城市气象科技信息监测简报

2023 年 2 月 （总第 20 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 3 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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❖报告概述

✧监测周期：

2023 年 02 月 01 日 - 2023 年 02 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 10 条，分别来自 WMO 7 篇，中科院大气物理研究所 3 篇：

1. GRL: 华北平原冬季 PM2.5 浓度的次季节翻转及成因

摘要：华北平原是我国大气污染最严重的区域之一。自《大气十条》和《蓝天保卫战五年计划》执行以来，华北平原的 PM2.5 浓度出现明显下降，但整体水平依旧高于世界卫生组织给定的健康阈值。华北平原 PM2.5 污染主要由排放和不利的气象因素所致，后者主要调制其年际变率。针对华北平原 PM2.5 污染的年际变率，前人做了充分研究。然而对华北平原 PM2.5 污染次季节变异的研究较少。此外，前人的研究指出引起华北平原秋季和冬季 PM2.5 污染次季节变异的环流具有对称性，而对于是否存在非对称的大气环流贡献于华北平原前冬（11 月至 12 月）和后冬（次年 1 月至 2 月）PM2.5 浓度异常的次季节变异尚不清楚。近日，中国科学院大气物理研究所和中国海洋大学联合培养博士研究生安霞东（导师陈文教授和盛立芳教授），联合马天娇博士、大气所毕业博士阿如哈斯、蔡晴宇博士以及中国海洋大学李春教授，利用 TAP 的 PM2.5 数据和 NCEP 再分析数据等揭示了华北平原 PM2.5 浓度异常在前冬和后冬的次季节翻转特征及其成因。研究结果发现华北平原初冬和晚冬存在明显的 PM2.5 浓度异常翻转现象（图 1），北极海冰异常对该现象起着重要的调制作用。前冬，与正北大西洋涛动（NAO）型有关的负类斯堪的纳维亚模态在东北亚地区引起准正压的反气旋式异常（东北亚异常反气旋），该反气旋异常通过动力和热力过程导致华北平原出现更高的 PM2.5 浓度。与此同时，与正 NAO 型相关的异常暖平流促使巴伦支海海冰融化，进而释放热通量，该热通量在后冬达到峰值。后冬，巴伦支海海冰融化后释放的热通量在北极地区激发出反气旋式异常，该反气旋式异常以波动的形式向低纬地区传播，形成极地-欧亚型（POL）遥相关，

进而在东北亚地区引起准正压的气旋式异常，该气旋式异常则通过动力和热力过程导致华北平原出现更低的 PM2.5 浓度。反之亦然（图 2）

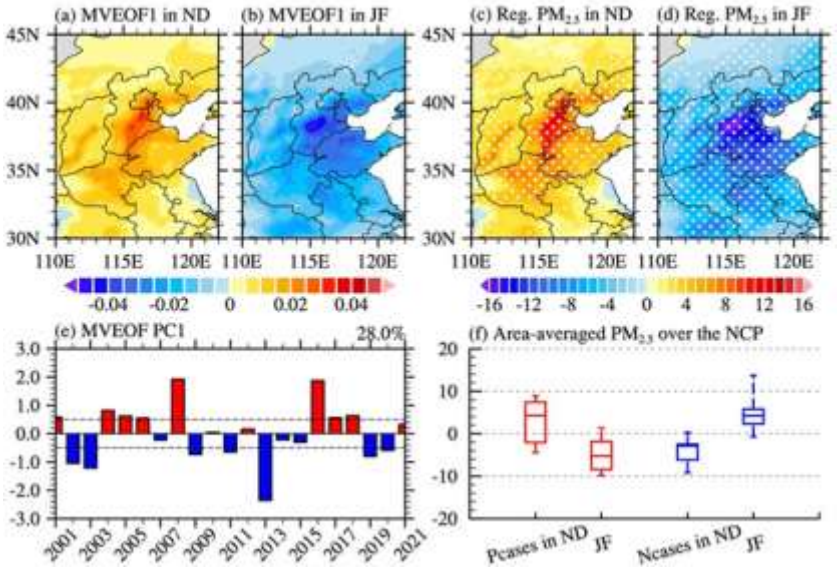


图 1. 基于多变量 EOF 的华北平原前冬（a 和 c）和后冬（b 和 d）PM2.5 浓度异常的空间分布及其时间序列（e）；（f）正、负 PM2.5 次季节翻转事件期间华北平原区域平均的 PM2.5 浓度异

