UKNCAR Reporting Template

1.	Principal UK Researchers	Claire Allen (BAS); Mike Bentley (Durham); Alex Burton-Johnson (BAS); Julian Dowdeswell (SPRI); Tina van De Flierdt (Imperial); Jane Francis (BAS); Jenny Gales (Plymouth); Kate Hendry (Bristol); Sian Henley (Edinburgh); Javier Hernandez-Molina (RHUL); Claus-Dieter Hillenbrand (BAS); Jo Johnson (BAS); Rob Larter (BAS); Erin McLymont (Durham); Keir Nichols (Imperial); Vicky Peck (BAS); Tim van Peer (Southampton); Clive Oppenheimer (Cambridge); Teal Riley (BAS); Steve Roberts (BAS); Laura Robinson (Bristol); Dylan Rood (Imperial); Richard Sanders (NOCS); Daniela Schmidt (Bristol); John Smellie (Leicester); James Smith (BAS); Pippa Whitehouse (Durham); John Woodward (Northumbria).
2.	Major activities and	International Thwaites Glacier Collaboration (ITGC):
	progress since previous year involving UK personnel/infrastructure	Following the first ITGC field season in Hudson Mountains in 2019-20, Joanne Johnson (BAS) and John Woodward (Northumbria), with support from Dylan Rood and Keir Nichols (Imperial), have been preparing rock samples for 10Be dating and processing radar data. The GHC team (co- led by Johnson) have chosen a site for subglacial bedrock recovery drilling in the Hudson Mountains, currently scheduled for the 2021-22 season (postponed from 2020- 21 due to covid). The GHC team have also constructed a
		Holocene relative sea-level curve for Pine Island Bay.
		ANiSEED project (NERC-funded): Joanne Johnson & Steve Roberts (BAS), Pippa Whitehouse (Durham) and Dylan Rood (Imperial) published a paper showing Holocene thinning of Pope Glacier, in the Amundsen Sea Embayment, which implies widespread early Holocene ice sheet thinning coinciding with enhanced upwelling of warm ocean water onto the continental shelf in this important area. They have also completed a data-model comparison for the wider Amundsen Sea Embayment, using the Penn State ice sheet model. One outcome of this study is suggestions of improvements for ice sheet models that are constrained by glacio-geological data.
		Linked SRPs: AntVolc: The major GeolSocLond Memoir on Antarctic volcanism, UK-led, is completed. A second GeolSocLond Memoir, on the Antarctic mantle, is progressing well, with most chapters accepted & going into production; completion next year. An illustrated booklet on Antarctic volcanism, aimed at primary school-age children, is currently in progress (outreach activity).

		Due to Covid restrictions, AntVolc was involved in unusually few meetings this year but it was represented by a digital bipolar session at EGU. All current funded field- based activities for AntVolc have been postponed due to Covid. See AntVolc report for more details.
		SERCE: SERCE-related thematic sessions or side meetings have taken place at EGU (2020 and 2021), AGU 2020, and SCAR OSC 2020. An overview of all activities and achievements during the lifetime of SERCE was presented during the SRP session of SCAR OSC 2020. Successful 2020-21 field season for NERC-funded project that uses GPS to measure bedrock deformation in response to ice sheet change (see SERCE report for details) Final SERCE report submitted December 2020 (see SERCE report for details). SERCE activities will cease in 2021, following the agreed carry-over of 2020 funds to 2021. Final planned activities are detailed in the SERCE report.
3.	Major future initiatives and actions involving UK personnel/infrastructure	A joint SERCE-PALSEA workshop: 'Improving understanding of ice sheet and solid earth processes driving paleo sea level change' is due to be held in New York in September 2021 (https://palseagroup.weebly.com/). See SERCE report for full details.
4.	Policy outcomes	SCAR White Paper review of the present state and future prospects for volcanic studies in Antarctica. Due to be published by the end of the year (see AntVolc report for details).
5.	Selected publications	 Johnson et al. (2020) Deglaciation of Pope Glacier implies widespread early Holocene ice sheet thinning in the Amundsen Sea sector of Antarctica. Earth & Planetary Science Letters 548, 116501. Johnson, J.S., Pollard, D., Whitehouse, P.L., Roberts, S.J., Rood, D.H., Schaefer, J.M. (decision pending, May 2021) Comparing glacial-geological evidence and model simulations of ice sheet change since the last glacial period in the Amundsen Sea sector of Antarctica. Journal of Geophysical Research-Earth Surface. Smellie, J.L., Panter, K.S. and Geyer, A. (eds) 2021. Volcanism in Antarctica: 200 million years of Subduction, Rifting and Continental Break-up. Geological Society, London, Memoirs, 55, 800 pp. Dowdeswell, J. A., Batchelor, C. L., Dorschel, B., Benham, T. J., Christie, F. D., Dowdeswell, E. K., & Gebhardt, C. (2020). Sea-floor and sea-ice conditions in the western Weddell Sea, Antarctica, around the wreck of Sir Ernest Shackleton's Endurance. Antarctic Science, 32(4), 301-313.

	 Burton-Johnson, A., Dziadek, R., & Martin, C. (2020). Geothermal heat flow in Antarctica: current and future directions. The Cryosphere, 14(11), 3843-3873. Henley, S. F., Cavan, E. L., Fawcett, S. E., Kerr, R., Monteiro, T., Sherrell, R. M., & Smith, S. (2020). Changing biogeochemistry of the Southern Ocean and its ecosystem implications. Frontiers in Marine Science, 7, 58. Li, T., Robinson, L. F., Chen, T., Wang, X. T., Burke, A., Rae, J. W., & Spooner, P. T. (2020). Rapid shifts in circulation and biogeochemistry of the Southern Ocean during deglacial carbon cycle events. Science advances, 6(42), eabb3807 Cassarino, L., Hendry, K. R., Henley, S. F., MacDonald, E., Arndt, S., Freitas, F. S., & Firing, Y. L. (2020). Sedimentary nutrient supply in productive hotspots off the West Antarctic Peninsula revealed by silicon isotopes. Global
	nutrient supply in productive hotspots off the West Antarctic Peninsula revealed by silicon isotopes. Global Biogeochemical Cycles, e2019GB006486.
6. Funding awards	
7. Points for discussion at	
UKNCAR meeting	

Physical sciences

We were starting to make plans for Hobart and many of our groups were running sessions in the open science conference.

In Hobart the 8 year term for the Chief Officer and Secretary ended but we have been asked to remain in post for the next 2 years to help with continuity.

We are putting together the final Physical Sciences report for EXCOM after getting reports from the different groups.

No plan at the moment to have an online Physical Science meeting but that may change depending on what SCAR decides.

For groups that have not put in a report this year we have decided that they will not get any funding allocated for next year and if they do not put in a report for two consecutive years then they will be considered for winding down.

Remote Sensing group plan to merge with Earth Observation group

OpMet.

Continue to maintain web pages showing which stations and automatic weather stations are currently operating in the Antarctic.

Working with the World Meteorological Organisation (WMO) towards the implementation of an Antarctic Regional Climate Centre. Regional Climate Centres (RCCs) are designated by WMO to create regional climate products, including long-range forecasts to support regional and national climate activities.

There are three mandatory functions, long range forecasts, data collection and monitoring.

There are also many highly recommended functions which include things like research which is then applicable for some SCAR groups and the national Antarctic operators.

A scoping workshop was held in Bologna in October and at this workshop it was decided that Australia would lead the ling range forecasts, the UK would lead on the data collection and Italy the monitoring.

The next stage is develop a concept paper and also get expression of interest on which countries would like to be involved, at the moment we have had responses from UK, USA, Australia, India, China, Sweden and Denmark.

