城市气象科技信息监测简报

2023 年 5 月 （总第 23 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 6 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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目　录

❖报告概述 3

✧监测周期: 3

✧监测主题: 3

❖行业动态 3

✧新闻资讯 3

1. Early Warnings for All officially becomes WMO's top priority 3
2. Top WMO prize winner Sue Barrell says put people at the centre 4
3. Big Tech and Artificial Intelligence can support Early Warnings for All 4
4. 清华大学地学系王焓研究组开发出基于生态演化最优性的普适性蒸散模型 5
5. NCAR develops advanced solar energy forecasting system 6
6. Renewable Energy: CMIP5 和 CMIP6 模式对北半球风能资源模拟能力评估和未来预估 6
7. AE: 利用高频光腔衰荡光谱技术同步观测北京和上海大气氨浓度 7
8. Centennial weather stations are vital for climate monitoring 8
9. Why did Boulder, CO look like this on May 20, 2023? 9
10. Economic costs of weather-related disasters soars but early warnings save lives 10
11. AAS 封面论文: 2023 年 3-4 月蒙古国对我国北方沙尘浓度贡献超过 42% 10
12. Global temperatures set to reach new records in next five years 11
13. 当前主流的陆面模式对全球陆气相互作用的模拟能力怎么样? 12

✧文献信息 13

城市边界层 13

气候态调整对华北冬、夏季气候监测的影响研究 13

"大气污染防治行动计划"执行以来我国夏季大气 OH 浓度变化的数值模拟 13

Linking gas, particulate, and toxic endpoints to air emissions in the Community Regional Atmospheric Chemistry Multiphase Mechanism (CRACMM) 14

Large Eddy Simulation Study of Atmospheric Boundary Layer Flow over an Abrupt Rough-to-Smooth Surface Roughness Transition 15

城市气象精细预报 16

Intercomparison of the weather and climate physics suites of a unified forecast–climate model system (GRIST-A22.7.28) based on single-column modeling 16

基于微雨雷达的降水参数反演和粒子相态识别 17

FY-4A 卫星闪电资料与 ADTD 闪电资料在四川省冕宁暴雨中的对比分析及数值模拟 18

冬奥会复杂山地百米尺度 10 m 风速预报的机器学习订正对比试验 18
Investigation on potential and limitations of ERA5 Reanalysis downscaled on Italy by a convection-permitting model 19
Comparison of ozonesonde measurements in the upper troposphere and lower Stratosphere in Northern India with reanalysis and chemistry-climate-model data..... 20
城市气候与生态..... 21
Synergy of climate change with country success and city quality of life..... 21
人工智能气象..... 21
冬奥会复杂山地百米尺度 10 m 风速预报的机器学习订正对比试验 21
Combining Weather Station Data and Short-Term LiDAR Deployment to Estimate Wind Energy Potential with Machine Learning: A Case Study from the Swiss Alps 22

❖报告概述

✧监测周期：

2023 年 05 月 01 日 - 2023 年 05 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 13 条

1. Early Warnings for All officially becomes WMO’s top priority

摘要：Geneva, 31 May 2023 (WMO) - The groundbreaking international campaign to ensure that everyone on Earth is protected against hazardous weather by life-saving early warning systems by the end of 2027 has been officially recognized as the top overriding priority of the World Meteorological Organization.'This resolution agrees that the fulfilment of the WMO contribution to the successful implementation of the Early Warnings For All Initiative shall be accorded the highest priority in the WMO Strategic Plan 2024–2027, ' said the World Meteorological Congress resolution. The 193-Member Congress, which is the WMO’s top decision-making body, said it was mindful of the “ambitious time frame, the complexity of the technological, social and economic aspects, and the urgency implied by the increasing threats and risks from natural hazards.”It said that key WMO activities should be coordinated and consolidated under the Early Warnings for All umbrella and WMO programmes, technical commissions and regional activities aligned to achieve the goal. National Meteorological and Hydrological Services are the official and authoritative providers of early warnings for hydrometeorological hazards.Climate Adaptation'Multi-hazard early warning systems are an international success story and have saved countless lives. They are widely regarded as the low-hanging fruit of climate adaptation. They are efficient and cost-effective, providing an estimated tenfold return on investment,' said WMO Secretary-General Prof. Petteri Taalas.'However, only half of countries have early warning systems in place with coverage especially low in Small Island Developing States (SIDS), Least Developed Countries (LDCs) and in Africa.

来源：WMO

发布时间：2023-05-31

数据类型：资讯

https://public.wmo.int/en/media/press-release/early-warnings-all-officially-becomes-wmo%E2%80%99s-top-priority

2. Top WMO prize winner Sue Barrell says put people at the centre

摘 要：Acclaimed Australian scientist Dr Sue Barrell has accepted World Meteorological Organization's top award at a ceremony which focussed on the need to put people at the centre of policy and services and to accelerate gender equality.Dr Barrell of Australia won the IMO prize (named after the International Meteorological Organization) for her leadership role in the global weather, water and climate community, for a career of commitment to WMO, and as a role model for female scientists."Your dedication to the application of science, technology and data in meteorology and climate science, which you never lost throughout your career, was always very impressive and sets an example for many people," said WMO President Gerhard Adrian. "The WMO and its community is still profiting from your vision, proficiency, relentless work and dedication," he said.Dr Barrell dedicated her award lecture to People."As we have expanded the Earth systems concept and embraced the digital era, data-related issues have escalated in importance," said Dr Barrell, who was instrumental in overhauling and updating WMO's data policy. "We often talk of data as being the lifeblood of WMO. However, we sometimes forget that the beating heart of WMO is its people and that without them, there would be no data, never mind systems, sharing, collaboration, services, research nor innovation," she said.She stressed that people must be at the heart of the UN's Early Warnings for All initiative."As a global WMO community, trusted to monitor, research, understand and predict the state of the Earth system and deliver much needed data, information and services, we know that people are impacted in many ways by weather, water and climate events.

