

# Indian IPY Activities



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# NCPOR – Indian Gateway of Polar Research

- **Antarctica** – *Maitri* & *Bharati* station (69°S) – expedition to the South Pole – **45** scientific expeditions – *Maitri-2* being planned.
- **Arctic** – *Himadri* station (79°N) - participated in expeditions to North Pole - expanding to Canadian Arctic, **wintering** in Arctic 2023 onwards – polar nights – **16** expeditions.
- **Himalaya** – *Himansh* station - monitoring the western Himalayan glaciers – India's highest research base at ~4000 m.
- **Southern Ocean** – undertook several expeditions that provided vital data on the role of SO on global circulation and carbon cycle – **12** Expeditions.
- **Indian Ocean** – deep sea drilling (IODP) - exploration of hydrothermal multi-metal sulphide mineralization in Central Indian Ridge & Southwest Indian Ridge



*Bharati*



*Himadri*

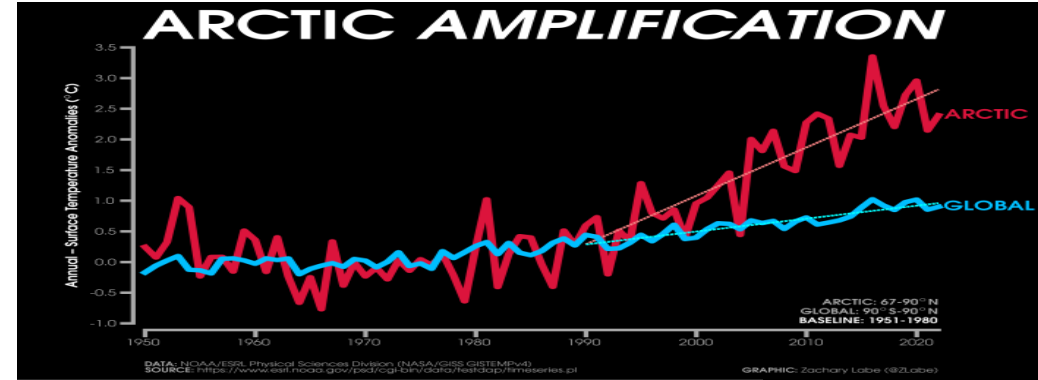