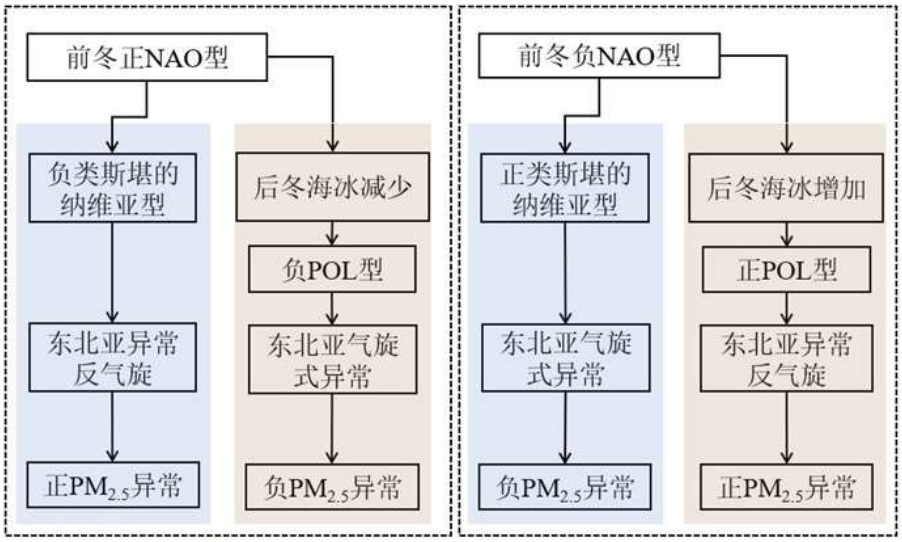


图 2. 相关物理机制流程图

来源：大气物理所

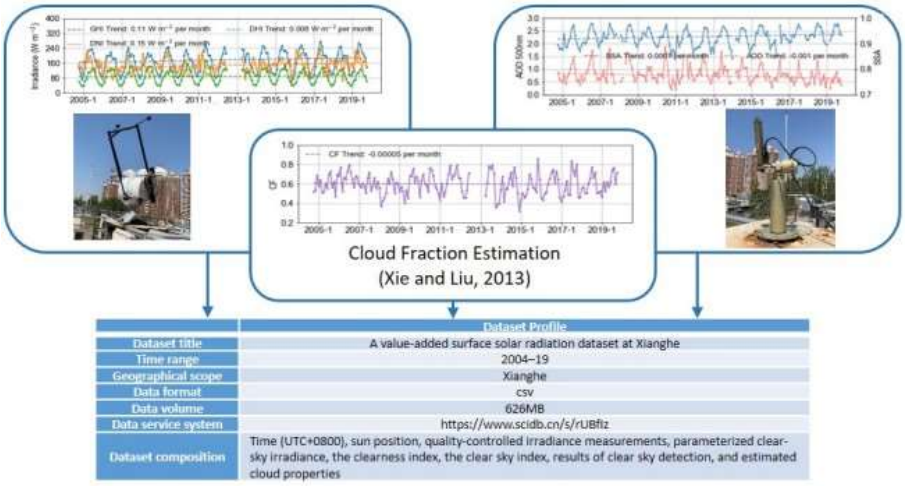
发布时间：2023-02-28

数据类型：资讯

http://www.iap.cas.cn/gb/xwdt/kyjz/202302/t20230228_6685821.html

2. AAS: 大气所发布香河站地表太阳辐射观测数据集

摘要：地表太阳辐射是地球辐射收支中非常重要的一部分，高质量长时间序列的地表太阳辐射观测有助于气候变化相关的监测与研究。夏祥鳌研究员带领的中国科学院大气物理研究所、成都信息工程大学和南京信息工程大学联合团队利用香河站高时间分辨率的地表太阳辐射观测数据，结合基于机器学习技术的晴空识别算法及云量提取算法，构建包含晴空识别结果和云量估算结果的长期高质量地表太阳辐射观测数据集，并对香河站 2005-2019 年的太阳辐射、气溶胶和云特征参数的长期变化趋势进行了评估。相关研究成果发表在 Adv. Atmos. Sci.杂志上。香河站长时间序列太阳辐射、气溶胶和云特征参数数据集结果表明，研究期间·香河站全天空地表太阳总辐射、直接辐射及散射辐射均呈增加趋势（1.32 Wm-2 yr-1、1.8 Wm-2 yr-1、0.096 Wm-2 yr-1）·气溶胶光学厚度呈降低趋势（-0.012 yr-1），气溶胶单次散射反照率呈增加趋势（-0.0012 yr-1）·云量呈降低趋势（0.0006 yr-1）。此外，研究表明，香河站地表太阳辐射在晴天和云天条件下均呈“变亮（brightening）”趋势。本研究构建的数据集有助于为华北平原的辐射与气候变化、太阳辐射资源预报、卫星产品验证及气溶胶-云-辐射相互作用等研究提供数据支持。



香河站长时间序列太阳辐射、气溶胶和云特征参数数据集

来源：大气物理所

发布时间：2023-02-24

数据类型：资讯

http://www.iap.cas.cn/gb/xwdt/kyjz/202302/t20230224_6682756.html

3. Better flood forecasting is key to Early Warnings for All

摘要：Only about 40 percent of WMO members provide flash flood forecasting, and one third provide drought forecasting – often not reaching all people of the country. This needs to improve in order to achieve the UN Early Warnings for All initiative and there needs to be a concerted effort towards a global water information system.WMO Secretary-General Prof Petteri Taalas told an international conference in Japan that the overall success of an early warning system ultimately depends on its ability to translate warnings, and particularly impact-based forecasts, into prevention and mitigation measures for all affected people, including hard-to-reach communities.Integrated flood and drought management – rather than patchy emergency driven responses is vital, as is a stronger monitoring network.“There is a particular need to develop capabilities at the regional, national, river-basin and community level,” said Prof. Taalas. “Collaboration is key across all sectors, and users,” he said in a keynote address to International Conference on Flood Management, which is held every three years.The conference is an important opportunity for interaction on flood issues. It took place just one month before the UN 2023 Water Conference, which will be the first UN Water Conference since 1977.“A global water information system, one of the game changers of the March UN Water Conference in New York is a solution to strengthen not only the information base we need to reduce vulnerability but also the solidarity that will make us more resilient, said UN General Assembly President Csaba Kőrösi,The conference hosted a High-level Symposium on “Integrated Water Cycle Management in the post-COVID-19 era” to compile collective messages from the flood community to submit to the UN Water Conference.

来源：WMO

发布时间：2023-02-22

数据类型：资讯

https://public.wmo.int/en/media/news/better-flood-forecasting-key-early-warnings-all

4. Heat and drought bite in large parts of South America

摘要：Since 2019 large parts of Argentina and neighboring countries have been reeling under drought conditions with the last four months of 2022 receiving less than half of the average precipitation: the lowest rainfall in 35 years.Combined with high temperatures, this has led to widespread crop failures. Argentina is one of the world’s top wheat exporters but agricultural exports for 2023 are projected to further drop 28% compared to 2022 levels. Uruguay declared an agricultural emergency in October 2022,

with 60% of the country's territory experiencing "extreme" or "severe" drought.Scientists from Argentina, Colombia, France, the United States of America, the Netherlands and the United Kingdom collaborated to assess to what extent human-induced climate change altered the likelihood and intensity of the low rainfall that led to drought, focussing on the particularly severe three months from October to December 2022.The World Weather Attribution rapid analysis concluded that climate change was NOT the main driver of the reduced rainfall. However, it also showed that climate change increased temperatures in the region, which probably reduced water availability and worsened the impacts of drought.The region is also experiencing intense heatwaves, which climate change has increased in frequency, intensity and duration. In a recent study conducted in an overlapping area, World Weather Attribution scientists found that human-induced climate change made extreme temperatures in December 2022 about 60 times more likely.Argentina experienced its warmest November-January on record and is now enduring its eighth heatwave of the season, according to Argentina's National Meteorological Service.

来源：WMO

发布时间：2023-02-21

数据类型：资讯

https://public.wmo.int/en/media/news/heat-and-drought-bite-large-parts-of-south-america

5. Weather balloons are important part of Global Observing System

摘要：Weather balloons are an important part of the Global Observing System which underpins weather forecasts and climate monitoring.Millions of observations are gathered worldwide every day: from space by over 50 satellites; from the ocean by 400 moored buoys, 1 250 drifting buoys and 7 300 ships; by 4 000 aircraft from around 40 commercial aircraft companies, 7 300 ships and 10 000 automated and land-based observing stations, and by nearly 1000 weather balloons equipped with radio-sondes.Radiosondes, which act as upper-air stations are attached to free-rising balloons and released simultaneously from almost 900 locations worldwide. Over two thirds of the stations report observations at 0000UTC and 1200UTC. Between 100 and 200 stations make observations once per day.The balloon flights last for around 2 hours, making measurements of pressure, wind velocity, temperature and humidity from just above ground to heights of up to 35 km. They can travel many kilometers before the balloon bursts and falls back to earth under a

parachute Weather balloons have been a very important part of the global observing network for decades as they are the primary source of data above the ground. They provide valuable input in real-time for computer forecast models, local data for meteorologists to make forecasts and predict storms, climate monitoring and data for research to better understand weather and climate processes. Computer forecast models which use weather balloon data are used by all forecasters worldwide.The balloons themselves are made of natural rubber latex or a synthetic latex based on polychloroprene.

