



Domain Science



Polar Research Infrastructure: future requirements

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Executive Summary

The polar regions may seem far away and not affecting the Netherlands directly. This is however not the case. The Arctic Circle is in fact closer to Amsterdam than Lisbon and changes in polar conditions are already affecting the Netherlands: we experience more extreme weather, a changing biodiversity and a rising sea level. With 50% of our national GDP being generated below sea level, we need to fully understand the rate and scope of the melting of the ice caps in Greenland and Antarctica. Polar research is not just an obligation that stems from the Antarctic Treaty and from our observer status at the Arctic Council, it is also the single most effective way to exercise soft power, both in terms of influencing international policies and grasping economic opportunities, especially in the Arctic region.

This report recommends to enhance the Netherlands Polar Programme (NPP) through strengthening of the polar research infrastructure, improving the budgeting process, increasing the budget and by adapting the NPP organisational and governance structure.

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Dutch polar research is policy and science relevant, internationally visible and of high quality. The Netherlands Polar Programme (NPP), that was initiated in 1985, covers four compelling scientific themes: (1) Ice, climate and rising sea levels, (2) Polar ecosystems, (3) Sustainable exploitation, (4) Social, legal and economic landscape. Executing polar research in the Arctic and Antarctica requires safe logistical support, excellent infrastructure and a sound international collaborating network.

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Dutch Polar research infrastructure was gradually developed during the last three decades to comprise the Netherlands Arctic Station in Svalbard (Spitsbergen), a series of mobile weather stations and more recently the Dirck Gerritsz Laboratory, co-located with the British Antarctic Survey station at Antarctica. Memoranda of Understanding (MOU's) with the Alfred Wegener Institute and the British Antarctic Survey strengthen our polar research collaboration and it provides Dutch scientists access to a vast array of German and British facilities and logistics. This polar research infrastructure has enabled excellent polar research through funding of the Netherlands Polar Program (NPP), effectively managed by NWO. In the period 2016–2020, the NPP budget averages €4.2 million per annum, of which €0.8 million is dedicated to infrastructure. **The NPP has maximized leverage of its funding and infrastructure for polar research, with Dutch polar research ranked 1st by number of citations in a recent international review¹. The unilateral announcement (2016) of The Ministry of Education, Culture and Science (OCW) to discontinue their contribution (of € 1.5 million per annum) to the NPP after 2020 would put the continuity of the Dirck Gerritsz Laboratory and related Antarctic research projects at risk, jeopardising the reputation of the Netherlands as a credible and reliable polar research partner. Furthermore, budget cuts to the NPP would disregard international obligations of the Netherlands and underestimate the relevance of Dutch polar research for economic and ecological safety in the Netherlands.**

The suggested polar budget cut happens at a time when other countries are increasing their investment in polar research, infrastructure and logistical capacity. For example, Russia, Germany, United Kingdom, China, South Korea and other countries have embarked on the construction of new powerful icebreakers. In absolute (total budget) and relative (measured per capita) terms, the NL polar research budget is dwarfed by budgets of like-minded countries (Germany, UK, France, Italy, South-Korea, Singapore). Without firm financial commitment from the government to safeguard the necessary

¹ Bibliometric survey of polar research in Sweden, 2015, Andreas Augustsson, Henrik Aldberg och Magnus Friberg Swedish Research Council, DIARIENUMMER: 354-2014-7378 and Norsk polarforskning – forskning på Svalbard, Ressursinnsats of vitenskapelig publisering – indikatorer 2014, Dag W. Aksnes, Kristoffer Rørstad, Rapport 2015:37

polar infrastructure and associated research projects, the Netherlands may be quickly side-lined at a time where other countries are stepping up their polar research activities. The Committee Polar Infrastructure considers this highly undesirable. **The Netherlands current “green” government coalition agreement refers to the melting of ice caps and allocates more budget for research, with ample attention for sustainable growth and climate change. The current political climate with high awareness for global climate change necessitates a more robust NPP, both in volume, structure and budget.**

Climate Change has become a leading issue in the global sustainability agenda and in 2017 the Dutch government has declared to strive towards an ambitious climate target and a reduction in greenhouse gas emissions by 55% by 2030 (compared to emissions in 1990), which is beyond the current European Union concession of a 40% reduction by 2030². The polar regions, which are globally the most sensitive regions to climate change, play a vital role in the global climate system as e.g. sea ice cover decline and permafrost degradation may accelerate global warming. **Polar research is essential to understanding Climate Change and its impacts on the environment, including sea level rise, which is of prime importance to the Netherlands. With the Arctic warming at a rate 2–3 times faster than the global average, changes in the polar region are likely to affect us even more in the future.** Polar research gives the Netherlands an opportunity to influence policies related to sustainable development and environmental protection in polar regions as active observer at the Arctic Council and as Consultative Party to the Antarctic Treaty. **However, polar research is not just an obligation, it is also crucial to exercise soft political power. Especially in the Arctic region, where economic opportunities and geopolitical issues are on the rise, a bigger commitment to the research will increase the status of the Netherlands.** Currently, such a firm commitment is not in place and the existing budget is under pressure. Visible involvement in polar research also paves the way to grasp the many economic opportunities for NL Inc. in especially the Arctic region, such as energy, mining, fishing, shipping and eco-tourism. For example, the Netherlands Arctic station in Svalbard and decades of polar research have been instrumental in the successful 2015 ‘Netherlands Scientific Expedition Edgeøa Spitsbergen’ and the ‘2 Degrees Noordpool’ expeditions. These expeditions have led to improved understanding and impactful communication of the climate challenge to policy makers, industry and the general public. By increasing the understanding and awareness of climate change impacts, Dutch polar research has contributed to consolidate significant commitments to ‘green’ investments in the Netherlands by both the public and private sector (e.g. NS, ING, Schiphol, Port of Rotterdam).

The Dutch government now has to decide how it wants to continue to fund and further develop polar research infrastructure and the Netherlands Polar Programme, especially for the longer term. The recent government coalition agreement² includes a paragraph on additional research funding including two times €50 million dedicated to research infrastructure. Also, funds allocated to ‘Climate’ in the Ministry of Economic Affairs and Climate (€ 300 million/year) could be a supplemental source for the Netherlands Polar Programme funding. Alternative scenarios as developed in this report aid in making decisions on polar research infrastructure. The scenario proposed by the Committee Polar Infrastructure is based on maintaining and extending polar research infrastructure to further improve the standing of the Netherlands as an efficient and excellent polar research operator and as a major ‘climate’ player. Thereto, the CPI also recommends to set up a virtual Dutch Polar Research Institute (DPRI) as part of the Netherlands Polar Programme to improve coordination, long term planning, communication between scientists and policy makers and engagement of the general public, and data management. Furthermore, to more effectively implement Dutch polar policy into research it is suggested, in consultation with the “Interdepartementaal Polair Overleg (IPO)” and the Netherlands Polar Committee (NPC), to install a polar steering committee. Urgent resolution is required to grasp attractive new opportunities for international polar research cooperation and to create a stable basis to step up polar research efforts commensurate with the climate change challenge and emerging economic opportunities for the Netherlands in the Arctic region.

² <https://www.government.nl/documents/publications/2017/10/10/coalition-agreement-confidence-in-the-future>

The Committee for Polar Infrastructure proposes to

1. Continue operation of the Dirck Gerritsz Laboratory post 2020 and to further develop the mobile lab concept.
2. Invest in a year-round facility at Ny-Ålesund with partners in Germany, France (AWIPEV) and Norway and further maximize leverage of infrastructure and NPP through international cooperation.*
3. Secure separate and stable long term (at least 10 years) funding for the aspired polar infrastructure in support of a credible and sustainable polar research programme.
4. Adopt recommendations of several previous reviews to increase the overall funding level (e.g. € 10 million per annum) and adopt a five year rolling budget for the research programme.
5. Kick-start the process for securing funds in the 'Interdepartementaal Polair Overleg' with a lead role of the Ministry of foreign of Affairs and decide by latest mid-2018.**
6. Set up a Dutch Polar Research Institute as a stable virtual single stop shop.
7. Strengthen the Governance of the Netherlands Polar Programme by installing a polar steering committee with appropriate mandates.

*) Also build additional smart weather stations and enhance existing MOU's and establish new ones.

***) To allow long term polar research planning, provide continuity and grasping attractive collaborative opportunities.



1 | Introduction

The Committee Polar Infrastructure (CPI) has been tasked to advise whether the Netherlands polar research should have its own polar research infrastructure and to identify an optimal future scenario for the financing and management of that polar research infrastructure (see *Appendix I*).

The current Dutch research infrastructure, funded through the Netherlands Organisation for Scientific Research (NWO) and relevant for the Netherlands Polar Programme (NPP) comprises (see *Appendix II*):

- The Dirck Gerritsz Laboratory (DGL) in Antarctica, operational since 2013 with an economic lifetime of some 20 years, co-located at Rothera research station of the British Antarctic Survey (BAS), operated by the NPP and BAS
- The Netherlands Arctic Station in Ny-Ålesund, Svalbard, operated by the Arctic Centre of the University of Groningen
- Ten intelligent weather stations (currently located in Greenland, Svalbard and Antarctica), operated by the Institute for Marine and Atmospheric Research (IMAU), Utrecht University
- Memoranda of Understanding (MOU) with the Alfred Wegener Institute (AWI) in Germany and the BAS in the United Kingdom, managed by the NPP
- Other cooperative programmes including the International Ocean Drilling Programme (IODP) and the Dronning Maud land Air Network (DROMLAN) (see *Appendix II*), managed by NWO and NPP

The polar infrastructure within the NPP should be reviewed in close connection with the funding of the research programme, international cooperation and engagement in the context of the Dutch polar research strategy. The annual budget for polar research in the period 2016–2020 is € 4.17 million, funded by multiple Government Departments i.e. Ministries of Foreign Affairs (BZ), Economic Affairs and Climate (EZK), Infrastructure and Environment (I&M), Education, Culture and Science (OCW) and the Netherlands Organisation for Scientific Research (NWO) (see *Appendix III*).

The sections below summarise the current state of affairs of Dutch polar research and related recent developments and is followed by a discussion and recommendations.

Why the NPP requires a 5-year rolling contract

1. The NPP requires a long-term budget to be able to fund, plan, and accommodate polar research. Especially long-term monitoring data in polar regions is urgently needed to study the impacts of climate change over relevant timescales on which climatic changes become apparent (20–30 years).
 2. Dutch polar research is anchored on close collaboration with partners Germany (AWI) and the UK (BAS) through MoU contracts. Uncertainty over NPP-funding at the end of the current NPP-period (2016–2020) threatens participation of the Netherlands in international research consortia and partner for new infrastructure projects, e.g. development of new international research station in Ny-Ålesund on Svalbard.
 3. The Netherlands is an active member of key international polar research organizations for Arctic (IASC, SIOS, EPB, ATCM) and Antarctic (SCAR, COMNAP) research, policy, and management fora. It required years for the Netherlands to build up a strong position as respected member of the international polar community, which for the NPP demands a guarantee for structural financial support to maintain the Netherlands to stay in this position.
 4. The development of the Dirck Gerritsz (DG) laboratory on Antarctica, in close collaboration with the BAS, binds the Netherlands to structural costs for access and logistic support for Dutch scientists (400 k€/yr). Uncertainty over funding prospects of the NPP beyond 2020 threatens continued operation of the DG lab and undermines the reputation of the Netherlands as reliable partner of the BAS.
 5. Uncertainty over the NPP-budget post-2020 requires a substantial provision in the NPP budget for decommissioning the DG lab (estimated at 1 M€), as obliged under the environmental protocol of the Antarctic Treaty, to which the Netherlands is a signed party. Without the financial security of a 5-year rolling contract, these reserved NPP-funds cannot be used for conducting polar research.
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2 | Summary of an Evaluation of the Netherlands Polar Programme 2009–2014

A more detailed overview and history of NL polar research is presented in Appendix IV. The following conclusions, quotes and recommendations of a 2014 evaluation of the NPP 2009–2014 by an independent committee chaired by Dr. Hessel Speelman (December 2014)³ are highly relevant to the work of the CPI:

- Over the years the Dutch polar research community has made excellent contributions to priorities set on national and international polar research agendas, such as climate change and sea-level rise, and the impact of human activity on the cryosphere, the polar marine and terrestrial ecosystems.
- The NPP delivers very good to excellent quality research, highly valued in the international community (volume, quality, citations).
- The NPP is based on strong collaboration and international embedding (partly as a result of limited own logistical support).
- The programme is well organised and clearly structured by means of four themes that tie in with national and international research agendas and NWO is a very suitable and successful administrator.
- The New NPP 2010–2014 was originally budgeted at € 10 million per annum in the Master Plan Pole Position NL (*“Poolpositie-NL”*, May 2009) and **included a proposed five-year rolling contract**, meaning the budget horizon would be extended automatically with one year every year. Budget changes, increase or decrease, to be implemented depending on formal periodic (5 year) evaluations. A budget of this size would be required for the Netherlands to be regarded as a strong international collaboration partner, it would allow crucial long-term investment agreements, and it would secure continuity for the programme. The Committee Terlouw⁴ (Report *“Evaluatie Nederlands Polair Programma”*, 2010) advised a budget of € 6.25 million, whereas the subsequent policy framework (*“Beleidskader Nederland en de poolgebieden 2011–2015”*, February 2014) resulted in a budget of only € 3.7 million per annum. The reduction in budget has led to significant missed opportunities.

Missed opportunities due to current NPP budget uncertainties

- Crucial long-term monitoring in the polar regions.
 - Participation in international polar flagship research consortia, e.g. Year of Polar Prediction (YOPP), Southern Ocean Observing System (SOOS).
 - Involvement in Arctic Research activities within Horizon 2020 through the Transatlantic Ocean research Alliance, e.g. INTAROS (Integrated Pan-Arctic Observation System), APPLICATE (Advanced Prediction in Polar Regions and Beyond).
 - Uncertainty over participation in new state-of-the-art infrastructure projects, e.g. collaboration with France (IPEV) and Germany (AWI) in new year-round research station at Ny-Ålesund (Svalbard).
 - Expansion international partnerships (e.g. Chili, South Korea).
 - Current budget limits the capacity for full development of all four NPP thematic cornerstones.
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³ Evaluation of the (New) Netherlands Polar Programme 2009–2014, NWO, December 2014

⁴ Rapport Evaluatie Commissie Nederlands Polair Programma' (Dr. J.C. Terlouw et al 2010)

- Whereas an ongoing support and continuation of the NPP is vital to retain Dutch positions in national and international polar research and policy forums, a long-term funding strategy is lacking. The continuity of the NNP with significant long-term research could consequently be at risk.
- The scientific community expresses an urgent need for investment in long-term research, including the possibility for long term monitoring. However, in the current set-up, NPP cannot secure funds for research proposals that exceed a running period of 5 years.
- It seems likely that the developed Dutch polar infrastructure has had a positive effect on the already established collaborations with the BAS and AWI and is leading to future collaboration with the French Institut Polaire Francais Paul Emile Victor (IPEV), e.g. as indicated by the intention to update the present Dutch polar station in Ny-Ålesund by joining building plans of AWI and IPEV for a new research station.
- The Dirck Gerritsz Laboratory (DGL) is a highly innovative, flexible, and world-class modular mobile lab facility. The initiative benefits both NWO and BAS due to cost sharing and close scientific collaboration. To secure the continued success of the DGL, a long-term strategy is needed and extra investments will be necessary as leverage in negotiations for polar research within MOUs.

The associated recommendations by the 2014 evaluation committee relevant to the above findings were to:

- Invest in extra attention among researchers for the translation of research results into policy-relevant information and create the possibility for wide-ranging integrated multi-disciplinary programme proposals (and encourage innovation through proposals from new entrants).
- Invest in extra awareness among policy makers for the translation of research results into policy-relevant information through more active engagement.
- Realise a better translation of research into policy; the responsible ministries need to follow the projects closely and direct communication between the interested ministries and the researchers involved needs to be established.
- Strengthen partnerships, consolidate existing collaboration, invest in new partners and strengthen the administrative support of the NNP.
- Increase the annual budget and supplement it with funds for long-term research (> 5 years).
- Seek alignment and synergy with one or more of the economic priority areas.
- Ensure a further harmonisation and synergy with international research programmes.

