Version 3
(one late review awaited, for AGCS)

EXTERNAL REVIEWS OF SCIENTIFIC RESEARCH PROGRAMMES

1. Background – the Review Process

The quality, the progress and success of SCAR's Scientific Research Programmes (SRPs) is to be reviewed every 2 years in order to determine that SCAR is obtaining good value for its investment and that results are emerging at an appropriate rate. A 4-year review is to include external evaluations. This is time for the 4-year review.

The success of SRPs depends primarily on science carried out, funded and peer-reviewed within national programs and there is no wish to duplicate the scientific review process of national activities. SCAR adds value to national efforts by facilitating international collaboration and communication that might not otherwise occur. An assessment of the extent to which that value has been added through such collaboration is the objective of the review process, providing a basis for prioritizing the many competing demands on SCAR's limited resources. If an SRP is judged to be deficient in its performance, SCAR will recommend changes to improve performance, or it may redirect funds to other more deserving activities. SRPs are also to be of a finite duration (6 to 8 years) allowing for the renewal and reinvigoration of the SCAR scientific portfolio on a regular basis. Reviews and assessments are used to encourage this replenishment.

The review process is not meant to be unduly burdensome and should be proportional to SCAR-provided funds. SRP leaders report biennially to the meetings of the Standing Scientific Groups and the SCAR Delegates. In the intervening years SRPS report to the Chief Officers of their Standing Scientific Groups who then report to the SCAR Executive Committee. Where feasible, SRP leaders should personally report to the SCAR Delegates. However, it is recognized that time and resources may not allow this, so the SRP reports can be made on behalf of the SRPs by the Chief Officers of the SSGs.

For the 4-year review of progress, the annual report of each SRP will be vetted by an independent external review group. The reviews will be provided to the Delegates meeting, along with the annual reports, to enable the Delegates to take make informed decisions about continued funding of the SRPs.

The plan was for each report to be reviewed by three external reviewers, by 31 May 2008. To the extent possible, reviewers should not be directly involved in the programme but should be knowledgeable about the demands of science in the Antarctic region (SRPs were asked for nominees). Reviewers evaluated the reports based on the evaluation criteria listed below. They were asked to comment on the extent to which each SRP has met the Terms of Reference given below.

Evaluation criteria for SCAR Scientific Research Programmes

Reviewers were asked to answer these questions, but to provide in total no more than 2 pages of A-4.

1. Science quality. Recognising that the national science on which the research was based has already been peer-reviewed, do the scientific highlights and published papers indicate that the internationally collaborative research stimulated by the programme has produced science that is excellent, or good, or fair? (delete whichever does not apply, and provide a brief justification for your choice).

2. Science importance/relevance/timeliness.

Has the work advanced understanding of the role of Antarctic in the overall earth System? (Yes or no; delete whichever does not apply, and provide a brief explanation for your choice).

3. International Polar Year

Is the programme contributing to the International Polar Year? (Yes or no).

4. Data archival and access

Is the programme adequately addressing the issues of data archiving and data access, and are its data accessible to the wider community? (Yes or no; delete whichever does not apply and provide a brief explanation of your choice).

5. Outreach - Public/policy profile

Is this programme enhancing the public profile of SCAR? (Yes or no; delete whichever does not apply, and provide a brief explanation of your choice).

6. Education

Is the work contributing to education about Antarctic science? (Yes or no; delete whichever does not apply, and provide a brief explanation of your choice).

7. Building capacity across all SCAR Member countries

Has the programme contributed to building the capacity of less technically advantaged nations a lot, modestly, little, or not at all? (delete whichever does not apply, and provide a brief explanation of your choice).

8. Value for Money

Considering that SCAR is only able to invest some $20-25,00 per year in each SRP, do the results indicate excellent/good/fair/poor value for money? (delete whichever does not apply, and provide a brief justification for your choice).

9. Terms of Reference

To what extent has the SRP met the Terms of Reference given below?:-

Terms of Reference for a Scientific Research Programme

- to oversee and guide the development and execution of the programme's implementation activities, adjusting and optimizing the science and implementation plans in the light of events and progress.
- to actively seek support of the programme's implementation through national and international mechanisms
- to ensure the delivery of agreed/approved scientific outcomes, including synthesis activities and public/policy outreach
- to respond to requests for expert advice/support from the SCAR Executive Committee in a timely and effective manner
- to ensure appropriate exchange and archival of data generated as a result of the programme
- to establish scientific liaison and logistic cooperation with other Antarctic activities as appropriate
- to advise the SCAR Executive Committee and Delegates on progress and on the use of funds

Criteria for Membership
The membership of a SRP will be:
- explicit
- appointed by the Executive Committee in consultation with the Meeting of Delegates
- based primarily on internationally recognized scientific expertise fulfilling required mix of skills and experience with geographical and gender mix taken fully into consideration
- for a 4-year term with the possibility of extension depending on contribution and performance
- governed by a phased rotation scheme.

