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EDUCATION:

Ph.D. *Atmospheric Dynamics* September 1983 – January 1987
The Graduate School of the Chinese Academy of Sciences and Institute of Atmospheric Physics (IAP), Chinese Academy of Sciences, Beijing, China

Dissertation: The Design of IAP General Circulation Model (GCM) and the Simulation of Climate and Interseasonal Variability

B.S. *Meteorology* September 1979 – July 1983
Hangzhou University (now part of Zhejiang University), Hangzhou, China

EMPLOYMENT AND RESEARCH EXPERIENCE:

Professor January 2011 – Present
Department of Atmospheric & Oceanic Science and Earth System Science Interdisciplinary Center University of Maryland at College Park (UMCP)

Professor February 2010 – December 2010
Department of Atmospheric Sciences, University of Illinois at Urbana-Champaign (UIUC)

Senior Professional Scientist January 2006 – December 2010
Professional Scientist May 2001 – December 2005
Associate Professional Scientist January 1999 – April 2001
Illinois State Water Survey (now part of Prairie Research Institute), UIUC

NCSA Faculty Fellow March 2002 – January 2004
National Center for Supercomputing Applications, UIUC

Senior Research Scientist May 1993 – January 1999
Research Scientist October 1990 – April 1993
Atmospheric Sciences Research Center, State University of New York at Albany

Research Associate January 1987 – September 1990
Institute for Terrestrial and Planetary Atmospheres, State University of New York at Stony Brook

AWARDS AND HONORS:

- October 1991: **First Class Award** of Natural Sciences given by the Chinese Academy of Sciences in recognition of research excellence in GCM development and application.
- August 2021: An **Elected Fellow** of the American Meteorological Society.
- April 2022: The **Board of Visitors' Distinguished Faculty Award** given by the College of Computer, Mathematical, and Natural Sciences, University of Maryland.
- September 2023: An **Elected Fellow** of the American Geophysical Union.

RESEARCH GRANTS:

Over 40 research grants, totaling more than $26 million dollars ($26,789,986 directly controlled by Liang out of $37,481,963 from all projects), were awarded by major funding agencies, including National

Aeronautics and Space Administration, National Oceanic and Atmospheric Administration, National Science Foundation, United States Department of Agriculture, United States Department of Energy, United States Environmental Protection Agency.

EDITORSHIPS:

- Editor, *Journal of Geophysical Research - Atmospheres*, 2022-2024
- Editor, *Journal of Climate*, 2017-2023
- Editorial Board Member, *Frontiers of Environmental Science & Engineering*, 2009-
- Newsletter Liaison (2013), Advisory Panel (2015-2016), *Eos, Transactions, American Geophysical Union*

PROFESSIONAL SOCIETY MEMBERSHIPS:

- American Meteorological Society, 1990-; Elected AMS Fellow of 2021.
- American Geophysical Union, 2004-; Elected AGU Fellow of 2023.
- American Association for the Advancement of Science, 2013-

MAJOR SCIENTIFIC ACHIEVEMENTS:

