城市气象科技信息监测简报

2023 年 6 月 （总第 24 期）

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 7 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。

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✧监测周期：

2023 年 06 月 01 日 - 2023 年 06 月 30 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 13 条

1. More support to implement the Early Warnings for All initiative

摘要：The Systematic Observations Financing Facility (SOFF) steering committee met on 20-21 June 2023 in Copenhagen. The adopted decisions respond to the ambition of the UN Secretary-General's Early Warnings for All Initiative. Funding for 10 additional countries with significant weather and climate data gaps are receiving SOFF support, and 22 countries were given the green light to start working on funding requests to close the countries' basic data gaps. More than 60 countries will be receiving SOFF support in 2023, including all initial countries for fast-track implementation of the UN Secretary-General's Early Warnings for All Initiative. Important strategic decisions were taken, including on SOFF's collaboration with the Green Climate Fund, Climate Investment Funds, Adaptation Fund, Global Environment Facility and the Climate Risk and Early Warning Systems initiative (CREWS)Belgium announced a EUR 6.68 million contribution to SOFF and becomes the 11th contributor to the SOFF UN fund that opened its doors for business in July 2022.The countries represent areas of high priority to close the weather and climate data gaps for better weather forecasts and climate projections. These countries will receive technical and financial support to build human capacity, install the needed infrastructure to collect and share data, as well as to sustain operation and maintenance. Where infrastructure is already existing, SOFF will provide support to improve and rehabilitate. Global data sharing is what matters for weather forecasting and climate prediction models and will contribute to improving climate services, including early warning systems across the globe.

来源：WMO

发布时间：2023-06-23

数据类型：资讯

https://public.wmo.int/en/media/news/more-support-implement-early-warnings-all-initiative

2. Improved hydrometeorological services in East Africa will support Early Warnings for All

摘要：The World Meteorological Organization is supporting a new regional project to strengthen hydro-meteorological services and early warnings in six countries in East Africa and around Lake Victoria to build resilience and support climate change adaptation.More than 60 representatives from the National Meteorological and Hydrological Services (NMHSs) and National Disaster Management Offices of Burundi, Kenya, Rwanda, South Sudan, Tanzania and Uganda met in Kigali, Rwanda, on 12 June to launch the US$7 million Climate Risk and Early Warning Systems Initiative (CREWS) East Africa project.The project is jointly implemented by WMO, the UN Office for Disaster Risk Reduction and the World Bank. It will scale up Early Warning Services (EWS) for Early and Anticipatory Actions (EWS-EAA) by building capacities of countries and regional institutions towards impact-based, people-centred weather predictions and warnings, specific to national and local context.“In the face of increasing climate uncertainty, the importance of Early Warning Systems cannot be overstated. They are the cornerstone of our preparedness and response efforts … in protecting lives, safeguarding livelihoods, and building resilient communities across Africa,” said the UN Resident Coordinator for Rwanda, Dr Ozonnia Ojielo.“The CREWS project aligns with and supports the ambition of the global Early Warning for All (EW4All) initiative announced by the UN Secretary General at COP27. We are glad that, in Africa, 13 countries have been chosen to pilot this initiative. EW4All envisions a world where every person, starting with the most vulnerable, has access to timely and accurate early warnings by 2027. This will require strengthening of national systems and capacities to deliver early warning services.

来源：WMO

发布时间：2023-06-20

数据类型：资讯

https://public.wmo.int/en/media/news/improved-hydrometeorological-services-east-africa-will-support-early-warnings-all

3. Climate change impacts scar Europe, but increase in renewables signals hope for future

摘要：Dublin, 19 June 2023 _ Climate change is taking a major human, economic and environmental toll in Europe, the fastest warming continent of the world. The year 2022 was marked by extreme heat, drought and wildfires. Sea surface temperatures around Europe reached new highs, accompanied by marine heatwaves. Glacier melt was unprecedented.The State of the Climate in Europe 2022 report, the second in an annual series, was produced jointly by the World Meteorological Organization and the European Union's Copernicus Climate Change Service.It shows how Europe has been warming twice as much as the global average since the 1980s, with far-reaching impacts on the region's socio-economic fabric and ecosystems. In 2022, Europe was approximately 2.3 °C above the pre-industrial (1850-1900) average used as a baseline for the Paris Agreement on climate change.But, in a sign of hope for the future, renewable energy generated more electricity than polluting fossil gas for the first time last year. Wind and solar power generated 22.