1. ACE

General Comments;
Reviewer 1: Overall, the 4-year review of the ACE programme is highly positive and therefore I would recommend it to continue. This programme has reached a mature state and has a promissory field for further development. Leading members should be congratulated by their efforts and commitment. SCAR should seek a way of gaining more benefit from this programme and its results.

1. Science quality.
Reviewer 1: Recognising that the national science on which the research was based has already been peer-reviewed, the scientific highlights and published papers indicate that the internationally collaborative research stimulated by the programme has produced science that is excellent. Both, the number and quality of the scientific output (as papers, chapters in books, conferences, etc.) are of high level and very significant impact in the scientific community.
Reviewer 2: The research excellence is demonstrated by the science-driven integration and hypothesis testing that has become a model for other groups. Data/model comparisons are extremely powerful for model validation but also for developing new science questions. The ACE program is clearing driving the international community beyond just the collection of records, but also testing what those records tell us about processes and rates of processes. The Milankovitch scale modeling, especially for records before 2 Ma, is driving the need for higer resolution studies of new records (ANDRILL and even Cape Roberts) as well as the reexamination of older records with fresh perspectives. The collaboration of marine and terrestrial/ice sheet researchers with modelers is motivating and improving, and a model for young scientists.
Reviewer 3: The combined work presented in this document has been stimulated by international collaboration and published in top journals. For example, deliverable 1.1 was published in Nature and has been continually enhance since it came out. Ditto for 1.2, which was published in Science.

2. Science importance/relevance/timeliness.
Reviewer 1: The work advanced in the understanding of the role of Antarctic in the overall earth System. The new hypothesis and GCM supporting CO2 and orbital forcing as primary controls on the developing of the Antarctic glaciations challenge previous views of ocean gateways as direct drivers of continental cooling. However a

deep understanding on the role of the coupled orbital and tectonic forces may be still achieved.

Reviewer 2: Resounding Yes! This is happening at a number of time scales but especially during periods of rapid change in the Oligocene and Miocene for comparison with other paleoceanographic reconstructions. The new ACEX cores from the Lomonosov Ridge and related studies at the opposite end of the planet provide fundamentally new and exciting records that must now be integrated and compared with more developed Southern Hemisphere records. The science to do this level of 2-pole integration relies on the progress made by ACE related research over the past few years. The Arctic science community still has a way to go in that regard. The BIPOMAC agenda in the coming years will drive the community to improve geochronologic issues and require innovative modelling efforts that should serve to energize young scientists and simulate growth in the field of climate-ice sheet model research.

Reviewer 3: This body of work encompasses broad temporal scales of change and has challenged conventional wisdom about Antarctic climate. One example is the challenge that Antarctic and northern hemisphere climates may vary in synchrony at times and that part of melt water pulse 1B is due to Antarctic melt. This is intriguing and unexpected.

3. International Polar Year

Reviewer 1: This is a full IPY proposal and many individual IPY projects are tied or have cross-links to ACE.

Reviewer 2: Yes. The IPY 2007-09 will be a benchmark and groups like ACE are in a strong position to capitalize on providing answers for many of the driving science questions involving systemic integration (themes outlined in their page 3). The group should be congratulated for the genuine international character of their subcommittees and the spirit of their efforts. Strong leadership in the planning and networking is paying off with no lack of ideas for the next few years as IPY field programs start to produce data for integration. The IPY will live on in this way.

Reviewer 3: ACE has directly contributed to our understanding of paleo-environmental change in polar regions.

4. Data archival and access

Reviewer 1: This point is difficult to evaluate from the provided information. ACE is linked to the ASDL System but I am not aware of the data delivered to it. On the other hand data delivered by publications is large and at hand. This may be a point to discuss and improve in the future considering the outflow of data expected after IPY.

Reviewer 2: Yes and maybe. I didn't see anything explicit in their report about archiving data from the various projects (a seismic data base is mentioned); however, I assume this is required by national funding agencies, especially as papers are published and moratorium periods for cores and seismic data etc. are passed. A quick web search suggests that the science community has easy access to the ice core data but I am less sure of the sediment core data and marine data based on their report. ACE may not be in charge of this

Reviewer 3: Yes and No. Seismic data are available online though you must be accredited at a participating library (USGS Reston is the only U.S.). The map search did not work. More importantly, I would like to see more open access and a similar database for all cores.

5. Outreach - Public/policy profile

Reviewer 1: This programme is enhancing the public profile of SCAR although it may seek for more visibility within the non-scientific community. This SCAR programme has the potential for reaching common people and policy makers due to its relationship with present day global change issues. SCAR and ACE may explore the possibility of gaining public attention by showing how the study of past global changes can help to understand today conditions and predict future changes.
Reviewer 2: Absolutely Yes. There have been a number of high profile papers produced by members of the ACE group (special volumes, see page 4) but also informative newsletter articles (PAGES, Geotimes). ACE is very visible at AGU, EGU (I usually attend the sessions). I am not clear what is meant by policy profile?
Reviewer 3: The outreach and education efforts are still somewhat limited, but acceptable (i.e., one piggybacked workshop and sponsoring of students to conferences).

