EDITORIAL

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Toward better watching of the deep atmosphere over East Asia

TianJun Zhou[1,2*]

[1]State Key Laboratory of Numerical Modeling for Atmospheric Sciences and Geophysical Fluid Dynamics (LASG), Institute of Atmospheric Physics, Chinese Academy of Sciences, Beijing 100029, China;

[2]College of Earth and Planetary Sciences, University of Chinese Academy of Sciences, Beijing 100049, China

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A salient feature of the East Asian orography is the huge Tibetan Plateau in the west and the broad Pacific in the east. Reversals in the temperature gradient between the Eurasian continent and the adjacent Pacific Ocean associated with the progression of the seasons have produced the prominent East Asian monsoon system. The summer monsoon contributes about 49% of the annual precipitation over East Asia. Anomalous monsoon activities have and will continue to affect more than one billion people living in this area (Zhou TJ et al., 2009, 2011). Reliable and accurate weather forecasting and climate prediction will help governments, the private sector, and citizens better cope with the damage and disruption caused by severe weather and climate. Successful prediction of monsoon activity relies heavily on a comprehensive understanding of the processes and mechanisms that dominate the evolution of the monsoon system. To achieve this goal, field observations that cover both the plenary- and synoptic-scale components of the East Asian weather system are necessary. In recent years, many field observations have been organized in China. The implementation of these field observations has provided a better understanding of the key physical processes involved in the evolution, maintenance, and variability of East Asian weather and climate. This special issue of *Earth and Planetary Physics* is dedicated to two major field observation projects that focus on monitoring the stratosphere and troposphere exchange over the Tibetan Plateau and the lightning physics associated with the mesoscale convective system in North China, respectively. Both projects have promoted research aimed at better watching the vertical structure of the atmosphere over East Asia.

The first project, the Stratosphere and Troposphere Exchange experiment during Asian Summer Monsoon (STEAM) (Zhang JQ et al., 2019), is a 5-year project (2018–2022) funded by the Strategic Priority Research Program of the Chinese Academy of Sciences. The objective of STEAM is to improve understanding of the key physical processes that control the stratosphere and troposphere exchanges over the Tibetan Plateau. Multiple instruments, including long-duration stratospheric balloons, dropsondes, unmanned aerial vehicles, special sounding systems, and ground-based and satellite-borne instruments, have been deployed in several locations of the Tibetan Plateau and thus form a three-dimensional observational network. The experiment was performed from late July to August in 2018, and the first comprehensive observational data set has been obtained. Field observations will continue in the following years. The implementation of STEAM will improve our understanding of how the Tibetan Plateau influences East Asian weather and climate and how the plateau helps transport water vapor and pollutants into the stratosphere.

The second project, the SHAndong Triggering Lightning Experiment (SHATLE), has been in operation since 2005 at Binzhou, Shandong Province of China (Qie XS et al., 2019). Jointly supported by funding from the Ministry of Science and Technology and the National Natural Science Foundation of China, this project has captured more than 70 negative flashes and 2 positive flashes triggered in the last decade. The data collected by the SHATLE project, with complementary data from other site observations such as the Beijing Lightning Network (Wang Y et al., 2016), has greatly promoted research on lightning physics in China. In this special collection, Qie XS et al. (2019) summarizes the propagation characteristics of positive leaders and negative leaders in lighting revealed by the observational data. The data from high-speed cameras, electromagnetic fields in rocket-triggered lightning, and tower-initiated lightning discharges are crucial to the findings summarized. Another new observation-supported finding from Wang YP et al. (2019) is based on observations of sprites near Beijing on 8 August 2017. The triangulation of red sprites was obtained based on concurrent observations over a mesoscale convective system in North China from two stations separated by about 450 km. This is the first triangulation of sprites in mainland China. It advances our knowledge of transient luminous event phenomena and their relationship with lightning and thunderstorms.

In addition to the above field observation-supported investiga-

Correspondence to: T. J. Zhou, zhoutj@lasg.iap.ac.cn
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tions, some proceedings reported in this special collection are related to watching the vertical structure of the atmosphere over East Asia and the surrounding regions, including the physical structures of clouds as revealed by cloud multispectral radiances (Huo J et al., 2019), the vertical structure of double cores of the ozone low over the Asian continent revealed by satellite data sets (Tang Z et al., 2019), the structure of East Asian summer monsoon revealed by the precipitation observations and a sensitivity numerical experiment (Chen X, 2019), the quasi-90-day oscillation observed in the mesosphere and lower thermosphere region at low latitudes from the Kunming meteor radar, and the SABER (Sounding of the Atmosphere using Broadband Emission Radiometry) data from April 2011 to December 2014 (Yi W et al., 2019).

