There is a need to shift from conventional approach to careers and consider more variations in academic fields that are focused on climate change; Young explorers in the Arctic.

PHOTO COURTESY: CONSTANCE GARCIA-BARRIO

11. Promoting Youth Engagement and Capacity-Building in Polar Knowledge Goals

The consequences of climate change in Polar regions are anticipated to disproportionately affect the younger generation, making it crucial to encourage them to engage in climate and environmental science more than ever. There is a gap between the interest and awareness of the youth towards Polar studies and its opportunities, especially in India. The goal is to shift away from the conventional approach of pursuing careers and instead consider more variations in academic fields that are focused on climate change and the science and policy of it. It is also essential to promote inter, trans and multidisciplinary expertise in the study and research of Poles. Therefore, the need of the hour is to broaden the horizons of Polar understanding for the youth by introducing and developing curriculum, organizing events and programmes, promoting knowledge about career opportunities in Polar studies, embracing technologies and innovations for sustainable and transformative ecosystems and thus, ensuring overall capacity-building in Polar knowledge goals.

11.1 Introduction

Polar regions are facing a myriad of challenges such as climate change, sea-level rise, plastic pollution, ocean acidification. Every biotic and abiotic entity on earth is facing the consequences of climate change directly or indirectly and youth is no different. Engaging the youth in Polar knowledge goals is essential for addressing the global challenges of climate change and promoting a broader understanding of environmental issues. By presenting Polar studies as an attractive educational and career option, a new generation of dedicated Polar professionals can be developed so that they can contribute towards the preservation and sustainable development of the Polar regions.

11.2 Rationale

India is becoming increasingly vulnerable to the effects of climate change, especially those occurring in the Polar regions. These impacts can be seen on agriculture, lifestyle, sustainable growth and livelihood of various communities. The rise in sea level is posing a threat to coastal communities of India, while alterations to monsoon patterns are affecting agriculture. These changes are consistent with the climatic changes, especially in the Arctic as studies have pointed out a relationship between Arctic ice melt and the monsoon precipitation (Verma, 2023). Furthermore, the loss of water resources and habitat, as well as disruptions in allied sectors such as fisheries and tourism are also being felt (Dayal, 2023). Additionally, the costs of disaster management and infrastructure adaptation are increasing (Ibid.).

disaster management

The youth is most likely to bear most of the consequences of climate change. Unfortunately, there is a significant lack of data in many areas of research (Dayal, 2023). However, the youth should be encouraged to recognise the abundance of job opportunities available in fields of climate and environmental science (Ibid.). To achieve this, there is a need to shift from the conventional careers such as doctors or engineers and instead consider new academic interests (Ibid.). Due to the widespread nature of climate change, it is also crucial for the students to have inter, trans and multidisciplinary expertise from different countries. Given the fact that the events in Polar regions, the Indian Oceans and the Himalayan glaciers are interlinked, it is shortsightedness to not open people's minds and study these existing links, even though the Poles may appear to be far away from India in terms of geography (Saran, 2023). Besides, COP 26 critically argued that climate change has to be tackled at three levels; at the country, company/ organisation, and at the citizen level (Singhania, 2023). This articulation by the COP 26 calls for youth participation in the Polar affairs to promote people's engagement with critical issues at the individual level.

job opportunities

COP 26
youth participation

Furthermore, the youth can consider both science and policy and geopolitical aspects of Polar studies. Historically, Polar discourse has been predominantly centred around science but with the escalated melting of sea ice, the Polar regions are being transformed resulting in increased strategic competition; thus, exposing a geopolitical hue. This is creating new opportunities for youth in various disciplines other than science to engage and explore in Polar research.

11.3 Capacity Building in Youth

A number of steps have been taken in India to achieve its Polar knowledge goals for the youth. These efforts can be categorised into four areas: recent initiatives at the elementary level of education, developments in Polar research at the academic level, advancements in professional research, and initiatives to generate interest to develop sustainable businesses.