6. Education

Reviewer 1: The work is contributing to education about Antarctic science although there is an open field in this issue for expanding the contribution of ACE in promoting Antarctic science.

Reviewer 2: Yes. Workshop efforts about data synthesis and modelling have been launched along with outreach and teaching to the Urbino Summer School. They provide funding for students to attend summer school-like activities. Many of the national programs also have their own required "broader impacts" including education. Many individual programs have extensive education elements like ANDRILL.
Reviewer 3: See comment on outreach.

7. Building capacity across all SCAR Member countries

Reviewer 1: The programme has modestly contributed to building the capacity of less technically advantaged nations. The list of participating scientists shows a clear participation of scientists from countries with well developed and strong Antarctic programmes and with large budgets. An effort must be done to include more people from different SCAR country members. It is clear that the ¨weight¨ of the program will be on these well established research groups but after four years and considering the programme ¨mature¨ it would be worth to try to include more active participants.
Reviewer 2: The effort to include scientists from developing countries is not clear and perhaps not expected given funding levels and requirements of science-access balance based on national contributions to international programs, as I understand it. Antarctica remains male dominated, as is typical of the geosciences at the assistant professor level and up; no fault of ACE.
Reviewer 3: I am not sure if I would include Poland, Italy, Spain, and China as less advantaged, but if so then they have met this goal. The bottom line is that this is a well-balanced international effort.

8. Value for Money

Reviewer 1: The programme has managed to get money from external sources, which is not only good for its budget but also shows its high impact/profile outside the SCAR community. From the balance provided for this review attention must be paid

in expending all the available money during the year of allocation (on the proposed activities).
Reviewer 2: Considering that SCAR is only able to invest some $20-25,000 per year in each SRP, the results indicate excellent value for money. They fund workshops and meetings with results that are always rapidly published for the community at large. The science output is excellent.
Reviewer 3: It is a very good deal for the money.

9. Terms of Reference
Reviewer 1: The ACE SRP has largely met its TORs. Special consideration must be paid to items related to exchange and archival of data, and expanding cooperation among all the SCAR members.
Reviewer 2: ACE meets all of the criteria for the TOR. The leadership of ACE is strong and will remain strong in the coming years give the election outcomes.
Reviewer 3: The ultimate judgment is that for the funds provided, ACE provides a good deal. They should work to open access to core and seismic data a bit more and try to be a bit more open. For the latter, the AGU town hall is an excellent start; keep up this approach.

2. AGCS

1. Science Quality
Reviewer 1: I Judge that the science quality the programme has generated as being excellent. The five scientific highlights are all very important for both regional and global studies and have – or will be published in high quality science journals. Clearly the program is successful.
Reviewer 2: Excellent science. A wide range of scientists have collaborated on the themes of AGCS, and the results have appeared in some of the top peer-reviewed journals in the field (e.g., Journal of Geophysical Research, Journal of Climate).
Reviewer 3: expected late

2. Science importance/relevance/timeliness
Reviewer 1: The work has clearly advanced the understanding of the role of the Antarctic in the Earth system, and the importance of this SRP in the SCAR portfolio should not be underestimated. For example, the community has been crying out for the State of the Antarctic and Southern Ocean Climate System review, and regional climate projections and a compilation of the ASPeCt are very important. All four themes are demonstrably delivering science of great relevance and timeliness.
Reviewer 2: The research has extended our knowledge of, for example: contemporary climate change; the role of the Southern Ocean in Antarctic and global climates; the role of human activities in contemporary climate changes; Antarctic sea ice changes and their relationships to atmospheric circulation teleconnections.
Reviewer 3: expected late

3. International Polar Year
Reviewer 1: The report clearly demonstrates a good contribution to IPY.
Reviewer 2: Yes, as demonstrated in several of the areas indicated in my response to question 2, above, and more specifically to areas such as shallow ice cores collected as part of ITASE; NASA's ICESAT retrievals for more accurate determination of ice-sheet properties, etc

Reviewer 3: expected late

4. Data Archival and access
Reviewer 1: The data are clearly accessible to the community through the Links from the AGCS www page. In particular the development of the OceanREADER portal, and the updating of the MET and ICE- READER data are very good advances.
Reviewer 2: Web sites and portals have been established to facilitate access to the data and research results; links with other SCAR programs—and also those outside SCAR (e.g., CLiC)—set up to share and disseminate data.
Reviewer 3: expected late