We have had a couple of online meetings since the scoping workshop and hope to have the concept paper ready soon so that it can go to WMO for approval and then we can start with the implementation stage of the RCC.

UKNCAR Reporting Template

Provide up to two pages of information following the structure below, only filling out those sections where there is new information to report.

Past Antarctic Ice Sheet Dynamics (PAIS)

1.	Principal UK Researchers	Non-exhaustive list: Bentley, Jamieson, Paxman (Durham) Hillenbrand, Larter, Sime, Hogan, Smith, Hodgson, Perez (BAS) Siegert, Van de Flierdt (Imperial) Hein (Edinburgh)
2.	Major activities and progress since previous year involving UK personnel/infrastructure	Much of the activity of PAIS in the last year was focussed on completion of the Scientific Research Programme and helping the INSTANT planning and leadership team to pick up the baton.
		UK personnel were closely involved in this including the final report (contributions from several including Hillenbrand, Bentley).
		PAIS is also publishing a book with contributions from several UK authors (see below)
		Two important final PAIS products were produced with close involvement of UK researchers (including key roles for Early Career researchers): offshore sediment and palaeotopography grids, and Palaeotopographic reconstructions of the continent (see publications below)
		This reporting period also just picks up the end of at least one cruise (Thwaites Offshore Research (THOR)) that was impacted by the March 2020 lockdown and where some staff did not return to home countries (incl. UK) until some weeks later. Larter was co-PI on this cruise.
3.	Major future initiatives and actions involving UK personnel/infrastructure	Much of the objectives and the delayed activities will be carried over into the new INSTANT programme.
4.	Policy outcomes	PAIS has fed into IPCC reports including the 6th Assessment Report (forthcoming 2021) and to the Special Report on the Ocean and the Cryosphere in a Changing Climate (SROCC, 2019)
5.	Selected publications	Antarctic Climate and Ice Sheet Evolution – Book 2nd edition (Elsevier, 2021, in preparation), Eds: Fabio Florindo, Martin Siegert, Laura De Santis, Tim Naish (UK authorship includes, Siegert, Hillenbrand, Perez, Francis, Bentley, Jamieson, Larter, Hein, van de Flierdt, Perez)
		PAIS Final Report – delivered to SCAR Delegates meeting, March 2021
		OPEN dataset : Hochmuth, K., Paxman, G., Gohl, K., Jamieson, S., Leitchenkov, G., Bentley, M., Ferraccioli, F., Sauermilch, I., Whittaker, J., Uenzelmann-Neben, G., Davy, B., DeSantis, L. (2020). Combined palaeotopography and palaeobathymetry of the Antarctic continent and the Southern Ocean since 34 Ma. PANGAEA, https://doi.org/10.1594/PANGAEA.923109

		Palaeo-bathymetric models reconstructed based on all available geophysical and geological data to form complete grids of the Southern Ocean and the Antarctic margins.
		Paxman, Guy J. G., Jamieson, S. S. R., Hochmuth, K., Gohl, K., Bentley, M. J., Leitchenkov, G., & Ferraccioli, F. (2020). Reconstructions of Antarctic
		topography since the Eocene–Oligocene boundary. Palaeogeography,
		Palaeoclimatology, Palaeoecology, 535, 109346.
		Klages, J.P., Salzmann, U., Bickert, T., Hillenbrand, CD., Gohl, K., Kuhn, G., Bohaty, S., Titschack, J., Müller, J., Frederichs, T., Bauersachs, T., Ehrmann, W., van de Flierdt, T., Simões Pereira, P., Larter, R.D., Lohmann, G., Niezgodzki, I., Uenzelmann-Neben, G., Zundel, M., Spiegel, C., Mark, C., Chew, D., Francis, J.E., Nehrke, G., Schwarz, F., Smith, J.A., Freudenthal, T., Esper, O., Pälike, H., Ronge, T., Dziadek, R., and Science Team of Expedition PS104 (2020). Temperate rainforests near the South Pole during peak Cretaceous warmth. Nature, 580, 81-86, doi:10.1038/s41586-020-2148-5.
6. Funding a	iwards	
7. Points for	discussion at	None
UKNCAR I	meeting	

	1
Principal UK Researchers	Dr Tom Bracegirdle, Chief Officer
 Major activities and progress since previous year involving UK personnel/infrastructure 	 AntClim21 ended during 2020. However, some final points to note: Since the last UKNCAR meeting, the three publications that were planned at the final workshop¹ have now been published (see below). They have been cited in drafts of the IPCC AR6 report, although this will only be confirmed once the final version of the report is published. AntClim21 contributed to recent papers from the Ice Sheet Model Intercomparison Projection (ISMIP), for which advice/input was provided in the use of climate model data ice sheet model simulations of future climate change (see publications list). A final presentation was given at the online version of the SCAR Hobart conference in summer 2020. ¹The CMIP6/IPCC AR6 workshop was held at BAS 26-28th June 2019 The papers are:
 Major future initiatives and actions involving UK personnel/infrastructure 	 AntClim21 will end in summer 2020. Key current activities are preparations for finalisation activities at the conference, including a summary report of achievements of the 8-year programme, organising science session at the SCAR Open Science Conference (OSC), and a final plenary overview presentation also as part of the OSC.
Policy outcomes	Citation of AntClim21 papers in draft versions of the IPCC AR6 report – awaiting final published version for confirmation. Use of AntClim21 expertise in developing scenarios of atmospheric forcing for ice sheet models in the Ice Sheet Model Intercomparison Project (ISMIP6).
Selected publications	Workshop-related papers
	AntClim21 members or workshop participants are in bold
	Bracegirdle, T. J., C. R. Holmes, J. S. Hosking, G. J.
	<i>Iviarsnall</i> , IVI. Usman, <i>IVI. Patterson</i> , I. Rackow.
	Extratronical Atmospheric Circulation in CMIP6 Compared

UKNCAR Report on SCAR SRP Antarctic Climate Change in the 21st Century (AntClim21)

	to CMIP5. Earth and Space Science, 7. 12 pp. doi: 10.1029/2019EA001065
	<i>Bracegirdle, Thomas J.</i> , Gerhard Krinner, Marcos Tonelli, F. Alexander Haumann, <i>Kaitlin A. Naughten</i> , Thomas Rackow, Lettie Roach, Ilana Wainer. Twenty first century changes in Antarctic and Southern Ocean surface climate in CMIP6, Atmospheric Science Letters. 21. doi: 10.1002/asl.984.
	Roach, Lettie A., Jakob Dorr, <i>Caroline R</i> . Holmes, Francois Massonnet, <i>Edward W. Blockley</i> , Dirk Notz, Thomas Rackow, Marilyn N. Raphael, Siobhan O'Farrell, David A. Bailey, Cecilia M. Bitz. Antarctic Sea Ice in CMIP6, GRL, 47. doi: 10.1029/2019GL086729
	ISMIP6 – related papers: Barthel, Alice, Agosta, Cécile, Little, Christopher M., Hattermann, Tore, Jourdain, Nicolas C., Goelzer, Heiko, Nowicki, Sophie, Seroussi, Helene, Straneo, Fiammetta, Bracegirdle, Thomas J. (2020) CMIP5 model selection for ISMIP6 ice sheet model forcing: Greenland and Antarctica. The Cryosphere, 14. 855-879. 10.5194/tc-14-855-2020
	Nowicki, Sophie, Goelzer, Heiko, Seroussi, Hélène, Payne, Anthony J., Lipscomb, William H., Abe-Ouchi, Ayako, Agosta, Cécile, Alexander, Patrick, Asay-Davis, Xylar S., Barthel, Alice, Bracegirdle, Thomas J. , Cullather, Richard, Felikson, Denis, Fettweis, Xavier, Gregory, Jonathan M., Hattermann, Tore, Jourdain, Nicolas C., Kuipers Munneke, Peter, Larour, Eric, Little, Christopher M., Morlighem, Mathieu, Nias, Isabel, Shepherd, Andrew, Simon, Erika, Slater, Donald, Smith, Robin S., Straneo, Fiammetta, Trusel, Luke D., van den Broeke, Michiel R., van de Wal, Roderik. (2020) Experimental protocol for sea level projections from ISMIP6 stand-alone ice sheet models. The Cryosphere, 14. 2331-2368. 10.5194/tc-14-2331-2020
	Payne et al., 2021. Future sea level change under CMIP5 and CMIP6 scenarios from the Greenland and Antarctic ice sheets. Geophysical Research Letters. 10.1029/2020GL091741
Funding awards	None
 Points for discussion at UKNCAR meeting 	UK involvement in climate-related SCAR SRPs has continued with the new AntClimNow SRP.