来源：WMO

发布时间：2023-02-17

数据类型：资讯

https://public.wmo.int/en/media/news/weather-balloons-are-important-part-of-global-observing-system

6. Another poor rainy season forecast for drought hit Horn of Africa

摘要：Catastrophic consequences of the multi-year drought will continue in 2023 in the Horn of Africa, leaving communities in urgent need of assistance. According to new seasonal forecast, below-normal rainfall is expected in most parts of the region over the next three months. Should this happen, it would be an unprecedented sixth poor season for the worst hit countries - Ethiopia, Kenya and Somalia.The IGAD Climate Prediction and Applications Centre (ICPAC), which is a WMO regional climate centre, announced that below-normal rainfall is expected in most parts of the Greater Horn of Africa (GHA) over the next three months, coupled with high temperatures. The announcement was made following the Greater Horn of Africa Climate Outlook Forum (GHACOF 63), which examined the forecast for the March to May 2023 season, which accounts for up to 60% of total annual rainfall in Equatorial parts of the region.In the regions severely hit by drought, the current trends are worse than those observed during the drought of 2010-2011. The Food Security and Nutrition Working Group (FSNWG), co-chaired by IGAD and FAO, estimates that close to 23 million people are currently highly food insecure in Ethiopia, Kenya, and Somalia.A joint statement from 15 meteorological and humanitarian agencies, including WMO, says that communities will need years to recover. It calls for a sustained “no regrets” humanitarian efforts.The current drought began with the poor performance of the October–December 2020 rains and has since deepened with all four subsequent seasons also performing poorly.

来源：WMO

发布时间：2023-02-17

数据类型：资讯

https://public.wmo.int/en/media/news/another-poor-rainy-season-forecast-drought-hit-horn-of-africa

7. Catastrophic consequences of Horn of Africa drought will continue in 2023

摘要：Catastrophic consequences of the multi-year drought will continue in 2023 in the Horn of Africa, leaving communities in urgent need of assistance. Seasonal forecasts suggest a reasonable chance that the upcoming March–May rains will again underperform. Should this happen, it would be an unprecedented sixth poor season, according to a new joint statement by meteorological agencies and humanitarian partners.WMO is one of the 15 signatories of the joint statement, which says that communities will need years to recover from this historically severe drought. It calls for a sustained “no regrets” humanitarian efforts.The Horn of Africa is facing an unprecedented, three-year drought, with catastrophic humanitarian impacts. The occurrence of another poor rainy season between March–May 2023, as forecast by some meteorological agencies, would have devastating consequences for communities.A more detailed seasonal forecast for the March to May rainy season will be provided by the Greater Horn of Africa Climate Outlook Forum on 22 February. This is organized by IGAD’s Climate Prediction and Applications Centre (ICPAC), which is a WMO regional climate centre. The forum brings together climate scientists, researchers, users from key socio-economic sectors, governmental and non-governmental organizations, development partners, decision-makers, media, and civil society stakeholders.

来源：WMO

发布时间：2023-02-17

数据类型：资讯

https://public.wmo.int/en/media/news/catastrophic-consequences-of-horn-of-africa-drought-will-continue-2023

8. AR&AE：聚类解析北京臭氧变化特征

摘要：近年来，北京臭氧污染问题日益凸显，臭氧污染已成为制约首都空气质量持续改善的重要因素之一。对流层臭氧主要由氮氧化物和挥发性有机物发生光化学反应生成，也会受平流层-对流层交换和臭氧及其前体物的区域输送等天气过程

影响。相比于月份、季节、年际等时间尺度的平均臭氧特征统计分析，聚类算法更有助于解析更短时间尺度天气过程对臭氧变化特征的影响。中国科学院大气物理研究所与成都信息工程大学、北京市城市气象研究院合作，分别使用北京长期臭氧探空数据集（2001-2019 年）和地面臭氧观测资料（2013-2020 年暖季）开展聚类分析，并结合多源数据和方法（常规气象要素，卫星观测，再分析资料，轨迹模拟，PSCF 潜在贡献源算法等）探讨北京地区对流层和近地层臭氧分布变化特征及其成因。对流层臭氧垂直特征研究表明，整体来说，由于同时受气象因子和臭氧前体物季节变化（暖季高 VOCs、冷季高 NOx）影响，北京地区对流层臭氧浓度呈暖季高、冷季低分布特征。聚类算法分类（图 1）及其分类节点 1、7 的 PSCF 算法（图 2）对比显示北京地区春夏季臭氧分布易受南部地区生物质燃烧活动影响，近些年华北平原生物质燃烧控制使得夏季对流层极高臭氧浓度出现频率有所减少。春冬季北京对流层臭氧分布易受平流层入侵和高纬地区臭氧输送影响（分类节点 3），使得上对流层臭氧浓度显著升高。针对北京地面臭氧日变化特征开展聚类分析来探讨主要型态、时变特征及其气象和化学影响机制，研究结果表明，北京地面臭氧日变化可分为四种类型：整日偏低型、夜高昼低型、夜低昼高型、整日偏高型。其中，整日偏高型具有更长的时间持续性（平均可达 2.3 天）。夜间异常的边界层气象条件是推动夜间臭氧浓度偏高的主要推手，其中夜间对流外围的下沉补偿气流导致夜高昼低型的夜间高浓度臭氧，夜间低空急流导致整日偏高型的夜间高浓度臭氧（图 3）。

来源：大气物理所

发布时间：2023-02-14

数据类型：资讯

http://www.iap.cas.cn/gb/xwdt/kyjz/202302/t20230214_6675742.html

9. Digital transformation will improve early warnings in Africa

摘要：Digital technologies could help hydrometeorological services in Africa to deliver services and early warnings more effectively and efficiently to user communities. The World Meteorological Organization is therefore holding a meeting of experts in weather, climate and water services to try to speed the digital transformation.The Regional Association for Africa conference, organized in collaboration with the Ethiopian Meteorological Institute, takes place this week in Addis Ababa.“The frequency and intensity of hazards is significant in Africa and the impacts are putting pressure on socioeconomic sectors. The government of Ethiopia, in partnership with the Ethiopian Meteorological Institute (EMI), has established a modernized network for collecting and interpreting meteorological data for early warning services to improve lives and

livelihoods," said Ethiopian State Minister for Water and Energy, H.E. Dr Abraha Adugna.Africa is highly vulnerable to impacts of climate change and extreme weather. The Greater Horn of Africa is gripped by extreme and prolonged drought, which has destroyed crops, killed livestock and plunged millions into acute food insecurity. Tropical cyclones and deadly floods have also caused many casualties and severe socio-economic losses in countries ranging from Madagascar to Nigeria to South Africa in the past year.

