城市气象科技信息监测简报

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北京气象学会
北京城市气象研究院
中国气象局城市气象重点开放实验室

2023 年 8 月 6 日

前 言

2021年7月，依托北京城市气象研究院行业信息监测与分析系统，北京气象学会与支撑单位北京城市气象研究院联合制作了《城市气象科技信息监测简报》，定期为会员提供科技信息服务。简报每月一期，每期分为文献和咨询两类。

目前，学会主要依据城市气象领域的关键词搜索信息，并形成每月简报。欢迎各位会员向我们提供相关科技领域信息及其搜索关键词，不断扩充简报的专业领域范围，丰富简报的内容，以更好地满足广大会员朋友们对快速更新科技信息的需求。

同时，热诚欢迎广大会员对简报的科技信息内容、展现形式、阅读体验和收获感悟等提出建议和点评。编辑团队将遴选出优秀建议和点评内容刊载在简报上。

2020年12月，学会换届成立了第21届理事会，现拥有52 家理事单位和 947 名会员。我们希望借助此简报，为广大会员朋友们提供高质高效的科技信息服务，同时在大家的支持和帮助下，我们共同将简报建设成为会员交流的友好平台。

编辑团队:

苏　晨 北京城市气象研究院办公室副主任

楚艳丽　北京气象学会副秘书长、北京城市气象研究院副研究员

苗世光　北京气象学会秘书长、北京城市气象研究院院长

郭佩芸 北京城市气象研究院专职副书记

胡永云 北京气象学会理事长、北京大学教授

刘　燕 北京气象学会副秘书长

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❖报告概述

✧监测周期：

2023 年 07 月 01 日 - 2023 年 07 月 31 日

✧监测主题：

行业动态——新闻资讯、文献信息；

❖行业动态

✧新闻资讯

本监测周期内，城市气象资讯信息共更新 17 条

1. 清华大学地学系杨军教授研究组对常用城市扩张模型进行系统评估

摘要：城市扩张模型(Urban growth models, 简称 UGMs)是预测城市扩张的主要研究工具。自 1950 年以来，基于不同建模框架和算法的 UGMs 大量出现，但当前对不同模型表现的对比研究相对不足。研究者在选择模型时缺乏参考依据，开展城市扩张预测研究时对 UAM 的选择通常偏主观，从而增加了预测结果的不确定性。针对上述问题，清华大学地球系统科学系（以下简称“地学系”）杨军教授研究组统计了 2000-2021 年间城市扩张模拟研究中的各类 UGMs 使用情况，并从中选择了六种常用的 UGMs，从用户角度出发对模型进行了验证，并评价了模型的数据需求和灵活度差异，以及在模拟预测城市扩张方面的性能差异。现有的 UGM 对比研究主要分为两类：第一类通过搜集不同研究者使用的模型和预测结果进行对比。该方法能够对更多的 UGM 研究实例开展评估，但由于各实例研究对象和输入数据的不同，模型结果的可比性较差；第二类对不同的 UGM 开展相同的模拟预测任务，对比其结果和精度的差异。该方法能够排除输入数据等因素，从而揭示模型本身导致的预测结果差异，但当前这类研究对 UGM 的选择依据不够充分，且较少关注模型的结构、数据需求、灵活度以及对模型的验证。针对上述问题，杨军教授研究组首先回顾了 2000-2021 年的各类 UGMs 在出版物中的使用情况（图 1）。在此基础上，研究组对六种最常用且具有详细指导手册的 UGM 进行了输入数据及可调参数数量的详细比对（表 1）。研究组进一步对六种 UGM 采用相同分辨率和类型的输入数据，分别对 2015-2020 年的城市扩张进行模拟预测，采用三图法对各模型的预测结果和集成结果进行精度验证和结果对比，对模型进行验证。

来源：清华大学

发布时间：2023-07-30

数据类型：资讯

http://www.dess.tsinghua.edu.cn/info/1108/5922.htm

2. July 2023 is set to be the hottest month on record

摘要：Bonn and Geneva, 27/07/2023 (Copernicus and WMO) - According to ERA5 data from the EU-funded Copernicus Climate Change Service (C3S), the first three weeks of July have been the warmest three-week period on record and the month is on track to be the hottest July and the hottest month on record. These temperatures have been related to heatwaves in large parts of North America, Asia and Europe, which along with wildfires in countries including Canada and Greece, have had major impacts on people's health, the environment and economies.« We don't have to wait for the end of the month to know this. Short of a mini-Ice Age over the next days, July 2023 will shatter records across the board, » said United Nations Secretary-General António Guterres.« According to the data released today, July has already seen the hottest three-week period ever recorded; the three hottest days on record; and the highest-ever ocean temperatures for this time of year, » Mr Guterres told journalists at UN headquarters in New York.« For vast parts of North America, Asia, Africa and Europe – it is a cruel summer. For the entire planet, it is a disaster. And for scientists, it is unequivocal – humans are to blame.All this is entirely consistent with predictions and repeated warnings. The only surprise is the speed of the change, » said Mr Guterres.

来源：WMO

发布时间：2023-07-27

数据类型：资讯

https://public.wmo.int/en/media/press-release/july-2023-set-be-hottest-month-record

3. Climate change impacts increase in Asia

摘要：Bangkok, Thailand 27 July 2023 (WMO) – Extreme weather and climate change impacts are increasing in Asia, which ricocheted between droughts and floods in 2022, ruining lives and destroying livelihoods. Melting ice and glaciers and rising sea levels threaten more socio-economic disruption in future, according to a new report from the World Meteorological Organization.Asia, the continent with the largest land mass extending to the Arctic, is warming faster than the global average. The warming trend in Asia in 1991–2022 was almost double the warming trend in the 1961–1990 period, according to the WMO State of the Climate in Asia 2022 report.There were 81 weather,

climate and water-related disasters in Asia in 2022, of which over 83% were flood and storm events. More than 5 000 people lost their lives, more than 50 million people were directly affected and there were more than US$ 36 billion in economic damages, according to the report. In addition, a large part of arid Asia experienced severe dust storms. Several severe dust storm events in western Asia affected civil lives in the region. “This report summarizes the state of the climate and the extreme events and their socioeconomic impacts in Asia in 2022. In 2022, many areas in Asia experienced drier-than-normal conditions and drought.

