**Supplement to: The importance of diabatic processes for the dynamics of synoptic-scale extratropical weather systems – a review**

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The following pages contain figures for the four "catalyst cyclones" discussed in the paper. The figures are all produced with ERA5 reanalysis data and serve to illustrate the structure and evolution of the four cyclones with synoptic and PV maps, and vertical cross sections (at selected times). The four catalyst cyclones are:

- QE II storm 00 UTC on 09 September – 18 UTC on 12 September 1978
- President's Day cyclone 00 UTC on 17 February – 18 UTC on 22 February 1979
- U.K. Great October storm 00 UTC on 13 October – 18 UTC on 18 October 1987
- Lothar 00 UTC on 23 December – 18 UTC on 28 December 1999

The following fields are shown for each cyclone at six-hourly intervals during the time periods indicated above:

- left panels: PV on 315 K (colours, in pvu) and MSLP (contours, every 4 hPa)
- middle panels: PV at 850 hPa (colours, in pvu) and MSLP (contours, every 4 hPa)
- right panels: potential temperature at 850 hPa (colours, in K), hourly accumulated precipitation (blue contours for 2 and 5 mm $h^{-1}$), and MSLP (contours, every 4 hPa)

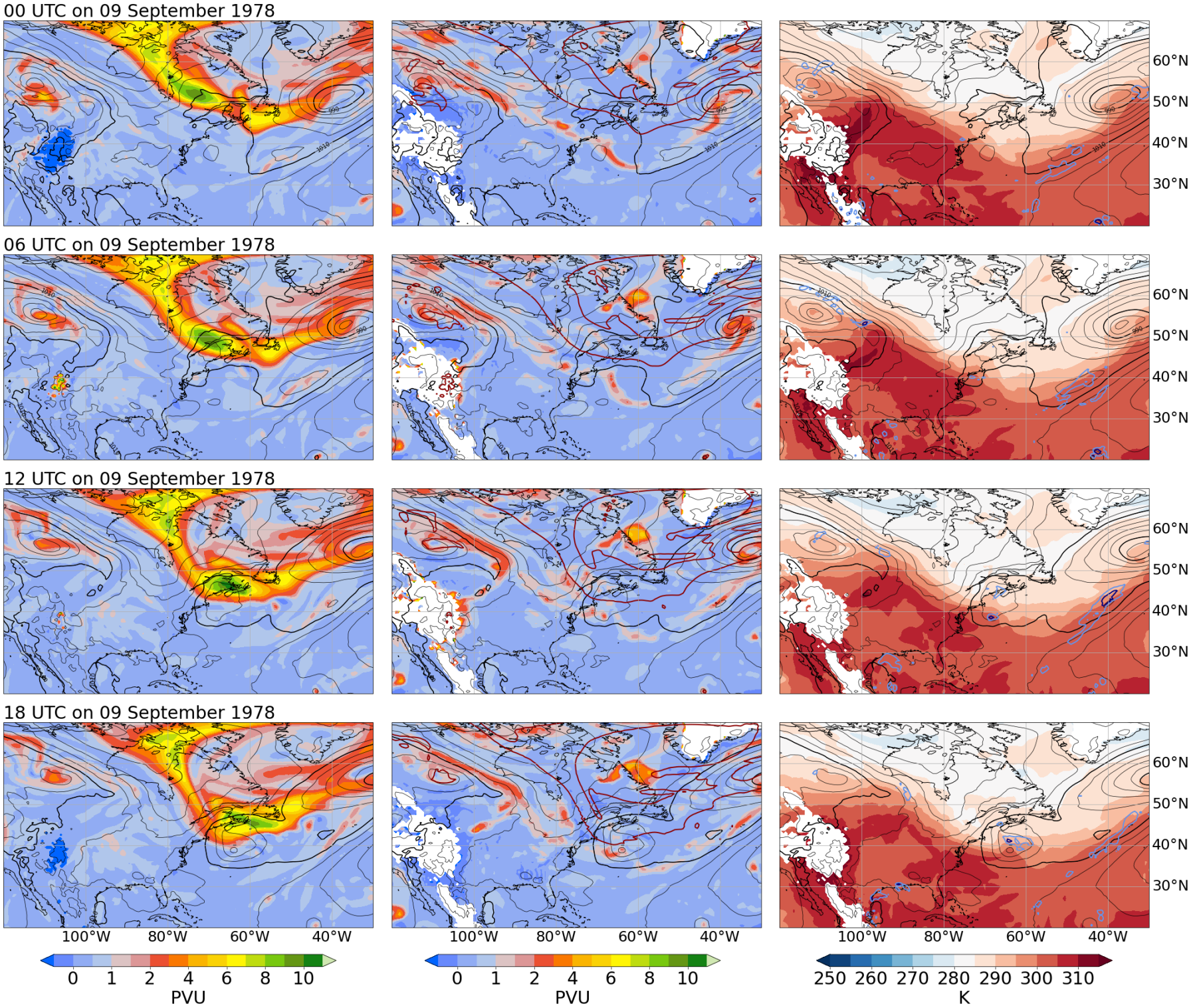
In addition, meridional (left panels, from S to N) and zonal (right panels, from W to E) vertical cross-sections are shown through the centre of the cyclones at the time of minimum MSLP and at a few earlier times (as indicated specifically for each cyclone). Cross-sections show PV (colours, in PVU) and equivalent potential temperature (contours, every 3 K).

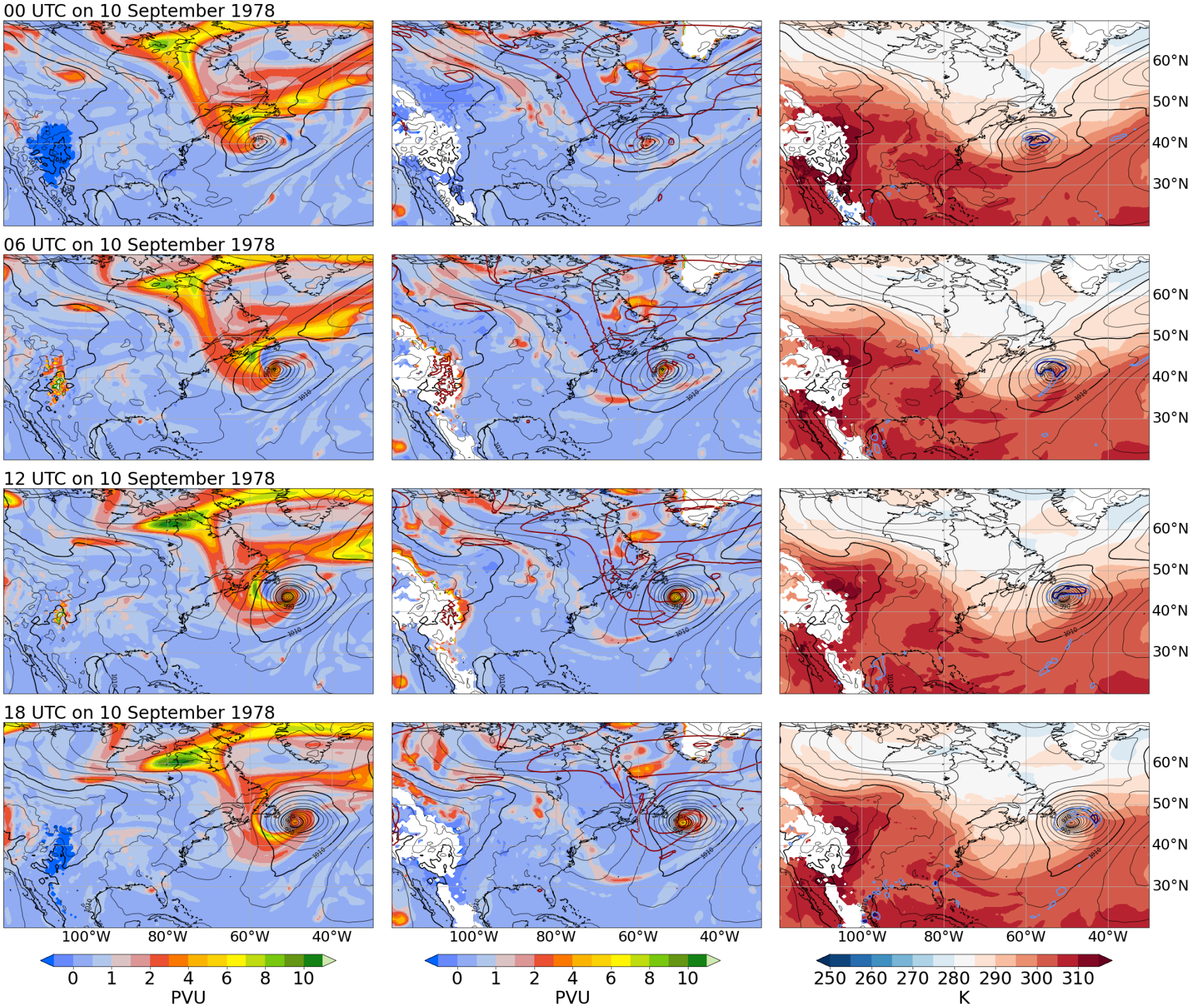
**Acknowledgements**: We are most grateful to Franziska Schnyder (ETH Zurich) for producing all figures shown in this Supplement.

