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EDITORIAL

East Asian climate under global warming: understanding and projection

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This special issue of Climate Dynamics is devoted to the recent progress in investigations of East Asian climate (EAC) under global warming: Understanding and projection.

East Asia is located in the southeast part of the Eurasian continent. It is bordered on the east by the Pacific Ocean and on the southwest by the Tibetan Plateau (TP). The unique geographic features produce distinct climate characteristics over this region (Li et al. 2011a, b), and EAC study is one of the foci of the Asian Monsoon Years (AMY 2007–2012) (Wang et al. 2010; Matsumoto et al. 2010), which is a coordinated observation and modeling effort under the leadership of the World Climate Research Programme (WCRP). A workshop was held on 18–20 October 1994 at the State University of New York at Albany to discuss this topic, and the participants agreed to embark a collaborative research project, "General Circulation Model (GCM) Simulations of the EAC". The project was subsequently listed as the Subproject #25 in the Atmospheric Model Intercomparison Project (AMIP)–Coupled Model Intercomparison Project (CMIP) in 1994 with Profs. Wei-Chyung Wang and Guoxiong Wu as the Coordinators; and Yihui Ding, Huang-Hsiung Hsu, Akio Kitoh, and Jeong-Woo Kim as members. From 2008 to 2009, Profs. Huang-Hsiung Hsu and Bin Wang are the EAC Coordinators. Since 2009 Profs. Huang-Hsiung Hsu and Jianping Li have become the EAC Coordinators, and there are 12 members. The project has three main objectives as follows:

i. To study the mechanisms and impacts of the EAC variability, especially for some extreme events;
ii. To understand the change of the EAC variability under global warming;
iii. To assess the technique of detection and the ability of current GCMs in simulating the EAC, and to discuss the predictability of the EAC.

Almost every 2 years, the EAC committee organizes an international workshop to present and discuss collaborative research progress in EAC study. Over the years, thirteen workshops were already organized and the latest one in Beijing, China on 24–25 March, 2016. The EAC 2016 workshop attracted about 100 participants from 7 countries or regions. The special collection includes papers studying the foci of EAC and reporting the latest advances in the aspects as follows: Detection and attribution; Climate variability; High-impact weather and extremes; and Predictability, prediction and projection.

Some important results come from the EAC 2016 workshop include:

- An out-of-phase rainfall variation is found over central Asia and northern China in the upper-level Asian westerly jet (AWJ) region in the interannual timescale, and is closely related to the southeast-northwest shift of AWJ.
- The increases in sea surface temperature (SST) and atmospheric heating over Southeast Asia result in a dry-

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ing southern China in spring, and a drying South Asia and Sahel regions in summer.
- The intraseasonal SST variations in the South China Sea (SCS) display a close association with the East Asian winter monsoon (EAWM) change with a time lag of 3–5 days.
- Some new modulators for Asian monsoon variability are introduced, e.g., IPOD (a cross-basin dipole pattern of SSTA variability between the Indo-Pacific warm pool (IPWP) and North Pacific Ocean), IPCO (Indo-Western Pacific convection oscillation), the warmest SST axis in the Bay of Bengal (BoB) and monsoon onset, synergistic effects of extratropical and tropical systems.
- Relative contributions of the TP thermal forcing and the Indian Ocean SST basin mode to the interannual variability of the East Asian summer monsoon (EASM) were discussed.
- Characteristics of SCS SST associated with ENSO shows interdecadal variability.
- Interannual and decadal variations of South Asian High (SAH) and UTTM intensity are strongly affected by EASM condensation over the eastern TP-Yangtze River Valley.
- The Asian summer monsoon is thermally controlled by both land-sea distribution and the presence of the Tibetan-Iranian Plateau (TIP).
- Coherent evidences suggest the recent intensification of the covariability between North Pacific subtropical high (NPSH) and western NPSH (WNPSH) along with considerable decadal variabilities.
- The WNP (western North Pacific) and CP (central Pacific) precipitation anomalies associated with ENSO have opposite effects on teleconnection patterns over North Pacific and East Asia.
- The change of El Niño behavior since 1999 is likely attributed to the interdecadal mean state change in the tropical Pacific. Global warming effect appears weak.
- The increase in anthropogenic emissions over East Asia may play a role in compensating for the weakening of the EASM caused by the SST forcing.
- The TP snow cover can influence the interannual variations of Eurasian heat wave frequency.
- The anthropogenic forcing has a detectable and attributable influence on the amount distribution of daily precipitation over Eastern China during the second half of the twentieth century.
- Long-term change of extreme daily precipitation over a 100 years in Japan shows increase in heavy precipitation and decrease in weak precipitation.
- Maximum 1-h rainfall for megacities (Shanghai and Guangzhou) has increased in recent 60–100 years. The increasing 1-h rainfall intensity is caused by both climate change and urbanization effects.
- The North American dipole (NAD) is closely related to the CP-type El Niño a year later.
- While in the subtropical domain of the WNP–EASM, the MME probabilistic skill improvement seems to be mainly due to the increase in ensemble size, in the tropical domain a significant component of the improvement comes from the model diversity inherent in the MME approach.
- An intra-seasonal view of monsoon onset over BoB is proposed, i.e., eastward MJO transit to first northward propagating ISO, triggered by central BoB warming.
- The increase of temperature and change in precipitation patterns lead to an increase in global aridity and expansion of global drylands.
- Two dominant global-scale teleconnections in the Northern Hemisphere extratropics during boreal summer were identified: the western North Pacific-North America (WPNA) and circumglobal teleconnection (CGT) patterns.