来源：WMO

发布时间：2023-07-27

数据类型：资讯

https://public.wmo.int/en/media/press-release/climate-change-impacts-increase-asia

4. AAS-CSSP: 2015 年中国东部夏季“南涝北旱”型降水异常的可能成因

摘要：中国东部夏季降水异常多呈现偶极子分布型，即南方与北方降水异常反位相变化的空间分布格局，俗称“南涝北旱”型。理解这种旱涝分布型对我国的水资源管理、农业发展规划以及防灾减灾等都具有十分重要的意义。2015 年是一个典型的“南涝北旱”年，南方遭受暴雨的同时北方出现了自 1979 年以来最严重的干旱，这造成了巨大的社会和经济损失。南京信息工程大学李卓媛博士、袁典博士和陆尔教授与中国科学院大气物理研究所杨庆副研究员、马柱国研究员合作，以 2015 年为例，分析了中国东部夏季降水异常的时空特征及其大气环流背景和可能的动力学机制。图 中国上空不同层次的大气环流异常及其可能的激发机制结果发现，2015 年的“南涝北旱”是赤道太平洋的暖海温异常（厄尔尼诺）和多个大尺度环流系统协同作用的结果。这些环流系统包括低层的太平洋日本/东亚太平洋型遥相关、中层的欧亚型遥相关、高层的英国-贝加尔湖走廊型遥相关和丝绸之路型遥相关。上述因子的协同作用导致了西太平洋副热带高压的南移和东亚夏季风的减弱，影响了东亚的风场和水汽分布，使得梅雨锋及其雨带难以向北推进，北方降水减少，而南方降水增多，最终形成了“南涝北旱”型降水异常分布。进一步分析发现全球海表温度和海冰异常是激发上述大气遥相关的关键因素。上述成果揭示了 2015 年夏季中国东部的“南涝北旱”是海温和多元大尺度环流系统共同作用的结果，这为理解和预测此类事件提供了新的视角。上述成果于近期发表在 Advances in Atmospheric Sciences 的 CSSP 专刊上（CSSP 专刊正在陆续更新中，更多专刊文章，请查看

http://www.iapjournals.ac.cn/aas/en/virtualTopic?id=bfc4a0fc-fe6a-4ed8-bc78-26b907e4dab7）。

来源：大气物理所

发布时间：2023-07-27

数据类型：资讯

http://www.iap.cas.cn/gb/xwdt/kyjz/202307/t20230727_6838626.html

5. Heatwaves, wildfires mark summer of extremes

摘要：Intense heat is gripping large parts of the Northern hemisphere in this summer of extremes, causing major damage to the people's health and the environment. China set a new national daily temperature record, and many new station temperature records have been broken.Wildfires have caused devastation and forced evacuations of thousands of people in parts of the Mediterranean, including Algeria, Greece, Italy and Spain. Canada has seen its worst wildfire season on record, harming air quality for millions of people in North America.Sea surface temperatures have hit new records, with severe marine heatwaves in the Mediterranean and off the coast of Florida."The extreme weather – an increasingly frequent occurrence in our warming climate – is having a major impact on human health, ecosystems, economies, agriculture, energy and water supplies. This underlines the increasing urgency of cutting greenhouse gas emissions as quickly and as deeply as possible," said WMO Secretary-General Prof. Petteri Taalas."In addition, we have to step up efforts to help society adapt to what is unfortunately becoming the new normal. The WMO community is providing forecasts and warnings to protect lives and livelihoods as we strive to achieve our goal of Early Warnings for All," said Prof.

来源：WMO

发布时间：2023-07-26

数据类型：资讯

https://public.wmo.int/en/media/news/heatwaves-wildfires-mark-summer-of-extremes

6. 清华大学地学系李伟课题组揭示全球生物能源作物种植引起的陆地降水改变

摘要：生物能源碳捕获与封存（BECCS）是实现碳中和目标、减缓气候变化的主要负排放技术之一。其基本原理是通过种植速生的能源作物（如桉树、柳树、柳枝稷等）将大气中的二氧化碳（CO2）固定在生物质中，并在生物质能燃烧之后

将排出的 CO2 进行封存，从而达到从大气中移除 CO2（Carbon Dioxide Removal，CDR）的目的。然而，BECCS 技术的大规模实施仍然存在诸多不确定性。例如，速生作物的生长过程需要消耗大量的水资源，可能会对淡水资源产生威胁。以往研究只关注生物能源作物生长本身的水分需求，而未考虑大规模能源作物种植通过生物物理过程对气候的反馈作用。清华大学地球系统科学系（以下简称“地学系”）李伟副教授课题组联合国内外多所研究机构，针对上述问题展开研究，揭示了全球大规模生物能源作物种植对全球陆地水循环的影响，并探究了不同种植策略（即不同生物能源作物类型、种植区分布/种植面积）通过生物地球物理作用对陆地降水和其他陆地水平衡分量（蒸散发、地表径流和土壤水存储量）的影响。研究使用了嵌入自主开发的第二代能源作物模块的动态植被模型，并与大气模式进行耦合，进而对 6 种生物能源作物种植情景的陆表生物物理特性和关键水文变量进行模拟。研究发现，在全球水平上，桉树（木本）和柳枝稷（草本）的种植分别使全球陆地年平均降水提高了 9.0±2.4 mm year-1 和 4.7±2.7 mm year-1，其中，分别有 15.5% 和 11.9% 的陆地面积年均降水呈现显著改变（图 1）。同时，利用大气水汽收支方程进行降水诊断的结果表明，在桉树种植情景中，地表蒸散发是增加降水的主要来源；而在柳枝稷的种植情景中，增加的降水同时来源于地表蒸散发和水汽平流（图 2）。增加的降水和减少的地表径流在一定程度上抵消了生物能源作物生长本身所消耗的水分。