# QE II storm

Horizontal maps from 00 UTC on 09 September – 18 UTC on 12 September 1978

Vertical cross sections from 18 UTC on 09 September – 18 UTC on 10 September 1978


00 UTC on 09 September 1978
06 UTC on 09 September 1978
12 UTC on 09 September 1978
18 UTC on 09 September 1978
60°N
50°N
40°N
30°N
100°W
80°W
60°W
40°W
0 1 2 4 6 8 10
PVU
0 1 2 4 6 8 10
PVU
250 260 270 280 290 300 310
K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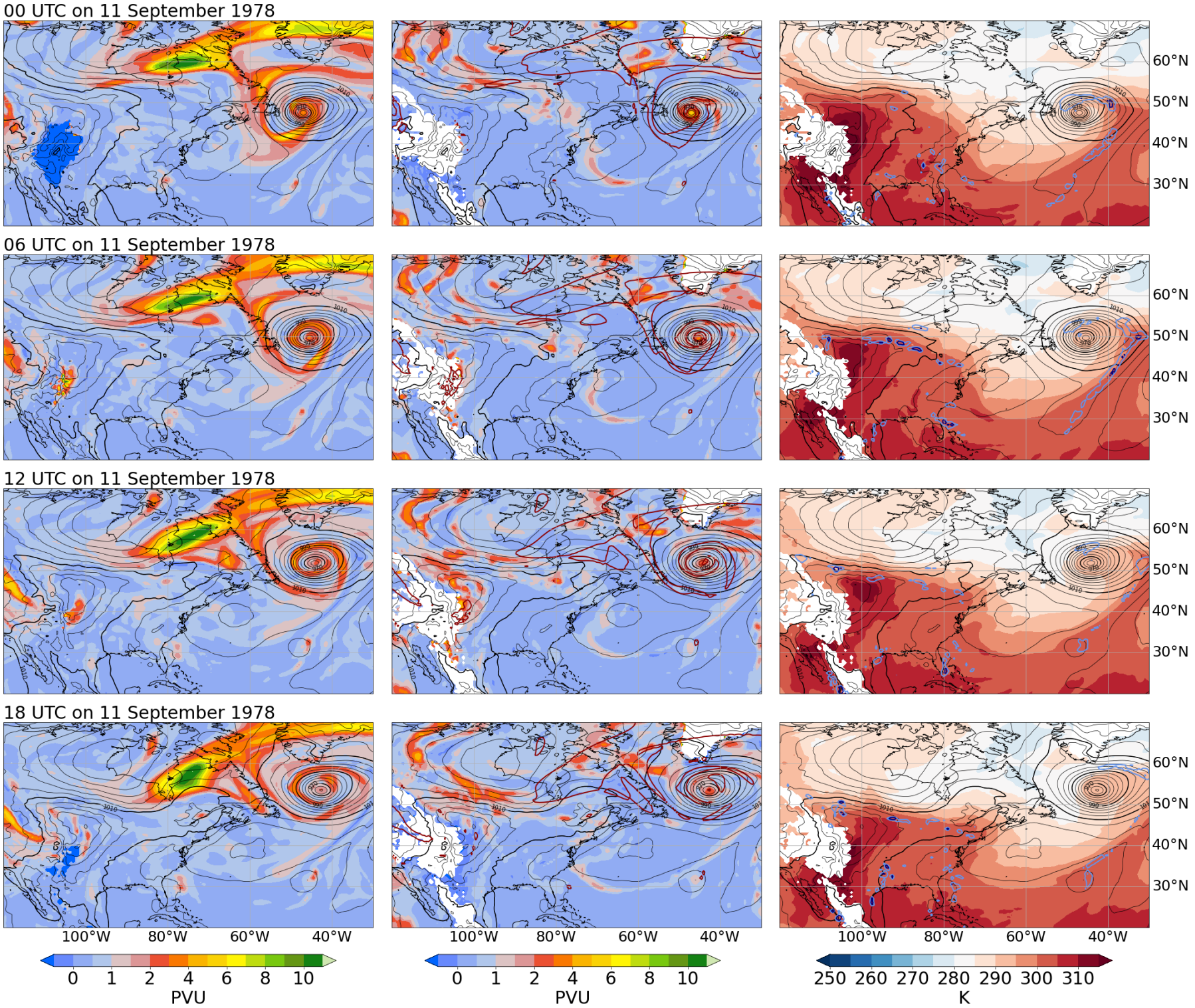
60°W
40°W
0 1 2 4 6 8 10
PVU
0 1 2 4 6 8 10
PVU
250 260 270 280 290 300 310
K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12 UTC on 11 September 1978
18 UTC on 11 September 1978
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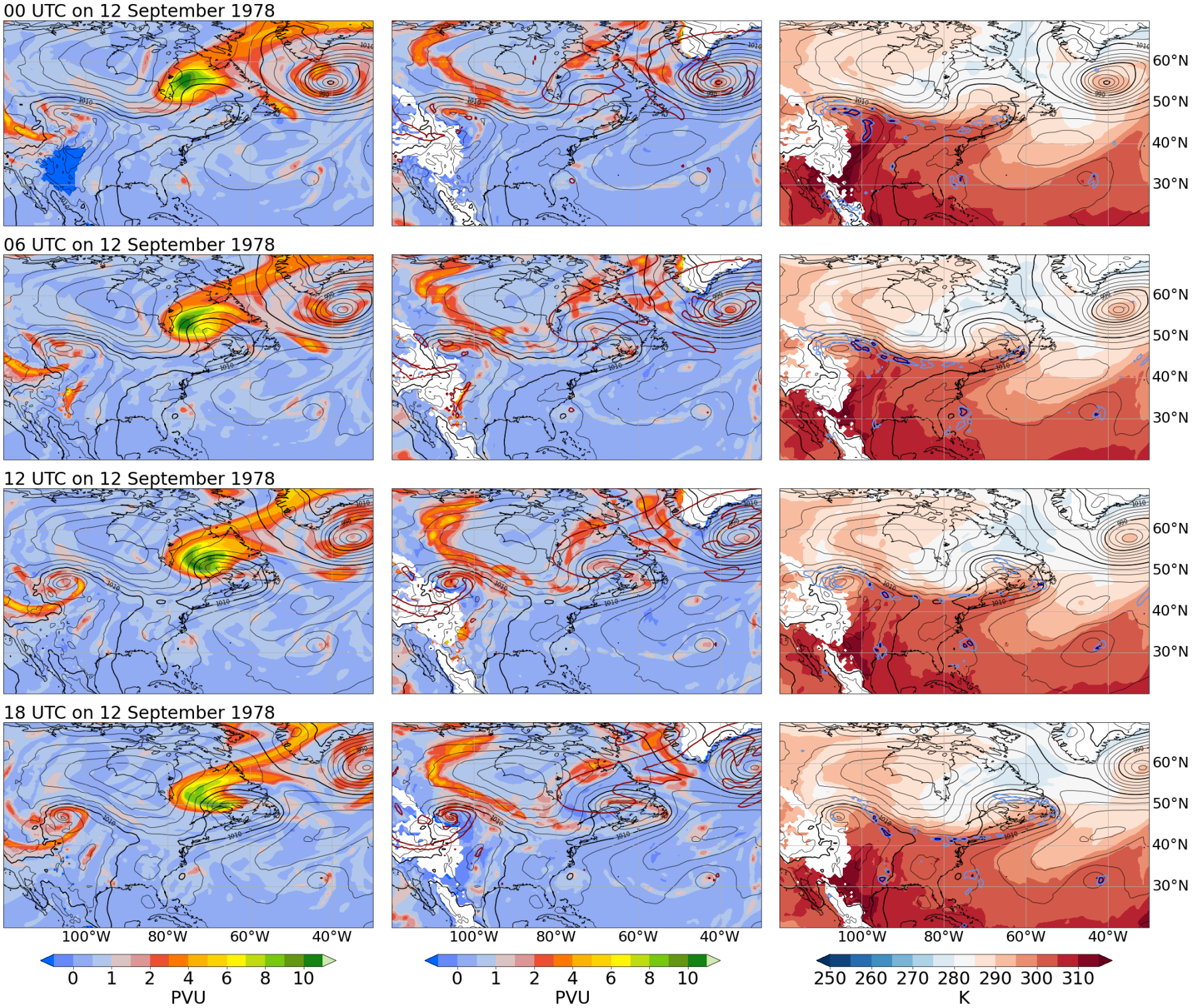
50°N
40°N
30°N
100°W
80°W
60°W
40°W
0 1 2 4 6 8 10
PVU
0 1 2 4 6 8 10
PVU
250 260 270 280 290 300 310
K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12 UTC on 12 September 1978
18 UTC on 12 September 1978
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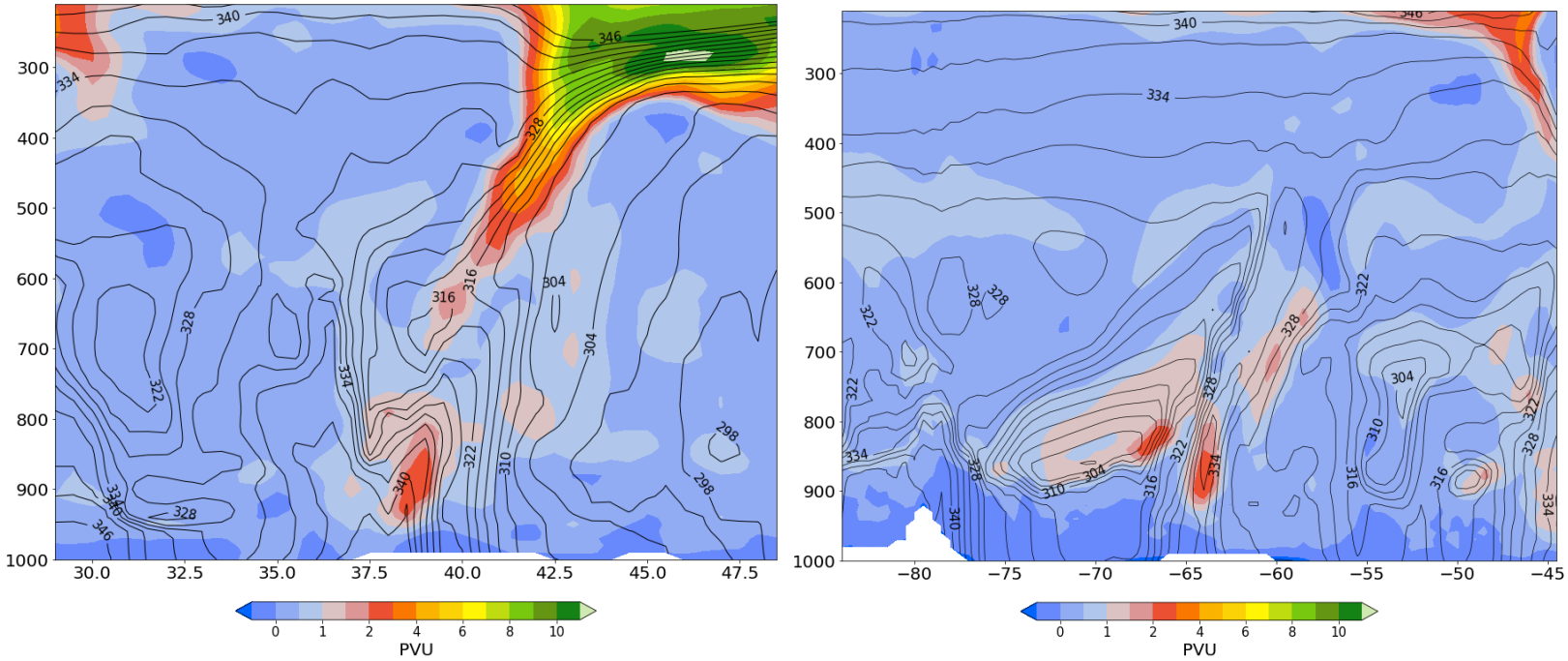
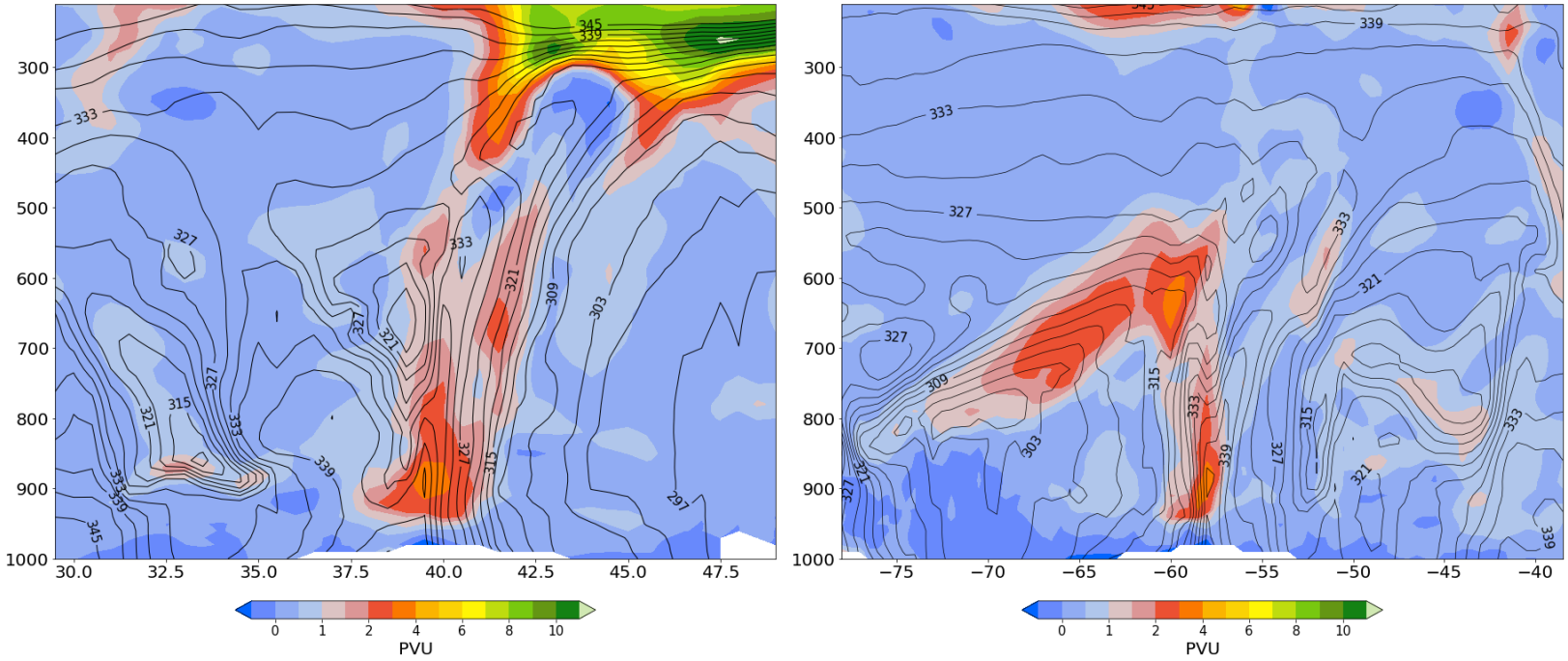
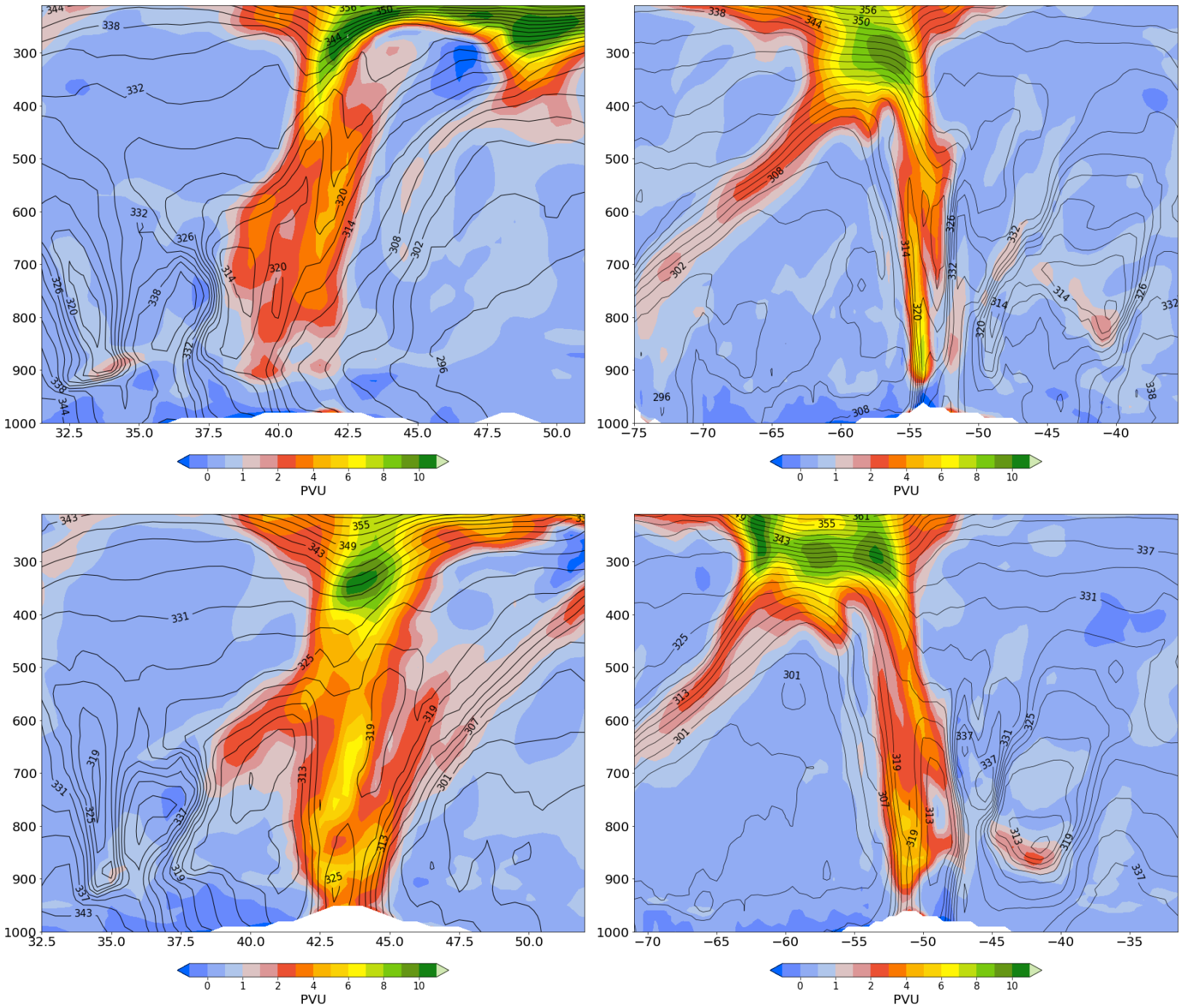
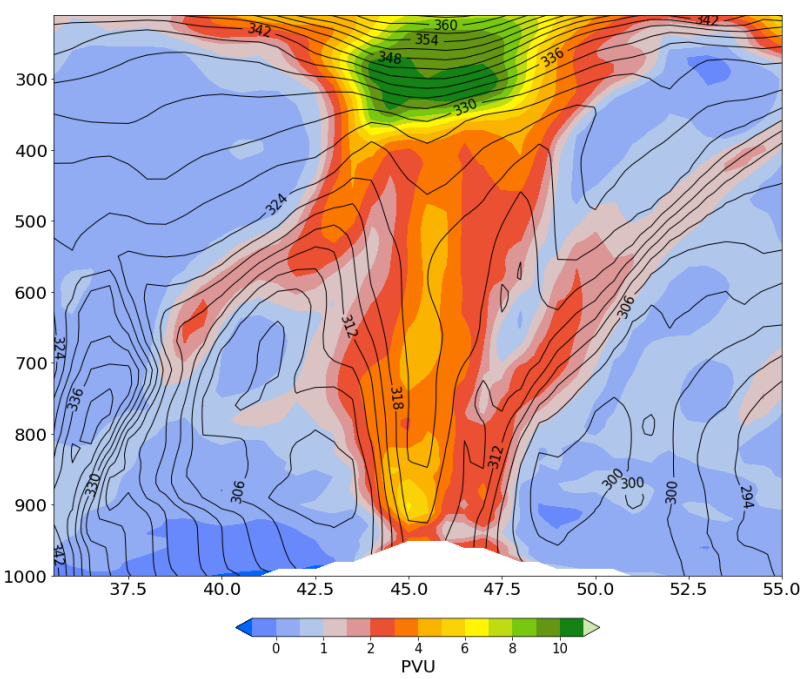
50°N
40°N
30°N
100°W
80°W
60°W
40°W
0 1 2 4 6 8 10
PVU
0 1 2 4 6 8 10
PVU
250 260 270 280 290 300 310
K

