INTERNATIONAL COUNCIL OF SCIENTIFIC UNIONS

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SCAR

SPECIAL COMMITTEE ON ANTARCTIC RESEARCH

BULLETIN

ARGENTINA AUSTRALIA BELGIUM
CHILE FRANCE JAPAN NEW ZEALAND
NORWAY SOUTH AFRICA UNITED KINGDOM
UNION OF SOVIET SOCIALIST REPUBLICS
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S.C.A.R. BULLETIN

No. 3, *September* 1959

Third meeting of S.C.A.R. held in Canberra, 2 to 6 March 1959

Present: President: G. R. Laclavere

Delegates: Argentine, R. N. Panzarini; Australia, K. E. Bullen; Belgium, J. van Meighem; France, G. Weill; Japan, K. Wadati; New Zealand, E. I. Robertson; Norway, L. Harang; South Africa, A. L. Hales; United Kingdom, G. de Q. Robin; United States, L. M. Gould; U.S.S.R., M. M. Somov

Observers: S.C.O.R., G. F. Humphrey; W.M.O., K. Langlo

Advisers: Argentina, I. Picard; Australia, R. Carrick, W. J. Gibbs, G. F. Humphrey, F. Jacka, B. P. Lambert, P. G. Law, D. F. Martyn, G. M. Rayner; France, J. Delannoy; New Zealand, R. G. Simmers; South Africa, J. J. Taljaard; United Kingdom, F. Debenham, M. Hotine, J. Macdowall, R. E. Priestley; U.S.A., R. Brode, A. P. Crary, T. Gray, W. Lanterman, C. Reece, M. J. Rubin, W. J. L. Sladen, H. Wexler, N. A. Weber, G. D. Whitmore; U.S.S.R., B. L. Dzerdzeyevskiy.

(*a*) *National Antarctic Committees.* It was reported that, since the second meeting of S.C.A.R., the following countries had formed these committees: Argentina, Norway, United Kingdom, U.S.S.R.

(*b*) *S.C.A.R. Bulletin.* It was stated that the Soviet Antarctic Committee did not wish to publish the bulletin in Russian. It would, therefore, only be published in English.

(*c*) *International co-operation and exchange of personnel.* The following examples of exchange of personnel were reported: two South African meteorologists worked at Halley Bay during 1959; at "Scott Base" an Italian worked during 1958, and United States scientists during 1958–59; a New Zealand scientist joined a United States traverse in 1958; "Hallett" station has been run jointly by New Zealand and the United States, and the United States are now co-operating with Australia and Argentina in "Wilkes" station and "Ellsworth" station; two United States biologists worked at the Argentine station on Deception Island during 1958–59; an Argentine meteorologist served at the Weather Central at "Little America" during 1958; and there had been several exchanges of personnel between "Mirnyy" and "Little America" during the past two years.

(*d*) *Programme for* 1960. Some tentative plans for 1960 were reported:

Argentina. The scientific programme will follow the same lines as that for 1959, with an increase in the glaciological observations at "Ellsworth" station and the establishment of a seismograph at "Orcadas".

Australia. Work at all A.N.A.R.E. stations will continue along similar lines to 1959 but with greater concentration on field activities. Seismic sounding equipment, for ice-thickness determinations, is to be transferred from

Mawson to "Wilkes" station. It is planned to make traverses inland from "Wilkes".

Belgium. An extension of the 1959 work is envisaged, with expanded programmes of biology and geology. It is hoped to establish a station on inland ice.

France. The 1960 party in Antarctica is expected to consist of fourteen men, including seven scientists. The 1959 programme will continue, with the possible addition of biology. Oceanographic work is envisaged, particularly between Tasmania and Terre Adélie. The geophysical programme at Îles de Kerguelen will continue and a party of sixty-seven men are expected to spend 18 months there.

Japan. Scientific activities are expected to continue at "Syowa".

New Zealand. Geological survey will be carried out in the area south of Nimrod Glacier and west of Beardmore Glacier. It is aimed to put two four-man parties into the field, one supported by Sno-cats and the other by dog teams and aircraft.

Oceanographic work will continue in the Ross Sea, probably on specific problems arising from the work carried out in 1959. A seismic programme is also planned to determine sediment thickness overlying the basement rock of the Ross Sea, and, if possible, to gain some information concerning the crustal structure. Hydrological and bottom samples will be collected in the Balleny Islands-Macquarie Island region and magnetic surveys with proton magnetometers will continue in this area. Land-based biological work will continue as in 1959, in particular a study of the Adélie Penguin rookery at Cape Royds, where it is hoped to station a party during the summer.

South Africa. Decisions on the 1960 programme have not yet been received. South Africa has a continuing interest in the establishment of a station on Bouvetøya, and consideration is being given to another reconnaissance expedition to the island.

United Kingdom. It is probable that operations during 1960 will be on the same scale as in 1959 and that the majority of stations will remain operative.

U.S.A. Scientific programmes will continue at the "Amundsen-Scott" South Pole station and at "Byrd" station, and a medical and biological research programme will be carried out at McMurdo Sound. During the summer of 1959–60 traverses are planned from "Byrd" station and McMurdo Sound. U.S. scientists will continue to work at the joint stations of "Hallett", "Wilkes" and "Ellsworth".

U.S.S.R. Work at "Mirnyy" and "Vostok" will probably continue at the same scale as during 1959. A programme of aero-meteorology, glaciology and terrestial magnetism is planned for "Lazarev" station. Traverses are planned along the route "Vostok"—South Pole—Pole of Relative Inaccessibility—"Lazarev", but details are not yet definite.