5. Outreach – Public / policy profile
Reviewer 1: Yes although this is, in my opinion, not as strong as it could be. The AGCS SRP is demonstrably successful in its aims and has a good community profile, but considering the achievements one would hope for a higher public profile of both SCAR and the SRP.
Reviewer 2: AGCS activities have helped foster increased public interest in the Antarctic Peninsula warming and other contemporary climate issues, as well as the role played by ice cores in determining climate changes; links with IPY, etc.
Reviewer 3: expected late

6. Education
Reviewer 1: The work is clearly contributing to education about Antarctic science. This is supported by evidence of peer review publications and associated media coverage, publicity talks and newsletter, and general university teaching from the scientist involved in the program.
Reviewer 2: In addition to the areas outlined in my response to question 5, above, AGCS has fostered polar science education for graduate students and also other scientists (e.g., via workshops and conference participation, data analysis and interpretation, publications).
Reviewer 3: expected late

7. Building capacity across SCAR Countries
Reviewer 1: I believe this SRP has made a modest contribution to building the capacity of less technically advantaged nations. Given the nature of the SRP I believe this has been best achieved by the AGCS supported workshops.
Reviewer 2: Modestly. Most participating countries/scientists seem to be in Europe, include Australia, etc. This is probably because of the high cost of doing science these days.
Reviewer 3: expected late

8. Value for money
Reviewer 1: I would rate this as excellent value for money. The bulk of the budget has been spent on workshops, which have demonstrably contributed to SCARS aims and built research communities such as the ASPeCt group.
Reviewer 2: Excellent value: the money has been used for a number of peer-reviewed articles (with page charges!), to sponsor workshops and small conferences, and to set up links with other related programs.
Reviewer 3: expected late

9. Terms of reference
Reviewer 1: Of the seven terms of reference for a SCAR SRP six are clearly fulfilled by the AGCS program. The on "expert advice" TOR this can be considered fulfilled given the input to other support to the SCAR expert groups.
Reviewer 2: . I would say to the fullest extent in all terms of reference, except for the 4th bulleted point ("to respond to requests…") because I do not have that information. Overall, I rate the AGCS program as highly successful and a model for SCAR SRPs.
Reviewer 3: expected late

3. EBA

General comments:
Reviewer 2: the continuation of national funding, which is so important for EBA is no longer secured in several countries (esp. Italy, Germany and possibly the UK), partly due to escalating logistic costs but possibly also due to
shifting National priorities. These shortcomings have already harmed international Biology programmes like Icefish and are about to harm others as well. EBA should be further encouraged and supported by SCAR to the maximum extent possible. It represents a timely and much needed programme, which supports the development of comprehensive insight into the functioning of Antarctic ecosystems and their sensitivity to ongoing change. At the same time I would like to encourage SCAR to take initiative at the level of individual nations to emphasize the relevance of this research programme and the need to secure national funding for its further continuation and success.
Reviewer 3:
As I mentioned when I agreed to do this – the research program that I have been involved with over the past 15 years, the
McMurdo Dry Valleys Long-Term Ecological Research (MCM-LTER) site program, currently is lumped under the EBA standard, so my review has some bias. In addition, as a terrestrial scientist, I am not as familiar with the marine side of EBA; so there is a bias there as well.

1. Science quality.

Reviewer 1: The program has resulted in many publications, mostly in high quality journals, representing a breadth of marine, terrestrial, limentic and astrobiological science. The published papers engage all fields of biology from genes to ecosystems over spatial (microhabitat to landscape to deep ocean) and temporal (paleo to seasonal) scales. The number (over 350) of scientific papers since 2006 (including those in press) is impressive. Articles include those resulting from new exploratory research, from multi-disciplinary integrated syntheses of research, and research incorporating new and old technology from ocean, field and laboratory settings. Papers appear as special issues of peer reviewed journals, as chapters in books, and in books devoted solely to state of knowledge of Antarctic systems. Some projects contributing to EBA have high numbers of peer reviewed publications (more than 60 per year for one project) while others have none; the latter appears to reflect differences in funding, start times for projects and time delays in obtaining data from the field.

Reviewer 2: Overall the coverage by EBA is impressive and that the contributing projects represent a balanced diversity of approaches to answering integrative evolutionary questions from molecular to systemic levels. The scientific highlights and published papers indicate that, in several of the programmes the internationally collaborative research stimulated by the programme has produced science that ranges from good to excellent. This impression relates to the fact that the level of productivity is very diverse between programmes. Some programmes like BIOFLAME may have thrived without EBA but both EBA and those programmes have mutually benefited from each other. Others were in fact set up under or concomitantly with EBA and have (like the programme Systco) already generated papers in Nature despite their short period of existence. Overall the productivity of EBA in terms of published studies is high and justifies its existence as the major SCAR Biology programme. However, it is endangered at the same time as outlined above.

