The Second Inter-Polar Conference:
Connecting the Arctic with the Third Pole Himalaya Hindu Kush
Cryosphere, People and Climate Change



ISTITUTO GEOGRAFICO POLARE "Silvio Zavatti"

IL POLO

RIVISTA DI STUDI, RICERCA E DOCUMENTAZIONE

LXXXI
N. 4/2026

IL POLO

Journal of the Istituto Geografico Polare "Silvio Zavatti"

LXXXI – No. 4/2026

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Kathmandu, Nepal
3–5 September 2025

Volume IV

Proceedings

IBF from the Arctic to the Himalayas: Visualising Socio-Ecosystem Impacts Across Interconnected Cryospheres

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Introduction

The Arctic and the Third Pole, the high-mountain cryosphere of the Hindu Kush Himalaya and the Tibetan Plateau, form two of the most rapidly changing cold regions on the planet. Though separated by thousands of kilometres, they are linked by large-scale atmospheric and oceanic teleconnections that transmit climatic anomalies across continents. Scientific advances now confirm that changes in Arctic circulation, sea-ice decline, and stratospheric variability can influence monsoon behaviour and summer extremes across High Mountain Asia[1]. Such connections make it increasingly important to view these cryospheres as parts of a single planetary system rather than isolated domains.

1 ESCAP, "An Era of Extreme Heat: Teleconnections of Glacial Risks from the Arctic to the Third Pole," ESCAP Blog (Bangkok: United Nations ESCAP, 2025), https://www.unescap.org/blog/era-extreme-heat-teleconnections-glacial-risks-arctic-third-pole.

Both regions are warming at rates far exceeding the global average. The Third Pole, warming at more than 0.3 °C per decade, faces accelerated glacier melt, expanding glacial lakes and destabilising permafrost[2]. The Arctic region of Russia has recorded rapid warming, particularly in spring, with temperatures rising by 0.70–0.91 °C per decade since the 1970s[3]. As warming intensifies, these cryospheric transformations produce cascading socio-ecological consequences: altered water availability, shifting hydropower potential, infrastructure instability, and heightened multi-hazard risks.

To support climate-resilient planning, the Economic and Social Commission for Asia and the Pacific (ESCAP) has developed Impact-Based Forecasting (IBF), a methodology and digital tool that integrates seasonal climate outlooks with exposure and vulnerability indicators[4].This article brings together scientific insights and regional climate outlooks to illustrate how IBF can visualise the potential impacts of anomalous seasons across both regions.

Teleconnections Shaping the Arctic–Third Pole System

Teleconnections describe long-distance climatic connections driven by atmospheric circulation, oceanic anomalies and stratospheric processes. Four mechanisms are especially relevant. Arctic amplification weakens the polar jet stream, leading to more frequent and persistent blocking patterns that subsequently alter monsoon behaviour and mid-latitude storm tracks. Stratosphere–troposphere interactions also shape regional climate: fluctuations in the Arctic polar vortex modify Eurasian pressure systems, influencing winter cold extremes and atmospheric conditions over the Himalayas. Oceanic linkages further reinforce these connections, as the decline in Arctic sea ice can affect the Atlantic Meridional Overturning Circulation and thereby modulate moisture transport into South Asia. Hydrological teleconnections complete the chain, with atmospheric changes reshaping snowfall distribution, the timing of seasonal melt, and glacier mass balance in the Third Pole, ultimately af-

2 ESCAP, "Warming Asian Glaciers: Regional Strategy for Riskscape," ESCAP Blog (Bangkok: United Nations ESCAP, 2024), https://www.unescap.org/blog/warming-asian-glaciers-regional-strategy-riskscape.

3 Rinke, Annette & Matthes, Heidrun & Dethloff, Klaus. (2010). Regional characteristics of Arctic temperature variability: Comparison of observations with regional climate simulations. Climate Research - CLIMATE RES. 41. 177-192. 10.3354/cr00854.