来源：WMO

发布时间：2023-05-31

数据类型：资讯

https://public.wmo.int/en/media/news/top-wmo-prize-winner-sue-barrell-says-put-people-centre

3. Big Tech and Artificial Intelligence can support Early Warnings for All

摘要：The private sector has a huge potential role to play in the achievement of Early Warnings for All, through leveraging the outreach of Big Tech and the power of Artificial

Intelligence.The World Meteorological Congress held two special dialogues dedicated to mapping the strengths and potential contribution from the private sector to the early warning-related capacity gaps in the Least Developed Countries (LDCs) and Small Island Developing States (SIDS).A high-level session of the Open Consultative Platform brought together the meteorological community with computer and mobile phone giants. A separate session examined Artificial Intelligence to support Early Warnings for All.“A growing number of big IT companies are interested in contributing to Early Warnings for All,” said WMO Secretary-General Prof. Petteri Taalas. “The challenge of natural and man-made disasters and anthropogenic climate change and water resource impacts have to be tackled as a joint venture of the public and private sectors,” he said.The upcoming strategic plan for 2024-2027 incorporates cutting-edge elements of AI to drive rapid progress in science and technology. One of the key aspects under consideration is implementing a pilot project for nowcasting, which will provide invaluable support for early warnings across various domains, said Prof. Taalas.

来源：WMO

发布时间：2023-05-31

数据类型：资讯

https://public.wmo.int/en/media/news/big-tech-and-artificial-intelligence-can-support-early-warnings-all

4. 清华大学地学系王焓研究组开发出基于生态演化最优性的普适性蒸散模型

摘要：蒸散是水循环的重要环节，当前蒸散建模多针对植物类型率定特征参数，限制了模型时空外推的可靠性。清华大学地学系王焓研究组基于生态演化最优性，引入叶片气孔对于气象条件的适应规律，开发并论证了一种具有普适性的蒸散模型，以期为蒸散估算和陆面模式发展提供方法支持。蒸散包括植物蒸腾和非生物蒸发两个主要组分，代表陆表水分汽化并扩散至大气边界层的速率，是流域水循环研究的重要过程。同时，蒸散和降水的关系也是诊断作物生长状态、预测植物生长约束的重要依据。深入理解蒸散过程并准确计算地表蒸散对于全球气候变化背景下的预测研究具有重要意义。Penman-Monteith（PM）公式是目前蒸散估算的方法之一，可利用遥感观测数据实现对地表蒸散的多尺度观测。该公式使用气孔导度来描述叶片气孔的开闭程度。作为连接植物体内外的通道，气孔的开闭程度直接影响着蒸腾和蒸散速率。同时，叶片气孔还是二氧化碳分子扩散的通道。因此，以往研究基于光

合作用与蒸腾的密切关系提出了基于水碳耦合原理的思路，以估算 PM 公式中的气孔导度。

来源：清华大学

发布时间：2023-05-30

数据类型：资讯

http://www.dess.tsinghua.edu.cn/info/1108/5879.htm

5. NCAR develops advanced solar energy forecasting system

摘要：The National Center for Atmospheric Research (NCAR) has successfully developed an advanced solar energy forecasting system for New York that offers the potential to help the state achieve its renewable energy goals while saving millions of dollars for ratepayers. The open-source system, called NYSolarCast, draws on weather forecasts, observations of atmosphere conditions, and machine learning techniques to generate accurate hours- and day-ahead predictions of solar irradiance and resulting power generation. These predictions, issued every 15 minutes for a three-kilometer grid covering all of New York State, can be used to forecast solar power generation for both major solar farms and rooftop solar panels. Forecasts of irradiance across New York State, produced every 15 minutes by NYSolarCast.In addition to showing promising results for New York, the technology can be applied elsewhere in the United States and other locations around the globe.'This system is applicable worldwide," said NCAR scientist Jared Lee, the lead developer. "It is highly configurable and customizable, so it can deliver forecasts at any desired time interval over any forecast region that a utility needs."The predictions for New York proved highly accurate. Over a one-year validation period, NYSolarCast's forecasts consistently came within about 10% of the actual amount of power generated. Encouragingly, the over-forecasts and under-forecasts were nearly balanced.

来源：NCAR

发布时间：2023-05-30

数据类型：资讯

https://news.ucar.edu/132897/ncar-develops-advanced-solar-energy-forecasting-system

6. Renewable Energy: CMIP5 和 CMIP6 模式对北半球风能资源模拟能力评估和未来预估

摘要：风能是重要的可再生能源，具有丰富、清洁、安全和发电技术成熟等优势，在近年来取得迅猛发展。全球陆地上的风电装机主要分布于北半球，我国占据全球风电市场的40%。但是目前的风电发展速度和涵盖范围仍然有限，不足以实现全球的能源转型。根据《巴黎协定》，为将全球气温升高控制在 1.5 摄氏度以下，必须将至少 80%的发电量转为低碳能源。为实现“碳达峰”和“碳中和”，我们需要减少二氧化碳排放量，发展更多的清洁能源，尤其是风能。因此，在“双碳”背景下，探讨北半球主要风电市场的风能资源未来如何变化至关重要。风能资源的强度与地理分布和气候变化息息相关，只有在特定的风速条件（3~24m/s）下才可以进行风力发电。中国科学院大气物理研究所黄刚研究员、苗昊泽予博士首先基于观测资料评估了 CMIP5 和 CMIP6 模式模拟北半球地表风速的表现，结果发现 CMIP6 模拟能力整体有较大改进，都可以重现出近几十年来地表风速的减小。并根据模拟效果更好的 CMIP6 模式，揭示了北半球风能资源到本世纪末（2100 年）在不同气候变化背景下的未来演变。研究采用四种不同的温室气体和气溶胶排放情景，结果发现，在所有排放情景下，未来的陆地地表风速都将继续下降，并在高排放情景下下降更显著。