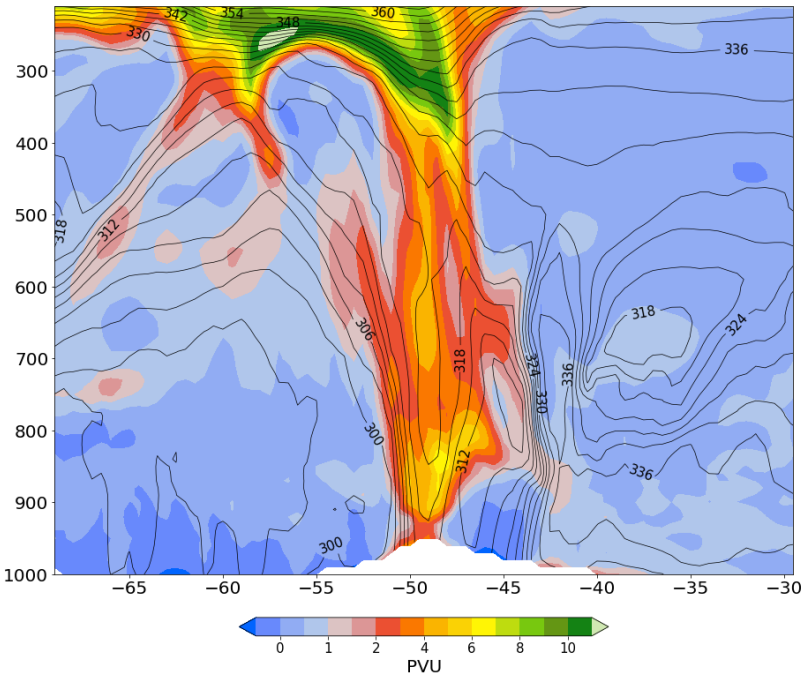
QE II Storm 18 UTC 09 Sep to 18 UTC 10 Sep 1978




