

发展战略论坛

气候变化对我国水资源影响研究面临的机遇与挑战

夏军<sup>1</sup>, 刘春蓁<sup>2</sup>, 任国玉<sup>3</sup>

1.中国科学院陆地水循环及地表过程重点实验室, 北京100101;  
2.水利部水利信息中心, 北京100053; 3.中国气象局气候研究开放实验室, 国家气候中心, 北京100081

摘要:

气候变化对水资源安全的影响是国际上普遍关心的全球性问题, 也是我国可持续发展面临的重大战略问题。在文献综述基础上, 总结提出气候变化与水循环是国际全球变化与水科学领域的重大交叉前沿科学问题之一。针对我国严峻的水资源问题和气候变化影响的巨大风险, 提出科学基础研究面临的机遇和挑战, 其中包括关键的科学问题和需要重点开展基础研究的问题。分析表明: 水循环要素变化的检测与归因已成为国内外研究的难点; 定量分析和预估水文的不确定性是国际上的难题; 气候变化下水循环响应研究正从大气到水文的单向连接向水文—气候作用与反馈的方向发展; 水资源脆弱性已成为应对气候变化、保障水资源安全重点关注的问题。气候变化挑战传统水文理论假定, 包括分析和预估水文变化所面临的区域分异性、不确定性和水文极值等问题。开展气候变化与水资源影响及其适应对策研究, 将是21世纪我国水科学及水资源领域面临的重大科学技术问题。

关键词: 气候变化 水资源安全 中国

Opportunity and Challenge of the Climate Change Impact on the Water Resource of China

Xia Jun<sup>1</sup>, Liu Chunzhen<sup>2</sup>, Ren Guoyu<sup>3</sup>

1.Key Laboratory of Water Cycle and Related Land Surface Processes, Institute of Geographic Science and Natural Resources Research, China Academy on Science, Beijing100101, China;  
2.Hydrological Bureau, Ministry of Water Resources of China, Beijing100053, China;  
3.Laboratory for Climate Studies, National Climate Center, CMA, Beijing100081, China

Abstract:

The impact of climate change on water resources security is a challenging issue with widespread concern globally. It is as well the great strategic issue in the national sustainable development of China. Based on a wide review of related research, it is concluded that the research of climate change impact on the water cycle is one of the most exiting research perspectives in the study of relationship of climate change and water science. Due to the serious water resource situation plus climate change influence, the challenge and opportunity of the basic research work in the climate change impact on water resource were given. The climate change and water cycle study is the international forefront in the area of climatology, meteorology and hydrology. The detection and attribution of water cycle components change have become the international challenging problems, as well as the quantitative analysis and prediction of the uncertainties in a hydrological system; the research of water cycle response to climate change is developing from offline hydrologic simulations to coupling climate change with hydrological dynamics; study of the water resources vulnerability has become a key problem to deal with climate change and secure the water resources security. In the circumstances of the climate change, it is necessary to reexamine the hypotheses in traditional hydrological theories, as well as the spatial variability, uncertainty and hydrological extremes in regional hydrological studies. Carrying out the research of climate change impact on water resource and adoption measures is one of the biggest scientific problems of water sciences and water resource in the 21 century.

Keywords: Climate change Water resource security China

收稿日期 2010-01-04 修回日期 2010-12-02 网络版发布日期 2011-01-10

DOI:

基金项目:

国家重点基础研究发展计划项目“气候变化对我国东部季风区陆地水循环与水资源安全的影响及适应对象”(编号:2010CB428406);水利部公益性项目“气候变化对我国水安全影响及对策研究”(编号:20080100107)资助。