(*e*) *Arrangements with World Meteorological Organization.* Dr Langlo announced that the W.M.O. has arranged to continue the I.G.Y. system of

allocating index numbers, and the use of special meteorological codes in Antarctica. The Commission for Synoptic Meteorology was investigating the communication problem of concentration and rediffusion of selected meteorological data for the whole of the Southern Hemisphere. The W.M.O. Conference in April 1960 would consider international arrangements for collecting and publishing selected data for the whole world, particularly upper air, ozone and radiation data.

(*f*) *I.C.S.U. rules for Special Committees.* It was noted that there were some differences between sections of the S.C.A.R. constitution and I.C.S.U. rules for Special Committees. This has now been referred to the I.C.S.U. Bureau, and the following answer has been received:

> "The Bureau of I.C.S.U., at its Meeting in Cambridge in April, agreed to recommend to the Executive of I.C.S.U., at its forthcoming meeting in The Hague, 30 September to 3 October, that the Constitution of S.C.A.R., as adopted at The Hague, March 1958, should be allowed to stand, in view of the exceptional structure of the Committee."

(*g*) *S.C.A.R. Publications.* Dr Robin was appointed Editor of S.C.A.R. publications.

(*h*) *Secretary and Vice-President.* The President announced with regret the resignation of Dr V. Schytt from the post of Secretary, owing to ill health. Dr Robin was elected in his place for a two-year term. Professor K. E. Bullen was re-elected as Vice-President for a further three years.

(*i*) *Message to Antarctic stations.* Delegates were requested to send the following message from S.C.A.R. to their respective Antarctic stations:

> "The 3rd Assembly of S.C.A.R. meeting in Canberra extends to all members of wintering parties heartiest wishes for every success in the field, and expresses confidence that their work will make international scientific co-operation a reality.
>
> Laclavere, President."

(*j*) *Polish membership.* An application by Poland to become a member of S.C.A.R. was considered, and the following resolution was approved: "This meeting accepts the adherance of Poland to S.C.A.R. as from the date of the disembarkment of their wintering party on the Antarctic continent." It was agreed that Poland should be kept fully informed of S.C.A.R. decisions and activities.

(*k*) *Argentine Antarctic Symposium.* It was suggested that the symposium, to be held in Argentina in November 1959, should include geology, glaciology and oceanography.

(*l*) *Working Groups.* The recommendations contained in the reports of the working groups (*m–r* below) were accepted.

(*m*) *Report of Working Group on Cartography.* Chairman, G. R. Laclavere

(1) The addresses of the Antarctic Mapping Centres were noted:

Argentina	Jefe de Servicio de Hidrografia Naval del Ministerio de Marina, Buenos Aires.

Australia	Division of National Mapping, Department of National Development, Canberra.
Belgium	c/o Comité Special Belge de la Recherche dans l'Antarctique, Ministère de l'Instruction Publique, Residence Palace Rue de la Loi 155, Bruxelles.
Chile	To be notified.
France	Institut Géographique National, 136 bis rue de Grenelle, Paris.
Japan	Geographical Survey Institute, 7–1000 Kamimegure, Megure-ku, Tokyo.
New Zealand	Surveyor-General, Lands and Survey Department, Wellington.
Norway	Norsk Polarinstitutt, Oslo.
Union of South Africa	Trigonometrical Surveys, Rhodes Avenue, Mowbray, Cape Town.
Union of Soviet Socialist Republics	Director, Arctic and Antarctic Institute, Leningrad.
United Kingdom	Directorate of Overseas Surveys, Kingston Road, Tolworth, Surbiton, Surrey.
United States of America	Chief Topographic Engineer, U.S. Geological Survey, Washington, 25, D.C.

(2) B. P. Lambert (Australia) was appointed permanent secretary of the working group.

(3) Members were urged to arrange automatic distribution to Antarctic Mapping Centres of all maps, and various types of information and data useful in the compilation of maps, of areas within the zone of interest of S.C.A.R.

The following recommendations were also made:

(4) All agencies planning activities in the polar plateau area should give serious consideration to the merits of continued geophysical and topographical surveys.

(5) On all flights in the polar plateau area airborne spot heights should be obtained by a combination of radio altimeter and barometric pressure readings, and be positioned by normal air navigation techniques.

(6) Antarctic Mapping Centres should forward to the Secretary their recommendations for all conventional signs, particularly those for ice features. The Secretary should prepare draft proposals for international conventional signs for consideration by the working group.

(7) That Australia, U.S.A. and U.S.S.R. should maintain and distribute up-to-date editions of their existing maps of Antarctica. This does not preclude other nations from publishing similar maps.

(8) That the metric system should be used in all Antarctic mapping.

(9) That a 500 m. contour interval, with supplementary contours at closer intervals when required, is suitable for maps at scales smaller than 1:1,000,000.

(10) That the International Spheroid should be used for all Antarctic mapping.

(11) That maps at a scale smaller than 1:1,000,000 should be on the polar stereographic projection, with standard parallel at 71°.

(12) That, in maps and charts at scale of 1:1,000,000, I.C.A.O. specifications for projections at that scale should be used, and also the common I.C.A.O., I.M.W. sheet lines along parallels and optional meridional limits.

(13) That, in maps and charts at scales larger than 1:1,000,000, sheet lines should normally subdivide 1:1,000,000 sheet lines and a conformal projection should be used.

(14) That the 1:1,000,000 scale should be adopted for hydrographic charting for scientific purposes, and general coastal navigation.

(15) That nations, while free to operate in such areas as they desire, should advise the Secretary of their proposed activities to preclude unnecessary duplication of effort.

