BAMS
Meeting Summary

Facilitating International Collaboration on Climate Change Research

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The Eighth COAA International Conference on Atmosphere, Ocean, and Climate Change

What: Researchers from China, the United States, India, Germany, Israel, and the United Kingdom presented research results on a variety of important topics related to atmospheric and oceanic sciences under global climate change, especially for China.

When: 10–12 July 2019

Where: Nanjing, China

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The Chinese-American Oceanic and Atmospheric Association (COAA) organized the Eighth COAA International Conference on Atmosphere, Ocean, and Climate Change (ICAOCC), which was held at the Nanjing University of Information Science and Technology (NUIST) campus in Nanjing, China, during summer. This international conference[1] provided a platform for weather and climate experts in the international oceanic and atmospheric sciences community to communicate their research, share ideas and experiences, and inspire new research strategies. It also provided a great opportunity for students and young scholars to forge professional relationships through their interactions with experts and senior professionals.

Global warming has emerged as a big threat to the security of human society and civilization. Understanding a problem of this scale and providing solutions to climate change issues require the involvement of researchers from countries all over the world and of different disciplines and research expertise. In light of this view, the Eighth ICAOCC focused on the theme of understanding climate change and accurate weather prediction under global warming. It covered several areas that are key to the understanding of climate change and its impact, including climate observations using satellite and conventional means, climate and hydrometeorological extremes, climate modeling and observational analyses, climate change impact and adaptation, ocean–land–atmosphere interactions, data assimilation techniques for accurate weather prediction, and severe weather analysis and prediction (detailed information is available at www.coaaweb.org/COAA2019/index.html).

The 3-day conference showcased more than 150 oral presentations and 40 posters within 11 scientific sessions (Table 1). Senior researchers and young scholars shared their research results during the meeting. Participants came from six countries, the majority from the United States and China. The Eighth ICAOCC succeeded in facilitating the communication of ideas and experiences in the practical application of innovative research to study climate change, weather prediction and global warming. The conference served as the premier platform for promoting international collaborations, a key to tackle such global problems as climate change, weather forecasting, and air pollution. With the increasing number of participants, ICOACC could become a major international conference in these fields to help policy makers around the world to develop better strategies and work together to confront global challenges.

[1] The conference was locally hosted by NUIST and cosponsored by Nanjing University.

Table 1. Session information of the Eighth ICAOCC meeting.

Session No.	Topical area	Conveners
S1	Climate observations	Qiang Fu, Likun Wang, et al.
S2	Climate dynamics, variability, and extremes	Gang Chen, Bin Wang, et al.
S3	Severe weather and mesoscale meteorology	Dalin Zhang, Ming Xue, et al.
S4	Climate modeling	Zhibo Zhang, Tianjun Zhou, et al.
S5	Climate reanalysis	Xudong Liang, Xingren Wu, et al.
S6	Oceanic processes and climate	Muyin Wang
S7	Air pollution, aerosol, and climate	Zhangqing Li, Renyi Zhang, et al.
S8	Integrative Monsoon Frontal Rainfall Experiment	Xiquan Dong, Chunguang Cui, et al.
S9	Land–atmosphere interactions	Yongjiu Dai, Haishan Chen, et al.
S10	Climate change impact and adaptation	Xin-Zhong Liang, Jianping Huang, et al.
S11	Hydrometeorological extremes	Huan Wu, Dingbao Wang

Research highlights

Dr. Bin Wang showed that the decadal variability of the Northern Hemisphere land monsoon rainfall (NHLMR) is determined primarily by the North–South Hemispheric thermal contrast in the Atlantic and Indian Oceans and by the east–west thermal contrast in the Pacific. Numerical hindcast simulations demonstrate that the decadal changes of NHLMR can be predicted approximately a decade in advance with significant skills (Wang et al. 2018). Dr. Zhuo Wang discussed the variability of tropical cyclone (TC) activities at the global scale. With more frequent Rossby wave breaking due to climate change over the North Atlantic, the basinwide TC counts are reduced, and TCs become less intense, have a shorter lifetime, and are less likely to make landfalls. Dr. Qinghua Ding presented a global view of the large-scale atmospheric circulation variability over the last 100 years. The classical ENSO is the leading factor driving global circulation variability on an interannual time scale. On longer time scales, circulation changes in the polar regions have largely been driven by the interdecadal tropical SST variability. Dr. Yi Deng demonstrated the existence of an important connection between the hydrological cycles of East Asia and North America that is dynamically intrinsic to the boreal summer upper-tropospheric flow. He applied a statistical analysis to historical data and found a northwest–southeast anomalous precipitation dipole over the United States that can be tracked to anomalous latent heating over East Asia.

The western North Pacific (WNP) is one of the most active regions for tropical cyclogenesis (TCG). Previous studies that focused more on the impact of tropical waves on TCG underestimated the multiscale modulation of TCG over WNP. An empirical orthogonal function analysis shows close associations of the WNP TCG events with synoptic-scale waves (SSWs; ~64%), the Madden–Julian oscillation (MJO; ~68%), quasi-biweekly oscillation (QBWO; ~64%), and equatorial Rossby (ER; ~65%) waves. Most TCG events (~79%) are influenced by more than one wave type. Moreover, multiscale interaction among these disturbances occurs during TCG. This result indicates that global warming may affect TCG through the synoptic to intraseasonal disturbances (Zhao et al. 2019).

