

Global Disastrous Weather Report in January 2024

Abstract: In January 2024, due to the influence of the stratospheric sudden warming, the cold air activity in the middle and high latitudes was frequent and the overall force was strong. In this context, strong cold waves happened in Europe, East Asia, North America and some other places with extreme cold weather, which had brought serious challenges in transportation, energy scheduling and other aspects for these countries and cities. Especially in the United Kingdom and France, there was a loss of life and property. In addition, there were five tropical cyclone events happened in global regions, slightly less than historical average.

1. Overview of global weather

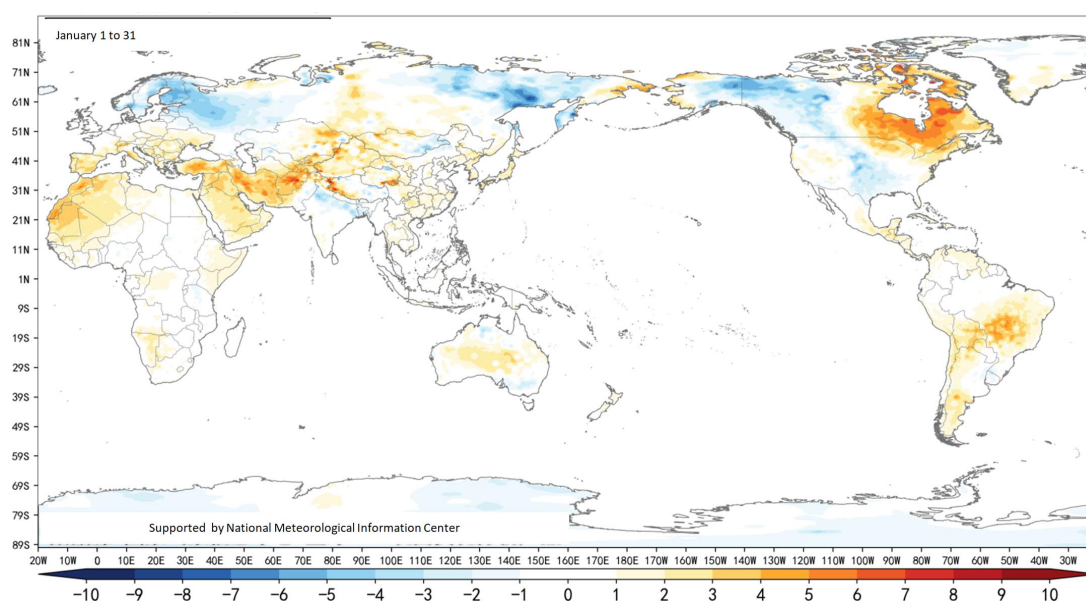


Fig.1 Monthly 2m temperature anomaly in January 2024 (unit:°C)

In January 2024, the temperature in central and northern Europe, eastern Russia, central and western Canada, Central America and other places is 2~3 °C lower than historical average, while the temperature in most of West Asia, most of Central Asia, Africa, northeastern North America, Australia and most of South America is 1~2 °C higher than the climatic normal, and some areas are more than 4 °C higher. Moreover, both northern Europe and central and western America have experienced a consistent low temperature weather, while central Oceania, Brazil and other places have undergone persistent high temperature heat wave.

In January 2024, there were heavy rain and snow in central and northern Europe, central and western Siberia, western and southeastern North America, East Asia and some other places, and the cumulative water volume in the above areas was generally between 20 to 60 mm, and more than 100 mm in some regions of East Asia and southeastern North America. The precipitation in the above areas is 60~ 80% more than the climatic normal, while some areas are 1~2 times more.