3 | Recent developments affecting NL polar research

Since the December 2014 evaluation report there have been a number of key developments directly and indirectly related to polar research that are relevant to the work of the CPI:

- NWO issued the strategy document ‘Poolpositie-NL 2.0’ for the NPP 2016–2020⁵.
- It recommends to increase the budget to €10 million per annum, focus the research around the existing NL infrastructure in Antarctica, Svalbard and Greenland (weather stations) and further build on the successful MOUs with AWI and BAS.
- The AIV (advisory council on international affairs) stated that The Netherlands should take the lead in research into rising sea levels and hence the mass balance of the Greenland icecap. The government should provide long-term funding for such research⁶.
- European Polar Board (EPB) members (representing the European Polar research community) entrusted NPP (and NWO) with the hosting of the EPB Secretariat for 5 years, from Jan 2015 to Dec 2019. NPP/NWO secured the mandate to host the EPB Secretariat through an open competition, with several other major European polar programmes and organisations competing.
- **The Ministry of Education, Culture and Science (OCW) stated the intent to discontinue its share of the funding for polar research as from 2020 (€1.50 million per annum), as communicated on 10/02/2016⁷. This development has been the direct trigger to the formation of the CPI. If continuation or alternative funding is not secured, most of the Antarctic research programme would be at risk (including sustained operation of the DGL).**
- Problems with the approval of the 5-year budget cycle not only led to missing attractive ad-hoc research opportunities, but also to discontinuity of projects and termination of Dutch participation in international collaborative projects. It illustrates the need for long-term planning and funding of polar research, in general, and monitoring programmes, in particular (long-term funding is a general problem with research).
- The window of opportunity to commit to collaboration with AWIPEV in Ny-Ålesund to build a modern research station, is closing in 2018 (note that no other locations will become available for a new research lab in Ny-Ålesund due to spatial restrictions).
- During a meeting at April 13th 2016 of the Parliamentary Committees of BZ, I&M and Defense⁸, the Minister of Foreign Affairs stated that “*The Netherlands is a major player in polar research; this enables to influence international policy setting*”. He committed himself to investigate a possible upgrade of polar infrastructure (including a broader international cooperation at Ny-Ålesund) and mentioned that also financial contributions by science institutions and the private sector need to be addressed. The Minister committed to look at financing of the polar research programme and added “*that it will take some time and that the Dutch Arctic Ambassador has a key role to play*”.
- **The 2016 Paris Climate Change Agreement and associated commitments (including to developing countries) imply an expected increased focus by the Dutch and foreign governments on climate change. The global attention to climate change has also elevated the importance of polar and climate research (see also next point).**
- Many countries acknowledge the urgent need for climate and polar research and massive investments in new polar research programmes, infrastructure and logistics were made by MOU partners BAS and AWI as well as by the Chinese (incl. the construction of new large ice breaking polar research vessels, planned for service in 2019–2020).
- During recent engagements (mid 2017) with AWI and BAS, both parties were very appreciative of the polar research cooperation under the MOUs and commented favourably on the flexible and modular laboratories (containers) and further development potential (see Appendix V).

⁵ Poolpositie-NL 2.0, NWO Earth and Life Sciences, December 2014

⁶ The future of the Arctic region. AIV report no. 90, September 2014

⁷ Letter to the Director of NWO regarding Polar Research sent on behalf of the State Secretary of OCW, dated 10th February 2016

⁸ Report (No. 68 dated 25 May 2016) of the general consultation of the Parliamentary Committees of BZ, I&M and Defense, on 13 April 2016



4 | Survey on NL polar research and infrastructure

The CPI has completed a survey to test the views of the (polar) science community on the Dutch polar research, (required) infrastructure and international cooperation (see *Appendix VI*).

The diversity of responses displays of course individual views, concerns and infrastructural needs (e.g. IMAU, RUG, NIOZ, WUR). Although the respondents (naturally) feel that the funds for research are limited, they acknowledge the international recognition of the high quality of Dutch polar research. There is concern regarding the level and stability of funding, especially for longer-term monitoring. Moreover, there is consensus that international cooperation is indispensable for Dutch polar science, notably with AWI and BAS but also others and further cooperation with international institutions should be promoted.

Concerning specifically polar infrastructure, there is agreement about the following:

- The NL polar infrastructure is regarded effective and seen as a key 'trading chip' in our international cooperation, but continued investment is proposed to remain credible.
- Flexible and mobile (specialised) laboratories are valued, also for (future) shipborne application and in larger international cooperation programmes. The automatic weather stations should also be acknowledged as flexible and mobile units with associated continuity of funding.
- Access to third party logistics and facilities, especially icebreakers, is a key requirement.
- Multiple suggestions were made to better pull together the polar science community and establish a (virtual) Dutch Polar Research Institute (DPRI).
- Multiple suggestions were made to improve coordination of best use of own and international infrastructure and logistics.



5 | Considerations and recommendations

Small footprint infrastructure and high quality NPP but stable long term funding is at risk

The Dutch approach to polar research to date has been very successful as evidenced by positive external reviews (including a recent publication by the Norwegian Polar Research Institute⁹) and the international standing of Dutch polar science. The polar research infrastructure and programme has been very effective in terms of return on investment. Through international cooperation and making good use of third party logistics and infrastructure a significant programme could be carried out at relatively low cost. Modest investment in innovative and small footprint infrastructure such as Dirck Gerritsz Laboratory and the automated weather stations has led to ground breaking polar research. Also the small and low cost station in Ny-Ålesund has been leveraged to good effect, resulting in excellent cooperation with international partners. The MOUs with AWI and BAS have been instrumental in great cooperation in polar research and low cost access to third party logistics, equipment and facilities.

The intent of the Ministry of Education, Culture and Science to discontinue its funding of the NPP after 2020 is urging the need to review the NPP, polar research infrastructure priorities, related budgeting issues and organisational constructs. This review should build on existing infrastructure and the strong foundation of the current NPP set-up, whilst grasping opportunities of implementing recommendations of earlier evaluations and changes in the external environment.

The five-year budget cycle and complex and lengthy approval process has led to discontinuity in funding of polar research (NPP budget 2016–2020). As a result of the budget delay, projects have slipped and cooperation opportunities and attractive ad-hoc opportunities had to be passed over. This has potentially tarnished our reputation as a reliable and credible partner in international polar research projects. Decision making on the selection of projects has been complicated by fragmentation and lack of alignment in committees and there is no effective forum to timely respond to ad-hoc opportunities. In meetings in the CPI and with the Chair of the Netherlands Polar Committee (NPC) it was discussed to consider restructuring of the future NPP budget to provide for separate 'buckets' for calls for proposal, long-term monitoring, strategic investment in infrastructure and ad-hoc opportunities. This proposal for budget restructuring, including a review of a possible streamlining of committees that select the projects within the four budget segments is believed to be important for the future of polar research infrastructure, but is beyond the terms of reference of CPI. However, in consultation with the chair of the NPC a proposal to install a polar steering committee is presented as part of this report (see *Supplement*) and added as a recommendation of the CPI.

KNMI Climate report (2014)

'The rate of sea level change will increase and greatly depends on global temperature rise. The rise will be up to 40 centimeters by 2050 relative to 1981–2010. By 2085 the sea level at the Dutch coast will be up to 80 centimeters higher. After 2100 the sea level will continue to rise'.

http://www.klimaatscenarios.nl/brochures/images/KNMI14_Klimaatscenarios_folder_EN_2015.pdf

⁹ Demonstration of "substantial research activity" to acquire consultative status under the Antarctic Treaty, A.D. Gray and K.A. Hughes, BAS, Polar Research 2016.

The Paris Agreement and the changing polar science landscape require focussed action

The largest (but certainly not the only) driver for polar research is global climate change. The ratification of the Paris Agreement has strengthened the legitimacy for a robust polar research portfolio that benefits understanding of climate change and mitigation of global warming. Polar research is a key ticket to the consultative status with the Antarctic Treaty (AT) and influence as observer to the Arctic Council (AC). Both policy and science driven research contributes to standing and influence in the AT and AC. The Ministry of Foreign Affairs (BZ) and its proxies are the main actors in engagement with international organisations and climate related diplomacy (e.g. Climate Envoy and Arctic Ambassador) and are the most actively involved in the Interdepartmental Polar Consultation (IPO) that establishes the NPP budget. Furthermore, BZ administers the Development Cooperation Budget, part of which may be used on climate change in developing countries as per Paris Climate Change Agreement. It is therefore proposed that BZ continues to play a key (lead) role in cooperation with other departments (IPO partners), in resourcing funds for NPP post 2020. As the continuity of Antarctic research and potential reputational impact is at stake if no replacement is found for the Ministry of Education, Culture and Science contribution, sustainable funding for the NPP should be addressed with the appropriate urgency.

More and more countries take an interest and participate in polar research (especially in the Arctic, in view of geopolitical and economic interests; e.g., as also reflected by the EU Policy for the Arctic) and some of our partners make massive investments in polar logistics (AWI and BAS). Through our MOUs with AWI and BAS we have preferential access to their facilities at relatively low cost. During the White House Arctic Science Ministerial of September 2016 in Washington, 24 countries (including NL) and the EU made a pledge to increase collaboration and advance arctic research activities as laid down by a joint statement (co-signed by the State Secretary of OCW)¹⁰. In order to remain credible and reliable as partners and at least maintain our international standing in polar science, we should maintain and further develop our innovative polar infrastructure, maximise leverage of international cooperation and increase the budget of our polar research programme (as repeatedly advised by previous reviews). Also the next generation supports a leading role for the Netherlands in polar research as reflected by the Manifesto of the Youth chapters of a number of political parties (see *Appendix VII*).

Alternative scenarios help in defining the options and support the recommendations

Three scenarios have been developed to guide decision making on the future of Dutch polar research and related infrastructure in terms of scope, funding and budget, predicted regrets, proposed organisation and expected impact on international standing (next page).

- The ‘Ground zero’ scenario (reducing NPP budget to €2.7 million per annum), without replacement of the €1.5 million per annum OCW funding post 2020, will inevitably lead to decommissioning of DGL and a drastic reduction of the polar science effort and marginalization of the standing of Dutch polar and climate science.
- The ‘Maintain Status Quo’ (maintaining NPP budget at €4.17 million per annum) scenario is based on continued funding at current level, maintaining current polar infrastructure, and will most likely lead to gradual erosion of the standing of Dutch polar and climate science (in view of extensive international polar research efforts and enhanced focus on climate change).
- **The ‘Proposed CPI’ scenario (safeguarding appropriate infrastructure for the long term and increasing NPP budget to €10 million per annum) builds on the foregoing considerations and is expected to further improve the standing of The Netherlands as efficient polar and climate science operator and enhance influence with the Antarctic Treaty organization and the Arctic Council as major ‘climate player’.**

¹⁰ Supporting Arctic Science – A summary of the White House Arctic Science Ministerial meeting September 28, 2016 – Washington D.C.

The Committee for Polar Infrastructure proposes to

1. Continue operation of the Dirck Gerritsz Laboratory post 2020 and further development of the mobile lab concept.
2. Invest in a year-round facility at Ny Ålesund with partners in Germany, France (AWIPEV) and Norway and further maximize leverage of infrastructure and NPP through international cooperation*.
3. Secure separate and stable long term (at least 10 years) funding for the aspired infrastructure in support of a credible and sustainable polar research programme.
4. Adopt recommendations of several previous reviews to increase the overall funding level (e.g. € 10 million per annum) and adopt a five year rolling budget for the research programme.
5. Kick-start the process for securing funds in the 'Interdepartementaal Polair Overleg' with a lead role for the Ministry of foreign of Affairs and decide by latest mid-2018**.
6. Set up a Dutch Polar Research Institute as a stable virtual single stop shop (see page 11).
7. Strengthen the Governance of the Netherlands Polar Programme by installing a polar steering committee with appropriate mandates.

*) Also build additional smart weather stations and enhance existing MOU's and establish new ones.

***) To allow long term polar research planning, provide continuity and grasping attractive collaborative opportunities.

Alternative Scenarios NL Polar Research

	Ground zero	Maintain Status Quo (+ options)	Proposed by CPI
Description	<ul style="list-style-type: none"> – Maintain Arctic research effort – Maintain AWI MoU – Reduce Antarctic research effort – Discontinue funding DG lab post 2020 – Discontinue MoU BAS post 2020 	<ul style="list-style-type: none"> – Maintain polar research effort – Maintain existing MoUs – Continue funding DG lab beyond 2020 and development of mobile laboratory containers 	<ul style="list-style-type: none"> – Continue funding DG lab beyond 2020, grow NPP and build on partnerships e.g.: – Commit to AWI-IPEV at Ny-Ålesund – Extend weather stations, remote sensing and model development – Build new mobile / flexible lab containers – Maximize and extend MOUs / new partnerships e.g. with US institutes – Capacity building polar science
Funding and Budget	<ul style="list-style-type: none"> – BZ, EZK, I&M, NWO and OCW (to 2020) – € 4.2 mln until 2020 – < € 2.7 mln 2020+ 	<ul style="list-style-type: none"> – BZ, EK, I&M, NWO and OCW – Prefer: Stable long term funding – € 4.2 mln (Real Terms) 	<ul style="list-style-type: none"> – Stable long term funding – Base funding infrastructure – Additional private sector funding – ~€ 10 mln*
Regrets	<ul style="list-style-type: none"> – Budget cut to 65% of current NPP – Funded PhD's from 6 currently to 1-2 per annum 	<ul style="list-style-type: none"> – Relatively modest number of projects by international comparison 	
Organisation	<ul style="list-style-type: none"> – 'As is' 	<ul style="list-style-type: none"> – 'As is' – Optional: establish virtual Dutch Polar Research Institute (home base polar scientists and research infrastructure) 	<ul style="list-style-type: none"> – BuZa as champion, build on NWO NPP by reinforcing with virtual Dutch Polar Research Institute (connecting, communication, coordination of infrastructure and advisory roles)
International standing	<ul style="list-style-type: none"> – Diminished under Antarctic Treaty (AT) and Arctic Council (AC) – Marginalized standing NL Polar and climate science 	<ul style="list-style-type: none"> – Standing polar and climate science gradually eroding in the face of new extensive international programmes and focus on Climate Change 	<ul style="list-style-type: none"> – Further improve NL standing as efficient operator and enhance NL capitalize influence with AT and AC as major 'climate' player

* 'Poolpositie – NL 2.0'

Indicative budget post 2020 – proposed scenario

Instruments / activities	2021 € Mln	2022 € Mln	2023 € Mln	2024 € Mln	2025 € Mln
DPRI programme (4 themes + longer term projects and monitoring)	4.0	4.0	4.0	4.0	4.0
Science call	4.0		4.0		4.0
Policy call		4.0		4.0	
Investment + operating costs	1.0	1.0	1.0	1.0	1.0
Policy driven opportunities	0.5	0.5	0.5	0.5	0.5
Policy support	0.1	0.1	0.1	0.1	0.1
Secretariat	0.4	0.4	0.4	0.4	0.4
Sum total	10.0	10.0	10.0	10.0	10.0

A Dutch Polar Research Institute to facilitate coordination and planning

In support of a sustainable commitment to polar research and required infrastructure it is proposed to set up a Dutch Polar Research Institute (DPRI) that coordinates the polar research infrastructure and logistics, connects polar scientists, acts as a repository for polar science (database), provides communication including events and supports an electronic virtual platform for polar research stakeholders. These roles build on feedback from polar scientists and earlier evaluations that propose to improve the connectedness, cooperation and communication within the polar science community and between the science community and policy makers.

DPRI should be a separate virtual (legal) entity that enables assignment of scientists in international projects and it should have a stable budget to manage its tasks. To safeguard its continuity, the DPRI should be embedded in a stable and professional organisation. Resourcing of DPRI (to include virtual roles) should build on the academic and professional interests of the various stakeholders. As much as possible the DPRI should build on existing organisations and institutions and not assume roles that are managed adequately already (such as maintenance of infrastructure). The management of the DPRI will be tasked by the NPP secretariat.

Nederlandse Organisatie voor Wetenschappelijk Onderzoek
NWO

NIOU 000081 2

NIOU 000083 3

oodschap

DSF Dry L

Geloof

st Lab



Appendices



Appendix IA | Terms of Reference Netherlands Committee on Polar Infrastructure

2016

Terms of reference

The General Board of NWO establishes with this resolution a Netherlands Committee on Polar Infrastructure (CPI).

Duration

The Netherlands Committee on Polar Infrastructure will work for a maximum period of 12 months, starting from 1 August 2016.

Task

The CPI's tasks are the following:

- To identify an optimal future scenario for the financing and management of the Dirck Gerritsz laboratory and other facilities that fall under the Netherlands polar facilities, incl. MoUs;
- To advise whether the Netherlands Polar research should and can have its own research infrastructure.