*Himansh*

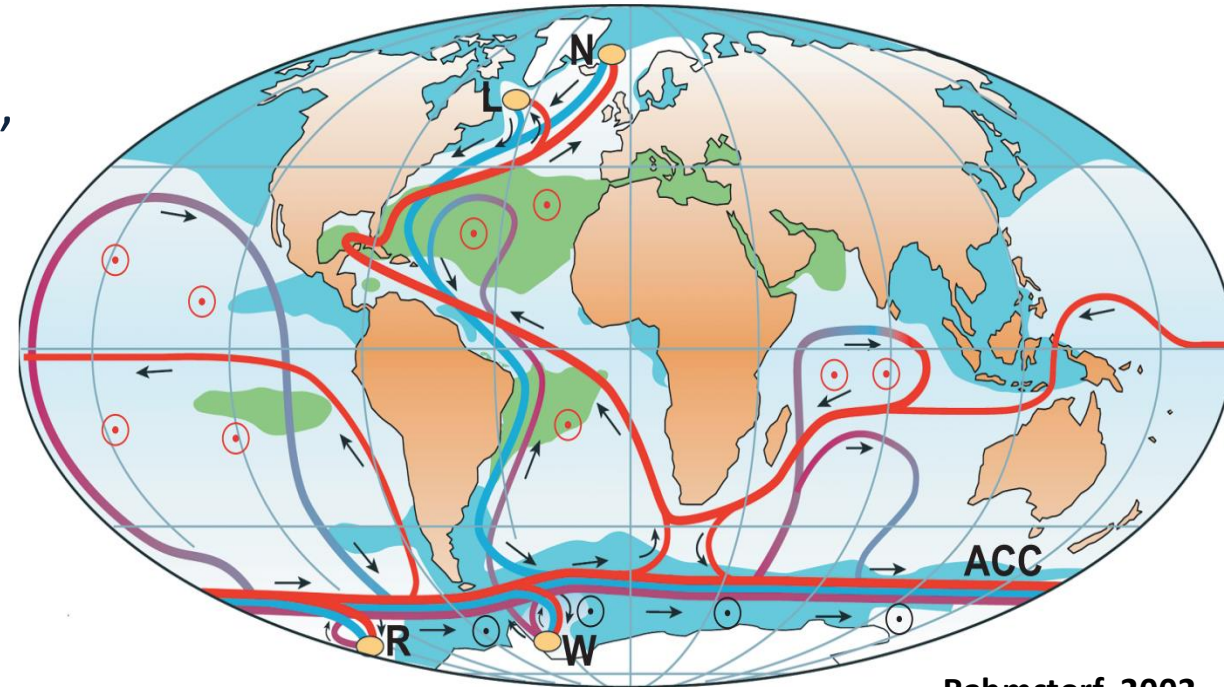
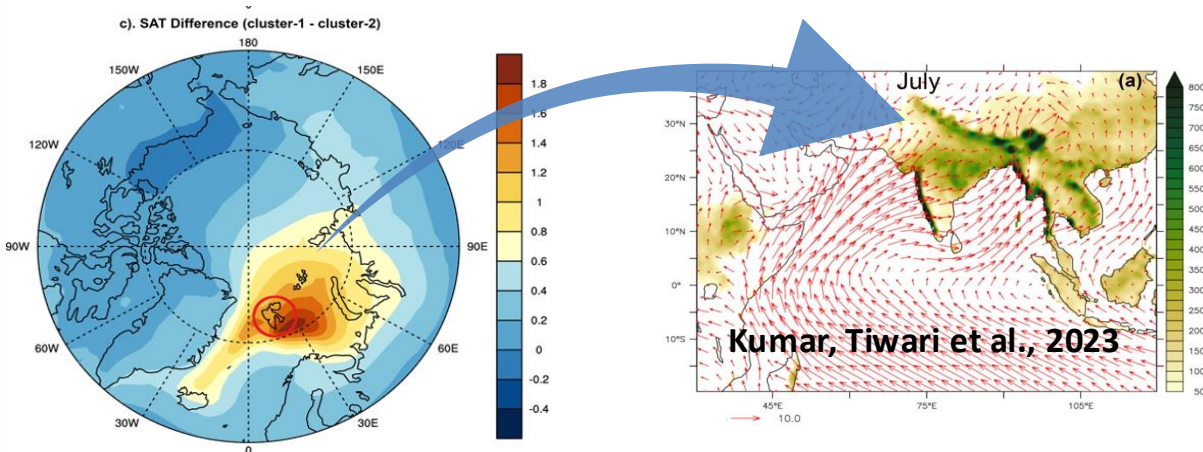


# Polar Climate: Significance for India

- Polar regions - **global thermometer** – Arctic ~4 times warming, loss of land & sea ice, freshening – Polar Amplification
- It influences the global climate via Atmospheric bridges and oceanic tunnels - changes in the Thermohaline Circulation or **AMOC**
- **Polar – Monsoon teleconnections**: India's economic, water, and food security - population sustenance



Courtesy: Zachary Labe, NOAA GFDL



Rahmstorf, 2002

# IPY-4: Catalyst for Arctic Research

The Fourth International Polar Year (2007-2009) acted as a primary inflection point, transitioning India from a uni-polar participant to a formidable bi-polar research power.

**2008**

Himadri Station inaugurated at Ny-Ålesund, Svalbard – India's leap to the North Pole.

**Post-IPY-4**

IndARC deployed – India's first multi-sensory moored observatory in Kongsfjorden.