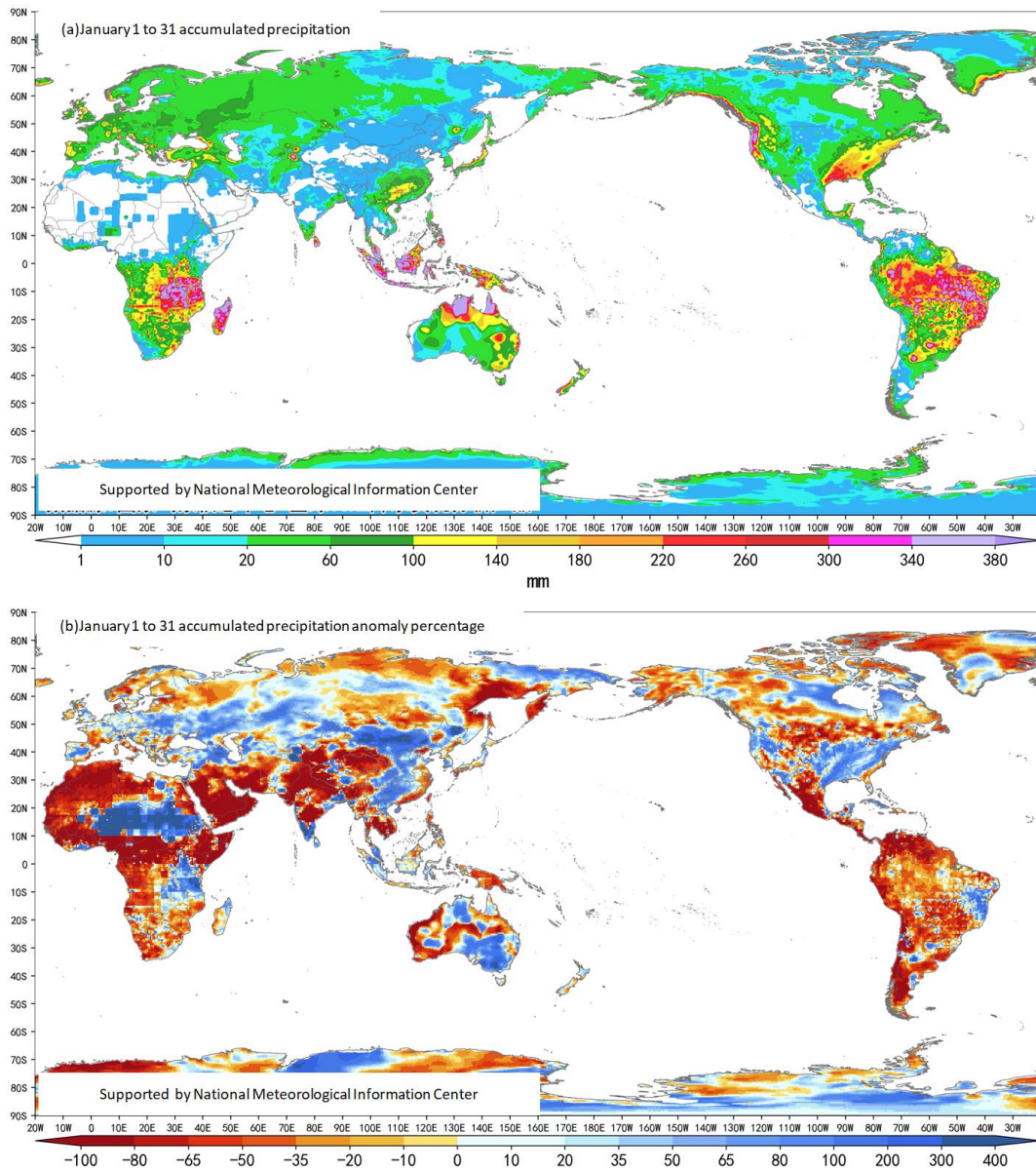


Fig.2 Monthly total accumulated precipitation (a, unit: mm) and accumulated precipitation percentage anomaly (b, unit:%) in January 2024

2. Severe weather

In January 2024, the global disaster weather mainly includes snowstorms, cold waves, torrential rains and floods, high temperature and heat waves, and strong storms. For example, most of Europe suffered many large-scale rain and snow cooling, Tanzania, Mozambique, Zambia, Argentina, Brazil, Paraguay and some other places were hit by heavy rainfall. In the same time, Brazil, Australia and some other places suffered sustained high temperature or heat waves.

In January 2024, there were five tropical cyclone activities in the southwest Indian Ocean, slightly less than the historical average (Fig.3). They are "Alvaro", "Beral", "Candice", "Anglaque", and "Kirilee". "Alvaro" made landfall on the

southwestern coast of Madagascar on January 1, while "Kirili" made landfall on the eastern coast of Queensland of Australia on January 25.

