



METEOWORLD

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WMO is pleased to announce that as of this issue *MeteoWorld* will no longer be printed, instead it will be distributed digitally to Members, Partners and the broader WMO Community. Both *MeteoWorld* and the *Bulletin* have been printed on recycled paper for several years, but greening efforts have to be stepped-up. Printing consumes our forests and requires great amounts of fresh water, while mail dispatches around the world carry a heavy carbon footprint.

MeteoWorld and the *Bulletin* articles can be read online or each issue can be downloaded in pdf. There are options to share articles at the bottom of each page in the online version. WMO encourages readers to promote the digital versions of *MeteoWorld* and the *Bulletin* and to share them with colleagues and friends.

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World Meteorological Day – 23 March

WMO marked its 70th anniversary on 23 March, World Meteorological Day. Members selected “Climate Change and Water” as the theme for this landmark year’s celebration to underline the impacts of climate change on water and raise the profile of water in the climate debate. One of the biggest impacts of climate change is on water, which in turn affects sustainable development and security.

UN Secretary-General António Guterres said in a message that the hydrological cycle is often taken for granted. “But it lies at the heart of many of our global Sustainable Development Goals – from ending hunger, to ensuring health and well-being, enabling productive industries, sustaining thriving communities and unlocking the potential of affordable and clean energy for all.” He continued, “We need to manage climate and water in a more coordinated and sustainable manner to address the urgent need for improved forecasting, monitoring and management of water supplies and to tackle the problem of too much, too little or too polluted water. We cannot manage what we do not measure. Improved hydrological monitoring and forecasting are vital to underpin effective water management policies and flood and drought early warning services.”

“We feel the effects of climate change mostly through water: more floods, more droughts, more pollution. Just like viruses, these climate and water-related shocks respect no natural boundaries,” said WMO Secretary-General Petteri Taalas. “The world needs to demonstrate the same unity and commitment to climate action and cutting greenhouse gas emissions as to containing the Coronavirus pandemic.”

Climate change is impacting snow cover and the “water towers of the world” – the snow and ice on mountains that feed fresh water supplies. In many parts of the world, seasonal rainfall patterns are becoming more erratic, affecting agriculture and food security and the livelihoods of millions of people. The WMO-coordinated [Statement on the State of the Global Climate 2019](#) reported that over 6.7 million new internal disaster displacements were recorded from January and June 2019, triggered by floods and tropical cyclones in Southeast Africa,

South Asia and the Caribbean. This number was forecast to reach close to 22 million in total for 2019, up from 17.2 million in 2018. Of all natural hazards, floods and storms contributed most to displacement.

Climate and water data underpin the management of surface-water supplies and disaster risk reduction. These include calculations of the frequency and duration of heavy rainfall, the probable maximum precipitation and flood forecasting. And yet, at a time when it is needed more than ever before, the capacity to forecast, monitor and manage water is fragmented and inadequate.

“It is worrying to see that Sustainable Development Goal 6, which focuses on clean water and sanitation, is so far off track now,” said Mr. Taalas. Last year, the UN General Assembly decided that implementation must be sped up. WMO is working with partners to deliver this through a water and climate coalition that focuses on finances, data and information, governance, capacity development, and innovation.

WMO is committed to eight long-term ambitions related to water:

- No one is surprised by a flood
- Everyone is prepared for drought
- Hydro-climate and meteorological data support the food security agenda
- High-quality data supports science
- Science provides a sound basis for operational hydrology
- We have a thorough knowledge of the water resources of our world
- Sustainable development is supported by information covering the full hydrological cycle
- Water quality is known

A joint World Water Day (22 March) and World Meteorological Day celebration was planned at WMO headquarters, but given the ongoing COVID-19 pandemic, the event was canceled. Where possible, some Members marked the event using the materials provided by WMO on its dedicated [World Meteorological Day website](#) while others postponed their celebrations.