PVU
0 1 2 4 6 8 10
PVU
0 1 2 4 6 8 10
PVU
0 1 2 4 6 8 10
PVU
0 1 2 4 6 8 10

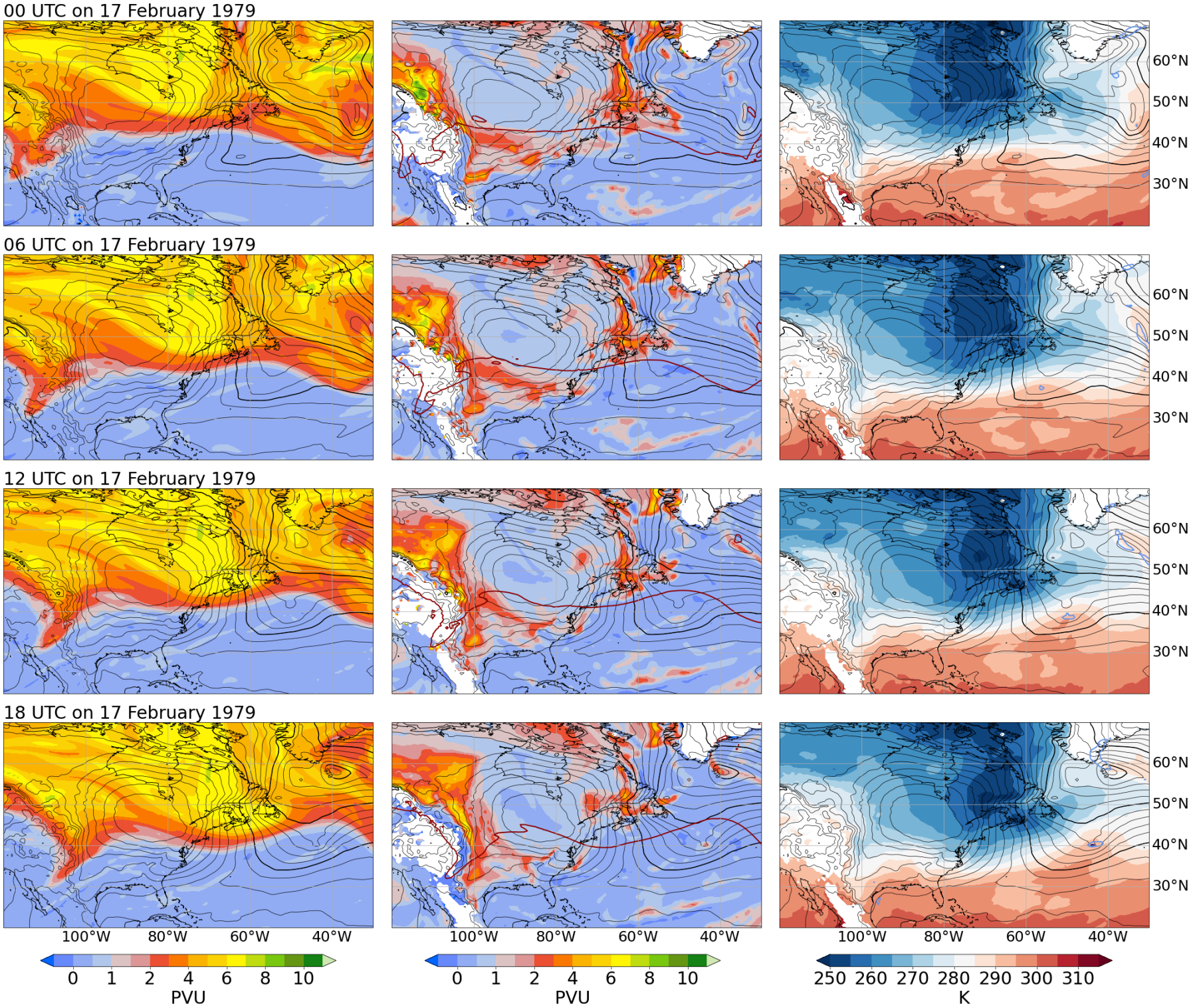

300
400
500
600
700
800
900
1000
37.5
40.0
42.5
45.0
47.5
50.0
52.5
55.0
0
1
2
4
6
8
10
PVU

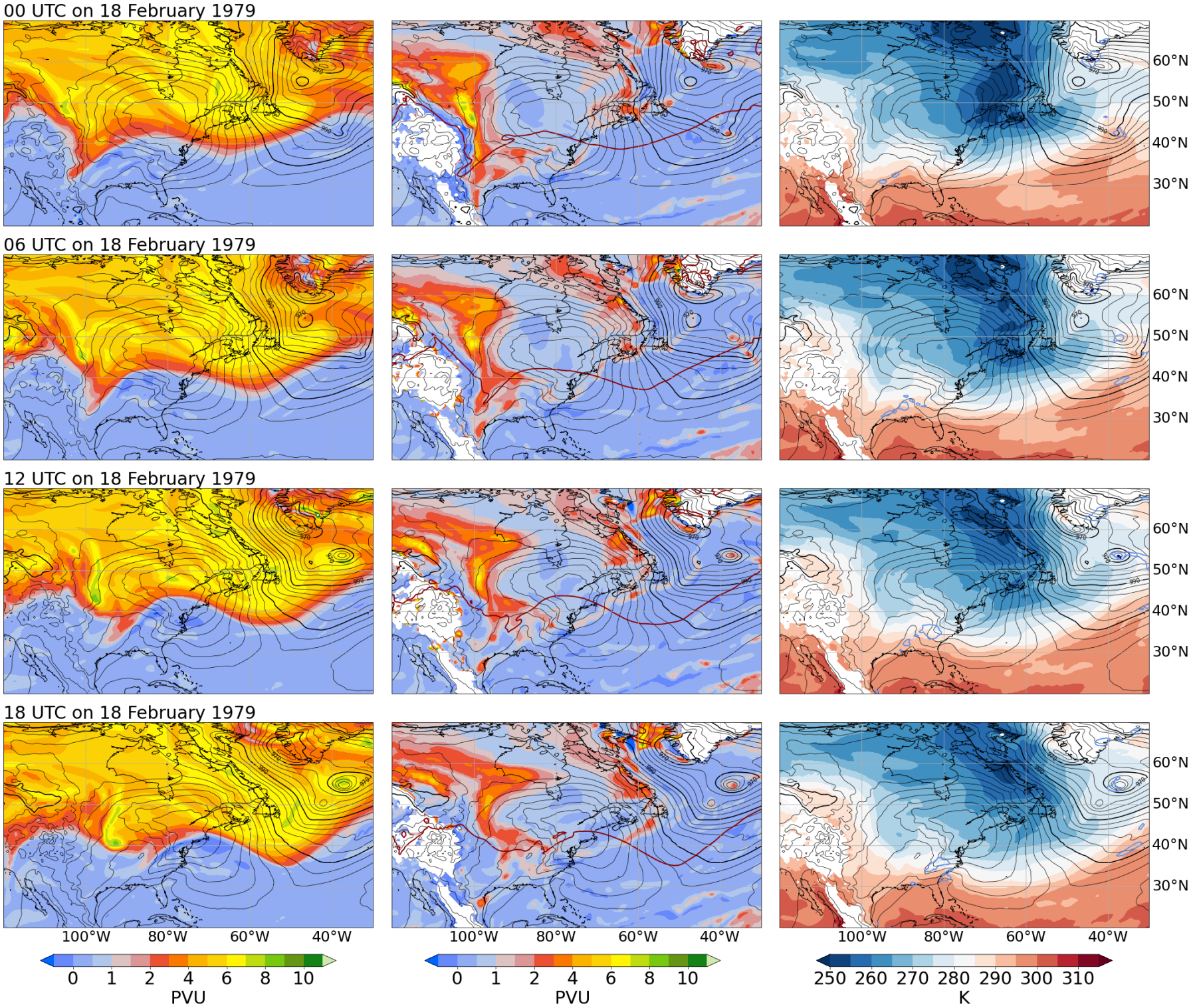

300
400
500
600
700
800
900
1000
−65
−60
−55
−50
−45
−40
−35
−30
0
1
2
4
6
8
10
PVU

# President’s Day cyclone

Horizontal maps from 00 UTC on 17 February – 18 UTC on 22 February 1979

Vertical cross sections from 12 UTC on 19 February – 18 UTC on 20 February 1979


00 UTC on 17 February 1979
06 UTC on 17 February 1979