Polar research

11.3.1 Education and outreach

Indian Navy
UGC
SWAYAM

Efforts have been made at the elementary or school level, to familiarise the students with the Poles and create the awareness that Polar studies could be a viable career option. For instance, the Indian Navy conducted a quiz related to Polar areas that involved 7,500 schools. The UGC has been reached out to conduct online courses on the SWAYAM portal to survey proposals for new educational courses. Among the 92 proposals, efforts are underway to consider four options to promote knowledge and awareness of the Poles. It is yet to be figured out as to how these can be financed so that the youth can get information online (Khanna, 2023).

In addition to conventional approaches, it is necessary to explore out-of-the-box solutions. SECMOL is an alternative school that aims to find solutions to prevent human involvement in emissions and pollution. The school teaches students innovative solutions such as ice stupas and refreezing of glacial lakes using thermal pumps and heat engines from an early age. Furthermore, the building itself serves as an inspiration for students to pursue a greener and more sustainable future. Built in the mid-1990s, the school was constructed using soil as the primary building material, which is readily available to everyone, regardless of their financial status. The building is also heated and powered by the sun, which is accessible to all. When these resources are combined with human ingenuity, remarkable accomplishments can be achieved, leading to a happier and healthier life for all (Wangchuk, 2023).

carbon-neutral
energy-positive school

Ladakh

The school building is powered entirely by solar electricity, with other major needs such as heating being met through passive solar heating. This innovative approach could potentially make it the world's first carbon-neutral, off-grid, energy-positive school. The use of solar energy is integrated into nearly all aspects of life at the school, from cooking with concentrated dishes to providing natural lighting, pumping electricity, and heating water. Even the cows on the campus live in solar-heated cow sheds. The concepts covered in 9th and 10th-grade textbooks, such as heat conduction, convection, and radiation, are put into practice to improve life at the school. Students collaborate on building designs that use only solar energy for heating, resulting in modern living conditions in even the coldest climates, such as Ladakh, that are comparable to those in New York or London without any negative impact on the atmosphere. Furthermore, by incorporating geography, it is possible to determine the orientation of the sun in each season, which can inform building design that maximizes natural cooling in the summer and warmth in the winter. The school strives to reduce its carbon footprint and mitigate air pollution through the implementation of sustainable practices, while also instilling these values in its students for lifelong adoption (Wangchuk, 2023).

Mission LiFE

Another effort to promote Polar knowledge and interest among the youth is being done through public schemes such as Mission LiFE, launched by the Prime Minister of India on June 5, 2022. This Mission does not rely solely on engineering-based solutions to address environmental issues. Rather, it emphasises on the importance

of minimizing our impact on the environment by practising conservation in every aspect of people's daily lives (Khanna, 2023). Apart from this, the Indian government is conducting television programmes where various government officials participate to convey Arctic related issues to the youth of India. UGC held a seminar along with the UArctic and Rashtriya Raksha University is the first university to gain a membership of the UArctic (Ibid.).