扩展功能

本文信息

- ▶ Supporting info
- ▶ PDF(985KB)
- ▶ [HTML全文]
- ▶ 参考文献[PDF]
- ▶ 参考文献

服务与反馈

- ▶ 把本文推荐给朋友
- ▶ 加入我的书架
- ▶ 加入引用管理器
- ▶ 引用本文
- ▶ Email Alert
- ▶ 文章反馈
- ▶ 浏览反馈信息

本文关键词相关文章

- ▶ 气候变化
- ▶ 水资源安全
- ▶ 中国

本文作者相关文章

PubMed

通讯作者: 夏军

作者简介: 夏军(1954-), 男, 湖北孝感人, 研究员, 主要从事水文资源研究.E-mail: xiaj@igsnr.ac.cn

作者Email: xiaj@igsnr.ac.cn

## 参考文献:

- [1]IPCC. Climate Change 2007The Physical Science Basis[M].Contribution of Working Group I to the Third Assessment Report of the IPCC. Solomon S, Qin D, et al,eds. Cambridge: Cambridge University Press,2007.
- [2]Bates B C, Kundzewicz Z W, Wu S,et al. Climate Change and Water[M]. Technical Paper of the Intergovernmental Panel on Climate Change, IPCC Secretariat, Geneva, 2008.
- [3]Chen Lei. Social and economical sustainable development guarantee by serious system of water resources management[EB/OL]. Presentation in working meeting of water resources of China,2009.<http://www.mwr.gov.cn/xwpd/slyw/20090214214359540317.aspx>. [陈雷. 实行最严格的水资源管理制度保障经济社会可持续发展[EB/OL]. 在全国水资源工作会议上的讲话,2009. <http://www.mwr.gov.cn/xwpd/slyw/20090214214359540317.aspx>.
- [4]Arnell N, Liu C. ‘Hydrology and Water Resources’: In Climate Change 2001[M]//Impacts, Adaptation, and Vulnerability. Intergovernmental Panel on Climate Change.Cambridge: Cambridge University Press, 2001.
- [5]Xia Jun, Tan Ge. Hydrological science towards global change: Progress and challenge[J].Resources Science, 2002, 24 (3): 1-7.[夏军, 谈戈. 全球变化与水文科学新的进展与挑战[J]. 资源科学, 2002, 24 (3): 1-7.]
- [6]UN. The 3rd United Nations World Water Development Report: Water in a Changing World (WWDR-3)[R].2009.
- [7]International GEWEX Project Office (IGPO). About GEWEX[EB/OL].[http://www.gewex.org/gewex\\_overview.html](http://www.gewex.org/gewex_overview.html),2004-12-01.
- [8]Biospheric aspects of the hydrological cycle: Highlights of the research synthesis conducted under the umbrella of IGBPBAHC and WCRPGEWX/ISLSCP international projects[R]. Dutch National Research Programme on Global Air Pollution and Climate Change RIVM Report,2002.
- [9]The Global Water System Project (GWSP). Science Framework and Implementation Activities[R]. Earth System Science Partnership (DIVERSITAS, IGBP, IHDP, WCRP) Report,2005.
- [10]United Nations Educational, Scientific and Cultural Organization. International Hydrological Programme(UNESCO-IHP)[EB/OL].<http://www.unesco.org/water/ihp/>,2008.
- [11]Labat D, Godderis Y, Probst J L,et al. Evidence for global runoff increase related to climate warming [J]. Advances in Water Resources,2004, 27(6): 631-642.
- [12]Legates D R, Lins H F, McCabe G J. Comments on “evidence for global runoff increase related to climate warming” by lab arterial[J].Advances in Water Resources,2005, 20 (12): 1 310-1 315.
- [13]IPCC. Climate Change 1990: The IPCC Impacts Assessment[M].Canberra, Australia: Australian Government Publishing Service, 1990.
- [14]IPCC. Climate Change 1995: The Science of Climate Change[M]. Contribution of Working Group I to the Second Assessment Report of the Intergovernmental Panel on Climate Change. Cambridge, UK and New York, USA: Cambridge University Press, 1996.
- [15]IPCC. Climate Change 2001: The Scientific Basis[M]. Contribution of Working Group I to the Third Assessment Report of the Intergovernmental Panel on Climate Change. Cambridge, UK and New York, USA:Cambridge University Press, 2001.
- [16]IPCC. Climate Change 2001: Impacts, Adaptation, and Vulnerability[M]. Contribution of Working Group II to the Third Assessment Report of the Intergovernmental Panel on Climate Change. Cambridge, UK and New York, USA: Cambridge University Press, 2001.
- [17]Milly P C D, Dunne K A, Vecchia A V. Global pattern of trends in streamflow and water availability in a changing climate[J].Nature,2005,(438): 347-350.[18]Milly P C D, Wetherald R T, Dunne K A,et al. Increasing risk of great floods in a changing climate[J].Nature,2002,(415): 514-517.
- [19]Taylor K.IPCC Coupled Model Output for Working Group 1[M]. Workshop on Analysis of Climate Model Simulations for IPCC AR4, Honolulu, Hawaii, 2005.
- [20]Coquard J, Duffy P B, Taylor K E. Simulations of western U.S. surface climate in 15 global climate models[J].Climate Dynamics,2004,(23): 455-472.[21]Covey C, AchutaRao K M, Cubasch U, et al. An overview of results from the coupled model intercomparison project[J].Global Planet Change, 2003, (37): 103-133.
- [22]Krishnamurti T N, Kishtawal C M, LaRow T E, et al. Improved weather and seasonal climate forecast from multimodel superensemble[J].Science,1999,285: 1 548-1 550.
- [23]Gates W L, Boyle J S, Covey C C, et al. An overview of the results of the Atmospheric Model Intercomparison Project (AMIP I)[J]. Bulletin of the American Meteorological Society,1999,(73): 1 962-1 970.
- [24]Barnston A G, Mason S J, Goddard L, et al. Multimodel ensembling in seasonal climate forecasting

