



Paper No: 10 Agenda item: 4.1.3
SCAR SRP INSTANT
Person Responsible: Tim Naish

**XXXVII SCAR Delegates Meeting
India, September 2022**

**INStabilities and Thresholds in
ANTarctica (INSTANT)
2020-22 Report**

Summary

Report Author(s)

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Alex Simms (USA), Co-Leader Theme 2
Andrew Lloyd (USA), Co-Leader Theme 2
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Summary of activities from 2020-22

INStabilities & Thresholds in ANTarctica (INSTANT) strategic research programme addresses - *the question of Antarctica's uncertain contribution to sea-level change*, by using a multidisciplinary Earth systems approach combining geoscience, physical sciences, biological and social sciences to improve understanding of the interactions between the ocean, atmosphere, solid Earth and the Antarctic Ice Sheet (AIS). It aims at ensuring effective communication on this topic with stakeholders. Therefore, it is sponsored by all 3 Science Standing Groups and works closely with SC-ATS and SC-HASS.

To achieve its goals, INSTANT with its internal SCAR and external partners in the World Climate Research Programme (e.g. CLiC¹, CLiVAR²), focuses on the poorly understood processes and feedbacks that influenced ice-sheets in the past, are influencing observed ice sheet changes, and will influence Antarctica's contribution to future global sea-level change. (see Fig. 1). The key outcomes are reconstructions of past and projections of future ice mass changes, with reduced uncertainties due to an improved knowledge of rate-determining instabilities and irreversible thresholds. These are shared with various stakeholder groups. The ice sheet projections are being integrated into probabilistic sea-level projection frameworks for Intergovernmental Panel on Climate Change (IPCC) Assessment Report 6 (AR6) shared socioeconomic pathways (SSPs)

Key contributions of INSTANT are at the interface of science and policy, and involve engagement between earth system scientists, social scientists, practitioners, decision-makers, planners and publics. Stakeholder engagement and science communication plays an important role in this SRP, especially in converting science data into usable climate information that helps understanding of risk and uncertainty. INSTANT is providing scientific

¹ Cryosphere in a Changing Climate core research programme of WCRP

² Climate Variability core research programme of WCRP

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evidence to assess the effectiveness of, and risks associated with, climate change mitigation pathways (e.g., UNFCCC³ Paris Agreement). This evidence is guiding adaptation approaches required to avoid the worst impacts, such as coastal flooding and erosion, groundwater inundation and salinization, habitat loss and large-scale human migration. The impacts of sea-level and ice sheet change around Antarctica are also of critical interest to CCAMLR⁴, COMNAP⁵ and Antarctic Treaty System parties, as they will have profound implications for key Antarctic stakeholder groups including national programme operations, tourism and fisheries.

Following a highly successful online kick off meeting in Feb 2021 (attended by 200 participants), INSTANT has formed and is now up and running. The 3 themes, and 15 subcommittees within, have also held their own virtual kick-off meetings, developed workplans, and have started activities. The steering committee which is made up of representatives of other key SCAR groups and external partners has met 3 times. Our official memberships has reached 300 from 31 countries, with 30% identifying as ECR. Our values of inclusiveness, diversity, and interdisciplinarity are at the forefront of our goal of facilitating excellent and impactful science. Figure 2 highlights a timeline of INSTANT activities over the last 2 years emphasising: (1) internal-operational activities, (2) SCAR internal collaborative activities, (3) external collaborative activities and (4) products and outputs.

Key highlights follow.

- **50X30 Coalition.** INSTANT supported the launch of the 50X30 Coalition (<https://www.50x30.net/launch-event>), which is an alliance between cryosphere and emissions research institutions, and governments that have accepted the scientific necessity to reduce emissions 50% by 2030; in order to prevent cascading and irreversible damage, on a planetary scale, from the impact of greenhouse gas emissions on the cryosphere.
- **WG1 AR6 IPCC.** INSTANT leaders and members co-authored the WG1 AR6 IPCC and had high-profile roles in its release in 2021 and outreach events.
- **COP26 - Glasgow.** INSTANT members, Rob DeConto and Florence Colleoni participated in a "side event" in the Cryosphere Pavilion at COP26 organised by SCAR-ICCI⁶, emphasising the urgency of keeping global warming below 2°C to avoid irreversible meltdown of marine-based AIS and commitment to multi-metre intergenerational, sea-level rise.
- **EOS Article.** INSTANT led the publication of an article in the American Geophysical Union's newsletter EOS, that introduced the programme and its aims and goals to the global climate science community. This article outlines that the key challenge is the "The Uncertain Future of Antarctica's Melting Ice" (Colleoni et al., 2021).
- **INSTANT Fellows.** 5 very talented ECR researchers (Brazil, Sri Lanka, Australia, China, Germany) have been awarded USD \$5K each for projects as the first recipients of INSTANT Fellowships.
- **ACCE Decadal Synopsis.** INSTANT members Tim Naish, Andrew Mackintosh were lead authors on the Antarctic Climate Change and Environment (ACCE) - A Decadal Synopsis and Recommendations for Action, led by Steven Chown. The concept of this product was developed by of Naish and Chown following the Antarctic Parliamentary Assembly held at Whitehall, London, in December 2019, to deliver on SCAR's commitment to the ATCM⁷ to do a 10 year ACCE update. It was very well accepted by the ATPs, in Berlin at the XLIV ATCM and provides an urgent call for action identifying its highest science priority, which is INSTANT's aim.
- **UN Polar Oceans.** INSTANT members invited to present at the United Nations Polar Oceans Conference - Engines to Global Climate - Messages & Messengers, June 2022

³ UNFCCC = United Nations Framework Convention on Climate Change

⁴ CCAMLR = Commission for the Conservation of Antarctic Marine Living Resource

⁵ COMNAP = Council of Managers of National Antarctic Programs

⁶ ICCI = International Cryosphere & Climate Initiative

⁷ ATCM = Antarctic Treaty Consultative Meeting

INSTANT: 2020-22 Report, cont.