**March 2007 - March 2009**

IPY-4 Catalyst Window. ICSU and WMO initiate the global collaborative push.

**Pre-2007**

Maitri Base established (1989) – India's established Antarctic foothold

**2009**

LOHAFEX Indo-German ocean fertilization experiment launched in the Southern Ocean

**2012**

Bharati Station established (planning initiated during IPY-4)





# Major Research Themes

## Atmospheric Sciences

Trace gases, Clouds, precipitation, hydrological cycle, Aerosols, Middle and Upper atmospheric studies, Atmospheric electric field measurement, Lightning studies

## Space Sciences

Astronomy and Astrophysics

## Environmental Sciences

Contaminants, long range pollutants, marine microplastic, persistent organic pollutants, heavy metals

## Biological Sciences

Diversity of marine organisms, Plant-microbe interactions, Nutrient fluxes, Permafrost studies

## Cryospheric Studies

Snow and ice chemistry, glaciology, Glacier biogeochemistry and microbial dynamics, remote sensing studies

## Geosciences

Paleoclimate, Biogeochemistry



## Marine Sciences

Dynamics and functioning of Arctic fjords, Hydrography observations, Land-sea-atmosphere interactions



# Milestones – Impact of IPY-4

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- Till 2025, India has successfully conducted 16 expeditions to Ny-Ålesund
- 500 research-visits from India to Ny-Ålesund till now from over 64 Indian universities/institutes
- High impact scientific findings published in reputed peer-reviewed journals
- India in Arctic – 300 days - Polar Nights 2023 onwards