UKNCAR Reporting Template AntEco

1.	Principal UK Researchers	Huw Griffiths, Pete Convey, Dom Hodgson
2.	Major activities and	Significant numbers of publications.
	progress since previous	Successful ending of the AntEco Programme – presentation
	year involving UK	to SCAR Online 2020 and the 2021 SCAR Delegates
	personnel/infrastructure	meeting.
3.	Major future initiatives	None – ended in 2021
	and actions involving UK	
	personnel/infrastructure	
4.	Policy outcomes	-
5.	Selected publications	
6.	Funding awards	Cancelled due to Pandemic
7.	Points for discussion at	Should Huw Griffiths step down from UKNCAR now that
	UKNCAR meeting	this programme has ended?

UKNCAR Reporting Template - SERCE

1	Dringinal LIK Decearchers	Rinna Whitehouse (Joint Chief Officer)
т.	Principal OK Researchers	Alika Bantlay (Staaring Committee Mamber)
		Mike Bentley (Steering Committee Member)
		Alex Burton-Jonnson (Geothermal Heat Flow lead)
2.	Major activities and progress since previous year involving UK personnel/infrastructure	Over the last year, SERCE-related thematic sessions or side meetings have taken place at EGU (2020 and 2021), AGU 2020, and SCAR OSC 2020. An overview of all activities and achievements during the lifetime of SERCE was presented during the SRP session of SCAR OSC 2020.
		Successful 2020-21 field season for NERC-funded project that uses GPS to measure bedrock deformation in response to ice sheet change: 5 sites upgraded to state-of-the-art equipment and an additional 4 sites serviced. Fieldwork made possible because instrument maintenance is carried out by BAS engineers rather than the scientific team – thank you to BAS for facilitating this work. 23 instruments transmit data automatically via iridium to an open access repository, benefitting research into ice sheet-solid Earth interactions across the international research community. Project has taken on instruments that were previously deployed under US and Australian programs, and considerable international collaboration still exists in association with running this GPS network.
		Final SERCE report submitted December 2020 highlighting: scientific advances since 2012, the benefit to the scientific community from collaboration and training opportunities created by SERCE, and recommendations for future research priorities in this area. We also acknowledged the substantial contribution from partner organisations who made it possible to host SERCE-facing workshops and training schools, and the excellent support from SCAR Secretariat throughout the duration of SERCE. SERCE activities will cease in 2021, following the agreed carry-over of 2020 funds to 2021. Final planned activities are reported below. SERCE leadership has played a key role in developing the new INSTANT SRP and SERCE-facing activities are well represented within this new program, as reported

3.	Major future initiatives and actions involving UK personnel/infrastructure	A joint SERCE-PALSEA workshop: 'Improving understanding of ice sheet and solid earth processes driving paleo sea level change' is due to be held in New York in September 2021 (<u>https://palseagroup.weebly.com/</u>). SERCE has contributed US\$10k in travel funds for early career researchers/researchers from countries with emerging Antarctic programs. We anticipate a strong UK presence at the workshop. Ongoing work is being undertaken within SERCE to identify the scientific beneficiaries and potential future of the internationally supported, Antarctic-wide GPS network, which measures the solid Earth response to cryospheric change. All instruments are deployed on a time-limited basis via national funding programs. Around a quarter of the instruments are NERC-funded UK infrastructure.
4.	Policy outcomes	n/a
5.	Selected publications	n/a
6.	Funding awards	n/a
7.	Points for discussion at UKNCAR meeting	SERCE activities will cease in 2021; presumably there is no requirement for representation from this SRP in future UKNCAR meetings?

SCAR Science Research Programme (SRP):

Ant-ICON: Integrated Science to Inform Antarctic and Southern Ocean Conservation

https://www.scar.org/science/ant-icon/home/

The Ant-ICON Scientific Research Programme aims to answer fundamental science questions (as identified by the SCAR Horizon Scan and emerging issues), relating to the conservation and management of Antarctica and the Southern Ocean. It will focus on research to drive and inform international decision-making and policy change.

While there is a strong biological focus for much of the research, this SRP will integrate research from multiple disciplines, complement existing SCAR activities and work with feedback from policy bodies to achieve conservation outcomes and improve environmental management in Antarctica, the Southern Ocean and the sub-Antarctic.

The programme will focus on three research theme:

- i. Current state and future projections of Antarctic systems, species and functions,
- ii. Sustainability and impact mitigation of human activities in the Antarctic region and
- iii. Socio-ecological approaches to Antarctic and Southern Ocean conservation,

It will also include a synthesis theme (Science synthesis for decision-making and policy development) to help facilitate the transition from scientific results to policy change.

1.	Principal UK Researchers	Dr. Kevin A. Hughes, British Antarctic Survey (Leader Research Theme 2: Sustainability and impact mitigation of
		human activities in the Antarctic region
		Dr. Adrian Howkins, Bristol University (Leader Research
		Theme 3: Socio-ecological approaches to Antarctic and
		Southern Ocean conservation)
2.	Major activities and	Ant-ICON was only established formally at the last SCAR
	progress since previous	Delegates meeting in March.
	year involving UK	
	personnel/infrastructure	
3.	Major future initiatives	The Ant-ICON SRP is still at the planning stage, but future
	and actions involving UK	deliverables and milestones are set out in Figure 1 (see
	personnel/infrastructure	below). The next deliverable is a virtual community
		engagement exercise on 12 May 2021.
4.	Policy outcomes	Close interaction between Ant-ICON, the Standing
		Committee on the Antarctic Treaty System and the SCAR
		Environments Portal will be developed. Links will be
		developed with the Committee for Environmental
		Protection (CEP) and Convention on the Conservation of

		Antarctic Marine Living Resources (CCAMLR) to facilitate provision of best available science to inform policy decision-making.
5.	Selected publications	Remedios-De León, Mónica, Hughes, Kevin A. , Morelli, Enrique, Convey, Peter . (2021) <u>International response</u> <u>under the Antarctic Treaty System to the establishment of</u> <u>a non-native fly in Antarctica.</u> <i>Environmental Management</i> . 10.1007/s00267-021-01464-z
6.	Funding awards	-
7.	Points for discussion at UKNCAR meeting	How can we facilitate greater UK involvement between Ant-ICON



Figure 1. Deliverables and milestone for the Ant-ICON SCAR science research programme

UKNCAR report on the SCAR Scientific Research Programme Near-term Variability and Prediction of the Antarctic Climate System (AntClimNow)



•	Principal UK Researchers	Tom Bracegirdle, co-chair Rachel Cavanagh (BAS), Steering Committee member Liz Thomas (BAS), Steering Committee member
•	Major activities and progress since previous year involving UK personnel/infrastructure	 AntClimNow has now been approved as Scientific Research Programme (SRP) and officially started at the beginning of 2021. Key activities have been: Formation of a Scientific Steering Committee, which has been approved by SCAR. Setting up a website and social media accounts. An early-career researcher competition to design a logo for the project (see above!) Monthly science talks within the Steering Committee to facilitate cohesion and collaboration; these may be extended to the wider membership in due course. A kick-off members' workshop on 7th and 8th June. A wider community launch event on 9th June (UTC).
•	Major future initiatives and actions involving UK personnel/infrastructure	None at present
•	Policy outcomes	None at present
•	Selected publications	None yet
•	Funding awards	Non yet
•	Points for discussion at UKNCAR meeting	• No specific points for discussion at this stage.