4 Pronina, E. Impact-Based Forecasting for Disaster Risk Reduction / E. Pronina, S. Hong, S. Shrivastava // , 30 May 2024, 2024. – P. 25-34. – EDN BORDNH.

fecting river discharge patterns and the stability of glacial lakes downstream. Multi-model ensemble research has significantly improved the seasonal prediction of summer extremes in High Mountain Asia, demonstrating that regional collaboration enhances forecast skill[5]. These advances strengthen the scientific foundations of operational early-warning systems across the cryosphere.

The Third Pole: A Region of Transforming Cryospheric Risks

The Himalaya, Karakoram, Pamir and the broader Third Pole region comprises more than 5 million km² and hosts the largest reserve of freshwater outside the polar regions. Ten major Asian rivers originate here, supplying water to nearly two billion people. Rapid warming has accelerated glacier loss, altered snow cover and expanded glacial lakes. Many hazards like glacial lake outburst floods (GLOFs), ice collapses, debris flows now occur more frequently and unpredictably.

The Third Pole Region contains some of the world's most consequential economic and social assets, assets that sustain nearly 250 million people and shape security, development and livelihoods across South and Central Asia. Terraced agriculture, high-value horticulture, pastoral systems, and medicinal plant economies are the backbone of mountain livelihoods, while hydropower complexes, national highways, border infrastructure, irrigation channels and tourism assets are critical pillars of national and subregional economies. Social systems (such as schools, health posts, monasteries, traditional settlements and culturally significant landscapes) play an equally essential role in anchoring identity, continuity and community resilience[6].

These assets are now facing unprecedented and escalating climate impacts. The Third Pole is warming two to three times faster than the global mean, triggering glacier mass loss, permafrost degradation, altered snowfall regimes, and heightened variability in the Indian Summer Monsoon and Western Disturbances. Hydropower plants are increasingly disrupted by heavy sediment loads, debris flows and rapidly fluctuating river discharge. Highways and transboundary corridors are experiencing more frequent slope failures, tunnel instability and washouts, cutting

5 A. Agarwal, S. Maskey, M. S. Shrestha, et al., "Seasonal Prediction of Summer Extremes in High Mountain Asia: Recent Advances and Regional Collaboration," npj Climate and Atmospheric Science 7 (2024): Article 42, https://doi.org/10.1038/s41612-024-00710-5.

6 ESCAP, Asia-Pacific Disaster Report 2025: Rising Heat, Rising Risk – Policy Pathways for Regional Resilience (Bangkok: United Nations ESCAP, 2025), https://repository.unescap.org/server/api/core/bitstreams/e55f8a9e-2e7a-414e-8e2e-4eb004248335/content.

off access to food, markets, education and health services. Agriculture is being hit by shortened growing seasons, frost anomalies, erratic rainfall, pest outbreaks and irrigation stress, undermining food security and income stability. Pastoral communities are losing rangelands and migration routes due to shifting snow patterns and vegetation loss, while tourism faces cancellations, route closures and safety risks from avalanches, landslides and glacial lake outburst floods. Cultural heritage sites and historic monasteries are cracking, eroding or destabilising due to warming, moisture shifts and terrain instability.

Harnessing the region's teleconnections (monsoon-westerly interactions, ENSO influence, westerly jet variability and emerging Arctic–Third Pole linkages) is central to reducing these impacts. Transforming this science into robust climate services and impact-based forecasting can drastically improve anticipatory action. AI-enabled risk mapping, hydrological nowcasting, cryosphere monitoring, and community-centred advisories, when coordinated through regional platforms like the Third Pole Regional Climate Centre and WMO climate forums, can help farmers adjust cropping cycles, hydropower operators manage reservoirs safely, transport agencies pre-position resources, and mountain communities prepare for extreme events. By grounding climate services in local knowledge and needs, the region can convert scientific foresight into targeted, life-saving adaptation–protecting the economic and social foundations of one of the world's most climate-exposed mountain systems[7].

