluated during 1997.
- Increase in the data exchange since the initial problems have been overcome; data from all groups can be read from Berlin, even though caution is needed due to storage restrictions. Assistance has been offered from PCMDI which may become essential eventually if data sets start becoming too large.
- Links with AMIP-II: GRIPS has assumed that it is a complementary project to AMIP and would support

Stratospheric Reference Climatology

One of the key questions to be addressed by GRIPS is how well comprehensive GCM's simulate the current climate and its variability. To answer this question requires a comprehensive documentation on stratospheric climate. To this end, the SPARC Stratospheric Reference Climatology (SRC) Group was established to provide an updated climatology of the middle atmosphere based on observations. Activity in this area is lead by a small group chaired by Dr. W. Randel (NCAR, USA). In the absence of W. Randel, a report on progress was presented by M. Geller.

Workshop at Port Jefferson

The first workshop of the SRC group, convened by W. Randel and M. Geller, took place in Port Jefferson in September 1996 and a short report is given in this issue. Prior climatologies were reviewed as well as the need for an updated data base. Details of the various data sets considered for inclusion in the climatology were discussed and firm plans for future work set.

Phase 1

The first phase of the SRC work involves compiling a set of global meteorological statistics derived from operational analyses, together with data sets describing tropical wind variability, mesospheric structure, and a climatology of selected trace gases, as summarised below:

- The stratospheric meteorological data to be used due to their global coverage are: the National Centers for Environmental Prediction (NCEP) operational stratospheric analyses (formerly called National Meteorological Center (NMC) data), the NASA Goddard Earth Observing System, Data Assimilation System (GEOS DAS) troposphere-stratosphere assimilation, and the United Kingdom Meteorological Office (UKMO) stratospheric assimilation products.
Tropical winds in the above global data sets will be analysed in order to characterise the quasi-biennial oscillation (QBO).

Mesospheric data are needed for comparison with models extending into the mesosphere. The Reference Climatology will include the COSPAR International Reference Atmosphere CIRA-86 and the empirical model of Hedin et al. (1993). A novel data set to include will be the stratospheric and mesospheric wind measurements from the High Resolution Doppler Imager (HRDI) instrument on the Upper Atmosphere Research Satellite (UARS). A coordination of this effort is anticipated with current revisions of the CIRA climatology.

Trace constituent data sets of interest in stratospheric modelling need to be included, i.e.: the monthly mean climatologies of ozone, water vapour and methane, mostly from the UARS data.

Comparison of climatologies will be performed systematically to highlight uncertainties in the data sets, mostly for more highly derived quantities.

**Phase 2**

Research topics of interest include obtaining better climatologies of tropical winds and updating our knowledge of the QBO, and improving data sets in the mesosphere (combining historical rocketsonde, lidar, and satellite data sets). Phase 2 may include more highly derived quantities to match future initiatives of GRIPS, to study troposphere-stratosphere statistical connections, diagnostics of sudden warmings and space-time spectra of transient atmospheric waves.

**SPARC Data Center**

The presentation of this project was the first opportunity during the SSG meeting to discuss the issue of the SPARC data base, common to several projects. The need for establishing a «SPARC Data Center » to aid in handling and disseminating the stratospheric climatological data was identified. Support for such a data center and a host institution will be sought.

**Gravity wave processes and their parameterisation**

K. Hamilton and R. Vincent reported on the SPARC Gravity Wave Initiative (GWI). Two principal activities have taken place since last year:

**The archiving of high-resolution radio-sonde data**

This initiative encouraged by the success of the Australian experience has gained in volume since the US National Weather Service (NWS) has accepted to archive the radiosondes in the continental US, Alaska, Hawaii and US territories in the tropical Pacific. These data are available to researchers through the US National Climate Data Center. In early 1997, it is expected that the NWS archive will include 7 Caribbean stations as well. Several other national meteorological services have also started the high resolution archiving routinely (France, UK), others such as Canada, New Zealand, Germany, Argentina, Japan and Italy, are joining the initiative but for some stations only and limited time periods. The connecting issue is the organisation of a data center to centralise this data (see above). The analysis of these data is being planned with a common approach, involving scientists from 11 countries under the leadership of R. Vincent.