UKNCAR Reporting Template - IPICS

1.	Principal UK Researchers	Robert Mulvaney, Eric Wolff and Liz Thomas are all on the									
		IPICS Steering Committee. Mulvaney is the national									
		representative for the UK. Thomas is a specialist									
		representing the 2k project, while Wolff as past chair									
		represents oldest ice. Other scientists from BAS and a									
		number of universities are involved in IPICS activities.									
2.	Major activities and	The European Beyond EPICA (oldest ice) project has of									
	progress since previous	course been delayed by the pandemic. Site maintenance									
	year involving UK	and cargo placement was achieved last season, and drilling									
	personnel/infrastructure	of the pilot hole and placement of the casing will happen									
		next season. Drilling should be completed in early 2024.									
		Mulvaney and Wolff are on the SC for the project, which is									
		coordinated from Italy.									
		Analysis is largely complete for the bedrock ice core drilled									
		on Skytrain Ice Rise in 2018/19, and an age model is under									
		construction. This work should make a major contribution									
		to the IPICS Last Interglacial project. Other UK field, lab and									
		modelling work is contributing to all IPICS priority projects.									
3.	Major future initiatives	BAS (Liz Thomas) has collaboration with India and Norway									
	and actions involving UK	for 500 m core (based out of Maitri): geophysics now									
	personnel/infrastructure	planned for 2022, 2 years to 500 m.									
4.	Policy outcomes	-									
5.	Selected publications	Bauska, T. K., S. A. Marcott, and E. J. Brook (2021), Abrupt changes in the global carbon cycle during the last glacial period, Nature Geoscience, 14(2), 91-96, doi:10.1038/s41561-020-00680-2.									
		Thomas, E. R., G. Gacitua, J. B. Pedro, A. C. F. King, B. Markle, M. Potocki, and D. E. Moser (2021), Physical properties of shallow ice cores from Antarctic and sub-Antarctic islands, Cryosphere, 15(2), 1173-1186, doi:10.5194/tc-15-1173-2021.									
6.	Funding awards	BAS is one of the partners in the EU Research Training									
		Network, DEEPICE, which will provide 15 studentships									
		across Europe.									
7.	Points for discussion at	IPICS Open Science Meeting originally to be held in Crans									
	UKNCAR meeting	Montana (Switzerland) in October 2020, then scheduled									
	-	for October 2021, will now take place in October 2022.									

UKNCAR Reporting Template - OpMet

1.	Principal UK Researchers	Steve Colwell						
2.	Major activities and	Several members of the group (including myself) were						
	progress since previous	involved in a scoping workshop for the Antarctic Regional						
	year involving UK	Climate Centre (RCC) in Bologna in October 2019. A						
	personnel/infrastructure	concept paper has since been written and this has been						
		approved by the World Meteorological Organisation						
		(WMO).						
3.	Major future initiatives	Now that the concept paper for the Antarctic RCC has been						
	and actions involving UK	approved by WMO an implementation workshop is being						
	personnel/infrastructure	planned for later in 2021.						
4.	Policy outcomes							
5.	Selected publications	Several members of the group (including myself) were						
		involved in writing the Antarctic section of the BAMS						
		annual state of the climate for 2020.						
6.	Funding awards							
7.	Points for discussion at							
	UKNCAR meeting							

UKNCAR Reporting Template 2021 - SCAGI

1.	Principal UK Researchers	1) Dr Adrian Fox, BAS.								
	·	Co-Chief Officer, SCAR Standing Committee on Antarctic								
		Geographic Information (SCAGI).								
		2) Louise Ireland, BAS. UK representative to SCAGI.								
2.	Major activities and	1) SCAGI meetings and UK representation: Two meetings were								
	progress since previous	held online on 29 and 31 July 2020 to replace the covid-								
	vear involving UK	cancelled meeting in Hobart. The meetings were chaired by A.								
	nersonnel/infrastructure	Fox and had 23 attendees and 12 National Reports were								
	personnely infrastructure	presented.								
		A. Fox and J-Y Pirlot (Belgian National Mapping Agency) stood								
		down as co-Chief Officers at the meeting after two terms in the								
		role and were replaced by Paul Morin (US Polar Geospatial								
		Center) and Prof Li Fei, (Wuhan University, China).								
		Louise Ireland (BAS) is the new UK representative to SCAGI.								
		2) <u>Antarctic Digital Database (ADD)</u> : There have been two update releases of the ADD in the past year; v7.3 in November 2020 and most recently, v7.4 in May 2021. The major aspects of both releases were ongoing improvements to the datasets included in the ADD. v7.3 in particular included a new contour dataset derived primarily using elevation data from REMA (Reference Elevation Mosaic of Antarctica), as well as updates and improvements to the coastline data. v7.4 included updates to coastline and ice shelves between Gipps Ice Rise and Ronne Ice Shelf, updated ice shelf fronts for Brunt, Stange and West ice shelves, Pine Island Glacier, and an updated coastline for Adelaide Island. A new hillshade was published to the ADD viewer as part of ongoing improvements to the data visualisation.								
		3) <u>SCAR Air Operations Planning Maps Series</u> : This is a series of maps designed for planning and situational awareness for Antarctic Air Operations. There is an overview map and 16 maps at 1:1M scale, produced as a collaboration between UK, Norway, Belgium and the US. The UK is responsible for Sheets 1-7 and the overview map. Following the major update in 2019 and the minimal level of Air Operations activity in 2020-21, there was no 2020 issue of the maps. However, a key new development is that Australian Antarctic Division have confirmed that they will produce Air Ops Planning maps for the un-mapped sector between 30°E and 150°E to complete continental coverage.								
		4) <u>SCAR place names</u> : the SCAGI WG on place-names finalised the document <i>'International Principles and Procedures for</i> <i>Antarctic Place Names'</i> . A. Fox (who is also Secretary of the UK Antarctic Place-names Committee) contributed to this review of place-names guidelines. The new Chair of the place-names WG								

		Ursula Harris (AAD) will now seek ratification of the document at
		the SCAR level.
3.	Major future initiatives	A virtual SCAGI meeting is to be confirmed for this summer.
	and actions involving UK	
	personnel/infrastructure	
4.	Policy outcomes	
5.	Selected publications	SCAR Air Operations Planning Maps Series.
		V7.4 of SCAR Antarctic Digital Database.
		https://www.add.scar.org/
6.	Funding awards	
7.	Points for discussion at	
	UKNCAR meeting	