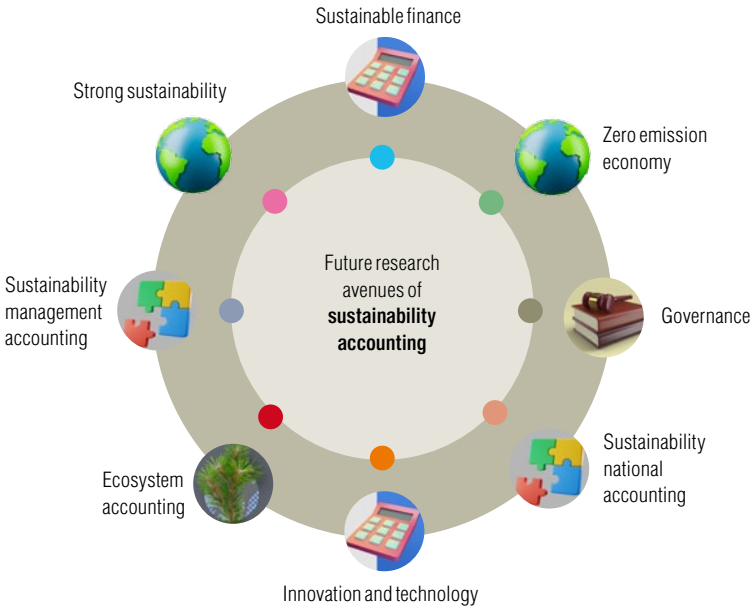
UArctic
Rashtriya Raksha University

11.3.2 Multidisciplinary Polar Studies

Academic research in multidisciplinary Polar studies is an area where youth participation has been lacking. A major reason for this has been the common misapprehension that one needs to be exclusively trained in physics, mathematics and natural sciences to work in the Polar regions (Dayal, 2023). However, the challenges faced by the Polar regions are not only climate change, but also security-related. This calls for the growth of transdisciplinary and multidisciplinary academic expertise in the field of Polar studies. For instance, there is research on areas related to accounting on climate change, climate finance, blue economy and more such issues that directly and indirectly facilitate the understanding of the Polar regions. Students pursuing undergraduate and post-graduate studies in the academic disciplines of biology can also pursue doctoral studies or higher education in climate sciences or climate studies (Ibid.). However, such opportunities are limited in India since there is a dearth of multidisciplinary academic programmes in the educational institutes (Ibid.). This is one of the biggest concerns

multidisciplinary academic programmes

Fig. 11.1: A holistic figure displaying future research avenues for youth in sustainability accounting



Source: Singhania, 2023

TERI
NCPOR
opportunities

for the Indian academia striving to involve the youth in Polar research. Despite this, institutes such as TERI and NCPOR provide opportunities for students to pursue postgraduate courses in sustainable development, environmental studies, and public policy and for minor internship projects in Polar studies, respectively (Ibid.). Students from different academic backgrounds including biological sciences, social sciences, environmental studies and more can pursue academic research in issues pertaining to Polar understanding. There are also various student participation schemes in India where students can submit independent research projects and even get opportunities to travel to the Polar regions of the Arctic and Antarctic (Ibid.). Thus, there are both field and lab-based academic opportunities for the youth wanting to pursue Polar research. An interested candidate can choose to be involved in lab-based studies of the Polar regions, or with several funding opportunities they can venture into the field, collecting samples and bringing them to the lab for extensive studies. Either way, today's youth can access limited but plausible opportunities in Polar academic research.

11.3.3 Sustainability Accounting

ESG

There are many new disciplines coming up in the field of climate change and Polar research. One of them is sustainability accounting or ESG (environmental, social and governance) accounting (Fig. 11.1). Sustainability accounting is an emerging trans-disciplinary field which culminates the actions, techniques and frameworks for recording, measuring and reporting the financial impact of social and environmental factors, impact of financial and economic activities on social and ecological systems and their interaction to attain socio-efficiency, eco-efficiency and eco-justice (Singhania, 2023). Sustainability accounting is interwoven with the complex challenge of climate change which mandates it to aggressively expand and entwine with other disciplines.

socio-efficiency
eco-efficiency
eco-justice

sustainability
reporting
Australia

The new areas of study is lucrative for the youth since climate change is now a topic that businesses are also engaging in. Sustainability accounting is one aspect of it, which refers to non-financial reporting from a business perspective. The goal is to achieve a universal standard for sustainability reporting, similar to the standardised, number-driven approach of financial accounting (Singhania, 2023). As a result, numerous research opportunities are emerging in this field around the world. Australia is placing significant emphasis on sustainability accounting, while countries such as the United States and China are also increasing their attention to this area (Ibid.). Therefore, the youth can explore climate change related sustainable businesses as both educational, research and career options.

sustainable finance
zero emissions
economy governance
national accounting

The adage 'what gets measured gets done' highlights the significance of corporate sustainability reporting. There are four levels of sustainability from an accounting and finance perspective: sustainable finance, zero emissions economy, governance, and national accounting (Singhania, 2023). The Scandinavian countries are leading the way in terms of emissions control, followed by the US and other countries at the second level, and China, India, and the rest of Asia at the third (Ibid.). In India, the Securities and