Given the region's transboundary nature, the Third Pole Regional Climate Centre Network (TPRCC-Network) was established to harmonise monitoring and seasonal forecasting. Its first seasonal outlook (June–September 2024) projected above-normal temperatures across most of the region and variable precipitation regimes[8].

The ESCAP-led project, "Enhancing knowledge and capacity to build resilience to slow-onset disasters in Central Asia" focuses on Kazakhstan, Kyrgyzstan and Tajikistan, through a comprehensive strategy that combines scientific analysis, capacity-building and regional cooperation.

One of the core objectives is to create a network of practitioners to enhance regional and subregional collaboration. This network brought together key institutions,

7 ESCAP, Asia-Pacific Disaster Report 2025, 2025.

8 WMO, "Third Pole Climate Forum Issues First-Ever Seasonal Outlook," World Meteorological Organization (Geneva: WMO, 2024), https://wmo.int/media/news/third-pole-climate-forum-issues-first-ever-seasonal-outlook.

including the North Eurasian Climate Centre (NEACC) as a WMO-designated Regional Climate Centre; the Yu. A. Izrael Institute of Global Climate and Ecology (IGCE); the Centre for Emergency Situations and Disaster Risk Reduction (CESDRR); and national hydrometeorology services and Emergency Committees (Emercoms) from these target countries and the Russian Federation.

This network fosters cross-border knowledge exchange and facilitates the co-development of methodologies for climate projections, impact-based forecasting and strategic adaptation planning. To support this collaboration, the project convened a series of regional, subregional and national policy dialogues, workshops and trainings, including special sessions during the North Eurasian Climate Outlook Forum (NEACOF) forums and the 2025 Arctic Summit in Saint Petersburg. Through platforms like NEACOF, participating experts explored how seasonal outlooks could translate into impact-based forecasting for strategic intervention using ESCAP's automated IBF tool.

In parallel, ESCAP, in collaboration with this network, such as NEACC and IGCE has produced a series of joint publications based on the developed methodologies and the findings to raise awareness and advance scientific dialogue. These include: Blog: "The Era of Extreme Heat: Teleconnections, Glacial Risks, and the Arctic-Third Pole"[9], Scientific article: "Arctic to the Himalayas: Teleconnections of Glacial Hazards" (2025)[10], which explores how warming in the Arctic affects glacier stability and water security across the Third Pole.

By synergizing the available data and leveraging the expertise of this network to create data-driven and risk-informed strategies and recommendations, the project laid the groundwork for regional resilience to slow- onset and emerging risks, targeting a long-term approach to disaster risk resilience in Central Asia[11].

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9 ESCAP, "An Era of Extreme Heat".

10 Арктика - Гималаи: телесвязи ледниковых опасностей / Е. А. Пронина, Л. Саларпур, С. Шривастава [и др.] // Арктика: перспективы, инновации и развитие регионов : IX Международный Арктический саммит : сборник материалов, Москва - Санкт-Петербург, 22–25 апреля 2025 года. – Москва: Всероссийский научно-исследовательский институт по проблемам гражданской обороны и чрезвычайных ситуаций МЧС России, 2025. – С. 83-96. – EDN XQUFYX.

11 ESCAP, Asia-Pacific Disaster Report 2025, 2025.

The Arctic Region of Russia: Rapid Warming and Socio-Economic Exposure

Across the Arctic zone of the Russian Federation, warming is progressing at an exceptionally rapid pace. Long-term observations show pronounced temperature increases since the late 1970s, with some eastern Arctic regions experiencing trends approaching 0.8 °C per decade and large parts of Siberia showing similarly elevated rates. Spring temperatures have intensified the fastest, making it the season with the most rapid warming across the region. These anomalies intensify permafrost thaw, destabilise foundations, modify river regimes and accelerate coastal erosion.

The North Eurasian Climate Outlook Forum provides seasonal climate guidance for this region. The latest consensus outlook (NEACOF-29[12]) indicates a warmer-than-usual winter for most of North Eurasia, with a high likelihood of positive temperature anomalies in northern Yakutia and Chukotka[13]. ESCAP's experimental IBF analysis suggests that nearly 100 million people in Russia could face elevated probabilities of above-normal winter temperatures, with associated impacts on tundra ecosystems and infrastructure stability.