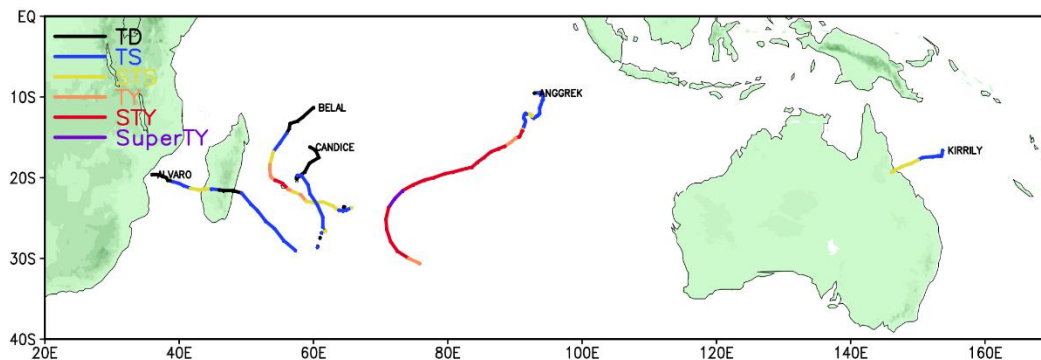


Fig.3 Global tropical cyclones in January 2024

2.1 Snowstorm in Europe during January 15-20

Under the influence of polar vortex splitting southward (Fig. 4a), from January 15 to 20, 2024, most parts of Europe experienced a heavy rain and snow weather. Brussels, the capital of Belgium, was covered in snow, with a depth of about 5cm. In the southern Walloon region, the depth of snow in some areas reached about 11cm, which was the biggest snowfall in this region during the last 11 years. Minimum temperatures in many parts of the United Kingdom fell below 0 ° C, and snow or sleet occurred in the north central region (Fig. 4b). Orange alerts have been issued across many parts of France as the blizzard process had a serious impact on transport. More than 300 flights were cancelled in Germany because of the heavy snowfall, affecting the travel of more than 110,000 passengers. Winter storm hit northern Spain on the 19th. Due to snow and ice road conditions, many drivers stranded on the highway. In addition, from the cumulative precipitation (Fig. 4c), the cumulative precipitation of several stations in central and western Spain exceeded 100mm, and some individual stations exceeded 200mm. Furthermore, according to the phase changes of rain and snow and the accumulated precipitation (Fig. 4b and 4c), Switzerland experienced a complex phase transition of rain-sleet and snow with the consistent decrease of temperature, and the accumulated precipitation reached 25~50 mm in the central and western and northern regions, and exceeded 60mm locally.