- at IRI, Bull[J]. Meteorological Society, 2003, (84): 1 783-1 796.
- [25]Raftery A E, Balabdaoui F, Gneiting T, et al. Using bayesian model averaging to calibrate forecast ensembles[R]. Technical Report no. 440, Deptment of Statistics, University of Washington, Seattle, 2003.
- [26]Georgakakos K P, Seo D J, Gupta H, et al. Towards the characterization of streamflow simulation uncertainty through multimodel ensembles[J]. Journal of Hydrology, 2004, 298: 222-241.
- [27]Duan Qingyun, Ajami N K, Gao Xiaogang, et al. Multi model hydrologic ensemble predictions using bayesian model averaging[J]. Advances in Water Resources, 2007, (30): 1 371-1 385.
- [28]Semenov M A, Brooks R J. Spatial interpolation of the LARSWG stochastic weather generator in great Britain[J]. Climate Research, 1999, (11): 137-148.
- [29]Xia J. A stochastic weather generator applied to hydrological model in climate impact analysis[J]. Journal of Theoretical and Applied Climatology, 1996, 55: 177-183.
- [30]Xia J, Huang G H, Brad B. Combination of differented prediction approach and interval analysis for the prediction of weather variables under uncertainty[J]. Journal of Environmental Management, 1997, 49(1): 95-106.
- [31]Wilby R L, Wigley T M L. Precipitation predictors for downscaling: Observed and general circulation model relationships[J]. International Journal of Climatology, 2000, (20): 641-661.
- [32]Liu Chunzhen. The issues in the impact study of climate change on the terrestrial hydrological cycle [J]. Advances in Earth Science, 2004, 19(1): 115-119. [刘春蓁. 气候变化对陆地水循环影响研究的问题[J]. 地球科学进展, 2004, 19(1): 115-119.]
- [33]Liu Chunzhen. The advances in studying detection of streamflow trend influenced by climate change[J]. Advances in Earth Science, 2007, 22(8): 777-783. [刘春蓁. 气候变化对江河流域流量变化趋势影响研究进展[J]. 地球科学进展, 2007, 22(8): 777-783.]
- [34]Zhang Jianyun, Liu Jiufu. An Assessment model of climate abnormality impact on water resources [J]. Advances in Water Sciences, 2000, 11: 1-9. [张建云, 刘九夫. 气候异常对水资源影响评估分析模型[J]. 水科学进展, 2000, 11: 1-9.]
- [35]Zhang Jianyun, Wang Guoqing. Climate Change Impacting on Hydrology and Water Resources[M]. Beijing: Science Press, 2007. [张建云, 王国庆. 气候变化对水文水资源影响研究[M]. 北京: 科学出版社, 2007.]