This special issue comprises 40 peer-reviewed papers, which is divided into four parts as follows. Part I, *detection and attribution*, which contains 13 papers, discusses responses of rainfall and circulations in summer over East Asia to anthropogenic aerosol climate forcing and global warming (Chen et al. 2018a, b; Kim and Ha 2018), analyses stratospheric impacts on East Asian winter climate (Wei et al. 2018) and spring precipitation in China (Xie et al. 2018) and effects of the Indo-Pacific warm pool on the stratosphere (Zhou et al. 2018), explores influences of regional and global SST anomaly (Han et al. 2018; Liu and Duan 2018), the Southern Hemisphere annular mode (SAM) and East Asian westerly jet on EAC (Liu et al. 2018; Wang et al. 2018a, b; Hu et al. 2018a, b), and detects hydrological processes over the TP and East Asia (Guo et al. 2018a; Meng et al. 2018).

Part II, *Climate variability*, which includes 13 papers, investigates intraseasonal oscillations and their impacts on seasonal mean SST (Wu 2018; Krishnamurthy 2018), explores linkages of EAC with South Asian summer monsoon and North Atlantic Oscillation (NAO) (Ha et al. 2018; Feng et al. 2018), analyses variability of water vapor transport associated with EAC (Li et al. 2018; Leung et al. 2018; Chen et al. 2018c; Wu et al. 2018), and discusses impacts of ENSO and its types, thermodynamic and dynamic responses to SST forcing associated with El Niño (Chen and Li 2018; Hu et al. 2018a, b; Kim et al. 2018), types of Indian Ocean Basin modes (Guo et al. 2018b) as well as decadal-scale variability of surface temperature over East Asia (Chen et al. 2018d).

Part III, *High-impact weather and extremes*, which is composed of 6 papers, analyses extreme precipitation over Japan (Nayak et al. 2018) and heat waves over the Yangtze

River valley (Chen and Zhou 2018; Gao et al. 2018), studies variability of spring dust weather in North China (Fan et al. 2018) and subseasonal shift in tropical cyclone genesis (Choi and Ha 2018), and discusses influences of extreme events on crop yield (Wang et al. 2018a, b).

Part IV, *Modelling, predictability, prediction and projection*, which consists of 8 papers, makes comparison of the global atmospheric model MRI-AGCM3.2 and the CMIP5 atmospheric models in simulating precipitation over East Asia (Kusunoki 2018a), discusses simulation biases of ENSO forced and local variability of North Tropical Atlantic SST (Yang et al. 2018) and the role of horizontal resolution over the TP in the REMO regional climate model (Xu et al. 2018), explores predictability of summer extreme precipitation days over eastern China (Li and Wang 2018) and predictability of two types of El Niño in coupled models (Lee et al. 2018), studies statistical model of interannual variability of the EAWM (Yu et al. 2018) and statistically seasonal prediction of the typhoon genesis frequency over the Western North Pacific (Zhang et al. 2018), and projects future changes in precipitation over East Asia (Kusunoki 2018b).

It is the editors' sincere hope that this special issue may contribute to relevant studies in EAC.

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