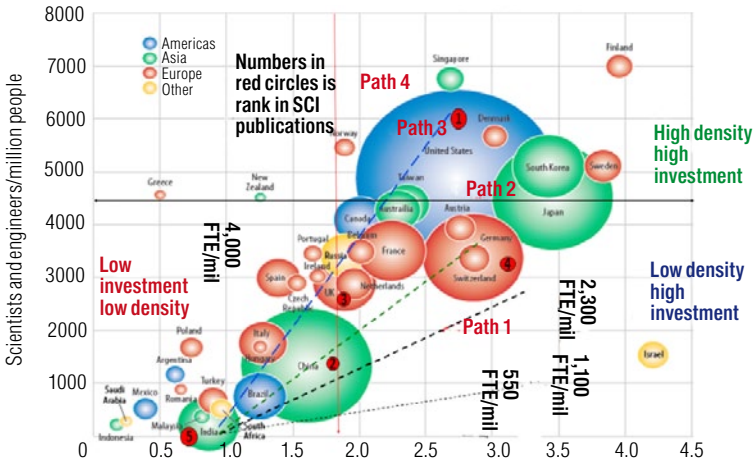
Exchange Board of India has mandated that the top 1000 listed companies need to report on sustainability beginning on April 1, 2023 (Ibid.). This regulation has generated interest in sustainability reporting in India. Therefore, sustainability reporting is a suitable career option for students pursuing finance and accounting and looking forward to engaging with sustainable development, climate change control and other similar fields.

Securities and Exchange Board

Another such area, ecosystem accounting, also known as biodiversity accounting, is gaining traction in research, as shown by the development of various frameworks and mechanisms. Accounting for climate change provides an excellent opportunity for academic research, including the examination of pressure from stakeholders such as employees, investors, media, and regulators (Singhania, 2023). At the national level, mapping of biodiversity footprints and carbon emissions accounting are important considerations. This interdisciplinary field appeals to the youth with a background in accounting and finance who are interested in making a concrete contribution towards addressing climate change.

Sustainability management accounting is another critical area that many companies are exploring, particularly in terms of their in-house products. India is a textile-driven economy with a significant focus on textile exports. Leading textile exporters from India are now incorporating sustainable value tags that demonstrate their commitment to environment-friendly production processes across the entire value chain. These initiatives are becoming the subject of case studies, which business schools are documenting as examples of successful transformation. For the youth working in companies, it is recommended that they utilize sustainability accounting to its fullest potential to reduce unnecessary costs and enhance the firm's performance. Research

Fig. 11.2: Number of researchers (per million people) vs annual R&D spending in the world, 2011



Number of resear chers (per million people) vs annual R&D spending in the world, 2011.
Source: Mehajan, 2023

indicates that companies that are aware of their ESG footprints and conduct their operations responsibly are valued differently. Greater attention to sustainability practices may also attract foreign investment.

carbon neutrality

Environmental considerations are crucial, particularly for environmentally sensitive industries in developing countries, which require a heightened focus on strategic risk planning. Additionally, technological advancements are enabling faster progress toward achieving carbon neutrality. These developments offer opportunities for young researchers to create case studies, drive theoretical innovations, and make meaningful contributions to the field.

11.3.4 Scientific Research in the Arctic

technical workforce

In the past 15 years, India has made significant progress in Polar research, especially when compared to the previous two decades. This is mainly because India has established itself as a scientific community, with the distinction of having the world's third-largest scientific and technical workforce (Mehajan, 2023). These efforts were further boosted by India unveiling its Arctic Policy in 2022, but its scientific community has been conducting research on the Poles for several years prior to its announcement. Earlier, the Poles were very narrowly limited to a small set of people and the connection between India and the Poles were not understood. Starting with humble beginnings, small budget, limited manpower, Indian researchers have engaged with the Poles for decades (Saran, 2023). Climate change and global warming are perhaps the most important aspect of the study that has facilitated an understanding in India about that connection. Gradually, the Indian government started making institutional arrangements, starting with the Department of Ocean Development a few decades ago to a full-fledged MoES. Over the years, other institutions have emerged to study the Arctic and the Antarctic, especially in the Indian Universities.