12 UTC on 17 February 1979
18 UTC on 17 February 1979
60°N
50°N
40°N
30°N
100°W
80°W
60°W
40°W
0 1 2 4 6 8 10
PVU
0 1 2 4 6 8 10
PVU
250 260 270 280 290 300 310
K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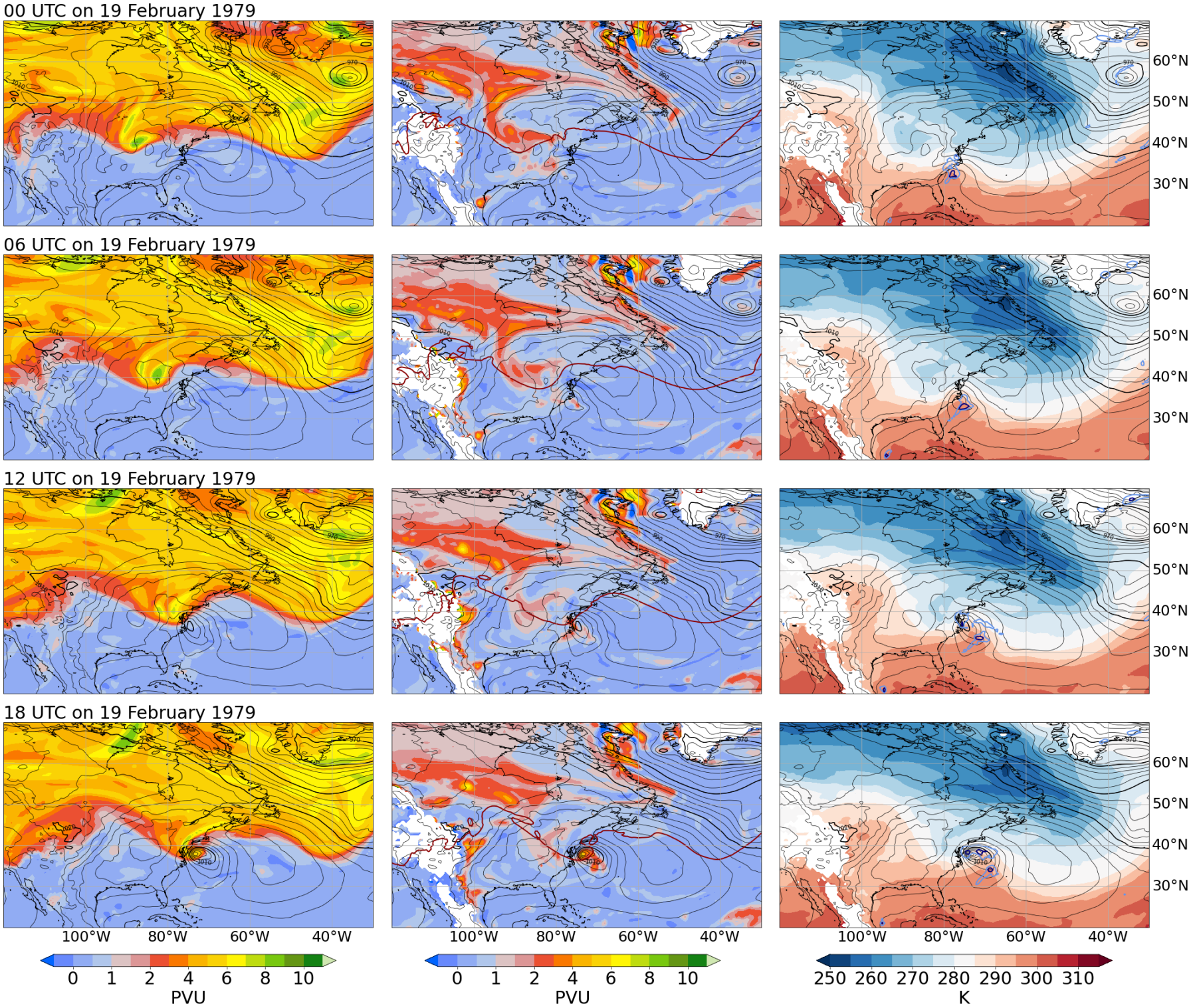
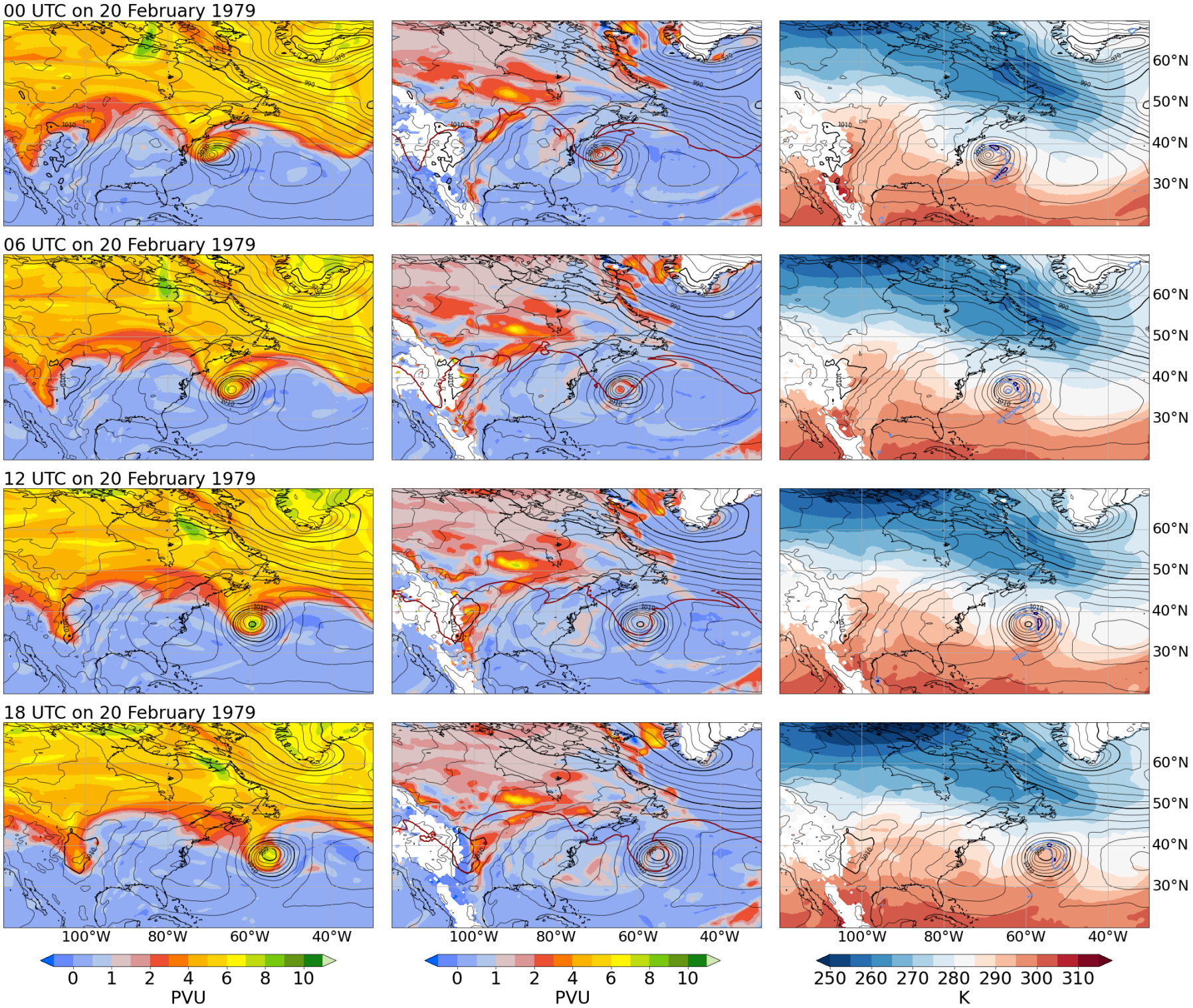
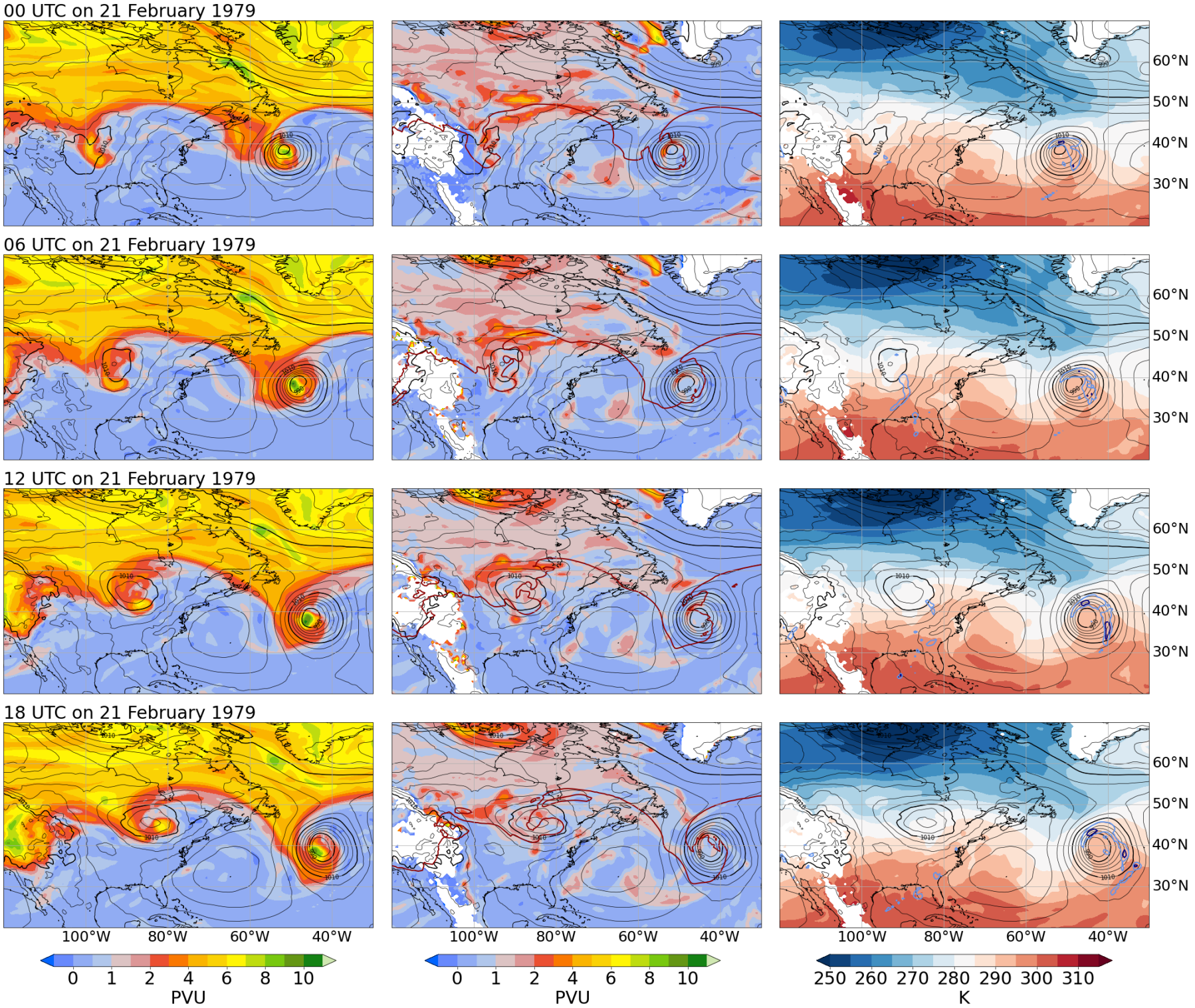
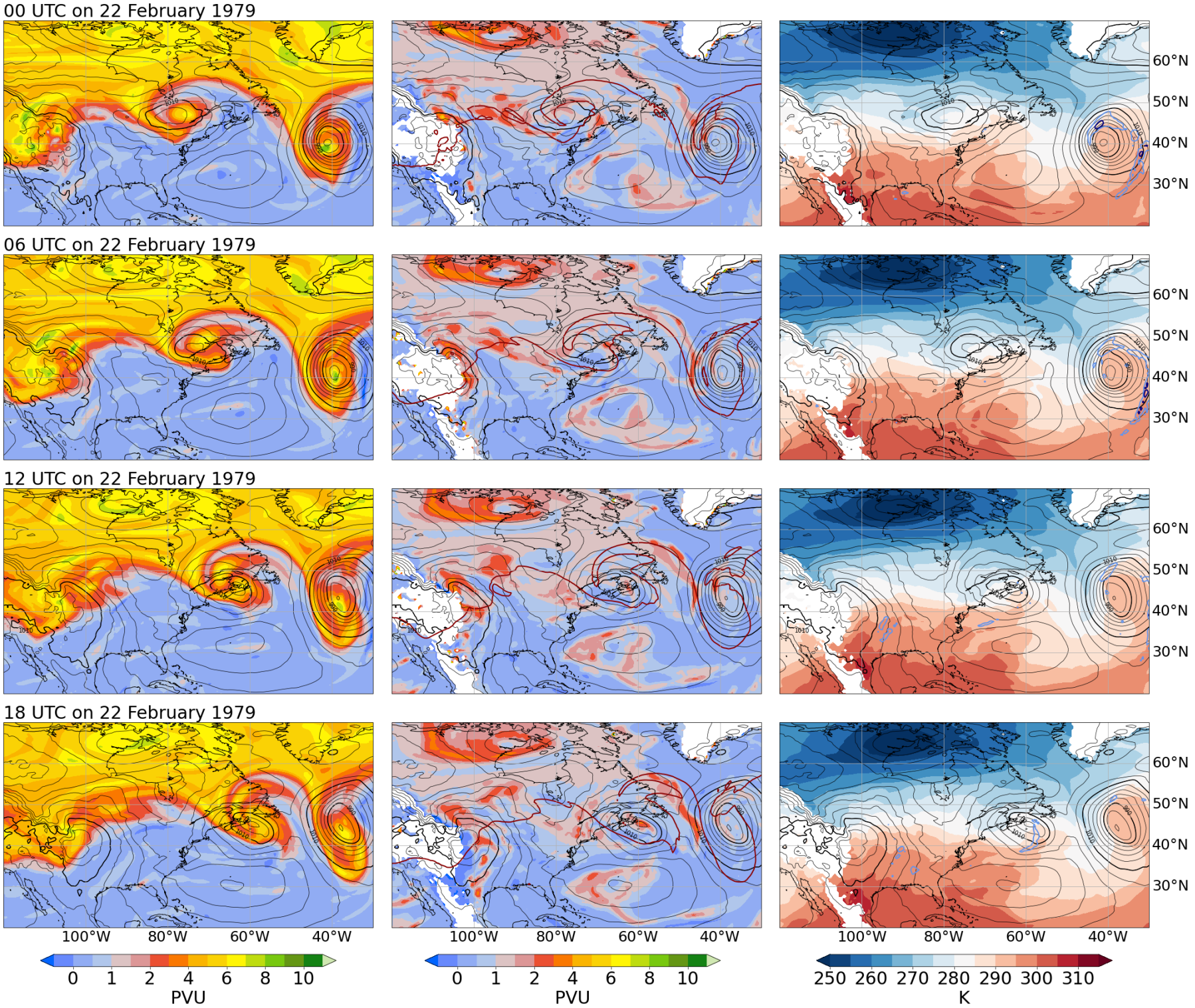
06 UTC on 18 February 1979
12 UTC on 18 February 1979
18 UTC on 18 February 1979
60°N
50°N
40°N
30°N
100°W
80°W
60°W
40°W
0 1 2 4 6 8 10
PVU
0 1 2 4 6 8 10
PVU
250 260 270 280 290 300 310
K

