Satellite monitoring of a "shallow" cold wave over the mid-to-high latitudes of the Northern Hemisphere in early November 2026

November 13, 2026

Anomalous high-latitude circulation and a disturbed stratospheric polar vortex in early November 2026 increased the likelihood of cold-air outbreaks across the mid-to-high latitudes of the Northern Hemisphere; the actual impact, however, depended on how far the anomaly propagated downward and on its spatial distribution. Using FY-3E/VASS atmospheric sounding products, this report examines lower-tropospheric cold-air activity during 1–10 November over four key regions—Mongolia, North China, Central Europe and the eastern United States. The evolution of the 850 hPa cold pool, its migration relative to these regions and the associated temperature changes are analysed to provide an observational basis for impact assessment. The episode is termed a "shallow" cold wave, denoting a brief low-level cold-air intrusion.

I. Evolution of the Polar Cold Vortex

Changes in the position and shape of the polar cold vortex provide a precursor for southward cold-air outbreaks. FY-3E/VASS daily mean 850 hPa fields (Figure 1) show three phases during 1–10 November: southward displacement, northward retreat and circumpolar reorganisation. Here the vortex is defined as the cold pool enclosed by the −15 °C isotherm. On 1–3 November its centroid moved from 76°N, 121°E to 62°N, 126°E, indicating low-level cold air advancing southwards along eastern Siberia. On 4–6 November the centroid retreated to 66–73°N, yet the southern cold tongue continued to extend: between 110°E and 140°E the −10 °C isotherm reached south of 45°N and to 41°N, 127°E on the 6th, while the area below −20 °C peaked near 1.7 × 10⁶ km². On 7–9 November the Asian cold pool contracted poleward and spread towards North America and the North Pacific, ending the southward phase.

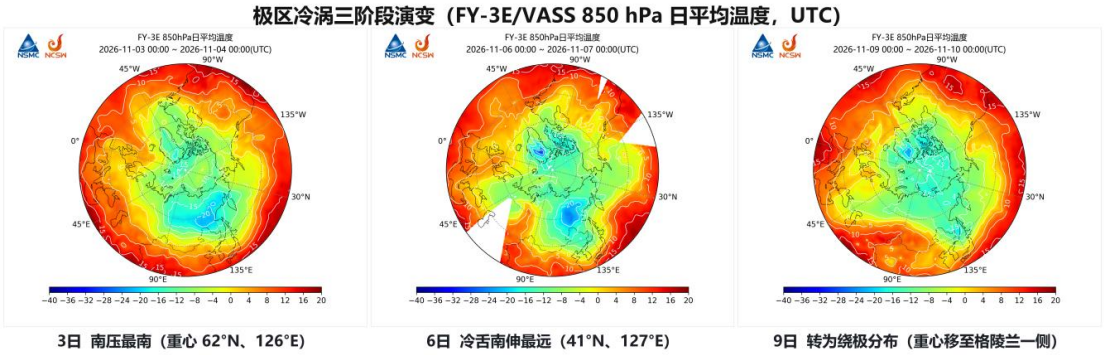


Figure 1. Three-stage evolution of the polar cold vortex
(FY-3E/VASS daily mean 850 hPa temperature; 3, 6 and 9 November 2026, UTC)

II. Influence of the Polar Cold Vortex on Four Key Regions

The distance from the cold-pool centroid to a region is a useful proxy for its potential exposure to cold air. Figure 2 shows daily great-circle distances from the 850 hPa centroid (the weighted centre of the cold pool below −15 °C) to the four regional centres. On 3 November the centroid reached 62°N, 126°E, shortening the distances to Mongolia and North China to about 1,900 km and 2,500 km—coincident with the 3–6 November cold spell over Mongolia and northern North China. Central Europe and the eastern United States remained more than 4,400 km away throughout 1–8 November, the latter reaching about 8,100 km on the 3rd. On 7–9 November, as the Asian cold pool contracted and the flow became circumpolar, the distances to Mongolia and North China increased to about 5,500 km and 6,400 km and both regions warmed. By the 9th the centroid had shifted towards Greenland (82°N, 73°W), reducing its distance to the eastern United States to about 4,100 km.