- **WCRP Sea Level Meeting.** INSTANT leaders and members attended WCRP sea-level conference in Singapore where the deep uncertainty in future sea-level rise due to Antarctic ice mass loss is one of the biggest concerns to coastal hazards practitioners and decision makers. INSTANT had a high profile. Meeting outcomes will help guide Theme 3 activities (e.g., reduce uncertainty in low confidence high impact projections – Antarctic contribution).
- **PALSEA Conference.** INSTANT leaders and members attended PALSEA⁸ conference - Paleo Sea Level & Ice Sheets for Earth's Future, Annual Meeting, Singapore, 2022. INSTANT is collaborating closely with PALSEA, especially on solid-Earth ice sheet interactions and their implications for ice sheet dynamics and far-field sea-level rise.
- **SCAR.** INSTANT has supported the development of two new SCAR science groups: (1) RINGS which is aiming to better observe and understand the grounding zone of the AIS, and (2) ICEPRO which help integrate high-resolution Antarctic ice core and marine records. INSTANT Sponsored the inaugural RINGS kick-off meeting in June 2022, as well as the Highly successful Glacial Sedimentology School (GLASS) for ECRs at the University of Oregon, Corvallis, USA in May 2022.
- **Climates of the Past/The Cryosphere Special Issue.** INSTANT is co-ordinating a combined special issue of the journals *Climates of the Past & The Cryosphere* where it will publish a series of "state of the art" research papers from the 3 Themes as well as several integrated summary papers that will profile the latest research developments in Antarctic ice sheet instabilities as well as identifying the challenges that lie ahead,
- **SCAR INSTANT Conference** will be hosted in Trieste, Italy September 11-14, 2023. This is open to all researchers with an interest in Instabilities and Thresholds in Antarctica and implications for sea-level. We expect between 300-500 registrations. We will provide travel support for ECRs. Days 1-3 will be for each theme. We will raise funding from sponsorship and are working with SCAR secretariat to carry over and bank unspent funds. We make a case in this report for approval of our budget to help fund the conference. The conference will be in plenary in mornings sessions and breakouts in afternoons. Day 4 is focussed on integration and with external partners. We will be inviting leading researchers and partitioners from within and outside of SCAR to facilitate discussion and give keynotes.

Summary Budget 2021 to 2024

The INSTANT SRP was allocated budgets of USD\$50,000 for 2021 and 2022, and requests the support for the SRP to be maintained at this level. Carry forward of funds remaining at the end of 2022 is also requested, with the main priority being support of the SCAR INSTANT Conference in September 2023. We anticipate the carry-forward to be USD\$50-60,000. To date INSTANT expenditure has targeted support for ECRs through the INSTANT Fellowships and attendance at meetings of strategic importance, including representing the SRP. INSTANT leadership have also coordinated and approved the use of Legacy SRP funds, from the previous PAIS and SERCE SRPs, to enable support of ECRs at the GLASS Summer School and PSE Workshop in 2022 and a GIA Training School in 2023. In 2023 INSTANT expenditure will focus on supporting the cost of the Conference and ECRs to attend. The next round of INSTANT Fellowships will be deferred until 2024.

	2021	2022	2023	2024
	Spent	Allocated	Request	Request
(US\$)	0	100000	50000	50000

⁸ PALSEA = Paleo Constraints on Sea-level rise

Progress and Plans

Main Activities & Future Plans (we have combined these sections)

We report on the main activities and future plans under the three themes of INSTANT (see Fig. 1 below).

INSTANT: Co-design & Co-implementation – Bridging research, information & society

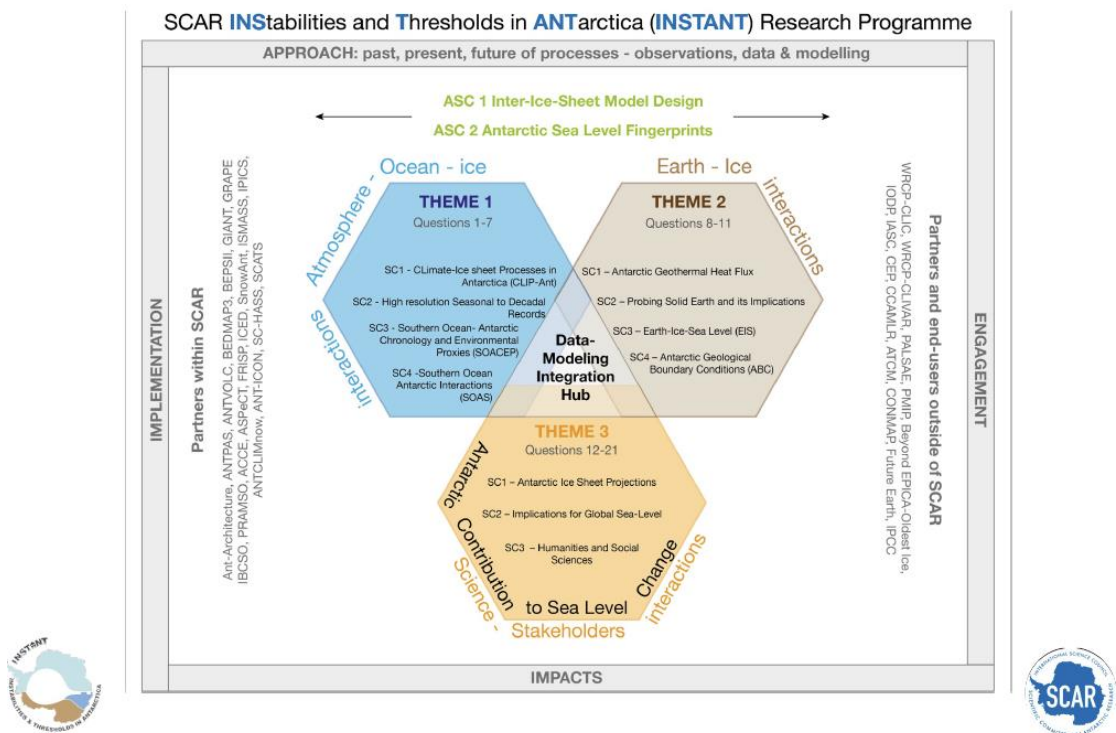


Figure 1. Operational and organisational structure of INSTANT. See <https://www.scar.org/science/instant/resources/> for Science and Implementation which outlines the approaches and key questions being addressed by the Themes.