来源：清华大学

发布时间：2023-07-25

数据类型：资讯

http://www.dess.tsinghua.edu.cn/info/1108/5921.htm

7. Spain’s Heatwave: Urban Strategies for a Warmer World

摘要：Last week, Spain experienced a remarkable event when surface temperatures soared to a staggering 60 °C. This severe heatwave has heightened worries over soil moisture depletion, worsening drought conditions in the impacted areas. The lack of moisture has magnified the heatwaves effects, initiating a concerning cycle that affects ecosystems, agricultural productivity, and even water resources.The Role of Ground and Soil Cover in Temperature FluctuationsInterestingly, ground and soil cover types play a crucial role in determining temperature fluctuations during such extreme events. Open soil types, like loamy soil and sand, often record much higher temperatures than concrete, stone, or asphalt surfaces. This difference is attributed to the higher heat absorption and dissipation capacity of the latter materials, whereas open soil tends to hold and amplify

heat, increasing the overall warming effect.Harnessing ENVI-met for Heatwave PredictionsIn this context, ENVI-met software presents cutting-edge tools to deeply understand and anticipate the implications of heatwaves across diverse ground and soil varieties. Utilizing an intricate simulation model, ENVI-met enables users to identify potential temperature trends and develop effective strategies to counter extreme heat. This software considers numerous aspects, such as multilayered soil moisture modeling, heat storage, reflection properties of materials, and vegetations influence on soil temperature.Mitigating Heat: The Way ForwardTo counter the detrimental impacts of extreme heat, its essential to adopt strategies like green infrastructure and encourage urban forestry.

来源：ENVI

发布时间：2023-07-24

数据类型：资讯

https://www.envi-met.com/spains-heatwave-crisis-urban-strategies-for-heatwaves-in-a-changing-climate/

8. ERL: 新冠期间减少的气溶胶通过增强亚洲西风急流而贡献于 2020 年的“暴力梅”事件

摘要：2020 年 6-7 月，江淮流域遭受了破纪录的梅雨侵袭，对当地的生命安全和社会经济活动造成了重大影响。近日，季风系统研究中心课题组在 2020 年夏季江淮流域“超级暴力梅”成因研究方面取得了新进展，该研究基于利用观测数据和数值模式分析了新冠疫情期间气溶胶减少对此次“超级暴力梅”事件的可能影响机制。结果表明，由于新冠疫情期间人类活动的减少，2020 年夏季我国南方地区的气溶胶浓度降到了近 30 年最低水平（图 1a 和 b），其通过影响地气系统辐射平衡使东亚南部的大气温度升高（图 1f）。升高的大气温度增大了东亚对流层的南北温度梯度（图 1c 和 g），并通过热成风平衡使得 2020 年夏季亚洲西风急流达到近 40 年来最强（图 1h）。强的亚洲西风急流通过引起对流层高层的辐散而使江淮流域上空的上升运动加强，配合西北太平洋异常反气旋输送的大量水汽，江淮流域出现了创纪录的梅雨事件（图 1e）。上述研究预示着在未来人为排放持续减少的背景下，极端暴雨事件可能会增多。该研究对认识和预测“双碳”背景下我国极端暴雨事件的认识和预测具有重要意义。

来源：大气物理所

发布时间：2023-07-24

数据类型：资讯

http://www.iap.cas.cn/gb/xwdt/kyjz/202307/t20230724_6815281.html

9. Simultaneous heatwaves hit northern hemisphere in summer of extremes

摘要：Intense heat is gripping large parts of the Northern hemisphere in this summer of extremes. New daily and station temperature records have been broken and it is possible that some national records may fall. The World Meteorological Organization will examine any potential new continental temperature records as the heatwave continues.June saw the warmest global average temperature on record, which continued into July, according to preliminary figures.“The extreme weather – an increasingly frequent occurrence in our warming climate – is having a major impact on human health, ecosystems, economies, agriculture, energy and water supplies. This underlines the increasing urgency of cutting greenhouse gas emissions as quickly and as deeply as possible,” said WMO Secretary-General Prof. Petteri Taalas.“In addition, we have to step up efforts to help society adapt to what is unfortunately becoming the new normal. The WMO community is providing forecasts and warnings to protect lives and livelihoods as we strive to achieve our goal of Early Warnings for All,” said Prof. Taalas.

来源：WMO

发布时间：2023-07-19

数据类型：资讯

https://public.wmo.int/en/media/news/simultaneous-heatwaves-hit-northern-hemisphere-summer-of-extremes

10. Heatwaves show importance of health early warnings and action plans

摘要：The World Meteorological Organization is stepping up efforts to strengthen heat-health early warnings and integrated action plans for heatwaves, which are amongst the deadliest natural hazards. Heat is a rapidly growing health risk, due to burgeoning urbanisation, an increase in high temperature extremes, and demographic changes in countries with ageing populations. Hundreds of thousands of people die from preventable heat-related causes each year.Global temperatures have been at unprecedented levels for several weeks. The extensive and intense heatwaves this year are alarming, but not surprising because unfortunately the conditions being observed are in accordance with

projections from the Intergovernmental Panel on Climate Change. The impacts on people, economies, and the natural and built environment are serious.A new study published last week, calculated last summer in Europe alone 60,000 additional people died due to extreme heat. Experts and governments consider this a conservative estimate. And it is worth noting, the figures are for Europe, which has some of the strongest early warning systems and heat-health action plans in the world," said Joy Shumake Guillemot, of the World Meteorological Organization/World Health Office joint office on Climate and Health.Current situationThere is currently a simultaneous heatwave phenomenon occuring, with temperatures in North America, parts of Asia, and across North Africa and the Mediterranean above 40°C for a prolonged number of days this week.

来源：WMO

发布时间：2023-07-18

数据类型：资讯

https://public.wmo.int/en/media/news/heatwaves-show-importance-of-health-early-warnings-and-action-plans

11. RSER: 新数据结合新方法提供太阳能资源新产品

摘要：碳中和目标背景下，中国未来将显著增加光伏等新能源在能源结构中的占比。太阳能资源评估是高效利用光伏资源的重要前提，迫切需要高时空分辨率太阳辐射数据。地面站点可提供长期且精度较高的观测数据，但站点分布稀疏，空间覆盖严重欠缺；再分析资料可提供时空覆盖完整的全球格点化数据，但时空分辨率较粗，精度较低，不能满足精细资源评估需求（Du et al., 2022）；搭载在新一代静止气象卫星的光谱成像仪显著提升了光谱、时间和空间分辨率，可反演获得公里/分钟级地表太阳辐射，为太阳能资源评估提供了新手段。新一代静止气象卫星风云四号的发射为我国太阳能资源评估和短临预报提供了新的契机，解决了日本葵花卫星 Himawari-8 和欧洲 Meteosat-9 在中国地区不完全覆盖问题和卫星观测边缘精度下降问题（图 1）。近日，中国科学院大气物理研究所施红蓉博士等联合哈尔滨工业大学能源科学与工程学院和中国气象局卫星气象中心合作者，利用风云四号 A 星（FY-4A）光谱成像仪数据，结合机器学习方法构建了中国地区高时空分辨率（4km/15min）地表太阳辐射数据集，进一步基于光伏模型链（图 2），获得了中国地区光伏有效辐射资源分布图（图 3），表明中国西北地区最大年有效辐射能超过 1700 kWh/m2。本研究工作表明新一代静止气象卫星在太阳能资源评估中的广阔应用前景，有望显著促进我国光伏太阳能能源发展和利用。上述研究成果收录在《Renewable and Sustainable Energy Reviews》，论文第一作者为中国科学院大气物