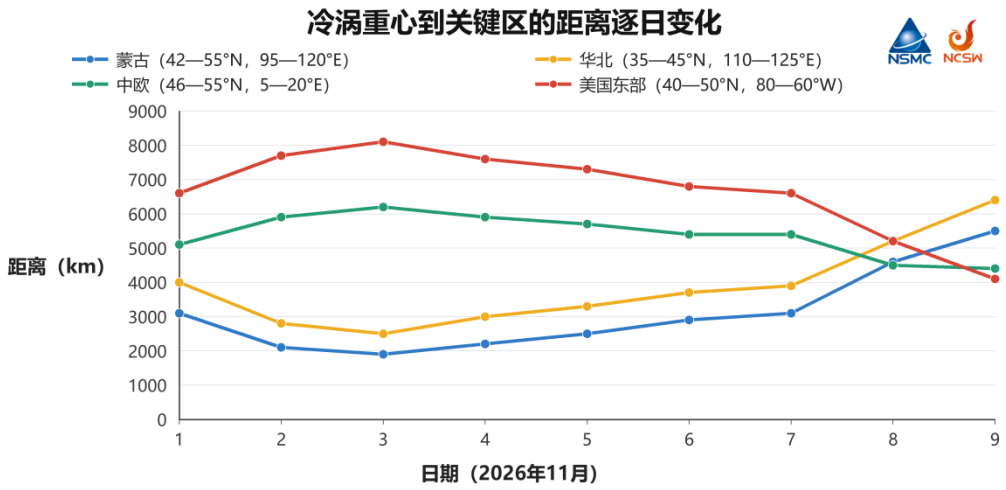


Figure 2. Daily distance from the cold-vortex centroid to the four key regions (1–9 November 2026, UTC; great-circle distance from the weighted centroid of the cold pool below −15 °C at 850 hPa to each regional centre)

Regional-mean daily temperatures (Figure 3) and cooling-area statistics (Table 1) show concentrated cooling over Mongolia and North China but gradual, multi-day cooling elsewhere. Mongolia cooled first: −5.5 °C in 48 h (3–5 November) to −9.6 °C on the 5th, with 24% of its area meeting the 48 h threshold. North China fell from 5.0 °C on the 3rd to −2.4 °C on the 5th (−7.4 °C in 48 h over 29% of the area, including −5.2 °C in 24 h over 28% on the 5th), so roughly one third of the region met the cold-wave reference threshold. Mongolia then warmed steadily to 5.2 °C on the 10th, and North China recovered to 2.2 °C on the 9th after a brief dip to −2.9 °C on the 8th. Central Europe cooled by 3.9 °C during 1–7 November and the eastern United States by 8.0 °C during 5–9 November; in both regions less than 1% of the area met the threshold, indicating gradual cooling or a return from antecedent warmth rather than a concentrated outbreak. (Central Europe is assessed over 40–60°N here, versus 46–55°N in Figure 3.)

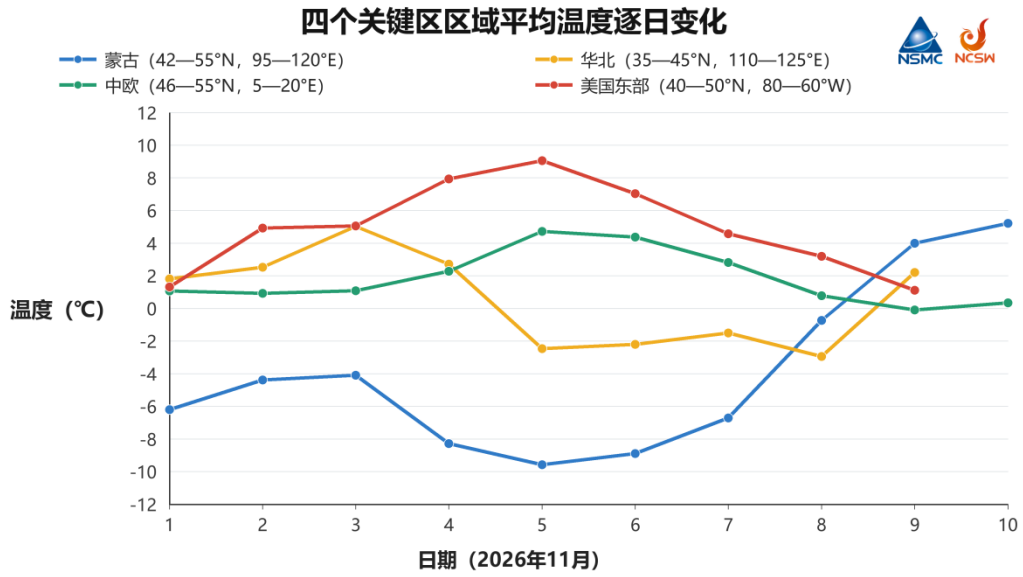


Figure 3. Daily regional-mean 850 hPa temperature of the four key regions (FY-3E/VASS, 1–10 November 2026, UTC)