MODEL DEVELOPMENT

- Global General Circulation Models (GCMs): A lead investigator to develop China's 1st and 2nd generations of GCMs, which are widely used in China for operational seasonal-interannual climate predictions, future climate change projections, as well as major research and higher educational tools. Major improvements to NCAR GCMs include parameterizations for convection, cloud, radiation and their interactions.
- Regional Climate Models (RCMs): The lead investigator to develop CMM5 and CWRF, which becomes the fundamental tools for realistic downscaling of regional climate variations, focusing on precipitation and surface temperature. They are used in numerous federal and state funded research projects, national and regional climate change assessments, as well as graduate and Ph.D. thesis studies. In particular, the public release of CWRF is highly demanded. New development of unique physics representations includes cloud-aerosol-radiation interactions, land surface albedo parameterization, optimized ensemble cumulus parameterization, conjunctive surface-subsurface terrestrial hydrology module, ensemble crop growth module and interactive upper ocean module. The CWRF contains a comprehensive ensemble of physics configurations representing cloud, aerosol, radiation, surface, planetary boundary layer, cumulus, and microphysics processes and their nonlinear interactions. It is a state-of-the-art regional climate modeling system that provides an unprecedented pathway to develop an optimized physics ensemble approach for tackling major roadblocks in weather and climate prediction at regional-local scales. The developed physics ensemble system is readily transferable to any global or regional model for weather forecast and climate prediction at high spatial resolution.
- Cloud-Aerosol-Radiation ensemble modeling system (CAR): The lead investigator to develop the system that consists of the largest ever free choices of alternative parameterizations for cloud properties (cover, water, radius, optics, geometry), aerosol properties (type, profile, optics), and radiation transfers (solar, infrared) and their interactions currently available in the literature, including those used by the world leading GCMs at NCAR, GFDL, NCEP, NASA, ECMWF, CCCMA, CSIRO, and UKMO. The CAR is the unprecedented collection of most available numerical representations of cloud-aerosol-radiation interactions that are fully selectable and exchangeable. It has been built in the CWRF and is being coupled with ESMs to embody the most ever complete range of climate sensitivities in existing GCMs. The system has broad, unique applications in physical process understanding, new parameterization development, remote sensing retrieval, climate sensitivity analysis, climate projection uncertainty, optimized physics ensemble design, and inverse physics modeling.
- Integrated Earth modeling system: The lead investigator to develop the system, which currently incorporates global general circulation models (CESM, CFS), global chemical transport models (CAM-Chem), mesoscale multi-nested regional climate models (CMM5, CWRF), advanced air quality models (CMAQ, WRF-Chem), a detailed emission inventory model (SMOKE), a state-of-the-art conjunctive surface and subsurface process model (CSSP), a comprehensive water quality model (SWAT), and dynamic ecosystem models (GOSSYM, DSSAT, BioCro, DayCent). It has been used as the principal tool to support the national assessments on the

impacts of global climate and emissions changes on air quality (ozone, particulate matter, mercury) and water quality (nutrients, pathogens, bacteria, sediments) and associated projection uncertainty by USEPA, on agricultural and invasive plant distributions, crop growth and agricultural productivity, and the predictive dashboard for agricultural decision support by USDA, on the food-energy-water nexus and system sustainability by NSF, and on watershed and ecosystem variability by NASA. The system is continuously expanding and subject to an increasing scope of applications, including seasonal-interannual climate prediction, regional climate and environment change projection and impact assessment, as well as critical interdisciplinary research such as economy, public health, and artificial intelligence/machine learning.

RESEARCH ADVANCE

- The developed or improved GCMs have been applied to study seasonal-interannual-decadal climate variability and predictability (East Asian and North American monsoons, El Niño-Southern Oscillation), climate feedbacks, climatic effects of anthropogenic emissions.
- The developed RCMs (CMM5, CWRF) have been applied to improve regional weather forecast and climate prediction, focusing on precipitation and surface temperature; to downscale climate change projections and reduce the corresponding uncertainties.
- The developed integrated Earth modeling system has facilitated interdisciplinary research on climate change and environmental issues. In particular, the study of the impacts of global climate and emissions changes on USA air quality has been well recognized, and the research on resilience and sustainability in the framework of the food-energy-water nexus has recently received a significant amount of federal funding.
- The developed new model physics representations of key significance include mosaic treatment of cloud overlap effects on radiation, dynamic-statistical parameterization of land surface albedo, conjunctive surface-subsurface terrestrial hydrology modeling with a scalable parameterization of subgrid topographic control, optimization of ensemble precipitation prediction, interactive climate-crop growth modeling, and grand cloud-aerosol-radiation ensemble modeling system.
- The developed "optimized physics ensemble (OPE)" approach, currently statistical, has been demonstrated to significantly improve model skill in weather forecast and climate prediction, especially for precipitation that is most challenging. The dynamical OPE approach being developed is anticipated to be more powerful.
- The core research is interdisciplinary across a wide range of sciences, including atmosphere/ocean/land physics and chemistry, biogeochemistry, climate dynamics, terrestrial hydrology, ecosystem, agriculture, economy, health, numerical prediction, decision support and supercomputing. This is well reflected by his winning numerous research grants from multiple federal agencies (DOE, EPA, NASA, NOAA, NSF, USDA) focusing on various fields.