UKNCAR Report: SCAR Action Group, AntArchitecture

1.	Principal UK Researchers	Robert Bingham (University of Edinburgh; steering committee chair); Neil Ross (Newcastle University; steering commitee); David Ashmore (University of Liverpool); Tom Jordan (British Antarctic Survey); Carlos Martin (British Antarctic Survey); Kate Winter (Northumbria University); Martin Siegert (Imperial College); Julian Dowdeswell (University of Cambridge); Julien Bodart (PhD student, University of Edinburgh); Rebecca Sanderson (PhD student, Newcastle University)						
2.	Major activities and progress since previous year involving UK personnel/infrastructure	This SCAR Action Group was established in 2018 with the basic remit of developing a continent-wide, age-depth model of Antarctica's ice using the internal layers and surfaces (<u>Antarctica's internal "Architecture</u> ") imaged by multiple radar- sounding surveys undertaken across Antarctica over the last five decades. Alongside the UK representatives and members listed above, the full steering committee and core members includes around 40 scientists spread globally.						
		Thanks to SCAR support, a website and mailing list were established, and the website in particular provides much information beyond this short report: <u>https://www.scar.org/science/antarchitecture/home/</u>						
		The following details progress against the four-year plan established in summer 2018:						
		Starting activities: Bring together Antarctic radar data providers compile a list of the main users and applications of Antarctic radar data; identify the wider possibilities by integrating with ice-sheet modellers, members of IPICS, and other relevant science groups as may be identified.						
		• Dedicated AntArchitecture workshops were held at the 2018 SCAR meeting in Davos, and 2019 International Glaciological Society meeting in Stanford, USA. These meetings have been successful in momentum building amongst the Antarctic radar-sounding community and some ice-sheet modellers, but future efforts need to engage more with the palaeoclimate community. The list of users/applications has been compiled for incorporation into the next objective.						
		Years 1-2 (2018-20): Identify with numerical modellers the data formats required to drive models. Identify best format and practices for lodging and sharing data on radar-imaged internal architecture. Converge on standards for metadata and data formats, and nomenclature. Undertake radar-system intercomparison exercises where overlapping areas have been surveyed with different instruments. Develop a document outlining the optimised processing flow for internal layering analysis of different datasets, which will also guide future data collection.						

	Milestone at end of Year 2: Produce a white paper, intended for submission to a relevant interdisciplinary, peer-reviewed journal, e.g. Global and Planetary Change, Climate of the Past, Frontiers of Earth Sciences, outlining the need for an Antarctic radar-layers database, the potential applications, and methods for achieving it. Activities in the bullet points above will underpin this activity.
	• Many of the datasets and passages of writing were prepared and on track for assembly into the white paper as the pandemic struck. A writing workshop to finalise the paper planned for April 2020 was cancelled, and the paper has been awaiting resumption since then while the lead author (Bingham) has been sidelined with childcare and enhanced institutional responsibilities during the pandemic. Now hoping for finalisation and submission in late summer 2021, one year behind schedule.
	Years 3-4 (2020-21): Compile the first pan-Antarctic database of ice-sheet stratigraphy from radar internal architecture, in a form suitable for informing numerical models, and informed by ice-core age-depth profiles.
	• Steady progress being made, exemplified by some publications listed in section 5.
	Milestone at end of Year 4: Publication of an online dataset and paper reporting the 3D internal architecture of the Antarctic Ice Sheet. In progress.
3. Major future initiatives and actions involving UK personnel/infrastructure	Future plans reported in section above. No infrastructure required. Good opportunities for some future PhD projects in UK institutions, potentially grant/PDRA opportunities.
4. Policy outcomes	Not at that stage.
5. Selected publications	 Ashmore, D.W.; R.G. Bingham, N. Ross, M.J. Siegert, T.A. Jordan and D.W.F. Mair (2020) Englacial architecture and age-depth constraints across the West Antarctic Ice Sheet. Geophysical Research Letters, 47, e2019GL086663. Bodart, J.A.; R.G. Bingham, D.W. Ashmore, N.B. Karlsson, A.S. Hein and D.G. Vaughan (2021) Age-depth stratigraphy of Pine Island Glacier inferred from airborne radar and ice-core chronology. Journal of Geophysical Research, 126, e2020JF005927. Delf, R.J.; D.M. Schroeder, A. Curtis, A. Giannopoulos and R.G. Bingham (2020) A comparison of automated approaches to extracting englacial-layer geometry from radar data across iso shoets. Annals of Glaciology, 61, 221, 241
	Ross, N.; H. Corr and M. Siegert (2020) Large-scale englacial folding and deep-ice stratigraphy within the West Antarctic
6 Funding awards	None vet, attempts pending publication of white paper
7. Points for discussion at	Nothing special this year; this report is just to raise awareness.
UKNCAR meeting	

SCAR Expert Group on Geological Heritage and Geoconservation https://www.scar.org/science/geoconservation/home/

1.	Principal UK Researchers	Dr. Kevin A. Hughes (Secretary)										
		Prof. Jane Francis										
		Prof. John Smellie										
		Prof. Mike Bentley										
		Dr. Alistair Crame										
2.	Major activities and progress since previous year involving UK personnel/infrastructure	During the SCAR Delegates meeting in March 2021, the Action Group was converted to a SCAR Expert Group. A workshop was held at BAS, Cambridge, in March 2020 to identify outstanding geological sites (geosites) representing the Geological Framework 'Cretaceous-Paleogene (K-Pg) transition'. The result was the selection of one specific sector of Seymour (Marambio) Island, north-eastern Antarctic Peninsula. Here, uninterrupted deposition across the K-Pg boundary reveals major declines in species diversity following the asteroid impact. Crucially, the location contains fossil evidence that the extinction at high										
		location contains fossil evidence that the extinction at high latitudes was just as extensive as in lower latitude sites closer to the impact site, and that the effects of the event were truly global. The general lack of surface cover and permanent ice/snow mean little of the sequence is obscured across the 7 km-long exposure of the K-Pg boundary, making it an exceptional site for research.										
3.	Major future initiatives	During the next year, circumstances permitting, the group										
	and actions involving UK	hopes to progress with the identification of Geosites for										
	personnel/infrastructure	another Geological Framework.										
4.	Policy outcomes	 Two Working Papers, drafted by the Group, have been submitted by SCAR to the Antarctic Treaty's Committee for Environmental Protection in June 2020: 1. A methodology for selection of Geological Frameworks and Geosites. 2. A SCAR environmental code of conduct for geoscience field researchers in Antarctica. 										
		A list of national repositories for Antarctic geological specimens was produced. See: <u>https://scar.org/library/science-4/geosciences/5595-list-</u> of-national-geosciences-repositories/file/										
5.	Selected publications	Hughes, Kevin A., Carcavilla, Luis, Crame, Alistair, Díaz-										
		Martínez, Enrique, Elliot, David, Francis, Jane , López-										
		Martínez, Jerónimo, Reguero, Marcelo. (2020) <u>Seymour</u>										

	(Marambio) Island: an outstanding example of Antarctic geological heritage. Antarctic Science, 32. 167-167. 10.1017/S0954102020000267
6. Funding awards	
7. Points for discussion at	
UKNCAR meeting	

