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Editorial

Advanced Climate Simulation and Observation

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Global climate changes, particularly extreme weather events, can directly or indirectly affect freshwater availability and food production, and cause disease outbreaks, floods and droughts. Therefore, there is an urgent and necessary need to develop advanced climate simulation and observation approaches and models, especially ones related to extreme climate events. Advanced climate simulations and observations can improve the accuracy of climate change predictions and long-term trends, which can mitigate the impacts of climate events on social and economic development, as well as human lives.

Under these conditions, this Special Issue entitled "Advanced Climate Simulation and Observation" aims to introduce advanced approaches in climate simulation and observation for use in various practical studies related to climate variations.

A total of 22 papers have been published in this Special Issue, with 8 original research articles reporting on climate change.

In their paper, Torsri et al. [1] evaluated the capability of the state-of-the-art atmospheric GCM of the Institute of Atmospheric Physics (IAP-AGCM) in simulating summer rainfall over Thailand by comparing the model's results with ground-truth observation during 1981–2012. It was found that the IAP climate model creditably reproduced the spatial patterns of the first three dominant modes of summer rainfall in Thailand, and that the correlation between the observed rainfall anomalies and the Niño 3.4 index could be reproduced through the use of the IAP model.

In order to study the sensitivity of meteorological factors in the western Tianshan Mountain region in China concerning different parameterization schemes of climate models, Cheng et al. [2] used the regional climate model RegCM4.5 to simulate the meteorological factor occurring in the western Tianshan Mountain region from 2012 to 2016, to investigate the effects of different cumulus convective schemes (Grell, Tiedtke and Emanuel). The results show that different combinations of cumulus convection schemes can improve the simulation performance of meteorological factors.

Based on Beijing's air quality index (AQI) and concentration changes of the six major pollutants from 2019 to 2021, Liu T et al. [3] through descriptive statistics visualized the results, and the air pollution status and influencing factors of Beijing's AQI were analyzed using the ARIMA model and neural network. The results show that PM2.5, PM10 and O3 of the six major pollutants had the greatest impact on the AQI. Meanwhile, the forecast effect of the neural network model was better than that of the ARIMA model.

Chen et al. [4] proposed a weather radar nowcasting method based on the temporal and spatial generative adversarial network (TSGAN), which can obtain accurate forecast results, especially in terms of spatial details, by extracting spatial and temporal features, combining attention mechanisms, and using a dual-scale generator and a multiscale discriminator.

Using the advanced research version of the weather research and forecasting model (ARWv3) and a hydrostatic wind speed change equation, Liu et al. [5] assessed the effects

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of four CPSs on a 10 m wind speed simulation over mainland China in the summer of 2003. The sensitivity of the wind speed simulation to CPSs was found to be the highest in eastern and southern China, followed by the Tibetan Plateau and then northwest China. In addition, the main physical processes influencing wind speed varied greatly with subregions.

In their paper, Gulakhmadov A et al. [6] evaluated the applicability of three gridded datasets in different combinations against observational data for predicting the hydrology of the Upper Vakhsh River Basin (UVRB) in Central Asia. The water balance components were computed, the results were calibrated with the SUFI-2 approach using the calibration of the soil and water assessment tool model (SWAT–CUP) program and the performance of the model was evaluated. The simulation for the calibration, validation and overall scales showed an acceptable correlation between the observed and simulated monthly streamflow for all combination datasets.

Uwamahoro et al. [7] clarified the precipitation types in two selected catchments by verifying the influence of accumulated and maximum temperatures on snow melting using a separation algorithm of rain and snow that incorporated the temperatures. The novel snow-melting process utilizing the algorithm in the soil and water assessment tool model (SWAT) was also developed by considering the temperatures.

The paper by Al-Helal et al. [8] shows that a 3 m depth was optimal to bury EAHE pipes, where the ground temperature was 32 °C in the summer and 29 °C in the winter. These temperatures would provide a maximum cooling/heating capacity of 1000/890 MJ day^{-1} for each 1 m^3 of humid air exhausted from a greenhouse. If the EAHE pipes were to operate in a closed loop with a greenhouse, the condensation of water vapor in them would be impossible during the cooling process.

There are six papers in this Special Issue that reported on the impact of climate change on society and the economy.

The paper by Li et al. [9] examines the decoupling between carbon emissions per capita and HDI and the welfare output of carbon emissions by using data from 189 countries, from 1990 to 2019; it also decomposes the drivers of the decoupling index and carbon emission performance (CEP) in the example countries. The results show that most countries that achieved strong decoupling had a very high human development, while the worst case was that a few countries with an extremely low human development achieved strong decoupling.

Li et al. [10] used panel data from 236 prefecture-level cities in China from 2001 to 2012 to verify the impact of urban population agglomeration on haze pollution and its mechanism based on a spatial lag model. They found that China's urban haze pollution had a significant positive spatial spillover effect, and presented a spatial distribution state of high–high and low–low agglomeration.