来源：WMO

发布时间：2023-06-19

数据类型：资讯

https://public.wmo.int/en/media/press-release/climate-change-impacts-scar-europe-increase-renewables-signals-hope-future

4. City dwellers will face more extreme precipitation in the future

摘要：A 2020 rainstorm in New York City. New research indicates urban areas will experience more extreme precipitation in the future. (Photo by Tony Hisgett via Wikipedia Commons.) As city populations increase worldwide, meteorologists are raising concerns about the potential for urban areas to experience heavier rainfall and flooding risks in the future.Decades of research has demonstrated that climate change can increase the intensity of precipitation events because a warmer atmosphere can hold more water. Research has also shown that major cities can create their own microclimates, influencing the local atmosphere in ways that can both magnify or suppress precipitation. For scientists, a pressing question is how the combination of warming temperatures and growing urbanization will affect the risk of extreme precipitation in major cities. This is an increasingly consequential issue for society, since more than two-thirds of the world's

population is projected to live in urban areas by 2050, up from about 55% today.A pair of papers co-authored by scientist Fei Chen at the National Center for Atmospheric Research (NCAR) and published over the last year indicates that urban inhabitants may indeed be in harm's way for more extreme hourly precipitation. Moreover, cities in the midlatitudes appear to be at especially high risk.

来源：NCAR

发布时间：2023-06-16

数据类型：资讯

https://news.ucar.edu/132901/city-dwellers-will-face-more-extreme-precipitation-future

5. 郭维栋和邱博团队研究揭示不同陆地生态系统对极端降水的响应差异

摘要：2020 年 6-7 月长江中下游地区经历了"超级暴力梅"事件，多地累积降水量与梅雨季持续时间均打破了自 1961 年以来的观测记录，对社会经济和生命财产安全造成了严重的损失。郭维栋教授和邱博副教授团队利用植被遥感数据和大气再分析资料研究了此次"超级暴力梅"事件对陆地生态系统的影响。研究发现，不同陆地生态系统的光合作用对于极端降水的响应具有很强的空间异质性：极端降水对人为管理的农作物光合作用的抑制效应显著高于自然植被，这是由前者的高脆弱性（例如，相对简单的冠层结构使得其对阴雨天散射光利用效率较自然植被更低，以及相对较浅的根系分布导致更易发生根系缺氧、溃烂等从而抑制植被生理活动等）造成的；同时，由于农作物主要分布在低海拔平原地区，低洼平坦的地形导致雨水更易在此积聚，增加了农作物的暴露度，从而加剧了极端降水对农作物生长的影响。此外，鉴于在全球变暖的趋势下我国长江中下游地区极端洪涝事件发生的频率和强度都可能呈现增加的趋势，本研究预示该地区作为我国粮食主产区之一，其农作物面临着更大的气候变化风险，并有可能对该地区的粮食安全产生潜在的重要影响。

来源：南京大学

发布时间：2023-06-16

数据类型：资讯

https://as.nju.edu.cn/99/85/c11323a629125/page.htm

6. Climate Risk and Early Warning Systems initiative helped protect 111 million people in 2022

摘要：An estimated 111 million people are better protected against climate-related hazards thanks to early warning systems put into place in 2022 by the Climate Risk Early Warning Systems (CREWS) Initiative.An additional 282 million people in least Developed Countries and Small Island Developing States should be covered by better weather and climate services in the next few years, according to the CREWS 2022 Annual Report.The annual report entitled “Delivering early warning for everyone,” maps how the initiative helps saves lives, livelihoods and assets in the world’s most vulnerable countries by building resilience against hazards like drought, floods, sand and dust storms and coastal flooding.CREWS is a key contributor to the international Early Warnings for All initiative spearheaded by UN Secretary-General, Antonio Guterres, who wants the whole world to be covered by an early warning system by 2027.“The CREWS initiative is key to the success of Early Warnings for All because it embodies a people-centred approach that prioritizes community engagement and helps transform and enhance meteorological and warning services, human capacities, and last mile action. WMO is committed to increasing resilience and climate adaptation through CREWS and to improving global basic weather and climate information through the Systematic Observations Financing Facility (SOFF),” said Prof. Petteri Taalas, Secretary-General of the World Meteorological Organization, which is an implementing partner of CREWS.Early warning systems are a proven way to protect lives and livelihoods in the face of climate hazards, which are responsible for 90% of extreme events, and are increasing as a direct result of climate change.“CREWS’ work with LDCs and SIDS to build more inclusive and multi-hazard early warning systems has never been more valuable in light of the goal set by EW4All”, said Mami Mizutori, Special Representative of the UN Secretary-General for Disaster Risk Reduction and Head of UNDRR, one of the implementing partners of CREWS.People-centredSince its inception in 2015, the CREWS Trust Fund has received US$ 105.