Reviewer 3: The production of archival articles in 2006 and 2007 is quite impressive – 314. Not only are these papers published in the best "topical" or "specialized" journals, but many are published in more "cosmopolitan" journals so the work will be seen and read by non-Antarctic scientists as well. This is good, in that it demonstrates the importance of Antarctic biology to a larger audience and acknowledges the importance of SCAR to this larger audience. The publications also differ dramatically in subject from genomics to ecosystem structure and function and everything in between, so the breadth is also very good. In general, I think that the publications show international collaboration, but not surprisingly perhaps, this collaboration is dominated by the larger national programs. There has been international collaboration stimulated by EBA with the LPG program being an excellent example of this. The new

"Gradients" program coming from LPG is taking advantage of the LPG initiative and adding to it. This is a very positive accomplishment. The "Trends" Book from the RSCC program and the Follonica, Gradients, Byers Peninsula, Jekyll Is workshops over the past few years that I have been involved in have all been important in producing a tighter international effort. I have not read anywhere close to a majority of these papers, but I would rate much of what I have read as "excellent".

2. Science importance/relevance/timeliness.

Reviewer 1: Yes. It is important on a global scale to understand how Antarctic biodiversity and ecosystems respond to change. The EBA research has contributed directly to increasing knowledge about Antarctic biological and system level response to global changes such as climate change, pollution, tourism and invasive species. Additional marine and terrestrial projects examine gene to cellular level responses and biogeochemical responses of ecosystems. Papers utilizing new technologies have advanced the ties of the polar biological community to those studying earth system science, while others are addressing basic, and heretofore unknown, issues of interest to the international scientific community, for example, how much diversity is in the ocean and are species declining? These and other topics such as evolution and phylogeny, ecology, biogeography, adaptation to cold and other survival mechanisms and carbon and nitrogen cycling are beginning to provide a cohesive body of knowledge as a result of the EBA project. The list of scientific publications is quite

large and very impressive because the work is focussed on important areas of research for polar systems and the earth system as a whole.
Reviewer 2: Yes. EBA not only brings in new more integrative approaches but nicely builds on previous activities, which have led to international efforts of synthesizing knowledge from both terrestrial and marine fields of research into comprehensive volumes (e.g. Antarctic Ecology: from Genes to Ecosystems, published by the Physiological Transactions of the Royal Society.)
Reviewer 3: For the most part, I would say "yes" to this. Recent papers on refugia and glacier dynamics and the Phil. Trans. Royal Soc. volumes are the ones that I am most familiar. Portions of the Antarctic are changing rapidly and other portions are predicted to change dramatically in the next decades, it is important that this is documented. EBA seems to be doing this well.

3. International Polar Year
Reviewer 1: Yes.
Reviewer 2: Yes. SCAR EBA is closely linked to IPY EBA which integrates several projects from inside and outside SCAR EBA.
Reviewer 3: "yes". The portion that I know most about is not directly involved in IPY, but it seems much of what is listed in Appendix 1 is involved.

4. Data archival and access
Reviewer 1: The EBA maintains a biodiversity data base at the Australian Antarctic Data Center which contains data on Antarctic and sub-Antarctic flora and fauna for freshwater, marine and terresrial ecosystems. This is in additon to individual projects and programs, many of which are linked to maps. Metadata (where, when and how data was collected) for Antarctica is stored in the Antarctic Master Directory hosted by the NASA Global Change Directory. This is searchable for EBA metadata. The two data bases are open to researchers of all nations.
Reviewer 2: Yes, the report explicitly and convincingly addresses the large scale collection of relevant data, esp. in the Biodiversity data base at AADC or the Antarctic Master directories but also mentions other data bases associated with specific projects.
Reviewer 3: "yes". This is an important issue in my mind and the data from all countries/programs/individuals involved in EBA should be made accessible to everyone after a short but reasonable time period. We find that there are some issues with metadata differing XML formats in the AMD.

5. Outreach - Public/policy profile
Reviewer 1: The EBA contributes to public understanding of Antarctica through its www site and through activities of individual projects. At present the EBA has little direct emphasis on publicity.
Reviewer 2: Yes, the public outreach for some of the projects and individual expeditions was and is outstanding, the EBA website and Newsletter will make long lasting and wide impacts. Public attention has already been significant, one example being the biodiversity studies in the Larsen area. High ranking publications in Nature and Science resulting from EBA activities also receive a lot of Press attention.
Reviewer 3: Probably could do a better job here. Although given the resources available for SCAR related outreach (zero??), the outreach has to be done by the

individual groups involved rather than SCAR itself. There is little about outreach in the report, so it is difficult to evaluate

6. Education

Reviewer 1: The newsletter and www site are means of education, as are the individual projects and workshops that magnify EBA knowledge.
Reviewer 2: Yes, in the sense outlined under 5.
Reviewer 3: I would think that each group and national program involved are training their own students – I know we are. Having said that, it might be good to poll the various groups involved in Appendix 1 and see how many students have been/are being trained through the umbrella of EBA activities.