PUBLICATIONS:

- *Over 200 publications (162 SCI articles) in reviewed literature in the following journals and books:*

  Nature, Science, Proceedings of the National Academy of Sciences, Science Bulletin, Science of the Total Environment, Bulletin of the American Meteorological Society, Environmental Health Perspectives, Environmental Research, Environmental Research Letters, Geoscientific Model Development, Geophysical Research Letters, Journal of Climate, Atmospheric Chemistry and Physics, Atmospheric Research, Journal of Advances in Modeling Earth Systems, Remote Sensing, Journal of Hydrology, Water Resources Research, Global and Planetary Change, Climatic Change, Journal of Geophysical Research–Atmospheres and –Biogeosciences, Climate Dynamics, Global Change Biology and -Bioenergy, Agricultural and Forest Meteorology, Atmospheric Environment, Environmental Modelling & Software, Frontiers in Sustainable Food Systems, Journal of Hydrometeorology, World Development, International Journal of Climatology, Journal of Water Resources Planning and Management, Journal of Atmospheric Sciences, Quarterly Journal of the Royal Meteorological Society, Monthly Weather Review, Advances in Atmospheric Sciences, Journal of Applied Meteorology and Climatology, Journal of Applied Meteorology, Water, Climate Research, Earth Interactions, Tellus, Journal of Great Lakes Research, Agronomy Journal, Journal of Hydrologic Engineering, Advances in Statistical Climatology, Meteorology and Oceanography, Frontiers of Earth Science, Acta Oceanologica Sinica, Chinese Journal of Atmospheric Sciences, Mitigation and Adaptation Strategies for Global Change, EOS, Advances in Natural Sciences, Acta Meteorologica Sinica, Atmospheric and Oceanic Science Letter, Plateau Meteorology, Open Atmospheric Science Journal, Transactions of

Atmospheric Science, NATO Advanced Science Institutes Series, Future Climates of the World, Climate-Biosphere Interactions.

REFEREED JOURNAL AND BOOK ARTICLES

[In the following, † denotes for a work conducted by a postdoctoral or associate scientist under my direct or significant supervision, * for a work by a graduate student under the same condition, and in both cases, they were supported under my research grants; x denotes for not a SCI journal.]

[200] †Zhang, Jingting; Hanqin Tian, Yongfa You, Xin-Zhong Liang, Zutao Ouyang, Naiqing Pan, and Shufen Pan, 2023: Balancing non-CO_2 GHG emissions and soil carbon sequestration in U.S. rice paddies: implications for natural climate solutions. *AGU Advances* (accepted).

[199] He, Yufeng; Deepak Jaiswal, Stephen P. Long, Xin-Zhong Liang, and Megan L. Matthews, 2024: Biomass yield potential on U.S. marginal land and its contribution to reach net-zero emission. *Global Change Biology-Bioenergy*, **16**, e13128, doi: 10.1111/gcbb.13128.

[198] *Dangol, Sijal; Xuesong Zhang, Xin-Zhong Liang, and Elena Blanc-Betes, 2023: Advancing the SWAT model to simulate perennial bioenergy crops: A case study on switchgrass growth. *Environmental Modelling and Software*, 105834, doi: 10.1016/j.envsoft.2023.105834.

[197] Liang, Xin-Zhong; Drew Gower, Jennifer A. Kennedy, Melissa Kenney, Michael C Maddox, Michael Gerst, Guillermo Balboa, Talon Becker, Ximing Cai, Roger Elmore, Wei Gao, Yufeng He, Kang Liang, Shane Lotton, Leena Malayil, Megan L. Matthews, Alison M. Meadow, Christopher Neale, Greg Newman, Amy Rebecca Sapkota, Sanghoon Shin, Jonathan Straube, Chao Sun, You Wu, Yun Yang, and Xuesong Zhang, 2023: DAWN: Dashboard for Agricultural Water use and Nutrient management - A predictive decision support system to improve crop production in a changing climate. *Bulletin of the American Meteorological Society* (accepted).