Scope

The CPI's advisory task is restricted to advising about the purpose and necessity of Dutch polar infrastructure to the NWO Accredited Board in 2017.

Members

- Members and chair of the CPI will be appointed on behalf of the General Board of NWO;
- Members and chair of the CPI will be appointed for the duration of the Committee on Polar Infrastructure (which is 12 months);
- Decisions within the CPI are taken by a majority of votes. In absence of members of the CPI, voting is only valid with a quorum of 50% + 1 of the total amount of CPI-members. In case of equality the chair decides, or in absence of the chair person, his / her stand-in;
- Expenses made by CPI-members and – chairperson during their performance as CPI-member will be reimbursed by NWO-ALW following the existing reimbursement rules of NWO and charged to the Netherlands Polar Programme (NPP).

Representation

The CPI will be represented publicly by its chair person.

The CPI is liable to the General Board of NWO 31 December 2016, and to the NWO Accredited Board from 1 January 2017.

Finances

The CPI does not have its own budget. Costs will be financed from the NPP budget.

Mode of operation

The mode of operation of the CPI will be to have several meetings to which each member's presence is of great importance. The CPI will have several explorative interview sessions with relevant persons within the Netherlands, or abroad.

Bureau

The CPI will be supported by an executive secretary, and supporting staff where necessary. Both will be delivered by NWO's department for Earth and life Sciences until 31 December 2016 and the ENW Domain afterwards.

In all cases not provided for in this ToR the General Board of NWO (until 31 December 2016) or the Accredited Board (from 1 January 2017) will decide.

Appendix IB | Composition of the Committee Polar Infrastructure (CPI)

Dr Renuka Badhe – Member

Executive Secretary of the European Polar Board

Robert Blaauw – Chair

Director at RJBC Arctic & Energy (formerly Arctic lead with Shell International Exploration and Production)

Prof. Corina Brussaard – Member

Research Leader at NIOZ and Professor Viral Ecology at the Institute for Biodiversity and Ecosystems Dynamics, 'Universiteit van Amsterdam'

Prof. Theo Elzenga – Member

Professor of Ecophysiology of plants at the 'Rijks Universiteit Groningen', Faculty of Science and Engineering

Dr Erica Koning – Member

Science Coordinator at National Marine Facilities, NIOZ

Dick van der Kroef – Advisor NWO / NPP

Director Netherlands Polar Programme (NPP) at NWO Science Domain

Prof. Rinus Wortel (em) – Member

Professor Geophysics / Tectonic Processes at the 'Universiteit Utrecht', Earth Sciences / Geophysics

Appendix II | Inventory research infrastructure including Memoranda of Understanding

	Asset	Location	Extra access to
1	NWO-NPP Dirck Gerritsz Laboratory	Rothera Research Station, Antarctica	
2	Current MoU BAS - NWO for scientific and logistic collaboration	Rothera Research Station, Antarctica	Bonner lab, Dash 7, Twin Otters, Icebreaker & supply/research ship J C Ross
3	Netherlands Arctic Station	Ny Alesund, Spitsbergen	
4	Current MoU AWI - NWO-NPP for scientific and logistic co-operation	Arctic and Antarctica	Ny Alesund facilities, Neumayer station, Dahlman station, Icebreaker Polarstern
5	10 Automatic Weather Stations IMAU in climate monitoring programme	Arctic, 6 on Greenland, and Svalbard, 4 on Antarctica	
6	International Ocean Discovery Program - IODP	Worldwide, incl Arctic and Antarctica	Joides Resolution, D/V Chikyu
7	Dronning Maud Land Air Network - DROMLAN	Service Cape Town – Dronning Maud land, Antarctica	ILyushin 76, Basler, Dornier, airfields Troll & Novolazarevskaya

DIRCK GERRITZ LABORATORY



Source: COMNAP Station Catalogue

1

Dirck Gerritsz Laboratory

Netherlands Organization for Scientific Research

67°34'11.8"S 68°74'63."W

Type: Laboratory

Operational period:
October–March

Location
Dirck Gerritsz Laboratory is located at Rothera Research Station, run by the British Antarctic Survey, Adelaide Island, Western Antarctic Peninsula.

Biodiversity and natural environment
See Rothera Research Station Information.

History and facilities
Officially opened January 2013, four flexible high tech mobile labs built in standard ISO 20 feet high cube containers. All four housed in a specially designed docking station.

1. A dry lab suitable for the use of a wide range of analytical instruments (e.g. flow cytometry) that need to be run at room temperature (15–22 °C).
2. A dry lab suitable for culturing using a cabinet with plasma lamps that provide the daylight spectrum. The temperature in this container is kept between 0 °C and 22 °C.
3. A wet lab suitable for processing water samples and biological rate measurements at the temperature of the sample of interest. The temperature in this container is kept between 2 °C and 15 °C.
4. A clean room laboratory suitable for trace metal research. It is equipped with special filters in the air-processing system to ensure that the air entering the container is completely particle free. The temperature in this container can be controlled between 5 °C and 20 °C.

General research and databases
Chemical oceanography, terrestrial and marine ecology. To view all the data collected, please visit www.npdc.nl.

CLIMATE	
Climate zone	Coastal Antarctica
Permafrost	Continuous
Mean annual wind speed (km/h)	
Max wind speed (km/h)	
Dominant wind direction	
Sea Ice Break Up	
Snow free period	
Total annual precipitation (mm)	
Precipitation type	
Mean annual temperature (°C)	-5
Mean temperature in February (°C)	0.1
Mean temperature in July (°C)	-11.6
ENVIRONMENT	
Region	Antarctic Peninsula
Antarctic environmental domain: G – Antarctic Peninsula offshore island geologic	
Antarctic Conservation Biogeographic Region: 4 Central South Antarctic Peninsula	
Altitude of facility (m)	18
Type of surface facility built on	Ice-free ground
Long term monitoring	No data
Waste management	No data
Hazard(ous) management	No data
Fuel spill response capability	No data



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COMNAP Catalogue of Antarctic Stations

NETHERLANDS

Features in the facility area

Biological features, Bird colonies, Coast, Crevasse, Fauna, Fjord, Ice cap or glacier, Ice shelf, Mountain, Permanent snowpatches, Rock, Sea, Sea ice, Seal colonies, Shoreline, Snow.

FACILITIES INFRASTRUCTURE	
Area under roof (m ²)	40
Area scientific laboratories (m ²)	48
Type of scientific laboratories: Biology, Chemistry,	
Conference room (capacity)	
Logistic area (m ²)	0
Number of beds	0
Showers	
Laundry facilities	
Power supply type	Fossil fuel, Renewable
Power supply (V)	
Power supply (hours per day)	
Hydroponics facilities	
Number of staff on station (peak/summer season)	2
Number of scientists on station (peak/summer season)	8
Number of staff on station (off peak/winter season)	
Number of scientists on station (off peak/winter season)	
Max number of personnel at a time (staff, scientists and others)	10
Specific device/Scientific equipment:	
Scientific services possible:	
Long term monitoring/observations:	No
MEDICAL FACILITIES	
Area of medical facility (m ²)	0
Staff with basic medical training or doctor (Summer)	0

Main science disciplines

Climate change, Climatology, Ecology, Environmental sciences, Glaciology, Isotopic chemistry, Marine biology, Microbiology, Oceanography, Terrestrial biology.

Staff with basic medical training or doctor (Winter)	0
Capability: None	
Equipment: None	
Distance to hospital (km)	
Closest emergency facility in Antarctica (km)	
Closest emergency facility external (km)	
Medical research capabilities	
Medical screening requirements	
VEHICLES AT FACILITY	
Sea transportation:	
Land transportation:	
WORKSHOP FACILITIES	
None	
COMMUNICATIONS	
E-mail, Telephone	
TRANSPORT AND FREIGHT	
Access	Air, Sea
Transport to facility: Airplane, Ship	
Number of airstrips	0
Length (m) of longest runway	
Width (m) of longest runway	
Number of flight visits per year	
Period of flight visits per year:	
Helipad	
Number of ship visits per year	
Period of ship visits per year:	
Ship landing facilities:	



2

Memorandum of Understanding

Between

**The British Antarctic Survey
Cambridge, United Kingdom**

And

**The Netherlands Organisation for Scientific Research,
The Netherlands**

For scientific and logistic collaboration



Source: from http://www.eu-interact.org/uploads/media/INTERACT_Station_Catalogue.pdf

3

NETHERLANDS ARCTIC STATION

STATION NAME AND OWNER

The Netherlands Arctic Station is owned and run by the Arctic Centre of the University of Groningen.

LOCATION

The Netherlands Arctic Station is situated in Kongsfjorden on the island of Spitsbergen and is part of an international research community in the former mining town of Ny-Ålesund, Svalbard. In this town, more than 10 nations have their own station while using shared facilities for meals and recreation. The whole local community is focussed on science and maintenance of infrastructure. Several stations have independent terrestrial research programmes and the Netherlands Arctic Station is the smallest of all.

BIODIVERSITY AND NATURAL ENVIRONMENT

Kongsfjorden is a beautiful high arctic environment with several glaciers terminating in the fjord. The raised beach terraces are sparsely vegetated with dense moss cover around small tundra lakes and below bird cliffs. Locally there are clear traces of former human activity by trappers and from coal mining. At present, the whole area is well-protected and a special permission is needed

to enter the islands during the bird breeding season. In 1978, reindeer was re-introduced and since 1982 barnacle geese have established a colony and are regularly feeding between the houses. Both herbivores have a clear impact on the vegetation.

HISTORY AND FACILITIES

From 1916 to 1968, the village of Ny-Ålesund was a coal mining settlement. This village has now developed into a unique mix of stations, laboratories, and research infrastructure. There is a small international community of 25 to 110 people – all temporal residents. Tourists are discouraged to stay overnight. In 1990, the University of Groningen initiated a project on barnacle geese and later joined the shared facilities with the establishment of Netherlands Arctic Station. The station consists of two small buildings for lodging with electricity but no plumbing. Shared facilities in town offer unique high-standard science and logistic support.

GENERAL RESEARCH AND DATABASES

Research focusses on the role of barnacle geese in the arctic ecosystem. Nutrient cycles, plant productivity, and vegetation





patterns are studied to understand plant-herbivore interactions. Behaviour, timing, and breeding success of individually ringed geese are observed over their lifetime, and the effect of predators is studied as a dynamic interaction. Population trends of plants, herbivores, and predators are monitored in a warming environment. Long term experiments include grazing exclosures and greenhouses on paired vegetation plots. There are also projects focussing on the history of human exploitation and the effect of tourism on cultural heritage.

HUMAN DIMENSION

The local community in Ny-Ålesund is a mixture of nationalities from the various stations. The area is owned by a company called Kings Bay, taking care of the logistics for the entire village. Ny-Ålesund has no permanent residents and all activity is linked to science. The closest town is the Norwegian village of Longyearbyen, which is the main hub of Svalbard. In Longyearbyen, permanent residents are few (c. 2000). There are no indigenous people and most inhabitants originate from the Norwegian mainland and live on Svalbard

only because of their temporal job assignment. Tourism, local administration, science, and coal mining are the most important sources of income.

ACCESS

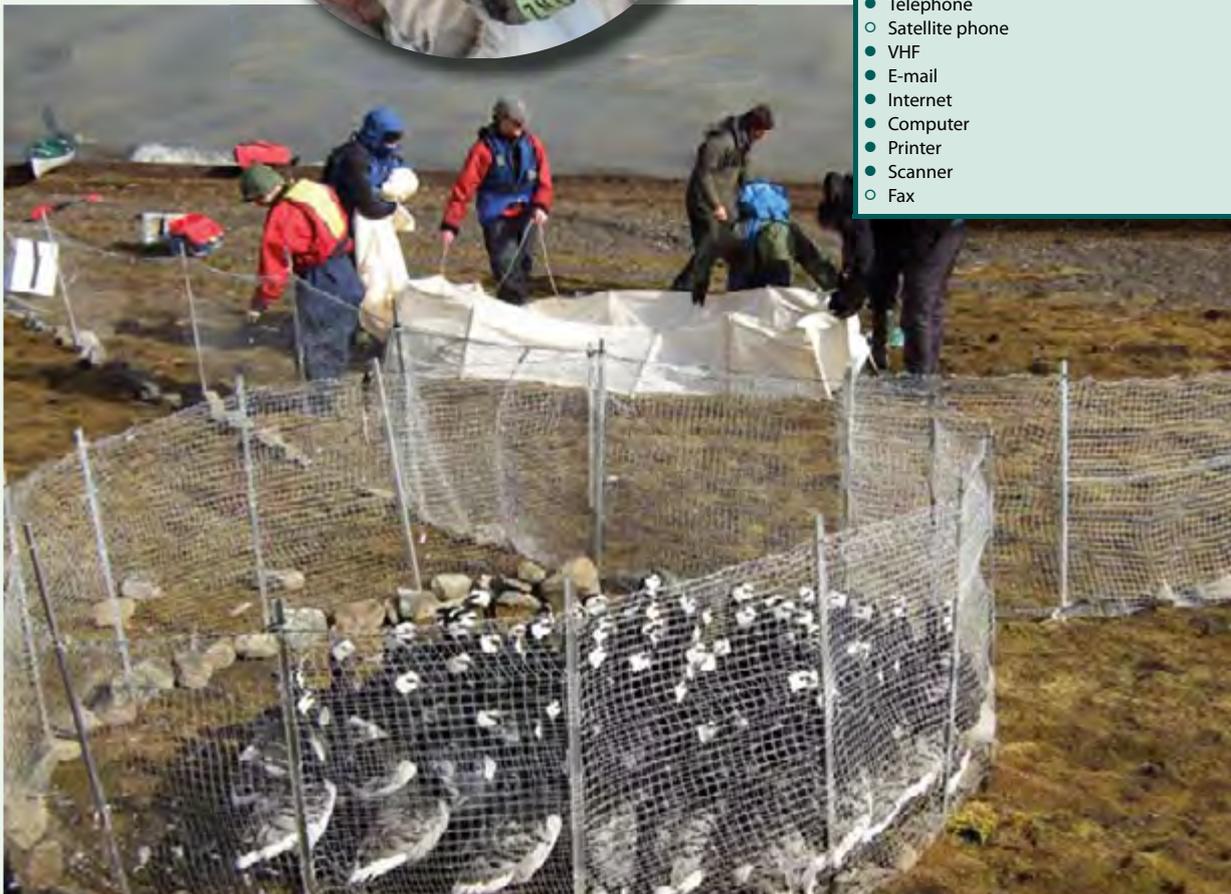
Throughout the year, Kings Bay organises two flights per week with a small plane (14 passengers) between Longyearbyen and Ny-Ålesund. In summer, there are about 30000 tourists landing by boat for just a few hours. There is

only a limited amount of roads near the village. Local transportation is possible by car,

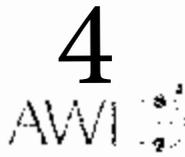
bicycle, snowmobile, or foot. Small boats are used for transportation inside the fjord.