来源：WMO

发布时间：2023-02-13

数据类型：资讯

https://public.wmo.int/en/media/news/digital-transformation-will-improve-early-warnings-africa

10. Barbados hosts regional launch of Early Warnings for All Initiative

摘要：Bridgetown, Barbados, hosts on 6 February the first regional launch of the United Nations' Early Warnings for All initiative (EW4ALL), which aims to ensure that every person on Earth is covered by an early warning system by the year 2027. WMO is one of the leading partners in the initiative.Caribbean leaders, including the Prime Minister of Barbados, Her Excellency, Mia Mottley, the Prime Minister of Saint Lucia, His Excellency, Philip J. Pierre, the Secretary-General of the Caribbean Community (CARICOM), Dr. Carla Barnett, and the Executive Director of the Caribbean Disaster Emergency Management Agency (CDEMA), Elizabeth Riley, are launching the initiative. The Deputy Secretary-General of the United Nations, Amina J. Mohammed, the Head of the United Nations Office for Disaster Risk Reduction (UNDRR), Mami Mizutori, the Secretary-General of the World Meteorological Organization (WMO), Professor Petteri Taalas, and the UN Resident Coordinator for Barbados and the Eastern Caribbean, Didier Trebucq, are also participating.The "Regional Launch of the Early Warnings for All Initiative (EW4ALL) for the Caribbean" aims to drive coordinated political action towards strengthening multi-hazard early warning systems for hazards such as hurricanes, tropical storms, tsunamis, volcanoes, floods, landslides, and epidemics, among others. It coincides with a WMO Regional Conference "Increasing weather, water and climate resilience in North America, Central America and the Caribbean" taking place in Kingston, Jamaica, from 6 to 9 February 2023.The Executive Action Plan for the implementation of the EW4ALL initiative was unveiled by United Nations Secretary-General António Guterres during the COP 27 Climate Change Conference in Sharm el-Sheikh, Egypt, to achieve the

goal of every person on Earth being protected by early warning systems by 2027, with the priority to support the most vulnerable.

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https://public.wmo.int/en/media/press-release/barbados-hosts-regional-launch-of-early-warnings-all-initiative

✧文献信息

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城市边界层

Long term spatiotemporal trends and health risk assessment of remotely sensed PM2.5 concentrations in Nigeria

摘要：PM2.5 is an important indicator reflecting air quality variations. Currently, environmental pollution related issues have become more severe that significantly threaten human health. The current study is an attempt to analyze the spatio-dynamic characteristics of PM2.5 in Nigeria based on the directional distribution and trend clustering analysis from 2001 to 2019. The results indicated that PM2.5 concentration increased in most of the Nigerian states, particularly in mid-northern and southern states. The lowest PM2.5 concentration in Nigeria is even beyond the interim target-1 (35 μg/m3) of the WHO. During the study period, the average PM2.5 concentration increased at a growth rate of 0.2 μg/m3/yr from 69 μg/m3 to 81 μg/m3. The growth rate varied from region to region. Kano, Jigawa, Katsina, Bauchi, Yobe, and Zamfara experienced the fastest growth rate of 0.9 μg/m3/yr with 77.9 μg/m3 mean concentration. The median center of the national average PM2.5 moved toward the north indicating the highest PM2.5 concentration in northern states. The Saharan desert dust is the dominant source of PM2.5 in northern areas. Moreover, agricultural practices and deforestation activities along with low rainfall increase desertification and air pollution in these regions. Health risks increased in most of the mid-northern and southern states. The extent of ultra-high health risk (UHR) areas corresponding to the 8×104−7.3×106 μg·person/m3 increased from 1.5% to 2.8%. Mainly Kano, Lagos, Oyo, Edo

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https://www.sciencedirect.com/science/article/pii/S0269749123003846

Multilayer inversion formation and evolution during persistent heavy air pollution events in the Sichuan Basin, China

摘要：The Sichuan Basin (SB) is one of the most air-polluted areas in China. The deep mountain-basin orography and the unique geographic location on the leeward slope of the Tibetan Plateau cause multilayer inversions to occur frequently in winter, which greatly increases the possibility of local heavy pollution. However, the genesis and development mechanisms of the multilayer inversions during the heavy pollution event are unclear. In this study, radiosonde measurements, air quality data, and European Centre for Medium-Range Weather Forecasts (ECMWF) ERA5 reanalysis data were employed to investigate the formation and evolution of the multilayer inversions during 10 persistent heavy pollution events from 2015 to 2019. The results revealed that >90% of the persistent heavy pollution events in the SB included multilayer inversions. The inversions occurred near the ground (i.e., boundary layer inversion) and at heights of approximately 2000–3800 m above the ground (i.e., lower troposphere inversion, LTI). The large-scale pressure patterns in the middle of the troposphere forced the formation and evolution of the multilayer inversions during the persistent heavy pollution events. Strong mid-level warm air advection induced by a large-scale warm high-pressure ridge was the dominant factor in the formation and maintenance of the multilayer inversion. Furthermore, strong cold advection associated with an approaching large-scale cold low-pressure trough played a prominent role in the weak

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https://www.sciencedirect.com/science/article/pii/S0169809523000881

Fine micro- and nanoplastics particles (PM2.5) in urban air and their relation to polycyclic aromatic hydrocarbons

摘要：Highlights•We measured atmospheric concentrations of three polymer types in urban PM2.5 samples.•Mean plastic concentration (size <2.5 μm) was 238 ng/m3, which is 0.67% of PM2.5 mass.•Correlations of PP and PE with single PAH congeners were identified.•Correlations are more likely with low molecular weight PAHs and polymers.•Results indicate possible PAH carrier activities of UFMNP.Microplastics and nanoplastics have been reported in nearly all environmental compartments, the dataset about their contributions and their role as a sink and carrier for other hydrophobic compounds in the atmosphere however is limited. This study presents, for the first time, atmospheric concentrations of ultrafine microplastics and nanoplastics (UFMNP) on the

single polymer level and their correlations with atmospheric concentrations of 23 polycyclic aromatic hydrocarbons (PAHs). Measurements of UFMNP in ambient particulate matter (PM2.5) were performed for an urban sampling site in Graz, Austria. During the sampling period of 02.01. – 31.03.2017 the average UFMNP concentration was 238 ng/m3, reaching up to 557 ng/m3. This accounts for an average contribution of 0.67% to PM2.5 mass and 1.7% of organic matter. The individual polymer types were polyethylene terephthalate (PET), polypropylene (PP) and polyethylene (PE), which sum up the most demanded polymer types in Europe. PET was found to be the most prominent polymer in the urban samples contributing to 50% of the overall UFMNP mass, followed by