(16) That the Secretary should distribute annually to all Antarctic Mapping Centres a list of new cartographical publications and publish a catalogue of these when necessary.

(17) That the Secretary should circulate to all Antarctic Mapping Centres details of the Soviet plan for the mapping of Antarctica, which suggests that different nations assume the responsibility for the mapping of certain sheets of a 1:3,000,000 scale map. That he should ascertain and distribute the views of member nations on this proposal, including proposed sheet lines and the areas they would be prepared to undertake. That the proposal should then be further considered at the next meeting of the working group.

(*n*) *Report of Working Group on Exchange of Information.* Chairman, G. de G. Robin. The working group recommended:

(1) The appointment of reporters for different scientific disciplines to assist the Secretary on Scientific matters. The following reporters and disciplines were suggested:

Physical and biological Oceanography. M. M. Somov, USSR, or substitute nominated by him.

Meteorology. W. J. Gibbs, Australia.

Geology. R. W. Willett, New Zealand.

Glaciology. A. P. Crary, U.S.A.

Terrestrial Biology and Medical Research. R. Carrick, Australia.

Upper Atmosphere Physics. O. Schneider, Argentina.

Seismology and Gravity. K. Wadati, Japan, or substitute nominated by him.

Cartography. Chairman of Working Group, G. R. Laclavere.

Communications. Chairman of Working Group, A. H. Sheffield.

Other recommendations were:

(2) That annual reports, consisting of brief factual statements of work carried out, should be distributed by Antarctic Committees. The secretary, with the help of the reporters, should list the nature of the material to be included in the report. Reports should include a bibliography of scientific works published during the year. The first report should cover the years 1957 and 1958 and should be distributed by November 1959; subsequent reports should be distributed by the end of June each year, beginning in 1960.

(3) That, to ensure full co-operation of effort in the fields of meteorology and oceanography, W.M.O. and S.C.O.R. should be invited to submit brief reports at the end of June each year, on activities of interest to S.C.A.R.

(4) That reports of activities proposed for the following year should be circulated not later than the end of June. The Secretary should indicate the nature of material to be included in these reports.

(5) That annual meetings of S.C.A.R. should take place in late August or September of each year in order that these reports may be previously available for delegates. This cancels the arrangement, made at the 2nd meeting of S.C.A.R., that meetings should be held during the northern hemisphere spring.

(6) That S.C.A.R. members should continue to make use of the services of I.G.Y. Data Centres as long as they continue to operate.

(*o*) *Report of Working Group on Biology.* Chairman, R. Carrick.

(1) It was recognized that marine biology is an integral part of oceanography and that the section in the Scientific Programme on "Oceanography" should include marine biology, and consist of two parts, physical and biological. Recommendations for the wording of this section were approved (see Annex, p. 596).

(2) It was recommended that an international symposium on biological and medical research in Antarctica should be held shortly.

(3) The need for conservation of Antarctic flora and fauna was noted, and the study of means of protection recommended.

(4) The formation of an international register of specialists, competent in the taxonomy of Antarctic flora and fauna, was recommended.

(5) The formation of a Biological Data Centre was not recommended.

(*p*) *Report of Working Group on Meteorology and Physical Oceanography.* Chairman, H. Wexler.

(1) Other member nations were urged to publish Antarctic climatological studies on the lines of those published by the United Kingdom and South Africa.

(2) W.M.O. was requested to co-ordinate arrangements for the continuation of the broadcasting of monthly "CLIMAT" and "CLIMAT TEMP" messages for Antarctic stations.

(3) The establishment of the International Antarctic Analysis Centre at Melbourne was welcomed; also the intention of U.S.A. to assign an analyst to the centre. It was noted that analyses would be distributed: (*a*) by radio, including radio teletype and facsimile, for current use, and (*b*) by reproduction for other uses. Requirements of various countries, and availability of technical facilities, require further investigation. Member countries were asked to make known their requirements.

(4) The intention of South Africa to continue a Southern Hemisphere Historical Map Analysis Series, after the completion of the I.G.Y. World Weather Map Series, was welcomed.

(5) Member nations were urged to develop and establish automatic weather stations and other methods of observation, such as reconnaissance aircraft and dropsondes, in Antarctica.

(6) The development of various types of equipment for measuring the horizontal transport of blowing snow was noted. Member nations were urged to pool knowledge of equipment and methods.

(7) The need for the establishment of weather stations on Bouvetøya and Peter I Øy was again emphasized.

(8) No action on the establishment of an Antarctic Meteorological Data Centre was recommended pending decisions reached at the forthcoming Third W.M.O. Conference.

(9) It was noted with satisfaction that most nations had already made arrangements for I.G.Y. meteorological observations to be placed on punch cards, as well as being published.

(10) A number of suggestions were put forward concerning improved Antarctic weather communications for the support of the International Antarctic Analysis Centre.

(11) A number of revisions were approved to the Meteorology section of the S.C.A.R. scientific programme (see Annex, p. 596).

(*q*) *Report of Working Group on Upper Atmosphere Physics.* Chairman, F. Jacka.

(1) The desirability for early publication of I.G.Y. data was stressed, in particular geomagnetic data, to assist in the planning of future work.

(2) The importance of stations within the southern auroral zone was stressed, and also the need for visual observations to supplement all-sky cameras. Visual observations should be made on the hours and quarter hours.

(*r*) *Report of Working Group on S.C.A.R. Programme amendments.* Chairman, L. M. Gould.

(1) It was recommended that proposed amendments for circulation to members should reach the Secretary at least three months before the meeting at which they are to be considered. Proposals reaching the Secretary after that time can be considered at the next meeting, but will not be incorporated in the S.C.A.R. Programme until ratified by a majority of National Antarctic Committees.