理研究所施红蓉博士，通讯作者为中国科学院大气物理研究所夏祥鳌博士和哈尔滨工业大学 Yang Dazhi 博士。该工作受大气物理研究所十四五基础科研新兴研究人工智能方向项目和国家自然科学基金重点项目（42030608）资助。相关文章信息：Shi H., Yang D.*, Wang W., Fu D., Gao L., Zhang J., Hu B., Shan Y., Zhang Y.

来源：大气物理所

发布时间：2023-07-18

数据类型：资讯

http://www.iap.cas.cn/gb/xwdt/kyjz/202307/t20230718_6812453.html

12. WMO is monitoring potential new temperature records

摘要：The World Meteorological Organization will examine any potential new temperature records as intense heatwaves grip the southern USA, Mediterranean, North Africa, Middle East and some countries in Asia, including China.National meteorological and hydrological services have reported a number of daily and station temperature records. Some countries may also break national temperature records. These will be reflected in WMO's State of the Global Climate report.WMO is the recognized authority for verifying extreme weather records. It maintains an official Archive of Weather and Climate Extremes. This includes records of temperatures (globally and per hemisphere), rainfall, aridity, lightning and weather-related mortality."If there are any new extreme temperature records during the ongoing heatwaves, we will issue a quick preliminary assessment and then start detailed evaluations as part of our painstaking verification process," said Prof. Randall Cerveny, WMO Weather and Climate Extremes Rapporteur."Climate change and temperature increase has spurred a surge in reports of record weather and climate extremes, especially for heat.

来源：WMO

发布时间：2023-07-17

数据类型：资讯

https://public.wmo.int/en/media/news/wmo-monitoring-potential-new-temperature-records

13. Urban vegetation and heatwave mitigation

摘要：Last weeks record-breaking temperatures spotlighted the dire consequences of extreme heatwaves, emphasizing the need to tackle their impacts more proactively.The Role of Vegetation in Urban CoolingIncorporating vegetation in various forms stands out as one of the paramount solutions to lessen the heat burden, particularly within urban

settings. Yet, as we see temperatures soar and experience prolonged dry periods, the cooling influence of vegetation becomes less pronounced.Beyond just providing shade, vegetations primary role in battling high temperatures lies in its capacity for evaporative cooling. This process involves the release of water vapor through the leaf stomata, which cools both the leaves and the surrounding air.Challenges of Urban VegetationThis cooling method hinges on the immediate replacement of water the canopy transpires with liquid water the root system pulls from the soil. When the soil-root system cant provide sufficient water, the plants internal water transport in the trunk and branches fails, preventing leaves from cooling themselves. Leaf temperatures exceeding 42 °C lead to irreversible damage in plant tissue for most species. And, even in instances where urban vegetation is meticulously managed and adequately watered, many urban trees dont have the needed root space to draw the necessary water from the soil.Introducing ENVI-met V5.

来源：ENVI

发布时间：2023-07-16

数据类型：资讯

https://www.envi-met.com/urban-vegetation-and-heatwave-mitigation-the-role-of-envi-met-v5-5/

14. Extreme heat, rainfall highlight need for more climate action

摘要：Intense heat is gripping large parts of the Northern hemisphere, whilst heavy precipitation has caused devastating floods and loss of life in several other regions. June saw the warmest global average temperature on record, which has continued into the first part of July according to preliminary figures.“The extreme weather – an increasingly frequent occurrence in our warming climate – is having a major impact on human health, ecosystems, economies, agriculture, energy and water supplies. This underlines the increasing urgency of cutting greenhouse gas emissions as quickly and as deeply as possible,” said WMO Secretary-General Prof. Petteri Taalas.“In addition, we have to step up efforts to help society adapt to what is unfortunately becoming the new normal. The WMO community is providing forecasts and warnings to protect lives and livelihoods as we strive to achieve our goal of Early Warnings for All,” said Prof. Taalas.HeatwavesHeatwaves are amongst the deadliest natural hazards with thousands of people dying from heat-related causes each year.Above-normal temperatures are forecast in the Mediterranean region at least during next two weeks, with weekly temperatures up to 5° Celsius above the long-term average, according to the Climate Monitoring node of

the WMO's Regional Climate Centre for Europe, operated by the Deutscher Wetterdienst (DWD), the German Weather Service.

来源：WMO

发布时间：2023-07-13

数据类型：资讯

https://public.wmo.int/en/media/news/extreme-heat-rainfall-highlight-need-more-climate-action

15. Mitigating Heat Risks with Outdoor Thermal Comfort Analysis

摘要：Heatwaves pose significant threats beyond just crops or forests; human health is at serious risk. A recent study published in Nature Medicine on 10 July underscored this peril, estimating a staggering 61,672 heat-related deaths in Europe from 30 May to 4 September 2022. Germany alone reported 8,173 of these unfortunate fatalities. A simulation of the nighttime air temperature in Vienna at 22:00 during a summer evening clearly illustrated the disparity in temperatures between the cooling breeze from the Donau river and the stifling heat of the citys dense areas.So, why is it essential to analyze and simulate architectural drafts or urban planning concepts before they come to fruition? There are multiple reasons: Promoting Human Comfort and Well-being: Understanding outdoor thermal comfort aids architects and urban planners in designing cities and public spaces conducive to human comfort. By evaluating solar radiation, wind patterns, and shading, they can craft environments that temper extreme heat, offering a more pleasant experience for pedestrians and residents. Mitigating the Urban Heat Island Effect: Urban regions frequently exhibit this phenomenon where temperatures soar much higher than in surrounding rural zones. Causes include dense buildings, asphalt surfaces, and diminished vegetation. Recognizing areas of high thermal discomfort can guide city planners in adopting measures like urban greening, using reflective surfaces, or introducing shade structures. Adapting to Rising Global Temperatures: With the mounting threat of heatwaves due to global warming, its imperative to comprehend heat stress risks and evolve with adaptive strategies.