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Ambient temperature and air pollution associations with suicide and homicide mortality in California: A statewide case-crossover study

摘要：Highlights•Increased ambient temperature was associated with increased odds of suicide deaths.•Increased ambient temperature was associated with increased odds of homicide deaths.•The temperature-mortality associations were larger among older individuals.•No associations with suicide or homicide deaths were observed for air pollutants.BackgroundHigher ambient temperature and air pollution may contribute to increased risk of behaviors harmful to oneself or to others; however, quantitative evidence is limited. We examined the relationship of deaths due to suicide and homicide with temperature and air pollution in California—a state prone to high levels of both exposures.MethodCalifornia death certificates from 2014 to 2019 were used to identify deaths due to suicide and homicide. Residential data for decedents were used to assign exposure to daily temperature (maximum[Tmax], minimum[Tmin]) and daily average air pollution concentrations (particulate matter <10 μm[PM10] and < 2.5 μm[PM2.5], nitrogen dioxide[NO2], ozone[O3]). Tmin served as a surrogate for nighttime temperature. A time-stratified case-crossover study design using conditional logistic regression was used to assess the effects of daily exposure to temperature and air pollutants on suicide and homicide mortality, adjusting for relative humidity. Effect modification by sex and age was

assessed.ResultsWe observed 24,387 deaths due to suicide and 10,767 deaths due to homicide. We found a monotonic temperature associatio

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Substantial short- and long-term health effect due to PM2.5 and the constituents even under future emission reductions in China

摘 要：Highlights•WRF-CMAQ are used to conduct climate and air quality simulation at present and future.•The future long-term exposure premature deaths are projected to increase due to aging.•The short-term exposure premature deaths are projected to decrease at SSP1-2.6.•For PM2.5 constituents, organic carbon leads to the most short-term exposure deaths.•We find an amplified health effect due to compound events compared to single events.Heavy pollution events of fine particulate matter (PM2.5) frequently occur in China, seriously affecting the human health. However, how meteorological factors and anthropogenic emissions affect PM2.5 and the major constituents, as well as the subsequent health effect, remains unclear. Here, based on regional climate and air quality models Weather Research and Forecasting (WRF) and Community Multiscale Air Quality (CMAQ), the PM2.5 and major constituents in China at present and mid-century under the carbon neutral scenario Shared Socioeconomic Pathways (SSP)1–2.6 are simulated. Due to anthropogenic emission reduction, concentrations of PM2.5 and the constituents decrease substantially in SSP1–2.6. The long-term exposure premature deaths at present are 2.23 million per year in mainland China, which is projected to increase by 76 % under SSP1–2.6 despite emission reduction, primarily attributable to aging which strikingly offsets the effect of air quality improvement. The number of annual premature deaths resulting from short-term exposure is 228,104 in

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Multi-output machine learning model for regional air pollution forecasting in Ho Chi Minh City, Vietnam

摘要：Air pollution concentrations in Ho Chi Minh City (HCMC) have been found to surpass the WHO standard, which has become a very serious problem affecting human health and the ecosystem. Various machine learning algorithms have recently been widely used in air quality forecasting studies to predict possible impacts. Training and constructing several machine learning models for different air pollutants, such as NO2, SO2, O3, and CO forecasts, is a time-consuming process that necessitates additional effort for deployment, maintenance, and monitoring. In this paper, an effort has been made to develop a multi-step multi-output multivariate model (a global model) for air quality forecasting, taking into account various parameters such as meteorological conditions, air quality data from urban traffic, residential, and industrial areas, urban space information, and time component for the prediction of NO2, SO2, O3, CO hourly (1 h to 24 h) concentrations. The global forecasting model can anticipate multiple air pollutant concentrations concurrently, based on past concentrations of covariate characteristics. The datasets on air pollution time series were gathered from six HealthyAir air quality monitoring sites in HCMC between February 2021 and August 2022. Darksky weather provided the hourly concentrations of meteorological conditions for the same period. This is the first model built using real-time air quality data for NO2, SO2, CO, and O3 forecasting in HCM city. To assess the effecti

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Enhanced nitrate contribution to light extinction during haze pollution in Chengdu: Insights based on an improved multiple linear regression model

摘要：In recent years, the annual mean concentration of PM2.5 has decreased in Chengdu, China; however, atmospheric visibility has not improved accordingly. Low-visibility events occurred even when the PM2.5 mass concentrations were below the national ambient air quality secondary standard (daily mean concentration, 75 μg/m3). In this study, the non-linear relationship between PM2.5 and visibility was analyzed under

different NO3− mass fractions in PM2.5 based on 2-year field observation data. The results indicated that NO3− formation contributed to particulate pollution events and reduced atmospheric visibility. Multiple linear regression was used to propose a localized reconstruction equation for the light-scattering coefficient. According to the maximum likelihood estimation method and log-transformed residuals, the mass scattering coefficients (MSEs) of organic matter (OM), NH4NO3, and (NH4)2SO4 in Chengdu were 7.42, 3.83, and 3.80, respectively. OM and NH4NO3 contributed to more than 50% of the light-extinction coefficient (bext). NH4NO3 was the main pollutant causing the substantial increase in bext. Chengdu has a high relative humidity (annual mean 70%), and under such conditions, the contribution of NH4NO3 to bext was considerably enhanced through hygroscopic growth and heterogeneous reactions. This study estimated the localized MSEs of OM, NH4NO3, and (NH4)2SO4 in Chengdu and emphasized that effective control measures to reduce nitrate and its precursors could simultaneous

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The shifting of secondary inorganic aerosol formation mechanisms during haze aggravation: the decisive role of aerosol liquid water