Theme 1 - Atmosphere-Ocean-Ice Interactions

- Theme 1 seminar series launched – bi-monthly talks relating the Atmosphere-Ocean-Ice interactions. Talks online (<https://www.youtube.com/channel/UCY-Jo9slQ2Lxqc-pt09lWuw?app=desktop>).
- SC1 (CLIP-Ant) 3 topics defined. 1: coupling earth system and ice sheet models for paleo investigation (LIG); 2: ice shelf stability (special issue paper); 2: ice-ocean interaction, discussion for Antarctic Slope Front Model Intercomparison, “ASFMIP”. Clip-Ant is planning an online workshop in September 2022 (date tbc) + special issue paper on ice-shelf stability
- SC2 (High resolution records) - Completion of data compilation for wind and sea ice proxies. Forming the leadership and defining papers for special issue. We need to discuss relationship with newly formed ICEPRO.
- SC3 (SOACEP) – Refining the topics and working towards two white papers; 1) Environmental proxies, existing datasets, and future reconstructions and 2) Chronology and correlation of Antarctic sediments. White papers are being prepared on ways forward for SOACEP (i) chronology and (ii) proxies. Further activities between 2022 and 2026. ENVIRONMENTAL PROXIES: Identifying key regions around antarctica, and gaps of knowledge for proxy development and improvements, with consultation of both proxy and modelling community. Compiling (in interactive format) and analysing paleo proxies

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used to reconstruct environmental variability throughout the geological past. CHRONOLOGY AND CORRELATION. Documenting chronological methodology and developing systematic assessment of age models for paleo records. Improve the correlation at a continental scale between terrestrial and proximal marine, to deep marine southern ocean environmental response through time. A recent meeting of ABC (SC4 theme 2) started to outline some potential contributions around reconstructions of past ice sheet extent, flow directions, sediment distribution.

- SC4 (SOAS) – Defining papers for the special issue. A session for the INQUA meeting next year in Rome has been accepted (session 59). It promotes INSTANT activities.

Theme 2 - Earth-Ice Interactions

- SC1: Antarctic Geothermal Heat Flow (GHF) Group meetings were initiated with a launch on July 7th and a side meeting at SCAR OSC on August 8th. Seminar series to start on September 13th. A seminar series is to commence in September with the first talk on September 13; William F. McDonough: Geoneutrinos constrain Earth's heat production & composition. Next seminar in November, speaker to be confirmed. We are planning 4-6 seminars every year. Planning for summer school in July 2023, most likely coordinated with IUGG geothermal group in Potsdam
- SC2: Probing the Solid Earth and its Interactions (PSE). PSE kick-off meeting on 30/31 March 2022 as a virtual meeting for about two hours with 45 participants. The agenda included an overview on the rationale of PSE and several concise presentations on the different in-situ geodetic and geophysical measurement techniques in Antarctica, followed by a general discussion. It was noted that there are plans by US and UK funding agencies to decommission GNSS and seismometer infrastructure beginning in 2024/2025 season, and it was emphasized that an international workshop should be held to come up with recommendations on priorities and scientific rationale to continue this capability which is critical for INSTANT researchers. This workshop entitled "The future of geodetic-geophysical observational networks in Antarctica" is now scheduled for 29 September - 1 October 2022, to take place at Colorado State University, Fort Collins (CO). As a major result of this workshop a White Paper should be drafted (Q4/2022 - Q1/2023).
- SC3: Earth-Ice-Sea Level (EIS). EIS maintains an active and close connection with PALSEA. PALSEA-EIS kick-off meeting in September 2021 was held bringing up the importance of incorporating lateral heterogeneity in the Earth structure in GIA modeling and the necessity of establishing a benchmark for 3-D GIA modeling. A session was co-organized at EGU general assembly, May 2022: session G3.3, "Linking ice sheets, solid Earth and sea levels – observations, analysis and modeling of glacial isostatic adjustment". Conveners from INSTANT-EIS: Maryam Yousefi and Jun'ichi Okuno. The 3-D GIA benchmarking has been initiated, led by Volker Klemann. Some preliminary synthetic experiments were done and the results were presented at EGU general assembly, May 2022. EIS were actively engaged in future discussions at the Singapore PALSEA Conference in July 2022. A GIA training school is in preparation for July 3rd to the 7th, 2023 in Gävle, Sweden. Several topics will be dedicated to Antarctica which gives the future generation of researchers the opportunity to better understand the complex properties of the Earth beneath this continent and the interactions between the solid-Earth response, sea-level change and the Antarctic ice-sheet evolution. A GIA session is co-organized with IAG at the IUGG meeting in July, 2023, Berlin. Convener from INSTANT-EIS: Lambert Caron EIS plan to arrange several virtual discussion meetings in online format with the benchmarking group including the 3-D GIA modelers and to organize a symposium on 3-D GIA modeling. Furthermore, we plan to host a GIA workshop in 2024.
- SC4: Antarctic Geological Boundary Conditions (ABC). The main ABC activity this year was a 'launch' on the 8th and 9th of June. The purpose of these launches was to enable community input in the planning of ABC. Thus the launches consisted of a general overview of the potential ABC scope, but then with some breakout room discussions facilitated by the steering committee which aimed to understand the priorities of the

attendees. There were 3 key areas where it was felt ABC could make a difference: 1) Working to make raw offshore seismic data accessible such that reprocessing using newer techniques would become possible; 2) Reflecting on and updating the RAISED dataset on Antarctic Ice Sheet change, perhaps incorporating other forms of data over and above extent, thickness and timing; and 3) Exploring the potential to use subglacial geomorphology to create a more coherent understanding of past ice sheet change, perhaps incorporating legacy data analysis and the use of machine learning. Over the course of 2022/23 these 3 activities will get underway (depending on identifying leadership). In autumn 2022 a workshop on subglacial geomorphology (point 3 above) will be run via Durham University, UK. This will bring a focussed group of researchers together to work on exploring possibilities for improving knowledge of the subglacial landscape and its evolution and interaction with the ice sheet using existing data.