来源：ENVI

发布时间：2023-07-10

数据类型：资讯

https://www.envi-met.com/mitigating-heat-risks-with-outdoor-thermal-comfort-analysis/

16. AOSL: 中国区域极端湿热事件及其影响在加剧

摘要：气候变暖的加剧使得极端热应激严重程度在加强。近日，Atmospheric and Oceanic Science Letters 在线发表了中国科学院大气物理研究所陈活泼研究员与何文悦博士生的题为“More extreme-heat occurrences related to humidity in China” 的研究论文。文章基于 ERA5 逐小时资料，揭示了中国区域极端日夜复合湿热和高温事件的变化及其影响。高温天气易使环境温度超过暴露人群的耐热极限，这不仅会影响人们的正常生产生活，还会增加人体的发病率和死亡率。例如，2003 年欧洲经历了有记录以来最炎热并伴随着严重干旱的夏季，多国日间最高气温超过 40℃，导致 7 万人死亡；2010 年俄罗斯罕见的“超级热浪”引发森林野火和干旱，造成大量人员伤亡，并至少导致 150 亿美元经济损失。我国近年来也频繁遭受严重极端高温天气的影响，比如 2013 年夏天的长江流域极端高温热浪事件，为 1961 年来持续时间最长、影响范围最广，造成了约 590 亿元人民币（约 90 亿美元）的直接经济损失，影响了超 5 亿人的生活。随着全球变暖，湿度的增加使得某些高温热浪事件的强度在增强。在炎热的环境中，蒸发被认为是人体降温的主要手段，而大气湿度是影响蒸发效率的关键因素。人体的正常温度约为 36.5℃，且在±1℃非常窄的范围内波动。如果在湿度较高的水平下体温超过这个阈值，人体将无法通过蒸发有效散热，从而加剧与高温有关的热不适。

来源：大气物理所

发布时间：2023-07-07

数据类型：资讯

http://www.iap.cas.cn/gb/xwdt/kyjz/202307/t20230707_6807281.html

17. GRL:用于风暴事件短临预报的多尺度深度学习框架

摘要：降水短临预报特别是对极端降水事件的预报至关重要。传统短临预报主要基于风暴识别追踪或者流场外推，但是这些方法通常存在模型过于简单导致准确率快速下降的问题。深度学习（DL）的最新进展显示出提高预报精度和预测低强度降水事件的潜力。然而，这些深度学习模型通常难以满足对极端天气如风暴事件或者强对流的预报，并且存在预报的雨区和真实的雨区不一致的情况。为了应对这些挑战，本研究尝试将气象中的一些关键特征和先验知识引入深度学习模型中。针对风暴的复杂多尺度时空变化提取和表征不足的问题，我们提出了一种新的多尺度（CM）深度学习框架，包括捕捉尺度变化的灵活注意力模块和确保多尺度时空一致性的定制损失函数（见图 1）。CM 框架被应用于风暴事件数据集（SEVIR）。代表性的案例表明，CM 框架保留了风暴的空间特征，并充分预测了强烈的风暴，即

使是更长的预测。定量评估表明，应用我们的框架的所有模型都可以将 1 小时短临预报的技巧评分提高 8.5%至 42.6%。这个框架证明了在使用 DL 时对气象变量的多尺度时空特征进行建模的重要性。

来源：南京大学

发布时间：2023-07-04

数据类型：资讯

https://as.nju.edu.cn/a5/fc/c11323a632316/page.htm

❖专题研究

✧城市边界层

本监测周期内，文献信息共更新 4 条：

Superimposed effects of typical local circulations driven by mountainous topography and aerosol–radiation interaction on heavy haze in the Beijing–Tianjin–Hebei central and southern plains in winter

摘要：Although China's air quality has substantially improved in recent years due to the vigorous emissions reduction, the Beijing–Tianjin–Hebei (BTH) region, especially its central and southern plains at the eastern foot of the Taihang Mountains, has been the most polluted area in China, with persistent and severe haze in winter. Combining meteorology–chemistry coupled model simulations and multiple observations, this study explored the causes of several heavy haze events in this area in January 2017, focusing on local circulations related to mountain terrain. The study results showed that on the weather scale, the configuration of the upper, middle, and lower atmosphere provided favorable weather and water vapor transport conditions for the development of haze pollution. Under the weak weather-scale systems, local circulation played a dominant role in the regional distribution and extreme values of PM2.5. Influenced by the Taihang and Yanshan mountains, vertical circulations and wind convergence zone were formed between the plain and mountain slopes. The vertical distribution of pollutants strongly depended on the intensity and location of the circulation. The circulation with high intensity and low altitude was more unfavorable for the vertical and horizontal diffusion of near-surface pollutants. More importantly, we found that the aerosol–radiation interaction (ARI) significantly amplified the impacts of local vertical circulations on heavy haze by two mechanisms. First,

the ARI strengthened the vertical circulations at the lower levels, with the zonal wind speeds increasing by 0.3–0.8 m s−1. Meanwhile, the ARI could cause a substantial downward shift in the vertical circulations (~ 100 m). Second, the ARI weakened the horizontal diffusion of pollutants by reducing the westerly winds and enhancing wind convergence and southerly winds. Under these two mechanisms, pollutants could only recirculate in a limited space. This superposition of the typical local circulation and the ARI eventually contributed to the accumulation of pollutants and the consequent deterioration of haze pollution in the region.