- [36]Qin Dahe, Ding Yihui, Su Jilan. Climate and Environment Change of China[M]. Beijing: Science Press, 2005. [秦大河, 丁一汇, 苏纪兰. 中国气候与环境演变(上卷)[M]. 北京: 科学出版社, 2005.]
- [37]Chen Yiyu, Ding Yongjian, She Zhixiang, et al. Climate and environment change in China [M]. Beijing: Science Press, 2005. [陈宜瑜, 丁永建, 余之祥, 等. 中国气候与环境演变(下卷)[M]. 北京: 科学出版社, 2005.]
- [38]Working Group of Climate Change Investigation. Investigation of Climate Change of China[M]. Beijing: Science Press, 2007. [气候变化国家评估报告编写组. 气候变化国家评估报告[M]. 北京: 科学出版社, 2007.]
- [39]Ren Guoyu. Climate Change and Water Resource in China[M]. Beijing: Meteorology Press, 2007. [任国玉. 气候变化与中国水资源[M]. 北京: 气象出版社, 2007.]
- [40]Ye Duzheng, Huang Ronghui. Investigation on Characteristics and Reasons of Drought and Flood in Yellow and Yangtze River Basin[M]. Ji' nan: Science and Technology Press of Shandong Province, 1996. [叶笃正, 黄荣辉. 黄河长江流域旱涝规律和成因研究[M]. 济南: 山东科学技术出版社, 1996.]
- [41]Fu Congbin, An Zhisheng, Guo Weidong. Evolution of lifesupportiong environment in our nation and the predictive study of aridification in northern China(I): Main scientific issues and achievements[J]. Advances in Earth Science, 2005, 20 (11): 1 168-1 175. [符淙斌, 安芷生, 郭维栋. 中国生存环境演变和北方干旱化趋势预测研究(I): 主要研究成果[J]. 地球科学进展, 2005, 20 (11): 1 168-1 175.]
- [42]Ding Yihui, Ren Guoyu, Shi Guangyu, et al. National assessment report of climate change (I): Climate change in China and its future trend[J]. Advances in Climate Change Research, 2006, 2(1): 3-8. [丁一汇, 任国玉, 石广玉, 等. 气候变化国家评估报告(I): 中国气候变化的历史和未来趋势[J]. 气候变化研究进展, 2006, 2(1): 3-8.]
- [43]Ding Yihui, Ren Guoyu. A Brief Survey on the Climate Change of China[M]. Beijing: Meteorology Press, 2008. [丁一汇, 任国玉. 中国气候变化科学概论[M]. 北京: 气象出版社, 2008.]
- [44]Chen Zhikai. Continue dryness and water crisis in northern China[J]. China Water Resources, 2002, (4): 8-11. [陈志恺. 持续干旱与华北水危机[J]. 中国水利, 2002, (4): 8-11.]
- [45]Liu Changming. Study of some problems in water cycle changes of the Yellow river basin [J]. Advances in Water Science, 2004, 15(5): 608-614. [刘昌明. 黄河流域水循环演变若干问题的研究[J]. 水科学进展, 2004, 15(5): 608-614.]
- [46]Qian Zhengying, Shen Guofang, Shi Yulin. Study on Several Issues of Soil and Water Optimazition, Ecology and Environment Protection and Sustainable Development in Northeastern of China[M]. Beijing: Science Press, 2007. [钱正英, 沈国舫, 石玉林. 东北地区有关水土资源配置、生态与环境保护和可持续发展的若干战略问题研究(综合卷)[M]. 北京: 科学出版社, 2007.]
- [47]Qiu Xinfa, Liu Changming, Zeng Yan. Changes of pan evaporation in the recent 40 years over the Yellow river basin[J]. Journal of Natural Resources , 2003, 18(4): 437-442. [邱新法, 刘昌明, 曾燕. 黄河流域近40年蒸发皿蒸发量的气候变化特征[J]. 自然资源学报, 2003, 18(4): 437-442.]
- [48]Yang Jianping, Ding Yongjian, Chen Rensheng, et al. Variations of precipitation and evaporation in

north China in recent 40 years[J].Journal of Arid Land Resources & Environment, 2003,17(2):6-11.[杨建平,丁永建,陈仁升,等.近40a中国北方降水量与蒸发量变化[J].干旱区资源与环境,2003,17(2):6-11.]

[49]Liu B, Xu M, Mark H,et al. A spatial analysis of pan evaporation trends in China,1955-2000 [J].Journal of Geophysical Research,2005,109: 1-9.

[50]Ren Guoyu, Guo Jun. Change in panevapotranspiration of China[J].Journal of Nature Resources,2006,21(1): 31-44.[任国玉,郭军.中国水面蒸发量的变化[J].自然资源学报,2006,21(1): 31-44.]

[51]Wang Guoqing, Wang Yunzhang, Kang Lingling. Analysis on the sensitivity of runoff in Yellow reiver to climate change[J].Quarterly Journal of Applied Meteorology,2002,13(1): 117-121.[王国庆,王云璋,康玲玲.黄河上中游径流对气候变化的敏感性分析[J].应用气象学报,2002,13(1):117-121.]

[52]Xia Jun, Thomas Tanner, Ren Guoyu,et al. Potential impacts of climate change on water resources in China: Screening for adaptation and management[J].Advances in Climate Change Research,2008,4(4): 215-219. [夏军,Thomas Tanner,任国玉,等.气候变化对中国水资源影响的适应性评估与管理框架[J].气候变化研究进展,2008,4(4): 215-219.]

[53]Lin Erda, Xu Yinlong, Jiang Jinhe,et al. National assessment report of climate change (II): Climate change impacts and adaptation[J].Advances in Climate Change Research,2006,2(2): 51-56.[林而达,许吟隆,蒋金荷,等.气候变化国家评估报告(II):气候变化的影响与适应[J].气候变化研究进展,2006,2(2):51-56.]

[54]Wang Shourong,Cheng Lei. Studies on impacts of climate change on water cycle and water resources in northwest China[J].Climatic and Environmental Research,2003,8(1): 43-51.[王守荣,程磊.气候变化对西北水循环和水资源影响的研究[J].气候与环境研究,2003,8(1): 43-51.]

[55]Liu Xinren. Soil moisture problems in the landatmospheric coupling[J].Advances in Water Science, 1996,7: 32-39.[刘新仁.陆气耦合中的土壤水问题[J].水科学进展,1996,7: 32-39.]

[56]Yong Bin, Zhang Wanchang, Liu Chuansheng. Advances in the coupling study of hydrological models and land surface models[J].Journal of Glaciology and Geocryology,2006,(6): 53-59.[雍斌,张万昌,刘传胜.水文模型与陆面模式耦合研究进展[J].冰川冻土,2006,(6): 53-59.]