The IBF tool visualises these risks by combining NEACOF probabilistic temperature maps with population datasets, enabling identification of the most exposed administrative regions– such as Yamalo-Nenets Autonomous Okrug, where more than 80 per cent of the population may experience a high probability of above-normal temperatures.

Almost 70% of the total population in Russia (roughly 100 million people) is likely to be affected by a 50-60% probability of above normal temperatures. Almost 40% of total population in Kazakhstan (around 7-8 million people) is likely to be affected by 35-40, 40-50% and 50-60% of probability of above normal temperature combined. Furthermore, above-normal temperatures are likely to be observed in the Russian Far East (as indicated in the map). This has a substantial impact on the region's tundra, as rising temperature accelerates permafrost thaw, destabilising ground and infrastructure while shifting ecosystems toward shrub- and grasslands[14].

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12 North Eurasian Climate Centre (NEACC), Final Consensus Statement of the Twenty-Ninth Session of the North Eurasian Climate Outlook Forum (NEACOF-29) (Moscow: NEACC, 2025), https://seakc.meteoinfo.ru/images/media/images-seakc/seakc/neacof29/Consensus%20statement_NEACOF-29_fin.pdf.

13 NEACC, *Final Consensus Statement of NEACOF-29*, 2025.

14 Zhiyong Wang, Qi Ding, Yufeng Guo, Rong Fan, and Wei Wei, "Spatiotemporal Dy-

Impact-Based Forecasting: From Climate Outlooks to Actionable Information

Impact-Based Forecasting represents a shift from predicting meteorological variables to assessing their consequences for people, infrastructure and ecosystems. ESCAP's IBF tool automates geospatial processing, combining seasonal forecasts with classified exposure datasets (population, infrastructure, agriculture, land cover). Users can import their own georeferenced hazard layers and generate impact maps, charts and exportable tables.

This approach strengthens early-warning capacities and enhances decision-making across water management, agriculture, infrastructure resilience, and high-mountain hazard monitoring.

For the Third Pole, IBF integrates TPCF forecasts with slope and cryosphere indicators, helping identify vulnerable valleys where anomalous melt coincides with steep terrain. For the Arctic, IBF enables evaluation of permafrost-related risks under anomalous seasonal warming. By harmonising these approaches across regions, ESCAP contributes to a transboundary framework for understanding interconnected cryospheric hazards.

The ESCAP Risk and Resilience Portal[15] is a regional knowledge and analytics platform designed to help countries across Asia and the Pacific better understand, visualise, and manage disaster and climate risks. By integrating geospatial information, climate data, and socio-economic indicators, the portal supports evidence-based policymaking and strengthens resilience planning at national and regional levels.

Under the project "Enhancing knowledge and capacity to build resilience to slow-onset disasters in Central Asia" ESCAP published an online tool "Major Teleconnections Influencing the Third Pole"[16] at the Risk Resilience Portal.

This interactive tool on the ESCAP Risk & Resilience Portal visualizes the key atmospheric teleconnection patterns that shape climate variability across the Third Pole region. It provides an accessible, science-based overview of how large-scale

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namics of Snow Cover in the Third Pole and Its Teleconnection with Atmospheric Circulation," *Land* 12, no. 1 (2023): Article 19, https://doi.org/10.3390/land12010119.

15 UNESCAP, Risk and Resilience Portal (Bangkok: United Nations ESCAP, n.d.), https://rrp.unescap.org/

16 UNESCAP, "Major Teleconnections Influencing the Third Pole," Risk and Resilience Portal (Bangkok: United Nations ESCAP, 2025), https://rrp.unescap.org/major-teleconnections-influencing-third-pole.

circulation systems such as ENSO, the Indian Ocean Dipole, the North Atlantic Oscillation, and other global patterns affect temperature, precipitation, monsoon behavior, drought risk, and extreme weather across High Mountain Asia.
The tool allows users to explore each teleconnection through clear explanations, spatial illustrations, and curated datasets, helping policymakers, researchers, and practitioners understand the linkages between distant climate drivers and local impacts. By translating complex climate dynamics into actionable insight, it supports better risk assessment, seasonal planning, and adaptation decision-making in the Third Pole and downstream regions.

