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Preface

Introduction to Thematic Set: Asian Climate

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In 2021 PAGES organised an Open Science Meeting meant to take place from 16th to 20th May at Agadir in Morocco. A session on *Drivers of Environmental Change in Asia* was offered by us to the meeting. Like many meetings at the time, COVID intervened; attending and meeting people from all over the world, which would have been magnificent, turned into an online event held in May 2022. The papers presented here are some that relate to the topic.

Asia not only is the largest continent but also is home to the majority of humankind. The range of environments is enormous, from the Arctic to the humid tropics and from the highest mountains to some of the driest places on Earth. Past climate changes have had enormous impacts on landcover, vegetation and ice distributions, sea-level changes and the course of human society developments. Present and future climate variability is having, and is expected to have, a major influence on the well-being of people and geopolitics of Asia. The four papers in this volume cover some of the themes of the session and represent the flavor of many more that were given as oral or poster presentations.

Despite the hundreds of papers published, it is the vastness of Asia that means that the depth of knowledge is patchy for many regions. Big issues like changes in biodiversity, intensity and distribution of the monsoon influence, the dynamics of desert boundaries, loss of high-altitude ice, and sea-level rises are part of the great unknowns; yet all are essential pieces of the puzzle for future-proofing societies and the health of environments and their biota. It is also important to understand the role of external forces outside of Asia and how these impact regions within Asia. The four papers in this set illustrate the role of glaciations and sea-level changes on landscape conditions, and on how the use of multiproxy analyses can broaden our understanding of processes, linkages, and environmental responses to climatic and environmental changes in parts of Asia.

Chai et al. (2024) used ^{10}Be exposure dating in the Taniantaweng Mountain on the Tibetan Plateau to describe the patterns of glaciation between MIS 6 and the present. The maximum extent of ice was in MIS 3, and while probably not the coldest period, the moisture conditions resulted in ice-sheet growth. Ice cover was quite variable in the Early to Mid-Holocene, and these can best be understood by comparing them to changes in the North Atlantic Ocean temperatures, Summer solar insolation and Asian Monsoon intensity. This study highlights how both local and global factors are responsible for ice sheet behavior.

Sea-level rise is a threat to many coastal cities, including several megacities of Asia. Relative sea-level rise is exacerbated in places by groundwater extraction to augment water supplies. Well-dated and preserved beach ridges provide evidence of past relative seal-level changes. The record by Ballian et al. (2024) from the Gulf of Thailand near Bangkok provide a record of Holocene relative land-surface and sea-level changes. However, projected ranges of a rise in sea-level of about 5 mm/yr is several times larger than observed for the past. This could result in an extensive loss of land and infrastructure. The question thus arises, can sediment supply result in coastal adjustments to accommodate this?

Two of the papers presented here use multiproxy analyses on lake sediments to address important environmental questions. The internationally significant grasslands of Inner Mongolia were studied using sediments from a lake near Chifeng. The region is very sensitive to climate change and human impacts. The record by Li et al. (2024) shows a major change in the character of the grassland as a result of the combined influence of increased human impact at the time there was a climate shift from humid to more arid conditions. This is a good illustration of the need to identify both natural and anthropogenic forces in addressing how environmental changes are expressed.

Duan et al. (2024) applied a range of techniques to investigate climate impacts in the Tengger Desert of arid to semiarid China. They identified an intense dry period between 7.6 and 2.8 cal ka BP. This had a major impact on vegetation cover that persisted until climate allowed groundwater recharge. This intense aridity probably also had an impact on human societies during the Mid-Holocene in the region.

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