(2) A number of recommended alterations to the programme were approved (see Annex, p. 596).

(*s*) *Date and place of next meeting.* Both Paris and Cambridge were suggested: It was agreed that the meeting should be held in late August or early September 1960. Final decisions as to time and place were left to the Executive Committee.

(*t*) The President thanked the Australian Academy of Sciences and the Australian Government for the invitation to hold the meeting in Canberra, the admirable arrangements made for the meeting and the hospitality extended to delegates and observers.

Annex

Scientific investigations recommended by S.C.A.R.

A number of important alterations and additions have been made to the programme of scientific investigations recommended at the first and second meetings of S.C.A.R. The following list incorporates these, and supercedes the list published in *S.C.A.R. Bulletin*, No. 1.

Meteorology

A. General

(*a*) The heat and moisture budgets of the Antarctic atmosphere and ice sheet
(*b*) The mean air circulation in the Antarctic regions
(*c*) Local effects in the Antarctic, particularly in the vicinity of the coastline
(*d*) The nature and extent of broad-scale meteorological processes over Antarctica and the remainder of the Southern Hemisphere
(*e*) The mutual influence between pack ice and the character and motion of the air
(*f*) The air flow in the friction layer over the Antarctic continent
(*g*) The Antarctic stratosphere and the exchange of air between the stratosphere and troposphere as shown by such atmospheric tracers as ozone

A ten-year period of observations is desirable.

B. Synoptic observations. The greatly increased networks of meteorological stations established in Antarctica during the I.G.Y. has enabled a reasonably detailed knowledge of weather processes over the Antarctic to be obtained for the first time, and every effort should be made to maintain the present scope of surface and upper air observations, and to increase the network where possible.

The areas deficient in observations are:

(*a*) the area bounded by lats. 45° S. and 60° S. and longs. 45° W. and 35° E.
(*b*) the area bounded by lats. 45° S. and 65° S. and longs. 80° W. and 150° E.
(*c*) the area bounded by lats. 45° S. and 65° S. and longs. 80° W. and 170° W.
(*d*) the Antarctic coastal area between longs. 80° W. and 150° W. and in the vicinity of longs. 155° E., 125° E.
(*e*) and the areas centred over the following positions:

lat. 80° S., long. 0°	lat. 75° S., long. 130° E.
lat. 75° S., long. 30° E.	lat. 80° S., long. 80° W.
lat. 75° S., long. 60° E.	

As W.M.O. considers that the greatest need for an increased network is in the ocean areas within the field of interest of S.C.A.R., every effort should be made to secure surface and upper air observations from islands, ships and floating automatic stations in these areas.

The method of obtaining temperature for use in pressure reduction in the Antarctic should be standardized through the normal W.M.O. machinery. In particular, the restrictions imposed by W.M.O. on the reduction of pressure should be observed, the preferred reduction levels being 850 or 700 mb. as appropriate.

C. Special observations

(*a*) Continuous measurements of the ozone content of air at the surface of the earth

(*b*) Observations of the primary and secondary directions, amplitude and wave length, and form of sastrugi at Antarctic stations. These are to improve methods of observation, and to develop the relationships between sastrugi and the station winds for the purpose of interpreting data obtained by traverse parties and through air photography, in studying the climatology of Antarctica

(*c*) Aerial determinations of the albedo

(*d*) Micrometeorological and meso-meteorological measurements

(*e*) Atmospheric chemical and precipitation content determinations

(*f*) Morphological determinations of falling snow crystals and of condensation nuclei

(*g*) Observations of noctilucent and mother-of-pearl clouds

(*h*) Aircraft flying over, near, and to and from Antarctica should continue the recommended meteorological observations, also, where possible, should utilize dropsondes and other techniques for vertical probing of the atmosphere, and should report all information promptly

(*i*) Traverse parties should measure the temperatures of the ice down to 15 m., as the temperature at this depth is very similar to the mean annual temperature at the surface

(*j*) S.C.A.R. welcomes the efforts in progress to obtain total ozone content, surface ozone measurements, and vertical distribution of ozone by means of ozone-sondes, and urges the International Ozone Commission and the W.M.O. to devise schemes whereby the intercomparison in the Antarctic of the standards used for such measurements can be effected

(*k*) Measurement of aerosols

(*l*) Observations of radiation, solar radiation from sun and sky, radiation balance, and the use of balloon-borne net radiometers

(*m*) Experimental measurements of the amount of blowing snow for the purpose of ultimately standardizing these techniques through W.M.O. action

D. Atmospheric nuclear radiation. Stations engaged in measuring the radio-activity of air and precipitation should carry that work on as far as possible after the I.G.Y. Other stations are invited to initiate such a programme.

E. Rockets. Rocket-sounding programme should be enlarged to cover the winter season, measuring temperatures and winds up to 80 km., at the rate of one per week. Rocket-borne experiments to greater altitude for studies of

high atmospheric conditions and parameters of particular interest for the south polar cap.

F. Acoustic probing of the upper atmosphere by means of surface explosions.

G. An *International Antarctic Analysis Centre* has been established by Australia in Melbourne in order to develop and undertake current analyses and to study the appropriate techniques of analysis.

It is hoped that countries other than Australia will support this by sending analysts to participate in the programme.

Ionosphere

(*a*) Vertical incidence sounding. The programme should follow the principles suggested in the 1958 Edinburgh report of the U.R.S.I.-A.G.I. Committee. At least two stations on the Antarctic continent should be Class F (full) and the remainder should be Class P (patrol) stations and as many as possible should be continued for at least another half solar cycle.