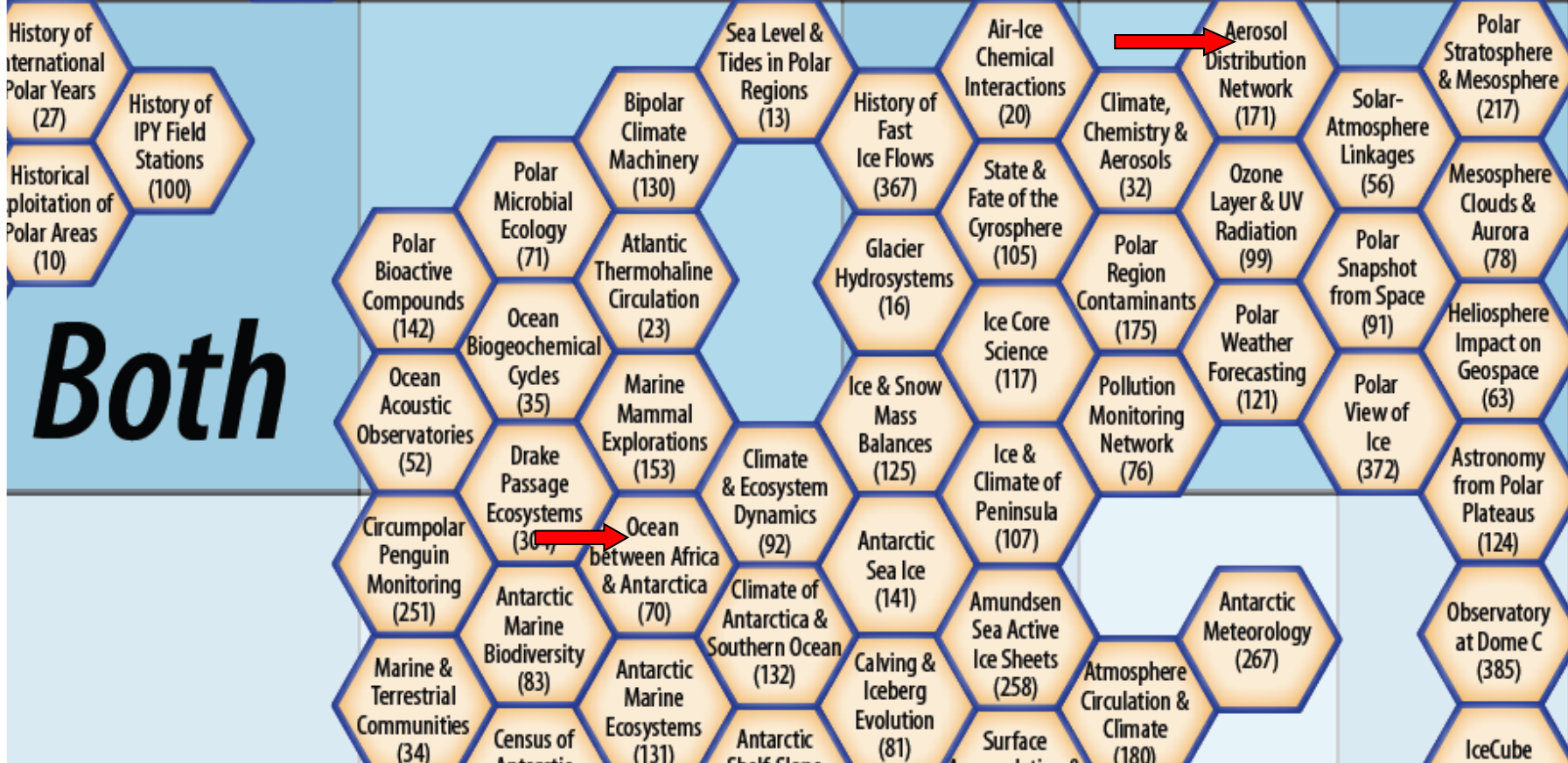
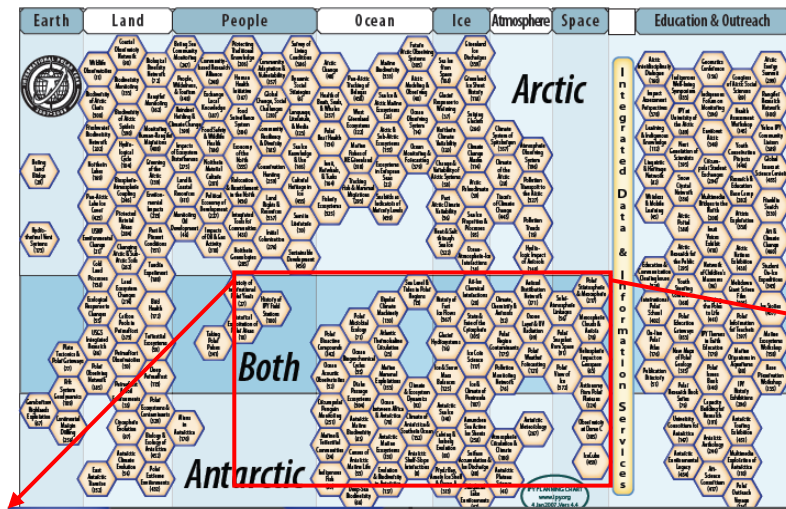
# Impact of IPY-4: Bharati

In Antarctica, planning for a new station began - establishment of the third Indian station, Bharati, in 2012



# NCPOR IPY Endorsed Projects

- Southern Ocean circulation monitoring
- Holocene paleoclimate reconstruction
- Atmospheric aerosol studies



# IPY-4: Indo-German Collaboration

## The Anatomy of LOHAFEX

### The Catalyst (Surface)

The German research vessel Polarstern deposits dissolved iron dust across a massive 300 km<sup>2</sup> patch in the southwest Atlantic sector of the Southern Ocean.

### The Bloom (Euphotic Zone)

An activation curve graphically shows a sudden, massive spike in phytoplankton blooming, triggered by the iron fertilization.

### The Goal (Deep Ocean)

Sequestration—the process of phytoplankton dying, sinking, and dragging sequestered atmospheric CO<sub>2</sub> into the deep ocean.