来源：WMO

发布时间：2023-06-14

数据类型：资讯

https://public.wmo.int/en/media/news/climate-risk-and-early-warning-systems-initiative-helped-protect-111-million-people-2022

7. ACP: 数据同化揭示新冠疫情爆发初期中国不同大气污染物排放的变化特征

摘要：2020 年新冠疫情爆发初期，为了抑制新型冠状病毒的传播，我国采取了限制交通出行、延长春节假期、关闭学校和娱乐场所等社交隔离措施，降低了城市人为活动水平，对大气污染排放和空气质量也产生了重要影响。目前关于新冠疫情对我国污染物排放影响仍存在较大争议，有研究认为疫情防控措施对不同行业、不同污染物的排放均有显著削减作用，也有研究认为仅仅影响交通源和轻工业排放。近日，我所正高级工程师唐晓课题组在《Atmospheric Chemistry and Physics》上发表论文，该研究依托地球系统数值模拟装置，利用自主研发的大气化学数据同化系统（ChemDAS）和区域高精度大气污染模式，同化融合全国国控站点的近地面污染物监测数据，实现了新冠疫情爆发初期（2020 年 1 月 1 日~2 月 29 日）全国多污染物排放量的高时频协同反演，获得了氮氧化物（NOx）、二氧化硫（SO2）、一氧化碳（CO）、细颗粒物（PM2.5）、粗颗粒物（PM10）排放的日分辨率反演数据。反演结果显示，新冠疫情爆发初期的社交隔离措施对不同污染物排放的影响具有显著差异，其中氮氧化物排放呈现出与其它污染物不同的排放变化特征，其排放量在采取疫情防控措施后整体下降 42.5%，二氧化硫、一氧化碳、细颗粒物和粗颗粒物排放量下降比例则仅有 7.9%~12.1%。分析表明，与以往大气重污染应急与重大活动保障采用的多行业减排措施不同，新冠疫情初期采取的社交隔离措施的主要影响是使得交通源活动强度下降至近零水平，从而导致氮氧化物和挥发性有机物（本文未具体讨论）排放量大幅下降。此外，针对采取社交隔离措施后，北京仍然出现 PM2.5 超标天、华北地区臭氧浓度出现显著上升的现象，课题组利用反演的排放清单开展模拟分析，对比有社交隔离减排和无社交隔离减排的模拟情景，发现气象条件变化对疫情爆发初期华北地区 PM2.5 浓度下降的贡献达到 90%以上，也是导致北京 PM2.5 出现超标的主导因子，但是影响臭氧浓度上升的主导因子却不同，氮氧化物排放的大幅下降减弱了对臭氧的滴定作用，对臭氧浓度上升的贡献超过 90%。这一工作通过数据同化定量评估了新冠疫情初期控制措施对我国不同污染物排放量的影响，定量分析了气象因子和排放变化对 PM2.5 和 O3 浓度变化的贡献，为理解新冠疫情控制措施对空气质量的影响提供了新的参考。该论文第一作者为孔磊博士后，通讯作者为唐晓正高级工程师，研究得到了国家自然科学基金（No. 42175132, 41875164, 92044303, 42205119）、中国科学院战略性先导科技专项（No.

来源：大气物理所

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数据类型：资讯

http://www.iap.cas.cn/gb/xwdt/kyjz/202306/t20230614_6777990.html

8. Air quality levels in parts of the U.S. plunge as Canada wildfires rage

摘要：Air pollution from wildfire smoke has become a significant health risk in the U.S., and it is growing worse. Stanford University researchers found that the number of people who experienced at least one day with unhealthy air quality because of smoke rose by 27 times over the last decade.Small particles in smoke that are less than 2.5 micrometers in diameter — about 4% of the diameter of an average human hair — are of particular concern to air quality researchers. “These are the particles that are small enough to breathe in and can cause cardiovascular issues,” said Brett Palm, a scientist at the National Center for Atmospheric Research in Boulder, Colorado.Read more at NBC News; June 5, 2023 Teaser summary Canada is experiencing one of the worst starts to its wildfire season ever recorded. This material is based upon work supported by the National Center for Atmospheric Research, a major facility sponsored by the National Science Foundation and managed by the University Corporation for Atmospheric Research. Any opinions, findings and conclusions or recommendations expressed in this material do not necessarily reflect the views of the National Science Foundation.