(*b*) Special observations. (1) Measurements of atmospheric radio noise should be continued for a full solar cycle at a minimum of two stations. (2) Special studies should be made on whistlers and very low frequency emissions, absorption and scatter and low-level echoes which may be peculiar to the southern auroral zone or polar cap. These studies should be co-ordinated with special studies in other disciplines concerning the high atmosphere.

Auroral physics

(*a*) The morphology of visible auroras, H and He emissions and H.F. radio scattering regions
(*b*) The sources of energy producing geomagnetic and ionospheric disturbances and auroras
(*c*) The nature of the agency causing excitation of auroral emission
(*d*) The composition and physical state of the upper atmosphere

Observational programmes should continue at stations well distributed in Antarctic regions using the several techniques available, such as visual observing, all-sky photography, photometric, spectrographic, radar and parallactic photography.

Attention is drawn to the possibility of gaining new information on the geomagnetic field in regions far from the earth by comparing Arctic and Antarctic observations on V.L.F. radio emissions, auroras and cosmic ray variations. Such comparisons may also contribute to understanding the mechanism of production of auroras. This possibility should be considered before fixing the positions of any new Antarctic stations.

Geomagnetism

(*a*) A geomagnetic observatory programme with base line control should be maintained at several stations as part of the global network. Geomagnetic variation recordings should be encouraged at all stations

involved in upper atmosphere studies and the recording and analysis should be designed to meet these requirements. The importance of low sensitivity recording is emphasized.

(*b*) A geomagnetic survey of the permanent field in the Antarctic area (continent and southern seas) should be carried out and co-ordinated with the projected World Magnetic Survey.

Cosmic Rays

(*a*) Sources and mechanism of generation of cosmic rays
(*b*) Cause of changes of cosmic ray intensity which appear to be associated with changes in the distribution of matter and/or magnetic fields in interplanetary space
(*c*) Form of the geomagnetic field at great distances from the earth

These should be the subject of long-term observations from well-distributed stations.

Geology

In addition to classical studies special attention should be directed to:

(*a*) The terrain beneath the ice as revealed by seismic studies
(*b*) Post-glacial and/or Quaternary geology at coastal stations
(*c*) Palaeoclimatic studies
(*d*) Palaeomagnetic studies
(*e*) Submarine geology
(*f*) Geochemical studies of rocks and minerals, including submarine deposits

Glaciology

(*a*) Thickness, structure and volume of inland ice as revealed in seismic soundings. The bedrock beneath the ice should also be investigated by seismic shooting
(*b*) Long-term observations:
  (1) Changes of elevation by repeated seismic soundings, gravity observations, and standard survey observations
  (2) Repeated astronomical fixes for absolute movement
  (3) Study of the ratio between the loss of ice by spreading and the gains by accumulation
(*c*) Annual stratification of firn to establish climatological significant precipitation records
(*d*) Structure of the inland ice sheet and ice shelves as revealed from deep pits and deep bore holes, particularly near the top of ice caps
(*e*) Variations of velocity of propagation with depth in typical ice areas should be made by long reversed refraction shooting and also shooting in deep bore holes. This might also aid in the study of propagation laws as a function of depth, temperature, stress, etc.
(*f*) The application of indirect techniques to determine the nature of the bedrock under the ice by the use of electrical methods, etc.

(*g*) Measurements of the chemical constituents of glacier ice, including constituents of gases occluded in the ice

Geomorphology

Studies of land forms with particular attention to the geological role of an inland ice sheet, past and present.

Cartography

A comprehensive, co-ordinated mapping programme should have high priority.

Details of the initial programme have been approved by S.C.A.R. and will, in future, be co-ordinated by a permanent Working Group on Cartography.

Seismology

There are two principal problems of Antarctic seismological research:

(*a*) to use local earthquakes and explosions to infer Antarctic crustal structure, and

(*b*) to use distant earthquakes both to obtain evidence on Antarctic structure and also on the earth's deeper structure. The establishment of first-class seismological observatories in the Antarctic can fill in an important global gap.

The setting up of new seismological observatories in the Antarctic is largely experimental. Relevant factors include the suitability of particular sites (difficulties with microseims, etc.), the human difficulties, and the as yet not fully known local seismicity. The present number of seismological observatories in the world is about 700. There should ultimately be not less than a corresponding number, determined on the basis of geographical area, in the Antarctic. Stations should normally be uniformly distributed, but special problems and features of local seismic activity may make this undesirable in some areas. Each station, in addition to having an adequate set of good seismographs, should have assured absolute time marks recorded on the seismogram so that absolute time can be read to less than a second. Suitably located stations should in due course become permanent.

Gravity

(*a*) The determination of gravity for the purpose of utilizing the data for geodesy as well as for the study of the upper layers of the earth's crust, and for solving some problems of glaciology

(*b*) Extension of the world networks of basic gravity points to the Antarctic

(*c*) Measurements of gravity by ship-borne gravity meters be made by ships operating in the area of interest of S.C.A.R.

(*d*) Measurement with pendulum instruments as well as gravimeters with small or constant drift

Vulcanology

To begin with, vulcanological studies are likely to emerge from broader geological studies, and then become more specialized as development continues. The Antarctic borders on the Pacific Ocean, from round the rim of which comes 85 per cent of the total energy released in earthquakes. It is therefore important that great attention be paid to the seismic and vulcanological problems of the area.

Oceanography

Investigation in the seas adjacent to Antarctic coasts should be developed. Physical and biological studies should be made together, because interpretation of the latter depends on the former and both require the same expensive facility—a research vessel. Circumpolar study is necessary with work extending as far from the Antarctic coast as necessary to define the relations between Antarctic and adjacent areas.