Category	Sub-Category	Netherlands Arctic Station
Website		www.arcticstation.nl
Country		Svalbard/The Netherlands
Opening year		1995
Operational period		Mid June to mid August
Permitting issues categories	Permits required for access to the station	Yes
	Permits required for studies	Yes
	Contact (permit issues)	m.j.j.e.loonen@rug.nl
Facility owner and manager	Name of the facility owner	University of Groningen, Arctic Centre
	Owner status	Private
	Institution responsible for managing the station	University of Groningen, Arctic Centre
	Contact (access to station)	m.j.j.e.loonen@rug.nl
	Website (institution)	www.rug.nl/arcticcentre
Other institutions	Name	–
	Country	–
Location	Geographical coordinates	78°55'32" N, 11°56'05" E
	Altitude of station	10 m a.s.l.
	Min. altitude within study area	0 m a.s.l.
	Max. altitude within study area	500 m a.s.l.
	Nearest town/settlement	Longyearbyen (2060 inhabitants)
	Distance to nearest town/settlement	115 km
	Map	1:100 000
		
Climate	Climate zone	High Arctic
	Permafrost	Continuous
	Years measured	–
	Mean annual temperature	-6 °C
	Mean temperature in February	-14.6 °C
	Mean temperature in July	4.9 °C
	Mean annual wind speed	4 m/s
	Max. wind speed	21.6 m/s
	Dominant wind direction	NW
	Total annual precipitation	400 mm
	Precipitation type	Snow, rain
	Ice break up	Lakes: May/June; Sea: May
	Station facilities	Area under roof
Scientific laboratories		16 m ²
Logistic		16 m ²
Number of rooms (beds)		6 rooms (8 beds)
Number of staff on station (peak/off season)		1/0
Max. number of visitors at a time		7
Showers		–
Laundry facilities		–
Power supply (type)		220 V
Power supply	24 hours per day	
Scientific equipment	Specific device	Very basic, blood sampling
	Scientific services offered	–
Medical facilities	Medical facilities	Basic
	Medical suite	–
	No. of staff with basic medical training or doctor	–
	Distance to hospital (estimated time)	115 km
	Compulsory safety equipment	Weapon, VHF radio, survival kit
Recommended safety equipment	–	
Landing facilities	Airstrip (Length × Width)	800 × 50 m
	Airstrip surface	Gravel
	Helipad	Yes
	Ship landing facilities	Port, landing wharf, pier, pontoon
Vehicles at station	Sea transportation	Aluminium small boats
	Land transportation	Bicycle
Transport and freight	Transport to station	Plane
	Number of ship visits per year (period)	Freight once per summer month, tourist cruiseships daily (May to November)
	Number of flight visits per year (period)	2 per week all year (year-round)



Features within study area	<input checked="" type="radio"/> Yes <input type="radio"/> No
<ul style="list-style-type: none"> <input checked="" type="radio"/> Ice cap or glacier <input checked="" type="radio"/> Permanent snowpatches <input checked="" type="radio"/> Mountain <input checked="" type="radio"/> Valley <input checked="" type="radio"/> Shoreline <input checked="" type="radio"/> Tundra <input type="radio"/> Tree line <input checked="" type="radio"/> Other (Bird cliffs and small islands) 	
Main science disciplines	
<ul style="list-style-type: none"> <input checked="" type="radio"/> Anthropology, Sociology, Archaeology <input type="radio"/> Astrophysics <input type="radio"/> Atmospheric chemistry and physics <input type="radio"/> Isotopic chemistry <input checked="" type="radio"/> Climatology, Climate Change <input checked="" type="radio"/> Environmental sciences, Pollution <input checked="" type="radio"/> Geodesy <input type="radio"/> Geology, Sedimentology <input type="radio"/> Geophysics <input type="radio"/> Glaciology <input type="radio"/> Geocryology, Geomorphology <input type="radio"/> Soil science <input type="radio"/> Human biology, Medicine <input checked="" type="radio"/> Mapping, GIS <input checked="" type="radio"/> Marine biology <input type="radio"/> Oceanography, Fishery <input type="radio"/> Microbiology <input type="radio"/> Hydrology <input checked="" type="radio"/> Terrestrial biology, Ecology <input type="radio"/> Paleolimnology <input type="radio"/> Paleocology <input checked="" type="radio"/> Limnology 	
Workshop facilities	
<ul style="list-style-type: none"> <input type="radio"/> Metal workshop <input type="radio"/> Wood workshop <input type="radio"/> Plexiglas workshop <input type="radio"/> Staff available to assist with constructions 	
Communication	
<ul style="list-style-type: none"> <input checked="" type="radio"/> Telephone <input type="radio"/> Satellite phone <input checked="" type="radio"/> VHF <input checked="" type="radio"/> E-mail <input checked="" type="radio"/> Internet <input checked="" type="radio"/> Computer <input checked="" type="radio"/> Printer <input checked="" type="radio"/> Scanner <input type="radio"/> Fax 	



Memorandum of Understanding
Between the
**Alfred Wegener Institute for Polar and
Marine Research**
Bremerhaven, Germany
and
The Netherlands Polar Programme
The Hague, The Netherlands

for

Scientific and Logistic co-operation

during

2006 – 2011

5

Source: IMAU, dr C. Tijm-Reijmer

Automatic Weather Stations in the Polar regions Institute for Marine and Atmospheric Research, Utrecht University, (IMAU)

Background

Glaciers, ice caps and ice sheets are losing mass at an unprecedented rate, contributing about 50% to current sea level rise. One of the main causes for mass loss is increased surface melt, which also is believed to have played a crucial role in the breakup of ice shelves in the Antarctic Peninsula.

Goals

In order to quantify the role of the different energy balance components on the observed mass loss, in situ observations are invaluable in order to:

- quantify the energy streams that steer the melt process, and
- to force, constrain and/or enable evaluation of (regional) climate models and satellite products.

Methods

Given the harsh conditions innovative automated methods are required to enable year-round observations in polar regions. The Institute for Marine and Atmospheric research has a long history of developing automatic weather stations; innovative systems for in situ meteorological observations on glaciers, ice caps and ice sheets.

Some of the resulting records are now over 20 years long and have proven invaluable in the study of the impact of climate change on large ice bodies in the Polar Regions.

Overview

Below follows an overview of stations currently operated by the Institute for Marine and Atmospheric research in the polar regions. More information on the stations, including the stations no longer operational and information on data availability can be found on the website: <http://www.projects.science.uu.nl/iceclimate/aws/>

Acknowledgements

We are very grateful to all people and institutes who help and helped maintaining our weather stations all over the world. Without their help, financial or practical, the automatic weather stations would not have worked as well as they have. Financial support was provided in several different projects and by several different organizations.



Antarctic stations

On Antarctica presently 5 stations are operational, three stations in the Dronning Maud Land region of East Antarctica, and two on the Larsen C ice shelf in the Antarctic Peninsula.

Name: AWS9, Kohnen station, Dronning Maud Land
Location: 75°00' S, 00°00' E/W, ~2900 m a.s.l.



Operational: Since December 1997

Information: The station is part of the Netherlands contribution to the deep drilling project EPICA (European Project on Ice Coring in Antarctica). The station is located at the 2001/2006 deep drilling site, Kohnen, providing the climatological background for the drilling project. With the aid of the Alfred Wegener Institute (AWI), the station was installed and is kept operational.



Name: AWS11, Halvfarryggen, Dronning Maud Land
Location: 71°10' S, 06°48' W, ~690 m a.s.l.



Operational: Since January 2007

Information: In close collaboration with the Alfred Wegener Institute (AWI), this station provides the climatological background for a planned medium deep ice core drilling on the Halvfarryggen ice ridge, about 120 km South East of the German Neumayer station.



Name: AWS16, Princess Elisabeth Station, Dronning Maud Land
Location: 71°57' S, 23°20' E, ~1300 m a.s.l.



Operational: Since February 2009

Information: In close collaboration with the Catholic university of Leuven, Belgium, this station provides the climatological background for operations around the Princess Elisabeth Belgium research station.



Name: AWS14, Larsen C North
Location: 67°01' S, 61°30' W, ~50 m a.s.l.



Operational: Since January 2009

Information: The station is located on the Larsen C ice shelf. In close collaboration with the British Antarctic Survey (BAS) this station provides data to multiple projects aimed at obtaining a better understanding of melt events on the ice shelf and the role of melt water in the break-up of ice shelves. This station also provides important information for flight operations around the BAS research station Rothera.



© BAS

Name: AWS18, Larsen C West
Location: 66°24' S, 63°44' W, ~70 m a.s.l.



Operational: Since December 2014

Information: The station is located close to the grounding line on the Larsen C ice shelf. In close collaboration with the British Antarctic Survey (BAS) this station provides data to multiple projects aimed at obtaining a better understanding of melt events on the ice shelf and the role of melt water in the break-up of ice shelves.



© BAS

Arctic stations: Svalbard

In the Arctic region of Europe two stations are currently operational.

Name: Nordensköldbreen, Svalbard, Norway
Location: 78°42' N, 17°01' E, ~530 m a.s.l.



Operational: Since March 2009

Information: The station is located on Nordensköldbreen, an outlet glacier of the Lomonosovfonna ice cap, central Svalbard. The station is part of a project in close collaboration with the University of Uppsala, Sweden, to study the relation between the mass balance and glacier velocity.



© IMAU

Name: Ulvebreen, Svalbard, Norway
Location: 78°12' N, 18°41' E, ~140 m a.s.l.



Operational: Since August 2015

Information: The station is located on Ulvebreen, central Svalbard. The station is installed as part of the Netherlands Scientific Expedition Edgeøya Spitsbergen in 2015.



Arctic stations: Greenland

On the Greenland ice sheet currently five stations are operational. Three are part of the Kangerlussuaq-transect (K-transect) on the Western Greenland ice margin. This transect is a project running since 1991 to study the mass budget of the Greenland ice sheet including observations of a.o mass balance, ice velocity, and subglacial water pressure. The transect now provides the longest continuous mass balance record from the Greenland ice sheet.

Name: S5, K-transect, western Greenland ice margin
Location: 67°05' N, 50°06' W, ~500 m a.s.l.



Operational: Since August 1997

Information: The station is located near the ice margin on the western Greenland ice sheet. It is part of the K-transect, which is a project running since 1991 to study the mass budget of the Greenland ice sheet.



Name: S6, K-transect, western Greenland ice margin
Location: 67°04' N, 49°23' W, ~1000 m a.s.l.



Operational: Since August 1996

Information: The station is located about 40 km from the ice margin on the western Greenland ice sheet. It is part of the K-transect, which is a project running since 1991 to study the mass budget of the Greenland ice sheet.



Name: S9, K-transect, western Greenland ice margin
Location: 67°03' N, 48°13' W, ~1500 m a.s.l.



Operational: Since August 2003

Information: The station is located about 90 km from the ice margin on the western Greenland ice sheet, close to the equilibrium line. It is part of the K-transect, which is a project running since 1991 to study the mass budget of the Greenland ice sheet.



© IMAU

Name: S22, North eastern Greenland
Location: 78°54' N, 22°23' W, ~535 m a.s.l.



Operational: Since August 2016

Information: The station is located on the North Eastern Greenland ice stream. It is operated in close collaboration with the University of California in Irvine and NASA, and the Danish Technical University in Copenhagen. The goal is to obtain climatological information and improve estimates of mass balance of this remote and least known part of the Greenland ice sheet.



© Uni. California

Name: S23, North eastern Greenland
Location: 78°55' N, 21°27' W, ~142 m a.s.l.

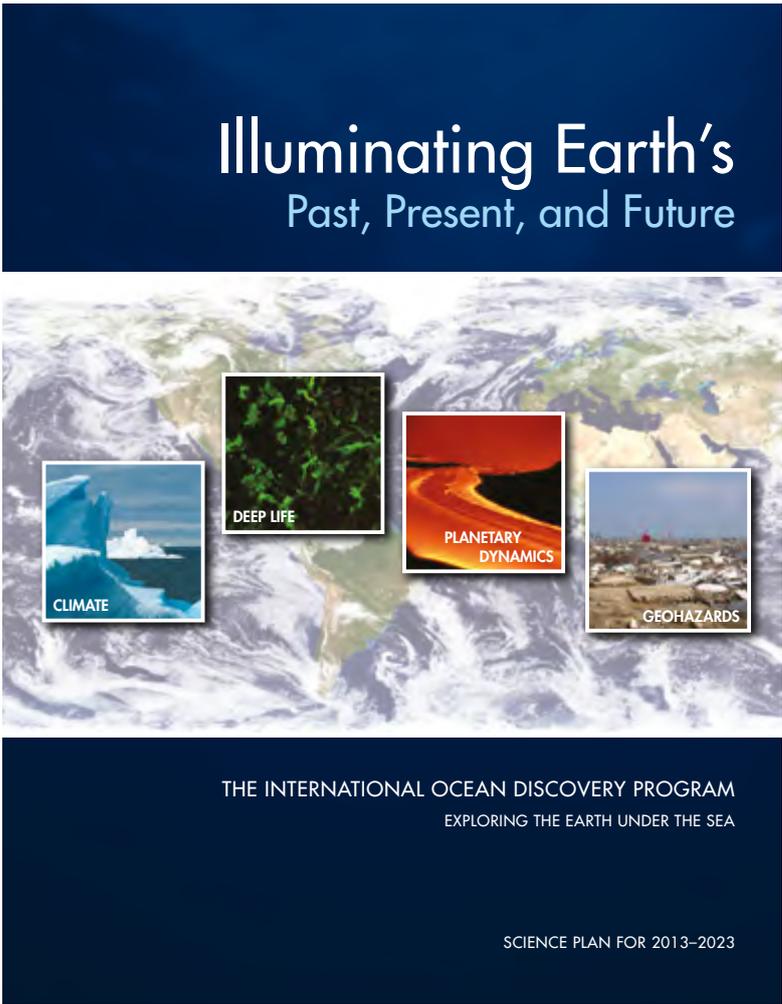


Operational: Since August 2016

Information: The station is located on the North Eastern Greenland ice stream. It is operated in close collaboration with the University of California in Irvine and NASA, and the Danish Technical University in Copenhagen. The goal is to obtain climatological information and improve estimates of mass balance of this remote and least known part of the Greenland ice sheet.



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Illuminating Earth's Past, Present and Future.
 The International Ocean Discovery Program.
 Exploring the Earth under the sea.
Science Plan for 2013-2023.

Challenge 2 | How do ice sheets and sea level respond to a warming climate?

Mean sea level is expected to rise between 0.5 and 1.5 m by the year 2100, affecting coastal ecosystems and water supplies, and flooding densely populated coastal communities. In the last decade, most of the measured global mean sea level rise has been caused by thermal expansion of the ocean in response to global warming. In the future, melting of the Greenland and Antarctic ice sheets, containing the equivalent of ~64 m of sea level, pose a far greater threat. Satellite-based measurements show that the ice sheets have recently begun to lose mass at an accelerating pace (Figure 2.4). This melting is contributing about half of the current sea level rise, but ice sheets will become the largest contributor if the rate of mass loss continues to increase.

Long-term projections of sea level rise remain highly uncertain, primarily due to our poor understanding of the dynamic behavior of ice sheets during sustained warming. The instrumental record of sea level extends back only about 150 years, a period when global mean sea level rose by only ~0.2 m, far less than the rise predicted for the future. By contrast, the geologic record of sea level change contains information about the full range of sea level variability, from warm periods that were virtually ice free and characterized by sea levels many tens of meters higher than today, to periods when ice sheets covered most of North America and Europe, exposing the continental shelves and forming land bridges. By studying the full spectrum of climate states, we can better understand the dynamic behavior of ice sheets.

The deep-sea record reveals the rates at which ice sheets and sea level responded to past episodes of global warming, providing insight into how much sea level might change in coming decades.

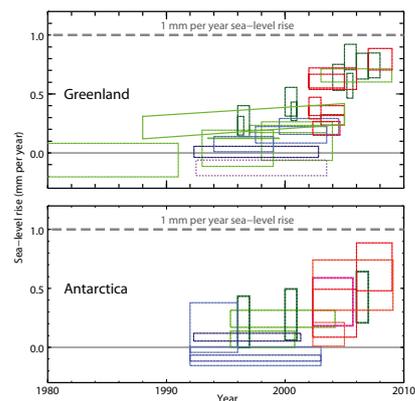


Figure 2.4. Estimates of equivalent sea level rise from (top) Greenland and (bottom) Antarctica polar ice loss over the last 30 years. Each box represents a range in equivalent sea level rise from an article reporting satellite data (colors represent different approaches). Sources listed in Berlier, and Barrett (2010).

6

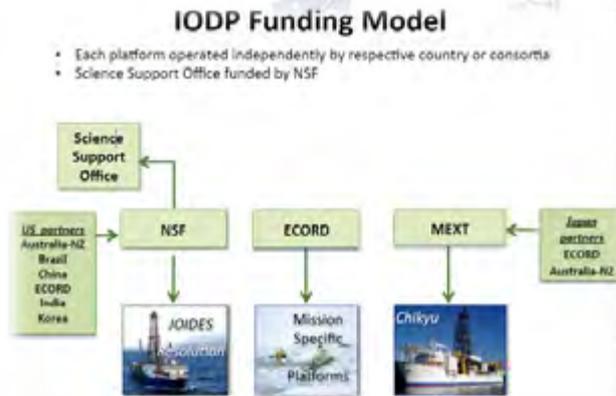
Source: taken from <https://www.iodp.org/> and NWO

IODP – International Ocean Discovery Program

The International Ocean Discovery Program (IODP) is an international marine research collaboration that explores Earth's history and dynamics using ocean-going research platforms to recover data recorded in seafloor sediments and rocks and to monitor subseafloor environments. IODP depends on facilities funded by three platform providers (**infrastructure**) with financial contributions from five additional partner agencies. Together, these entities represent [twenty-three nations](#) whose scientists are selected to staff IODP research expeditions conducted throughout the world's oceans. Scientist activities are managed by the IODP [Program Member Offices](#).