Theme 3 - Antarctic contribution to sea-level change - Science-stakeholder interactions

- SC1: Antarctic Ice Sheet contribution to sea Level projections (relative/local and global) This subcommittee is yet to be formally established. Currently led by Sophie Nowicki with others to join. The group will guide experiments that aim to explore the impact of ice sheet processes that cause potential instabilities (e.g. MISI and MICI) on future projections via a series of Antarctic MIPs (to be determined).
- SC2: Antarctic Coastal Hazards and Impacts (local affects). This subcommittee is yet to be formally established. Currently led by Richard Levy with others to join. This group will focus on local effects and impacts of Antarctic ice sheet projections. How will local sea level rise or fall and how will these changes impact coastal inundation in sensitive regions (protected areas and bases etc.) Outputs will inform Antarctic management.
- SC3: HASS – Underway [Rebecca Priestley and Heidi Roop]. This subcommittee's members are: Rebecca Priestley, New Zealand (lead), Heidi Roop, United States (deputy), Daniela Liggett, New Zealand, Bruce Tranter, Australia, Elizabeth Leane, Australia, Monica Morrison, United States, Katie Marx, Australia, Miranda Nieboer, Australia, Natasha Gardiner, New Zealand. A wider INSTANT-HASS community is developing and includes PhD students, interested scientists and practitioners (artists, communicators).
- Antarctic Ice Sheet projections were key to the updated sea level projections presented in Chapter 9: in AR6. These projections were produced in part through research supported through the SCAR PAIS Programme and initial work under the auspices of INSTANT Theme 3. WCRP-CliC ISMIP played the major coordinating role. INSTANT Theme 3 community members that directly contributed to this chapter include: Bob Kopp, Sophie Nowicki, Nick Golledge, Dan Lowry, Tamsin Edwards, Rob DeConto, Heiko Goetzler, Frank Pattyn, Alessio Rovere.
- Theme 3 papers for special issue include: (1) Long-term projections / where future meets with paleo timescales (ISMIP) led by Helene Serousi with input from ISMIP and paleo communities. (2) Sea level projections around Antarctica's coastline (link to ATCM and COMNAP) led by Richard Levy, Tim Naish, and Bob Kopp with input from Theme 2 community members (GNSS network data – Terry Wilson coordinating). (3) Projecting coastal hazards in Antarctica under a changing climate led by William Power and Dan Lowry with support from Alex Simm. This paper will examine the effect of projected change (sea level and ice shelf extent) on Tsunami's in and around regions of Antarctica. (4) Human understandings and perceptions of the Antarctic ice sheets and sea level rise over time led by Rebecca Priestley and Heidi Roop.

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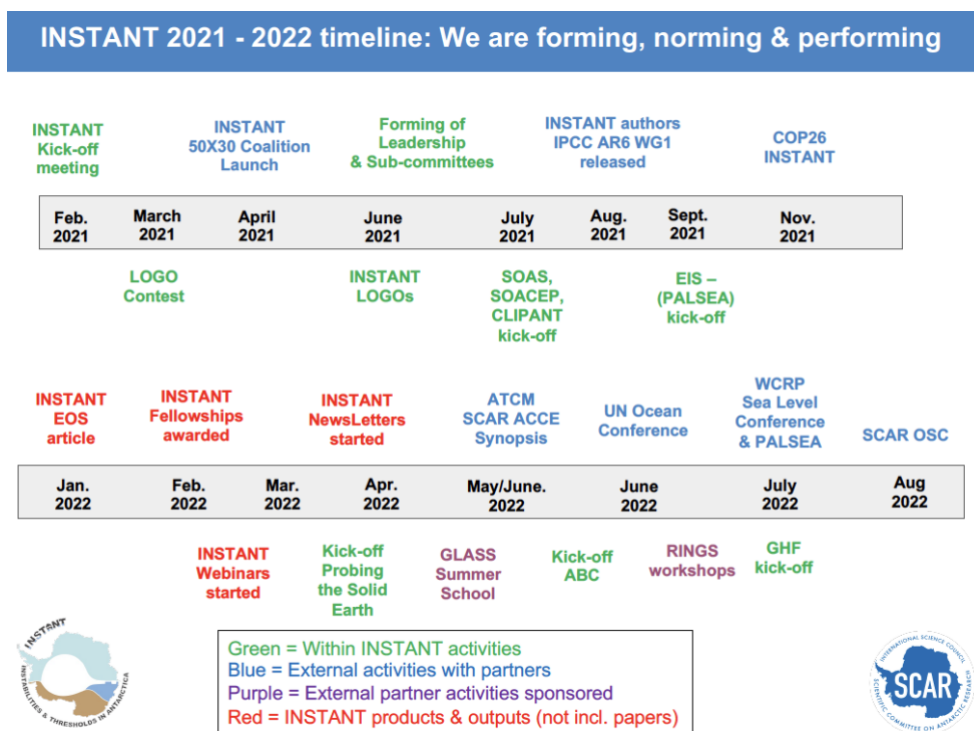


Figure. 2. Timeline of INSTANT Activities outlined in text.

Major Outcomes

- **50X30 Coalition.** INSTANT supported the launch of the 50X30 Coalition (<https://www.50x30.net/launch-event>), which is an alliance between cryosphere and emissions research institutions, and governments that have accepted the scientific necessity to reduce emissions 50% by 2030; in order to prevent cascading and irreversible damage, on a planetary scale, from the impact of greenhouse gas emissions on the cryosphere.
- **WG1 AR6 IPCC.** INSTANT leaders and members co-authored the WG1 AR6 IPCC Chapter 9 - Ocean, Cryosphere and sea-level change, and had high-profile roles in its release in 2021 and outreach events.
- **COP26 - Glasgow.** INSTANT members, Rob DeConto and Florence Colleoni participated in a "side event" in the Cryosphere Pavilion at COP26 organised by SCAR-ICCI⁶, emphasising the urgency of keeping global warming below 2°C to avoid irreversible meltdown of marine-based AIS and commitment to multi-metre intergenerational, sea-level rise.
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INSTANT: 2020-22 Report, cont.

Assembly held at Whitehall, London, in December 2019, to deliver on SCAR's commitment to the ATCM⁷ of a 10-year ACCE update. It was very well accepted by the ATPs, in Berlin at the XLIV ATCM and provides an urgent call for action identifying as its highest science priority Antarctic contribution to future sea-level rise, which is INSTANT's aim.