### The Scale

A collaborative milestone. A 48-member scientific team, including 30 Indian scientists from the National Institute of Oceanography (NIO), partnered with the Alfred Wegener Institute (AWI) for this 2009 experiment.





# IPY Outreach Activities



## Education for School Children

Category	Activity	Theme	Date of Submission	Announcement of results
Open	Poster & Slogan writing competition	"PEOPLE & THE POLES"	April 10, 2007	April 22, 2007
Grades 5-8	Project	Model of the Antarctica region with ice caps, penguins and signs of human activities	July 31, 2007	Oct 1st Week Wildlife Week 2007
Grades 9-12	Project	Measure your footprint on Polar Ice	July 31, 2007	Oct 1st Week Wildlife Week 2007
Grades 5-8	Stamp designing competition	India in Antarctica 25 years	April 10, 2008	April 22, 2008
Grades 9-12	Project	Draft a Petition letter to the Head of Governments of industrialised countries, on the impact of climate change on humans & bio-diversity, urging them to reduce emissions to pre-1990 level	April 10, 2008	April 22, 2008

2007

2008



WWF-Cannon/Fritz Polking

**EXCURSION TOUR TO GOA IN OCT- NOV 2008  
FOR WINNERS FROM ALL CATEGORIES**





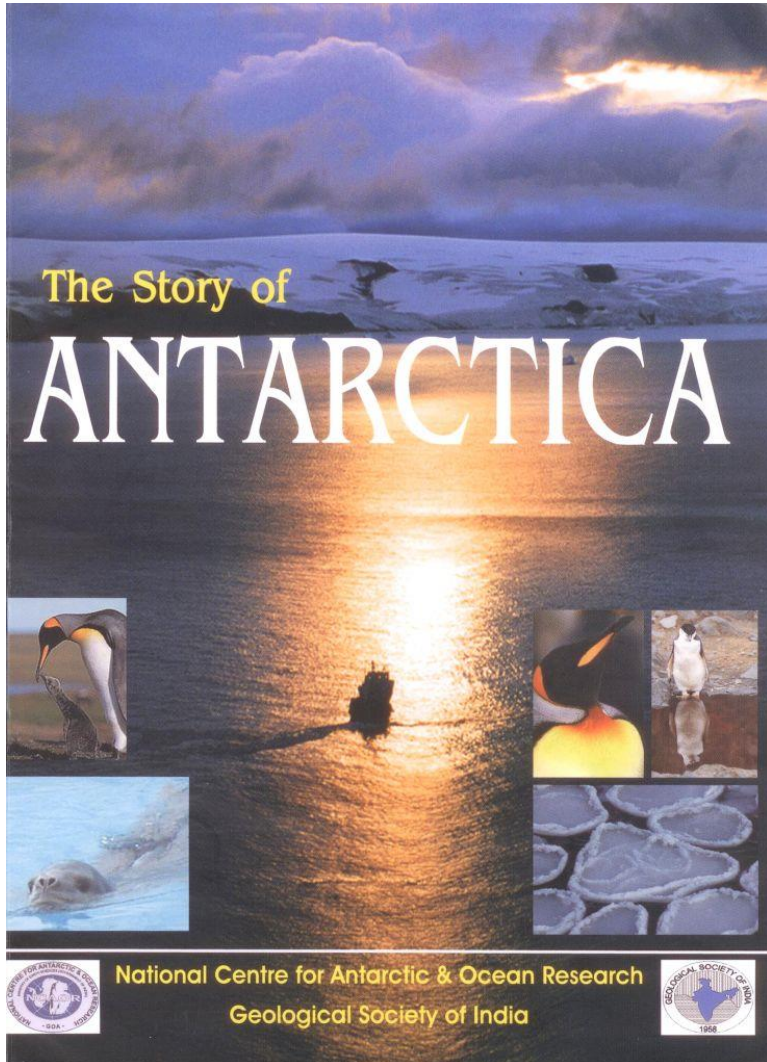
# Scientific Publications – IPY-4



- Two special issues of *Indian Journal of Marine Science* –
- “Antarctic & Southern Ocean – Physical Processes”, and
- “Antarctic & Southern Ocean – Geoscientific & Biological Studies”, in 2008.
  