来源：大气物理所

发布时间：2023-05-29

数据类型：资讯

http://www.iap.cas.cn/gb/xwdt/kyjz/202305/t20230529_6764188.html

7. AE: 利用高频光腔衰荡光谱技术同步观测北京和上海大气氨浓度

摘要：氨气是形成二次气溶胶的重要前体物，也是城市大气环境治理的关键物种。中国科学院大气物理研究所组织实施的全国大气氨观测研究网络（AMoN-China）通过被动离线采样发现，城市已成为大气氨排放热点区域。然而，被动采样周期较长（周-月），难以捕捉大气氨浓度在日尺度上的快速变化。同时，以往研究常观察到大气氨浓度在早上 5:00-12:00 快速增加，这一早高峰现象是否具有普遍性亟待更多高频观测站点资料的验证。鉴于此，中国科学院大气物理研究所研究员潘月鹏课题组与华东师范大学教授吴电明团队合作，基于高频光腔衰荡光谱技术在北京和上海两个超大城市开展了大气氨浓度同步观测实验（测量频率 1Hz，精度 0.03ppb，图 1）。这两个城市位于华北平原氨排放热点区域的南北边缘，是研究区域传输和局地排放对大气氨浓度叠加影响的理想站点。图 1. 基于光腔衰荡光谱法测量北京和上海的大气氨浓度 2020 年 5 月观测结果发现，北京大气氨平均浓度（23.1±10.3 ppb）接近上海（12.0±5.0 ppb）的两倍，与卫星观测的氨气柱浓度和自

下而上统计的氨气排放量的空间分布一致。研究还发现两个城市同时存在氨气早高峰现象，其发生频率大于 50%，机动车排放是导致氨气浓度早高峰形成的主要原因。早晨边界层打破后，随着对流发展，富含氨气的残留层向下传输也对早高峰有一定贡献。上述结果促进了我们对城市大气氨浓度动态变化特征及背后驱动因素的科学认识，其高频观测数据可用于提升大气化学传输模型的模拟精度，有助于评估大气氨污染的生态环境效应并为氨减排策略的制定提供参考。

来源：大气物理所

发布时间：2023-05-26

数据类型：资讯

http://www.iap.cas.cn/gb/xwdt/kyjz/202305/t20230526_6763641.html

8. Centennial weather stations are vital for climate monitoring

摘要：The World Meteorological Congress has recognized the vital contribution of long-term weather observations to monitoring climate change, given the need for reliable historical records of the past to understand the present and prepare for the future.In a ceremony, WMO President Gerhard Adrian presented certificates of recognition to centennial observing stations - which have marked their 100th anniversary of operation – as part of an initiative to encourage governments to preserve our scientific memory.The World Meteorological Organization has so far recognized 291 centennial weather stations and Congress increased this by a further 118 by including, for the first time, hydrological and marine stations.A recent publication Centennial Observing Stations State of Recognition Report – 2021 shows how observations from long-term observing stations and other platforms (including satellites, buoys, vessels, airplanes and so forth) are vital inputs to climate models that scientists use to understand the climate and create credible scenarios of future climate change.They accurately measure how high-impact events such as intense heatwaves or extreme rainfall are changing in terms of occurrence, and so make it possible to evaluate risks and find solutions.Other impacts might include mudslides and rockslides due to melting permafrost, or reduced hydropower supply due to changes in water flows, or damaged crops due to drier and hotter summers, all of which have the potential to have devastating effects on a country’s long-term socioeconomic development.Beyond providing consistent data over decades, many Centennial Observing Stations also contribute to the WMO World Weather Watch system, ensuring that weather data are shared around the world every day.WMO’s climate monitoring and its annual State of the Global Climate reports would not be possible without long-term observations from weather

stations around the world. These make an essential contribution to our understanding of the climate system and inform international mechanisms such as the United Nations Framework Convention on Climate Change (UNFCCC).Staff and resourcesThe history of coordinated weather observations by an observational network dates back to more than 200 years ago when, in 1781, the Societas Meteorologica Palatina in Europe began systematic and coordinated weather observations.

来源：WMO

发布时间：2023-05-25

数据类型：资讯

https://public.wmo.int/en/media/news/centennial-weather-stations-are-vital-climate-monitoring

9. Why did Boulder, CO look like this on May 20, 2023?

摘 要：Hazy smoke seen near Chautauqua Park in Boulder, CO Pieternel LeveltResidents of Boulder, Colorado were greeted with an unwelcome visitor this week: a decline in air quality that left them with hazy skies and concerns about their well-being. The source of this phenomenon, as it turned out, lay far beyond the state borders. Across the Canadian wilderness, raging wildfires had unleashed a cascade of effects that ultimately impacted Boulder's air quality from May 18 to May 24. In this article, we aim to shed light on the connection between these Canadian wildfires and the deterioration of air quality in Boulder, bringing awareness to the public about this concerning environmental issue.Atmospheric Transport:The prevailing winds carried the smoke and airborne pollutants southward, spanning thousands of kilometers. This transport phenomenon is not uncommon, as winds can disperse pollutants over great distances, impacting regions far from the source of the fires. In this case, Boulder, Colorado, found itself on the receiving end of the smoke plumes, leading to a significant decline in air quality. (Figures 1 and 2 above) Carbon monoxide measured on May 19 and 20, 2023. Boulder, CO indicated by the white star, is at the western edge of the plume, although measurements west of Boulder were likely obscured by clouds on May 19. MOPITT CO and MODIS/VIIRS Aerosol 20 May, 2023(Figures 3 and 4 below) MOPITT, which measures around 10 am, did not have coverage over Boulder for this day, but compared to TROPOMI, it demonstrates how the plume moved out of Wisconsin by the afternoon when TROPOMI measures around 1:30 pm.