来源：NCAR

发布时间：2023-06-12

数据类型：资讯

https://www2.acom.ucar.edu/news/air-quality-levels-parts-us-plunge-canada-wildfires-rage

9. Rebecca Hornbrook discusses health hazards from wildfire smoke

摘要：Canadian wildfires are spewing smoke into New York City and Washington, DC, threatening the health of millions. Welcome to the “Pyrocene.” Wildfire smoke is a complex amalgam of materials, including burned plant material and—if buildings go up in flames—human-made stuff like plastic. What makes smoke visible are its toxic particulates—dubbed PM 2.5 and 10, meaning particles smaller than 2.5 and 10 microns. But there are a lot of invisible nasties in there too, like benzene, formaldehyde, carbon gases and even fungal pathogens.As the smoke travels through the atmosphere, it can actually form new chemical hazards over time, like ozone, which exacerbates asthma. “The biggest health impacts are definitely from the particulate matter,” says Rebecca Hornbrook, an atmospheric chemist at the National Center for Atmospheric Research, who has flown planes through wildfire smoke to study its components. “But there are a lot of things that are emitted that are on the EPA’s list of dangerous chemicals.

来源：NCAR

发布时间：2023-06-12

数据类型：资讯

https://www2.acom.ucar.edu/news/rebecca-hornbrook-discusses-health-hazards-wildfire-smoke

10. GRL: 未来排放情景下中国城市群臭氧变化预估的不确定性

摘要：近年来，我国城市地区臭氧(O3)浓度持续升高，臭氧污染问题日益凸显。在未来排放情景下，我国重点城市群地区臭氧浓度是否将随着前体物排放的减少而有所下降？利用模式预估的未来臭氧变化趋势不确定性如何？就以上问题，中国科学院大气物理研究所李嘉伟副研究员和东英吉利大学(University of East Anglia)的翁翔博士、Forster L. Grant 教授、Peer Nowack 教授合作利用 WRF-Chem 模式及中国未来情景（2030 年）排放清单 DPEC（Dynamic Projection model for Emissions in China, 清华大学发布）开展了深入研究。结果表明，在 2030 年的臭氧前体物排放大幅减少情景下，我国大部分地区臭氧浓度将显著下降，但对于重点城市群地区臭氧浓度是否下降，不同大气化学机制之间存在明显分歧，MOZART 机制预估城市群地区臭氧浓度将继续上升，而 CBMZ 机制预估的臭氧上升得到抑制，两者差异显著。进一步分析发现，不同化学机制中臭氧对前体物响应机制（臭氧敏感性）的显著差异是上述模式不确定性的主要原因。本研究有助于进一步深入认识未来排放情景下我国重点城市群地区臭氧污染的变化趋势，并指出数值模式在臭氧预估问题的研究中不确定性较大。本研究于 2023 年 4 月发表在《Geophysical Research Letters》上，第一作者为东英吉利大学的翁翔博士，翁翔和本所李嘉伟副研究员为共同通讯作者，研究得到国家重点研发计划（2022YFF0802503）资助。参考文章：Weng, X.*, Li, J.W.*, Forster, G. L., Nowack, P. (2023). Large modeling uncertainty in projecting decadal surface ozone changes over city clusters of China. Geophysical Research Letters, 50, e2023GL103241.

来源：大气物理所

发布时间：2023-06-07

数据类型：资讯

http://www.iap.cas.cn/gb/xwdt/kyjz/202306/t20230607_6775197.html

11. World Meteorological Congress sets new strategic priorities for an era of rapid climate, societal and technological change

摘要：Geneva, 2 June 2023 - The World Meteorological Congress has approved new top strategic priorities to guide it through the next four years at a time of rapid climate, societal and technological change. It also appointed its first female Secretary-General, Prof. Celeste Saulo. WMO's top over-arching goal will be achievement of the ground-breaking international campaign to ensure that everyone on Earth is protected against hazardous weather by life-saving early warning systems by the end of 2027.Congress approved a new Global Greenhouse Gas Watch to strengthen monitoring of heat-trapping gases to inform implementation of the Paris Agreement on climate change. It backed a rafter of proposals to strengthen observations and data exchange and to increase support for climate adaptation and resilience. The cryosphere and hydrology will be given greater prominence in future, given the increasing impacts of diminishing sea ice, melting glaciers, ice sheets, permafrost and snow on sea level rise, water-related hazards and water security, economies and ecosystems. Congress updated WMO's science and innovation policy to adapt to new research priorities and embrace the technological might of super-computing and Artificial Intelligence. It stressed the urgency of closing the growing capacity gap, which threatens observations and services. It ramped up WMO's Gender Action Plan.

