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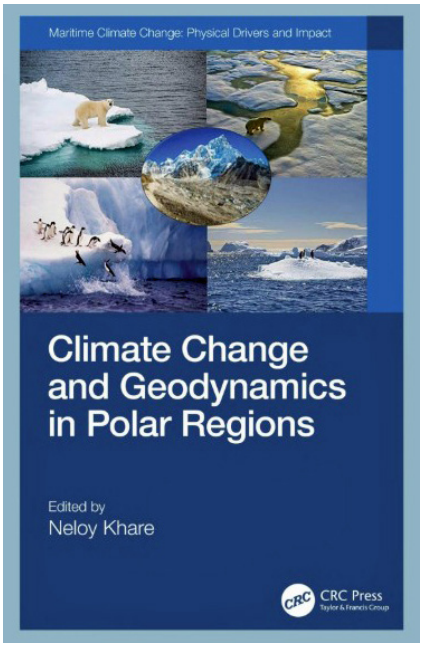
Book reviews

Climate Change and Geodynamics in Polar Regions, by Neloy Khare, 2022. CRC Press Taylor & Francis Group, 272 pages. Paperback: price €46.74, VitalSource eBook: price €30.25. ISBN 9781003284413.



The book was published by CRC Press, a Taylor & Francis Group in the series "Maritime Climate Change. Physical Drivers and Impact" and is presenting (as a second volume after "Climate Change in the Arctic – an Indian Perspective") results of investigations undertaken by Indian scientists in polar regions and mountainous environment of the Himalayas. This publication, as the whole series, is edited by Neloy Khare PhD, DSc, a prominent scientist and science booster with a background in marine research in tropical and high latitude areas. His experiences come from field works in the Indian Ocean, Arabian Sea, Gulf of Bengal, Southern Ocean, Antarctic and Arctic. Under his leadership was gathered significant group of 35 authors who presented nine chapters covering most important issues in the scope of climate change and various aspects of its impact on the environment from Svalbard, different regions in Antarctica and from the Himalayas. This approach helps to understand the variety of problems in the fragile environment of polar and mountainous regions related to climate shift, as well as different aspects of appearing consequences.

In the foreword to the book Professor Somnath Dasgupta, Senior Scientist at Indian Statistical Institute in Kolkata and Honorary Professor at Indian Institute of Science Education and Research wrote: "…The unprecedented warming in the Arctic, Antarctic and the Himalayan region is severely causing changes not only to the physical environment but to the entire ecosystem. It is believed that understanding climate change impacts on all these three poles (the Arctic, the Antarctic, and the Himalayas) is a matter of critical importance not only for the region alone but globally".

Within nine chapters of the book, in the order of their appearance, one is devoted to geomorphology of NW part of Spitsbergen Island in Svalbard (Arctic), seven to various aspects of Antarctic environment from geology and geomorphology of ice-free areas, throughout foraminiferal studies in the Southern Ocean to palaeoclimatic issues saved in ice cores record and ionosphere reaction during total solar eclipse, and finally one discusses landforms, sediments and processes following glacial and slope dynamics in the Garhwal Himalaya.

In Chapter 1 Jitendra Kumar Pattanaik and co-authors from Central University of Punjab and Amity University Haryana are discussing variety of landforms of different origin and their sedimentological references, pointing among other things at their potential as environmental archives, however, it is difficult to agree with one of the conclusions related to low sediment fluxes in these areas, especially in conditions of accelerated glaciers melt.

Mass balance of the East Antarctic Ice Sheet of a part of Central Dronning Maud Land (the Nivlisen Ice Shelf Basin near Schirmacher Oasis), presented in Chapter 2, was studied in relation to climate change by Pradeep Kumar and others (Polar Stud-

ies Division, GSI, Faridabad and SU: ODISHA, GSI, Bhubaneswar). Observations consisted of ice front behavior (recession/advancement), snow cover accumulation/ablation and ice thickness. The well documented processes of glacial realm changes revealed moderate dynamics of the ice surface with rather positive snow-cover budget and ice loss rather due to out-flux to the ocean than restricted surface melting.

Ashutosh K. Singh et al. in Chapter 3 gave extensive review of Antarctica ice cores studies in relation to Antarctic climate history and its relationship with global climate change. The authors indicate references to some important ice cores and discuss such issues as e.g. formation of ice sheet, palaeotemperatures and winds, gases, isotopes, contaminations, etc. Allover it is a very good review of the state of art in Antarctic environment system with high resolution palaeoclimate issues and their relations to global climate functioning, as far as we can recreate the signal recorded in the ice.