来源：ACP

发布时间：2023-07-25

数据类型：期刊

https://acp.copernicus.org/articles/23/8325/2023/

Wind-Tunnel Experiments of Turbulent Wind Fields over a Two-dimensional (2D) Steep Hill: Effects of the Stable Boundary Layer

摘要：Flow separation caused by steep topography remains a significant obstacle in accurately predicting turbulent boundary-layer flows over complex terrain, despite the utilization of sophisticated numerical models. The addition of atmospheric thermal stability, in conjunction with steep topography, further complicates the determination of disrupted turbulent wind patterns. The turbulent separated flows over a two-dimensional (2D) steep hill under thermal stratification has not been extensively addressed in previous experimental studies. Such measurements are crucial for enhancing our comprehension of flow physics and validating numerical models. We measured the turbulent wind flows over a 2D steep hill immersed in a stable boundary layer (of the bulk Richardson Number \(\textrm{Ri}_b\) = 0.256) in a thermally-stratified boundary-layer wind tunnel. The flow separation, re-circulation zone and flow reattachment were characterized by the planar particle image velocimetry technique. Vertical profiles of mean air temperature and its fluctuations are also quantified at representative locations above the 2D steep hill and in the near wake region. Results indicate that the separated shear layer, initiated near the crest of the 2D steep hill, dominates the physical process leading to high turbulence levels and the turbulent kinetic energy production in the wake region for both stable and neutral thermal stability. Although the stable boundary layer does not dramatically change the turbule

来源：Springer

发布时间：2023-07-13

数据类型：期刊

https://link.springer.com/article/10.1007/s10546-023-00820-2

Changes in atmospheric circulation and evapotranspiration are reducing rainfall in the Brazilian Cerrado

摘要：Here we analyze the trends of rainfall and the frequency of rainy days over the Brazilian Cerrado between 1960 and 2021 in four distinct periods according to the seasonal patterns over the region. We also evaluated trends in evapotranspiration, atmospheric pressure, winds, and atmospheric humidity over the Cerrado to elucidate the possible reasons for the detected trends. We recorded a significant reduction in rainfall and frequency of rainy days in the northern and central Cerrado regions for all periods except at the beginning of the dry season. The most pronounced negative trends were recorded during the dry season and the beginning of the wet season, where we recorded reductions of up to 50% in total rainfall and the number of rainy days. These findings are associated with the intensification of the South Atlantic Subtropical Anticyclone, which has been shifting atmospheric circulation and raising regional subsidence. Moreover, during the dry season and the beginning of the wet season, there was a reduction in regional evapotranspiration, which also potentially contributed to the rainfall reduction. Our results suggest an expansion and intensification of the dry season in the region, potentially bringing broad environmental and social impacts that transcend the Cerrado boundaries.

来源：Nature

发布时间：2023-07-11

数据类型：期刊

https://www.nature.com/articles/s41598-023-38174-x

An approach to refining the ground meteorological observation stations for improving PM2.5 forecasts in the Beijing–Tianjin–Hebei region

摘要：This paper investigates how to refine the ground meteorological observation network to greatly improve the PM2.5 concentration forecasts by identifying sensitive areas for targeted observations that are associated with a total of 48 forecasts in eight heavy haze events during the years of 2016–2018 over the Beijing–Tianjin–Hebei (BTH) region. The conditional nonlinear optimal perturbation (CNOP) method is adopted to determine the sensitive area of the surface meteorological fields for each forecast, and a total of 48

CNOP-type errors are obtained including wind, temperature, and water vapor mixing ratio components. It is found that, although all the sensitive areas tend to locate within and/or around the BTH region, their specific distributions are dependent on the events and the start times of the forecasts. Based on these sensitive areas, the current ground meteorological stations within and around the BTH region are refined to form a cost-effective observation network, which makes the relevant PM2.5 forecasts starting from different initial times for varying events assimilate fewer observations, but overall, it achieve the forecasting skill comparable to and even higher than that obtained by assimilating all ground station observations. This network sheds light on the idea that some of the current ground stations within and around the BTH region are very useless for improving the PM2.5 forecasts in the BTH region and can be greatly scattered to avoid unnecessary work.

来源：GMD

发布时间：2023-07-11

数据类型：期刊

https://gmd.copernicus.org/articles/16/3827/2023/

✧城市气象精细预报

本监测周期内，文献信息共更新 8 条：

Implementation and application of ensemble optimal interpolation on an operational chemistry weather model for improving PM2.5 and visibility predictions

摘要：Data assimilation techniques are one of the most important ways to reduce the uncertainty in atmospheric chemistry model input and improve the model forecast accuracy. In this paper, an ensemble optimal interpolation assimilation (EnOI) system for a regional online chemical weather numerical forecasting system (GRAPES_Meso5.1/CUACE) is developed for operational use and efficient updating of the initial fields of chemical components. A heavy haze episode in eastern China was selected, and the key factors affecting EnOI, such as localization length scale, ensemble size, and assimilation moment, were calibrated by sensitivity experiments. The impacts of assimilating ground-based PM2.5 observations on the model chemical initial field PM2.5 and visibility forecasts were investigated. The results show that assimilation of PM2.5 reduces the uncertainty in the

initial PM2.5 field considerably. Using only 50 % of observations in the assimilation, the root mean square error (RMSE) of initial PM2.5 for independent verification sites in mainland China decreases from 73.7 to 46.4 μg m−3, and the correlation coefficient increases from 0.58 to 0.84. An even larger improvement appears in northern China. For the forecast fields, assimilation of PM2.5 improves PM2.5 and visibility forecasts throughout the time window of 24 h. The PM2.5 RMSE can be reduced by 10 %–21 % within 24 h, and the assimilation effect is the most remarkable in the first 12 h. Within the same assimilation time, the assimilation efficiency varies with the discrepancy between model forecasts and observations at the moment of assimilation, and the larger the deviation, the higher the efficiency. The assimilation of PM2.5 further contributes to the improvement of the visibility forecast. When the PM2.5 increment is negative, it corresponds to an increase in visibility, and when the PM2.5 analysis increment is positive, visibility decreases. It is worth noting that the improvement of visibility forecasting by assimilating PM2.5 is more obvious in the light-pollution period than in the heavy-pollution period. The results of this study show that EnOI may provide a practical and cost-effective alternative to the ensemble Kalman filter (EnKF) for the applications where computational cost is the main limiting factor, especially for real-time operational forecast.