[57]Xie Zhenghui, Liu Qian, Yuan Fei, et al. Macro scale land hydrological model based on 50km×50km grids system[J].Journal of Hydraulic Engineering,2004,(5): 76-82.[谢正辉,刘谦,袁飞,等.基于全国50km×50km网格的大尺度陆面水文模型框架[J].水利学报,2004,(5): 76-82.]

[58]Wang Shourong. Improvements of a distributed hydrology model DHSVM and its climatological hydrological off-line simulation experiments[J].Acta Meteorologica Sinica,2002,60(4): 421-427.[王守荣.分布式水文—土壤—植被模式的改进及气候水文Off-line模拟试验[J].气象学报,2002,60(4): 421-427.]

[59]Zhang Hongping, Zhou Suoquan, Xue Genyuan,et al. Numerical experiment of the coupling of RegCM2 and a hydrological model[J].Journal of Nanjing Institute of Meteorology,2006,29(2): 158-165. [张红平,周锁铨,薛根元,等.区域气候模式(RegCM2)与水文模式耦合的数值试验[J].南京气象学院学报,2006,29(2): 158-165.]

[60]Li Kai, Zeng Xinmin. The annualtime scale simulation of a regional climate model with its improved hydrological process[J]. Scientia Meteorologica Sinic,2008,3: 308-315.[李凯,曾新民.一个区域气候模式水文过程的改进及年尺度模拟研究[J].气象科学,2008,3: 308-315.]

[61]Feng Jinming, Fu Congbin. Intercomparison of longterm simulations of temperature and precipitation over China by different regional climate models[J].Chinese Journal of Atmospheric Sciences,2007,31(5): 805-814.[冯锦明,符淙斌.不同区域气候模式对中国地区温度和降水的长期模拟比较[J].大气科学,2007,31(5): 805-814.]

[62]Zhang Zitai, Zhang Qianhong. Chinese legislation on adaptation to climate change[J].Global Law Review, 2008,5: 57-63.[张梓太,张乾红.论中国对气候变化之适应性立法[J].环球法律评论,2008,5: 57-63.]

[63]Xiao Fengjin, Zhang Haidong, Wang Chunyi,et al. Impact of climatic change on agriculture and its adaptation countermeasures in China[J].Journal of Natural Disasters,2006,15(6): 327-331.[肖风劲,张海东,王春乙,等.气候变化对我国农业的可能影响及适应性对策[J].自然灾害学报,2006,15(6): 327-331.]

## 本刊中的类似文章

1. 贾丙瑞,周广胜.北方针叶林对气候变化响应的研究进展[J].地球科学进展,2009,24(6): 668-674
2. 陈木宏.国际综合大洋钻探计划IODP323白令海航次介绍[J].地球科学进展,2009,24(12): 1352-1356
3. 刘小茜,王仰麟,彭建.人地耦合系统脆弱性研究进展[J].地球科学进展,2009,24(8): 917-928
4. 胡永云,丁峰,夏炎.全球变化条件下的平流层大气长期变化趋势[J].地球科学进展,2009,24(3): 242-251
5. 吕达仁,卞建春,陈洪滨,陈月娟,陈泽宇,胡永云,刘毅,任荣彩,田文寿.平流层大气过程研究的前沿与重要性[J].地球科学进展,2009,24(3): 221-227
6. 范丽军;符淙斌;陈德亮.统计降尺度法对未来区域气候变化情景预估的研究进展[J].地球科学进展,2005,20(3): 320-329
7. 曾静静,曲建升,张志强.国际温室气体减排情景方案比较分析[J].地球科学进展,2009,24(4): 436-443
8. 许强,陈伟,张倬元.对我国西南地区河谷深厚覆盖层成因机理的新认识[J].地球科学进展,2008,23(5): 448-456
9. 侯春梅;张志强;李明;迟秀丽.气候变化的影响与长期气候目标的建立研究进展[J].地球科学进展,2005,20(11): 1243-1248
10. 熊伟,居辉,许吟隆,林而达.气候变化对中国农业温度阈值影响研究及其不确定性分析[J].地球科学进展,