Table 1. Classification of cold-air events in the four key regions (Reference thresholds: ≥10 °C cooling in 48 h; ≥8 °C in 24 h)

Region	Period	Regional-mean cooling	Area meeting threshold	Classification
Mongolia (42–55°N)	3–5 Nov (48 h)	−5.5 °C	24% with 48 h ≤ −10 °C	Upstream cold air arrived first; regional mean −9.6 °C on 5 Nov
North China (35–45°N)	3–5 Nov (48 h)	−7.4 °C	29% with 48 h ≤ −10 °C; 28% with 24 h ≤ −8 °C on 5 Nov	A single cold-air event; about 30% of the area met cold-wave thresholds
Central Europe (40–60°N)	1–7 Nov	−3.9 °C	<1% with 24 h ≤ −8 °C	Gradual cooling; no cold wave
Eastern United States (40–50°N)	5–9 Nov	−8.0 °C	<1% with 48 h ≤ −10 °C	Cooling after antecedent warmth; cold core did not move south

The daily mean 850 hPa temperature fields (Figure 4) highlight the contrasting thermal patterns. On 5 November a cold tongue extended southwards over Mongolia and North China, the −10 °C isotherm reaching northern North China and Northeast China; by the 9th it had retreated sharply and warm air dominated the southern parts of both regions. On 9 November the 0 °C isotherm lay along the northern edge of Central Europe, most of which remained in a weak 0–5 °C cold sector with a flat gradient and no southward cold tongue. On 5 November cold air covered mid- and high-latitude North America, but the 0 °C isotherm stayed far north and the 40–50°N eastern United States remained in a warm sector—the cold core did not surge southwards.