UKNCAR Reporting Template

1.	Principal UK Researchers	UK Polar Network								
2.	Major activities and	Polar Early Career Conference (5-6 May 2021):								
	progress since previous	O Polar ECC is a United Nations Ocean Decade								
	year involving UK	endorsed activity. The conference was co-organised								
	personnel/infrastructure	by the UKPN and the Changing Arctic Ocean								
		programme and led entirely by the ECRs. The two								
		days of the conference included scientific talks								
		days of the conference included scientific tarks,								
		poster sessions, employability workshops, and panel								
		discussions.								
		Cardiff Science Festival (18-21 February 2021):								
		O UKPN Festivals organisers, as well as a team of volunteers, organised a series of online events ranging from origami sessions to careers panel								
		sessions for the Cardiff Science Festival 2021.								
		O UKPN Festivals organisers Chloe Nunn and Eva								
		Prendergast made an appearance on BBC Radio								
		Wales in order to advertise these sessions								
		UK-Russia Arctic Science Priorities Conference (18-19 February 2021):								
		• This was a two-day event with invited speakers and								
		presentations from a wide variety of disciplines.								
		• This event will likely be run again next year.								
		Other conferences/Networking Events (online)								
		• The UKPN also had a primary role in the organisation								
		of the UK Antarctic Science Conference 2021 (22-25								
		March 2021), as well as organising social events and								
		a careers panel session for early career scientists.								
		o Polar Horizons 2021 - Several UKPN members								
		attended and/or presented at the UK Polar Horizons								
		Initiative, hosted by BAS.								
		Fruelity, Discovity, and Inclusion								
		Equality, Diversity, and Inclusion:								
		• An accessibility document has been created for								
		during the Polar Early Carpor Conferences								
		O Polar Pride Day being planned in collaboration with								
		other ADECS committees								
		other Ar Les committees.								
		Outreach Activities:								

	• The Antarctic Flags project received almost 200 flags in the 2020-2021 season, which were sent South with researchers/technicians and have now been returned to their respective schools. This was an incredibly successful year for Antarctic Flags considering the limitations imposed by the global pandemic.
	 Current social media reach: 5546 followers Twitter; 766 followers Instagram; 910 followers Facebook. We continue posting regular updates, relevant news, and social media campaigns on all our platforms.
3. Major future initiatives	
and actions involving UK	
personnel/infrastructure	
4. Policy outcomes	
5. Selected publications	
6. Funding awards	
7. Points for discussion at	
UKNCAR meeting	

Report from UK Polar Data Centre (PDC) for UKNCAR 7/06/2021

The UK Polar Data Centre (PDC) is the UK's National Antarctic Data Centre. It provides a secure longterm repository for polar and cryospheric data. Data are made available, normally using the UK Open Government Licence (<u>http://www.nationalarchives.gov.uk/doc/open-government-</u> <u>licence/version/3/</u>), and can be provided with a DOI to allow proper citation of the data. It forms part of NERC's Environmental Data Service which is commissioned on a five year basis with current funding running from 2018-2023. The PDC has recently been certified by the <u>CoreTrustSeal</u>. This is an internationally recognised certification scheme for data repositories that signifies a repository is sustainable and trustworthy, following best practices to manage the data it holds.

SCADM

The Standing Committee for Antarctic Data Management has monthly video calls which are attended by Helen Peat. The annual UK report to SCADM was presented in October. The terms of reference for SCADM can be found in Appendix A. One of its primary aims is to support National Antarctic Data Centres in making Antarctic data FAIR (Findable, Accessible, Interoperable and Reusable). Finding data is facilitated by the Antarctic Master Directory which is a metadata catalogue provided by NASA's Global Change Master Directory.

SCADM is keen to work more with SCAR's research programmes and can provide data management advice, particularly when the research programme includes development of a data product. You can get in touch with Helen Peat (hjpe@bas.ac.uk) or the SCADM Chief Officer, currently Johnathan Kool at AADC, if you would like to find out more.

SCADM has been working with other polar data communities such as the Arctic Data Committee to hold bimonthly 'hackathons'. Each session has three breakout groups – one focusing on policy, one on federated search (how to easily search multiple data catalogues to find polar data) and one on vocabularies and semantics. The policy group focused its work on the alignment of polar data policies. It has drafted a list of core principles that all polar data policies should include which are shown in Appendix B. These principles have been circulated to SCAR delegates and will be used to update the SCAR data policy in the coming year. The PDC has provided input into the policy document and the work of the federated search and semantics groups.

SOOS

A member of the PDC, Petra ten Hoopen is co-chair of the data management subcommittee of the Southern Ocean Observing System (SOOS).

Contribution to relevant international data collaborations

The PDC is contributing to the International Bathymetry Chart of the Southern ocean (IBCSO) data compilation. This project aims to design and implement an enhanced digital database that contains bathymetric data available south of 50°S latitude. PDC has provided multibeam data from 100 UK cruises for this new version. As a comparison, the first version included data from 30 UK cruises.

The PDC is also contributing to the SCAR BEDMAP3 project that aims at producing a new dataset of Antarctic ice thickness and bed topography for the international glaciology and geophysical community. At the PDC, we are checking the data, standardising them to CSV format and providing polyline and point shapefiles for the online web browser.

Data from the SCAR Biological Investigations of Marine Antarctic Systems and Stocks (BIOMASS) programme of the 1980s have been made available: <u>https://doi.org/10/d9n3</u>.

Helen Peat 12/05/2021

Appendix A: The Terms of Reference¹ for SCADM are to:

- 1. Promote long-term preservation and accessibility of data relating to Antarctica and the Southern Ocean in sustainable repositories.
- 2. Assist in establishing and implementing Antarctic data management policies, priorities and best practices, taking into account and contributing to global best practices.
- 3. Promote a distributed, interoperable network of accredited National Antarctic Data Centres (NADCs), in accordance with ATCM XXII Resolution 4.1 (1998)².
- Encourage and enable the community to make data Findable, Accessible, Interoperable, and Re-usable according to the FAIR Principles³ by submission of metadata and data to the Antarctic Data Management System (ADMS).
- 5. Further develop, design, implement, and improve the ADMS a system that encompasses the Antarctic Master Directory (AMD), NADCs, other interoperable, networked data repositories, and key data discovery tools.
- 6. Provide linkages and improve interoperability with other relevant data management systems, initiatives, and repositories; and thereby enhance the accessibility of data relating to Antarctica and the Southern Ocean.
- 7. Provide guidance to the AMD host.
- 8. Work with other SCAR groups, Council of Managers of National Antarctic Programs, Committee for Environmental Protection, Commission for the Conservation of Antarctic Marine Living Resources, the Antarctic Treaty Secretariat, and other relevant groups to identify, develop, and publish fundamental datasets of value to the Antarctic Community.

¹ The procedural parts of SCADM's mandate are covered in SCAR's "Rules of Procedure for Subsidiary Bodies", see https://scar.org/scar-library/search/governance/780-rules-of-proc-subsidbodies-aug10/

² http://www.ats.aq/devAS/info measures listitem.aspx?lang=e&id=258

³ <u>https://www.force11.org/group/fairgroup/fairprinciples</u>

Appendix B: Recommended core principles for all polar data policies

These principles have been developed in collaboration involving SCADM, the Arctic Data Committee and the SOOS data management committee

Scientific advancement depends on cooperation among researchers, policy makers, government, rights holders, residents, and other members of the public, crossing scientific disciplines and national boundaries. International data policies should serve to facilitate such collaboration. The following sections present a set of fundamental principles that are widely acknowledged in global and regional data policies, which we believe should form the core of polar data policies as well. This set of agreed principles is aimed to provide a foundation for an aligned view of how polar data and information should be curated, managed, and delivered. We have worded the principles in a way that should be suitable for direct inclusion in formal, polar data policy documents, with only minor modifications dependent on local context (such as the exclusion of the reference to the Antarctic Treaty in Arctic documents).

Members of the Arctic, Antarctic, and Southern Ocean science communities work in nations, institutions, and disciplines that have varied laws and research policies. Data centres, funding agencies, and research institutions are encouraged to develop more specific policies and procedures to implement the policy elements contained in this document in a manner that aligns appropriately with more local policy and legal requirements.

<Data must be ethically open>

Data from publicly funded research should be open by design and by default in order to release their full potential as a primary resource for knowledge discovery. Full, free, and open access for all users should be the norm unless there are valid reasons for restricted access. For Antarctic research data, this is also a requirement of the Antarctic Treaty. This principle may be referred to as "as open as possible, as closed as necessary" or as ethically open data.