**The Santa Fe Workshop**

The International NATO Workshop organised under the leadership of the GWI has been reviewed in SPARC Newsletter # 7 and a proceedings volume will be published in early 1997 by Springer-Verlag. A number of very exciting results were presented. It now appears that the one-dimensional (vertical) spectrum of typical variability in the upper stratosphere and mesosphere can be characterised quite well from observations, particularly as radar measurements are being increasingly supplemented by lidar measurements of various types. Work on detailed numerical modelling of the generation and propagation of gravity waves is also progressing quite rapidly. A driving consideration is to incorporate better gravity wave parametrisation in models. However to characterise the performances of various schemes, it was decided that a set of standard « test bed » atmospheric profiles will be developed, so the different modelling groups can usefully compare their gravity wave parametrisation implementations in an efficient « offline » approach. This step seems necessary before approaching the more ambitious project of comparing results of global model integrations using different gravity wave drag schemes. All further work will be carried out in close connection with GRIPS.

A plan for a future Gravity Wave Field Experiment developed by C. Gardner to examine middle atmospheric gravity waves in relationship with their sources, and modelled after the ALOHA-93 campaign at Hawaii, was presented. There was overall concern that the scientific issues to be addressed and hypotheses to be tested were not clearly enough described to lead to a definite conclusion. The question was raised whether such a large scale field experiment was necessary or whether the priority should be given to a more specific campaign to study for example convection sources. One site offered for such a campaign, Darwin in Australia, was recognised to be an ideal location for such a regional experiment. The use of data obtained from ER-2 flights was also discussed and considered as very important for such studies.

**Stratosphere-troposphere exchange (STE)**

After the SPARC workshop on STE, which took place at La Pointe-du-Lac, Québec, 13-15 June 1995, (cf Shepherd’s review in SPARC Newsletter # 6), an unresolved issue remained; that was
« to develop combined measurement and modelling strategies to progress in gaining the necessary understanding of these processes that are needed for better assessments ». This difficult task has not been dealt with during the past year and the discussion recognised that the evolution of the concept of STE should be viewed in the broader context of transport and mixing of mass and chemical species. As pointed out by T. Shepherd at the SPARC General Assembly, (cf the Assembly Report session 5 in this issue) even though there are many promising new approaches, the community is not ready for a « grand measurement strategy » which could lead to a major step forward. The field is changing extremely rapidly and a detailed strategy will stand a high risk of being obsolete before it happened. Measurements are being carried out anyway but improved coordination between the different programmes would be beneficial to avoid the serious limitations associated with particular measurement platforms or strategies (e.g. intrinsic biases and under-sampling inherent in fixed-location measurements ; the inability of the ER-2 aircraft to cruise low enough to intersect the midlatitude tropopause; the lack of chemical tracer measurements in traditional meteorological studies of STE). His suggestion was that SPARC should provide strong « steering » to avoid scientists losing their efforts on what does not work and provide focus on key scientific questions.

The subject of STE is very important in many areas of SPARC and in atmospheric science in general, particularly as they relate to climate. A few examples are: the impact of aircraft emissions on the ozone layer, the vertical distribution of greenhouse gases in the UT/LS, and midlatitude ozone depletion. In this context a document on Chemical-Radiative-Dynamical Coupling in the UT/LS will be written in co-operation with the UT/LS Chemistry study Group.

Upper tropospheric and lower stratospheric Ozone, Aerosols and climate (UT/LS)

The question of upper tropospheric/lower stratospheric (UT/LS) chemistry is of the utmost importance since changes in trace species, in particular ozone and water vapour at this altitude are crucial in determining the overall climatic effects of stratospheric changes and in assessing the potential impact of aircraft emissions.

The main activity in this initiative in the last year was the organisation in October 1996 of the Strasbourg Workshop on heterogeneous chemistry. A. Ravishankara reported on the highlights of this workshop. It was noted that the treatment of reactions in/on stratospheric sulphuric acid aerosols is « mature » and the information to include them well in models is available, but the knowledge of reactions on solids (PSCs, SAT, ... ) is not as developed and its parametrisation in models is very approximate. The question was raised whether it is necessary to unravel all the details of these reactions. It was considered that it may not be for ozone holes issues, but it is required for reactions at high latitudes and the edges of the vortex. The role of temperature as a key parameter which controls the heterogeneous chemistry was highlighted ; it conditions the appearance of PSCs, ternary solutions and it controls the relative humidity. The predictive ability is very much dependent on large unknowns in the « microphysics ». The state of UT heterogeneous chemistry appeared to be in a worse shape : the nature of the substrate is unclear, and even the potential importance of heterogeneous processes in this region is not known. A short report of this workshop is given in this issue, and a complete report will be published in 1997 as a SPARC/WCRP Report.

