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Editorial: Changes in Snow, Monsoon and Snow-Monsoon Relationship in the Warming Climate

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Editorial on the Research Topic

Changes in Snow, Monsoon and Snow-Monsoon Relationship in the Warming Climate

Monsoons affect a large percent of the world's population. Snow cover modulates land surface conditions and consequently the land-sea thermal contrast. Thus, snow over the land is an important factor for monsoon variations. In a warming climate, both snow and monsoon are subject to notable changes. The snow-monsoon relationship has also experienced changes in the past. Improved understanding of the factors responsible for the changes in snow over various regions and in different components of monsoon, and the physical reasons for the changes in snow-monsoon relationship will help to alleviate monsoon-related adverse impacts on societal development.

This special issue "Changes in Snow, Monsoon and Snow-Monsoon Relationship in the Warming Climate" includes articles that address the impacts of snow cover on Asian climate and changes in the snow-monsoon relationship in a warming climate. Papers range from the impacts of the Tibetan Plateau and Eurasian snow cover on the winter atmospheric circulation and East Asian winter monsoon to summer precipitation and extremes. Papers also consider the regulation of solar activity on the Tibetan Plateau snow variations and their impacts on summer precipitation in China and evaluate the ability of coupled models in simulating the Eurasian snow and its relationship with atmospheric circulation.

Three papers in this special issue are focused on the impacts of the Tibetan Plateau snow changes. Chen et al. analyzed the role of eastern Tibetan Plateau autumn-winter snow cover in the variability of the northern component of the East Asian winter monsoon. Song et al. documented the linkage of the spring Tibetan Plateau snow to summer precipitation in China. Wang et al. examined the impact of summer western Tibetan Plateau snow cover on East Asian summer precipitation. Four papers are focused on the impacts of Eurasian snow on winter atmospheric circulation. Yang and Fan analyzed the influence of November Siberian snow on the out-of-phase Siberian High change in December and January and the responsible physical mechanism. Sun et al. documented the connection of diverse winter Siberian high variation modes with preceding autumn and simultaneous winter Eurasian snow cover. Zhang and Sun revealed the impacts of central Siberian October snow cover on spring extreme precipitation in southern China. Yao et al. identified the relation of summer compound hot and dry extreme days in China to the preceding winter Northern Hemisphere snow.

Four papers revealed that the effects of snow on climate have experienced interdecadal changes. Chen et al. identified an interdecadal weakening in the relationship of the northern component of East Asian winter monsoon to autumn-winter Tibetan Plateau snow cover in the mid-1990's. Yang and Fan unraveled the intensified impact of spring Siberian snow on the out-of-phase December-January Siberian high relation after 2000. Song et al. showed that the linkage of Tibetan Plateau snow

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to summer precipitation in China was regulated by the solar activity. Wang et al. found that the influence of summer western Tibetan Plateau snow on East Asian precipitation had decreased after the early 2000's due to the reduction of Tibetan Plateau snow cover variability.

The paper by Sun et al. evaluated the model simulation of the relationship of the Eurasian snow to Siberian high variation. They showed that the models needed to capture the snow pattern properly in order to simulate the influence of snow on the Siberian high variation realistically. Zhang and Sun, and Yao et al. revealed evidence for the role of snow in the occurrence of extreme events.

With the increase in global temperature, the domain and variability of snow cover are likely to undergo continuous changes. While snow cover over land may continue to play a role in the climate variability in different regions and different seasons, the key regions of snow and the magnitude of snow influence may change under a warming climate, as indicated by several articles in this special issue. For future projections of snow and its impacts using climate models, there exist uncertainties related to the ability of models in capturing the realistic snow distribution and the spatial pattern of snow variability. Efforts are needed in the future to improve the simulations of the distribution and variability of continental and regional snow and understanding of the physical processes of snow impacts on climate variability in various regions and seasons.

AUTHOR CONTRIBUTIONS

RW drafted the manuscript. All the authors contributed to the revising of the manuscript.

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