In their paper, Li et al. [11] measured the green innovation efficiency of 30 provinces in China from 2009 to 2019 using the SBM (slack-based measure) of super efficiency based on the undesirable output. The results reveal that the green innovation efficiency of the 30 provinces showed a fluctuating upward trend, but that the differences among provinces were relatively significant.

Based on data of historical floods in 31 provinces and municipalities in China from 2006 to 2018, Chen et al. [12] compared five machine learning methods to predict direct economic losses. Among them, GBR performed the best, with a goodness-of-fit of 90%. The results of the data showed that, in China, provinces heavily reliant on agriculture suffered the most with the proportion of direct economic losses to provincial GDP exceeding 1‰.

With a set of panel data released from Hubei and Hunan provinces in China, Liu et al. [13] adopted the mediating effect model to explore the relationship between rural labor migration and air pollution caused by agricultural activity in China. They found that the increase in labor migration had intensified the comprehensive index of air pollution caused by agricultural activity by changing the supply of labor force in the agricultural sector, the budget line of rural residents, the scale of agricultural production and crop planting structure.

Abdul-Rahim et al. [14] investigated the environmental Kuznets curve (EKC) for haze in 31 cities and provinces across China using the spatial data for a period of 15 years, from 2000 to 2014. The results of the GWR model found the spatial variability of each variable and showed significant spatial heterogeneity in the EKC across regions.

Three papers reported on the impact of climate change on agriculture in this Special Issue.

Miao et al. [15] examined the spatiotemporal pattern of China's drought conditions and cropland exposure to droughts under global warming of 1.5 °C and 2 °C, along with the avoided impacts (as evaluated through the cropland exposure to droughts) when limiting global warming to 1.5 °C instead of 2 °C. The results suggest that drought conditions could be alleviated when the projected rise in mean global temperature is limited to 1.5 °C rather than 2.0 °C. In addition, the total cropland exposure to droughts across China exhibited an increasing trend in response to the 0.5 °C of additional global warming.

The paper by Shen et al. [16] used beans, the food crop with the largest supply and demand gap in China, as the research object, and established a panel spatial error model consisting of multiple indicators of four factors, including the climate environment, economic market, human planting behavior and technical development level of 25 provinces in China, from 2005 to 2019, to explore the impact of climate environmental changes on the yields of beans.

Tao et al. [17] conducted [CO_2] (ambient and enriched up to 500 μmol moL^{-1}) and temperature (ambient and increased by 1.5~2.0 °C)-controlled experiments from 2015 to 2017, as well as in 2020 in two free-air CO_2 enrichment (FACE) sites. They provide evidence that SPAD readings are significantly linearly correlated with the rice leaf chlorophyll a + b content (chl a + b) and N content, while the relationships are profoundly affected by elevated [CO_2] and warming.

The impact of climate change on human health was studied in five articles of this Special Issue.

In their paper, Zhang et al. [18] investigated the impact of air pollutants on the respiratory system and its action mechanism by using information on inpatients with respiratory diseases from two IIIA (highest) hospitals in Wuhan from 2015 to 2019, information on air pollutants and meteorological data, as well as relevant demographic and economic data in China. According to the findings, the economic losses caused by PM2.5, PM10, SO_2, NO_2 and CO exposure totaled USD 454.46 billion, or, approximately, 0.20% of Wuhan's GDP in 2019.

In the study by Hao et al. [19], 26 environmental variables, namely, climatic, geographical and 2 socioeconomic indicators, were collected from regions where MT-ZVL patients were detected during the period from 2019 to 2021, with the aim of creating 10 ecological niche models. They found multiple ensemble ecological niche models based on climatic and environmental variables to be effective at predicting the transmission risk of MT-ZVL in China.

Based on the core collection of the Web of Science and CNKI databases, Gao et al. [20] used CiteSpace software to draw and comment on maps of Chinese and English keywords, publishing times, authors, countries and research institutions concerning the relationship between air pollution and public health. The results point out that the number of studies on the relationship between air pollution and health had increased year by year. Meanwhile, the three areas of sustained pollution exposure, indirect consequences of negative health effects of air pollution and air pollution and climate change may be the future focus of the field.

Du et al. [21] used the 2018 China Health and Retirement Longitudinal Study (CHARLS) project database for their paper. The multivariate linear regression analysis and binomial logistic regression model were applied to detect the impact of the subjective evaluation of air quality on QOL. The results show that there is a significant positive correlation between the subjective evaluation of air quality and the two dimensions of QOL.

In the paper by Gao et al. [22], a penalized distributed lag nonlinear model was applied to explore the influence of meteorological factors on the PTB incidence in Xinjiang from

2004 to 2019. Moreover, they firstly used a comprehensive index (apparent temperature, AT) to access the impact of multiple meteorological factors on the incidence of PTB. Overall, it was indicated that environments with low air temperature, suitable relative humidity and wind speed were more conducive to the transmission of PTB, and low AT was significantly associated with an increased risk of PTB in Xinjiang.

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