来源：NCAR

发布时间：2023-05-23

数据类型：资讯

https://www2.acom.ucar.edu/news/why-did-boulder-co-look-may-20-2023

10. Economic costs of weather-related disasters soars but early warnings save lives

摘要：Geneva, 22 May 2023 (WMO) - Extreme weather, climate and water-related events caused 11 778 reported disasters between 1970 and 2021, with just over 2 million deaths and US$ 4.3 trillion in economic losses, according to a new figure from the World Meteorological Organization (WMO).Economic losses have soared. But improved early warnings and coordinated disaster management has slashed the human casualty toll over the past half a century. Over 90% of reported deaths worldwide occurred in developing countries.The USA alone incurred US$1.7 trillion, accounting for 39% of economic losses worldwide in the 51 years. But Least Developed Countries and Small Island Developing States suffered a disproportionately high cost in relation to the size of their economies.WMO issued the new findings for the quadrennial World Meteorological Congress, which opens on 22 May with a high-level dialogue on accelerating and scaling up action to ensure that early warning services reach everyone on Earth by the end of 2027.The United Nations Early Warnings for All initiative is one of the top strategic priorities due to be endorsed by the World Meteorological Congress, WMO's top decision-making body.

来源：WMO

发布时间：2023-05-22

数据类型：资讯

https://public.wmo.int/en/media/press-release/economic-costs-of-weather-related-disasters-soars-early-warnings-save-lives

11. AAS 封面论文: 2023 年 3-4 月蒙古国对我国北方沙尘浓度贡献超过 42%

摘要：沙尘暴是我国常见的自然气象灾害，具有突发性强、影响范围广等特点，给农业生产、交通运输、空气质量等造成严重灾害，影响了人民群众正常的生活生产。今年春季我国沙尘天气频发。研究发现，蒙古国沙尘跨境输送是影响我国沙尘天气的重要源地，对我国沙尘浓度的贡献已远超我国境内最大沙源塔克拉玛干沙漠。5 月 11 日，兰州大学大气科学学院黄建平院士团队在 Advances in Atmospheric

Sciences 发表题为“2023 年 3-4 月蒙古国对我国北方沙尘浓度贡献超过 42%”的研究论文，研究指出蒙古国沙尘席卷我国北方，是影响我国北方空气质量的罪魁祸首，对我国北方沙尘浓度贡献超过了 42%。随着 2 月下旬蒙古高原气温上升、降水减少和裸露地表持续干燥，近地表沙尘气溶胶在强风作用下极易扬起。在强烈偏北风的作用下，沙尘一路向南席卷并影响其下游地区。其中，冷锋和蒙古气旋给沙尘起沙及其跨境传输提供了便利天气条件。此后，随着西伯利亚冷空气南下、近地表风速迅速增强，沙尘事件得到迅猛发展，来自蒙古国的跨境沙尘逐渐漫卷了我国北方大部分地区。蒙古国对我国北方沙尘浓度的贡献到底有多大？基于耦合了动态沙源的数值模式，HYSPLIT 模型以及轨迹聚类方法，我们详细量化了今年 3 月初至 4 月底蒙古国对我国北方沙尘浓度的贡献。研究表明，在我国北方发生的沙尘事件中，有 4 次主要源自塔克拉玛干沙漠，5 次主要源自蒙古国。

来源：大气物理所

发布时间：2023-05-22

数据类型：资讯

http://www.iap.cas.cn/gb/xwdt/kyjz/202305/t20230522_6760722.html

12. Global temperatures set to reach new records in next five years

摘要：Geneva, 17 May 2023 (WMO) – Global temperatures are likely to surge to record levels in the next five years, fuelled by heat-trapping greenhouse gases and a naturally occurring El Niño event, according to a new update issued by the World Meteorological Organization (WMO). There is a 66% likelihood that the annual average near-surface global temperature between 2023 and 2027 will be more than 1.5°C above pre-industrial levels for at least one year. There is a 98% likelihood that at least one of the next five years, and the five-year period as a whole, will be the warmest on record.“This report does not mean that we will permanently exceed the 1.5°C level specified in the Paris Agreement which refers to long-term warming over many years. However, WMO is sounding the alarm that we will breach the 1.5°C level on a temporary basis with increasing frequency,” said WMO Secretary-General Prof. Petteri Taalas.“A warming El Niño is expected to develop in the coming months and this will combine with human-induced climate change to push global temperatures into uncharted territory,” he said.

来源：WMO

发布时间：2023-05-17

数据类型：资讯

https://public.wmo.int/en/media/press-release/global-temperatures-set-reach-new-records-next-five-years