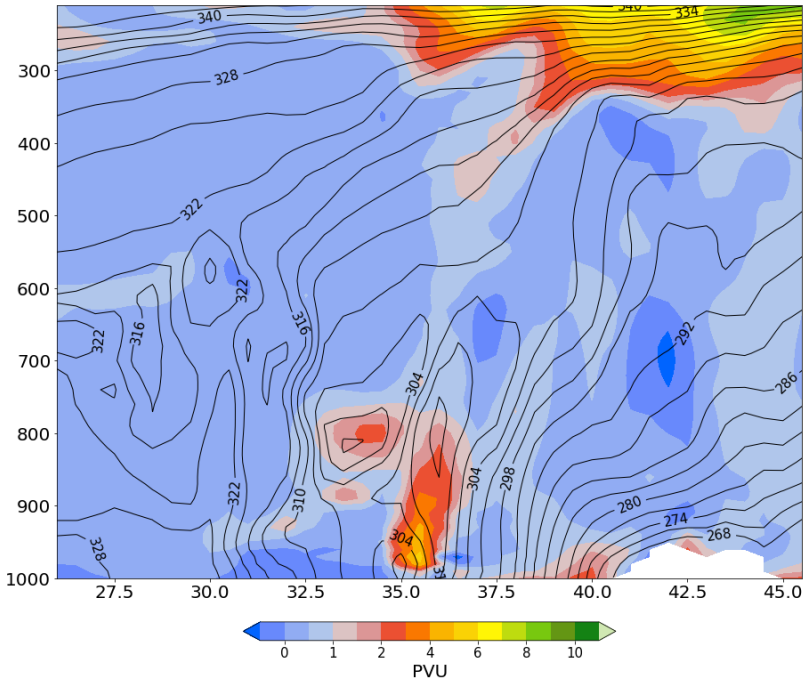

00 UTC on 19 February 1979
06 UTC on 19 February 1979
12 UTC on 19 February 1979
18 UTC on 19 February 1979
60°N
50°N
40°N
30°N
100°W
80°W
60°W
40°W
0 1 2 4 6 8 10
PVU
0 1 2 4 6 8 10
PVU
250 260 270 280 290 300 310
K