11. 孙军.今生颗石藻的有机碳泵和碳酸盐反向泵[J]. 地球科学进展, 2007,22(12): 1231-1239
12. 陈星,雷鸣,汤剑平. 地表植被改变对气候变化影响的模拟研究[J]. 地球科学进展, 2006,21(10): 1075-1082
13. 任小波,曲建升,张志强.气候变化影响及其适应的经济学评估[J]. 地球科学进展, 2007,22(7): 754-759
14. 张雪芹, 彭莉莉, 林朝晖. 未来不同排放情景下气候变化预估研究进展[J]. 地球科学进展, 2008,23(2): 174-185
15. 赵哈林, 大黑俊哉, 周瑞莲, 李玉霖, 左小安, 黄刚.人类活动与气候变化对科尔沁沙质草地植被的影响[J]. 地球科学进展, 2008,23(4): 408-414
16. 邓振镛,张强,徐金芳,黄蕾诺,文小航,王润元,王小燕,奚立宗. 全球气候变暖对甘肃农作物生长影响的研究进展[J]. 地球科学进展, 2008,23(10): 1070-1078
17. 王芳, 陈泮勤, 葛全胜. 气候变化谈判的共识与分歧初析[J]. 地球科学进展, 2008,23(2): 186-192
18. Pavel Ya. Groisman, Richard W. Knight.在过去40年里出现的新趋势——北美持续旱段[J]. 地球科学进展, 2007,22(11): 1191-1207
19. 肖生春, 肖洪浪. 黑河流域水环境演变及其驱动机制研究进展[J]. 地球科学进展, 2008,23(7): 748-755
20. 王亚平, 黄耀, 张稳. 中国东北三省1960—2005年地表干燥度变化趋势[J]. 地球科学进展, 2008,23(6): 619-627
21. 靳立亚,陈发虎. 千百年尺度气候快速变化及其数值模拟研究进展[J]. 地球科学进展, 2007,22(10): 1054-1065
22. 刘春蓁.气候变化对江河流域流量变化趋势影响研究进展[J]. 地球科学进展, 2007,22(8): 777-783
23. 赵鸿,肖国举,王润元,邓振镛,王鹤龄,杨启国.气候变化对半干旱雨养农业区春小麦生长的影响[J]. 地球科学进展, 2007,22(3): 322-327
24. 赵生才.气候变化的应对战略——香山科学会议第 232次学术讨论会侧记[J]. 地球科学进展, 2004,19(5): 867-871
25. 周立旻,Brian A. Tinsley, 郑祥民,王世杰.太阳活动驱动气候变化空间天气机制研究进展[J]. 地球科学进展, 2007,22(11): 1099-1109
26. 刘春蓁.气候变化对陆地水循环影响研究的问题 [J]. 地球科学进展, 2004,19(1): 115-119
27. 高晓清, G. P. Gregori. ALB上焦耳热场的形态分布特征及环境意义探讨[J]. 地球科学进展, 2002,17(4): 487-490
28. 王宝鉴,宋连春,张强,黄玉霞,杨选雄,韩兰英.石羊河流域水资源对气候变暖的响应及对生态环境的影响[J]. 地球科学进展, 2007,22(7): 730-737
29. 王绍强,刘纪远.土壤碳蓄积量变化的影响因素研究现状[J]. 地球科学进展, 2002,17(4): 528-534
30. 赵红岩,杨瑜峰,赵庆云,汤懋苍,康凤琴,白彦芳.西北区冰雹日气候分析及预测方法研究[J]. 地球科学进展, 2007,22(2): 136-142
31. 李明;迟秀丽. 减缓气候变化的若干建议[J]. 地球科学进展, 2005,20(12): 1376-1378
32. 李晓兵, 陈云浩, 张云霞, 范一大, 周涛, 谢锋.气候变化对中国北方荒漠草原植被的影响[J]. 地球科学进展, 2002,17(2): 254-261
33. 胡永云;闻新宇. 冰雪地球的研究进展综述[J]. 地球科学进展, 2005,20(11): 1226-1233
34. 李晶莹, 张经.流域盆地的风化作用与全球气候变化 [J]. 地球科学进展, 2002,17(3): 411-419
35. 汤懋苍;朱德琴;高晓清.地球系统演化原因研究的回顾与展望 [J]. 地球科学进展, 2004,19(1): 55-062
36. 吴金水;童成立;刘守龙.亚热带和黄土高原区耕作土壤有机碳对全球气候变化的响应 [J]. 地球科学进展, 2004,19(1): 131-137
37. 石广玉,刘玉芝.地球气候变化的米兰科维奇理论研究进展[J]. 地球科学进展, 2006,21(03): 278-285
38. 张强;韩永翔;宋连春. 全球气候变化及其影响因素研究进展综述[J]. 地球科学进展, 2005,20(9): 990-998
39. 孙秉强;张强;董安祥;陈少勇.甘肃黄土高原土壤水分气候特征[J]. 地球科学进展, 2005,20(9): 1041-1046
40. 王宁练;姚檀栋;邵雪梅.温室气体与气候: 过去变化对未来的启示 [J]. 地球科学进展, 2001,16(6): 821-828
41. 张树清;张柏;汪爱华.三江平原湿地消长与区域气候变化关系研究 [J]. 地球科学进展, 2001,16(6): 836-841
42. 何勇;董文杰;季劲均;丹利. 基于AVIM的中国陆地生态系统净初级生产力模拟[J]. 地球科学进展, 2005,20(3): 345-349
43. 汪卫国;冯兆东;P.Khosbayan;T.Narantsetseg. 蒙古全新世气候变化研究进展[J]. 地球科学进展, 2005,20(2): 240-247
44. 夏军, 邱冰, 潘兴瑶, 翁建武, 傅国斌, 欧阳如林.气候变化影响下水资源脆弱性评估方法及其应用[J]. 地球科学进展, 2012,27(4): 443-451
45. 戴小苏, 高云.关注气候变化, 倡导可持续发展 [J]. 地球科学进展, 2004,19(5): 872-872
46. 陈泮勤,程邦波,王芳,曲建升.全球气候变化的几个关键问题辨析[J]. 地球科学进展, 2010,25(1): 69-75