来源：GMD

发布时间：2023-07-25

数据类型：期刊

https://gmd.copernicus.org/articles/16/4171/2023/

2022 年我国夏季极端高温阶段性特征及成因

摘要：利用常规观测和自动气象站加密观测资料以及 ERA5 再分析资料分析 2022 年夏季我国大范围极端高温阶段性特征及其热动力成因，结果表明：此次极端高温存在两个不同阶段：6 月高温区集中在华北黄淮地区，7—8 月高温区位于四川盆地—长江中下游地区；两个阶段极端高温均发生在异常环流背景条件下，对流层上层为显著偏强的南亚高压控制区，其主导系统分别为 500 hPa 强烈发展的华北高压脊和异常强盛的副热带高压坝；Rossby 波能量自上游向华北地区持续频散和瞬变天气扰动偏弱是华北高压脊增强和维持的主要成因，西北太平洋副热带高压南侧的大气热源增强、赤道附近热带辐合区异常偏强的上升气流在 30°N 副热带高压脊线附近下沉，有利于西北太平洋副热带高压的西伸加强且稳定维持。对流层低层强烈暖平流和边界层非绝热加热是华北黄淮地区高温形成的主要影响因子，高温的

维持主要依靠异常强烈的非绝热加热；四川盆地—长江中下游地区高温的形成受深厚对流层内异常下沉增温和边界层内非绝热加热共同影响，高温长时间维持的影响因子除非绝热加热外，极端强盛的南亚高压控制区内异常绝热加热项（下沉增温）的贡献亦不可忽视。关键词:极端高温;华北高压脊;Rossby 波能量;大气热源;非绝热加热。

来源：应用气象学报

发布时间：2023-07-24

数据类型：期刊

http://qikan.camscma.cn/cn/article/doi/10.11898/1001-7313.20230401

南海雷暴大风时空分布及闪电和对流活动特征

摘要：利用 2019—2020 年风云四号气象卫星 A 星（FY-4A）多通道扫描成像辐射计（AGRI）提供的云顶数据和地基全球闪电定位网（WWLLN）提供的闪电数据，结合 MICAPS 气象观测站和海洋浮标记录的极大风数据，研究南海区域（5°~30°N，105°~125°E）71 次雷暴大风过程的时空分布及其闪电和对流活动特征。结果表明：观测站记录的雷暴大风主要分布在南海北部；雷暴大风主要发生在 5—9 月，峰值出现在 8 月，3 月发生次数最少；雷暴大风主要发生在 07：00—12：00（北京时，下同），10：00 频次最高，午后频次减少。雷暴大风闪电密度的极大值分布在广东南部近海区域，且闪电集中发生在距离观测站 40～80 km 半径范围内；孤立雷暴大风过程首次闪电跃变的发生时刻相对大风峰值时刻超前 30 min 至 2 min。在对流特征方面，在雷暴大风风速峰值时刻，观测站处的云顶亮温为 200～220 K，云顶高度为 12.5～15 km。孤立雷暴大风云团云顶亮温最低值（即最强对流发生位置）与大风观测站点的距离平均为 77.2 km，云顶亮温平均相差 2.6 K。关键词:闪电;雷暴大风;对流;南海。

来源：应用气象学报

发布时间：2023-07-24

数据类型：期刊

http://qikan.camscma.cn/cn/article/doi/10.11898/1001-7313.20230410

黄淮地区副高边缘型降水数值预报精细化检验

摘要：以 2020—2021 年 5—10 月副高边缘型明显降水过程作为研究对象，针对黄淮地区太行山南麓、伏牛山东麓、东部平原 3 个典型区域，采用多种检验方法对 CMA-MESO，CMA-SH9 两模式降水日变化预报性能进行评估。结果表明：在

山区，CMA-MESO 预报有效降水时次占比与降水强度均偏小，CMA-SH9 则相反，两模式分别在伏牛山东麓的 04：00—10：00（北京时，下同）和太行山南麓的 10：00—16：00 预报有效降水时次占比偏小（大）更为显著；在平原，CMA-MESO 对 03：00—07：00 和 17：00—20：00 有效降水时次占比显著低估，CMA-SH9 对于 17：00—20：00 降水量的高估则主要来源于降水强度预报明显偏大。FSS（fractional skill score）评分结果显示：CMA-MESO 对于伏牛山东麓 15：00—17：00 及 21：00—22：00、东部平原 02：00—04：00 等时段 10 mm·h-1 以上降水预报能力优于 CMA-SH9，在太行山南麓 17：00—23：00 则相反。基于 STFSS （spatial temporal fractional skill score）评分的评估表明：CMA-SH9 对于太行山南麓前一日 14：00—当日 02：00 的降水预报较实况显著偏晚，CMA-MESO 对于伏牛山东麓 02：00—08：00 及平原地区 08：00—14：00 的降水预报均表现出较实况偏早的特征。
关键词:副热带高压;复杂地形;降水日变化;时空邻域

来源：应用气象学报

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雨滴谱分布参数化对改进新疆强降水过程预报的评估

摘要：本文利用 2018 年 7 月 3 日至 10 月 3 日新疆乌鲁木齐的雨滴谱观测资料，改进了乌鲁木齐区域高分辨率数值预报系统中 WRF 模式的 WSM6 单参数方案，对新疆 2021 年 6 月 15 日 12 时（北京时，下同）至 17 日 00 时一次强降水过程的预报改进效果进行评估研究。结果表明：观测显示，乌鲁木齐地区雨滴平均直径（D0）、最大直径（Dmax）和质量加权平均直径（Dm）分别为 0.65 mm、1.60 mm 和 0.93 mm。引入新疆地区参数 lgNw 和 Dm 拟合关系的 WSM6-new 方案对降水强度和强中心范围的预报能力均有一定提高。从 TS、BR、ETS 和 TSS 四个指标的评分结果上看，随着降雨等级的增加，WSM6-new 方案预报能力相比 WSM6 方案明显提高，对于大雨和暴雨的预报显示出明显的优势。不同雨滴谱分布参数化方案对降水云系结构特征、垂直速度、大气层结和散度场都有着一定的影响，对于云微物理过程的影响主要体现在雨水含量和分布上。WSM6-new 方案引入了新疆雨滴谱统计特征，在模式中对雨滴谱分布的描述更接近实际。雨滴谱的大雨滴数浓度明显增加，雨滴下落末速度增加，拖曳作用增强，有利于零度层以下的下沉气流增强和维持。强下沉气流在近地层形成更强的辐散出流，加强了近地面对流区气流的辐合，有利于上