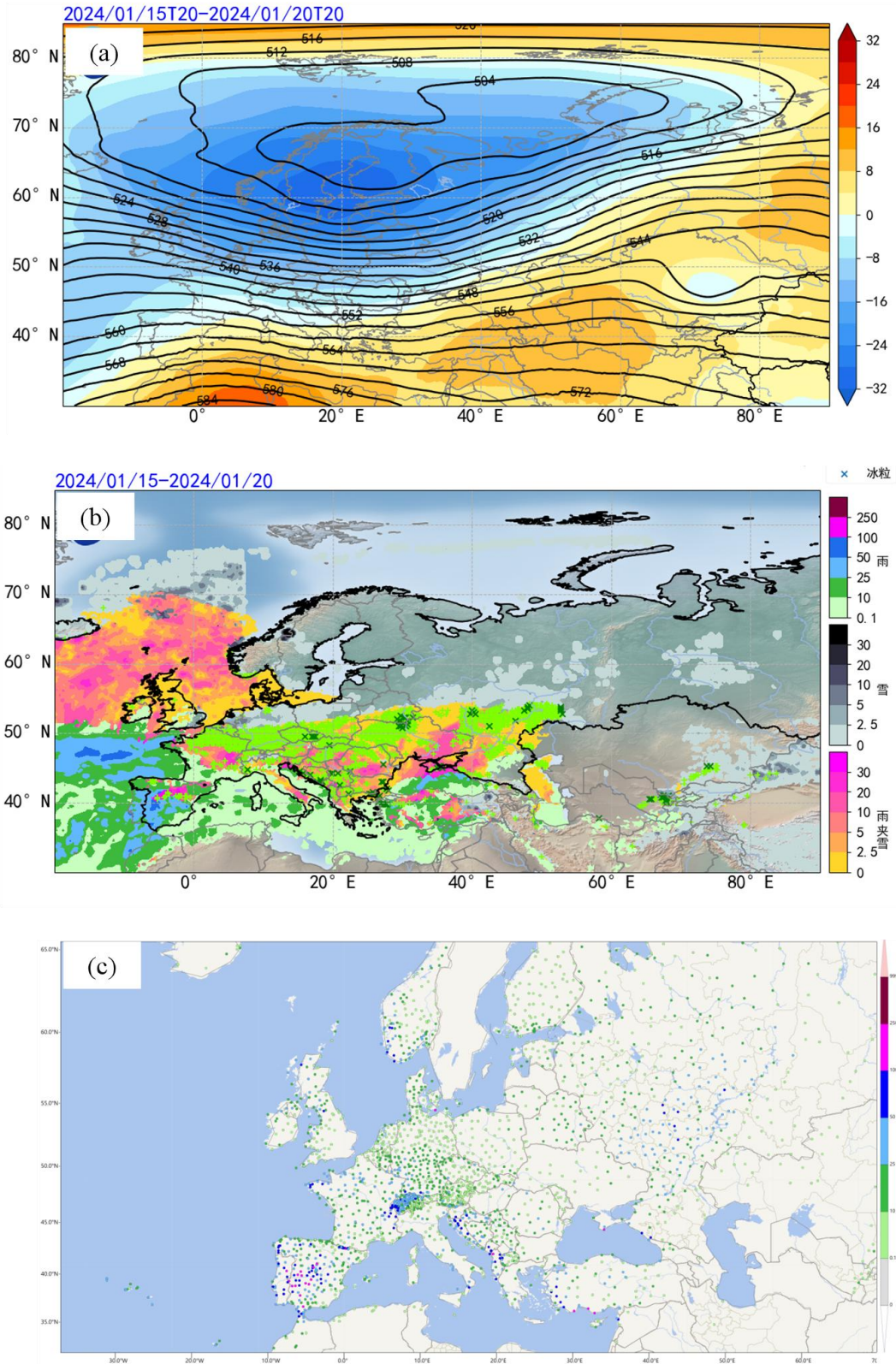


Fig.4 (a) 500hPa mean geopotential height (contours) and anomaly (shadow) (unit: dagpm), (b) rain and snow phase diagram, (c) Cumulative precipitation (unit: mm) during January 15-20, 2024

2.2 Strong cold wave in North America during January 13-16

From January 13 to 16, under the influence of the southward polar vortex, a strong cold wave took place in the United States. The system appeared as an extratropical cyclone over the Northeast Pacific Ocean on January 12, and was named "Winter Storm-Heather" because of its landfall and significant impacts. It began to make landfall on the West Coast of the United States on January 13, bringing heavy snow and large areas of power line accumulation, resulting in power outages in some areas and some avalanches happened in the mountains of Colorado and Utah. Both strong cooling and gales have killed at least 30 people in the southern United States and led to regional closures in several states. New York City, Washington, D.C., Philadelphia and some other cities saw more than 2 inches (5.1 cm) of snow for the first time in nearly two years, ending a streak of more than 700 days without snow.

As can be seen from the horizontal distribution of the 500hPa circulation field (Fig. 5a), the height field in western and central North America is significantly lower by 2~3 standard deviations, indicating that it will bring strong cooling and extremely cold weather. The average temperature in Midwest Canada and central and eastern United States would be 12 to 14 ° C lower than the climatic normal, and the lowest temperature in western Canada and northern United States would reach below -40 ° C (Fig. 6b). In addition, in the western and northeastern United States, there was a significant rain and snow cooling weather, with blizzard in some areas (Fig. 6c).