- **UN Polar Oceans.** INSTANT members invited to present at the United Nations Polar Oceans Conference - Engines to Global Climate - Messages & Messengers, June 2022
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Budget

Planned use of funds for 2022 to 2024

Year (YYYY)	Purpose/Activity	Amount (in USD)	Contact Name	Contact Email
2022	Meetings & workshops support	\$10,000		
2022	INSTANT Fellows	\$25,000		
2022	Carry forward	\$60,000		
2023	Internal costs (e.g. website, comms etc..)	\$5,000		
2023	INSTANT Conference	\$90,000		
2023	Other meeting and ECR support	\$5,000		
2023	Internal costs (e.g. website, comms etc..)	\$5,000		
2024	Meetings & workshops support	\$20,000		
2024	INSTANT Fellows	\$25,000		
2024	Internal costs (e.g. website, comms etc..)	\$5,000		

⁷ ATCM = Antarctic Treaty Consultative Meeting

⁸ PALSEA = Paleo Constraints on Sea-level rise

Percentage of the budget to be used for support of early-career researchers

2022: ~80%

2023: At least 50%

2024: At least 50%

Percentage of the budget to be used for support of researchers from countries with developing Antarctic programmes

2022: ~80%

2023: At least 50%

2024: At least 50%

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Membership

Leadership

Role	First Name	Last Name	Country	Email
Co-Chief Officer	Tim	Naish	New Zealand	Tim.naish@vuw.ac.nz
Co-Chief Officer	Florence*	Colleoni	Italy	fcolleoni@inogs.it
Steering Committee	Heiko	Goelzer	Norway	heig@norceresearch.no
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Steering Committee	Ayako	Abe-Ouchi	Japan	abeouchi@aori.u-tokyo.ac.jp
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Steering Committee	Daniela	Liggett	New Zealand	daniela.liggett@canterbury.ac.nz
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Theme 1 Leader	Nick	Golledge	New Zealand	Nicholas.golledge@vuw.ac.nz
Theme 1 Leader	Alessandro	Silvano	UK	a.silvano@soton.ac.uk
Theme 2 Leader	Andrew*	Lloyd	USA	andrewl@ldeo.columbia.edu
Theme 2 Leader	Alex*	Simms	USA	asimms@geol.ucsb.edu
Theme 2 Leader	Paolo	Stocchi	Netherlands	Paolo.Stocchi@nioz.nl
Theme 3 Leader	Richard	Levy	New Zealand	r.levy@gns.cri.nz
Theme 3 Leader	Bob	Kopp	USA	robert.kopp@rutgers.edu
Theme 3 Leader	Sophie	Nowicki	USA	sophien@buffalo.edu
Theme 3 Leader	Rob	DeConto	USA	deconto@geo.umass.edu
Theme 3 Leader	Rebecca	Priestley	New Zealand	Rebecca.priestley@vuw.ac.nz
Inter-ice sheet model design ASC leader	Catherine	Ritz	France	catherine.ritz@univ-grenoble-alpes.fr
Inter-ice sheet model design ASC leader	Heiko	Goelzer	Norway	heig@norceresearch.no

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Antarctic Sea-level fingerprints ASC leader	Alessio	Rovere	Germany	arovere@marum.de
Antarctic Sea-level fingerprints ASC leader	Natasha*	Barlow	UK	N.L.M.Barlow@leeds.ac.uk
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CLIP-Ant SC1 leader (Theme 1)	Edward*	Gasson	UK	E.Gasson@exeter.ac.uk
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SOAS SC4 leader (Theme 1)	Frank	Lamy	Germany	frank.lamy@awi.de
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ABC SC4 leader (Theme 2)	Stewart	Jamieson	UK	stewart.jamieson@durham.ac.uk
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Data-modelling hub SC1 leader (Theme 3)	Paolo	Stocchi	Netherlands	Paolo.Stocchi@nioz.nl
Data-modelling hub SC1 leader (Theme 3)	Cat	Ritz	France	catherine.ritz@univ-grenoble-alpes.fr
AIS Projections SC2 leader (Theme 3)	Sophie	Nowicki	USA	sophie.nowicki@nasa.gov
AIS Projections SC2 leader (Theme 3)	Rob	DeConto	USA	deconto@geo.umass.edu

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Implications for global SL SC3 leader (Theme 3)	Richard	Levy	NZ	r.levy@gns.cri.nz
Implications for global SL SC3 leader (Theme 3)	Roderick	Van de Wal	Netherlands	r.s.w.vandewal@uu.nl
Implications for global SL SC3 leader (Theme 3)	Bob	Kopp	USA	robert.kopp@rutgers.edu
HSS (social implications) SC4 leader (Theme 4)	Rebecca	Priestley	NZ	Rebecca.priestley@vuw.ac.nz
HSS (social implications) SC4 leader (Theme 4)	Heidi*	Roop	USA	

*(Please identify early-career researchers with * in first column)*

Complete membership list (as of 1st August 2022)