Global oceanic area, especially the Arctic Ocean, is a data-sparse region with a short period of observational records, although efforts have been made to collect as much data as possible both spatially and temporally. Thus, products from data assimilation and model simulations are the major tools to study changes in and over the ocean. Progress in ocean observation, data assimilation, and climate model simulations [including CMIPs, NCAR Community Earth System Model (CESM) Large Ensemble Numerical Simulations (LENS), and the high-resolution WRF regional climate model] were highlighted. Atlantic meridional overturning circulation (AMOC) variability based on LENs was discussed. Arctic sea ice variation and projections and ocean frontal zones on the wintertime atmospheric large-scale circulations were other topics presented at the meeting.

As another key component of the climate system, land surface processes received a lot of attention. Advances in land surface model improvements including subgrid hydrology, snow albedo, canopy structure, and lake parameterization were presented. Several presentations emphasized the importance of the land surface in operational weather forecasting and climate prediction. These studies showed the evident response of the land surface temperature and soil moisture to global warming and explored the impact of land surface warming on regional climate. Meanwhile, the land surface processes relevant to human activity have been incorporated in current research. It is well recognized that the land surface process is key in linking energy, water, food, and the ecosystem, which can be an important direction of future research.

In the recent decade, China has experienced severe and persistent haze pollution with high levels of particulate matter in many major cities. Dr. Renyi Zhang reviewed the current understanding and various mechanisms of new particle formation in China (An et al. 2019).

Dr. Zhanqing Li pointed out that the high level of pollution originates from both emissions and complex interactions between meteorology, pollution sources, and atmospheric boundary layer processes (Li et al. 2017; 2019). Dr. Yang Yang presented studies showing that the recent intensification of winter haze over China can be attributed to Arctic changes through weakening of the East Asian monsoon (Lou et al. 2019) and the slowdown of foreign emission reductions (Yang et al. 2018). Complex interactions between aerosols and climate require reliable estimates of cloud condensation nuclei (CCN) at the global scale, especially over remote oceans. Dr. Yannian Zhu presented a new methodology for ascribing cloud properties to CCN and isolating aerosol effects from meteorological effects (Rosenfeld et al. 2019). This study found that CCN can explain three-fourths of the variability in the radiative cooling effect of clouds, mainly through affecting shallow cloud cover and water path, which is much larger than the previously reported sensitivity of cloud radiative forcing to CCN. This extra cooling could be compensated by the potential warming due to aerosol effects on deep convective and ice clouds. Therefore, current global climate models might not correctly take into account the significant effects of aerosols on clouds and on Earth's overall energy balance. To identify and estimate the effects of aerosols on clouds more accurately, Dr. Youtong Zheng presented novel methods of estimating updraft and cloud–surface coupling by means of satellite remote sensing (Zheng and Li 2019).

It has been realized that long-term climate observations sustained over decades are fundamental and critical to understanding, predicting, and adapting to climate change and variability. Thus, the climate observation session was focused on generation and analysis of long-term data products of essential climate variables that are urgently needed to understand the climate system on different time scales (from subseasonal to decadal). On the one hand, progress was reported for recent reprocessing efforts to develop long-term consistent datasets from existing observations in order to address data discontinuity caused by the discrepancies of instruments and processing software. The exploration and analysis of climate datasets to monitor and detect changes in the Earth system relative to climate variability were also presented.

The multiscale mei-yu frontal system is responsible for the majority of heavy rainfall and flooding events in China during the boreal warm season, yet observations are seriously lacking for such a system of tremendous scientific and societal importance. To address this critical need and provide an observational basis for understanding, modeling, and predicting the mei-yu frontal system, an intensive field campaign, the Integrative Monsoon Frontal Rainfall Experiment (IMFRE), was conducted at the Xianning surface site in the summer of 2018 to lay out the foundation for integrative ground-based, satellite-based, and aircraft in situ measurements and monitoring of the mei-yu frontal system. A special focus was placed upon the 3D structure of the embedded mesoscale convective systems (MCSs) and the associated cloud and precipitation processes. The ground-based observations include those obtained from the Mesoscale Heavy Rainfall Observing System (MHROS), regular soundings, and surface meteorological variables. The ShanXi King-Air aircraft equipped with many cloud probes and sensors flew more than 25 h during IMFRE. Multiple satellites' observations and retrievals were collected and processed, including from Chinese Fengyun series and the Japanese *Himawari-8* satellite. We had a special session of observational and modeling studies that made use of IMFRE and/or existing observations of the mei-yu frontal system.

Recommendations for the future COAA conferences

In the Eighth ICAOCC conference, very few studies were presented in the oceanic and sea ice session. Future COAA conferences are likely to involve more oceanographers. The ocean and atmosphere are two major components of the climate system, and a better understanding of their coupling poses a great challenge to making better predictions of the Earth system at all time scales. Participation from both the oceanic and atmospheric fields ensures issues in the coupled system will be fully discussed and investigated. The conference also had participants and interests from international communities other than the Chinese–American oceanic and atmospheric sciences community. Future COAA conferences shall expand the science scope and keep embracing individual professionals or groups from diverse regions and cultures so that they can better serve the purpose of facilitating international collaborations on accurate weather prediction and climate change research.

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