COVID-19 and Climate Action

The COVID-19 virus has led to localized improvements in air quality due to the reduction in economic activity from efforts to control the pandemic. But cuts in emissions as a result of the economic crisis triggered by COVID-19 will not substitute for concerted Climate Action. "Past experience suggests that emissions declines during economic crises are followed by a rapid upsurge. We need to change that trajectory," said WMO Secretary-General Petteri Taalas.

"Despite local reductions in pollution and improvement in air quality, it would be irresponsible to downplay the enormous global health challenges and loss of life as a result of the COVID-19 pandemic," said Secretary-General Taalas. "However, now is the time to consider how to use economic stimulus packages to support a long-term switch to more environmentally and climate-friendly business and personal practices."

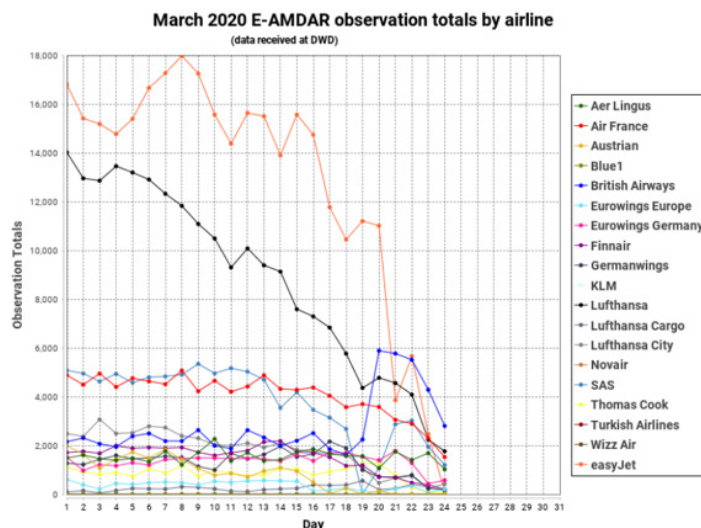
"The world needs to demonstrate the same unity and commitment to climate action and cutting greenhouse gas emissions as to containing the Coronavirus pandemic. Failure in climate change mitigation could lead to greater human life and economic losses during the coming decades," said the Secretary-General.

It is too early to assess the implications of the slacking-off in economic activity for concentrations of greenhouse gases that are responsible for long-term climate change. Carbon dioxide levels at key observing stations have been higher so far this year than they were last year.

COVID-19 Impacts on Global Observing System

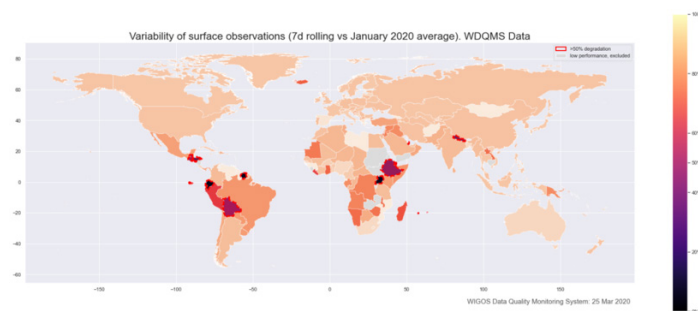
The overall health and performance of WMO coordinated Global Observing System is under continued monitoring during the current COVID-19 outbreak. Large parts of the system, for instance its satellite components and many ground-based observing networks, are either partly or fully automated, and are therefore expected to continue functioning without significant degradation for several weeks, and in some cases even longer. However, if the outbreak lasts more than a few weeks, missing redeployments, repair, maintenance and supply work, etc. will negatively impact the performance of some systems.

The significant decrease in air traffic caused by the outbreak has had a clear impact. In-flight measurements of ambient temperature and wind speed and direction made by commercial airliners are a very important source of information for both weather prediction and climate monitoring. In some parts of the world, in particular over Europe, the decrease in the number of in-flight measurements over the last couple of weeks has been dramatic (see chart top right provided by EUMETNET). The countries affiliated with EUMETNET, a collaboration between the 31 national weather services in Europe, are currently discussing ways to boost the short-term capabilities of other parts of their observing networks in order to partly mitigate this loss of aircraft observations.