ICSU (2004) defines "Full and open access" as equitable, non-discriminatory access to all data. Open data as a concept is generally understood to denote data in an open, platform-independent format that can be freely used, re-used and shared by anyone for any purpose.

It is generally recognised that sharing and use of some data must remain partially or completely limited for ethical, cultural or legal reasons (IPY 2006, IASC 2013, CARE 2019). Valid reasons for such limitations may relate to privacy where human subjects are involved, safety, security, environment protection, and other ethical considerations, including protection of the rights of indigenous peoples. However, it is emphasised that data should not be labelled as sensitive or restricted without proper justification.

<Data should be free>

The distribution and reuse of research data should be free of charge, and delivered at no more than the cost of reproduction and delivery. With modern digital communication technologies the distribution costs for modest data volumes have largely been eliminated, and typically do not justify any cost recovery on the distributor side. The costs of open data processes should be regarded as an intrinsic part of the cost of doing the research, and thus funded as such.

However, the handling of large data volumes ('big data') may incur significant costs, primarily due to bandwidth requirements. Where such usage-dependent costs cannot reasonably be funded as part of the original research activity or the operating budget of the data centre, or avoided by performing the data analyses without moving the data, some cost recovery may be justified even under a free and open access data policy.

<Data must be provided in a timely manner>

To facilitate reuse of data while they are most valuable, all research data should be made available as soon as possible after their collection and if possible near real-time. Some latency may be required for data processing, quality control, compilation of well-documented and FAIR data products, and, in some disciplines, formal peer review of initial scientific findings.

Some data policies allow researchers a certain period of privileged use to facilitate publication and recognition, through an embargo on data publication. Such data embargoes should be applied only for good cause and for the shortest time feasible to allow for good data processing practices and to respect the scientific endeavours of data creators. When embargoes are considered, it is important to evaluate the broader benefits of immediate release, and to consider the negative effects of embargoes on scientific productivity. A maximum embargo limit should be stipulated, and embargoed data should include a date for review of their embargoed status, along with documented reasons for the embargoed status.

<FAIR Principles should be applied to the greatest extent practicable>

To ensure the efficient and effective uptake of data, the <u>FAIR principles</u> (Wilkinson et al. 2016) must be followed to the greatest extent practicable and ethical ("FAIR as far as possible"). The FAIR principles assert that data collections should be Findable, Accessible, Interoperable, and Reusable. These principles depend on community-agreed formats, languages, and vocabularies for both data and metadata.

The FAIR principles involve technical requirements that may be costly to implement. For this reason it is unrealistic to make all data fully FAIR, especially if we consider "the long tail" of research data.

When unrestricted open access is unethical or otherwise inappropriate the FAIR principles envisage creation of different user roles and mechanisms for user verification to provide controlled access.

The FAIR principles put specific emphasis on enhancing the ability of machines to automatically find and use the data. However, the principles also represent best practices for data management and can be implemented along a continuum from unstructured, undocumented data to fully FAIR data. Findability and online data accessibility should be regarded as universal requirements. Some FAIR elements are important also when considering data reusability in general, and will be reiterated in the following as universally important requirements for the long-term management of research data.

<All data must be accompanied by a complete set of metadata>

Structured, standardised metadata are essential to the discovery, access, and effective reuse of data, allowing users to assess the quality of the data and any processing that has been applied to it. All data must be accompanied by a full set of metadata that appropriately documents and describes the data. Metadata elements should provide a clear description of the data; their provenance, the data structure; calibrations; and methods, including units, associated errors, or other limitations where possible. Shareable metadata, with sensitive details obscured or generalised, must always be available, even when the data themselves cannot be made publicly available for ethical or practical reasons.

More specific metadata requirements are included in the FAIR principles.

<Data should have persistent and globally unique identifiers>

Persistent and globally unique identifiers (PIDs) should be used for all data and remain linked to the data through republication or data aggregation processes. Unequivocal dataset identification is key to long-term data preservation, identification, attribution, data citation, provenance tracking, linking research data with scientific results, and tracking of the distribution and impact of data collections. For data and research products this includes the use of Digital Object Identifiers (DOIs) and other persistent identifiers that can be applied to both datasets and observations. Other types of PIDs should be considered when helpful in managing the data, such as ORCIDs for researchers.

Further guidance on persistent identifiers is included in the FAIR principles.

<Data must be labelled as reusable>

Open data access and legal interoperability requires that the rights to reuse the data are made clear to the user. For this reason, the rights and obligations of the data originator and the data user should be declared by attaching a rights waiver, a public domain statement, or an internationally recognised data licence to the dataset. This should be a non-restrictive licence specifying that the data may be re-used and specifying no requirement more onerous than an acknowledgement of the data's source, e.g. the Creative Commons open attribution licence (CC-BY). Where possible, the rights waiver or licence should be assigned by the owner or source of the data, and these parties should be identified in accompanying metadata. Failure to label the data as reusable may render the data legally unusable in some jurisdictions.

Further metadata requirements are included in the FAIR principles.

<Data sources should be attributable and attributed>

Data citation is an essential element of good research practice. To recognise the valuable contributions of data providers and to enhance repeatability and transparency of research results, data users must formally acknowledge data authors and sources. In some cases, aggregated datasets may comprise contributions from large numbers of data producers. Data managers should investigate and develop best practice methods for citing such datasets. Where possible, authors should use and cite original data, not subsets or derivatives, to prevent fragmentation of attribution. Best practices for data citation are outlined in the <u>Joint Declaration of Data Citation Principles (JDDCP)</u>.

For data to be easily attributable they must have a persistent and unique identifier. The information attached to the citation and the identifier must allow the provenance of the data to be assessed. Data should be referenced by means of a citation including a permanent digital identifier and should be curated in and accessible from a trusted repository.

<Data must be appropriately preserved for the long term>

Given that the long-term value of data may not be recognised until long after collection, preservation of data to ensure a lasting legacy of research programmes and projects is essential.

Data must be preserved in such a manner that it is resilient to corruption or loss. This requires ensuring that adequate backup procedures are in place, that metadata records are maintained, and that files and formats remain readable and free from damage and degradation over time. Data must be protected against unintentional and unauthorised modifications. The use of open and well-documented formats is strongly encouraged to ensure that data are in a suitable form for long-term curation.

<Data management and long-term curation must be planned and resourced>

Proper planning of data management and long-term curation is an integral part of any scientific endeavour. Projects should develop data management plans in advance of collecting data that outline how any data captured, modelled or acquired will be managed both during the life of the program and beyond. Where possible, data should be deposited for long-term management in repositories that adhere to the <u>TRUST principles</u>.

Funding agencies and science managers must consider the long-term resource required to host and manage data beyond the project lifespan. This will involve consideration of hardware and software costs and the need for staff with specialist skills in data preservation, data curation, providing access to data and increasing interoperability between datasets.