[196] Tang, Jianping; Yongkang Xue, Mengyuan Long, Mengnan Ma, Xin-Zhong Liang, Shiori Sugimoto, Kun Yang, Zhenming Ji, Jinkyu Hong, Jeongwon Kim, Haoran Xu, Xu Zhou, Tomonori Sato, Hiroshi G. Takahashi, Shuyu Wang, Guiling Wang, Sin Chan Chou, Weidong Guo, Miao Yu, Xiaoduo Pan, 2023: Regional Climate Model Intercomparison over the Tibetan Plateau in the GEWEX/LS4P Phase I. *Climate Dynamics* (accepted).

[195] You, Yongfa; Hanqin Tian, Shufen Pan, Hao Shi, Chaoqun Lu, William Batchelor, Bo Cheng, Dafeng Hui, David Kicklighter, Xin-Zhong Liang, Xiaoyong Li, Jerry M Melillo, Naiqing Pan, Stephen Prior, and John Reilly, 2023: Net greenhouse gas balance in U.S. croplands: How can soils be a part of the climate solution? *Global Change Biology*, doi: 10.1111/gcb.17109.

[194] Xue, Yongkang; Ismaila Diallo, Aaron A. Boone, Yang Zhang, Xubin Zeng, William K.M. Lau, J. David Neelin, Tandong Yao, Qi Tang, Tomonori Sato, Myung-Seo Koo, Frederic Vitart, Constantin Ardilouze, Subodh K. Saha, Stefano Materia, Zhaohui Lin, Yuhei Takaya, Jing Yang, Tetsu Nakamura, Xin Qi, Yi Qin, Paulo Nobre, Retish Senan, Hailan Wang, Hongliang Zhang, Mei Zhao, Hara Prasad Nayak, Yan Pan, Xiaoduo Pan, Jinming Feng, Chunxiang Shi, Shaocheng Xie, Michael A. Brunke, Qing Bao, Marcus Bottino, Tianyi Fan, Songyou Hong, Yanluan Lin, Daniele Peano, Yanling Zhan, Carlos R. Mechoso, Xuejuan Ren, Gianpaolo Balsamo, Sin Chan Chou, Patricia de Rosnay, Peter J. van Oevelen, Daniel Klocke, Michael Ek, Xin Li, Weidong Guo, Yuejian Zhu, Jianping Tang, Xin-Zhong Liang, Yun Qian, Ping Zhao, 2023: Remote effects of Tibetan Plateau spring land temperature on global subseasonal to seasonal precipitation prediction and comparison with effects of sea surface temperature: the GEWEX/LS4P Phase I experiment. *Climate Dynamics*, doi:10.1007/s00382-023-06905-5.

[193] Yu, Junfeng; Liang Zhao, Xin-Zhong Liang, Hung Chak Ho, Masahiro Hashizume, Cunrui Huang, 2023: The mediatory role of water quality on the association between extreme precipitation events and infectious diarrhea in the Yangtze River basin, China. *Fundamental Research*, doi: https://doi.org/10.1016/j.fmre.2023.05.019.

[192] †Wu, You; Shuhan Meng, Chaoshun Liu, Wei Gao, and Xin-Zhong Liang, 2023: A bibliometric analysis of research for climate impact on agriculture. *Frontiers in Sustainable Food Systems,* **7**, 1191305. Doi: 10.3389/fsufs.2023.1191305.

[191] *Dangol, Sijal; Xuesong Zhang, Xin-Zhong Liang, Martha Anderson, Wade Crow, Sangchul Lee, Glenn E Moglen, Greg W McCarty, 2023: Multivariate calibration of the SWAT model using remotely sensed datasets. *Remote Sensing*, **15**(9), 2417. doi: 10.3390/rs15092417

[190] *Kennedy, Jennifer; George C. Hurtt, Xin-Zhong Liang, Louise Chini, Lei Ma, 2023: Changing cropland in changing climates: quantifying two decades of global cropland changes. *Environmental Research Letters,* **18** (6), 064010. doi: 10.1088/1748-9326/acca97.