- Special section in *Current Science* that contains several scientific papers on Indian Antarctic studies



# Popular Publication – IPY-4



- Under the "Popular Book Series" initiative of the Ministry of Earth Sciences, a book entitled "The Story of Antarctica" is published by NCPOR
- Free distribution among school students.
- Rasik Ravindra and Manish Tiwari. International Polar Year (2007-2008). *Hill Geographer*, vol. 23, 1-2.



# 5<sup>th</sup> International Polar Year - 2032-33

Addressing urgent climate and environmental shifts through large scale international cooperation

## *Themes*

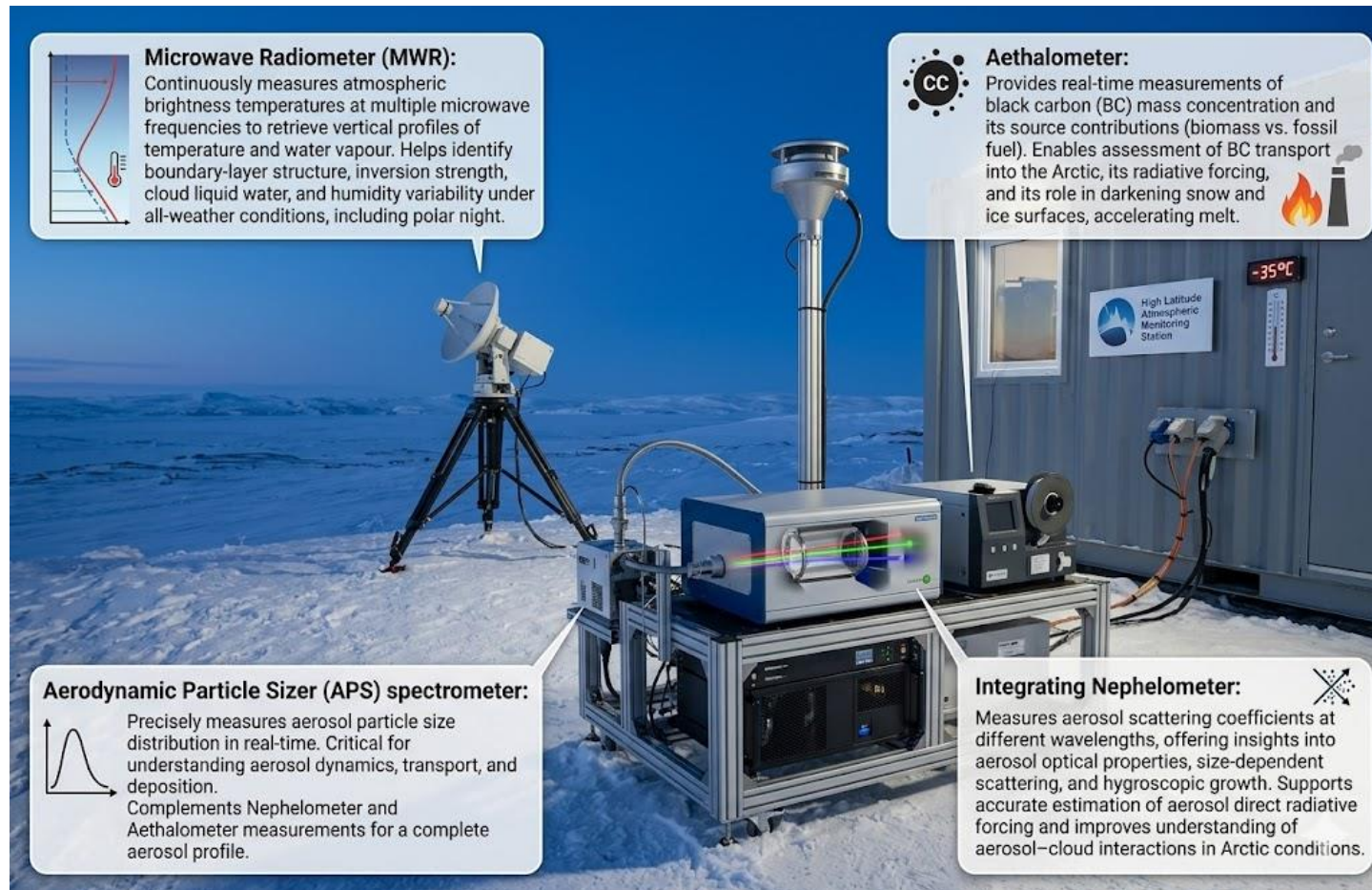
- *Atmospheric Observations*
- *Oceanic Observations*
- *Land-Ocean Interactions*