Arctic Council working groups

IndArc

Currently, India has many national Polar Programmes, which includes the Indian Antarctic programme, Indian Arctic programme, Himalayan studies, and Southern Ocean research programme (Jain, 2023). The Indian Arctic Programme started in 2007 when a team of five scientists went to the Arctic. Thereafter in 2008, Himadri Station was inaugurated in the Arctic to continue scientific observations. And in 2013, India was awarded the Arctic Council 'Observer' status. The Indian Arctic programme is conceived to cater to the Indian scientific community and we have scientific themes other than the teleconnection between Indian monsoon and the Arctic climatic variabilities. Majority of our scientific themes are in line with the Arctic Council working groups and few of them are like biodiversity assessment, long term monitoring, atmospheric prediction, atmospheric sciences, aerosol and so forth. To cater to this kind of scientific objectives, India has been constantly investing in the capacity-building in the Arctic. In 2014, India deployed IndArc mooring in collaboration with IIT, Chennai and it was the first mooring in the offshore waters or outside the Indian waters. Subsequently, an atmospheric laboratory was established in Svalbard to cater to the atmospheric study

and several instruments were installed that continuously measure different atmospheric parameters. Scientists at NCPOR utilize this data to understand atmospheric variability in the Arctic to cater to a broader perspective and to gain a pan-Arctic understanding of the atmospheric processes. India embarked on an Arctic Ocean cruise in 2019. A team of two scientists from NCPOR collected samples from the region (Jain, 2023).

The Indian Antarctic Programme is one of the finest examples of a long-term research effort of key national research institutions. It is also an important component of the international scientific community's effort to understand Antarctica. Indian contributions to the knowledge of Polar science, over the last two and a half decades, have been significant, well recognized internationally and published in scientific journals. The scientific programmes being pursued in Antarctica broadly fall in eight major domains—atmospheric science, geoscience, biology, environmental sciences, human physiology, medical science, cold regions engineering and communication (Nayak, 2023).

Antarctica
Polar science

The regular participating institutions in annual Antarctic expeditions are GSI, IMD, SoI, ZSI, BSI, DRDO laboratories, CSIR laboratories (NGRI, CCMB, NBRI, NEERI, NPL, SERC, CFTRI, NIO, RRL, NAL, etc.), DST laboratories (BSIP, IIG, WIHG, etc.), academic institutions like NITs and universities and other government departments (Nayak, 2023). Such institutions bring about opportunities for Indian youth to pursue professional research careers in Polar studies (Fig. 11.2).

In addition to the aforementioned initiatives, the EAPG, led by the Secretary of MoES, has been established. This group meets twice a year, and based on their discussions, road maps are developed, incorporating feedbacks received. Points of contact have been established in key ministries including the MoES, MoEFCC, MEA, MoPS, MoPNG, MoD, and DST. Quarterly meetings are held to analyse the activities conducted, and a newsletter is circulated to the missions overseas to ensure alignment of all stakeholders. Think tanks have also been engaged, and their activities are captured in the think tank segment (Khanna, 2023).

EAPG

ministries

Besides, the existing limited organisations focussing solely on the science of Polar regions, it is crucial to involve other disciplines such as finance, politics, humanities, etc. to comprehensively examine and comprehend Polar systems and tackle the challenges they present.