来源：WMO

发布时间：2023-06-02

数据类型：资讯

https://public.wmo.int/en/media/press-release/world-meteorological-congress-sets-new-strategic-priorities-era-of-rapid-climate

12. EP: 不同来源气溶胶对北京城市边界层的反馈作用

摘要：不同来源气溶胶成分组成与垂直分布对城市边界层发展产生着复杂的反馈作用，研究不同天气条件下气溶胶与边界层的相互作用，可为区域大气污染气象成因分析与防控策略的制定提供科学指导。我所 LAPC 国家重点实验室辛金元研究员、马永敬博士等合作者基于北京城市大气污染边界层理化结构多年观测，利用高分辨率边界层大涡模型，系统分析了不同来源气溶胶对北京城市边界层的反馈过程。聚类分析 2016-2019 年秋冬季节气团轨迹，北京地区主要受三类气团控制：Type-1 西西伯利亚平原气团、Type-2 中西伯利亚高原气团和 Type-3 蒙古高原气团。三类气团控制下局地气溶胶理化特性、垂直分布和大气边界层结构差异显著。在 Type-1

和 Type-2 气团控制下，气溶胶光学厚度分别为 0.28±0.26 和 0.15±0.08，其中 80%集中在 1500m 以下；同时，两类气团控制下大气热力层结不稳定，大气扩散能力较好。Type-3 气团控制下气溶胶光学厚度和单次散射反照率分别为 0.75±0.54 和 0.91±0.05，表明含有大量散射性气溶胶且污染程度严重；在该类气团控制下，大气更为稳定，大气扩散能力较差，80%的气溶胶分布在 1150 米高度范围内。利用不同气团的大气热力层结与气溶胶约束驱动大涡模式，模拟发现不同源区气溶胶均对边界层产生抑制作用。边界层高度从清洁条件的 1120m（Type-1）、1160m（Type-2）、820m（Type-3）分别下降到污染情景的 980m、1100m 和 600m。研究发现，残留层之下吸收性气溶胶的“火炉效应”对边界层的促进作用较弱，很大程度上被残留层之上吸收性气溶胶“穹顶效应”和整层散射性气溶胶的“阳伞效应”所抑制。而在未来减排情景下，城市地区的气溶胶-边界层相互作用仍存在很大的不确定性。

来源：大气物理所

发布时间：2023-06-02

数据类型：资讯

http://www.iap.cas.cn/gb/xwdt/kyjz/202306/t20230602_6768596.html

13. NCAR’s next-gen airborne radar will have unmatched ability to peer deep inside storms

摘要：High-resolution image The NSF/NCAR C-130 sits in its hangar at the Research Aviation Facility in Broomfield, Colo. NCARs new Airborne Phased Array Radar (APAR) will be mounted on this C-130 and made available to the university research community. Image ©□UCAR. A next-generation airborne radar designed by the National Center for Atmospheric Research (NCAR) that could revolutionize our ability to observe, understand, and ultimately predict high-impact weather events has received $91.8 million in funding from the National Science Foundation (NSF).The Airborne Phased Array Radar (APAR) will improve on existing radar by allowing scientists to sample the atmosphere at higher spatial resolution and probe more deeply into storms, ultimately painting a more detailed picture of storm dynamics and microphysics. APAR will also be an extremely flexible platform. Its agile scanning capability can switch radar beam directions almost instantaneously, allowing scientists to scan the atmosphere in any direction, a contrast to traditional fixed-direction airborne scanning radars.The rich data generated from APAR will give forecasters critical information for better predicting a range of high-impact weather events, including hurricanes, atmospheric rivers, tornadoes, derechoes, and blizzards. “As society struggles with an increase in devastating extreme weather events,

it’s imperative that the Earth system science community has the tools it needs to provide the actionable information communities need to become more resilient,” said NCAR Director Everette Joseph.