March 2020 E-AMDAR observation totals by airlines

The COVID-19 outbreak may also be impacting other types of weather observations. In most developed countries, surface-based weather observations are now almost fully automated. However, in many developing countries, the transition to automated observations is still in progress, and the meteorological community still relies on observations taken manually by weather observers and transmitted into the international networks for use in global weather and climate models. WMO has seen a significant decrease in the availability of this type of manual observations over the last two weeks. Some of this may well be attributable to the current coronavirus situation, but it is not yet clear whether other factors may play a role as well. WMO is currently investigating this. In the map below, countries shown in darker colours provided fewer observations over the last week than averaged for the month of January (pre-COVID-19). Countries shown in black are currently not sending any data at all.



Variability of surface observations (7 days rolling vs January 2020 average)

At present, the adverse impact of the loss of observations on the quality of weather forecast products is still expected to be relatively modest. However, as the decrease in availability of aircraft weather observations continues and expands into areas of the world where it cannot easily be mitigated, we may expect a gradual decrease in reliability of the forecasts. The same is true if the decrease in surface-based weather observations continues, in particular if the COVID-19 outbreak starts to more widely impact the ability of observers to do their job in large parts of the developing world. WMO will continue to monitor the situation. The organization is working with its Members to mitigate the impact. The WMO Global Observing System serves as a backbone for all weather and climate services and products provided by the 193 WMO Member states and territories to their citizens.

World Water Development Report

Climate change will affect the availability, quality and quantity of water needed for basic human needs, thus undermining enjoyment of the basic rights to safe drinking water and sanitation for billions of people, warns the latest UN World Water Development Report. The authors call on States to make more concrete commitments to address the challenge.

An estimated 2.2 billion people currently do not have access to safely managed drinking water, and 4.2 billion, or 55% of the world's population, are without safely managed sanitation.

Water use has increased sixfold over the past century and is rising by about 1% a year. However, it is estimated that climate change, along with the increasing frequency and intensity of extreme events – storms, floods and droughts, will aggravate the situation in countries already currently experiencing 'water stress' and generate similar problems in areas that have not been severely affected. Furthermore, the report highlights the fact that poor water management tends to exacerbate the impacts of climate change, not only on water resources but on society as a whole.

The [United Nations World Water Development Report](#) is a UN-Water flagship report that focuses on a different water and sanitation theme each year. The report is published by UNESCO, on behalf of UN-Water, of which WMO is a member.

Climate Science Basis for Funding

From October 2019 to March 2020, WMO completed a series of five national pilot workshops aimed at enhancing the climate science basis for projects and activities seeking financing from the Green Climate Fund (GCF). The first workshop, St. Lucia, the Democratic Republic of Congo, Cabo Verde, Cambodia and Paraguay were the five countries to benefit. The workshops also look at National Adaptation Plans (NAP) and the Nationally Determined Contributions (NDCs) – under the Cancun Adaptation Framework and the Paris agreement of the United Nations Framework Convention on Climate Change (UNFCCC) – to strengthen the quality, effectiveness, and value of climate action on the basis of objective, scientific, and climate data-driven conclusions and analysis.

GCF responds to climate change by investing in low-emission and climate-resilient development. Thus, the workshops assessed the relevance and adequacy of climate information for GCF activities in a collaborative and consultative framework, drawing on the resources of the national, regional and global hydro-meteorological communities. The participants include national and sectoral decision-makers, GCF Accredited Entities, international intergovernmental and bilateral organizations, and other national stakeholders engaged in the development project for GCF approval.

Through the workshop, WMO supported the Nationally-Designated Authority (NDA), the National Meteorological and Hydrological Service (NMHS) and national and sectoral decision-makers to develop the climate science basis under which their country can prioritize adaptation and mitigation options as expressed in its NDCs and NAPs. The workshop further developed methodological materials and data sources designed to generate sector specific indices based on historical datasets and future projections of key climate indicators for country analysis.