SCIENCE PLAN 2013-2023

IODP expeditions are developed from hypothesis-driven science proposals aligned with the program's [Science Plan](#) Illuminating Earth's Past, Present, and Future and are carried out in accordance with the program's [Principles of Scientific Investigation](#). The science plan identifies 14 challenge questions in the four areas of climate change, deep life, planetary dynamics, and geohazards.

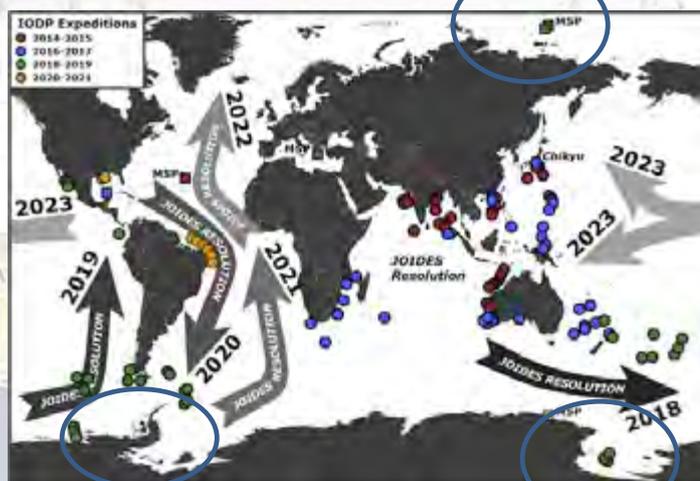


The Netherlands are a partner in ECORD, the European Consortium for Ocean Research Drilling, consisting of 14 European countries plus Canada. The NL contribution via NWO to ECORD is approx. 400 kEuro annually.

Two upcoming legs (373 and 377) with active proposals (708 and 813) are valuable for the Netherlands due to Dutch participation by prof.dr. H. Brinkhuis c.s. (NIOZ).
 Proposal 708: Arctic Ocean Paleoclimatology, scheduled for summer 2018, leg 377
 Proposal 813: Antarctic Cenozoic Climate, scheduled for winter 2020-2021 earliest, leg 373

JOIDES Resolution Ship Track 2018 - 2023

As approved by JRFB May 17, 2017: "The JRFB affirms that, based on current and anticipated proposal pressure, the JOIDES Resolution will follow a path from the Gulf of Mexico in FY2020 to the South Atlantic, starting to drill in that region. The JRFB expects that the JR will start to operate in the general area of the Equatorial and North Atlantic, Gulf of Mexico, Mediterranean, Caribbean, and **the Arctic in FY2021 and through FY2022**. Furthermore, the JRFB expects that the JR will complete its global circumnavigation in the Indo-Pacific region in FY2023."



Circles point out future Arctic/Antarctic expeditions

Source: <https://www.iodp.org/>

D/V Chikyu (photo courtesy of JAMSTEC; CC BY-NC 4.0)



The JOIDES Resolution in port in Yokohama, Japan (photo courtesy of JRSO; CC0/PDM)

Source: <https://www.iodp.org/>



Exploring the Earth Under the Sea

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You are here: Home Expeditions Expeditions Schedule

Expeditions Schedule

Expedition name	ID	Dates	Ports	Operator
Tasman Frontier Subduction Initiation and Paleogene Climate	371	July 27 - Sept 26, 2017	Townsville / Hobart	JRSO
Australia Cretaceous Climate and Tectonics	369	Sep 26 - Nov 26, 2017	Hobart / Fremantle	JRSO
Corinth Active Rift Development	381	Oct - Dec 2017 (offshore)	Corinth / Corinth	ESO
Creeping Gas Hydrate Slides and Hikurangi LWD	372	Nov 26, 2017 - Jan 4, 2018	Fremantle / Wellington	JRSO
Ross Sea West Antarctic Ice Sheet History	374	Jan 4 - Mar 8, 2018	Wellington / Wellington	JRSO
NanTroSEIZE Frontal Thrust Borehole Monitoring System	380	Jan 12 - Feb 24, 2018	Shimizu / Shimizu	CDEX
Hikurangi Subduction Margin Observatory	375	Mar 8 - May 5, 2018	Wellington / Auckland	JRSO
Brothers Arc Flux	376	May 5 - July 5, 2018	Auckland / Auckland	JRSO
Arctic Ocean Paleoclimatology	377	Summer 2018 (offshore)	TBD	ESO
South Pacific Paleogene Climate	378	Oct 14 - Dec 14, 2018	Wellington / Papeete	JRSO
NanTroSEIZE: Riser Hole at C0002	388	Nov 15, 2018 - March 31, 2019	TBD	CDEX
Amundsen Sea West Antarctic Ice Sheet History	379	Jan 18 - Mar 20, 2019	Punta Arenas / Punta Arenas	JRSO
Iceberg Alley Paleoclimatology & South Falkland Slope Drift	382	March 20 - May 20, 2019	TBD	JRSO
Dynamics of Pacific Antarctic Circumpolar Current	383	May - July 2019	TBD	JRSO
Panama Basin Crustal Architecture (504B) and Engineering Testing	384	July - September 2019	TBD	JRSO
Guaymas Basin Tectonics and Biosphere	385	September - November 2019	TBD	JRSO
Gulf of Mexico Methane Hydrate	386	January - March 2020	TBD	JRSO
South Atlantic Expedition TBD	387	March - May 2020	TBD	JRSO
Antarctic Cenozoic Paleoclimate	373	winter 2020 - 2021 (earliest)	Hobart (provisional)	ESO

Source: <http://www.iodp.org/expeditions/expeditions-schedule>

JOIDES Resolution

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Source: taken from DROMLAN Flyer en NWO



DROMLAN

Dronning Maud Land Air Network

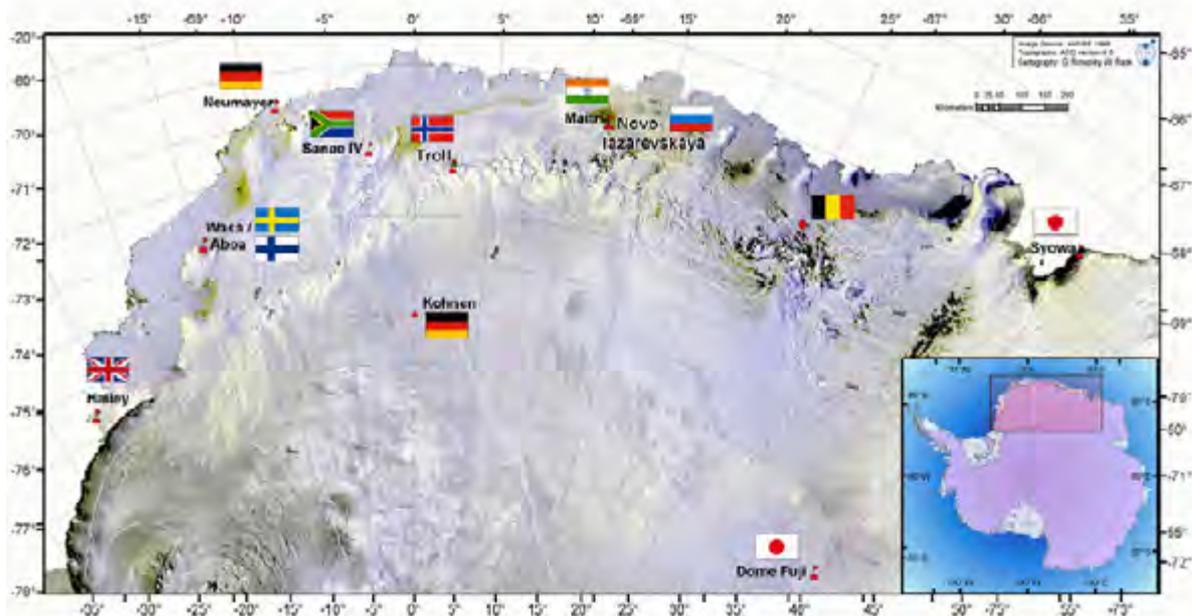


Ilyushin (IL-76TD) at Novolazarevskaya Airfield



Hercules C-130 at Troll Airfield

Operational area DROMLAN



GENERAL ASPECTS

The Dronning Maud Land Air Network (DROMLAN) is a non-profit, international co-operative project formed by a group of national Antarctic operators. Its purpose is to provide its participants with a more economic, flexible and timely entry into the Antarctic. Bi- and multilateral agreements between national Antarctic operators are the basis for co-operation within DROMLAN. Founding members are the national Council of Managers of National Antarctic Programmes (COMNAP) organizations of Belgium, Finland, Germany, India, Japan, the Netherlands, Norway, Russia, South Africa, Sweden and the United Kingdom.

BACKGROUND

Already in the 1990's Norway contacted the other nations with facilities in Dronning Maud Land (DML) to discuss the possibilities of an evaluation of flight operations in DML using the commercial operator Adventure Network International (ANI).

An evaluation flight with 20 people from 8 countries was carried out in 2000. The group included several specialists within different fields. The flight evaluation report concluded that the work with an international air network should continue. During the COMNAP meeting in China in July, 2002 it was agreed to establish an organisation, DROMLAN.

ADMINISTRATION

The administrative structure of DROMLAN consists of a Steering Committee, a Support Group and an Executive Director. The Steering Committee is responsible for the general direction of the DROMLAN, and consists of one representative from each participating country. This Committee is the DROMLAN project's decision making body for policy, financial matters, operating guidelines and the annual programme and decisions are reached by consensus. The Executive Director acts on behalf of DROMLAN nations within a framework agreed by the Steering Committee.

PURPOSE

The aim of the DROMLAN project is to provide air transport to/from and within DML to any member country of COMNAP and the Scientific Committee for Antarctic Research (SCAR) in science related activities, including logistics. This includes the following actions:

- To organize air transport between Cape Town and DML
- To maintain and improve the airfield at the Novolazarevskaya station and establish and maintain an airfield at the Troll station
- To organize feeder flights inside DROMLAN area
- To organize any other service necessary for the flights above.

DROMLAN OPERATIONS UP TO DATE

The intercontinental flights between Cape Town and Novolazarevskaya (Russia) and Troll (Norway) have been performed with Ilyushin IL 76TD and C-130 Hercules aircraft. The Antarctic Logistic Center International (ALCI) performed the majority of the DROMLAN operations to date in co-operation with the DROMLAN members.

The C-130 flights have been carried out to TROLL Airfield, only (by the Norwegian Royal Air Force in season 2004/2005 and by the Swedish Royal Air Force in season 2005/2006).

Since the 2002/2003 season, flight operations are being established under contract between national operators and the commercial operator (for the time been ALCI) organizing intercontinental flights. National operators support feeder flights to various stations and provide other services necessary.

One important development has been the establishment of a detailed and individual weather forecast at Neumayer station, in order to improve safety and reliability of intercontinental and feeder flight activities.

DROMLAN FLIGHT PATTERN

Both Novolazarevskaya Airbase and Troll Runway have been fully operational since the 2004/2005 season. National and commercial operators will further support feeder flights within Dronning Maud Land. Supporting services such as weather forecasts, fuel provision and accommodation are being provided by national operators. The principle flight pattern is to get rapid access to the region as well as to extend the summer season period. Depending on the requested number of passengers and amount of cargo DROMLAN aims to perform 6 to 7 intercontinental flights from Cape Town (see Preliminary flight schedules for summer season). The connection flights to the various destinations in the operational area (see map) will be provided by small aircraft such as Basler (B1-67), Twin Otter, Dornier 228-101 operated by the national programs.

DROMLAN LONG TERM PLANS

A long term plan has been worked out for 5 years, as the first period of the project, lasting from 2003 until 2008. Both the Airfields at Novolazarevskaya and TROLL will be operational for intercontinental flights and in use during this period. Necessary upgrading of both airfield facilities will take place in the said period, as needs arise and funds are made available. National and commercial operators will further support feeder flights within DML with weather forecast, fuel and accommodation.

CONCLUSION

Based on experience thus far, DROMLAN has proved to be a very efficient way for national operators with mutual interest in the same geographical area to solve transport needs in a cost effective and rapid way. Preparation and daily administrative matters can be directed to a smaller group, tasked to deal with these issues, and working effort can be given in full scale to own programmes and scientific work.

We, the DROMLAN Community, like to think that this set up could stand as a model for other international co-operation, both in science and logistics in Antarctica, and hope that other COMNAP and SCAR members can also benefit from our airlink set up.



Appendix III | Budget NPP 2016–2020

Budget party	Current Budget (k€/year)	Pool Positie NL 2.0 (k€/year)
OCW	1.500	2.000
I & M	792	2.000
BZ	455 + 270*	1.000
EZ	400	2.000
NWO	750	1.000
PPS		2.000
Total	4.167	10.000

*) 270 K€ for 'polar activity program' via BZ

Infrastructure	Annual Fixed Costs (K€/year)
Other costs NPP including infrastructure and MOU's	730
Total	730

Programme	Budget (k€)	Time frame	Comments
Polar Science call	6.000	2016–2020	13 projects out of 44 (22 M€)
Policy call	4.000 to 6.000	2016–2020	Selection 2017, decision 2018
PPS proposals call	1.000	2017	Selection fall 2017
Other opportunities	1.200		e.g. Belmont Forum and MOSAIC

1.8 M€ to be transferred from NPP 2011–2015 to NPP 2016–2020: reservations made for decommission fund DG Lab (1 M€ static budget), investment Spitsbergen, Ny Alesund (0,6 M€ dynamic budget). To be made available for opportunities (257 k€).



Appendix IV | Short overview and history NL Polar Programme

1 Origin in politics

The Netherlands Polar Program (NPP) originates from an interplay between scientists and environmentalists and finally a political desire based on a Cabinet decision to obtain the formal consultative status for the Netherlands under the Antarctic Treaty¹. The Netherlands had signed the Antarctic Treaty in 1967, but according to Art. IX.2, countries are only eligible to participate in the decision making process during such times if they have demonstrated their interest in Antarctica by *“conducting substantial research activity there, such as the establishment of a scientific station or the dispatch of a scientific expedition”*². To be able to comply to this provision several actors had begun to lobby and initiate a scientific Antarctic programme in 1985. Based on the lobby by several actors, NWO (ZWO) took the lead and started this programme. With it, governmental funding was secured to be able to maintain the programme as a treaty requirement. In later years NWO developed into the operator of the programme tasked with the (inter)national coordination and quality control. In 1989 the programme was built up sufficiently to be accepted and recognized according to the provision. The Netherlands obtained the consultative status in 1990, giving it the desired voting power and the right to participate in the decision-making during the Consultative Meetings. A national Antarctic science program is mandatory for as long as the Netherlands wants to maintain its consultative status. The programme provided opportunities for capacity building and with it built up a national polar science community.

The onset of the International Polar Year (2007–2008) also put polar research in the limelight in the Netherlands and with it the growing importance of the Arctic region on many levels (science, (geo) politics, societal challenges). For that region, it is also recognized there is a close relationship between science and inferred political influence (soft diplomacy).

When the Arctic Council was founded in 1996 the Netherlands was granted an observer status within this council, mainly based on its respectable and high quality scientific research in the Arctic over the past years³.

Germany

Our next door neighbor Germany took a different, less modest approach that illustrated their perception of the importance of polar research. When applying for its consultative status in 1981 Germany founded the Alfred Wegener Institute (AWI) as their “substantial research activity” to be recognized under the treaty, next to the polar research communities at the universities. Nowadays AWI is a very successful polar and marine research institute of strategic importance operating in cold and temperate waters with an annual budget of 128 MEuro/year, employing on its own 1100 people and operating several Antarctic stations, planes and an icebreaker (operational costs 40 MEuro/year), now soon to be replaced at a cost of several hundred million Euros.

In both cases, for Antarctica and for the Arctic, the existing polar program is an ongoing testimonium for the added political value of scientific (polar)research. For Antarctica, it fulfills a treaty obligation.

UK

The annual budget of the British Antarctic Survey (BAS), our other major collaborative partner, is around 50 M£. The majority of it comes from the Natural Environment Research Council (NERC). BAS employs over 500 people, operates five research station in Antarctica, one in the Arctic, several airplanes, a research vessel and an icebreaker. The UK started its scientific operation in Antarctica in 1943 during World War Two. Already after the war it was put on a long term footing as the Falkland Islands Dependencies Survey (FIDS) and later re-named the British Antarctic Survey in 1962. The UK is one of the original Signatories of the Antarctic Treaty in 1961. The BAS is now a world-leading research centre for earth-system science and global climate change. The next three years the UK is investing 300 M£ in the upgrade of its stations and in 2019 a new icebreaker (200 M£) will enter into service replacing the two existing ships. All this is part of a major Government polar infrastructure investment programme designed to keep Britain at the forefront of world-leading research in Antarctica and the Arctic.