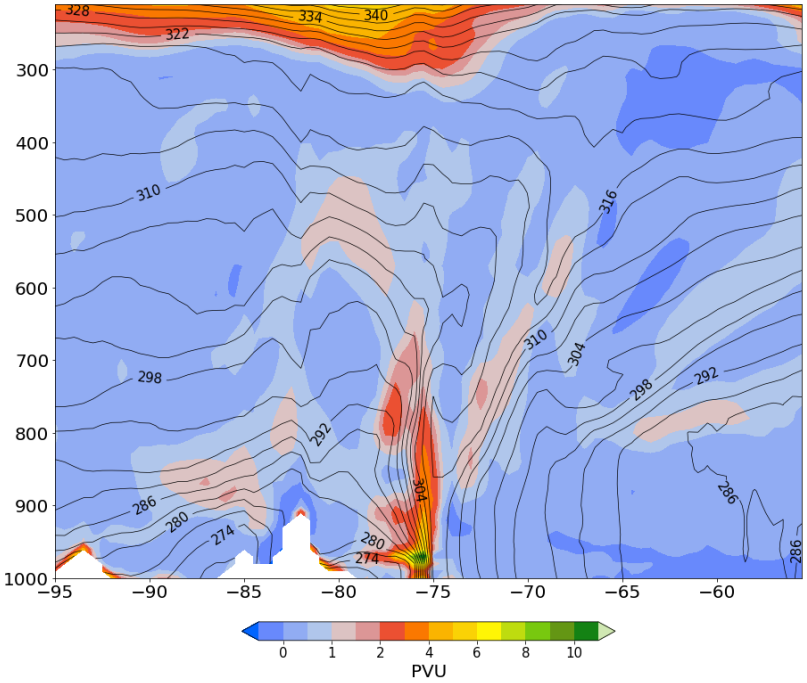

00 UTC on 20 February 1979
06 UTC on 20 February 1979
12 UTC on 20 February 1979
18 UTC on 20 February 1979
60°N
50°N
40°N
30°N
100°W
80°W
60°W
40°W
0 1 2 4 6 8 10
PVU
0 1 2 4 6 8 10
PVU
250 260 270 280 290 300 310
K

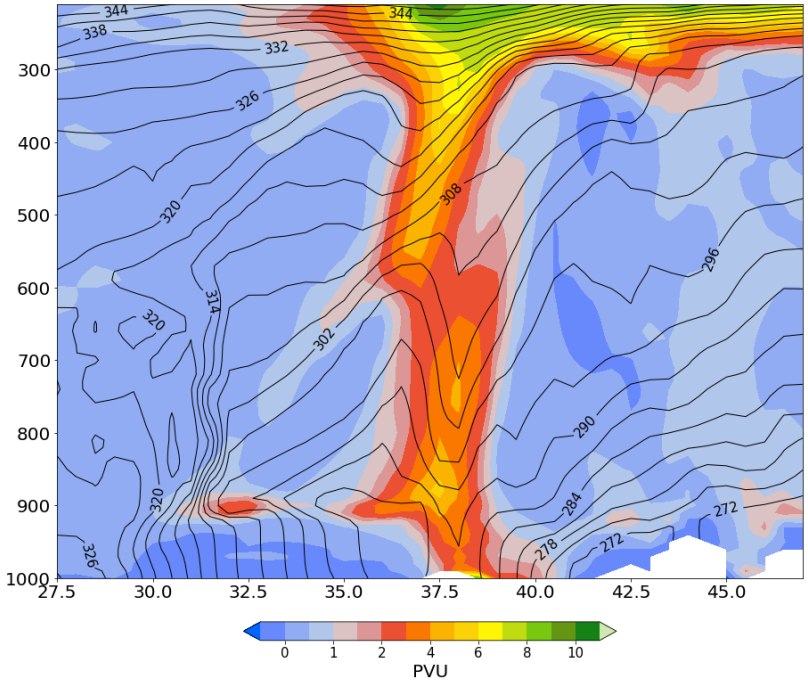

00 UTC on 21 February 1979
06 UTC on 21 February 1979
12 UTC on 21 February 1979
18 UTC on 21 February 1979
60°N
50°N
40°N
30°N
100°W
80°W
60°W
40°W
0 1 2 4 6 8 10
PVU
0 1 2 4 6 8 10
PVU
250 260 270 280 290 300 310
K

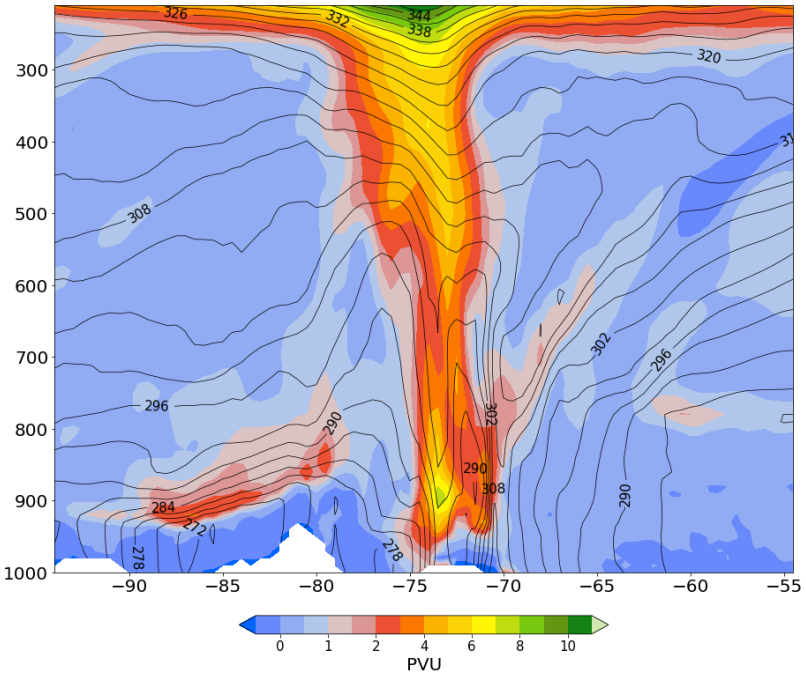

00 UTC on 22 February 1979
06 UTC on 22 February 1979
12 UTC on 22 February 1979
18 UTC on 22 February 1979
60°N
50°N
40°N
30°N
100°W
80°W
60°W
40°W
0 1 2 4 6 8 10
PVU
0 1 2 4 6 8 10
PVU
250 260 270 280 290 300 310
K

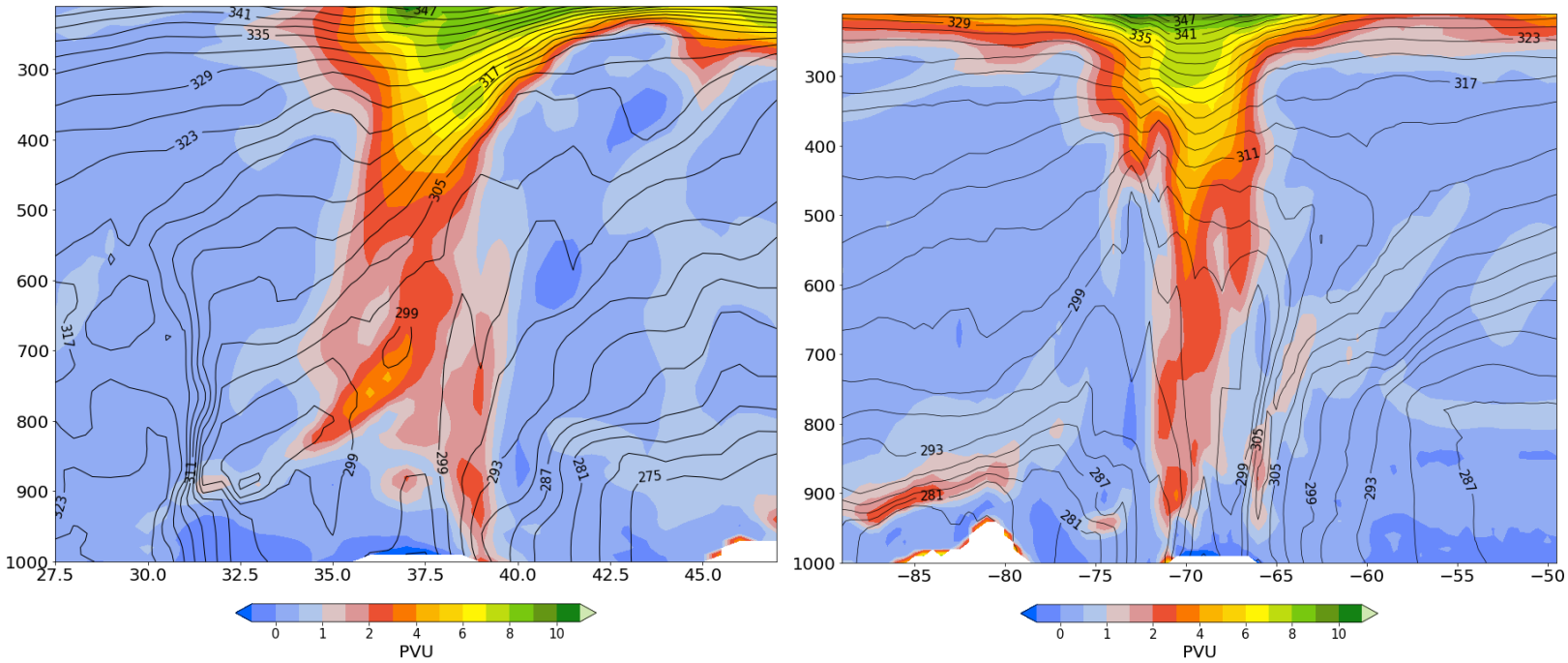
President's Day Cyclone 12 UTC 19 Feb to 18 UTC 20 Feb 1979