47. 申彦波,赵宗慈,石广玉.地面太阳辐射的变化、影响因素及其可能的气候效应最新研究进展[J]. 地球科学进展, 2008,23(9): 915-924
48. 刘健,Hans von Storch;陈星;Eduardo Zorita;王苏民.近千年全球气候变化的长积分模拟试验[J]. 地球科学进展, 2005,20(5): 561-567
49. 熊伟,杨婕,林而达,许吟隆.未来不同气候变化情景下我国玉米产量的初步预测[J]. 地球科学进展, 2008,23(10): 1092-1101
50. 任国玉.气候变暖成因研究的历史、现状和不确定性[J]. 地球科学进展, 2008,23(10): 1084-1091
51. 曲建升,葛全胜,张雪芹.全球变化及其相关科学概念的发展与比较[J]. 地球科学进展, 2008,23(12): 1277-1284
52. 王辉,王东晓,杜岩.2002年国外物理海洋学研究主要进展[J]. 地球科学进展, 2003,18(5): 797-805
53. 翦知聿,黄维.快速气候变化与高分辨率的深海沉积记录 [J]. 地球科学进展, 2003,18(5): 673-680
54. 杨保,施雅风,李恒鹏.过去 2ka气候变化研究进展[J]. 地球科学进展, 2002,17(1): 110-117
55. 郭正府,刘嘉麒.火山活动与气候变化研究进展[J]. 地球科学进展, 2002,17(4): 595-604
56. 吕红华,周祖翼.前陆盆地陆源沉积序列的特征与成因机制[J]. 地球科学进展, 2010,25(7): 706-714
57. 王国庆,金君良,王金星,贺瑞敏,刘翠善,刘艳丽.辽河流域径流对气候变化的响应特征研究[J]. 地球科学进展, 2011,26(4): 433-440
58. 赵天保,符淙斌,柯宗建,郭维栋.全球大气再分析资料的研究现状与进展[J]. 地球科学进展, 2010,25(3): 241-254
59. 付培健,王世红,陈长和.探讨气候变化的新热点:大气气溶胶的气候效应[J]. 地球科学进展, 1998,13(4): 387-392
60. 马浩,王召民,史久新.南大洋物理过程在全球气候系统中的作用[J]. 地球科学进展, 2012,27(4): 398-412
61. 宋洪军,季如宝,王宗灵.近海浮游植物水华动力学和生物气候学研究综述[J]. 地球科学进展, 2011,26(3): 257-265
62. 董文杰,汤懋苍,惠小英.日地关系研究的一种新观点介绍[J]. 地球科学进展, 1994,9(4): 84-90
63. 康兴成,张其花, Lisa J. Graumlich, Paul Sheppard.青海都兰过去2000年来的气候重建及其变迁[J]. 地球科学进展, 2000,15(2): 215-221
64. 高洪林,穆治国,马配学.古气候变化的周期性与驱动机制研究的回顾[J]. 地球科学进展, 2000,15(2): 222-227
65. 丁永建,秦大河,叶柏生,刘时银.陆地表层水贮量变化对海平面上升贡献的综合评估[J]. 地球科学进展, 2001,16(1): 106-112
66. 谢树成,姚檀栋.冰雪层中记录气候与环境变化的痕量含碳杂质[J]. 地球科学进展, 1998,13(4): 376-382
67. 孙成权,曲建升,赵转军.美国全球变化研究计划实施进展与研究展望[J]. 地球科学进展, 2001,16(4): 574-579
68. 罗云峰,周秀骥,李维亮.大气气溶胶辐射强迫及气候效应的研究现状[J]. 地球科学进展, 1998,13(6): 572-581
69. 郝永萍,陈育峰,张兴有.植被净初级生产力模型估算及其对气候变化的响应研究进展[J]. 地球科学进展, 1998,13(6): 564-571
70. 马柱国,符淙斌,谢力,陈文海,陶树望.土壤湿度和气候变化关系研究中的某些问题[J]. 地球科学进展, 2001,16(4): 563-566
71. 陈骏,杨杰东,李春雷.大陆风化与全球气候变化[J]. 地球科学进展, 2001,16(3): 399-405
72. 邓慧平.气候与土地利用变化对水文水资源的影响研究[J]. 地球科学进展, 2001,16(3): 436-441
73. 曲绍厚.全球大气臭氧层的主要特征和变化趋势[J]. 地球科学进展, 1994,9(5): 39-47
74. 孙成权,朱岳年.21世纪能源与环境的前沿问题——天然气水合物[J]. 地球科学进展, 1994,9(6): 49-52
75. 汤懋苍,高晓清.气候变化的“地心说”——关于短期气候预测的新思维[J]. 地球科学进展, 1995,10(1): 47-56
76. 卢昌义,林鹏,叶勇,汪和海.全球气候变化对红树林生态系统的影响与研究对策[J]. 地球科学进展, 1995,10(4): 341-347
77. 唐国平,李秀彬,刘燕华.全球气候变化下水资源脆弱性及其评估方法[J]. 地球科学进展, 2000,15(3): 313-317
78. 林而达,王京华.全球变化对农业的影响及适应对策[J]. 地球科学进展, 1995,10(6): 597-604
79. 杨英,沈承德,易惟熙,孙彦敏.大火历史及其与古气候关系研究[J]. 地球科学进展, 2000,15(3): 328-334
80. 洪业汤.太阳变化驱动气候变化研究进展[J]. 地球科学进展, 2000,14(4): 400-405
81. 曹明奎,李克让.陆地生态系统与气候相互作用的研究进展[J]. 地球科学进展, 2000,14(4): 446-452
82. 贺芳芳,赵兵科.近30年上海地区暴雨的气候变化特征[J]. 地球科学进展, 2009,24(11): 1260-1267
83. 彭少麟,侯爱敏,周国逸.气候变化对陆地生态系统第一性生产力的影响研究综述[J]. 地球科学进展, 2000,15(6): 717-722