13. 当前主流的陆面模式对全球陆气相互作用的模拟能力怎么样？

摘要：在地球系统模式中，陆面模式对全球陆气相互作用的模拟能力显著地影响着天气预报和气候预测的准确性。但是，由于缺乏全球尺度的观测资料，很难在评估全球陆面模式对陆气相互作用的模拟能力，进而阻碍了模式的改进和发展。近年来，卫星遥感观测提供了全球覆盖的土壤水分数据，为在全球尺度上评估陆面模式的陆气相互作用模拟能力提供了可能。针对上述问题，清华大学地学系卢麾课题组使用 SMAP(Soil Moisture Active Passive)卫星观测的表层土壤水分数据，提取了基于遥感观测的土壤水分记忆时间（τS 和 τL），将其用来评估当前主流的四个陆面模式的土壤水分记忆性模拟能力，并诊断分析可能的误差来源。研究使用全球尺度的卫星观测资料对陆面模式的陆气相互作用模拟能力进行了深入系统的评估和误差归因分析，可为改进陆面模式的模拟预测能力提供重要线索和参考。成果以“Soil Moisture Memory of Land Surface Models Utilized in Major Reanalyses Differ Significantly from SMAP Observation”为题，近期在《地球未来》（Earth’s Future）期刊发表。图 1 多模式平均的土壤水分记忆时间 τS (a)和 τL (b)与 SMAP 卫星观测对比散点图。图 2 各模式土壤水分记忆时间 τS 的空间分布图(a – f)，以及各模式与 SMAP 估算结果逐年对比箱型图(g)图 3 各模式土壤水分记忆时间 τL 的空间分布图(a – f)，以及各模式与 SMAP 估算结果逐年对比箱型图(g)研究结果表明，陆面模式模拟的土壤水分记忆时间与卫星估算值有显著差异。模式高估了代表低频土壤水分损失过程的时间 τL，而低估了代表高频土壤水分损失过程的时间 τS（图 1）。研究发现，各模式对 τS 和 τL 的模拟表现也存在一定差异（图 1-3）。

来源：清华大学

发布时间：2023-05-07

数据类型：资讯

http://www.dess.tsinghua.edu.cn/info/1108/5854.htm

✧文献信息

本监测周期内，文献信息共更新 33 条

城市边界层

气候态调整对华北冬、夏季气候监测的影响研究

摘要：本研究对比分析了不同气候态下，华北冬、夏季降水及气温的差异，分析了气候平均值的改变对历史极端事件监测的可能影响。研究结果发现，1991～2020 年（简称气候□态）的冬季和夏季的平均降水量均略多于 1981～2010 年（简称气候□态），但接近或略少于 1961～2020 年的平均降水量，平均降水量逐年变化幅度冬季□态小于□态，夏季反之。气候□态冬季降水空间分布不均，夏季较□态呈“中部减少，东西增加”的分布型。冬季和夏季极端降水阈值□态（0.86 mm 和 22.0 mm）较□态（0.83 mm 和 21.6 mm）均略有提高，造成近 60 年华北大部基于□态阈值的冬、夏季极端降水日数较□态略减少。此外，气候□态的华北冬、夏季平均气温均明显高于□态，也高于 1961～2020 年平均值。□态气温较□态基本呈全区增加特征，但空间分布不均匀。冬季极端低温和夏季极端高温阈值□态（−9.8°C 和 27.9°C）较□态（−10.2°C 和 27.5°C）均有所有所提高，造成华北大部分地区基于□态阈值的近 60 年冬季极端低温日数较□态有所增加，夏季极端高温日数较□态存在不同程度的减少。因此，新气候态下华北气温和降水均值，华北大部极端降水阈值和极端气温阈值均有所提高，造成气候监测中更容易出现气温偏低，降水偏少，历史极端事件监测中极端事件略减少的情况，在未来 10 年的气候监测预测业务中要充分考虑新气候态可能造成的影响。关键词:华北/冬季/夏季/气候态差异。

来源：大气科学

发布时间：2023-05-15

数据类型：期刊

http://www.iapjournals.ac.cn/dqkx/cn/article/doi/10.3878/j.issn.1006-9895.2202.21200

“大气污染防治行动计划”执行以来我国夏季大气 OH 浓度变化的数值模拟

摘要：OH 自由基是对流层中主要的氧化剂，是大气氧化性的重要表征。文章利用 GEOS-Chem 模式量化了 2014～2017 年“大气污染防治行动计划”执行以来，人为排放和气象因素变化对中国夏季大气 OH 浓度变化的贡献。模拟结果表明，

2014～2017 年间夏季整个中国 OH 浓度呈现上升趋势，最大上升出现在 30°N 附近的华南地区。在华北平原地区，OH 浓度也呈明显的上升趋势（0.1×106 molecules cm−3 a−1），而 OH 浓度比较高的珠江三角洲地区的 OH 变化趋势较小。敏感性试验结果表明，气象和人为排放变化都对 2014～2017 年华北平原 OH 浓度上升有促进作用，但人为排放的贡献（OH 增加 10.0%）远大于气象的贡献（OH 增加 1.5%）；OH 浓度变化最大的南方地区主要是气象条件控制。进一步对气象因素分析发现，影响全国 OH 变化最重要的气象要素是太阳短波辐射，决定了 2014～2017 年中国 OH 浓度增长趋势最大的区域。但在华北地区，2014～2017 年短波辐射略微减少的影响被边界层高度明显降低带来的 OH 增加所抵消。关键词:OH 自由基/GEOS-Chem 模式/气象/人为排放

来源：大气科学

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Linking gas, particulate, and toxic endpoints to air emissions in the Community Regional Atmospheric Chemistry Multiphase Mechanism (CRACMM)