2 Risen to world class research with highest possible impact

In over 30 years polar scientist in the Netherlands were able to build up and maintain a high quality scientific programme. The quality and its relevance are evaluated every 4–5 years. It requires continuous commitment from the universities and research institutions involved in polar research, from the cofunding Ministries and from NWO (ZWO). Every evaluation reconfirmed the value, importance and the quality of the programme, and provided valuable directions for improvements. For a long time, the polar regions have been recognized as the canary in the coalmine when it comes to investigating the effects of global climate change. They function as the airconditioners of our planet.

Polar research is challenging in many ways.

- It addresses many fundamental, societal and economical relevant scientific questions.
- It is technically and logistically highly demanding, due to the remote and hostile environments for field research and as a consequence very costly
- It is highly relevant in the (geo)political spectrum.

The research programme over the years evolved around four thematic cornerstones¹¹ that defined the scope of the programme:

1. Ice, climate and rising sea levels,
2. Polar ecosystems
3. Sustainable exploitation
4. Social, legal and economic landscape

It also pays attention to transcending themes and connecting lines like international collaboration and coordination and collaboration with private partners. It is internationally embedded in a well-established international network.

A series of (inter)national publications and evaluations give unequivocal proof of the established excellent quality of polar research in the Netherlands.

The NWO installed an international evaluation committee for the NPP 2009–2014, reporting the following in 2014:⁴

“The evaluation committee concludes that in general the quality of Dutch polar research projects, researchers, and output has been very good to excellent. As mentioned, these conclusions are partly based on the bibliometric analysis of Dutch polar research provided by the CWTS. This analysis involves all Dutch polar research publications that appeared between 2000 and 2013 and not only NNPP publications.” (p 11)

The CWTS⁵ analysis indicates that Dutch polar publications are well cited and relatively often appear in top-tier journals. It is also consistent with studies from Aksnes et al 2009⁶ and Ji et al 2014⁷. The committee’s positive view of Dutch polar projects was further supported by the policy representatives who were interviewed: results from Dutch polar research are used in (inter)national negotiations. Together this evidence indicates that Dutch polar research is internationally highly regarded. (p12)

The committee sees a strong international embedding of Dutch polar science. It seems likely that the developed Dutch polar infrastructure has had a positive effect on the already established collaborations with the British Antarctic Survey (BAS) and the German Alfred Wegener Institute (AWI) and is leading to future collaboration with the French Institut polaire francais Paul Emile Victor (IPEV). A successful example is the realization of the Dirck Gerritsz Laboratory at the British Rothera Research Station during the evaluated period. (p12)

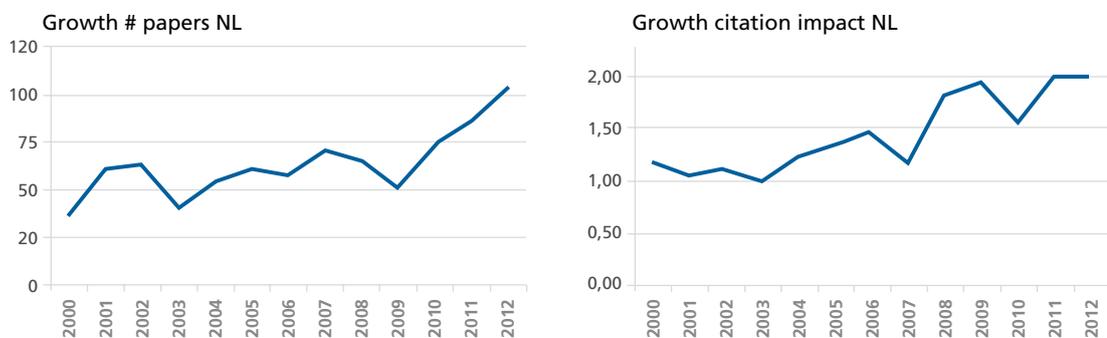


Figure 1 | Development of polar research in the Netherlands in the new millennium. In the left panel the number of polar publications per year are depicted. In the right panel the citation impact indicator MNCS⁷ is presented. Figure above taken from the report ‘Evaluation of NPP 2009–2014’, December 2014, p121

A significant jump in the citation impact for the NL publications shows in the above figure and appears around 2008. This coincides with increased attention for, and relevance of polar research due to the International Polar Year (2007–2008) and the improvement of the available infrastructure for polar research.

Taken the citation impact of Netherlands polar research based on the data provided by CWTS (period 2000–2013) the Netherlands ranks in the underneath figure as number three among the countries considered in this study for the evaluation.

Top 10 Polar citations, normalized for field and year

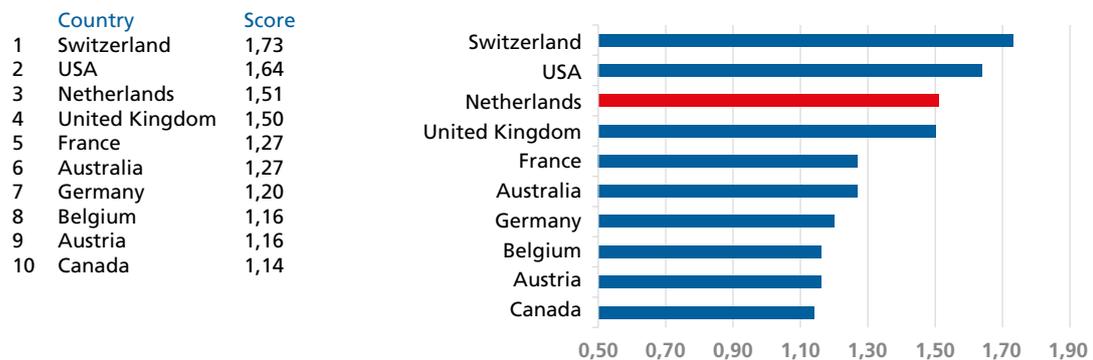


Figure 2 | Citation impact MNCS. The average number of citations of the polar research publications of a country. Citations have been normalized for field and publication year. An MNCS value of 2 for instance means that the polar research publications of a country on average have been cited twice as frequently as the average of their field and publication year.

Independently from the findings of the international evaluation committee for the NPP 2009–2014 a bibliometric analysis of international polar research made under the auspices of the **Norwegian research Council** also shows an outstanding performance of Dutch polar research. For the indicator “relative citation index” the Netherlands ranks second in the world for the period 2005–2009 and **first in the world** for the period 2010–2013⁸, p36. These studies clearly show that the Netherlands has even further improved its excellent performance in the most recent years.

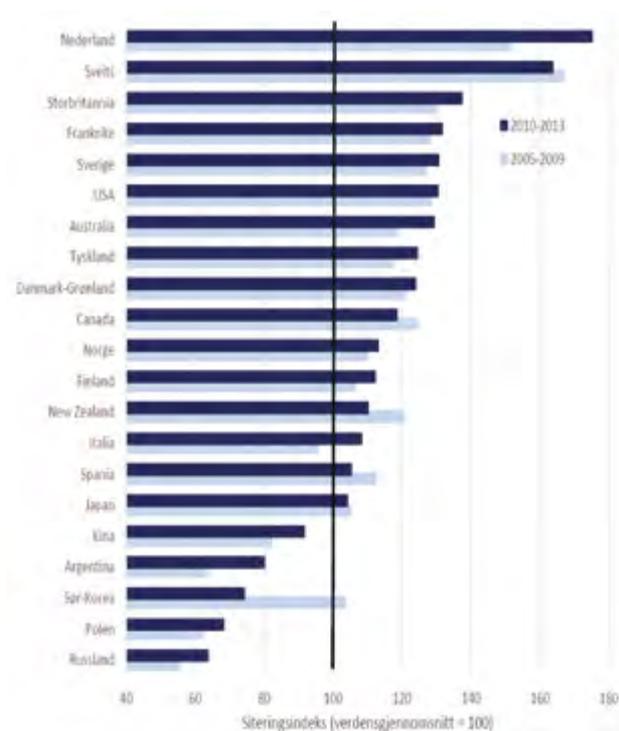


Figure 3 | Relativ siteringsindeks for the største polarforskningsjonene, basert på artiklene fra perioden 2005–2009 og 2010–2013. Kilde: NIFU/Web of Science

A second comparable bibliometric analysis under the auspices of the **Swedish Research Council** in 2015⁹ (period 2008–2012) confirms this international top ranking performance. It ranks the Netherlands as the second-best country with its share of highly cited polar research publications and **first in the world** when it comes to mean citation rate in polar research.



Figure 4 | Polar research citation impact of selected countries for publication from 2008–2012, sorted by share of highly cited publications. *Data from Science Citation Index – Thomson Reuters.*

Broken down by country, figure 4 from the report of the Swedish research Council (*p 9-10*) shows four leading nations in terms of citation impact: Switzerland, the Netherlands, United Kingdom, and United States. Here we show averaged data over the last five years (2008-2012) to obtain better statistics.

The success of the Netherlands Polar Program in international publications not only shows the quality of its science. It also shows the way it collaborates with other countries and its arrangement to make use of existing infrastructure wherever this is possible. A recent publication by Andrew D. Grey & Kevin A. Hughes¹⁰ in 2016 examined the relationship between Antarctic infrastructure extent and scientific research output. For scientific output the Scopus database (www.scopus.com) was used (only Antarctic research papers, period 2011–2015).

In an attempt to calculate the amount of publications per station bed (as a metric for costs of infrastructure vs output on infrastructure) the Netherlands produces the highest number of publications per station bed (see figure 5 taken from Grey & Hughes¹⁰). This is mainly because all of our logical requirements at the Dirck Gerritsz Laboratory at Rothera Research Station have been provided by the United Kingdom. However, this result shows the efficiency of the polar program and the great value of shared infrastructure by means of Memoranda of Understanding between nations.

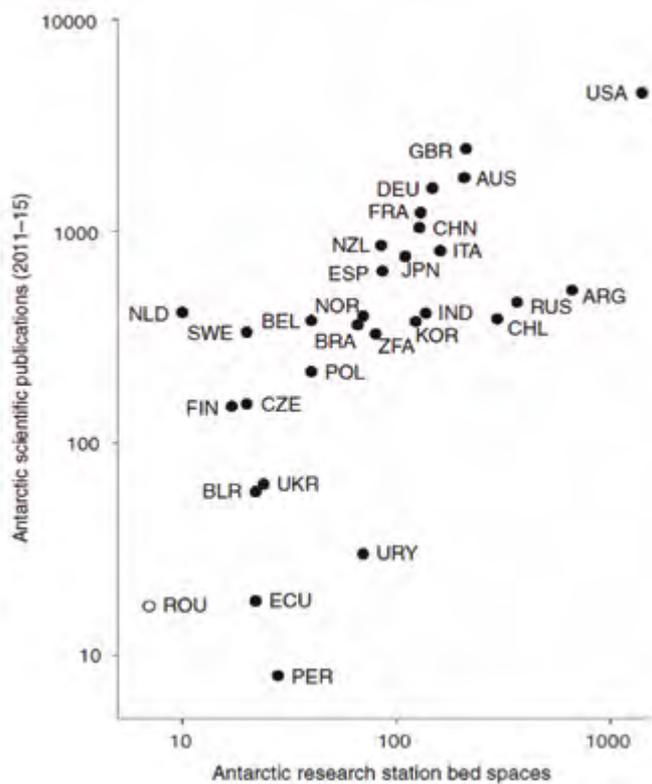


Figure 5 | The number of scientific research publications produced during the study period 2011–2015 by each Party compared with the number of bed spaces within that Party’s land-based Antarctic research facilities. Consultative Parties are denoted by black dots. Romania, the only non-Consultative Party with a research station, is denoted by an empty circle (Grey & Hughes¹⁰).

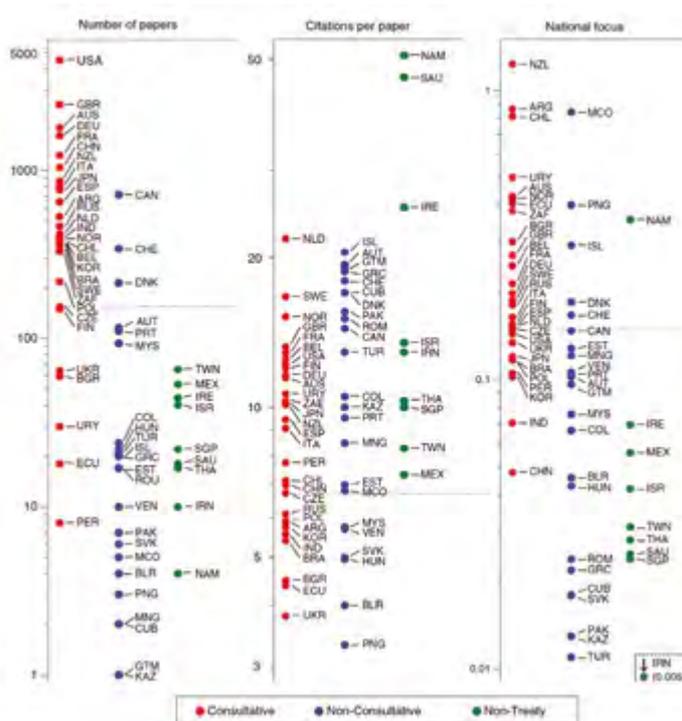
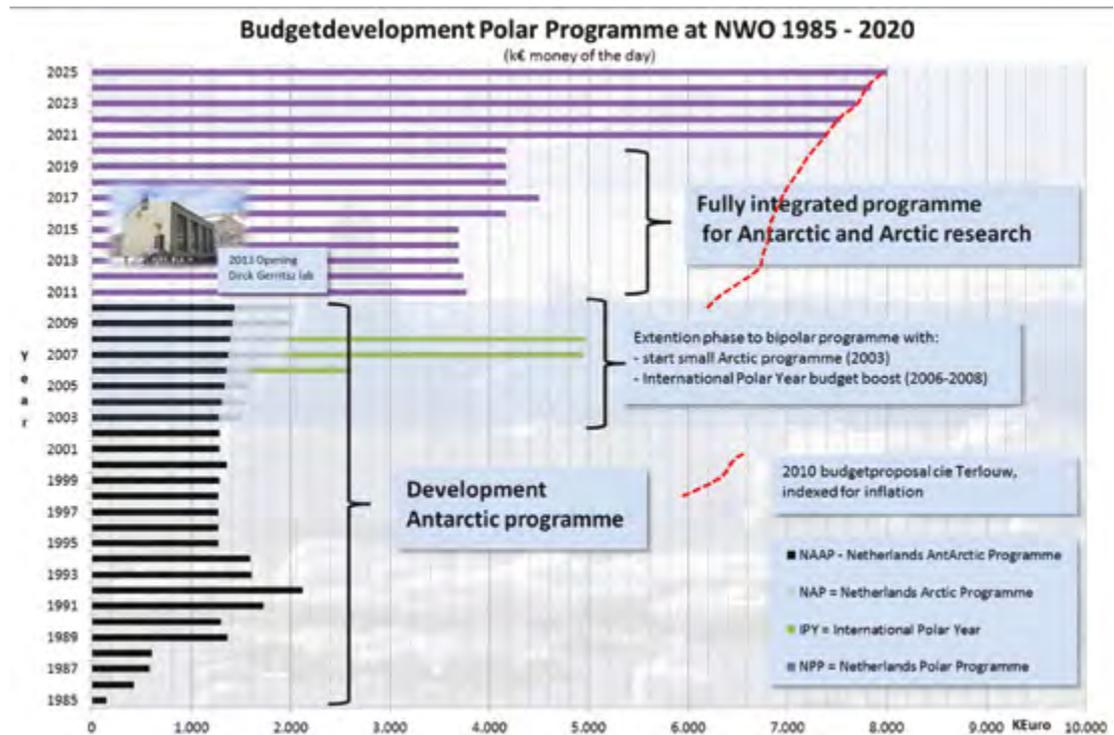


Figure 6 | Potential metrics to demonstrate “substantial research activity” by each nation based on scientific research publications generated during the study period 2011–2015: (a) number of papers, (b) mean citations per paper and (c) national focus (i.e., Antarctic research outputs as a percentage of total national science output). The dotted lines indicate the values for the Czech Republic, the most recent Consultative Party (Grey & Hughes¹⁰).