# Theme 1: Atmospheric Observations

Arctic boundary-layer structure and thermodynamics, improve climate model validation and parameterization

Long-range transported aerosols and pollutants and their influence on the Arctic atmosphere, including its chemistry and radiative forcings



# Theme 2: Oceanic Observations

Year-round, heat and freshwater, and Sea-ice measurements for selected Russian Arctic shelf-gateway systems using direct mixing and turbulence observations and numerical ocean modelling

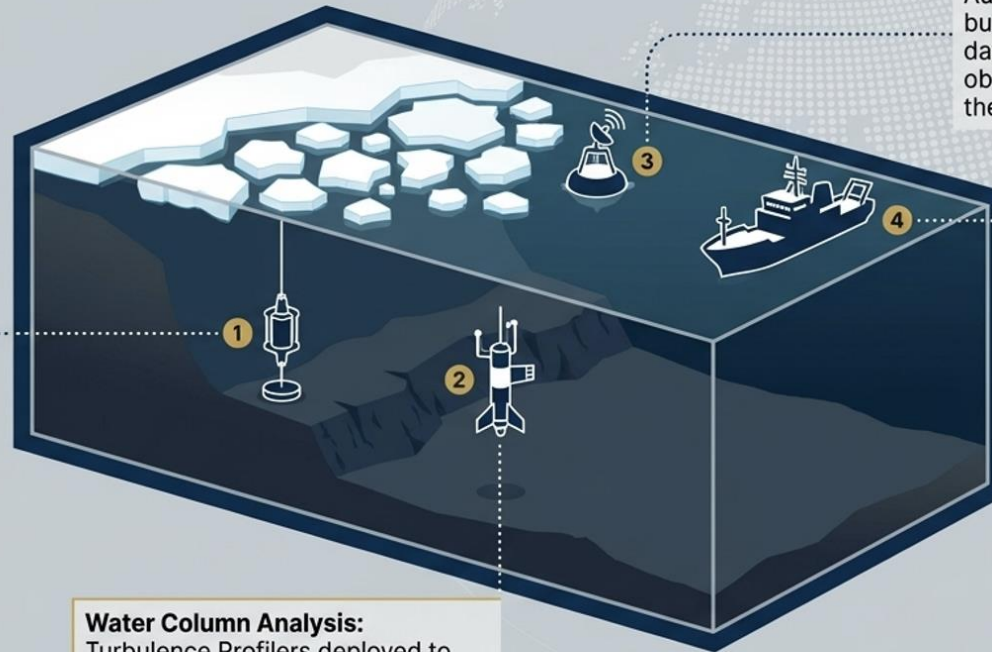
## Methodology Blueprint

**Shelf-Gateway System: Moored Gateway Sensors:** Acoustic Doppler Current Profilers (ADCP) anchored to gateway moorings to continuously measure velocity and close volume/transport budgets.