[189] †Liang, Kang; Xuesong Zhang, Xin-Zhong Liang, Virginia L. Jin, Girma Birru, Marty R. Schmer, G. Philip Robertson, Gregory W. McCarty, and Glenn E. Moglen, 2023: Simulating agroecosystem soil inorganic nitrogen dynamics under long-term management with an improved SWAT-C model. *Science of the Total Environment*, **879**, 162906. doi: 10.1016/j.scitotenv.2023.162906

[188] *Dibia, Emmanuel; Rolf Reichle, Jeffrey Anderson, and Xin-Zhong Liang, 2023: Non-gaussian ensemble filtering and adaptive inflation for soil moisture data assimilation. *Journal of Hydrometeorology*, **24**, 1039-1053. doi: 10.1175/JHM-D-22-0046.1.

[187] Zhang, Shiyu; Minghao Wang，Lanning Wang， Xin-Zhong Liang，Chao Sun，and Qingquan Li, 2023: Sensitivity of the simulation of extreme precipitation events in China to different cumulus parameterization schemes and the underlying mechanisms. *Atmospheric Research*, **285,** doi: j.atmosres.2023.106636.

[186] Zhu, Yuejian; Bing Fu, Bo Yang, Hong Guan, Eric Sinsky, Wei Li, Jiayi Peng, Xianwu Xue, Dingchen Hou, Xin-Zhong Liang, and Sanghoon Shin, 2023: Quantify the coupled GEFS forecast uncertainty for the weather and subseasonal prediction. *J. Geophys. Res.-Atmospheres,* **128**, e2022JD037757, doi: 10.1029/2022JD037757.

[185] †Sun, C., and X.-Z. Liang, 2023: Understanding and Reducing Warm and Dry Summer Biases in the Central United States: Analytical Modeling to Identify the Mechanisms for CMIP Ensemble Error Spread. *Journal of Climate*, **36**, 2015–2034, doi:10.1175/JCLI-D-22-0255.1.

[184] †Sun, C., and X.-Z. Liang, 2023: Understanding and Reducing Warm and Dry Summer Biases in the Central United States: Improving Cumulus Parameterization. *Journal of Climate*, **36**, 2035–2054, doi:10.1175/JCLI-D-22-0254.1.

[183x] *Zhang, H.，X.-Z. Liang，F. Wang，B. Xie，and Q. Li, 2023: CWRF downscaling improves BCC_CSM seasonal prediction of summer precipitation in China. *Transactions of Atmospheric Sciences*, **46**(2):161-179. doi:10.13878/j.cnki.dqkxxb.20210116001.

[182] You, Yongfa; Hanqin Tian, Shufen Pan, Hao Shi, Zihao Bian, Angelo Gurgel, Yawen Huang, David Kicklighter, Xin-Zhong Liang, Chaoqun Lu, Jerry Melillo, Ruiqing Miao, Naiqing Pan, John Reilly, Wei Ren, Rongting Xu, Jia Yang, Qiang Yu, and Jingting Zhang, 2022: Incorporating dynamic crop growth processes and management practices into a terrestrial biosphere model for simulating crop production in US: Toward a scalable agricultural modeling framework. *Agricultural and Forest Meteorology*, **325**, 109144, doi: 10.1016/j.agrformet.2022.109144

[181] *Dangol, Sijal; Xuesong Zhang, Xin-Zhong Liang, and Fernando Miralles-Wilhelm, 2022: Agricultural irrigation effects on hydrological processes in the US Northern High Plains aquifer simulated by the coupled SWAT-MODFLOW system. *Water*, **14** (12), 1938.

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[179] Liang, X.-Z., 2022: Extreme rainfall slows the global economy. *Nature*, **601**, 193-194. doi:10.1038/d41586-021-03783-x

[178] Xue, Yongkang; Ismaila Diallo, Aaron A. Boone, Tandong Yao, Yang Zhang, Xubin Zeng, J. David Neelin, William K.M. Lau, Yan Pan**Error! Bookmark not defined.**, Ye Liu, Xiaoduo Pan, Qi Tang, Peter J. van Oevelen, Tomonori Sato, Myung-Seo Koo, Stefano Materia, Chunxiang Shi, Jing Yang, Constantin Ardilouze, Zhaohui Lin, Xin Qi, Tetsu Nakamura, Subodh K. Saha, Retish Senan, Yuhei