来源：NCAR

发布时间：2023-06-01

数据类型：资讯

https://news.ucar.edu/132898/ncars-next-gen-airborne-radar-will-have-unmatched-ability-peer-deep-inside-storms

❖专题研究

✧城市边界层

本监测周期内，文献信息共更新 2 条：

Vertical distribution of black carbon and its mixing state in the urban boundary layer in summer

摘要：The vertical distribution of black carbon (BC), as well as its mixing state, is of great concern due to BC's strong regional climatic and environmental effects. In this study, vertical measurements were conducted through a moveable container based on a meteorological tower in the Beijing urban area during June and July. A total of 112 vertical profiles (0–240 m), including the concentrations of BC, O3, NOx and the optical properties of aerosols, were obtained. Based on BC concentration, the vertical profiles could be classified into four categories: uniform, gradual decrease, sharp decrease and sudden increase. The uniform type indicates strong vertical mixing with similar pollutant concentrations along the vertical direction. The gradual and sharp decrease types indicate stable vertical conditions with higher pollutant concentrations on the ground and lower concentrations at higher altitudes. Due to the strong radiation in summer, the vertical profiles exhibited a clear diurnal variation in which ~ 80 % of profiles were uniform during the daytime and ~ 40 %–90 % of profiles were of the gradual and sharp decrease types at night. O3 is an exception, and its concentration generally increases with height, even under strong vertical mixing conditions. The size distribution of the BC core varied slightly along the vertical direction, and the coating thickness, denoted by the diameter ratio between the BC-containing particle and BC core (Dp/Dc), of BC increased with height under stable

conditions. Although the coating thickness could increase the absorption ability with an average absorption enhancement of 1.25 at 23:00 LT (local time: UTC+8), the vertical difference of Dp/Dc (2 %) was much lower than that of BC concentration (~ 35 %). The vertical variation in absorption ability was mainly caused by the variation in BC concentration. In addition, O3 and Dp/Dc occasionally increased during 06:00–08:00 but remained stable during 08:00–10:00. Vertical mixing and transportation from upper heights, such as the residual layer, could significantly influence the pollutant properties on the surface during early mornings. This study exhibits a continuous vertical picture of BC and its mixing state in urban areas, which would be helpful for understanding BC's regional environmental effect.

来源：ACP

发布时间：2023-06-30

数据类型：期刊

https://acp.copernicus.org/articles/23/7225/2023/

The Departure from Mixed-Layer Similarity During the Afternoon Decay of Turbulence in the Free-Convective Boundary Layer: Results from Large-Eddy Simulations

摘要：This study analyses the departure of the velocity-variances profiles from their quasi-steady state described by the mixed-layer similarity, using large-eddy simulations with different prescribed shapes and time scales of the surface kinematic heat flux decay. Within the descriptive frames where the time is tracked solely by the forcing time scale (either constant or time-dependent) describing the surface heat flux decay, we find that the normalized velocity-variances profiles from different runs do not collapse while they depart from mixed-layer similarity. As the mixed-layer similarity relies on the assumption that the free-convective boundary layer is in a quasi-equilibrium, we consider the ratios of the forcing time scales to the convective eddy-turnover time scale. We find that the normalized velocity-variances profiles collapse in the only case where the ratio (\(\widetilde{r}\)) of the time-dependent forcing time scale to the convective eddy-turnover time scale is used for tracking the time, supporting the independence of the departure from the characteristics of the surface heat flux decay. As a consequence of this result, the knowledge of \(\widetilde{r}\) is sufficient to predict the departure of the velocity variances from their quasi-steady state, irrespective of the shape of the surface heat flux

decay. This study highlights the importance of considering both the time-dependent forcing time scale and the convective eddy-turnover time scale for evaluating the respo

来源：Springer

发布时间：2023-06-21

数据类型：期刊

https://link.springer.com/article/10.1007/s10546-023-00812-2

✧城市气象精细预报

本监测周期内，文献信息共更新 3 条：

Precipitable water vapor in regional climate models over Ethiopia: model evaluation and climate projections

摘要：Precipitable Water Vapor (PWV) has strong relations with extreme rainfall and their increments in a future warming world are typically associated. It is, however, unclear how different climatic conditions and orographic effects modulate these changes in the equatorial region. We investigate PWV and heavy rainfall over Ethiopia using Regional Climate Models (RCMs) from the Coordinated Regional Climate Downscaling Experiment (CORDEX). An in-depth RCM evaluation is first provided by comparing the modeled annual cycle of PWV with those obtained from Global Positioning System observations and reanalysis, and, by investigating the changes in PWV before and after a heavy-rainfall event. Two characteristic timescales are found for the buildup and decline of PWV before and after such events: a short of about 2 days and a long timescale extending beyond ten days. Overall RCMs reproduce well the PWV annual cycle but substantial biases appear for some models in the very dry and in the tropical wet climate zones. CORDEX models simulate well the peak in PWV anomalies at the day of a heavy-rainfall event but strongly overestimate the timescales of buildup and decline. Future scenarios all point towards a PWV increase (up to 40%) for end-of-the-century RCP8.5 with limited spatial and seasonal variations. PWV changes align with near-surface temperature changes at a rate of 7.7% per degree warming. Changes in daily heavy rainfall, on the other hand, are lower especially in northwestern Ethiopi