升气流的发展加强，从而地面产生更强的降水，对暴雨的预报能力明显增强。关键词:新疆/WRF 模拟/WSM6 参数化方案/暴雨/雨滴谱/降水预报评估

来源：大气科学

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中南半岛和华南地区极端降水时空特征

摘要：全球变暖使得极端降水事件的强度和频率均呈上升趋势，位于亚洲季风区的中南半岛和华南地区更易受到极端降水影响而发生洪涝灾害。本文利用逐日降水资料对 1951～2015 年中南半岛和华南地区湿季（5～10 月）的极端降水事件进行客观分类，并对每一类极端降水事件的大尺度流型特征及年际、年代际和长期趋势特征进行了分析。结果表明：（1）根据降水中心位置，中南半岛和华南地区的极端降水可客观分为华南类、中南半岛类、缅甸—云南类和华南南部—越南北部类，它们所联系的大尺度流型以中高纬波列和热带偶极子环流为主。其中，华南类的大尺度流型在对流层高层为类似于东亚—太平洋（East Asia–Pacific，简称 EAP）遥相关型的“+－+”经向型波列，但中心位置较典型 EAP 型偏西南，中东部的负异常环流为关键系统，低层为位于低纬度地区的“+－”经向型波列。中南半岛类大尺度流型为热带偶极子异常环流，对流层低层较高层更为显著宽广。其余两类极端降水大尺度流型特征为在对流层高层受 Rossby 波列影响，低层主要为偏弱的热带偶极子异常环流。（2）中南半岛和华南地区极端降水的频次呈显著上升的趋势，主要来自于华南类和中南半岛类极端降水的贡献。其中，“+－+”经向型波列的频发是造成华南类极端降水增多的原因。（3）中南半岛与华南地区极端降水的空间分布具有反对称特征。关键词:中南半岛/华南/极端降水/大尺度流型/东亚—太平洋遥相关型

“21·7”河南特大暴雨的中尺度系统活动特征

摘要：2021 年 7 月 17 日至 22 日河南省遭遇了罕见特大暴雨过程，特别是郑州市在 7 月 20 日出现了极端降水事件。本文首先分析了有利的大尺度环流背景，然后采用多源高分辨率观测和再分析资料深入分析了此次特大暴雨过程中不同阶段的水汽来源以及中尺度系统的活动特征。此次特大暴雨过程主要分为三个阶段，其主要的中尺度系统包括：黄淮气旋、中尺度对流系统（MCS）以及与 MCS 伴随的中

尺度对流涡旋（MCV）。第一阶段（7 月 17～18 日）主要为分散性降雨，水汽主要来自于南海、东南沿海、西北太平洋、长江中游地区的近距离水汽输送和河套地区。影响河南地区的中尺度系统为黄淮气旋，其于 7 月 15 日 11 时（协调世界时，下同）生成河南的东北部，18 日 23 时在河南西南部消亡，垂直伸展最大高度为 1000～350 hPa，维持时间约为 89 小时。第二阶段（7 月 19～20 日），随着西太平洋副热带高压的北抬和台风“烟花”的西进北移发展，西北太平洋的水汽贡献也逐渐增多。由于黄淮气旋中心移动到河南西南部，其北部东南气流影响河南大部分地区。二级地形（伏牛山）东部的局地对流发展为 MCS。由于地形的抬升作用，对流系统中强上升运动的维持有利于低层气旋性切变的增强，从而诱发了对流层中低层（750～600 hPa）MCV 的生成。MCV 的增强发展又进一步促进了 MCS 的维持以及偏南气流的增强。偏南气流输送大量水汽有利于午后分散性强对流单体的生成，分散对流单体与原有河南中北部 MCS 的合并后增强发展，从而造成了郑州极端小时降雨的出现。第三阶段（7 月 21～22 日），暴雨过程的水汽主要来自于西北太平洋地区，其主要影响系统是 MCS。低层气流受到二级地形（太行山）的阻挡，地形东部边界强的水汽通量辐合有利于 MCS 不断与新生对流单体合并发展，从而在河南、河北交界区域产生较强的降雨中心。关键词:特大暴雨/中尺度对流涡旋/黄淮气旋/中尺度对流系统来源：大气科学

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An approach to refining the ground meteorological observation stations for improving PM2.5 forecasts in the Beijing–Tianjin–Hebei region

摘要：This paper investigates how to refine the ground meteorological observation network to greatly improve the PM2.5 concentration forecasts by identifying sensitive areas for targeted observations that are associated with a total of 48 forecasts in eight heavy haze events during the years of 2016–2018 over the Beijing–Tianjin–Hebei (BTH) region. The conditional nonlinear optimal perturbation (CNOP) method is adopted to determine the sensitive area of the surface meteorological fields for each forecast, and a total of 48 CNOP-type errors are obtained including wind, temperature, and water vapor mixing ratio components. It is found that, although all the sensitive areas tend to locate within and/or

around the BTH region, their specific distributions are dependent on the events and the start times of the forecasts. Based on these sensitive areas, the current ground meteorological stations within and around the BTH region are refined to form a cost-effective observation network, which makes the relevant PM2.5 forecasts starting from different initial times for varying events assimilate fewer observations, but overall, it achieve the forecasting skill comparable to and even higher than that obtained by assimilating all ground station observations. This network sheds light on the idea that some of the current ground stations within and around the BTH region are very useless for improving the PM2.5 forecasts in the BTH region and can be greatly scattered to avoid unnecessary work.

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✧城市气候与生态

本监测周期内，文献信息共更新 1 条：

Characterization of precipitation and temperature equilibrium and its driving forces in the Yangtze river basin under climate change

摘要：Global warming has severely affected the climate in the Yangtze River Basin (YRB), resulting in complex and varying meteorological and hydrological processes. Therefore, identifying the effects of climate change in the YRB is important for characterizing the affected meteorological and hydrological processes. In this study, the characteristics of climate equilibrium were analyzed and the natural drivers of climate change in the YRB were explored using precipitation and temperature data from 1961 to 2018. The major findings can be summarized as follows. (1) Significant spatial and temporal differences in precipitation and temperature occurred. For example, annual precipitation showed a decreasing trend in the middle reaches but a significant increasing trend in the headwaters area and lower reaches. Between 1981 and 2001, annual precipitation and temperature exhibited overall increasing trends as well as abrupt changes. (2) Temporal changes in precipitation were primarily low in the middle and lower reaches and high in the headwater region of the YRB, although a low precipitation concentration degree (CD) occurred in summer in the upper reaches. High temperature changes over time

mainly occurred in the headwater region of the YRB, although a high temperature CD occurred in winter in the northern parts. (3) Different teleconnection indices affected precipitation and temperature in different seasons. In particular, the Niño 3.4, North Atlantic Oscillation, and North Pacific Inde

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