In summary, this special issue reports the recent progress Chinese scientists have made in revealing prominent features of the vertical structure of the atmosphere over East Asia and the surrounding regions based on field observations. The implementation of these field observation projects has provided fundamental data that help us better watch the atmosphere over East Asia. The continual implementation of projects such as STEAM and SHATLE will undoubtedly advance our understanding of key mechanisms that affect the thermal and dynamic processes associated with East Asian weather and climate, and finally lead to improved predictions.

References

Chen, X., Zhong, Z., Hu, Y. J., Zhong, S., Lu, W., and Jiang, J. (2019). Role of tropical cyclones over the western North Pacific in the East Asian summer monsoon system. *Earth Planet. Phys.*, *3*(2), 147–156. https://doi.org/10.26464/epp2019018

Huo, J., Lu, D. R., and Xu, W. J. (2019). Application of cloud multi-spectral radiances in revealing cloud physical structures. *Earth Planet. Phys.*, *3*(2), 126–135. https://doi.org/10.26464/epp2019016

Qie, X. S., Yuan, S. F., Zhang, H. B., Jiang, R. B., Wu, Z. J., Liu, M. Y., Sun, Z. L., Pu, Y. J., Li, J. L., Srivastava, A., Ma, Z. L., and Lu, G. P. (2019). Propagation of positive, negative, and recoil leaders in upward lightning flashes. *Earth Planet. Phys.*, *3*(2), 102–120. https://doi.org/10.26464/epp2019014

Tang, Z., Guo, D., Su, Y. C., Shi, C. H., Zhang, C. X., Liu, Y., Zheng, X. D., Xu, W. W., Xu, J. J., Liu, R. Q., and Li, W. L. (2019). Double cores of the Ozone Low in the vertical direction over the Asian continent in satellite data sets. *Earth Planet. Phys.*, *3*(2), 93–101. https://doi.org/10.26464/epp2019011

Wang, Y., Qie, X. S., Wang, D. F., Liu, M. Y., Su, D. B., Wang, Z. C., Liu, D. X., Wu, Z. J., Sun, Z. L., and Tian, Y. (2016). Beijing Lightning Network (BLNET) and the observation on preliminary breakdown processes. *Atmos. Res.*, *171*, 121–132. https://doi.org/10.1016/j.atmosres.2015.12.012

Wang, Y. P., Lu, G. P., Ma, M., Zhang, H. B., Fan, Y. F., Liu, G. J., Wan, Z. R., Wang, Y., Peng, K. M., ... and Zhou, R. X. (2019). Triangulation of red sprites observed above a mesoscale convective system in North China. *Earth Planet. Phys.*, *3*(2), 111–125. https://doi.org/10.26464/epp2019015

Yi, W., Xue, X. H., Chen, J. S., Chen, T. D., and Li, N. (2019). Quasi-90-day oscillation observed in the MLT region at low latitudes from the Kunming meteor radar and SABER. *Earth Planet. Phys.*, *3*(2), 136–146. https://doi.org/10.26464/epp2019013

Zhang, J. Q., Liu, Y., Chen, H. B., Cai, Z. N., Bai, Z. X., Ran, L. K., Luo, T., Yang, J., Wang, Y. N., … Lu, D. R. (2019). A multi-location joint field observation of the stratosphere and troposphere over the Tibetan Plateau. *Earth Planet. Phys.*, *3*(2), 87–92. https://doi.org/10.26464/epp2019017

Zhou, T. J., Gong, D., Li, J., and Li, B. (2009). Detecting and understanding the multi-decadal variability of the East Asian Summer Monsoon? Recent progress and state of affairs. *Meteorol. Z.*, *18*(4), 455–467. https://doi.org/10.1127/0941-2948/2009/0396

Zhou, T. J., Hsu, H.-H., and Matsuno, J. (2011). Summer monsoons in East Asia, Indochina, and the western North Pacific. In C.-P. Chang et al. (Eds.), The Global Monsoon System: Research and Forecast (2nd ed., pp. 43–72). Singapore: World Scientific Publishing.