摘要：Chemical mechanisms describe the atmospheric transformations of organic and inorganic species and connect air emissions to secondary species such as ozone, fine particles, and hazardous air pollutants (HAPs) like formaldehyde. Recent advances in our understanding of several chemical systems and shifts in the drivers of atmospheric chemistry warrant updates to mechanisms used in chemical transport models such as the Community Multiscale Air Quality (CMAQ) modeling system. This work builds on the Regional Atmospheric Chemistry Mechanism version 2 (RACM2) and develops the Community Regional Atmospheric Chemistry Multiphase Mechanism (CRACMM) version 1.0, which demonstrates a fully coupled representation of chemistry leading to ozone and secondary organic aerosol (SOA) with consideration of HAPs. CRACMMv1.0 includes 178 gas-phase species, 51 particulate species, and 508 reactions spanning gas-phase and heterogeneous pathways. To support estimation of health risks associated with HAPs, nine species in CRACMM cover 50 % of the total cancer and 60 % of the total non-cancer emission-weighted toxicity estimated for primary HAPs from anthropogenic and

biomass burning sources in the US, with the coverage of toxicity higher (80 %) when secondary formaldehyde and acrolein are considered. In addition, new mechanism species were added based on the importance of their emissions for the ozone, organic aerosol, or atmospheric burden of total reactive organic carbon (ROC): sesquiterpenes, furans, propylene glycol, alkane-like low- to intermediate-volatility organic compounds (9 species), low- to intermediate-volatility oxygenated species (16 species), intermediate-volatility aromatic hydrocarbons (2 species), and slowly reacting organic carbon. Intermediate- and lower-volatility organic compounds were estimated to increase the coverage of anthropogenic and biomass burning ROC emissions by 40 % compared to current operational mechanisms. Autoxidation, a gas-phase reaction particularly effective in producing SOA, was added for C10 and larger alkanes, aromatic hydrocarbons, sesquiterpenes, and monoterpene systems including second-generation aldehydes. Integrating the radical and SOA chemistry put additional constraints on both systems and enabled the implementation of previously unconsidered SOA pathways from phenolic and furanone compounds, which were predicted to account for ～30 % of total aromatic hydrocarbon SOA under typical atmospheric conditions. CRACMM organic aerosol species were found to span the atmospherically relevant range of species carbon number, number of oxygens per carbon, and oxidation state with a slight high bias in the number of hydrogens per carbon. In total, 11 new emitted species were implemented as precursors to SOA compared to current CMAQv5.3.3 representations, resulting in a bottom-up prediction of SOA, which is required for accurate source attribution and the design of control strategies. CRACMMv1.0 is available in CMAQv5.4.

来源：ACP

发布时间：2023-05-04

数据类型：期刊

https://acp.copernicus.org/articles/23/5043/2023/

Large Eddy Simulation Study of Atmospheric Boundary Layer Flow over an Abrupt Rough-to-Smooth Surface Roughness Transition

摘要：The atmospheric boundary layer flow downstream of an abrupt rough-to-smooth surface roughness transition is studied using large eddy simulations (LES) for a range of surface roughness ratios. Standard wall models assume horizontal homogeneity and are inapplicable for heterogeneous surfaces. Two heterogeneous-surface wall models are evaluated, one based on a local application of similarity theory using a twice-filtered

velocity field (BZ model) and another based on a local friction-velocity obtained by blending the upstream and downstream profiles (APA model). The wall shear stress and the turbulence intensity (TI) are sensitive to the wall model while the mean streamwise velocity and the total shear stress (TSS) are less sensitive. The APA model is more accurate than the BZ model on comparison to previous experiments. The wall shear stress obtained using the APA wall model is sensitive to the ratio of the equilibrium and the internal boundary layer (IBL) heights, while other statistics are not. The IBL height is insensitive to the turbulent quantity (TSS or TI) on which it is based. Several analytical relations for the IBL height are evaluated using the LES data. Two models are found to be accurate for different roughness ratios while one model is reasonable over the full range investigated. A phenomenological model is developed for the TI downstream of the roughness jump using a weighted average of the upstream and far-downstream profiles. The model yields reasonable predict

来源：Springer

发布时间：2023-05-02

数据类型：期刊

https://link.springer.com/article/10.1007/s10546-023-00811-3

城市气象精细预报

Intercomparison of the weather and climate physics suites of a unified forecast–climate model system (GRIST-A22.7.28) based on single-column modeling

摘要：As a unified weather-forecast–climate model system, Global-to-Regional Integrated forecast SysTem (GRIST-A22.7.28) currently employs two separate physics suites for weather forecast and typical long-term climate simulation, respectively. Previous AMIP-style experiments have suggested that the weather (PhysW) and climate (PhysC) physics suites, when coupled to a common dynamical core, lead to different behaviors in terms of modeling clouds and precipitation. To explore the source of their discrepancies, this study compares the two suites using a single-column model (SCM). The SCM simulations demonstrate significant differences in the simulated precipitation and low clouds. Convective parameterization is found to be a key factor responsible for these differences. Compared with PhysC, parameterized convection of PhysW plays a more important role in moisture transport and rainfall formation. The convective

parameterization of PhysW also better captures the onset and retreat of rainfall events, but stronger upward moisture transport largely decreases the tropical low clouds in PhysW. These features are in tune with the previous 3D AMIP simulations. Over the typical stratus-to-stratocumulus transition regime such as the Californian coast, turbulence in PhysW is weaker than that in PhysC, and shallow convection is more prone to be triggered and leads to larger ventilation above the cloud layer, reducing stratocumulus clouds there. These two suites also have intrinsic differences in the interaction between cloud microphysics and other processes, resulting in different time step sensitivities. PhysC tends to generate more stratiform clouds with decreasing time step. This is caused by separate treatment of stratiform cloud condensation and other microphysical processes, leading to a tight interaction between macrophysics and boundary layer turbulence. In PhysW, all the microphysical processes are executed at the same temporal scale, and thus no such time step sensitivity was found.