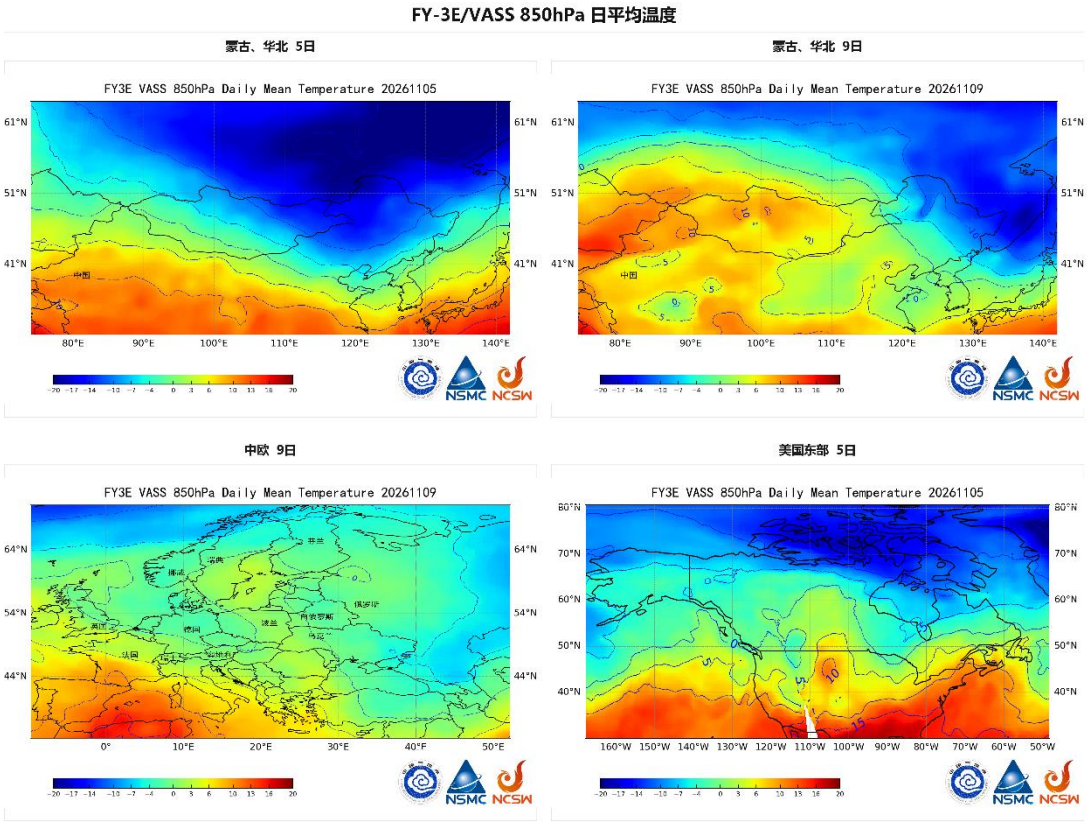


Figure 4. FY-3E/VASS daily mean 850 hPa temperature over the four key regions (Mongolia and North China on 5 and 9 November; Central Europe on 9 November; eastern United States on 5 November, UTC)

Twenty-four-hour temperature changes at 850 hPa (Figure 5) confirm the contrast in timing and location. On 5 November pronounced cooling, exceeding 10 °C at its centre, extended from central–eastern North China to Northeast China in a NE–SW band, indicating southward cold-air advance; by the 9th widespread warming had replaced it, marking the end of the event. On 9 November Central Europe showed only weak, scattered cooling, and on 7 November cooling over the United States was confined to the central plains and the Great Lakes while the east coast continued to warm. Grid-point statistics show less than 1% of Central Europe cooling by ≥8 °C in 24 h and less than 1% of the eastern United States by ≥10 °C in 48 h, against 28% of North China cooling by ≥8 °C in 24 h on the 5th. Together with the distance evolution, these results identify Mongolia and northern North China as the regions chiefly affected by this southward outbreak.

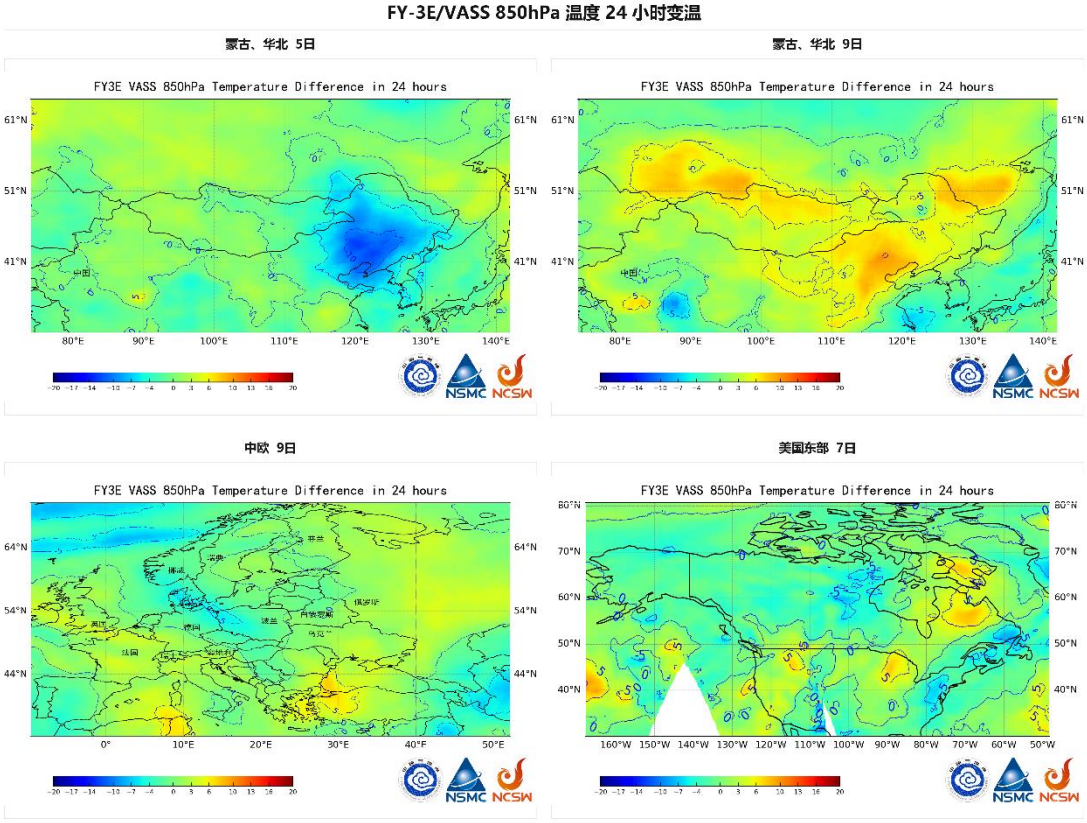


Figure 5. FY-3E/VASS 24 h 850 hPa temperature change over the four key regions (Mongolia and North China on 5 and 9 November; Central Europe on 9 November; eastern United States on 7 November, UTC)