A. Physical

(*a*) Study of bottom relief and sediments in the shallow shelf zone of the seas around the Antarctic continental shelf, as well as in the oceanic regions adjacent to the slope. Deep cores should be taken off the Antarctic continent

(*b*) Study of the Antarctic coastal current

(*c*) Study of ice in the Southern Ocean (its nature, distribution and movement) by systematic sea and air observations. S.C.A.R. recommends that all expeditions participating in the Antarctic and using aircraft should make systematic sea ice observations from aircraft throughout the year, and should organize the exchange of data with other expeditions using W.M.O. codes. Experiments with radio direction tracking of icebergs might be undertaken to study currents

(*d*) Study of the Antarctic Convergence zone in the Southern Ocean. Here multiple sections across the Antarctic Convergence are specially recommended (oceanographic observations and measurements of the surface currents should be made not far from the frontal line). It is desirable to carry out synchronous observations in the zone of the Antarctic Convergence, employing for this the greatest possible number of oceanographic vessels and expedition ships working in the Antarctic

(*e*) Study of the deep currents in the Southern Ocean especially in the field of the western wind drift, using the method of absolute water age determination

(*f*) Study of tides and tidal current changes in the coastal regions of the Antarctic. It is highly desirable to make a cycle of at least one full year and if possible continuous observations of sea level fluctuations at shore stations in the Antarctic

(*g*) Systematic seasonal deep observations along the following sections should be considered the minimum requirement:
  (1) South from Cape Town along long. 20° E.
  (2) South from New Zealand along long. 165° E.
  (3) Across Drake Passage

(*h*) Geochemistry. Measurements of major and minor chemical constituents in oceanic waters

B. Biological

(*a*) Regular collections in all seasons for qualitative and quantitative phyto- and zoo-plankton, with special reference to:
  (1) euphausiids, copepods, larvae and eggs
  (2) physical and chemical conditions associated with plankton occurrence
  (3) checks of zoo-plankton occurrence against stomach contents

(*b*) Primary production (pigments, ^{14}C fixation, oxygen method)

(*c*) Biochemistry of depigmented fish (Nototeniformes)

(*d*) Microbiological study of sea water, ice over sea water (in comparison with ice over land) and sea bottom

(*e*) Collections of coastal and pelagic fish and invertebrates

(*f*) Ecology and life histories of coastal flora and fauna (especially those under ice shelf) and of all benthic forms

(*g*) Results of work on whales should be exchanged with the Scientific Subcommittee of the International Whaling Commission

Terrestrial Biology and Medical Research

A. General

(*a*) The Antarctic offers unique opportunities for biological research, much of which closely relates to human occupation of this region. At present, there is much less research there in biology than in the physical sciences

(*b*) Mans' physical and biological impact on the endemic Antarctic animals, plants and microbes is still slight, but this undisturbed situation will soon pass as the isolation of this region from the rest of the world is reduced

(*c*) The severe environment has led to high physiological adaptation and relative ecological simplicity, the understanding of which sheds light on conditions elsewhere

(*d*) Biogeographical problems in the southern hermisphere require circumpolar study of the distribution of flora and fauna. This should extend as far from the Antarctic continent as is necessary to establish the biological relations between Antarctica and other land masses

B. Botany

(*a*) Surveys. Systematic and ecological studies should be supplemented by mapping and the establishment of permanent reference areas

(*b*) Phytogeography. Further work is needed in the following fields:
(1) Experimental cyto-taxonomy
(2) Physiological and ecological studies of related species-groups
(3) Micro-fossil investigations (peat pollens, diatoms, etc., including dating of peats and other organic materials)

(*c*) Conservation. Protection of representative areas of natural environments is an urgent need. The impact of man and introduced animals on the Antarctic environment should be assessed

C. Zoology

(*a*) Modern reference collections should be made throughout the region. Important groups are mammals, birds (breeding adults and immatures of known age), and external parasites

(*b*) Details of seasonal cycles (movements, breeding, moulting, etc.) should be based wherever possible on marked individuals (banded birds, branded seals) of known age and sex

(*c*) Collections of food samples and observations of feeding habits throughout the year

(*d*) Studies on population ecology of species which can be accurately counted (e.g. seals, birds). These should preferably be based on marked individuals

(*e*) Studies of land invertebrates and their ecological associations

D. Physiology

(*a*) Investigations of the effects of cold and of photoperiodism on man in the polar regions

(*b*) Antarctica offers highly specialized fauna with many possibilities for comparative studies of adaptation to extreme temperatures and light variation.

E. Behaviour

(*a*) Antarctic animals, especially sea birds and seals, are excellent subjects for analysis of social behaviour

(*b*) Study of the psychology of isolated groups of men

F. Microbiology

(*a*) Studies of snow, ice, frozen soil and air

(*b*) Investigation of the possible incidence of living microbes in rocks, fossils, meteorites, etc.