摘要：Although many considerable efforts have been done to reveal the driving factors on haze aggravation, however, the roles of aerosol liquid water (ALW) in secondary inorganic aerosol (SIA) formation were mainly focused on the condition of aerosol liquid water content (ALWC) 100 μg m−3. Based on the in situ high-resolution field observations, this work studied the decisive roles and the shifting of secondary inorganic aerosol formation mechanisms during haze aggravation, revealing the different roles of ALWC on a broader scale (~500 μg m−3) in nitrate and sulfate formation induced by aqueous chemistry in the ammonia-rich atmosphere. The results showed that chemical domains of perturbation gas limiting the generation of secondary particulate matter presented obvious shifts from a HNO3-sensitive to a HNO3- and NH3-co-sensitive regime with the haze aggravation, indicating the powerful driving effects of ammonia in the ammonia-rich atmosphere. When ALWC 75 μg m−3, the sulfate generation was preferentially triggered by the high ammonia utilization and then accelerated by nitrogen oxide oxidation from

clean to moderate pollution stages, characterized by nitrogen oxidation ratio (NOR) 0.3, sulfur oxidation ratio (SOR) 0.4, ammonia transition ratio (NTR) 0.7 and the moral ratio of NO3-/SO42-=2:1. When ALWC 75 μg m−3, the aqueous-phase chemistry reaction of SO2 and NH3 in ALW became the prerequisite for SIA formation driven by Henry's law in the ammonia-rich atmosphere during heavy and serious stages, characterized by high SOR (0.5–0.9), NOR (0.3–0.5) and NTR (0.7), as well as the high moral ratio of NO3-/SO42-=1:1. A positive feedback of sulfate on nitrate production was also observed in this work due to the shift in ammonia partitioning induced by the ALWC variation during haze aggravation. It implies the target controlling of haze should not simply focus on SO2 and NO2, but more attention should be paid to gaseous precursors (e.g., SO2, NO2, NH3) and aerosol chemical constitution during different haze stages.

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https://acp.copernicus.org/articles/23/2365/2023/

A nested machine learning approach to short-term PM2.5 prediction in metropolitan areas using PM2.5 data from different sensor networks

摘要：Highlights•Create a machine learning approach that uses PM2.5 observations from different sensor networks for short-term predictions•Present a complete case study using the novel prediction approach in an urban setting•Conduct comprehensive evaluations of the novel approach against common baseline modelsMany predictive models for ambient PM2.5 concentrations rely on ground observations from a single monitoring network consisting of sparsely distributed sensors. Integrating data from multiple sensor networks for short-term PM2.5 prediction remains largely unexplored. This paper presents a machine learning approach to predict ambient PM2.5 concentration levels at any unmonitored location several hours ahead using PM2.5 observations from nearby monitoring sites from two sensor networks and the locations social and environmental properties. Specifically, this approach first applies a Graph Neural Network and Long Short-Term Memory (GNN-LSTM) network to time series of daily observations from a regulatory monitoring network to make predictions of PM2.5. This network produces feature vectors to store aggregated daily observations as well as dependency characteristics to predict daily PM2.5. The daily feature vectors are then set as the precondition of the hourly level learning process. The hourly level learning again uses a GNN-LSTM network

based on daily dependency information and hourly observations from a low-cost sensor network to produce spatiotemporal feature vectors cap

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数据类型：期刊

https://www.sciencedirect.com/science/article/pii/S004896972300952X

Exploring air pollution characteristics from spatio-temporal perspective: A case study of the top 10 urban agglomerations in China

摘 要：Air pollution has become a global public health risk factor as rapid urbanization advances. To observe the air pollution situation, air monitoring stations have been established in many cities, which record six air pollutants. Previous studies have identified cities exhibiting similar air pollution characteristics by combining principal component analysis (PCA) with cluster analysis (CA). However, spatial and temporal effects were neglected. In this paper, we focus on the combination of GTWPCA and STCA, which fully incorporates spatio-temporal effects. It is then applied to air pollution data from the top 10 urban agglomerations in China during 2016–2021. Key experimental findings include: 1. GTWPCA provides a more detailed interpretation of local variation than PCA. 2. Compared with CA, STCA highlights the coupling effect in the spatial and temporal dimensions. 3. The combination of GTWPCA and STCA captures similar air pollution characteristics from spatio-temporal perspectives, which has the potential to help environmental authorities take further action to control air pollution.

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Different Turbulent Regimes and Vertical Turbulence Structures of the Urban Nocturnal Stable Boundary Layer

摘 要：Turbulence in the nocturnal boundary layer (NBL) is still not well characterized, especially over complex underlying surfaces. Herein, gradient tower data

and eddy covariance data collected by the Beijing 325-m tower were used to better understand the differentiating characteristics of turbulence regimes and vertical turbulence structure of urban the NBL. As for heights above the urban canopy layer (UCL), the relationship between turbulence velocity scale (VTKE) and wind speed (V) was consistent with the “HOckey-Stick” (HOST) theory proposed for a relatively flat area.Four regimes have been identified according to urban nocturnal stable boundary layer. Regime 1 occurs where local shear plays a leading role for weak turbulence under the constraint that the wind speed VVT and is mainly driven by bulk shear. Regime 3 is identified by the existence of moderate turbulence when upside-down turbulence sporadic bursts occur in the presence of otherwise weak turbulence. Regime 4 is identified as buoyancy turbulence, when V>VT, and the turbulence regime is affected by a combination of local wind shear, bulk shear and buoyancy turbulence.The turbulence activities demonstrated a weak thermal stratification dependency in regime 1, for which within the UCL, the turbulence intensity was strongly affected by local wind shear when V

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https://link.springer.com/article/10.1007/s00376-022-2198-8

Associations of outdoor fine particulate air pollution and cardiovascular disease: Results from the Prospective Urban and Rural Epidemiology Study in China (PURE-China)

摘要：Background Evidence on whether an excess risk of incidence and mortality of cardiovascular disease (CVD) among people exposed to a high level of ambient PM2.5 in low- and middle-income countries (LMICs) is lacking. This study aimed to investigate the associations between long-term exposure to ambient fine particulate matter<2.5 μm (PM2.5) concentrations and the risk of incidence and mortality of CVD in a large cohort study from 115 communities. Methods In this cohort study, we followed 42 160 adults aged 35–75 years at baseline who enrolled in the Prospective Urban and Rural Epidemiology Study conducted in China (PURE-China) between 2005 and 2009 with ambient PM2.5 estimates, and followed up until August 2021. Cox proportional hazards frailty models were used to estimate the associations between long-term mean outdoor PM2.5 concentrations and CVD events, CVD mortality, and all-cause mortality. Findings During

a median follow-up period of 11.8 years, we documented 2 190 deaths, including 732 CVD deaths. There were 4 559 (10.8 %) of 42 160 participants who experienced incident total CVD, among them there were 861 myocardial infarctions (MI) and 2 338 S. The 3-year median concentration of ambient PM2.5 before the cohort commencement was 52.7 μg/m3 (interquartile range [IQR] 30.3–74.6). In full adjusted model, a 10 μg/m3 increase in PM2.5 was associated with a hazard ratio (HR) of 1.12 (95 % CI 1.11–1.14) for major CVD and 1.03 (95 % CI 1.01–1.05) for all-cause mortality. Besides, lon