In 2010 the committee Terlouw evaluated the polar program operated by NWO. Its conclusions are summarized in a national policy framework The Netherlands and the Polar areas 2011–2015 (official name: **Beleidskader: Nederland en poolgebieden 2011–2015**), published by the Ministry of Foreign Affairs. This document provides the Polar Policy of the Netherlands for that period. It also gives an extensive explanation of the relationship between the polar policy and the polar programme and a historical overview of that programme since 1985.



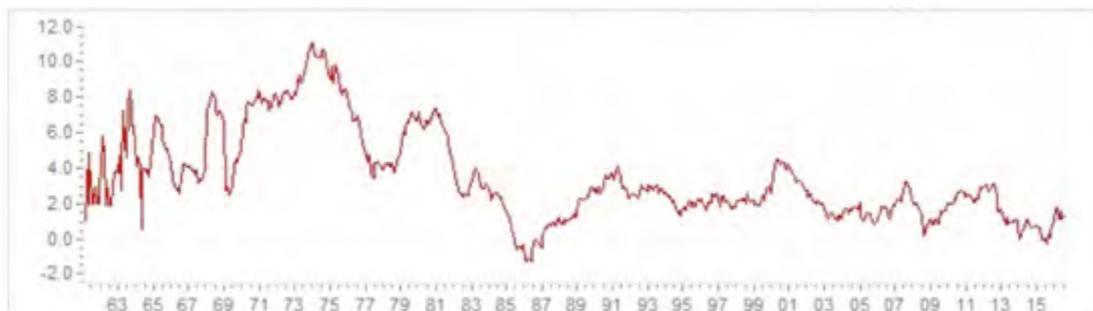
The figure above gives the development of the budget of successive polar programmes in money of the day. It started in 1985 as a single Antarctic research programme that leveled out to 1,4 MEuro/year until 2005. Euros before 1 January 2002 are recalculated from Guildens (1 Euro = 2,2 Gulden). The single Antarctic programme (NAAP) existed until 2002. The research area and topics were then expanded with a small separate Arctic research programme (NAP) and the overall budget for NAAP and NAP was boosted in 2006 due to the International Polar Year (2007–2008). From 2011 an integrated Netherlands Polar Programme was established to coordinate, support and initiate polar science in the Arctic and in Antarctica.

The dashed line indicates the 6,25 MEuro budget proposed in money of the day by the evaluation committee Terlouw et al. including its recommended indexation based on inflation. This unaltered recommendation would reach to a projected budget of 8 MEuro/year by 2025.

It is pointed out that a perhaps perceived budget leap in real terms for Antarctic research never took place until today, set against the initial budget of 1989.

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Grafiek | Historische Consumer Prize index inflatie Nederland (jaarbasis) – volledige looptijd.

Appendix V | Feedback by AWI, BAS and IPEV on Dutch polar research

Interview (by telephone) with Karin Lochte (Director AWI, Bremerhaven +49 (0) 170 918 4620). The interview was conducted on April 21st, 2017

The first question was her opinion on the concept of the laboratory containers that are stationed on Rothera, but are also used on ships like the AWI vessel Polarstern.

Lochte: Using the container concept is a very clever way of doing research on board ships and on land based stations. The labs in the containers can be made to very specifically suit the type of measurements you want to do. You can use them wherever you want and if the Germans would have a choice then they would also use the concept. The mobile laboratories in sea containers is definitely a successful concept!

What is your opinion of the Dutch research quality and commitment to polar research?

Lochte: Considering that the Dutch do not have a ship that can be used in arctic and antarctic conditions and are open to collaboration the mobile lab concept is a very money-efficient way of doing science.

Would there be interest in utilizing these mobile labs by German polar researchers?

Lochte: The community of Dutch research groups is maybe not always large enough to justify a very specific design for a lab and if you still want to push that design ahead, you need to have more support and use for the specific lab. Depending on the specifics of the lab, there certainly would be interest in using the lab by German groups. There are several ways of doing it:

- 1) include an international team of researchers in deciding the design of a lab and draft a research programme for it (using for instance EU money)*
- 2) be clever yourself and bring the use of the lab into a joint, collaborative programme, as has been done in the past for expeditions on German ships*
- 3) have an international competition for a programme in a specific lab.*

Do you see potential to incorporate a Dirck Gerritszlab type of docking station to house mobile container labs on Svalbard?

Lochte: It would certainly be a very nice option. The way the Dutch input (in making mobile labs available) can be realized on Svalbard of course depends on the model that is being used, but we could share facilities (diving facilities of Germans, specific analysis in mobile labs of the Dutch). Everything depends on the willingness of the Norwegian management of the station.

Is there an advice you would like to give the Dutch Committee on Polar Infrastructure?

The container concept really is a good direction and has the full support of AWI.

Interview (by telephone) with Jane Francis (Director, BAS Cambridge +44 1223 221449). She knows the concept of the sea container-based laboratories, as BAS is the institute that runs the Rothera research base where the DG laboratory is located. The interview was conducted on April 25th, 2017

What is your opinion of the Dutch research quality and commitment to polar research?

Francis: The Dutch scientists are well integrated and perform well in collaboration with the British scientist at the Rothera station. Science is of excellent quality and the Dutch focus on algal blooms is welcomed.

Do you feel that the concept of mobile 'sea container' labs is a successful concept?

Francis: The labs are well received and revolutionized the way the Dutch scientific community work at the station and how science on ships can be performed. The footprint of this design is quite green, it is relatively cheap to build and maintain. The concept is very innovative and efficient.

Do you see possibilities for use by other, international, polar researchers to make use of these mobile labs?

Francis: The current MoU between BAS and NWO covers the issue of the other scientists working in the lab at Rothera. All arrangements have to be made with full agreement between NWO and BAS.

Do you see potential to incorporate a Dirck Gerritsz lab type of docking station to house mobile container labs on Svalbard?

Francis: These kind of mobile labs have potential to be used in other locations. It should be possible to use them on Svalbard, with agreement from the relevant authorities.

Interview (by telephone) with Pascal Morin (Director Scientifique des Programmes IPEV 00033 2 98 05 65 03). Marine Chemist, knows the concept of the containers very well. The interview was conducted on April 28th, 2017

What is your opinion of the Dutch research quality and commitment to polar research?

Morin: I'm aware of the Dutch arctic research, that is of good quality and is useful for the scientific community because of the long term presence: the conditions are quickly changing and long term data sets are essential. Presence is already for 20 years and the Dutch have brought in their specific expertise. Combining expertise in the polar research effort is essential since the conditions and logistics are so difficult that no single country can do all efforts that are necessary.

Do you feel that the concept of mobile 'sea container' labs is a successful concept?

Morin: Excellent for short term projects, not for long term monitoring project. For the long term fixed structures are more suitable.

Do you see potential to incorporate a Dirck Gerritsz lab type of docking station to house mobile container labs on Svalbard?

Morin: Svalbard is considered a long term project and needs a fixed structure. The preference is for an involvement of the Dutch in a shared fixed structure shared with the French-German initiative. The Dutch are welcome to join, but they should be in for at least a number of years >4. A project update should follow before summer and then it should be clear whether the Dutch will participate. There is a clear benefit of sharing access and logistics.

Is there an advice you would like to give the Dutch Committee on Polar Infrastructure?

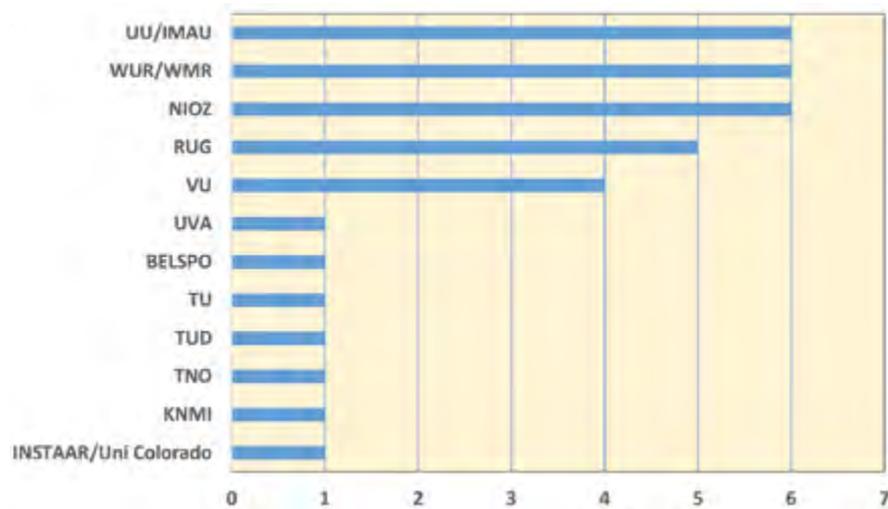
Morin: Try to have a vision that is at least for the mid – to long-term. Since the type of changes that we see presently cannot be studied with short-term projects.



Appendix VI | Outcome survey on NL polar research and Infrastructure by the polar science community

(July 2017)

The CPI has completed a survey to test the views of the (polar) science community. The questionnaire was designed to maximise anecdotal information and views on the quality of Dutch polar research, required infrastructure and international cooperation.



The diversity of responses demonstrates the wide ranging research objectives of the participating individuals and their Institutes. Although the outcome reflects the individual views, concerns and infrastructural needs (e.g. IMAU, RUG, NIOZ, WUR), the general view is that the NL polar research is of high quality and that it is internationally esteemed (especially considering the limited funds for NL polar research). There is concern regarding the level and stability of funding, especially for longer-term monitoring. The overwhelming consensus is that international cooperation is indispensable for Dutch polar science, notably with AWI and BAS but also others and further cooperation with international institutions should be promoted.

Concerning specifically polar infrastructure, there is agreement about the following:

- The NL polar infrastructure is regarded effective and seen as a ‘trading chip’ in our international cooperation, but continued investment is proposed to remain credible at the time that other countries significantly step up their polar research efforts and investment in polar research infrastructure.
- Flexible and mobile (specialised) laboratories are valued, mainly by current users, also for shipborne application and in larger international cooperation programmes. The automatic weather stations should also be acknowledged as flexible and mobile units with associated continuity of funding.
- Access to third party logistics, field stations and facilities, especially icebreakers, is a key requirement. Successful collaboration is the cornerstone to maximise access to third party infrastructure.
- Suggestions are made to establish a Dutch Polar Research Institute to coordinate best use of own and international infrastructure and logistics and pulling together of the polar science community.

The full feedback is listed in the table below; minor edits have been made to limit the size of the document.

Institute	Field of Research	Involvement in polar research projects	Views on Dutch Polar Research	Infrastructural Requirements	International Cooperation	Views on Flexible/Mobile labs	Other comments
BELSP	Research management	Yes, program manager BELSP	Substantial and essential support to Polar research by N.W.O.	NA	BELSP MOU 2016 led to Belgian-Dutch research project	Helps to promote international cooperation	Balance logistics support expenditure against research budget
IMAU	Ice, climate and sea level	Yes	Wide ranging requirements. Difficult to manage.	Specialized equipment and modelling. LT focus for monitoring.	AWI, BAS and many others	Relevant for a number of projects, location bound.	
IMAU	Ice, climate and sea level	Yes, 4 decades of experience with IMAU	High scientific impact with small budget	Weather stations, access to satellites, modelling	Excellent support from AWI and BAS and Scandinavian partners	Good for specific applications. In parallel need automated weather stations	Financial basis unstable for the future
IMAU	Atmospheric research, paleoclimate	Yes, analysed air trapped in ice, ice coring	High scientific impact with small budget	Access to international ice drilling operations	Very good, and they bring the infrastructure and logistics	Prefer more funding focus on science and international infrastructure	Need LT funding for monitoring (equipment)
INSTAAR, Uni of Colorado	River and coastal processes	Yes, Greenland, Canada and Alaska	Impressive	Access to local facilities for IPY project (incl. boats)	Good with USGS, BLM, GEUS et al	Seems great. Also need for small boats.	
KNMI	Climate change and modelling	Yes	Too much focus on life sciences, less on earth sciences	None	None	NA	
NIOZ	Marine microbiology	Yes, past and hopefully future	Successful	Access to research stations and labs	Very good with AWI	Great options where applicable	
NIOZ	Trace metals	Yes, A and AA	Good research and high quality	Access to icebreaker and clean labs and equipment	AWI and Stanford University	Perfect	
NIOZ	Animal ecology (birds)	Yes	Good. Also reach out to Russian researchers	Access to field station Taimyr and helicopter	Uni of Moscow	Good, we should have more of these.	
NIOZ	Chemical oceanography, trace metals	Yes	High standard	Access to icebreakers and clean sampling equipment	Good with AWI and KOPRI	Good	
NIOZ	Marine sciences and geology	Yes, A and AA via IODP	Excellent science and critical contributions, although funding is limited	Access to IODP	IODP, AWI, BAS and others	Essential requirement. Best deployed in large scale international efforts.	Embed NL polar research infrastructure within 'NWO-I'

Institute	Field of Research	Involvement in polar research projects	Views on Dutch Polar Research	Infrastructural Requirements	International Cooperation	Views on Flexible/Mobile labs	Other comments
NIOZ/JUVA	Marine microbiology/viral ecology	Yes	High quality and internationally acknowledged. Continues to need investment.	Specialized labs, equipment and a base	Excellent with BAS and AWI. Prefer more international MoU's.	Great idea for specialized research. Move them around as required. Needs more international approach.	NL research depends on investments of other countries in infrastructure and icebreakers. We should still invest to make our effort credible and our cooperation productive.
RUG	Biology	Yes, own research in A and teaching A and AA	Interesting volume. Focus on scientific innovation, less on strategic investment	Access to Ny-Ålesund station. Foreign partners.	Very good with AWI, IPEV and NPI et al	Interesting for specialized applications	Invest in research groups/programmes more than in infrastructure
RUG	Ecophysiology of marine micro-algae	Yes	Encouraging international cooperation	Access to coastal research stations and ice breakers	Very good with AWI and BAS	Excellent facilities. Not sure on flexibility and mobility.	No need for NL infrastructure
RUG	Sea ice ecosystems and climate gasses	Yes	Very successful projects. Maintain open calls for proposals. Not sure about policy driven research.	Specialized lab containers	Cooperation with BAS + many parties re modelling	Good idea, but perhaps not very flexible (Rothera only). Need somebody to manage the labs.	
RUG	Social sciences	Yes	Cooperation between researchers and institutes can be improved	International collaboration. Better coordination on NL polar infrastructure.	Fruitful collaboration with partners in EU-PolarNet	Positive	
RUG	Ethnography, history	In the past		Access to Russian network	With BAS and Tromsø University	NA	Include linguistic, history and law sciences in the infrastructure esp. in Russia
TNO	Geology	Yes	Good in relation to limited funding	Access to Ny-Ålesund facilities	NA	Limited focus on small infrastructural support	
TU	Law	Yes	NPP is important. Support both small and large institutes.	Access to polar stakeholders	Collaboration with participants of Polar Law Symposium	Make the best use of the many polar facilities internationally (NL or other)	Infrastructure requirement should be science driven; no political motives.
TUD	Remote sensing snow & ice	Yes, papers and BELSPO project	World class quality. Maintain balance in Programme.	Access to different locations for flexible campaigns (tents) and international cooperation	Excellent with Belgian Polar Programme.	Good idea. No need for our work.	
UU	Earth sciences	Yes (not through N.W.O.)		Access to IODP expeditions	IODP and AWI	NA	

Institute	Field of Research	Involvement in polar research projects	Views on Dutch Polar Research	Infrastructural Requirements	International Cooperation	Views on Flexible/Mobile labs	Other comments
UU	Biogeochemistry, ecosystems, oceanography	Yes, 2 field campaigns in A (no N.W.O. funding)	Mixed	Access via international partners	Excellent with multiple foreign partners	NA	
UU	Polar meteorology	Yes, surface mass loss A and AA. SLR.	IMAU makes great contribution. Budget is (too) small.	Automated Weather Stations	International collaborations with AWI, BAS and others very fruitful	Good. It implicitly focuses NPP to certain themes.	Need stable funding
UvA	Scandinavian cultures and literature	Yes, Arktisk in Norway	Excellent, important to be an international player	Possibility for international collaboration	Many different partners incl. APECS etc. etc.	Very important (but not for my work)	
VU	Polar terrestrial ecosystems	Yes since 2003	Strong. Funding issue for multi season projects.	Access research stations Antarctica (Spain and UK)	Very good with BAS	Good for specialized equipment and environments	Promote more research cooperation between AT members
VU	Terrestrial ecology and biogeochemistry	Yes	NPP is good focussed effort, outstanding performance	Access to Polar stations through international partners	Very good with BAS and UNIS	Focus more on third party facilities and international cooperation	
VU	Permafrost, carbon cycle	Yes	Dutch polar research should remain science driven	Access to equipment and international cooperation (incl. Russia and Japan)	Excellent with AWI	These facilities focus too much on a single area	
VU	Paleoecology, climatology	Yes, Greenland and Svalbard	Limited funding for my project	Access to boats and bottom coring equipment in Svalbard	NPI	NA	
WMR	Marine ecology	Yes since 1984	Much focus on scientific program, less on applied and policy LT research	Variable, access to icebreakers	Very good with AWI	Too much focus on these units. Limits choices for other facilities.	
WMR	Ice-associated zooplankton	Yes	Nice array of topics. Need for more LT monitoring	Access to icebreaker	Close coop with AWI	May restrict research to certain regions	
WMR	Marine mammals (seals)	Only on the sideline		NA	NA	NA	
WMR	Marine research	Yes, AA in 1997 and A since 2012	Highly qualified international programme. Too much focus on fundamental research, less on applied research.	Specialized marine laboratory and access to sampling vessels	Good with NPI and Akvaplan-Niva	Useful also for Ny-Alesund. Ensure access for all Dutch polar scientists.	