来源：Springer

发布时间：2023-06-16

数据类型：期刊

https://link.springer.com/article/10.1007/s00382-023-06855-y

Estimation of extreme precipitation events in Estonia and Italy using dual-polarization weather radar quantitative precipitation estimations

摘要：Evaluating extreme rainfall for a certain location is commonly considered when designing stormwater management systems. Rain gauge data are widely used to estimate rainfall intensities for a given return period. However, the poor spatial and temporal resolution of operational gauges is the main limiting factor. Several studies have used rainfall estimates based on weather radar horizontal reflectivity (Zh), but they come with a great caveat: while proven reliable for low or moderate rainfall rates, they are subject to major errors in extreme rainfall and convective cases. It is widely known that C-band weather radar can underestimate precipitation intensity due to signal attenuation or overestimate it due to hail and clutter contamination. From the late 1990s, dual-polarization weather radar started to become operational in the national surveillance radar network in Europe, providing innovative quantitative precipitation estimation (QPE) based on polarimetric variables. This study circumvents Zh shortcomings by using specific differential-phase (Kdp) data from operational dual-polarization C-band weather radars. The rain intensity estimates based on a specific differential-phase data are immune to attenuation and less affected by hail contamination.In this study, for the first time, QPEs based on polarimetric observations by operational C-band weather radars and without any rain gauge adjustments are analyzed. The purpose is to estimate return periods for 1 h rainfall total computed from polarimetric weather radar data using non-adjusted QPEs based on R(Zh,Kdp) data and to compare the results with those derived using R(Zh) and rain gauge data. Only the warm period during the year is considered here, as most of the extreme precipitation events for such a duration occur for both places studied (Italy and Estonia) at this time. Limiting the dataset to warm periods also allows us to use the radar-based rainfall quantitative precipitation estimations, which are more reliable than the snowfall ones. Data from operational dual polarimetric C-band weather radar sites are used from both Italy and Estonia. Given climatologically homogeneous regions, this study demonstrates that polarimetric weather radar observations can provide reliable QPEs compared to single-polarization estimates with respect to rain gauges and that they can provide a reliable estimation of return periods of 1 h rainfall total, even for relatively short time series.

来源：AMT

发布时间：2023-06-14

数据类型：期刊

https://amt.copernicus.org/articles/16/2943/2023/

Influence of cloud microphysics schemes on weather model predictions of heavy precipitation

摘要：Cloud microphysics is one of the major sources of uncertainty in numerical weather prediction models. In this work, the ability of a numerical weather prediction model to correctly predict high-impact weather events, i.e., hail and heavy rain, using different cloud microphysics schemes is evaluated statistically. Polarimetric C-band radar observations over 30 convection days are used as the observation dataset. Simulations are made using the regional-scale Weather Research and Forecasting (WRF) model with five microphysics schemes of varying complexity (double moment, spectral bin (SBM), and Predicted Particle Properties (P3)). Statistical characteristics of heavy-rain and hail events of varying intensities are compared between simulations and observations. All simulations, regardless of the microphysics scheme, predict heavy-rain events (15, 25, and 40 mm h−1) that cover larger average areas than those observed by radar. The frequency of these heavy-rain events is similar to radar-measured heavy-rain events but still scatters by a factor of 2 around the observations, depending on the microphysics scheme. The model is generally unable to simulate extreme hail events with reflectivity thresholds of 55 dBZ and higher, although they have been observed by radar during the evaluation period. For slightly weaker hail/graupel events, only the P3 scheme is able to reproduce the observed statistics. Analysis of the raindrop size distribution in combination with the model mixing ratio shows that the P3, Thompson two-moment (2-mom), and Thompson aerosol-aware schemes produce large raindrops too frequently, and the SBM scheme misses large rain and graupel particles. More complex schemes do not necessarily lead to better results in the prediction of heavy precipitation.