11.4 Challenges

India has made progress in Polar scientific research; however, they are far from being sufficient when compared to other nations such as China. Approximately 1,500 Indians are among the top 2 per cent scientists in the world (Mehajan, 2023). There are several statistics to celebrate the progress of the country's youth, including India's 41st rank in

Global Innovation Index

policy framework

the Global Innovation Index (Ibid.). In terms of India's role in the Arctic, India has made significant scientific contributions, particularly in the last few years through seismic monitoring observations that began in 2016 and 2017, building on our decades-long history in the region. India's progress as a science powerhouse is supported by a well-crafted policy framework that promotes rising incomes and evolving lifestyles of youth. The STIP 2020 and the NRF, with a budget of approximately INR 2,000 crore provided by the DST, are instrumental in strengthening institutional and human capacity for basic research. In addition, private and philanthropic investments along with the ever-growing IT sector are providing the necessary seed funding for this research revolution.

Accelerate Vigyan Scheme

TARE

Unfortunately, India's scientific workforce is relatively small with only 200 scientists per million people, compared to China's 1,000. Nevertheless, in the last five years, the government has launched several schemes to strengthen and expand this research base—including internships and workshops and a higher number of MSc and PhD students. The TARE programme, which allows young faculties to take a three-year break from their parent institute to gain knowledge and skills from premier institutions, are also in place. Additionally, the recently launched SERB-SURE scheme targets state universities, some central universities, and private university setups. Although limited to the SERB, the results of these schemes have been promising in expanding the research base.

transformative ecosystem

India needs to establish a pioneering research and development ecosystem that not only focuses on service-centric growth but also generates cutting-edge technology applications for the betterment of society. Although India has a robust funding mechanism, it has not been able to capture the outcomes. Moreover, most of the country's programmes are organised with a focus on industrial benefits. The need of the hour is to broaden our horizons and embrace the latest technologies and innovations to create a sustainable and transformative ecosystem that can cater to the needs of the society (Mehajan, 2023).

Global Research Council

Another challenge is the absence of interdisciplinary research in Polar studies which presents a significant loophole in the research system as mankind's problems may not be fully understood by being centric to one's own field. At the Global Research Council meeting, two themes were discussed, namely women's participation and interdisciplinary research. However, many R&D funding agencies worldwide do not have specific policies supporting interdisciplinary research.

11.5 Recommendations

There are many ways for young people to participate in Polar studies beyond the traditional role of a scientist. The involvement of individuals from diverse backgrounds, such as finance, business and humanities is valuable because a multidisciplinary approach is crucial. Following are the various ways in which youth can engage in Polar studies:

i. The primary focus in realigning and revamping the innovative research ecosystem for youth in the country is to ensure that strategic road maps are synchronized with the ambitious aspirations of the 21st century. Prior to any transformation, it is essential to understand both its strengths and limitations (Mehajan, 2023).

ii. It is essential to promote Polar studies through educational governance, both at the primary and higher educational level. India is a country with the youngest demographic dividend in the world. Yet, the participation from youth in Polar studies is limited. There is an urgent need to address the gaps in Polar studies by taking appropriate steps that encourage the youth to embrace new career goals (Dayal, 2023).

iii. It is essential to modify existing review processes and give sufficient time to the principal investigators to produce tangible results. This requires a change in the mindset of researchers and reviewers alike, to make them free of risk-aversion. Moreover, mentoring research at the early stages and incentivizing it with recognition can drive significant improvements at the government sector, and the institutional levels. Nevertheless, it is crucial to balance the act on the part of the institution itself while implementing these measures (Mehajan, 2023).