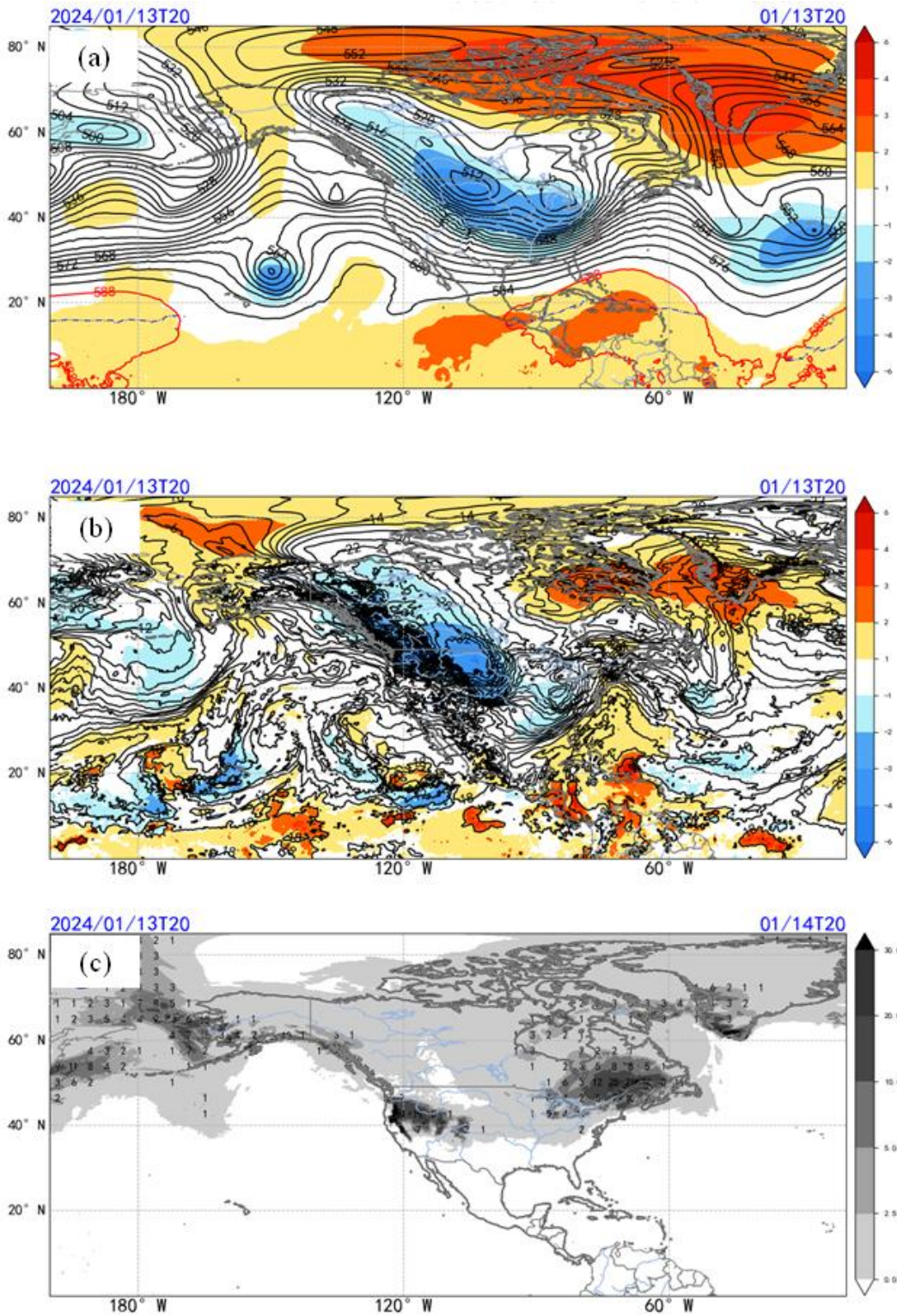


Fig.5 (a) 500hPa geopotential height and standardized anomaly, (b) 850hPa temperature field and standardized anomaly, (c) Cumulative snowfall in 24 hours on the 14th, (500hPa height field unit: dagpm, 850hPa temperature unit: °C) on January 13th, 2024

3. Outlook

In the next two weeks, the temperature in northern Europe, eastern Siberia,

northeastern and southern North America will expect to be 2~3 °C lower than the climatic mean, while the temperature in southern Europe, Central Asia, most of East Asia, central North America and other places will probably be 1~2 °C higher. In the southern hemisphere, the high temperature weather will continue in central and western Australia, southern Brazil, with the highest temperature in some areas reaching 40 °C, and even reaching more than 42 °C locally.

In terms of precipitation, during the next two weeks, the main rainfall will take place in the tropical islands of Southeast Asia, southeast North America, northern Australia, northern and central South America, southern and central Africa and northern Madagascar with the cumulative precipitation between 80 to 150 mm in most places, and some areas can reach 200 to 400 mm. The precipitation in the mentioned above areas will be more than the climatic mean, while the precipitation in the other parts of the world will be less than or close to the historical average.

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