(*c*) In medical and animal microbiology, unique opportunities exist in Antarctica for studying man's impact upon a relatively uncontaminated environment. Study of public health problems such as the survival of bacteria under polar conditions, sewage disposal, and upper respiratory tract virus infections which occur when wintering-over groups are exposed to infective agents brought in on relief ships. A survey is required of diseases already present in Antarctica's isolated or semi-isolated fauna, and of their potential threat to man

Scientific stations in Antarctica, 1959 (omitted from *S.C.A.R. Bulletin* No. 2)

New Zealand

Scott Base

Location: lat. 77° 51′ S., long. 166° 48′ E., 15 m. above sea level.
Site: on rock. Method of supply, by sea and tractor.
Climate: Temperature, mean annual −20·8° C., max. 5° C., min. −52·5° C.
Wind, mean annual, 4·9 m./s., max. 39 m./s.
Cloudiness, mean annual 4⅝ oktas.
Facilities available: Buildings 10, accommodating 22.
Electrical power available: 28 kW.
Aircraft: 1 Beaver, 1 Auster during summer only.
Tractors, etc.: 4 Ferguson, 1 Weasel, 2 Sno-cats.
Personnel: Leader, L. R. Hewitt.
Chief scientist: B. P. Sandford.
Total: including U.S. scientists during winter of 1959, 4 scientists, 5 technicians, 4 others.
Scientific programme: Auroral physics, biology, cartography, geology, geomagnetism, gravity, ionosphere, meteorology surface and upper atmosphere, oceanography, seismology.

United Kingdom

Detaille Island (Base W) did not operate during the year.

Symposium on Antarctic Meteorology, Melbourne, 1959

The Symposium on Antarctic Meteorology was organized by the Australian Commonwealth Bureau of Meteorology, and supported by the Australian Academy of Science, the Special Committee for the I.G.Y. (C.S.A.G.I.) and S.C.A.R. It was held in Melbourne from 10 to 25 February 1959, with W. J. Gibbs as Chairman.

The symposium was divided into seven sessions, each with its own chairman and each dealing with particular subjects. Summaries of all papers, in English, French and Russian, were available before the symposium began.

1*st Session. Local effects.* Chairman, K. Langlo.

Dr Langlo drew attention to the many difficulties involved in defining local effects and determining their origin; questions of exposure, katabatic winds and methods of reduction of pressure were all closely related to local effects in the Antarctic.

Papers by F. K. Ball, G. M. Tauber and B. Valtat dealt with the katabatic wind, one of the most spectacular and persistent of Antarctic phenomena. Ball's contribution gave an interesting theoretical treatment of the problem. P. J. R. Shaw described the results of local observations near Mawson and the paper by Y. Morita and N. Murakoshi treated a similar aspect of observations from ships and shore stations. B. L. Dzerdzeyvskiy outlined some weather peculiarities of the Antarctic coastline.

In summing up discussions in this session, Dr Langlo said that, with the present density of observing network in the Antarctic, it was difficult to distinguish between local effects and the effects of large-scale circulation. He

stressed the importance of studies of local variation of elements in the vicinity of reporting stations, which should indicate to what degree observations are representative of the effects of large-scale circulations.

2nd Session. Synoptic analysis and forecasting. Chairman, Professor J. Van Mieghem.

The chairman pointed out that the symposium stressed the two basic aims of the I.G.Y. meteorological programme in the Antarctic: (*a*) the investigation of the general circulation in the Antarctic region, and (*b*) the investigation of the influence of the Antarctic on the general circulation of the Southern Hemisphere and the planetary circulation as a whole.

Operational meteorological problems and means of securing observations from automatic weather stations and similar devices were described by Commander W. S. Lanterman, U.S.N. T. I. Gray reported on the operation of the U.S. Weather Central in "Little America". W. J. Gibbs reviewed existing methods and models used in synoptic analysis of the Antarctic and the surrounding oceans, and J. J. Taljaard and H. Van Loon discussed the method of preparation of 500 mb. analyses. Synoptic case studies were described in papers by B. Lieske and J. Alvarez and by K. Hansen.

Professor Van Mieghem, in concluding the session, stressed the need for attention to the telecommunications system for transmission of Antarctic and sub-Antarctic data, and also referred to the need for the publication, on a uniform world wide basis, of controlled data for meteorological research on a planetary scale. He urged the provision of automatic weather stations and transosondes to fill the gaps in the reporting network over the oceans. He said that differences in meteorological practices had arisen regarding the identification of fronts and blocking, and suggested that the jet stream may form a useful foundation on which analyses could be constructed. Referring to the case studies which had been discussed in the session, he said that many more case studies were needed to improve our knowledge of the thermal and dynamic processes in the atmosphere.

3rd Session. Synoptic influences on lower latitudes. Chairman, J. F. Gabites.

E. B. Kraus posed a number of problems including questions of synoptic interaction, the effect of sudden warming of the Antarctic stratosphere, likely effects of hypothetical changes in solar radiation over the Antarctic, and the contribution made by Antarctica to the annual oscillation of air between the hemispheres.

A paper by F. A. Berson and U. Radok discussed the relationship between Antarctic surges and variations in the zonal circulation, including the effect of blocking and evidence of Simpson's pressure surges. Contributions by A. K. Hannay, and by R. Falconer and H. M. Treloar, discussed the synoptic features in the southern oceans and over Antarctica which are associated with cold outbreaks over Australia.

Dr Gabites, recapitulating the discussion, said that in order to determine influences of the Antarctic on synoptic processes in lower latitudes, it was

necessary to increase the available network of observations. He pointed out that the Antarctic continent now had a reasonable network of reporting stations, but that studies such as those described in the session were hampered by the very considerable distance between those in oceanic areas, and indicated that little progress could be expected with this problem until some method had been found of filling this gap. He also suggested that it was necessary to look at the hemisphere as a whole in studying the interaction between processes over the Antarctic and lower latitudes, and, in particular, to have due regard for the significance of the long wave pattern in the development of significant synoptic features.

4th Session. Circulation studies. Chairman, W. J. Gibbs.