In the light of these conclusions, the need for an enlarged programme on this topic was recognised. It will be carried out as a joint SPARC/IGAC initiative. The programme should take into account the following issues:

- the need to include laboratory chemists in the programme,
- the necessity of data evaluation for heterogeneous and gas-phase chemistry, (through the organisation of a joint workshop as a first step),
- the definition of a measurement program for UT chemistry

The need to include a modelling component was stressed. A letter was addressed to the IGAC Chairman with this proposal.

Stratospheric Water Vapour Climatology

In complement to the above discussions, J. Gille who chairs the SPARC Stratospheric Water Vapor group indicated his intention to focus the effort on the atmosphere up to 20km (UT/LS). It is intended to assess the available instrumentation, review the present data base, explore future plans, and suggest a monitoring programme that could lead to a climatology of UT/LS water vapour.

The two first tasks have been considered by the group in the last year. The measurement strategy comprises three components: determination of the UT/LS global water vapour distribution and temporal variations in the tropopause region, understanding of the processes that maintain the distribution and developing a capability to model and predict its future evolution with a hierarchy of models both interpretative and predictive.

More precisely the determination of the present global LS/UT water vapour distribution, which is also a priority of GVap within GEWEX, should take into account the following data sources:
• Observation from satellites, limb absorption or limb emission, to show global, spatial and temporal variation: currently data from SAGE II, HALOE, MLS, ILAS are available, and later data from SAGE III, MIPAS, HIRDLS, MLS and other future instruments can be used.

• In-situ measurements from balloons and aircraft, with accurate high spatial and temporal resolution, using frost point, Lyman α, tunable diode laser instruments.

• Ground and aircraft based remote observations, with continuous spatial and temporal data based mostly on Raman lidar and DIAL.

• The strategy will use satellite observations to observe spatial and temporal variations, intercompare satellite observations to reduce systematic effects, and anchor observations as firmly as possible to coincident in-situ and ground-based observations.

The understanding of the mechanisms that maintain the water vapour distribution requires both tropical and mid-latitude observations. The tropics are the region of highest priority, but studies in this region are compromised by the small number of stations. Extra sites are needed in the convectively active western Pacific, the subsidence region in the eastern Pacific, the monsoon-controlled Indian ocean, South America and Africa. A proposed installation of three new sites (Galapagos, Ecuador and Christmas Island) by Japan, which has received a high support from the SSG, may contribute to an improvement in this area, if implemented.

Several measurement campaigns are being planned in the coming years at different latitudes and will contribute to water vapour climatology. The establishment of such a climatology will require extended efforts, both in logistical and financial supports and it will be obviously more productive to conduct these studies in concert with GEWEX and maybe IGAC.

Assessment of stratospheric temperature trends

Dr. V. Ramaswamy reviewed progress in this SPARC initiative whose aim is to investigate stratospheric temperature trends using and inter-comparing all sources of data.

Progress so far includes:

• The preparation of the data base of zonal and monthly-mean time series of radiosondes, lidar, MSU and SSU satellites and analyses products from CPC/NOAA, UKMO/SSU Analysis, NCEP/Reanalysis and NASA/GEOS1.


• The intercomparison of the trends obtained from the different data sets and the comparison of the model results with observed trends.

The results confirm the cooling of the lower stratosphere especially in mid-to-high latitudes and its significance particularly in mid-latitudes and during the Antarctic winter/spring. Model simulations confirm that ozone loss plays a dominant role in this cooling and thus affects strongly the vertical profile of the atmospheric temperature change due to anthropogenic emissions. In the middle and upper stratosphere, modelled greenhouse gas cooling (including ozone) is qualitatively consistent with observations, however GCM simulations suggest a warming above the lower stratospheric ozone loss region.

A complete review of these results was presented by M. Gelman at the General Assembly and a summary can be found in the General Assembly Report session 3 in this issue. The complete report of the results obtained during this first phase should be available in mid 1997 and will be published as a SPARC/WCRP Report. It will be available for the next WMO-UNEP Scientific Ozone Assessment.

Phase 2

During Phase 2, the analysis of trends including detailed comparisons of rocketsonde and lidar with satellite data, and analysis of the causes of differences observed between the different datasets will be pursued. Time series and trends will also be studied at individual geographic locations. Numerous modelling experiments are also planned to estimate changes in stratospheric temperature which may come from spatial and temporal inhomogeneities in the radiative species as water vapour, clouds, ozone around the tropopause.