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数据类型：期刊

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Source apportionment of ambient PM2.5 in an industrialized city using dispersion-normalized, multi-time resolution factor analyses

摘要：Ambient fine particulate matter (PM2.5) data were collected in the lower City of Hamilton, Ontario to apportion the sources of this pollutant over an 18-month period. Hamilton has complex topographical features that may result in worsened air pollution within the lower city, thus, dispersion-normalized, multi-time resolution factor analysis (DN-MT-FA) was used to identify and quantify contributions of factors in a manner that reduced the influence of local meteorology. These factors were secondary organic aerosols type 1 (SOA_1), particulate nitrate (pNO3), particulate sulphate (pSO4), primary traffic organic matter (PTOM), Steel/metal processing and vehicular road dust emissions (Steel & Mobile) and, secondary organic aerosols type 2 (SOA_2) with origins ranging from mainly regional to mainly local. Factors that were mainly local (PTOM, Steel & Mobile, SOA_2) contributed up to 17% of the average PM2.5 mass while mixed local/regional factors (pNO3, pSO4) made up 43% on average, indicating the potential for further reduction of harmful PM concentrations locally. Of particular interest from a health protection perspective, was the composition of PM2.5 on days when an exceedance of the 24-hr WHO air quality guideline for this pollutant was observed. In general, SOA_1 was found to drive summer exceedances while pNO3 dominated in the winter. During the summer period, SOA_1 was attributable to wildfires in the northern parts of Canada while local traffic sources in winter contribut

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Short-term association of air pollution with lung cancer mortality in Osaka, Japan

摘要：Long-term air pollution exposure has been linked to increased lung cancer mortality. However, little is known about whether day-to-day fluctuations in air pollution levels are in relation to lung cancer mortality, particularly in low-exposure settings. This study aimed to evaluate the short-term associations between air pollution and lung cancer mortality. Daily data on lung cancer mortality, fine particulate matter (PM2.5), nitrogen dioxide (NO2), sulfur dioxide (SO2), carbon monoxide (CO), and weather conditions were collected from Osaka Prefecture, Japan, from 2010 to 2014. Generalized linear models were combined with quasi-Poisson regression were applied to evaluate the associations between each air pollutant and lung cancer mortality after adjusting for potential confounders. Mean (standard deviation) concentrations of PM2.5, NO2, SO2, and CO were 16.7 (8.6) μg/m3, 36.8 (14.2) μg/m3, 11.1 (4.0) μg/m3, and 0.51 (0.16) mg/m3, respectively. Interquartile range increases in concentrations of PM2.5, NO2, SO2, and CO (2-d moving average) were associated with 2.65% (95% confidence intervals [CIs]: 0.96%–4.37%), 4.28% (95% CIs: 2.24%–6.36%), 3.35% (95% CIs: 1.03%–5.73%), and 4.60% (95% CIs: 2.19%–7.05%) increased risk of lung cancer mortality, respectively. Stratified analyses showed that the associations were strongest in the older population and men. Exposure–response curves showed a continuously increasing mortality risk from lung cancer with elevation of air pollution levels

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https://www.sciencedirect.com/science/article/pii/S0013935123002955

Chemical composition and potential sources of PM2.5 in Hanoi

摘要：Highlights•Highest daily concentrations occurred during winter with stagnant meteorological conditions.•Half of resolved PM2.5 mass was organic matter of which about 40% attributable to biomass burning.•One third of PM2.5 mass was secondary inorganic aerosol dominated by sulphates.•With the PMF analysis following source factors

were found LRT and local SIA, traffic, biomass burning, industry and dust.•During the COVID-19 lockdown period concentration of elemental carbon was halved at the traffic site.The chemical composition of PM2.5 was monitored simultaneously at two sites, one in a general area of the city center and one at a roadside, in Hanoi, Vietnam, during August 2019–July 2020 using 220 daily (24 h) filter samples. PM mass, water soluble ions, trace elements, organic and elemental carbon and sugar anhydrides were measured. The annual average PM2.5 concentrations, 49 and 46 μg m−3 at the traffic and the general urban site, respectively, exceeded the national (25 μg m−3) and 2021 WHO limit values (5 μg m−3). Daily PM2.5 concentrations were the highest in winter when stagnant meteorological conditions prevailed. On average, half of the resolved mass was organic matter, of which about 40% was attributable to biomass burning, most likely rice straw field burning and domestic fuel combustion. One third of PM2.5 was secondary inorganic aerosol which was dominated by sulphate hence indicating a high contribution of stationary sources like coal combustion. The elemental carbo

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Effects of green infrastructure on the dispersion of PM2.5 and human exposure on urban roads

摘要：Urban green infrastructure (GI) has been widely demonstrated to effectively improve air quality in the built environment. However, due to the lack of comparative studies of the effects of different GI forms on PM2.5 dispersion, optimal GI designs suitable for different urban road types currently remain unclear. In this study, we adopted different roadside GI types in Hangzhou city as case studies and used the ENVI-met model to compare the effects of the different GI forms on PM2.5 dispersion and human exposure to PM2.5. The results indicated that 1) In open roads, the concave-shaped GI type could effectively reduce PM2.5 aggregation and human exposure on motorways, and the all-tree GI type performed the best in terms of sidewalk PM2.5 purification. 2) In street canyons, green roof and green screen were highly conducive to PM2.5 concentration reduction under commuter exposure compared with traditional green solutions. 3) There were trade-offs in the GI-PM2.5 interaction. GI types which can reduce pedestrian exposure tend to increase exposure in motorways. The same GI type deployed along the two different road types

could yield completely opposite dispersion effects. Novel GI types had better environmental performance and relatively high economic cost. All decision-making should be based on the trade-offs between the advantages and disadvantages of GI. Our study also highlights the importance of comprehensive consideration of GI and road types and local wind conditions in futur

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Heat-related cardiorespiratory mortality: Effect modification by air pollution across 482 cities from 24 countries

摘要：Highlights•Heat effect modification by air pollution on cardiovascular and respiratory mortality was investigated across 482 cities.•Heat effect was seen to be significantly modified by air pollutants PM10, PM2.5, O3, and NO2.•This study is the most extensive research to date investigating the heat effect modification on cardiovascular and respiratory mortality.•This is the first-ever study to deeply investigate effect modifications by air pollutants such as PM2.5 and NO2.BackgroundEvidence on the potential interactive effects of heat and ambient air pollution on cause-specific mortality is inconclusive and limited to selected locations.ObjectivesWe investigated the effects of heat on cardiovascular and respiratory mortality and its modification by air pollution during summer months (six consecutive hottest months) in 482 locations across 24 countries.MethodsLocation-specific daily death counts and exposure data (e.g., particulate matter with diameters ≤ 2.5 μm [PM2.5]) were obtained from 2000 to 2018. We used location-specific confounder-adjusted Quasi-Poisson regression with a tensor product between air temperature and the air pollutant. We extracted heat effects at low, medium, and high levels of pollutants, defined as the 5th, 50th, and 95th percentile of the location-specific pollutant concentrations. Country-specific and overall estimates were derived using a random-effects multilevel meta-analytical model.ResultsHeat was associated with increased cardiorespiratory mort