First Name	Last Name	Affiliation	Country	Career stage
Jane Lund	Andersen	Aarhus University, Denmark	Denmark	ECR
Jacqueline	Austermann	LDEO, PALSEA3	USA	ECR
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Stephen	Chuter	University of Bristol	UK	ECR
Margot	Courtillat	CEFREM	France	ECR
Anna	Crawford	University of St Andrews	UK	ECR
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Katherine	Hendry	SOOS	UK	ECR
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Hyunju	Lee	KOPRI	Korea	ECR
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Alena	Malyarenko	NIWA & ARC, Victoria University of Wellington	NZ	ECR
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Felicity	McCormack	Monash University	Australia	ECR
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Jasmin	Naher	Graduate student	USA	Ph.D./Master student
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Linda	Pan	Harvard University	Canada	Ph.D./Master student
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Anna Ruth	Halberstadt	UMass Amherst	USA	Ph.D./Master student
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Akintunde	Kuye	Imperial College London	UK	Ph.D./Master student
Mareen	Lösing	Kiel University	Germany	Ph.D./Master student
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Meike	Bagge	GFZ	Germany	Researcher
Natasha	Barlow	University of Leeds	UK	Researcher
Mike	Bentley	Durham University	UK	Researcher
Sonja	Berg	University of Cologne	Germany	Researcher
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Steve	Bohaty	University of Southampton	UK	Researcher
Fernando	Bohoyo	Geological Survey of Spain - IGME (CSIC)	Spain	Researcher
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Alex	Burton-Johnson	British Antarctic Survey	USA	Researcher
Lucilla	Capotondi	CNR-ISMAR	Italy	Researcher
David	Chandler	NORCE Norwegian Research Centre	Norway	Researcher
Steven	Chown	Monash University	Australia	Researcher
Christopher	Little	AER	USA	Researcher
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Ralf	Greve	Hokkaido University	Japan	Researcher
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Ivan	Haigh	University of Southampton	UK	Researcher
Jacqueline	Halpin	University of Tasmania	Australia	Researcher
Samantha	Hansen	The University of Alabama	USA	Researcher
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Dominic	Hodgson	British Antarctic Survey	UK	Researcher
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Goosse	Hugues	Université Catholique de Louvain	Belgium	Researcher
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Won Sang	Lee	KOPRI	Korea	Researcher
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Belinda	Nhesvure	University of Cape Town	South Africa	Researcher
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Yongcheol	Park	KOPRI	Korea	Researcher
Frédéric	Parrenin	CNRS/IGE	France	Researcher
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Michele	Rebesco	OGS	Italy	Researcher
James	Renwick	Victoria University of Wellington, WCRP-ClIC	NZ	Researcher
Christina	Riesselmann	University of Otago	NZ	Researcher
Stephen	Rintoul	CSIRO	Australia	Researcher
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Stephen	Roberts	BAS	UK	Researcher
William	Roberts	Northumbria University	UK	Researcher
Sharon	Robinson	University of Wollongong	Australia	Researcher
Yann	Rolland	Université de Savoie	France	Researcher
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Francesca	Sangiorgi	Utrecht University	Netherlands	Researcher
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Amelia	Shevenell	University of South Florida	USA	Researcher
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Arjen	Stroeven	Stockholm University	Sweden	Researcher
Jan	Strugnell	James Cook University	Australia	Researcher
Yusuke	Suganuma	National Institute of Polar Research	Japan	Researcher
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Stuart	Thomson	Department of Geosciences, University of Arizona	USA	Researcher
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Leonardo	Uieda	University of Liverpool	UK	Researcher
Roger	Urgeles	Institute of Marine Sciences (CSIC)	Spain	Researcher
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Tess	Vance	University of Tasmania	Australia	Researcher
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Alessandra	Venuti	Istituto Nazionale di Geofisica e Vulcanologia	Italy	Researcher
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Mike	Weber	University of Bonn	Germany	Researcher
Julia	Wellner	University of Houston	USA	Researcher
Pippa	Whitehouse	Durham University	UK	Researcher
Joanne	Whittaker	University of Tasmania	Australia	Researcher

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Trevor	Williams	Texas A&M University	USA	Researcher
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Terry	Wilson	Byrd Polar and Climate Research Center	USA	Researcher
Gisela	Winckler	Lamont-Doherty Earth Observatory	USA	Researcher
Ricarda	Winkelmann	PIK, FRISP	Germany	Researcher
Mathias	Zeller	GEOMAR	Germany	Researcher
Tong	Zhang	Beijing Normal University	China	Researcher
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Additional information (optional)

Notable papers & policy relevant publications

This list is not comprehensive but highlights examples of impactful publications.

*Papers led by ECRs are denoted with an **

1. Chown, S.L., Leihy, R.I., Naish, T.R., Brooks, C.M., Convey, P., Henley, B.J., Mackintosh, A.N., Phillips, L.M., Kennicutt, M.C. II & Grant, S.M. (Eds.) (2022) **Antarctic Climate Change and the Environment: A Decadal Synopsis and Recommendations for Action**. Scientific Committee on Antarctic Research, Cambridge, United Kingdom. www.scar.org.

This work was prepared for the Antarctic Treaty Parties and was delivered by SCAR to the XLIV ATCM in Berlin. It provides a concise up to date summary for policy and decision makers on the state of the Antarctic and Southern Ocean climate and environment and makes recommendations for policy and priorities for future research. It assesses the recent IPCC and IPBES reports and draws on, and updates, key elements of SCAR's horizon scan. This product is an outcome of all SCAR programmes, but INSTANT played a significant role.

2. DeConto, R. M., Pollard, D., Alley, R. B., Velicogna, I., Gasson, E., Gomez, N., et al. (2021). **The Paris Climate Agreement and future sea-level rise from Antarctica**. *Nature*, 593(7857), 83-89. <https://doi.org/10.1038/s41586-021-03427-0>.
3. Edwards, T. L., Nowicki, S., Marzeion, B., Hock, R., Goelzer, H., Seroussi, H., et al. (2021). **Projected land ice contributions to twenty-first-century sea level rise**. *Nature*, 593(7857), 74-82. <https://doi.org/10.1038/s41586-021-03302-y>

These two papers were published in the same issues of *Nature* prior to release of the IPCC AR6 WG1 and underpin the land ice contributions to sea-level projections in Chapter 9. DeConto et al (2021) presents a statistical emulation of an ensemble of Antarctic ice sheet projections calibrated to paleoclimate reconstructions that includes the "low-confidence" process of marine ice cliff instability (MICI), which leads to higher global mean sea-level projections of 2m by 2100 and 15m by 2300. Edwards et al (2021) presents statistical emulation of ISMIP6 projections and finds East Antarctic sea-level contributions of -4 to +7 cm from 2015–2100 under SSP1-2.6 and SSP2-4.5 (5–95% range), increasing to -1 to +21 cm under a risk-averse subset of the most sensitive models and inputs. Numerous INSTANT members co-authored these papers.

4. Florindo, F., Siegert, M., De Santis, L., Naish, T. (eds) (2022). **Antarctic Climate Evolution** (2nd edition), 786p. Elsevier ISBN: 978-0-12-819109-5. <https://www.elsevier.com/books-and-journals>

This book provides a series of state-of-the-art review and synthesis papers based on the last ten years of knowledge of Antarctic Ice Sheet dynamics from paleoclimate archives, modern process understanding observations, reconstructions and models. It represents the legacy of the SCAR PAIS Programme and was compiled and written during the initiation of the INSTANT Programme. More than 70 INSTANT researchers co-authored papers in the book. It is a critical reference for students and researchers.