Institute	Field of Research	Involvement in polar research projects	Views on Dutch Polar Research	Infrastructural Requirements	International Cooperation	Views on Flexible/Mobile labs	Other comments
WUR	Animal ecology	Yes, between 1993 and 2008 in Taimyr	Not enough focus on Russian Arctic ecosystems	Simple field station in Taimyr	Very good with Russian Institutes	NA	
WUR	Social and environmental sciences	Yes, oil, gas and tourism in Norway	Well established and internationally renowned	Access to research stations	Good collaboration with NPI	NA	Difficult to get access to science community in Ny-Alesund
APECS	Association Polar Early Career Scientists		NPI	Norwegian Polar Institute		UU	Utrecht University
BELSP0	Belgian Science Policy Office		RUG	Rijks Universiteit Groningen		UvA	Universiteit van Amsterdam
IMAU	Institute for Marine and Atmospheric Research Utrecht		TNO	NL Organisation for Applied Scientific Research		VU	Vrije Universiteit Amsterdam
INSTAAR	Institute of Arctic and Alpine Research (Uni. of Colorado)		TU	Tilburg University		WMIR	Wageningen Marine Research
KNMI	Koninklijk Nederlands Meteorologisch Instituut		TUD	Technical University Delft		WUR	Wageningen University & Research



Appendix VII | Arctic Manifesto

ARCTISCH MANIFEST

We weten het al jaren: klimaatverandering heeft grote gevolgen voor onze planeet. Deze effecten zien we versterkt in het Noordpoolgebied. In de Nederlandse politiek en zeker tijdens de campagne voor de Tweede Kamerverkiezingen 2017 blijven deze problemen onderbelicht. Wij, politieke jongeren, presenteren dit manifest om een duurzame omgang met het Noordpoolgebied hoog op de agenda te plaatsen. Daartoe behoort het drastisch minimaliseren van de gevolgen van klimaatverandering, beschermen van leefgebieden van dier en mens, bevorderen van onderzoek en versterken van internationale samenwerking. De samenwerkende Politieke Jongerenorganisaties zien het centrale deel van het Noordpoolgebied als globaal publiek goed. Daar moet Nederland ook naar gaan denken en handelen.

van leefgebieden van dier en mens, bevorderen van onderzoek en versterken van internationale samenwerking. De samenwerkende Politieke Jongerenorganisaties zien het centrale deel van het Noordpoolgebied als globaal publiek goed. Daar moet Nederland ook naar gaan denken en handelen.

Minimaliseer de gevolgen van klimaatverandering

Tijdens COP21 in december 2015 in Parijs werd een historisch klimaatakkoord gesloten. We reldwijd spraken we af dat de gemiddelde temperatuurstijging beneden de 2 graden moet blijven en gestreefd wordt naar maximaal 1,5 graden opwarming. Zelfs als we dit dusdanig weten te beperken, betekent dit naar verwachting 4 tot 5 graden opwarming van het Noordpoolgebied, met alle ecologische, economische en geopolitieke gevolgen van dien. Voor Nederland betekent dit een stijgende zeespiegel, extreem weer door 'haperende polen' en veranderende biodiversiteit, onder andere in het Waddengebied.

Om het smelten van de ijskappen te minimaliseren, moeten we de opwarming van de aarde een halt toe roepen. Daar hoort, zeker in Nederland, een ambitieus energie- en klimaatbeleid bij, gericht op zowel mitigatie (het voorkomen van meer klimaatverandering) als adaptatie (het aanpassen aan klimaatverandering). De overheid faciliteert particulieren en bedrijven in schone oplossingen voor energie en investeert in een verdere ontwikkeling van deze oplossingen.

Bescherm leefgebied van dier en mens

Het Arctische ecosysteem is uniek, maar ook kwetsbaarder dan andere gebieden op aarde. Dit betekent dat in eerste plaats bescherming van biodiversiteit en ecosystemen nodig zijn. Voor gevoelige gebieden zijn "no-go zones" een effectief middel om verstoring van ecologische processen te voorkomen. Ook de leefbaarheid voor de circa 3,8 miljoen mensen die in het Arctisch gebied wonen, waaronder inheemse volken, dient bewaakt te worden. Ondersteuning van nieuwe mogelijkheden voor duurzame economische ontwikkelingen, ook in de 'groene' en 'blauwe' economie, en de inzet van innovatieve technologieën in het Noordpoolgebied is daar onderdeel van. Daarvoor zijn strenge richtlijnen nodig en Nederland dient daarbij een actieve en constructieve rol te spelen.

Stimuleer onderzoek

Op dit moment vindt er baanbrekend en noodzakelijk onderzoek plaats in het Noordpoolgebied gericht op klimaat, milieu, biodiversiteit en energie. Wetenschappelijk onderzoek en kennis van het Arctisch gebied zijn het fundament voor bescherming, beheer en behoud van kwetsbare ecosystemen en leefgebieden. Nederland kan door internationale onderzoekssamenwerking een grote bijdrage leveren aan de kennis over het Arctische gebied en daarmee een zichtbare speler blijven in dit snel veranderende gebied. Onderzoek staat aan de basis van beslissingen en maatregelen die in nationale en internationale fora worden genomen voor een zo duurzaam mogelijke omgang met het gebied. De resultaten van dit onderzoek dient daarmee leidend te zijn in het verdere beleid van de Nederlandse overheid.

Versterk internationale samenwerking

Het centrale deel van het Noordpoolgebied is een global public good. Hoe er mee om wordt gegaan is daarom een mondiale kwestie en niet uitsluitend een aangelegenheid van de Arctische staten. De omgang met de Zuidpool is een goed voorbeeld voor het Noordpoolgebied. Onder het Antarctisch Verdrag hebben vrede, onderzoek en de bescherming van het gebied prioriteit. Ook voor het Noordpoolgebied moet gestreefd worden naar een vergelijkbaar verdrag. Daartoe moet internationale samenwerking versterkt worden en de internationale gemeenschap haar verantwoordelijkheid nemen. Nederland dient een actieve rol te spelen bij de Arctische Raad en bij het versterken van Europees Noordpoolbeleid. De participatie en belangen van de inheemse bevolking moeten in dit beleid veilig gesteld worden.





Supplement | Recommended Governance NPP

The Committee for Polar Infrastructure (CPI), among other things, was tasked to identify an optimal future scenario for the management of the polar research infrastructure. In addition to the original scope of the CPI, also the governance of the Netherlands Polar Programme was addressed as a timely and urgent matter, based on engagement with both the “Interdepartementaal Polair Overleg (IPO)” and the Netherlands Polar Committee (NPC) members.

Based on the following considerations it is recommended that NWO installs a Steering committee for the Polar Programme (SPP) instead of the Netherlands Polar Committee (NPC) to strengthen the governance of the NPP.

1. The NPC with its current terms of reference has no formal mandate or real steering power. It remains a polar platform for information exchange, debate and ad-hoc advice. Due to its fragmentation and lack of alignment it cannot develop and execute a strong (long-term) vision or respond well to ad-hoc opportunities.
2. There is a need for a more effective governance driven and supported by science and politics, with a mandate to decide on the required deployment of the NPP budget. Special attention is needed for:
 - long term strategic planning, including infrastructure and monitoring.
 - an ability to respond timely and decisively with an NPP budget commitment to ad hoc opportunities.
3. Evaluations (e.g. NPP evaluation 2014) recommended to invest in more active engagement and awareness of (polar) policy makers, recognizing the need for them to follow projects more closely and to translate research results into policy relevant information. Implementation is still due during NPP 2016–2020.
4. The proposed scenario presented in this report requires well informed, (polar) expert management and (stronger) governance to deal with the complex scientific, political and international playing field.
5. There is a need for a five year rolling budget and long term planning (as outlined in the report).
6. NWO (operator of the NPP) is a long term minority funding partner (20%) in the NPP. Applying the principle of a more even representation of other funding partners (BZ, I&W, EZK, LNV and OCW) will help to improve their support and enhance their level of engagement.
7. The NPP is a multidisciplinary programme bound by the polar regions. It goes beyond the Domain Science with a theme embedded in social sciences and humanities. As such an improved governance of the NPP should also go beyond the predominant domain.
8. Under the terms of reference of the Domain Science there is an excellent possibility under chapter 8 to install a (polar) steering committee. The steering committee described under that chapter recognizes the need for some specific programs under the auspices of NWO to be governed in a more specific, dedicated way. Ten articles describe the tasks, responsibilities and (budgetary) mandates of standard steering committee. Such a committee would be an appropriate candidate to strengthen the governance of the NPP.

A steering committee would be able to accommodate and to properly address all the above considerations.

Advised operational mode of the Steering Committee Polar Programme (SPP)

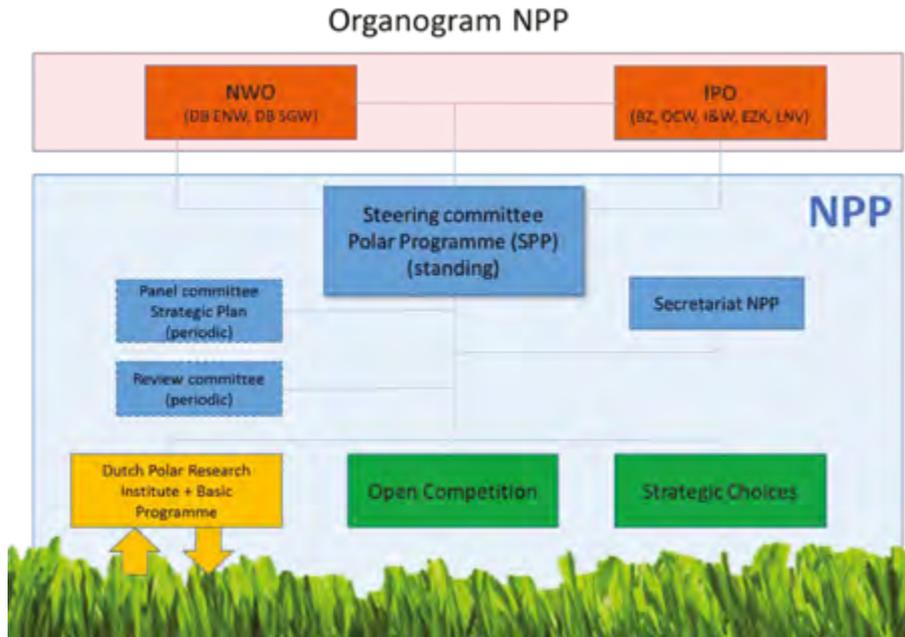
To effectively govern and to be decisive and without conflict of interests the proposed SPP will comprise of a maximum of five members: two scientists nominated by NWO (1 ENW, 1 SGW) and two policy representatives nominated by IPO. The chair will be independent, either a senior politician, former industry executive or an emeritus professor. The NWO nominees can be related to the advisory structure of the domains. An appointment is for four years and limited to two terms. The SPP will meet at least twice a year.

Every five years the SPP will install and supervise a polar panel committee that is tasked to draft an updated (long term) polar research strategy known as 'Poolposition-NL' underpinning the NPP. The SPP will need to agree upon terms of reference for this panel. The polar research strategy will need to take into account the actual polar policy of the NL Government, infrastructural legacy and demands and the (international) polar sciences agenda together with national developments at the Universities and knowledge institutes. The SPP will approve and supervise the deployment of its available NPP budget into three lines.

1. **Open competition**, guided by the approved polar strategy. Calls will be run by the NPP secretariat. Call design will be according to NWO standards and content will be directed by the strategy document 'Poolposition-NL'. The SPP will approve the calls and install the required associated review committees. For polar sciences it will require an international profile. A polar policy review committee will need to have a national profile and requires policy experts to be nominated by the IPO.
2. **Strategic Choices**, supported by a separate budget. This budget is dedicated to high gain ad-hoc polar research opportunities that arise within the international realm and can provide challenging opportunities for (parts of) the polar research community. It can also be utilized for upcoming polar opportunities that arise from (international) high level political meetings or to support (new) bilateral agreements, expeditions (alike SEES) and polar stakeholder communication events. Choices will be underpinned by proposals from the polar science community (e.g. periodic call for ideas/opportunities), IPO and the NPP management.
3. **Dutch Polar Research Institute (DPRI) and Basic Programme**. It is envisaged that the virtual DPRI entity establishes a polar research programme focused on long term monitoring and on effectively utilizing the long term investments made in polar infrastructure. The programme also needs to be developed as a cornerstone for each of the (four) established polar research themes within the NPP and will also address and coordinate the data management of all NPP projects. The SPP will govern the DPRI and direct and supervise its development.



The SPP will be supported by the NPP secretariat. Successive NPP evaluations recommended strengthening of the its secretariat beyond 2 f.t.e. policy officers. The SPP will need to look further into solving this persistent capacity problem. The SPP will initiate required periodic evaluations of the NPP and also task and constitute required evaluation committees.



All activities under and by the SPP will be subject to NWO procedure and codes of conduct. Every year the SPP (chair) meets with the ENW domein board to exchange views and report on activities.

Glossary of terms and abbreviations

AC	Arctic Council
AIV	Advisory Council on International Affairs (Adviesraad Internationale Vraagstukken)
ARICE	Arctic Research Icebreaker Consortium for Europe
AT	Antarctic Treaty
ATCM	Antarctic Treaty Consultative Meeting
AWI	Alfred Wegener Institute
BAS	British Antarctic Survey
BZ	Ministry of Foreign Affairs (Buitenlandse Zaken)
COMNAP	Council of Managers of National Antarctic Programs
CPI	Committee Polar Infrastructure
CWI	National Research Institute for Mathematics and Computer Science
DGL	Dirck Gerritsz Laboratory
DPRI	Dutch Polar Research Institute
DROMLAN	Dronning Maud Land Air Network
ENW	NWO Domain Science (Exacte en Natuurwetenschappen)
EPB	European Polar Board
EU	European Union
EZ	Ministry of Economic Affairs (Economische Zaken)
IASC	International Arctic Science Committee
I&M	Ministry of Infrastructure and Environment (Infrastructuur & Milieu)
IODP	International Ocean Discovery Programme
IPO	Interdepartmental Polar Consultation (Interdepartementaal Polair Overleg)
IPEV	Institut Polaire Francais Paul Emile Victor
MARVEL	Modular Arctic Research Vessel
MOSAiC	Multidisciplinary drifting Observatory for the Study of Arctic Climate
MoU	Memorandum of Understanding
NIOZ	Royal Netherlands Institute for Sea Research
NPC	Netherlands Polar Committee
NPP	Netherlands Polar Research Programme
NWO	Netherlands Organisation for Scientific Research (Nederlandse Organisatie voor Wetenschappelijk Onderzoek)
OCW	Ministry of Education, Culture and Science (Onderwijs, Cultuur en Wetenschappen)
SCAR	Scientific Committee on Antarctic Research
SGW	NWO Domain Social Sciences and Humanities (Sociale en Geesteswetenschappen)
SIOS	Svalbard Integrated arctic Earth Observation System

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