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Relationship of long-term air pollution exposure with asthma and rhinitis in Italy: an innovative multipollutant approach

摘要：Highlights•Air pollution is related to increased global prevalence of allergic disease.•New evidence on health effects in adults has been added.•The multipollutant approach has given a thorough information on health effects.•New evidence has been brought about NO2 and summer O3 health effects.•PM2.5 and PM10 have been confirmed as main drivers of health effects.Backgroundair pollution is a complex mixture; novel multipollutant approaches could help understanding the health effects of multiple concomitant exposures to air pollutants.Aimto assess the relationship of long-term air pollution exposure with the prevalence of respiratory/allergic symptoms and diseases in an Italian multicenter study using single and multipollutant approaches.Methods14420 adults living in 6 Italian cities (Ancona, Pavia, Pisa, Sassari, Turin, Verona) were investigated in 2005–2011 within 11 different study cohorts. Questionnaire information about risk factors and health outcomes was collected. Machine learning derived mean annual concentrations of PM10, PM2.5, NO2 and mean summer concentrations of O3 (μg/m3) at residential level (1-km resolution) were used for the period 2013–2015. The associations between the four pollutants and respiratory/allergic symptoms/diseases were assessed using two approaches: a) logistic regression models (single-pollutant models), b) principal component logistic regression models (multipollutant models). All the models were adjusted for age, sex, education level, smoking

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A new strategy for risk assessment of PM2.5-bound elements by considering the influence of wind regimes

摘要：Highlights•Local environmental constraints modulate the impact of air pollution.•A combined investigation of surface meteorological data and PM2.5 characterization.•A holistic assessment of air pollution risks conditioned by the atmospheric dynamic.•Assessing local airshed dynamics is crucial to safeguard ecosystems and human health.•This new approach can be employed in any citys longer-term

comprehensive plan.For regulatory purposes, air pollution has been reduced to management of air quality control regions (AQCR), by inventorying pollution sources and identifying the receptors significantly affected. However, beyond being source-dependent, particulate matter can be physically and chemically altered by factors and elements of climate during transport, as they act as local environmental constraints, indirectly modulating the adverse effects of particles on the environment and human health. This case study, at an industrial site in a Brazilian coastal city – Joinville, combines different methodologies to integrate atmospheric dynamics in a strategic risk assessment approach whereby the influence of different wind regimes on environmental and health risks of exposure to PM2.5-bound elements, are analysed. Although Joinville AQCR has been prone to stagnation/recirculation events, distinctly different horizontal wind circulation patterns indicate two airsheds within the region. The two sampling sites mirrored these two conditions and as a result we report different PM2.5 m

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城市气候与生态

How to simulate future scenarios of urban stormwater management? A novel framework coupling climate change, urbanization, and green stormwater infrastructure development

摘要：Highlights•A novel framework for simulating future urban stormwater is proposed.•GSI efficiency significantly affects the control of stormwater runoff.•Adaptive strategies to cope with climate change and urbanization are indicated.•Improving the GSI facilities efficiency has higher benefits in old urban areas.Climate change, urbanization, and green stormwater infrastructure (GSI) planning policies lead to uncertainties in future urban sustainability. Coupling multiple influencing factors such as climate change, urbanization, and GSI development, this study proposes a novel framework for simulating future scenarios of urban stormwater. Subsequently, the changes in annual surface runoff and runoff pollutants in Shanghais new and old urban areas were compared and analyzed based on 35 typical future and seven baseline scenarios. The following results were obtained: 1) The runoff control rate of the new urban area was significantly higher than

that of the old urban area before GSI construction. After GSI construction, both areas could control stormwater runoff and pollutants, while the decline in efficiency in GSI facilities enormously impacted the old area. 2) Surface runoff in the new urban area was mainly affected by urbanization, while climate change was a major factor in the old urban area; runoff pollutants in new and old urban areas were mainly affected by urbanization, and the change in pollutants in new areas was more pronounced. 3) GSI facilities were unlikel

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Factors influencing vulnerability to climate change-related health impacts in cities – A conceptual framework

摘要：Climate change will have adverse impacts on human health, which are amplified in cities. For these impacts, there are direct, indirect, and deferred pathways. The first category is well-studied, while indirect and deferred impacts are not well-understood. Moreover, the factors moderating the impacts have received little attention, although understanding these factors is critical for adaptation. We developed a conceptual framework that shows the pathways of climate impacts on human health, focusing specifically on the factors of urban environment moderating the emergence and severity of these health impacts. Based on the framework and literature review, we illustrate the mechanisms of direct, indirect, and deferred health impact occurrence and the factors that exacerbate or alleviate the severity of these impacts, thus presenting valuable insights for anticipatory adaptation. We conclude that an integrated systemic approach to preventing health risks from climate change can provide co-benefits for adaptation and address multiple health risks. Such an approach should be mainstreamed horizontally to all sectors of urban planning and should account for the spatiotemporal aspects of policy and planning decisions and city complexity.

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The impact of climate change on the water quality of Baiyangdian Lake (China) in the past 30 years (1991–2020)

摘要：Highlights•Climate change significantly influenced the water quality of Baiyangdian Lake.•The rising temperature increased the oxygen demand of organic matter in the lake.•The increasing precipitation diluted COD but increased TP in the lake.•Extreme temperature altered nitrogen and DO concentrations in the lake.•The increasing extreme precipitation purified the lake water quality by dilution.Climate change significantly influenced the water quality of lakes in recent decades. This study investigated the effects of climate change on the water quality of Baiyangdian Lake (China) in the past 30 years (1991–2020) using correlation analysis, regression analysis, and the generalized additive model (GAM). The results show that water quality grade, chemical oxygen demand (COD), total phosphorus (TP) concentrations, and annual average and minimum air temperatures of the lake showed significant differences ($p < 0.05$) in the one-way ANOVA during the studied period. The concentration of dissolved oxygen (DO) and TP, annual average and minimum air temperatures, and annual precipitation decreased, while the COD and total nitrogen (TN) concentration, annual maximum temperature, and monthly maximum precipitation increased. The annual average and minimum air temperature affected all water quality variables and explained 12.3 %–54.5 % of variation deviation in correlation and GAM analyses, indicating that the changes of air temperature influenced the water temperature, which then affected the

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