5. Fox-Kemper, B., Hewitt, H. T., Xiao, C., Aðalgeirsdóttir, G., Drijfhout, S. S., Edwards, T. L., et al. (2021). **Chapter 9: Ocean, Cryosphere and Sea Level Change**. In V. Masson-Delmotte, P. Zhai, A. Pirani, S.L. Connors, C. Péan, S. Berger, N. Caud, Y. Chen, L. Goldfarb, M.I. Gomis, M. Huang, K. Leitzell, E. Lonnoy, J.B.R. Matthews, T.K. Maycock, T. Waterfield, O. Yelekçi, R. Yu, and B. Zhou (Ed.), *Climate Change 2021: The Physical Science Basis. Contribution of Working Group I to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change*. Cambridge University Press.

Numerous INSTANT researchers (Bob Kopp, Sophie Nowicki, Nick Golledge, Dan Lowry, Tamsin Edwards, Rob DeConto, Heiko Goetzler, Frank Pattyn, Alessio Rovere) contributed to Chapter 9 of the WG1 AR6 Report, which provides projections for future sea-level rise based on Antarctic ice sheet processes known with both "medium" and "low confidence".

6. *Lowry, D. P., Krapp, M., Golledge, N. R. & Alevropoulos-Borrill, A. (2021). **The influence of emissions scenarios on future Antarctic ice loss is unlikely to emerge this century.** *Nature Communications. Earth Environ.* 2, 221

This paper uses a statistical emulation of an ensemble of AIS models using the PISM model to show that while forcing will occur this century the divergence of scenarios for Antarctic ice loss will not occur until the 21st century. This timing contrasts with DeConto et al. (2021).

7. *Colleoni, F., Naish, T., DeConto, R., De Santis, L. and Whitehouse, P.L., 2022. **The uncertain future of Antarctica's melting ice,** *Eos*, 103.

This paper was published in the widely distributed newsletter of the American Geophysical Union. It advertises and introduces the INSTANT programme to the world. It explains its mission and approach and invites researchers to participate.

8. *Jones, Richard S., Johnson, Joanne S., Lin, Yucheng, Mackintosh, Andrew N., Sefton, Juliet P., Smith, James A., Thomas, Elizabeth R., Whitehouse, Pippa L. (2022) **Stability of the Antarctic Ice Sheet during the pre-industrial Holocene.** *Nature Reviews Earth & Environment.* 10.1038/s43017-022-00309-5

9. *Stokes, C.R., Abram, N.J., Bentley, M.J. et al. (2022) **Response of the East Antarctic Ice Sheet to past and future climate change.** *Nature* **608**, 275–286 (2022). <https://doi.org/10.1038/s41586-022-04946-0>

These two review papers published in Nature family journals provide state-of-play syntheses of East Antarctic ice sheet dynamics with implications for future response. Jones et al. (2022) presents a synthesis of the evolution of the EAIS during the Holocene into the pre-industrial era. The Stokes et al. (2022) reviews the response of the East Antarctic Ice Sheet to past warm periods going back to the Miocene when atmospheric CO₂ was up to 600ppm, it synthesizes current observations of change and evaluates future projections, noting the importance of 2°C of global warming as a tipping point for the marine-based EAIS.

10. *Marschalek, J.W., Zurli, L., Talarico, F. et al. (2021) **A large West Antarctic Ice Sheet explains early Neogene sea-level amplitude.** *Nature* **600**, 450–455 (2021). <https://doi.org/10.1038/s41586-021-04148-0>.

This paper is the flagship result of IODP Expedition 374 to the Ross Sea led by PAIS and now INSTANT researchers Rob McKay and Laura DeSantis. It uses a well dated multi-proxy data set from geological drill cores directly affected by the WAIS and documents the development of a large-scale ice sheet that helps explain the large global sea-level variations in the far-field global sea-level record and provides insights into the sensitivity of marine-based ice sheets.

11. *Johnson, J., Venturelli, R., Balco, G., Allen, C., Braddock, S., Campbell, S, Goehring, B., Hall, P., Neff, P., Nichols, K., Rood, D., Elizabeth T., Woodward, J. (2022) **Existing and potential evidence for Holocene grounding line retreat and readvance in Antarctica.** *The Cryosphere*, 16, 1543-1562.

This paper outlines a multidisciplinary approach involving ice cores, sediment cores subglacial geophysical observations, radar and geodetics to reconstructing the potential

for Holocene readvance of the marine margin of the AIS. This is important in the context of the rate of future retreat if glacio-isostatic rebound stabilises a retreating ice margin.

12. Weber, M.E., Bailey, I., Hemming, S.R. et al. (2022) **Antiphased dust deposition and productivity in the Antarctic Zone over 1.5 million years**. *Nature Communication* 13, 2044 (2022). <https://doi.org/10.1038/s41467-022-29642-5>

This paper is one of the first of a series of high profile publications to come from IODP Expedition 382 to Ice Berg Alley in the Weddell Sea. These exceptionally high-resolution sediment records of dust deposition effectively extend the ice core records to 1.5 Ma allowing a continuous reconstruction of dust and Southern Ocean productivity of the last 25 glacial-interglacial cycles.

13. *Pérez, L. F., de Santis, L., McKay, R. M., Larter, R. D., Ash, J., Bart, P. J., et al. (2022). *Early and middle Miocene ice sheet dynamics in the Ross Sea: Results from integrated core-log-seismic interpretation*. **Bulletin of the Geological Society of America**, 134(1-2), 348-370. doi:10.1130/B35814.1

This paper provides an integrated chronostratigraphic framework for understanding the regional architecture of the Ross Sea Embayment and combines re-interpretation of a network of seismic reflection data with existing and new drill core data from IPDP Expedition 374. It allows the geometry of Miocene West Antarctic ice sheet evolution and variability to be reconstructed and the timing better understood.

14. *Yousefi M., Wan, J., Pan, L., Gomez, N., Latychev, K., Mitrovica, J.X., Pollard D., DeConto, R., (2022), **The influence of the solid Earth on the contribution of marine sections of the Antarctic ice sheet to future sea level change**, *Geophysical Research Letter* (GRL), <https://doi/10.1029/2021GL097525>.

This paper models the role of melt water expulsion from rebounding bedrock beneath the melting WAIS under future scenarios to 2100 and 2500 and shows that it makes a significant contribution to global mean sea-level rise.