来源：GMD

发布时间：2023-05-31

数据类型：期刊

https://gmd.copernicus.org/articles/16/2975/2023/

基于微雨雷达的降水参数反演和粒子相态识别

摘要：本文基于微雨雷达原始的后向散射信号，采用一种新的功率谱处理算法（RaProM算法），在功率谱计算、噪声去除、退模糊等处理的基础上计算了雷达基本参量, 并反演了液态降水参数，例如雷达反射率因子、雨强等, 并对粒子相态进行识别。RaProM 算法综合考虑粒子下落速度、等效雷达反射率因子、不同相态粒子的尺度特征以及是零度层亮带位置等信息，可识别的粒子相态包括雪、毛毛雨、雨、冰雹以及混合相态。选取了三个山东地区较为典型的个例对 RaProM 反演算法进行验证，即 2021 年 7 月 2 日典型层状云降水个例、2019 年 12 月 25 日雨雪转换个例以及 2018 年 3 月 4 日零度层高度逐渐降低的降水个例。结果显示：粒子识别方法应用于典型层状云降水，垂直方向上不同相态粒子的分层较为明显，过冷层里的固态降水雪花、零度层附近冰水转换区的混合相态降水以及零度层以下的液态降水符合现有认识，验证了反演算法以及粒子识别算法的有效性。将结果进一步在雨雪转换降水相态识别中和零度层高度的检测，该反演算法均能得到较好应用，与同址同步观测的微波辐射计、云雷达、二维视频雨滴谱仪等观测结论一致。另外，与微雨雷达标准反演算法对比，RaProM 算法的优势是没有粒子相态的原始假设，且考虑

降水粒子向上的速度，反演结果与微波辐射计、云雷达在垂直结构上有较高的一致性。与地面激光雨滴谱仪观测数据对比显示,也有效提升了微雨雷达对雨滴谱和雨强的反演能力。关键词:微雨雷达/降水相态分类/方法验证/同址观测/垂直结构

来源：大气科学

发布时间：2023-05-15

数据类型：期刊

http://www.iapjournals.ac.cn/dqkx/cn/article/doi/10.3878/j.issn.1006-9895.2201.21210

FY-4A 卫星闪电资料与 ADTD 闪电资料在四川省冕宁暴雨中的对比分析及数值模拟

摘要：FY-4A 卫星闪电资料与地基 ADTD（Advanced Direction and Time of arrival Detecting system）闪电资料对于研究暴雨等强对流天气具有一定的指示意义，通过对四川省冕宁暴雨个例的研究，对比分析了这两种闪电资料的差别，设计了将两种闪电资料引入数值预报模式的多组数值试验。结果表明：（1）两种闪电资料在不同地区有不同的探测效果，ADTD 闪电资料范围更广且分散，FY-4A 卫星监测到的闪电数量更密集、分布更集中；两种闪电资料在进入模式之后所转化成的代理雷达回波具有很好的一致性；对于低频次的闪电来说，ADTD 闪电定位仪可能比 FY-4A 闪电成像仪探测效率更高。（2）引入任何一种闪电资料都对降水预报具有正效果，其中 ADTD 闪电资料的应用对于短时降水预报准确率的提高更为有效。（3）两种闪电资料对于云微物理量的调整作用，在不同的区域有不同效果，说明这两种闪电资料的分布不完全一致，揭示出这两种闪电资料具有一定的互补性。关键词:闪电资料/对比分析/云分析/数值试验

来源：大气科学

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冬奥会复杂山地百米尺度 10 m 风速预报的机器学习订正对比试验

摘要：本文以传统机器学习算法 XGBoost 和深度学习算法 CU-Net 为基础，针对北京快速更新无缝隙融合与集成预报系统（RISE 系统）预报的北京冬奥会延庆及张家口赛区 100 米分辨率的冬季近地面 10 m 风速数据，进行每日逐小时起报的

未来逐 6 小时间隔的冬奥高山站点及其周边地区风速预报偏差订正方法研究和对比分析。对于站点订正，首先将 RISE 系统预测的 10 m 风速插值到对应的自动气象站站点，然后根据风速等级表归类，针对每个分类单独构建 XGBoost 模型，每个区间模型合并后形成 L-XGBoost，使用均方根误差和预报准确率作为评分标准，结果表明风速归类的 L-XGBoost 算法订正效果比不归类的原始 XGBoost 模型有一定提升，说明在传统机器学习中加入归类方法有助于改善复杂山地站点风速预报技巧。对于站点及其周边地区风速订正，本文在 CU-Net 模型基础上，通过引入不同深度的 CU-Net 子网络，构建了新的算法模型 CU-Net++，并考虑了预报日变化误差和复杂地形对 10 m 风速的影响，以自动气象站为中心构建空间小区域样本数据，对 RISE 系统风速预报偏差进行订正。试验结果表明，CU-Net 和 CU-Net++均可以充分挖掘时间和空间维度的风场变化规律，且 CU-Net++模型风速订正结果优于 CU-Net 模型，有效降低了 RISE 产品的格点风速预报误差，也发现预报误差和复杂地形的引入对 10 m 风速偏差订正起到重要的正向作用。关键词:百米尺度预报/复杂山地/机器学习/风速订正

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Investigation on potential and limitations of ERA5 Reanalysis downscaled on Italy by a convection-permitting model

摘要：This study presents a comprehensive assessment of a dynamical downscaling of ERA5 Reanalysis recently performed over Italy through the COSMO-CLM model at a convection-permitting scale (0.02°) over the period 1989–2020. Results are analysed against several independent observational datasets and reanalysis products. The capability of the downscaling to realistically represent the climatology for 2 m temperature and precipitation is analysed over the whole peninsula and subdomains. Hourly precipitation patterns, orography effects, and urban climate dynamics are also investigated, highlighting the weaknesses and strengths of the convection-permitting model. In particular, gains in performances are achieved in mountainous areas where the climate characteristics are correctly represented, as are the hourly precipitation characteristics. Losses in performances occur in coastal and flat areas of the Italian peninsula, where the convection-

permitting model performance does not seem to be satisfactory, as opposed to complex orographic areas. The adopted urban parameterisation is demonstrated to simulate heat detection for two Italian cities: Rome and Milan. Finally, a subset of extreme climate indicators is evaluated, finding: (i) a region-dependent response, (ii) a notable performance of the convection-permitting model over mountainous areas and (iii) discrepancies in the South, Central and Insular subdomains. Climate indicators detect extreme events at a detailed scale, becoming an i