As a result, 17 reports were produced offering climate analyses in support of priority climate actions in sectors such as agriculture, water, energy, forestry, health, coastline preservation and early warning systems. This led to proposals for adaptation and mitigation pathways that both address the past, present and expected future behaviour of relevant climate indicators – as much as that is feasible and effective under expected climate conditions. Following the final workshop in Paraguay, which took place in March, WMO will consolidate guidance materials on how to assemble the climate science basis for incorporation into GCF project proposals.

The series of pilot workshops were organized under the framework of the GCF-WMO Expert Service Agreement signed in October 2018. The GCF is the world's largest dedicated fund helping developing countries reduce their greenhouse gas emissions and enhance their ability to respond to climate change. It was set up by UNFCCC in 2010.

Funds Released Following Extreme Winter Forecast

The Red Cross announced the release of funding to reduce the impacts of extreme winter weather on vulnerable herders following an announcement of Mongolia's National Agency for Meteorology and Environmental on 2 January that 50% of the country was at risk of an extreme winter. It was the first time that the early action funding mechanism developed by the International Federation of Red Cross and Red Crescent Societies (IFRC) was used anywhere.

Using meteorological models and historical data, experts can forecast the probability of extreme weather events with increasing accuracy. Combining weather forecasts with risk analysis allows IFRC funding to be released so people can prepare for extreme weather. The goal of forecast-based financing is to anticipate disasters, prevent their impact, if possible, and reduce human suffering and losses. The key element is to agree in advance to release financial resources if a specific forecast threshold is triggered.

The early warning from the National Agency triggered the pre-agreed release of CHF210 968 (US\$217 000) to the Mongolian Red Cross Society for forecast-based action from IFRC's Disaster Relief Emergency Fund (DREF). The funding provides 88 Swiss francs (US\$90.6) cash each for 1 000 vulnerable herder families to prevent the starvation, dehydration and cold exposure of their livestock because of poor access to feed, water, veterinary care and shelter. A livestock nutrition kit will support livestock health during winter's lean months.

"Forecast-based financing helps communities move from reacting to disasters to anticipating them. Climate change, which brings disasters that are increasing in frequency, length and intensity makes this kind of finance model even more crucial. Simply waiting for disasters to strike is no longer an option," said Gwendolyn Pang, IFRC Head of Beijing Country Cluster Support Team.

Source: [IFRC Press Release - Red Cross Releases Funds in Anticipation of Extreme Winter in Mongolia](#)

WHO and WMO Strengthen Work on Health, Climate and Environment

WMO and the World Health Organization (WHO) have agreed on a roadmap to strengthen the provision and use of weather, climate, water and environmental information and services in evaluating

human health risks and thereby improve health outcomes. The roadmap was developed by a group of experts from the health, weather and climate sectors representing research, operational, and policy interests. They met in Geneva from 21-23 January to advance the joint Framework Agreement on Health, Climate and Environment and to gain a better understanding of health needs, applications and operational mechanisms.

The experts made several recommendations:

- More integrated and comprehensive risk management and capacity building is needed at national, regional, and global levels
- The new Research Board needs to consider health research and information needs and to establish coordination/harmonization, or even hybrid mechanisms, with the Services Commission on matters of health
- Joint advisory and implementation mechanisms are needed to move the workplan forward
- Coordination and technical support functions for integrated health information science and services need to be strengthened.

A synthesis of the type of scientific cooperation and services that NMHS already provide to the health sector were highlighted at the meeting. Canada, Finland, Germany, Hong Kong (China SAR), India, Peru, United States of America, the United Kingdom and the Regional Climate Centre at the Caribbean Institute for Meteorology and Hydrology demonstrated the broad scope and breadth of expertise in the WMO community for providing operational health services and supporting health research. These include heat health warning systems, cold warning systems, pollen advisories, ultraviolet (UV) index forecasts and services, air quality monitoring and forecasting, harmful algal bloom forecasts, recreational water safety advisories, cholera monitoring and forecasting, seasonal advisories, and a broad range of support for infectious diseases research.