7. Building capacity across all SCAR Member countries

Reviewer 1: Yes, modestly, but more so for the developing Antarctic nations. The EBA has projects in several less technically advantaged nations but additonally with nations who are developing programs in Antarctic research.
Reviewer 2: EBA involves workshops, training programmes and largely links nations and projects with existing activities in the Antarctic.
Reviewer 3: Very little is said about this in the report. There are numerous countries listed in column 8 of Appendix 1, so based on what I see in this, I would have to assume that some capacity building is taking place through EBA efforts.

8. Value for Money

Reviewer 1: Yes, excellent value. The EBA Programme has succeeded in providing a network for all biologists that encourages connections across disciplines, biomes, cultures and scales. The many outlets for information exchange (newsletter, www site, workshops, email communication) provide a means for personal and scientific communication and encourage development of a collaborative Antarctic biological research community. This will extend our knowledge base and understanding of global changes.
Reviewer 2: The results already indicate excellent value for money and more than justify the integration of national projects under the EBA umbrella. However, SCAR should support EBA also by responding adequately to the current developments of severe funding shortages at national levels (see above).
Reviewer 3: YES, emphatically, yes! For the little money allocated EBA by SCAR, based on publications alone, this has been an excellent investment. Having said that, it's at the workshops and such functions where real collaborations are begun and sustained. Some of these are supported through national programs and some through SCAR. Finding opportunities for scientists from the smaller national programs to attend these and contribute should be an important consideration in the future.

9. Terms of Reference

Reviewer 1: Most have been met or are underway and show a commitment by the EBA Committee to make this an exceptionally active and productive program.
Reviewer 2: EBA has met most of the terms and is well integrated as well as a strong component of activities of SCAR. Overall, it is definitely developing to be the core program for Antarctic Biology within SCAR.
Reviewer 3: Of the seven terms, I cannot comment on #4 and #7. I would argue that

#1 has been done well. We are just beginning to make inroads in #2 and have made important strides (through the workshops) in #3. Number #6, in my view needs much work – as if the EBA (and other biological programs) are to provide contributions to earth system science, we need to have better integration with physical and geo scientists. This is NOT the fault of the current EBA leadership, but, as I see it, a flaw in the way SCAR is set up. I bet other research programs of SCAR have similar issues. We are making progress on #5. So overall, I would say "yes", EBA is meeting the majority of the Terms of Reference.

4. ICESTAR

1. Science quality.

Reviewer 1: Recognising that the national science on which the research was based has already been peer-reviewed, the scientific highlights and published papers indicate that the internationally collaborative research stimulated by the programme has produced science that is generally good , with many excellent pieces of work as evident from the selected list of publications.

Reviewer 2: The scientific highlights and published papers indicate that the internationally collaborative research stimulated by the programme has produced science that is excellent. The effect of energetic particle precipitation on the composition of the atmosphere in different layers is an important topic with implications for several scientific disciplines. Interesting results regarding this issue have been reached not only for specific events but the results also indicate a systematic and persistent effect on the upper atmosphere and stratosphere. Another interesting result is the systematic asymmetric behaviour and IMF By control of the location of aurora and substorm onset. Some of the features are consistent with model simulations but others show discrepancies, which clearly demonstrate where future models need to be improved.

Reviewer 3: EXCELLENT. The program covers a wide variety of scientific activities in the upper atmosphere of the polar regions. There is no doubt about the high quality of science that is reported in both the scientific highlights and published papers. In that sense the science is highly rated. However, an important qualification is that there is no indication in the many papers that I surveyed that ICESTAR played any role in stimulating the research that was reported in these papers. Not even an acknowledgment. Given the lags that inevitably occur between the start of a science programme and publications this may not be surprising, but certainly disappointing.

2. Science importance/relevance/timeliness.

Reviewer 1: Yes; by adding new elements of knowledge concerning the coupling of the polar atmosphere to the global atmosphere and the geospace, particularly, concerning similarities and differences between conjugate polar Arctic and Antarctic regions.

Reviewer 2: The work has advanced understanding of the role of Antarctic in the overall earth System. One of the aims of the programme is to examine the conjugacy of geospace coupling processed because the way this conjugacy is manifested in the observations provide a big clue on the physical mechanisms involved. As such it is obvious that observations in the region of Antarctica are fundamental for the selected scientific projects.

Reviewer 3: YES. Many papers compare and contrast coupling processes in the

Arctic and Antarctic upper atmospheres. For example, the production of NOx in the thermosphere by particle precipitation and its downward transport into the middle atmosphere is important for understanding its possible role in ozone destruction and links to meteorology. These will be different between hemispheres due to differences in precipitation and differences in circulation.

3. International Polar Year

Reviewer 1: Yes, in a very distinct way, through the collaborative project IPY#63 (Heliospheric impact on Geospace).