Conclusion

The Arctic and the Third Pole illustrate how distant cryospheric systems are linked by shared climatic drivers and mutually reinforcing vulnerabilities. Through the integration of scientific advances, regional climate outlooks and impact-based visualisation tools, it becomes possible to translate seasonal anomalies into concrete socio-economic insights. As warming accelerates, strengthening regional cooperation – through NEACOF, TPRCC and ESCAP's IBF framework – will be essential for safeguarding the resilience of communities from the Arctic coast to the Himalayan highlands.

Bibliography

ESCAP. "An Era of Extreme Heat: Teleconnections of Glacial Risks from the Arctic to the Third Pole." ESCAP Blog, 2025. https://www.unescap.org/blog/era-extreme-heat-teleconnections-glacial-risks-arctic-third-pole.

ESCAP, "Warming Asian Glaciers: Regional Strategy for Riskscape," ESCAP Blog (Bangkok: United Nations ESCAP, 2024), https://www.unescap.org/blog/warming-asian-glaciers-regional-strategy-riskscape.

Rinke, Annette & Matthes, Heidrun & Dethloff, Klaus. (2010). Regional characteristics of Arctic temperature variability: Comparison of observations with regional climate simulations. Climate Research - CLIMATE RES. 41. 177-192. 10.3354/cr00854.

Pronina, E. Impact-Based Forecasting for Disaster Risk Reduction / E. Pronina, S. Hong, S. Shrivastava // , 30 May 2024, 2024. – P. 25-34. – EDN BORDNH.

A. Agarwal, S. Maskey, M. S. Shrestha, et al., "Seasonal Prediction of Summer

Extremes in High Mountain Asia: Recent Advances and Regional Collaboration," npj Climate and Atmospheric Science 7 (2024): Article 42, https://doi.org/10.1038/s41612-024-00710-5.

ESCAP, Asia-Pacific Disaster Report 2025: Rising Heat, Rising Risk – Policy Pathways for Regional Resilience(Bangkok: United Nations ESCAP, 2025), https://repository.unescap.org/server/api/core/bitstreams/e55f8a9e-2e7a-414e-8e2e-4eb004248335/content.

WMO, "Third Pole Climate Forum Issues First-Ever Seasonal Outlook," World Meteorological Organization (Geneva: WMO, 2024), https://wmo.int/media/news/third-pole-climate-forum-issues-first-ever-seasonal-outlook.

Арктика - Гималаи: телесвязи ледниковых опасностей / Е. А. Пронина, Л. Саларпур, С. Шривастава [и др.] // Арктика: перспективы, инновации и развитие регионов : IX Международный Арктический саммит : сборник материалов, Москва - Санкт-Петербург, 22–25 апреля 2025 года. – Москва: Всероссийский научно-исследовательский институт по проблемам гражданской обороны и чрезвычайных ситуаций МЧС России, 2025. – С. 83-96. – EDN XQUFYX.

North Eurasian Climate Centre (NEACC), Final Consensus Statement of the Twenty-Ninth Session of the North Eurasian Climate Outlook Forum (NEACOF-29) (Moscow: NEACC, 2025), https://seakc.meteoinfo.ru/images/media/images-seakc/seakc/neacof29/Consensus%20Statement_NEACOF-29_fin.pdf.

UNESCAP, Risk and Resilience Portal (Bangkok: United Nations ESCAP, n.d.), https://rrp.unescap.org/

UNESCAP, "Major Teleconnections Influencing the Third Pole," Risk and Resilience Portal (Bangkok: United Nations ESCAP, 2025), https://rrp.unescap.org/major-teleconnections-influencing-third-pole