WMO and WHO have long cooperated on climate and health. The two organizations agreed in May 2018 to step up action to tackle environmental health risks that cause an estimated 12.6 million premature deaths every year. Toward this goal, WMO has engaged to meet the global commitment to reduce deaths due to air pollution by two thirds by 2030.

Serbia Successfully Models Dust Storm in High Latitudes

The Republic Hydrometeorological Service of Serbia (RHMSS), a partner in the WMO Sand and Dust Storm Warning Advisory and Assessment System (SDS-WAS), has numerically simulated an Australian dust storm event using DREAM dust model. The simulation was part of WMO SDS-WAS initiative to include dust impacts to high latitudes in its research agenda.

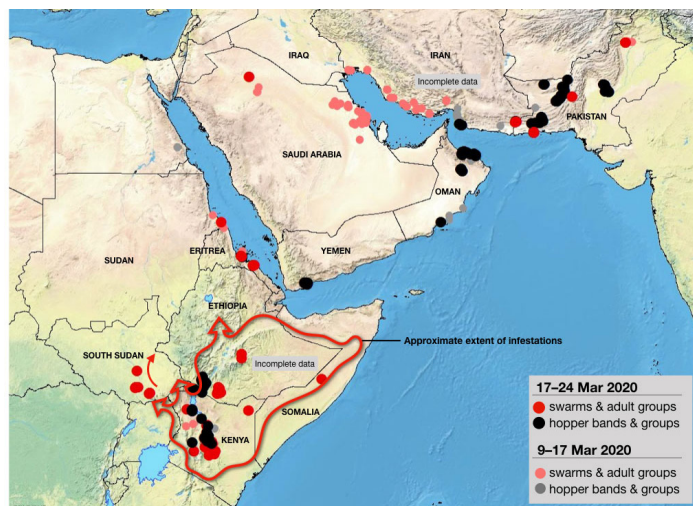
The hottest, driest year on record in Australia – 2019 – triggered a series of major dust storms in the first weeks of 2020. The storms formed over dust sources in the central part of the sub-continent. The Australian Bureau of Meteorology issued a warning for one of the storms on 22 January, predicting "damaging winds of 60-70km/h with gusts of 90km/h" associated with thick raised dust. Later that day, a dust storm moved through New South Wales over parts of

Victoria to arrive in Melbourne. The air became orange and visibility dropped significantly, it became almost impossible to drive. After two days, the dust pattern moved southward to cover a large part of Antarctica's Eastern coast.

"When we noticed the extreme character of the storm, we set-up the model with 8 km horizontal resolution over Australia, finer than usual, to explore the capability of high-resolution models to predict such extreme dust storms," said Slobodan Nickovic, Chair of the WMO SDS-WAS Regional Node for Northern Africa, Middle East and Europe, who conducted the experiment. "When we understood that the dust was moving fast southward, we did the simulation for the same case but with the global model version. It showed that the dust would arrive on 24 January in Antarctica and cover a large sector of the eastern continent coastline." The model also predicted that a fraction of dust would have the role of ice nuclei in the formation of cold clouds (Nickovic et al, 2016). The simulated ice cloud formed by dust compared well with the NASA observation of the ice cloud phase over the Antarctic region.

Accelerated warming in the Arctic and Antarctica is determined by numerous processes in which aerosol plays a significant role at high latitudes. Dust in particular changes snow/ice albedo and melting rates, affects the marine productivity, alters microbial dynamics in glaciers and causes indirect (cloud formation) and direct (solar radiation) effects. The numerical experiment conducted in Serbia demonstrates the potential of modeling and observational facilities to better understand why climate change is happening so fast in the high latitudes.

Desert Locust outbreak continues to threaten food security and livelihoods in East Africa



The desert locust situation remains extremely alarming in the Horn of Africa, specifically Kenya, Ethiopia and Somalia. Widespread breeding is in progress and new swarms are starting to form, representing an unprecedented threat to food security and livelihoods at the beginning of the upcoming cropping season. The high risk of further spread in the East Africa region necessitates an immediate and significant intensification of control activities.

