



International Workshop on Arctic Ocean Observation:  
Future Collaboration by Research Vessels and Icebreakers  
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Science Session

## Indian Scientific Activities in the Arctic Region and Future Plans

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The polar and the high-latitude regions (Southern Ocean, Arctic Ocean, and North Atlantic Ocean) play an essential role in governing Earth's climate by forming major deep and intermediate water masses and air-sea interactions. In the present global warming scenario, the Arctic is especially vulnerable to climate change. Studies have shown that it's warming around four times the global average, resulting in the loss of land and sea ice and freshening and stratification of the upper ocean. It influences the global climate, oceanic and atmospheric circulations and various biogeochemical cycles. Arctic climate variability has also been proposed to affect monsoons via "atmospheric bridges" and "oceanic tunnels". This complex interaction between the monsoon and the Arctic region remains to be fully explored. Recent findings using observational and proxy data have noted teleconnections between the Arctic climate and monsoon on various timescales. Monsoons are the backbone of South and East Asia's economy, water and food security - essential for population sustenance. Considering the Arctic's importance to the tropical climate, India commenced its scientific activities in 2007 and established the research station - Himadri - in 2008. The National Centre for Polar and Ocean Research (NCPOR) under the Ministry of Earth Sciences (MoES) is the nodal agency to plan, formulate, coordinate and implement the program as a multi - institutional endeavour. The major thrust areas of our research are Marine Science (Dynamics and functioning of Arctic fjords), Atmospheric Science (Aerosols, trace gases and precipitation), Environmental Science (Contaminants in food webs and long-range pollutants), Cryospheric Studies (snow and ice chemistry, glaciology), and Geosciences (Paleoclimate). Till now, India has successfully conducted 15 expeditions to the Ny-Ålesund during the boreal summers. From this year onwards, we make a new beginning by initiating winter expeditions to Ny-Ålesund during polar nights. It would help address the knowledge gap and data deficiency for the winter season/polar nights. This year, Indian researchers also visited the Canadian High Arctic Research Station (CHARS) in Cambridge Bay under an MoU with Polar Knowledge Canada, reflecting India's commitment to international collaboration. The Arctic, being a vast area, requires a concerted effort from several countries to understand the changes happening there and how they influence the global climate. The various institutions must coordinate the observations and sample collection judiciously to cover the largest possible area - spatially and temporally. This is one of the keystones of India's Arctic Policy. Japan's new icebreaker can provide an important platform for various institutions to collaborate with each other in the Arctic region, reaching deeper and farther. For example, from a paleoclimatic perspective, there is a lack of studies to understand Arctic-tropics teleconnection on longer timescales. The new icebreaker can enable the collection of sediment cores and other samples from the central Arctic Ocean that can help such paleoclimatic studies.



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## Arctic Ocean and Atmosphere Studies - Relevance and Indian Perspectives -

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India has started organized Arctic research only in the past 15 years. Nonetheless the significance of the Arctic has never been more evident. Arctic warms at an unprecedented rate at least twice the global rate. Some of the locations warms even at a faster rate, leading to a hitherto unheard decline in sea-ice. This has led to changes in atmospheric circulation, that connect even to the tropics. Indian monsoon is also seems to be influenced by the Arctic ocean changes. Reduction in Barents and Kara sea ice may have a potential link to the extreme rains in India. The WACE seems to influence the Arabian sea cyclogenesis. Not only the Arctic influence the rest of the hemisphere, tropics also have a fair share of Arctic variability. MJO seems to modulate the Arctic precipitation and temperature. Heat released during monsoon rains travels all the way upto the Bering strait melting the ice there. Thus, there seems to be an intricate two-way link. Studies also show the impact of sea-ice changes to the Pacific trade winds, does this impact ENSO, more research is required. If it happens so, then the impact of Arctic changes can push vulnerable nations to climate exigencies. Even the Arctic environmental changes have the potential to unleash hitherto dormant microorganisms in to the environment. Linking Arctic change to the economics, studies suggest the cost of the Arctic climate impact in trillion of dollars. Realizing the need, Indian has framed the Arctic policy, which stress the need of collaboration among the nations for sustainable Arctic research. This will help to reduce the operating and maintenance costs, dissemination of knowledge to a relatively large community.