NERC South Proposal Success

50+

Polar South %

	2013		013 2013 Total		14	2014 Total	14 Total 2015		2015 Total	2016		2016 Total	20	17	2017 Total 2		18	2018 Total		19	2019 Total	2020		2020 Total	Grand Total
	N	Y		Ν	Y		Ν	Y		Ν	Y		Ν	Y		Ν	Y		Ν	Y		N	Y		
Fellowship	1	1	2	4		4	7		7	2	2	4	3		3	4		4	7	1	8	7*		7	39
Atmospheric				1		1	2		2				2		2				1		1	1		1	7
Earth																			1		1	3		3	4
Marine	1	1	2	3		3	4		4	1	2	3	1		1	3		3	5		5	2		2	23
Terrestrial							1		1	1		1				1		1		1	1	1		1	5
Large		1	1				2		2	1		1								2	2				6
Atmospheric							1		1																1
Marine		1	1							1		1								2	2				4
Terrestrial							1		1																1
Research Programmes	2	1	3	1		1	1	1	2	3	7	10	1		1	4		4	5	2	7	8**		8	36
Atmospheric	2		2	1		1										1		1		1	1				5
Earth		1	1								2	2				1		1	1		1	2		2	7
Freshwater											1	1										3		3	4
Marine							1	1	2	3	3	6							4	1	5	2		2	15
Terrestrial											1	1	1		1	2		2				1		1	5
Standard RM	15	4	19	39	2	41	25	4	29	16	1	17	9	3	12	14	2	16	11	4	15	16***	2	18	167
Atmospheric	5		5	7		7	5	2	7	3		3	3	1	4	4		4	1		1	1	1	2	33
Earth	4	2	6	9	2	11	2	1	3	2		2	1	1	2	3	1	4	2	1	3	4		4	35
Freshwater				2		2	1		1	1		1		1	1							1		1	6
Marine	6	2	8	17		17	14	1	15	5	1	6	5		5	7	1	8	7	1	8	9		9	76
Terrestrial				4		4	3		3	5		5							1	2	3	1	1	2	17
Grand Total	18	7	25	44	2	46	35	5	40	22	10	32	13	3	16	22	2	24	23	9	32	31	2	33	248

* One propsal in progress

** Four proposals in progress

*** Four proposals in progress

Polar South % Under 50

	20	13	2013 Total	20	14	2014 Total	20	15	2015 Total	20)16	2016 Total	20)17	2017 Total	20)18	2018 Total	20	19	2019 Total	202	0	2020 Total	Grand Total
	Ν	Y		Ν	Y		Ν	Y		Ν	Y		N	Y		Ν	Y		Ν	Y		Ν	Y		
Fellowship	6		6	6	1	7	2	1	3	5	1	6	3	1	4	4	1	5	3		3	1		1	35
Atmospheric	3		3	2		2				1	1	2	1		1	2	1	3	2		2				13
Freshwater													1		1							1		1	2
Marine	3		3	2	1	3	2	1	3	3		3	1	1	2	2		2	1		1				17
Terrestrial				2		2				1		1													3
Large				2	1	3					2	2	1		1										6
Atmospheric				1		1																			1
Marine				1	1	2					2	2	1		1										5
Research Programmes	4	2	6	1	2	3	5	4	9	7	3	10		3	3	4	2	6	3	4	7	7		7	51

Atmospheric	1	2	3	1	1	2	3	3	6		3	3		1	1	1	1	2		1	1	3*	3	21
Earth	2		2				1		1	1		1				1		1		2	2	1	1	8
Freshwater										1		1												1
Marine	1		1		1	1	1	1	2	3		3		2	2	1	1	2	1	1	2	2	2	15
Terrestrial										2		2				1		1	2		2	1	1	6
Standard RM	5	2	9	12	1	13	8	1	9	9	3	12	6	6	12	6	3	9	7		7	6	6	75
Atmospheric	2		2	4		4	4		4	6	1	7	2	2	4	4	1	5	5		5	2	2	33
Earth	2		3	4		4	1	1	2	1		1	2	1	3	1	1	2				1	1	15
Freshwater				1		1											1	1						2
Marine	1	2	4	3	1	4	2		2	2	2	4	2	3	5	1		1	2		2	3	3	24
Terrestrial							1		1															1
Grand Total	15	4	21	21	5	26	15	6	21	21	9	30	10	10	20	14	6	20	13	4	17	14	14	167

* One proposal still in progress

Please note values may differ slightly from 2020 due to exclusion of transfers to prevent double counting of applications. Also some of the major classifications for applications may have changed, due to the fact that a grant may have 2 or more equal classification percentages (e.g. 30% marine and 30% earth, and in last years version it may have come up as marine, whereas this year the application has come up as earth)

NERC South Funding Awarded

50+

Polar South %

	2013	2014	2015	2016	2017	2018	2019	2020	Grand Total
Fellowship	£587,936			£1,143,808			£653,780		£2,385,524
Atmospheric									
Earth									
Marine	£587,936			£1,143,808					£1,731,744
Terrestrial							£653,780		£653,780
Large	£2,845,069						£2,943,870		£5,788,939
Atmospheric									
Marine	£2,845,069						£2,943,870		£5,788,939
Terrestrial									
Research Programmes	£448,005		£99,110	£6,110,638			£3,179,810		£9,837,563
Atmospheric				£459,733			£2,840,469		£3,300,202
Earth	£448,005			£278,337					£726,342
Freshwater				£514,391					£514,391
Marine			£99,110	£4,468,714			£339,341		£4,907,165
Terrestrial				£389,463					£389,463
Standard RM	£2,467,157	£1,005,348	£1,824,797	£298,337	£1,866,729	£1,368,996	£2,113,165	£1,366,141	£12,310,670
Atmospheric			£953,226		£628,390			£701,631	£2,283,247
Earth	£1,191,223	£1,005,348	£291,024		£610,107	£585,987	£625,099		£4,308,788
Freshwater					£628,232				£628,232
Marine	£1,275,934		£580,547	£298,337		£783,009	£458,883		£3,396,710
Terrestrial							£1,029,183	£664,510	£1,693,693
Grand Total	£6,348,167	£1,005,348	£1,923,907	£7,552,783	£1,866,729	£1,368,996	£8,890,625	£1,366,141	£30,322,696

Polar South %

Under 50

	2013	2014	2015	2016	2017	2018	2019	2020	Grand Total
Fellowship		£494,297.00	£153,697.00	£206,806.00	£483,315.00	£567,508.00			£1,905,623.00
Atmospheric				£206,806.00		£567,508.00			£774,314.00

Freshwater								
Marine		£494,297.00	£153,697.00		£483,315.00			£1,131,309.00
Terrestrial								
Large		£2,648,083.00		£5,093,929.00				£7,742,012.00
Atmospheric								
Marine		£2,648,083.00		£5,093,929.00				£7,742,012.00
Research Programmes	£332,032.00	£216,453.00	£16,843,520.00	£2,942,913.00	£278,675.00	£727,806.00	£1,008,912.00	£22,350,311.00
Atmospheric	£332,032.00	£125,347.00	£9,625,768.00	£2,381,551.00	£101,894.00	£403,415.00	£299,658.00	£13,269,665.00
Earth				£561,362.00			£600,956.00	£1,162,318.00
Freshwater								
Marine		£91,106.00	£7,217,752.00		£176,781.00	£324,391.00	£108,298.00	£7,918,328.00
Terrestrial								
Standard RM	£823,943.00	£318,753.00	£411,139.00	£1,319,816.00	£3,164,105.00	£1,896,217.00	£146,306.00	£8,080,279.00
Atmospheric				£403,379.00	£1,157,308.00	£632,736.00	£146,306.00	£2,339,729.00
Earth			£411,139.00		£404,136.00	£650,359.00		£1,465,634.00
Freshwater						£613,122.00		£613,122.00
Marine	£823,943.00	£318,753.00		£916,437.00	£1,602,661.00			£3,661,794.00
Terrestrial								
Grand Total	£1,155,975.00	£3,677,586.00	£17,408,356.00	£9,563,464.00	£3,926,095.00	£3,191,531.00	£1,155,218.00	£40,078,225.00

Please note amount awarde may differ slightly from the information provided in 2020 as a different method of obtaining the 'Amount Awarded' has been used to exclude theoretical award values.