**Water Column Analysis:** Turbulence Profilers deployed to quantify mixing rates and turbulent heat fluxes beneath the ice.

**Surface/Ice Tracking:** Autonomous Lagrangian buoys integrated with satellite data to maintain vital observation continuity through the polar winter.

**Spatial Gap-Filling:** Shipboard Hydrography operations designed to complement fixed-point moorings with broad spatial mapping.

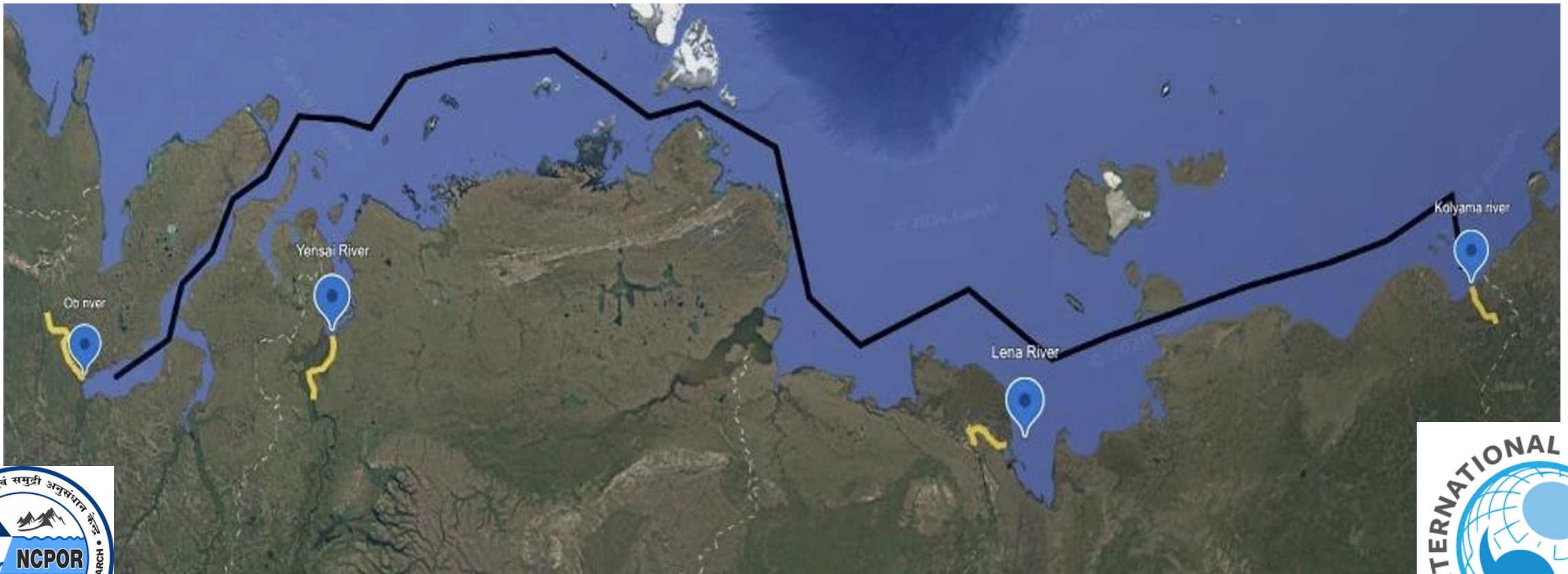


# Theme 3: Land-Ocean Interactions

Fate of Permafrost carbon and excessive terrestrial organic matter input across the land-ocean continuum

Future Arctic act as a net carbon source or sink

Arctic paleoclimate variability and its teleconnection with the Indian monsoons





# Infrastructure Upgradation during IPY-5 duration



- **Construction of a dedicated Polar Research Vessel**
- **Construction of a new research station to replace Maitri in Antarctica**



# Expected Outcome