15. King, M. A., Watson, C. S., & White, D. (2022). **GPS rates of vertical bedrock motion suggest late Holocene ice-sheet readvance in a critical sector of East Antarctica**. *Geophysical Research Letters*, 49, e2021GL097232. <https://doi.org/10.1029/2021GL097232>

This paper uses GPS time series from the Totten-Denman glacier region to show up lift in the immediate vicinity consistent with contemporary ice sheet retreat, while widespread subsidence along adjacent parts of the coast suggest possible late Holocene readvance.

16. *Halberstadt, A., Chorley, H., Levy, R. H., Naish, T., DeConto, R. M., Gasson, E., & Kowalewski, D. E. (2021). **CO₂ and tectonic controls on Antarctic climate and ice-sheet evolution in the Mid-Miocene**. *Earth and Planetary Science Letters*, 564 doi:10.1016/j.epsl.2021.116908.

This integrated ice sheet model and geological data study of the EAIS and nested high-resolution simulations in northern Victoria Land and Wilkes Land describe a highly dynamic, but largely terrestrial EAIS during the warm middle Miocene with climate capable of supporting an alpine tundra vegetation and mean summer temperatures - 7-9°C. It shows the critical role of mean climate state controlled by CO₂ concentration and importance of tectonic controls such as Transantarctic Mountain uplift on ice sheet dynamics. Glacial-interglacial volume changes were significant and consistent with far-field and proxy sea-level records. Ice advanced through outlet glaciers onto the marine

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continental shelf in the Ross Sea during the Middle Miocene Climate Transition as CO₂ and regional temperatures fell.

17. Golledge, N. R., Clark, P. U., He, F., Dutton, A., Turney, C. S. M., Fogwill, C. J., . et al. (2021). **Retreat of the Antarctic ice sheet during the last interglaciation and implications for future change.** *Geophysical Research Letters*, 48(17) doi:10.1029/2021GL094513.

This paper addresses the topical issue of how much did Antarctica's ice sheets contribute to the Last Interglacial highstand when sea-level was 6-9m higher than today. An GCM-forced transient ice sheet model experiment suggests a contribution of 4m and that the current AIS is in a state of destabilisation that could lead to +4m of future sea-level rise without any additional forcing.

18. *Patterson, M. O., Levy, R. H., Kulhanek, D. K., Van De Flierdt, T., Horgan, H., Dunbar, G. B et al. (2022). SWAIS 2C Science Team. (2022). Sensitivity of the West Antarctic Ice Sheet to +2 °C (SWAIS 2C). *Scientific Drilling*, 30, 101-112. doi:10.5194/sd-30-101-2022

This paper outlines an exciting new international drilling project to recover Late Pleistocene sediment cores from the Siple Coast margin of WAIS to provide direct evidence of WAIS variability during past warmer than present interglacials such as the Last Interglaciation. The project is supported by ICDP and INSTANT and is scheduled for drilling on the 2022-2023 austral summer. This geological data will enable model simulations and reconstructions such as Golledge et al (2021) above to be tested.

Major collaborations your SRP has with other SCAR groups and with organisations/groups beyond SCAR

Within SCAR

1. ANTClimNow, ANT-ICON, PRAMSO, RINGS, SC-ATS, SC-HASS, ICEPRO, BEDMAP3, ANT-Architecture, BEPSII, IMASS, IBSCO, GIANT, GRAPE, FRISP, IPICS, SOOS, ADMAP

Outside SCAR

1. WCRP-CLIC, WCRP-CLIC-ISMIP7, WCRP-CLIVAR, PALSEA, PMIP, PAGES – CLIVASH2k, APECS, IPCC, UNFCCC, ICCI, IAG, IGC, Beyond EPICA - Oldest Ice, IODP, IACS, CEP, CAMMLR, ATCM, COMNAP

Outreach, communication and capacity building activities

1. INSTANT Website set up and running, SCAR (internal) website: www.scar.org/science/instant/home/, INSTANT (external) website: www.scar-instant.org/, scarinstant@gmail.com
2. INSTANT Communications Manager employed ECR Simone Vecchi (INGV, Rome).
3. INSTANT Facebook scar_instant and Twitter @instant.scar
4. INSTANT bimonthly newsletter set up and running. <https://www.scar-instant.org/index.php/news-events/newsletter>
5. INSTANT email list has 300 members
6. INSTANT Sponsored the inaugural RINGS kick-off meeting in June 2022,
7. INSTANT sponsored the highly successful Glacial Sedimentology School (GLASS) for ECRs at the University of Oregon, Corvallis, USA in May 2022.
8. 5 very talented ECR researchers (Brazil, Sri Lanka, Australia, China, Germany) have been awarded USD \$5K each as the first recipients of INSTANT Fellowships.

9. INSTANT supported the launch of the 50X30 Coalition (<https://www.50x30.net/launch-event>), which is an alliance between cryosphere and emissions research institutions, and governments that have accepted the scientific necessity to reduce emissions 50% by 2030; in order to prevent cascading and irreversible damage, on a planetary scale, from the impact of greenhouse gas emissions on the cryosphere.
10. INSTANT leaders and members co-authored the WG1 AR6 IPCC and had high-profile roles in its release in 2021 and outreach events.
11. INSTANT members, Rob DeConto and Florence Colleoni participated in a "side event" in the Cryosphere Pavilion at COP26 organised by SCAR-ICCI⁶, emphasising the urgency of keeping global warming below 2°C to avoid irreversible meltdown of marine-based AIS and commitment to multi-metre intergenerational, sea-level rise.

Contributions to equality, diversity, and inclusion (EDI)

1. 31 member countries
2. 30% of members identify as ECR
3. 4 of the 5 inaugural INSTANT Fellows are female
4. Leadership of Themes and Subcommittees comprises a mix of experience, ECRs, gender and nationality
5. Research is being lead demonstrably by ECRs (see lead authors of profiled publications).

SCAR Fellowship Reviewers

First Name	Last Name	E-mail	Principal Expertise
Tim	Naish	See list above	geological paleoclimate
Florence	Colleoni		ice sheet and climate modelling
Richard	Levy		sea-level
Alex	Simms		solid Earth
Andrew	Lloyd		solid Earth
Alessandro	Silvano		oceanography

⁶ ICCI = International Cryosphere & Climate Initiative