Reviewer 2: The programme is certainly contributing to the International Polar Year in a very comprehensive way. In particular this reviewer wants to compliment the programme for being substantially involved in one of the core programmes of IGY, the Heliophere impact on Geospace together with the IHY (International Heliophysics Year) community. The programme in a natural way elaborates on the scientific questions that were in focus during the IGY. But the programme also demonstrates that although some of main questions remain, there has been a huge advancement in the general understanding of which elements are important

Reviewer 3: YES.

4. Data archival and access

Reviewer 1: Yes, these issues were in the focus of the collaborative projects. I found the projects making possible the quick and easy web-based access (e.g. virtual observatories approach, like GAIA) to the worldwide auroral, magnetic and riometer observations highly useful.

Reviewer 2: The programme is adequately addressing the issues of data archiving and data access, and its data is made accessible to the wider community. The active participation in the eGY by participating in the development of an eWorkshop on System tools and software and the ICESTAR workshop in Toulouse on data sharing issues demonstrate the dedicated effort of the ICESTAR project.

Reviewer 3: YES. Data are archived on widely used websites that offer easy access.

5. Outreach - Public/policy profile

Reviewer 1: Yes, this was done via different kinds of coordinated activity, including popular lections, media events, press-releases etc, opening the access to real-time observational data etc.

Reviewer 2: The programme is enhancing the public profile of SCAR. Members of the ICESTAR community have succeeded in being present at the relevant international symposia, workshops and conferences during the 4 year period not only as individual scientists but also as representatives of ICESTAR and thereby SCAR.

Reviewer 3: NOT CLEAR: There is a plan for outreach, but no real indication that it has been implemented. No examples provided. No indication that southern hemisphere countries are involved.

6. Education

Reviewer 1: The SRP provided an easy access to observational (including real-time) and educational material on the topic , fostering its use by students and interested people.

Reviewer 2: The work is contributing to education about Antarctic science.

During the 2007 Space Science Symposium in Greenland, for example, a special effort was made together with the sponsoring organizers to have a team dedicated to film the lectures and to make interviews with the scientists. The interviews we put on the web and were aimed at young school children.
Reviewer 3: NOT CLEAR: There is no real evidence that anything of substance has occurred.

7. Building capacity across all SCAR Member countries
Reviewer 1: modestly, I think, by allowing open access to valuable data
Reviewer 2: The technical issue of the ICESTAR programme is probably most relevant for the technically advanced nations and has probably only had little effect on the capacity in developing countries. However, the contribution to the virtual observatories does provide an excellent data base to be used by scientists from the developing countries and may thus have an important long-term effect on the capacity building.
Reviewer 3: NO. No evidence provided that capacity building has really taken place, especially with regard to less technically advantaged nations.

8. Value for Money
Reviewer 1: I found the coordination efforts and their outcome to be quite useful, so my evaluation is close to excellent.
Reviewer 2: Considering that SCAR is only able to invest some $20-25,000 per year in each SRP, the results indicate excellent value for money.
Reviewer 3: FAIR VALUE. Some good science is coming out of ICESTAR, but more evidence needs to be provided that ICESTAR is really enhancing Antarctic upper atmosphere science and is providing adequate support for all countries involved in this science. It is not clear what new science would have occurred or new facilities (data archiving etc) provided if ICESTAR had not existed. It is presumed that the support for people to attend meetings, as shown in the budget, was for young scientists (post_docs, students etc), but no direct evidence that this is the case. All appear to be from NH countries.

9. Terms of Reference
Reviewer 1: I think it well met the terms of reference indicated.
Reviewer 2: This reviewer finds that the ICESTAR has been very successful in meeting all the Terms of Reference.
Reviewer 3: Most terms have been met in principle, but see 8 for comments about execution.

5. SALE

General Comments
Reviewer 3: Overall grade – excellent. SALE is an excellent, dynamic and high-value programme that has been of considerable benefit to SCAR, not only in science, but in outreach, education and international visibility.

1. Science quality.
Reviewer 1: The science that SALE has produced over the last 4 years has been of an excellent quality, with several high impact papers published in Science and Nature.

These outstanding achievements are the direct result of there being an international community that functions well as a consortium and who interact regularly via SALE meetings.
Reviewer 2: I would place the recent work highlighting the spatial distribution of, and dynamic hydrologic nature of these systems near the top of the Antarctic scientific achievements over the past 5 years.
Reviewer 3: The programme has produced *Excellent* science with a high publication record in high impact journals. Major advances have been made in understanding of the scale, numbers and coverage of subglacial lakes. The research has completely changed our thinking on the interconnectedness of Antarctica's subglacial water bodies and the dynamics of the hydrological systems under ice on a continental scale. New and exciting technologies are proposed or in place.