III. Southward Propagation of Cold Air

The latitude–time cross-section of 850 hPa temperature along 120°E (Figure 6) resolves the meridional progression. During 1–3 November the high-latitude cold source advanced southwards and the −5 °C and −10 °C isotherms shifted markedly equatorward. On 4–6 November the cold tongue reached its southernmost position: on the 5th the 0 °C isotherm lay near 37.5°N and the −10 °C isotherm near 44.2°N, concentrating the core influence around that date. On 7–9 November, as the polar cold pool retreated, the 0 °C and −5 °C isotherms returned rapidly northwards, the 0 °C isotherm reaching north of 44.8°N by the 9th. The event thus followed a brief "southward push–bottoming out–retreat" sequence whose core phase coincided with the temperature minima over Mongolia and North China, producing a "shallow" cold wave over North China.

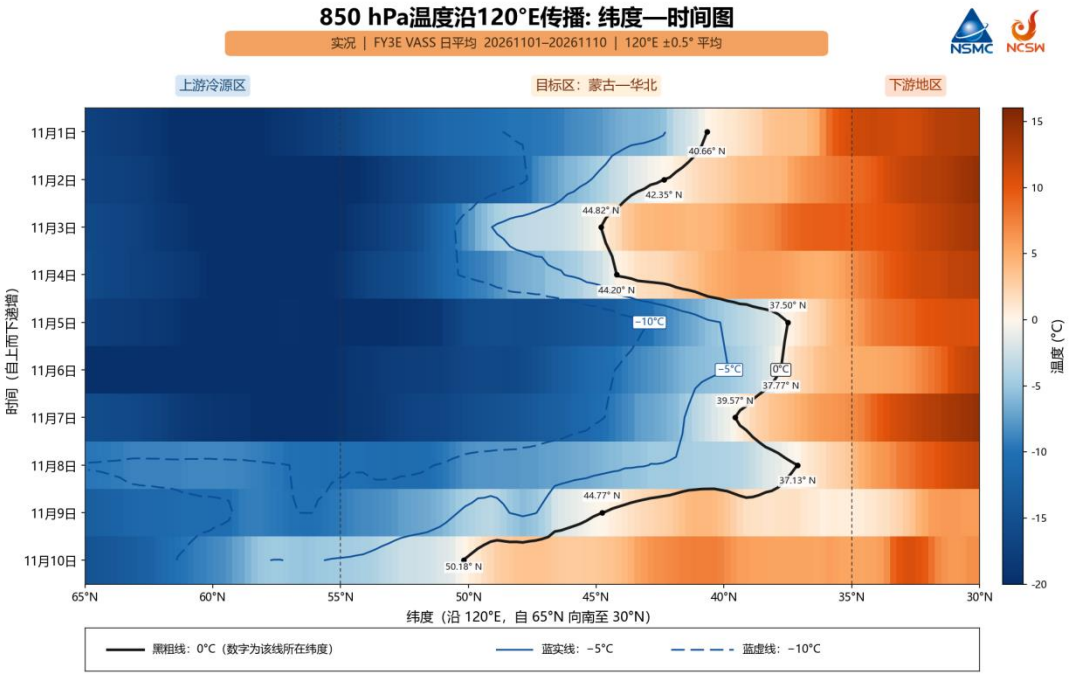


Figure 6. Latitude–time cross-section of 850 hPa temperature along 120°E (FY-3E/VASS daily mean, 1–10 November 2026, UTC)

In summary, this event was a brief southward excursion within the three-stage evolution of the polar cold vortex, although the intense high-latitude cold pool persisted. During 1–6 November the cold pool advanced along eastern Siberia and the cold tongue extended southwards along 120°E, affecting Mongolia and then North China. North China recorded the largest short-term cooling of the four regions—7.4 °C during 3–5 November—with about 30% of its area meeting the cold-wave reference threshold; it warmed markedly during 7–9 November as the cold pool contracted and became circumpolar. Central Europe and the eastern United States instead underwent gradual cooling and a return from antecedent warmth, with less than 1% of either area reaching the thresholds and no comparable concentrated cold outbreak. The position of the polar cold pool, mid- and high-latitude cooling, and stratosphere–troposphere coupling signals will continue to be monitored.

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