Understanding ozone trends

The primary objective of this group is to improve understanding of trends in the vertical distribution of ozone, the second to help ensure that the data sets collected by the instruments measuring ozone are consistent. The work involved is being undertaken jointly with the International Ozone Commission and the WMO Global Atmosphere Watch.

The first objective takes as a starting point the results of the last WMO-UNEP Scientific Assessment, in which the trend in total ozone were well characterised. However there is still uncertainty about the trends below 20km, with SAGE giving considerably larger trends than the sondes. A joint SPARC/IOC/GAW workshop was held at the Observatory of Haut Provence from July 8-11, 1996 to review the state of knowledge and to document and understand better the questions involved (see Newsletter # 7). It was attended by 28 scientists who agreed to undertake a number of studies in 1997 and to prepare a report for the end of 1997.

The report will be structured in the following way:


Chapter 4: Lessons learned from this study. Provisional responsibility: N. Harris, R. Hudson.

A further meeting of the group is scheduled for September 1997 in Cambridge to review the work and finalise the report which should be published as a SPARC/IOC/WMO Report and will come in time to contribute to the next WMO-UNEP Scientific Ozone Assessment.

Phase 2 of this work, very likely to be carried out in 1998, will include the study of instrument consistency, the attribution of trends and the study of sources of variability (solar, volcanic). The need for more measurements in the tropics was again stressed and the SPARC interest for the ITOY initiative of IGAC was confirmed. The Japanese proposal to set up new sites in the tropics, and which was strongly supported by the SPARC SSG, may contribute in this area.

UV Monitoring

J. M. Miller presented the activities of the WMO/GAW Programme on UV-B and commented the status of the different reports prepared by the 9 members of the UV Committee on the issues relevant to UV monitoring and modelling. Some of those are already avaible on the Web: http://www.srb.noaa.gov/UV/.

New Initiative: The role of the QBO in the coupling between the stratosphere and the troposphere

At the SPARC General Assembly, it was clear that a large amount of work was evolving around the QBO issue and its role in the coupling between the stratosphere and the troposphere. This is a major issue for SPARC, but could also be of interest for CLIVAR which is focusing specifically on different modes of climate variability.

Recognising what is already known on the signature of the QBO on ozone, temperature, winds, tides, occurrence of hurricanes, changes in SST... it appears that identifying the connection between the QBO and climate may be a key issue for SPARC. The issues to be considered include:

- what drives the QBO?
- how do models simulate it?
- what role is the QBO playing in climate coupling?

The SSG is setting up a study group on this topic, and will organise a workshop leading to review the issue. This will help to decide if such a topic should become a new SPARC project. Professor Hirota will lead this activity, with Dr M. Baldwin as co-chair.

Preparation of the SPARC implementation plan

A first outline of the Implementation Plan was proposed at the 1995 SSG and a number of initial draft contributions have been prepared. After the intensive discussions at this meeting on the issue of STE and the unifying theme of UT/LS, new emphases and a new time table have been established with the goal of having a completed document at the end of 1997.

In discussing the role and form of the plan, it was noted that an implementation plan should spell out clearly the basic scientific requirements and what nations have to do to meet these. It should identify what is already being done nationally or regionally and what specific EXTRA observational programmes or activities (or developments/extensions of existing activities) are needed.

If contacted by the writers of the different sections inquiring about your national programmes, please be cooperative, since this document's purpose is to help the future development of the overall SPARC programme, as well as individual nation's contributions.

Other issues

Cooperation with other international programmes:

IGAC. The major issues of cooperation between the two programmes are, firstly, the joint initiative in the organisation of the IGAC/SPARC/GAW Conference on « Global Measurement Systems for Atmospheric Composition » to be held in Toronto in May 1997 (cf announcement in Newsletter # 7). Another important joint activity is « Laboratory kinetics/spectroscopy » related to gas-phase and heterogeneous chemistry. This issue would become part of the enlarged UT/LS joint initiative described above.

A major concern for IGAC is to implement the ITOY (International Tropospheric Ozone Year) proposed originally by P. Crutzen; one of its main objectives is to increase the number of ozonesonde stations in the tropical and southern Hemisphere troposphere to detect ozone trends around the tropopause. J. M. Miller, convener of the GLONET Project to which ITOY belongs, presented the situation of ITOY and announced a document highlighting the scientific objectives of ITOY for 1997. This topic is strongly related to the SPARC Ozone Trends Initiative and close collaboration between SPARC and IGAC is in everybody's interest.