2. Science importance/relevance/timeliness.
Reviewer 1: The work published by the SALE community has led to new insights into sub-Antarctic hydrology, with direct implications for ice sheet dynamics and sub-surface biodiversity. Both of these have implications at the Earth-system scale. I would say that the field is still too young to enable the nature of Earth system impacts to be fully evaluated, but this is not a reflection on the success of the programme.
Reviewer 2: Yes, questions surrounding the hydrology and biology of the subglacial lake systems are paramount in understanding sea level rise and the limits of life in a very extreme enviroment with obvious extencions to ice masses on other celestial bodies (Mars, Europea).
Reviewer 3: *Yes* this work has advanced understanding of the role of the Antarctic in the overall Earth system, in particular the continental scale hydrological connections to the Southern Ocean and an improved understanding of the dynamics of the Ice Sheet.

3. International Polar Year
Reviewer 1: SALE is contributing in a number of ways to IPY; to include visibility in national programmes, it is an IPY programme itself and has a number of national activities scheduled for 08/09.
Reviewer 2: SALE is recognized by the IPY as SALE-UNITED and appears to be very active.
Reviewer 3: *Yes* this programme has contributed to IPY as outlined in section (b) "*Contributions to IPY programme*" in the report. There is a significant list of these.

4. Data archival and access
Reviewer 1: Most research related to SALE has been conducted by national SALE programmes, the review document states that "SALE does not take credit for, nor is it credited in, such publications", it also states that "SALE does not attempt to archive data or monitor access to data other than acting as a portal to existing data repositories and archives". In this sense, the archiving of such information does not fall within the SALE remit and this has been made clear from the outset. A useful data portal does exist on the SALE website for the purpose of directing people to the appropriate data archive location nationally.
Reviewer 2: Though SALE does not generate data, it adheres to SCAR data archival policies. Their web site provides a wealth of data sources and is extremely user friendly and easy to navigate.

Reviewer 3: *Yes* this programme has clear meta-data archiving processes through acting as a portal to existing data repositories and data management policies that are explained on the SALE website.

5. Outreach - Public/policy profile

Reviewer 1: The volume of media coverage that this group has had is impressive – this is all archived on their website. It includes posters, press/media articles and various other PR materials. There is clearly a commitment to communicate science more widely and to maintain a record of this material.
Reviewer 2: The numerous events associated with international meetings must enhance SCAR visibility.
Reviewer 3: *Yes*, this programme has enhanced the public profile of SCAR. These are clearly outlined in the SALE Report under "Programmatic Achievement #5 and sections (c), (d), (e) and (f) covering the outputs in terms of Publications. Brochures, posters, media releases and the Web Sites.

6. Education

Reviewer 1: The work has had significant media coverage and has made considerable efforts itself in this area (e.g. brochure production, teaching materials, website).
Reviewer 2: Yes, primarily through their fantastic web site as well as the exposure during international meetings.
Reviewer 3: *Yes* this Programme is contributing to education about Antarctic science. This is clearly evident, not only from the Programme web sites, but also from the brochures, public relations material and the meetings with students at the SALE workshops.

7. Building capacity across all SCAR Member countries

Reviewer 1: Modestly; the membership was widened during the last 4 years to include some less technically advantaged nations.
Reviewer 2: If you call China and/or Belgium "less technically advantaged", then yes. Otherwise, no but I consider this to be a poor criterium upon which to assess SCAR activities.
Reviewer 3: This programme has contributed *modestly* to capacity building across all SCAR member countries. SALE, by definition requires considerable and complex logistic input from contributing nations. Few National Programmes are able to provide the support for this and the SCAR contribution to SALE is far below that required to meaningfully assist in this particular aspect. However, this criterion crosses that of #5-Outreach, and in this respect, SALE has been very active. My recommendation is that SALE researchers also seek participation from young scientists in less developed nations through the SCAR fellowships.

8. Value for Money

Reviewer 1: Excellent. By facilitating the creation and continued strengthening of an international consortium of scientists in this area the value gained in terms of science and international collaboration has been extremely high.
Reviewer 2: The group has leveraged monies for major annual meetings from other countries using SCAR money as seed money. Excellent utilization.
Reviewer 3: SALE has provided *Excellent* value for money. Given the number of high profile science publications, international meetings, publications, reports and the outreach and education activities, SALE has done extraordinarily well for a small

investment from SCAR. The value of National Programme contributions has been considerable.

9. Terms of Reference

Reviewer 1: On the basis of material provided in the report and on the SALE website, I would say that the terms of reference have been well met. I do not have any significant criticisms in this area.

Reviewer 2: All items listed in the Terms of Reference seem to have been adequately met with a couple items standing out at exemplary. The international exchange of information and representation is great. The current scientific panel has addressed the need for diversity among the interested international communities and enlisted new representatives to foster new ideas for the next few years.

Reviewer 3: The SALE Scientific Research programme has met all the Criteria and Terms of Reference for a SCAR SRP, but there is one ToR for which information is lacking); it is not known how SALE has responded to requests for advice.