This is the worst Desert Locust situation in 25 years for most of the affected countries – for Kenya, in 70 years – according to the Food and Agriculture Organization of the United Nations (FAO). Unusual weather and climate conditions, including heavy and widespread rains since October 2019, have contributed to the spread. A further increase in

locust swarms is likely to continue until June due to the continuation of favourable ecological conditions for Desert Locust breeding.

Outbreak update (24 March 2020):

Ethiopia - Hopper bands are present in Oromiya and SNNPR regions, including the Rift Valley. A new generation of immature swarms are forming and maturing. Aerial and ground control operations continue.

Iran - Hatching started on western Hormozgan coast in past few days. More hatching expected in southern Khuzestan, Busherh, southern Fars. Late instar hopper bands forming near Jask.

Kenya - Hopper bands continue to develop and form an increasing number of first-generation immature swarms in northern and central counties. The swarms are maturing and will be ready to lay eggs from the first week of April onwards. Further concentration expected in Marsabit and Turkana. Aerial and ground control operations continue.

South Sudan - Several mature swarms from the south appeared in the southeast near Torit on 18-19 March; at least one moved to Juba on the 21st, continuing to Bor on the 23rd and flew towards southwest Ethiopia.

Yemen - Hopper bands continue forming on southern coast near Aden and immature adults starting to form groups. Heavy rains and flooding in Wadi Hadhramaut. Scattered adults on northern Red Sea coast.

The situation is currently under control in the following countries: Eritrea, India, Iraq, Oman, Pakistan, Saudi Arabia and Sudan.

For more information, please go to the [FAO Desert Locust webpage](#) for the latest updates.

Report Shows Cloud Seeding can generate Snowfall

We can definitely say that cloud seeding enhances snowfall under the right conditions," said Sarah Tessendorf, a scientist at the National Center for Atmospheric Research (NCAR) and co-author of Quantifying snowfall from orographic cloud seeding, published in Proceedings of the National Academy of Sciences in late February. She was one of a group of scientists who used a combination of radars and snow gauges to measure the impact of cloud seeding on snowfall. They observed that clouds injected with silver iodide generated precipitation at multiple sites, sometimes creating snowfall where none had existed.

The study provides the most comprehensive evidence to date that cloud seeding can generate rain or snow. The study cautions that clouds must be present to produce precipitation and that results are dependent on atmospheric factors such as local winds.

"The seeding produces ice and that ice can form snow, but is it enough additional snow to make it cost effective?" asked Ms Tessendorf. "For water managers, the bottom line is the amount of snowpack that you're building over the whole winter and how much runoff it will generate. We are looking into some promising approaches to address those bigger questions, but we still have plenty of work to do to get there."

(Source: [NCAR UCAR News - Scientists Demonstrate that Cloud Seeding can Generate Snowfall](#))

WMO Chronology of Weather Science

MeteoWorld invites its readers to visit the multimedia [WMO Chronology of Weather Science](#) and fly through the history of weather research on the traces of the people and institutions that have supported the progress of Earth System Science!

Experts will accompany you from the beginnings of weather research in the early 20th Century to the advent of the first electronic computers and satellites then onward to the super computers that have revolutionized numerical weather prediction. The online museum showcases contributions that international weather science has made to society over the last decades and highlights the role of WMO in facilitating this research.

Our readers are also encouraged to contribute facts, comments or anecdotes as well as supporting visuals to enrich the WMO Chronology of Weather Science.

Newly Issued

WMO Statement on the State of the Global Climate in 2019, WMO No. 1248, ISBN 978-92-62-11248-5. Available in English. Translations are being prepared in Arabic, Chinese, French, Russian and Spanish.

Manual on the High-quality Global Data Management Framework for Climates, WMO No.1238, ISBN 978-92-63-11238-5. Available in Arabic, Chinese, English, French, Russian and Spanish.

International Cloud Atlas: Manual on the Observation of Clouds and Other Meteors, WMO No. 407, is now available in Arabic, Chinese, French, Russian and Spanish.

We welcome your comments about MeteoWorld and look forward to hearing from you: editor@wmo.int

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