A paper by R. H. Clarke gave the results of a model experiment containing a cold dome to simulate the Antarctic continent. A paper by A. M. Gousev discussed wave disturbances on the permanent low level inversion over the Antarctic continent. Studies by J. Langford, H. Van Loon and P. D. Astapenko dealt with the nature of circulations over Antarctica and surrounding oceans, and papers by I. S. Kerr and S. Karelsky also treated this subject, using a synoptic climatological approach.

Reviewing the session, the chairman stated that the papers presented appeared to belong to two categories: (*a*) model experiments or theoretical treatments of circulation features, and (*b*) deduction and inferences regarding circulations based on synoptic studies. He thought that R. H. Clarke's paper was of value, not only because the model exactly simulated atmospheric behaviour, but because observation of the processes occurring in the model could stimulate ideas regarding the circulation of the atmosphere. He also thought that the group of papers based on synoptic studies indicated that there was a general agreement among meteorologists regarding the occurrence and behaviour of the large-scale features of the circulation over Antarctica and surrounding oceans. He pointed out that, in Antarctica, a network density has been achieved which enables a reasonably accurate charting of large-scale circulations, but that, over the surrounding ocean areas, the network was not adequate to arrive at reliable circulation concepts.

5th Session. Snow and ice characteristics. Chairman, G. de Q. Robin.

An instrument which has been designed for the measurement of snow drift was described in a paper by M. Mellor. A study by M. Mellor and U. Radok discussed the results of observations obtained with this instrument, concluding that "saltation" occurred near the snow surface in a manner similar to that observed with blowing sand. They found that snow drift transport was apparently much larger than previously believed, and suggested that it could form an important item in the mass budget of the ice sheet. The method of formation of puddles in sea ice was discussed by Y. Takahashi, and K. B. Mather discussed the results of observations of sastrugi, suggesting some relationships with wind directions.

Summarizing the discussion, Dr Robin said that the papers were of interest both to glaciologists and to meteorologists. The work on methods of measurement of snow drift and discussion of results indicated considerable progress in this field, but knowledge of the subject is likely to remain incomplete for some considerable time. He remarked that observations of the occurrence of puddles in sea ice seemed to agree admirably with theoretical considerations, also that the question of sastrugi was of great interest, but care must be taken not to infer a detailed relationship with wind direction which, in fact, may not occur.

6th Session. Heat and mass exchanges. Chairman, C. H. B. Priestley.

F. Loewe reviewed the various items in the mass budget of the Antarctic ice sheet and M. J. Rubin dealt with advection of sea across the Antarctic boundary. J. F. Gabites discussed the role of the Antarctic in the general circulation of the atmosphere by estimating the individual items of the heat budget. A paper by W. B. Moreland gave a comparison of the observed structure of the stratosphere over Antarctica in winter with that obtained from a consideration of infra-red cooling rates from theoretical models. J. MacDowall commented on observations of ozone at Halley Bay.

Dr Priestley, in reviewing the subject of exchange processes, pointed out that it is in this field that quantitative values are allotted to large-scale physical processes, and remarked that the degree of unbalance in the exchange budget provides a yardstick to measure the progress in knowledge of the subject. He indicated that there are various types of exchange studies; one in which an attempt is made to draw up a complete balance to see whether any systematic change is occurring, another in which values are assigned to a number of terms in order to arrive at one otherwise unknown, and a third in which, after having inferred the magnitude of a missing term, its value is obtained by computing it from another method. Dr Priestley thought that Gabites's paper was a major work and would be a valuable reference for the Southern Hemisphere for many years. He drew attention to the fact that exchange studies provide a guide as to the desirable network density in Antarctica. He suggested that the main reason for the study of local meteorology in Antarctica was to be able to isolate the effects of local phenomena.

7th Session. Climatological aspects of the Antarctic. Chairman, J. J. Taljaard.

A paper by H. Wexler discussed the annual variation of temperature in the Antarctic and suggested that horizontal advection of maritime air in the Antarctic troposphere, and the restriction of advection by the strong stratospheric jet stream encircling Antarctica, were important factors. Climatological studies of certain Antarctic localities were presented by J. Zimmerman and J. MacDowall, and a brief summary was given of a major study of the meteorology of the South American Antarctic sector by W. Schwerdtfeger, L. M. de la Canal and J. Scholten. The upper air climatology over the South Pole was discussed in a paper by E. Flowers, and R. C. Taylor presented mean monthly cross-sections from pole to pole.

Commenting on this session, the Chairman said that the need for climatological statistics and derived charts or documents of the Antarctic is in general different from the requirements of the remainder of the globe. There was likely to be little demand for climatological studies for permanent settlements or other utilization of the Antarctic continent; the requirements for climatological data from Antarctica and surrounding oceans is based on its role in the local, regional and general circulation of the atmosphere and its part in determining exchange processes. He thought that the conventional climatological analyses for individual locations in Antarctica were not sufficient, but must be supplemented by preparation of climatological charts for Antarctica and surrounding oceans. He suggested that it might be difficult in the near future to improve upon existing climatological charts for the ocean areas (such as those published by the South African Weather Bureau), but that considerably improved charts and statistical studies should be possible for the Antarctic continent within the next few years.

A report of the symposium, including copies of papers presented and summaries of discussions, will be published by Pergamon Press, London.

NOTICE

The SCAR Bulletin is published in England in January, May and September each year as part of the *Polar Record*, the journal of the Scott Polar Research Institute.

Contributions are invited, and should consist of factual notes on the membership, equipment and activities of Antarctic parties; articles on matters of particular interest in connection with these activities are also welcome. Contributions should be sent to the Editor, Scott Polar Research Institute, Lensfield Road, Cambridge, England.

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