The operation of Indian Antarctic Station "Maitri" in Schirmacher Oasis, established in 1989, facilitated largely research in this area. In Chapter 4, experiences from past and recent expeditions allowed Jittendra Kumar Pattanaik and Waseem Ahmad Baba from Central University of Punjab to summarize glacial geomorphological topics from ice free areas. Rocky surfaces reveal traces of earlier glaciers advances and movements throughout the Oasis, sedimentary records are sources of information on geomorphological processes of various origins. The relief privileges also the existence of water bodies, within which and due to water level changes, lacustrine sediments are preserved. Exposed rock and sediments surfaces are subjected periglacial conditions in the harsh Antarctic climate. The possibility of field works based on the research station provides unique results and opportunities to set up long-term environmental monitoring system.

Chapter 5 by Subodh Kumar Chaturvedi (University of Lucknow) and Neloy Khare (Ministry of Earth Sciences, India) is another overview, this time regarding foraminiferal studies from Antarctica and its surroundings. High southern latitudes are in this topic of special interest in terms of the role and record of climate change. Foraminifera studies provide exclusive information about their past and present living conditions in the sensitive polar environment, used as a proxy of climate and water quality characteristics. Foraminifera record is found in Antarctica and discussed here both in terrestrial (lakes and land-based sections) and marine environments. For this latter one, the authors cite as many as 298 references from the years 1916-2022. They point at such areas of interest in foraminiferal studies as e.g.: biostratigraphic studies, past circulation changes, ice-sheet dynamics, seawater temperature reconstructions, etc. There is also a hint for the potential of future studies (called "grey areas") in such fields as the formation and distribution of water masses, source and sink of organic carbon, variation in biological productivity, climate system teleconnections and many others.

Another group of authors led by A.S. Sunil from Cochin University of Science and Technology (Kochi, India), took for elaboration the ionospheric response over Antarctica during the December 4, 2021, total solar eclipse (Chapter 6), as such phenomena were relatively weekly described from high southern latitudes. The eclipse occurred in Western part of Antarctic Continent, from Weddell Sea to the Getz Ice Shelf (Amundsen Sea), with the greatest stage N of the coast of Berkner Island. Based on Global Positioning System the Total Electron Content was investigated over the obscuration area and its clear depletion was observed. The study has its importance regarding the rarity of observations of this type with the described method in the Antarctic environment.

In Chapter 7 the lakes and transient ponds of Schirmacher Oasis and Larsemann Hills (located 60 deg. East from the first area, on the coast of Prydz Bay, where another Indian Research Station "Bharti" is operating) were described by T.R. Resmi (from Centre for Water Resources Development and Management, Kozhikoide) and co-authors in terms of water chemistry and isotopic composition (Oxygen and Hydrogen stable isotopes), showing the meltwater origin and specific conditions of weathering and precipitation/evaporation ratios. These researches show a potential of future insight in the landscape and sediments evolution.

A pristine environment of the lake Priyadarshini (largest and deepest lake in Schirmacher Oasis) and other water bodies and streams were studied by Rajni Khare et al. i.e. to determine physicochemical and biotic parameters of these habitats, within which a zooplanktonic phytoplanktonic and bacterioplanctonic assemblages were distinguished. During consecutive campaigns spatial and diurnal variability of water chemistry and organisms was investigated in harsh polar conditions, in some cases freezing to the bottom. The arising problem is connected also with the growing impact of human activity in vicinities of Antarctic stations, although, it is still at a very low level and limited with many restrictions of environmental protection.

The last part of the book (Chapter 9) by Anoop Kumar Singh et al., mostly representing University

of Lucknow, is devoted to glacial geomorphology and sedimentology, as well as contemporary geological processes of area associated with Gangtori Glacier in the Garhwal Himalaya. Main geomorphological features of decaying glacier front as moraines, outwash plains and kames, and associated with them sediments were distinguished during the field and remote sensing surveys. This is constituting a very unstable and dynamic environment, where abrupt meltwater discharge processes known as glacial lake outburst floods (GLOF's) and landslide lake outburst floods (LLOF's) occur, interesting not only from the point of view of geological processes, but also in terms of effects that may be triggered in populated mountain valleys below. The occurrence of such phenomena, as other catastrophic events, seem to increase, therefore they are worthy of paying more attention to them.

The monograph we have become acquainted presents the results of research conducted by a considerable group of researchers from India, operating in both the land and marine areas of Antarctica, but also in the Arctic and the Himalayas, based on field stations and vessels, carrying out environmental monitoring as well as remote investigations. There is undoubtedly still much to investigate and improve in the approach to the ongoing work. There should be the possibility of further expanding and developing international cooperation, in order to transform case studies into well-documented regularities regarding the functioning and variability of the polar and high mountains environment. Presented areas are highly sensitive to stimuli reaching these isolated regions in light of the overall state of uncertainty regarding the future of the Earth's natural system. At the end let me quote once again Professor Somnath Dasgupta: "…It will be of immense value to all researchers keen to understand the science of climate change in these sensitive regions. It will also help the Decision Support System and the development of climate models".

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