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Comparison of ozonesonde measurements in the upper troposphere and lower Stratosphere in Northern India with reanalysis and chemistry-climate-model data

摘要：The variability and trend of ozone (O3) in the Upper troposphere and Lower Stratosphere (UTLS) over the Asian region needs to be accurately quantified. Ozone in the UTLS radiatively heats this region and cools the upper parts of the stratosphere. This results in an impact on relative humidity, static stability in the UTLS region and tropical tropopause temperature. A major challenge for understanding ozone chemistry in the UTLS is sparse observations and thus the representation of precursor gases in model emission inventories. Here, we evaluate ozonesonde measurements during August 2016 at Nainital, in the Himalayas, against ozone from multiple reanalyses and the ECHAM6-HAMMOZ model. We find that compared to measurements both reanalyses and ECHAM6-HAMMOZ control simulation overestimate ozone mixing ratios in the troposphere (20 ppb) and in the UTLS (55 ppb). We performed sensitivity simulations using the ECHAM6-HAMMOZ model for a 50% reduction in the emission of (1) NOx and (2) VOCs. The model simulations with NOX reduction agree better with the ozonesonde observations in the lower troposphere and in the UTLS. Thus, neither reanalyses nor ECHAM6-HAMMOZ results can reproduce observed O3 over the South Asian region. For a better representation of O3 in the ECHAM6-HAMMOZ model, NOX emission should be reduced by 50% in the emission inventory. A larger number of observations of ozone and precursor gases over the South Asian region would improve the assessment of ozone chemistry in

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城市气候与生态

Synergy of climate change with country success and city quality of life

摘要：Most people around the world have felt the effects of climate change on their quality of life. This study sought to achieve the maximum efficiency for climate change actions with the minimum negative impact on the well-being of countries and cities. The Climate Change and Country Success (C3S) and Climate Change and Cities Quality of Life (C3QL) models and maps of the world created as part of this research showed that as economic, social, political, cultural, and environmental metrics of countries and cities improve, so do their climate change indicators. For the 14 climate change indicators, the C3S and C3QL models indicated 68.8% average dispersion dimensions in the case of countries and 52.8% in the case of cities. Our research showed that increases in the success of 169 countries saw improvements in 9 climate change indicators out of the 12 considered. Improvements in country success indicators were accompanied by a 71% improvement in climate change metrics.

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人工智能气象

冬奥会复杂山地百米尺度 10 m 风速预报的机器学习订正对比试验

摘要：本文以传统机器学习算法 XGBoost 和深度学习算法 CU-Net 为基础，针对北京快速更新无缝隙融合与集成预报系统（RISE 系统）预报的北京冬奥会延庆及张家口赛区 100 米分辨率的冬季近地面 10 m 风速数据，进行每日逐小时起报的未来逐 6 小时间隔的冬奥高山站点及其周边地区风速预报偏差订正方法研究和对比分析。对于站点订正，首先将 RISE 系统预测的 10 m 风速插值到对应的自动气象站站点，然后根据风速等级表归类，针对每个分类单独构建 XGBoost 模型，每个区间模型合并后形成 L-XGBoost，使用均方根误差和预报准确率作为评分标准，结果

表明风速归类的 L-XGBoost 算法订正效果比不归类的原始 XGBoost 模型有一定提升，说明在传统机器学习中加入归类方法有助于改善复杂山地站点风速预报技巧。对于站点及其周边地区风速订正，本文在 CU-Net 模型基础上，通过引入不同深度的 CU-Net 子网络，构建了新的算法模型 CU-Net++，并考虑了预报日变化误差和复杂地形对 10 m 风速的影响，以自动气象站为中心构建空间小区域样本数据，对 RISE 系统风速预报偏差进行订正。试验结果表明，CU-Net 和 CU-Net++均可以充分挖掘时间和空间维度的风场变化规律，且 CU-Net++模型风速订正结果优于 CU-Net 模型，有效降低了 RISE 产品的格点风速预报误差，也发现预报误差和复杂地形的引入对 10 m 风速偏差订正起到重要的正向作用。关键词:百米尺度预报/复杂山地/机器学习/风速订正

Combining Weather Station Data and Short-Term LiDAR Deployment to Estimate Wind Energy Potential with Machine Learning: A Case Study from the Swiss Alps

摘要：Wind energy potential in complex terrain is still poorly understood and difficult to quantify. With Switzerland’s current efforts to shift to renewable energy resources, it is now becoming even more crucial to investigate the hidden potential of wind energy. However, the country’s topography makes the assessment very challenging. We present two measurement campaigns at Lukmanier and Les Diablerets, as representative areas of the complex terrain of the Swiss Alps. A general understanding of local wind flow characteristics is achieved by comparing wind speed measurements from a near-surface ultra-sonic anemometer and from light detection and ranging (LiDAR) measurements further aloft. The measurements show how the terrain modifies synoptic wind for example through katabatic flows and effects of local topography. We use an artificial neural network (ANN) to combine the data from the measurement campaign with wind speed measured by weather stations in the surrounding area of the study sites. The ANN approach is validated against a set of LiDAR measurements which were not used for model calibration and also against wind speed measurements from a 25-meter mast, previously installed at Lukmanier. The statistics of the ANN output obtained from multi-year time series of nearby weather stations match accurately the ones of the mast data. However, for the rather short validation periods from the LiDAR, the ANN has difficulties in predicting lowest wind speeds at both sites, and highest

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