84. 苏 珍,刘宗香,王文梯,姚檀栋,邵文章,蒲健辰,刘时银.青藏高原冰川对气候变化的响应及趋势预测[J]. 地球科学进展, 1999,14(6): 607-612
85. 施雅风, 范建华.中国气候和海面变化及其趋势和影响的初步研究[J]. 地球科学进展, 1991,6(4): 18-23
86. 任国玉.太阳辐射与气候变化[J]. 地球科学进展, 1991,6(6): 37-41
87. 倪建红.地球系统演化过程中的主要矛盾——汤懋苍教授关于“气候变化地心说”的新探索[J]. 地球科学进展, 1997,12(3): 305-305
88. 丁一汇.IPCC第二次气候变化科学评估报告的主要科学成果和问题[J]. 地球科学进展, 1997,12(2): 158-163
89. 郑景云,葛全胜,张丕远.气候突变: 史实与意义[J]. 地球科学进展, 1999,14(2): 177-182
90. 马柱国,魏和林,符淙斌.土壤湿度与气候变化关系的研究进展与展望[J]. 地球科学进展, 1999,14(3): 299-305
91. 钱 云,符淙斌,王淑瑜.沙尘气溶胶与气候变化[J]. 地球科学进展, 1999,14(4): 391-394
92. 李玉成,王苏民,黄耀生.气候环境变化的湖泊沉积学响应[J]. 地球科学进展, 1999,14(4): 412-416
93. 钱云, 符淙斌.SO<sub>2</sub>排放、硫酸盐气溶胶和气候变化? [J]. 地球科学进展, 1997,12(5): 440-446
94. 熊尚发, 丁仲礼, 刘东生.第四纪气候变化机制研究的进展与问题[J]. 地球科学进展, 1998,13(3): 265-272
95. 王绍武.气候学研究进展[J]. 地球科学进展, 1996,11(2): 169-177
96. 朱复成.近年来大气科学某些进展及其展望[J]. 地球科学进展, 1992,7(5): 15-
97. 丁永建, 刘时银, 周文娟, 炳宏涛.北半球冰川物质平衡变化的若干特征及其气候意义[J]. 地球科学进展, 1996,11(6): 590-596
98. 陈华, 赵士洞.全球气候变化对森林生态系统影响的研究(述评)[J]. 地球科学进展, 1993,8(1): 1-7
99. 王万里, 王颢樾, 谢应齐, 王卫国, 王祖武, 王凯, 杜良敏, 邓南圣, 蔡述明, 刘耀林 .夏季东亚大槽和副热带高压年代际变化的分析[J]. 地球科学进展, 2012,27(3): 304-320
100. 周洪建, 孙业红.气候变化背景下灾害移民的政策响应[J]. 地球科学进展, 2012,27(5): 573-580