Takaya, Hailan Wang, Hongliang Zhang, Mei Zhao, Hara Prasad Nayak, Qiuyu Chen, Jinming Feng, Michael A. Brunke, Tianyi Fan, Songyou Hong, Paulo Nobre, Daniele Peano, Yi Qin, Frederic Vitart, Shaocheng Xie, Yanling Zhan, Daniel Klocke, Ruby Leung, Xin Li, Michael Ek, Weidong Guo, Gianpaolo Balsamo, Qing Bao, Sin Chan Chou, Patricia de Rosnay, Yanluan Lin, Yuejian Zhu, Yun Qian, Ping Zhao, Jianping Tang, Xin-Zhong Liang, Jinkyu Hong, Duoying Ji, Zhenming Ji, Yuan Qiu, Shiori Sugimoto, Weicai Wang, Kun Yang, Miao Yu, 2022: Spring land temperature in Tibetan Plateau and global-scale summer precipitation – Initialization and improved prediction. *Bull. Amer. Meteor. Soc.,* **103** (12), E2756–E2767. doi: 10.1175/BAMS-D-21-0270.1

[177] Wang, Y., Y. Xiang, L. Song, and X.-Z. Liang, 2022: Quantifying the urbanization contribution to summer extreme high-temperature events in the Beijing-Tianjin-Hebei urban agglomeration. *J. Appl. Meteor. Climatol*., **61**, 669-683. doi:10.1175/JAMC-D-21-0201.1

[176] *Xu, H., X.-Z. Liang, and Y. Xue, 2022: Regional climate modeling to understand Tibetan heating remote impacts on east China precipitation. *Climate Dynamics*, https://doi.org/10.1007/s00382-022-06266-5.

[175] †He, Y., D. Jaiswal, X.-Z. Liang, C. Sun, and S.P. Long, 2022: Perennial biomass crops on marginal land improve both regional climate and agricultural productivity. *Global Change Biology-Bioenergy*, **14**, 558–571. doi:10.1111/gcbb.12937

[174] Chen, H., L. Zhao, W. Dong, L. Cheng, W. Cai, J. Yang, J. Bao, X.-Z. Liang, S. Hajat, P. Gong, W. Liang, and C. Huang, 2022: Spatiotemporal variation of mortality burden attributable to heatwaves in China, 1979-2020. *Science Bulletin*, **67**, 1340-1344. Doi: 10.1016/j.scib.2022.05.006

[173] Remigio, R., R. Turpin, J. Rainmann, P. Kotanko, F. Maddux, A. Sapkota, X.-Z. Liang, R. Puett, X. He, and A. Sapkota, 2022: Assessing proximate intermediates between ambient temperature, hospital admissions, and mortality in hemodialysis patients. *Environmental Research*, **204**, 112127. doi:10.1016/j.envres.2021.112127

[172] Remigio, R., H. He, J. Raimann, P. Kotanko, F.W. Maddux, A.R. Sapkota, X.-Z. Liang, R. Puett, X. He, and A. Sapkota 2021: Combined effects of air pollution and extreme heat events among ESKD patients within the Northeastern United States. *Science of the Total Environment*, **812**, 152481. Doi:10.1016/j.scitotenv.2021.152481

[171] Zhu, Y., F. Qiao, Y. Liu, X.-Z. Liang, Q. Liu, R. Wang, and H. Zhang, 2021: The impacts of multi-physics parameterization on forecasting heavy rainfall induced by weak landfalling Typhoon Rumbia (2018). *Atmospheric Research*, 265, 105883. Doi:10.1016/j.atmosres.2021.105883

[170] Ji, P., X. Yuan, X.-Z. Liang, Y. Jiao, Y. Zhou, and Z. Liu, 2021: High-resolution land surface modeling of the effect of long-term urbanization on hydrothermal changes over Beijing metropolitan area. *Journal of Geophysical Research-Atmospher*es, **126**, e2021JD034787. Doi:10.1029/2021JD034787.