来源：ACP

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数据类型：期刊

https://acp.copernicus.org/articles/23/6255/2023/

✧城市气候与生态

本监测周期内，文献信息共更新 2 条：

Changes in atmospheric moisture transport over tropical South America: an analysis under a climate change scenario

摘要：Warming induced by increased greenhouse gas emissions is intensifying the global water cycle and increasing the water vapor content of the global atmosphere. However, there is a lack of scientific literature assessing how regional atmospheric moisture transport and recycling will change in a warming climate. This work analyzes the projections of atmospheric moisture transport and recycling over tropical South America by the end of the twenty-first century (2070–2100) under a climate change scenario (RCP8.5). We used the Dynamic Recycling Model to estimate atmospheric moisture contributions to the region considering input data from the European Centre for Medium-Range Weather Forecasts ERA5 reanalysis and 11 models included in the Fifth Phase of the Coupled Model Intercomparison Project. Projected increases of precipitable water in tropical South America are linked with increased evaporation from the oceans. However, those projections also indicate (1) reductions in the precipitation contributed by the main atmospheric moisture sources to the continental regions of tropical South America, (2) reductions of total precipitation, and (3) reductions of recycled precipitation over the region. The largest reductions of precipitation recycling are projected over the southern Amazon during the dry-to-wet transition season (about 31%) and the northern Amazon during its dry season (about 25%). This is particularly relevant since the southern Amazon has experienced the occurrence of long

来源：Springer

发布时间：2023-06-15

数据类型：期刊

https://link.springer.com/article/10.1007/s00382-023-06833-4

Predicting the climate impact of aviation for en-route emissions: the algorithmic climate change function submodel ACCF 1.0 of EMAC 2.53

摘要：Using climate-optimized flight trajectories is one essential measure to reduce aviation's climate impact. Detailed knowledge of temporal and spatial climate sensitivity for aviation emissions in the atmosphere is required to realize such a climate mitigation

measure. The algorithmic Climate Change Functions (aCCFs) represent the basis for such purposes. This paper presents the first version of the Algorithmic Climate Change Function submodel (ACCF 1.0) within the European Centre HAMburg general circulation model (ECHAM) and Modular Earth Submodel System (MESSy) Atmospheric Chemistry (EMAC) model framework. In the ACCF 1.0, we implement a set of aCCFs (version 1.0) to estimate the average temperature response over 20 years (ATR20) resulting from aviation CO2 emissions and non-CO2 impacts, such as NOx emissions (via ozone production and methane destruction), water vapour emissions, and contrail cirrus. While the aCCF concept has been introduced in previous research, here, we publish a consistent set of aCCF formulas in terms of fuel scenario, metric, and efficacy for the first time. In particular, this paper elaborates on contrail aCCF development, which has not been published before. ACCF 1.0 uses the simulated atmospheric conditions at the emission location as input to calculate the ATR20 per unit of fuel burned, per NOx emitted, or per flown kilometre.In this research, we perform quality checks of the ACCF 1.0 outputs in two aspects. Firstly, we compare climatological values calculated by ACCF 1.0 to previous studies. The comparison confirms that in the Northern Hemisphere between 150–300 hPa altitude (flight corridor), the vertical and latitudinal structure of NOx-induced ozone and H2O effects are well represented by the ACCF model output. The NOx-induced methane effects increase towards lower altitudes and higher latitudes, which behaves differently from the existing literature. For contrail cirrus, the climatological pattern of the ACCF model output corresponds with the literature, except that contrail-cirrus aCCF generates values at low altitudes near polar regions, which is caused by the conditions set up for contrail formation. Secondly, we evaluate the reduction of NOx-induced ozone effects through trajectory optimization, employing the tagging chemistry approach (contribution approach to tag species according to their emission categories and to inherit these tags to other species during the subsequent chemical reactions). The simulation results show that climate-optimized trajectories reduce the radiative forcing contribution from aviation NOx-induced ozone compared to cost-optimized trajectories. Finally, we couple the ACCF 1.0 to the air traffic simulation submodel AirTraf version 2.0 and demonstrate the variability of the flight trajectories when the efficacy of individual effects is considered. Based on the 1 d simulation results of a subset of European flights, the total ATR20 of the climate-optimized flights is significantly lower (roughly 50 % less) than that of the cost-optimized flights, with the most considerable contribution from contrail cirrus. The CO2

contribution observed in this study is low compared with the non-CO2 effects, which requires further diagnosis.

来源：GMD

发布时间：2023-06-13

数据类型：期刊

https://gmd.copernicus.org/articles/16/3313/2023/