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ASOC	Antarctic and Southern Ocean Coalition
ASSOCHAM	The Associated Chambers of Commerce and Industry of India
ATCM	Antarctic Treaty Consultative Meeting
ATS	Antarctic Treaty System
AWiFS	Advanced Wide Field Sensor
AYUSH	Ayurveda, Yoga and Naturopathy, Unani, Siddha and Homeopathy
BCE	Before Common Era
BBNJ	Biodiversity Beyond National Jurisdiction
CAV	Cumulative Absolute Velocity
CCAMLR	Commission for the Conservation of Antarctic Marine Living Resources
CE	Common Era
CEP	Committee for Environmental Protection
CFCs	Chlorofluorocarbons
CHARS	Canadian High Arctic Research Station
CMIP6	Coupled Model Intercomparison Project 6
COP	Conference of Parties
CRAMRA	Convention on the Regulation of Antarctic Mineral Resource Activities
CSIR	Council of Scientific and Industrial Research
DNA	Deoxyribonucleic Acid
DRDO	Defence Research and Development Organisation
DST	Department of Science and Technology
EAPG	Empowered Arctic Policy Group
EEZ	Exclusive Economic Zone
ELB	Explicit Load Balancing
EVRI	Electric-field vector resistivity imaging
FICCI	Federation of India Chambers of Commerce and Industry
GDP	Gross Domestic Product
GLOF	Glacial Lake Outburst Flood
HCFCs	Hydrochlorofluorocarbons
HFCs	Hydrofluorocarbons
IACR	International Arctic Research Center
ICC	Indian Chamber of Commerce
IHR	Indian Himalayan Region
IIT	Indian Institute of Technology
IITM	Indian Institute of Tropical Meteorology
IMD	India Meteorological Department
IndArc	Indian Arctic mooring
INR	Indian Rupees
ICIMOD	International Centre for Integrated Mountain Development
IONS	Indian Ocean Naval Symposium
IORA	Indian Ocean Rim Association
IPCC	Intergovernmental Panel on Climate Change

IPCCAR6	Intergovernmental Panel on Climate Change Annual Report 6
ISA	International Seabed Authority
ISRO	Indian Space Research Organisation
KHertz	kilohertz
LIDAR	Light Detection and Ranging
LiFE	Lifestyle for Environment
LIGHTS	Learnings in Geography, History, Technology and Science
LISS	Linear Imaging Self-Scanner
MEA	Ministry of External Affairs
MoD	Ministry of Defence
MoEFCC	Ministry of Environment, Forest and Climate Change
MoES	Ministry of Earth Sciences
MoPNG	Ministry of Petroleum and Natural Gas
MoPSW	Ministry of Ports, Shipping and Waterways
NASA	National Aeronautics and Space Administration
NCERT	National Council of Educational Research and Training
NCPOR	National Centre for Polar and Ocean Research
NCS	National Center for Seismology
NIOT	National Institute of Ocean Technology
NISAR	NASA-ISRO Synthetic Aperture Radar
NIT	National Institute of Technology
NMSHE	National Mission for Sustaining the Himalayan Ecosystem
NSIDC	National Snow and Ice Data Center
NSR	Northern Sea Route
OCM	Ocean Color Monitor
ODS	Ozone Depleting Substances
OMZs	Oxygen Minimum Zones
OTEC	Ocean Thermal Energy Conservation
PDGL	Potentially Dangerous Geological Locations
PFCs	Perfluorocarbons
PPA	Post P-Wave Arrival
S2S	Subseasonal-to-seasonal
SAR	Synthetic Aperture Radar
SaGAA	Science and Geopolitics of Arctic and Antarctic
SCAR	Scientific Committee on Antarctic Research
SCAT	Scatterometer
SECMOL	The Student's Educational and Cultural Movement of Ladakh
SERB-SURE	SERB-State University Research Excellence Fellowship
SERB	Science and Engineering Research Board
SF6	Sulphur Hexafluoride
SSP	Shared Socioeconomic Pathways
SST	Sea Surface Temperatures
SUNA	Submersible Ultraviolet Nitrate Analyzer

SWAYAM	Study Webs of Active-Learning for Young Aspiring Minds
Swiss ADC	The Swiss Agency for Development and Cooperation
TARE	Teachers Associateship for Research Excellence
TERI	The Energy and Resources Institute
TRISHNA	Thermal InfraRed Imaging Satellite for High-resolution Natural Resource Assessment
UArctic	University of the Arctic
UGC	University Grants Commission
UN	United Nations
UNCLOS	United Nations Convention on the Law of the Sea
UNEP	United Nations Environment Programme
UNFCCC	United Nations Framework Convention on Climate Change
V-SAT	Very Small Aperture Terminal
WTO	World Trade Organisation