[169] Xue, Yongkang; Tandong Yao, Aaron A Boone, Ismaila Diallo, Ye Liu, Xubin Zeng, William KM Lau, Shiori Sugimoto, Qi Tang, Xiaoduo Pan, Peter J. van Oevelen, Daniel Klocke, Myung-Seo Koo, Zhaohui Lin, Yuhei Takaya, Tomonori Sato, Constantin Ardilouze, Subodh K. Saha, Mei Zhao, Xin-Zhong Liang, Frederic Vitart, Xin Li, Ping Zhao, David Neelin, Weidong Guo, Miao Yu, Yun Qian, Samuel S. P. Shen, Yang Zhang, Kun Yang, Ruby Leung, Jing Yang, Yuan Qiu, Michael A. Brunke, Sin Chan Chou, Michael Ek, Tianyi Fan, Hong Guan, Hai Lin, Shunlin Liang, Stefano Materia, Tetsu Nakamura, Xin Qi, Retish Senan, Chunxiang Shi, Thomas M. Smith, Hailan Wang, Helin Wei, Shaocheng Xie, Haoran Xu, Hongliang Zhang, Yanling Zhan, Weiping Li, Xueli Shi, Paulo Nobre, Yi Qin, Jeff Dozier, Craig R. Ferguson, Gianpaolo Balsamo, Qing Bao, Jinming Feng, Jinkyu Hong, Songyou Hong, Huilin Huang, Duoying Ji, Zhenming Ji, Shichang Kang, Yanluan Lin, Weiguang Liu, Ryan Muncaster, Daniele Peano, Patricia de Rosnay, Hiroshi G. Takahashi, Jianping Tang, Guiling Wang, Shuyu Wang, Weicai Wang, Xu Zhou, Yuejian Zhu, 2020: Impact of initialized Land temperature and Snowpack on SubSeasonal to Seasonal Prediction Project (LS4P), Phase I: Organization and experimental design. *Geoscientific Model Development*, **14**, 4465–4494. https://doi.org/10.5194/gmd-14-4465-2021.

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[167] Wei, J., J. Zhao, H. Chen and X.-Z. Liang, 2021: Coupling between land surface fluxes and lifting condensation level: mechanisms and sensitivity to model physics parameterizations *Journal of Geophysical Research-Atmospheres*, doi:10.1029/2020JD034313.

[166] *Zhang, G., G. Zeng, X.-Z. Liang, and C. Huang, 2021: Increasing heat risk in China's urban agglomerations. *Environmental Research Letters*, **16**, 064073. doi:10.1088/1748-9326/ac046e.

[165] *Kholodovsky, V., and X.-Z. Liang, 2021: A generalized spatio-temporal threshold selection method for identification of extreme event patterns. *Advances in Statistical Climatology, Meteorology and Oceanography,* **7**, 35–52, doi: 10.5194/ascmo-7-35-2021.

[164x] *Shi, W., H. Chen, and X.-Z. Liang, 2021: CWRF-based ensemble simulation of tropical cyclone activity near China and its sensitivity to the model physical parameterization schemes. *Atmospheric and Oceanic Science Letters*, **14**, doi:10.1016/j.aosl.2020.100004.

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[162] Randell, H., C. Jiang, X.-Z. Liang, R. Murtugudde, and A. Sapkota, 2021: Food insecurity and compound environmental shocks in Nepal: Implications for a changing climate. *World Development*, **145**, 105511, doi:10.1016/j.worlddev.2021.105511.

[161] Wang, R., Y. Zhu, F. Qiao, X.-Z. Liang, H. Zhang, and Y. Ding, 2021: High-resolution simulation of an extreme heavy rainfall event in Shanghai using WRF: Sensitivity to planetary boundary layer parameterization. *Advances in Atmospheric Sciences*, **38**, 98-115. doi:10.1007/s00376-020-9255-y.

[160x] *Xu, R., X.-Z. Liang, and M. Duan, 2021: Evaluation of CWRF's simulation of temperature and precipitation on the Qinghai-Tibet Plateau. *Transactions of Atmospheric Sciences*, **15** (12), 125015.

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[158] *Sun, L., X.-Z. Liang, and M. Xia, 2020: Developing the coupled CWRF-FVCOM modeling system to understand and predict atmosphere-watershed interactions over the Great Lakes region. *Journal of Advances in Modeling Earth Systems,* **12**, e2020MS002319. doi:10.1029/2020MS002319.

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