GAW. The attendance and the active participation of J. M. Miller, Chief, Environment Division, WMO Atmospheric Research and Environment Programme, in this SSG session was extremely important in developing the cooperation between SPARC and GAW in areas of mutual interest as UV and ozone monitoring, and the SSG confirmed its equal interest in working closely with GAW on these issues.

National activities

NASA. J. Kaye presented the recent NASA activities of interest
to SPARC. In the Strategic Research Plan of NASA, the Atmospheric Ozone Research is of greatest relevance to SPARC. It includes Laboratory Science, Ground-based, Balloon-based, Aircraft-based and Space-based Measurements, Modelling and Data Analysis. The future emphasis is placed on the following topics: chemistry-climate coupling, constituent assimilation, atmospheric chemistry-aerosol interface, atmosphere-land and atmosphere-ocean interface, air quality and applications. Several field missions are planned with the instrumented DC-8: PEM/TROPICS in tropical Pacific, SUCCESS in central US (mainly focused on the radiative effect of exhaust/particles), and OMS Balloons will be launched in support of STRAT at several locations.

The satellite programme includes the launch of a third TOMS on Meteor 3M in 2000, following the launches of EP-TOMS and ADEOS TOMS both in 1996. Active discussions are under way with CNES for a third SAGE III to fly on SPOT, and with the Canadian space agency for a total solar irradiance instrument to go on Canadian SciSat. J. Kaye described the new EOS chemistry-climate focus and the establishment of new teams on issues of interest for SPARC. (For more information about future space projects and their complementary aspect in the international scale see the article by J. Kaye on « Space-based observations of atmo-spheric chemistry » in this issue.)

NASA/GSFC has made a commitment to provide for the continuation of laboratory calibration facilities (UV, visible, near IR) for both NASA and non-NASA spacecraft. NASA also has plans to assist/support non-US atmospheric chemistry instruments, including ozone-measuring instruments from Chile (OLME), Israel (TECHNSAT) and Europe (GOME and SCHIAMACHY).

NASA has strong interest in promoting major Uncrewed Aerial Vehicles (UAV) activity, and the development of instruments and platforms to fly on Theseus and Perseus B aircraft. It is considering launching an A.O. for UAV Science missions with possibilities of UAVs carrying a 300kg payload, with up to a 24 hour duration, altitudes of 40-65 kft, and flying around the year 1999. The SPARC community should benefit from these opportunities.

**Japanese Proposals**

Two presentations of Japanese projects were made during the SSG:

- F. Hasebe, from the Department of Environmental Sciences of Ibaraki University, presented a proposal made to NASDA concerning a measurement programme for tropical ozone and water vapour soundings. The SSG recognised the importance of this proposal as a complement to the need for ADEOS-TOMS validation.

- Dr Imamura from NIES presented a proposal of H. Nakane to the Japanese Environment Agency entitled «Ozone depletion mechanisms and modelling from satellite, balloon and ground-based data». It is planned to include observations by FTIR, lidar, radiometers, spectrometers and in situ sensors to be used in an international context at different sites. The SSG encouraged the analysis, modelling and laboratory studies proposed in this project.

**German CRISTA-CRISTINE Projects**

D. Offerman, from the University of Wuppertal, Germany, presented the first results of the CRISTA experiment which flew on the space shuttle in November 1994 and which are the subject of a special article in this issue. He then described future plans to fly CRISTINE, an instrument with similar capabilities, on the International Space Station, and asked for a recommendation of the SSG on this new proposal. The SPARC SSG agreed that this would be an important contribution to SPARC objectives.

**Activities of the SPARC Office**

The year 1996 has clearly been a busy year for the SPARC Office due partly to the preparation of the SPARC General Assembly, (even though most of the organisational burden was handled at the SPARC-96 Office). Together with all the other continuing activities, these included updating and enlarging the SPARC directory (currently 2150 names) following a partial merging of the SPARC and IGAC mailing lists.

The activity of the Office in handling the organisation of study group meetings, the research of financial support and the writing of reports has been increasing as expected, and the preparation of the Implementation Plan will be a major load in 1997. The staff needs to be complemented, and an invitation is made for foreign scientists to join the Office. Ideally, they would be able to pursue their research part-time and their stay would be supported by their own funding agency, although they may also solicit partial support from the French Research Agency CNRS. Propositions should be sent to the SPARC Office as soon as possible.

The SPARC home page is updated regularly by C. Phillips. It was proposed during the SSG to use the Web site as a platform for educational documents on SPARC and SPARC related science.