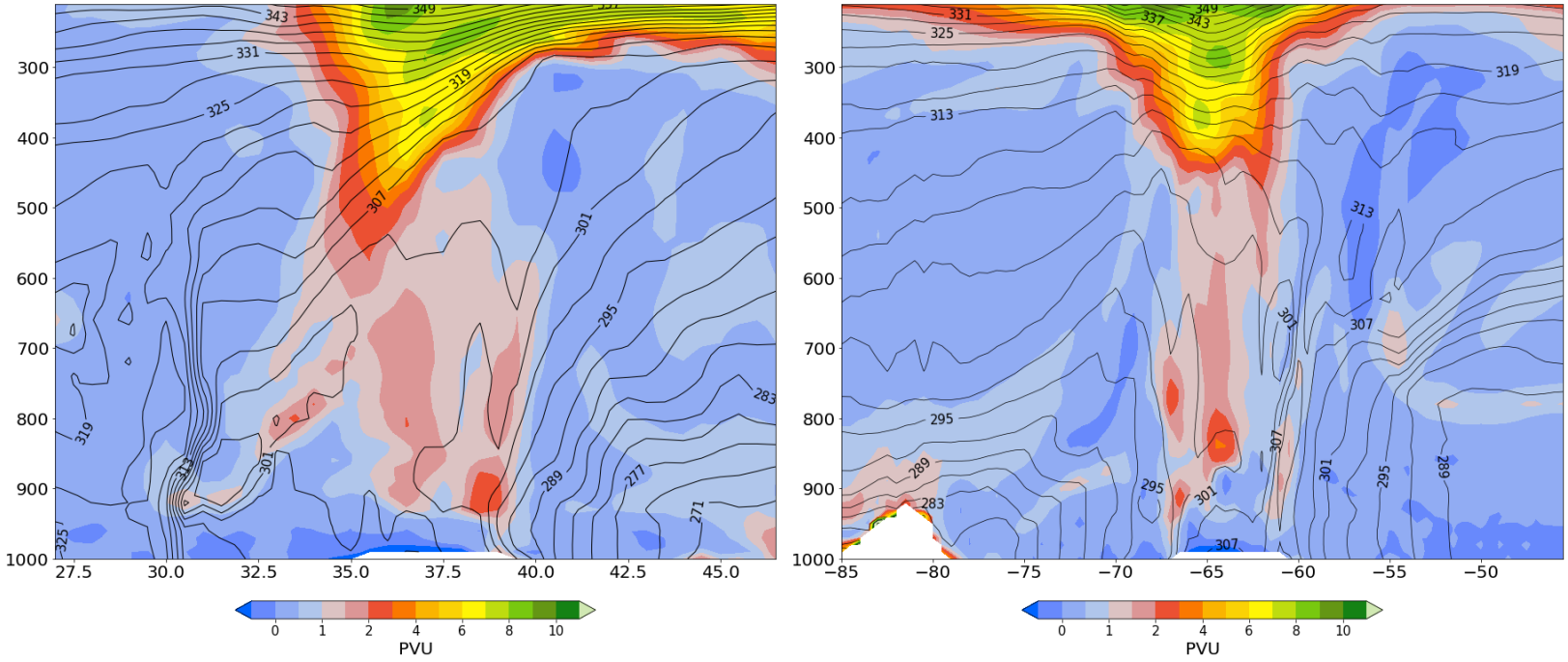



PVU
0 1 2 4 6 8 10
PVU
0 1 2 4 6 8 10


PVU
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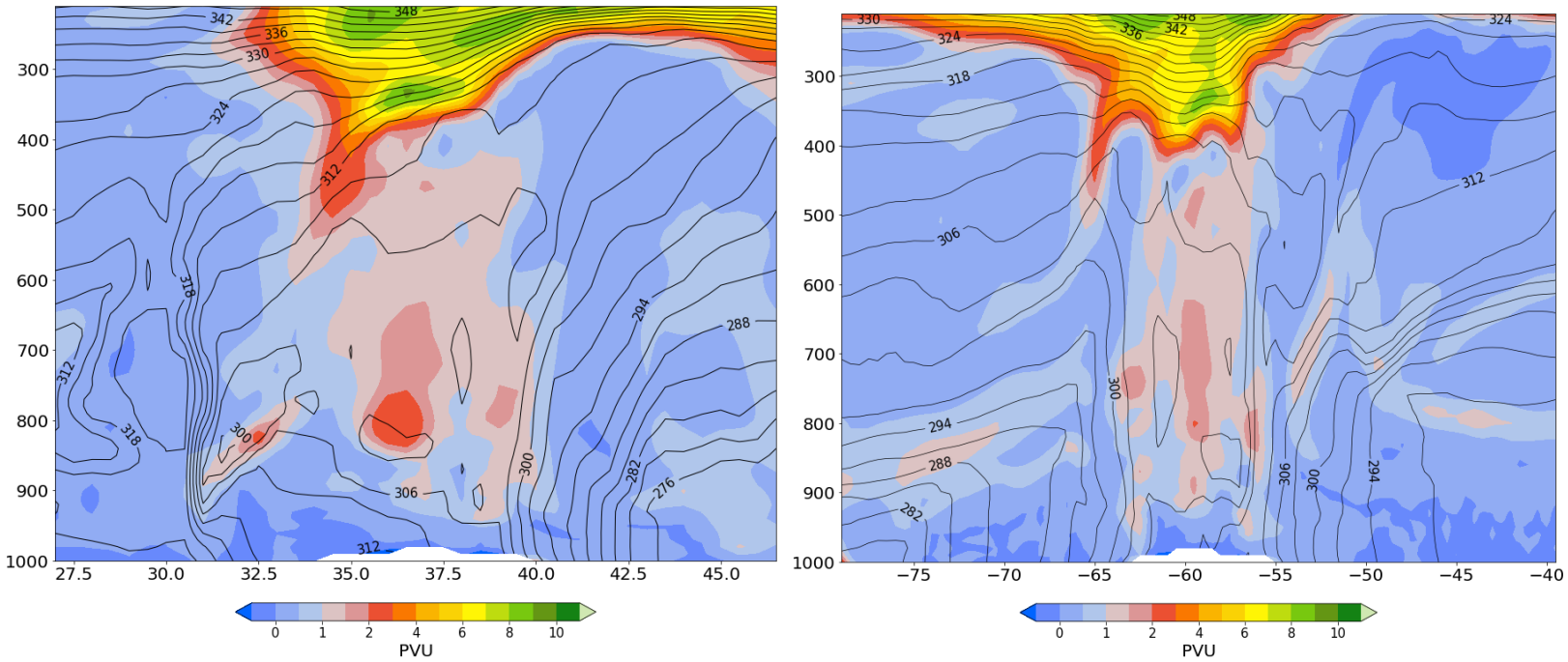
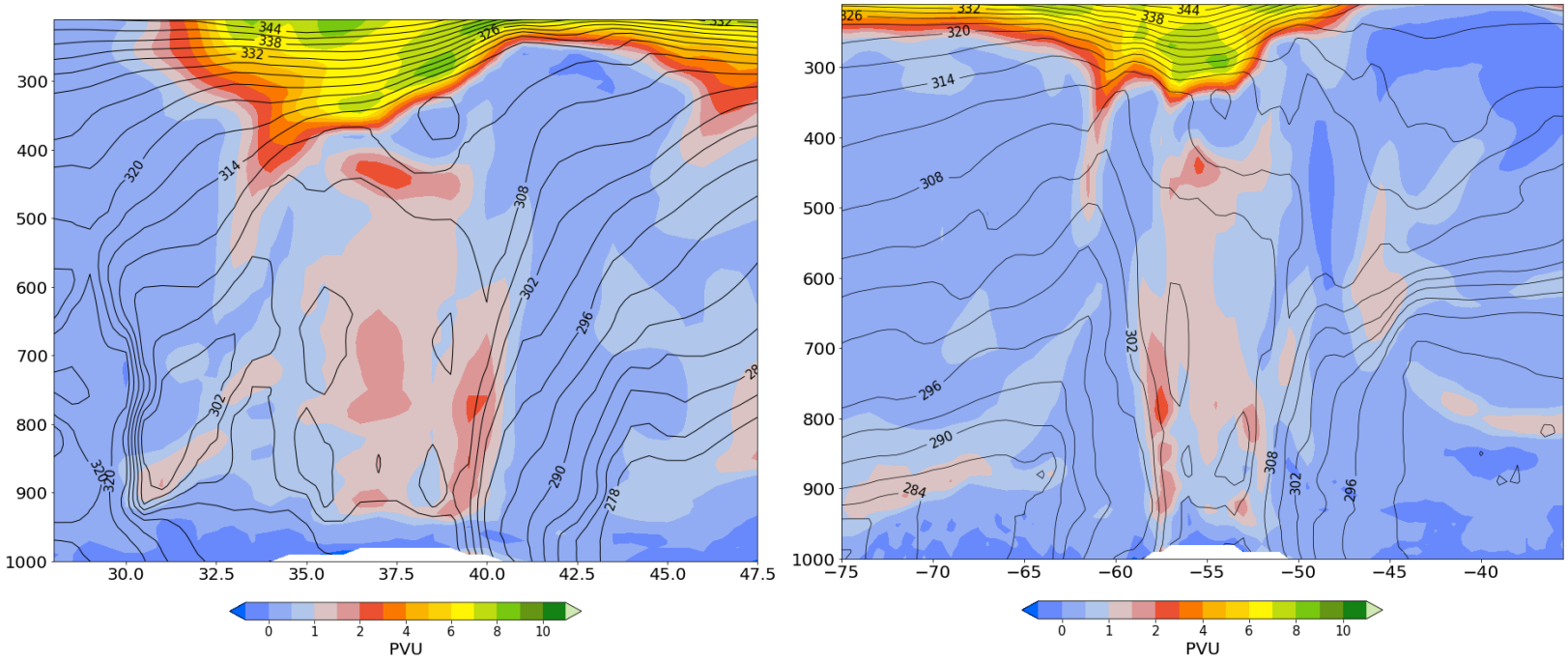
PVU
0 1 2 4 6 8 10

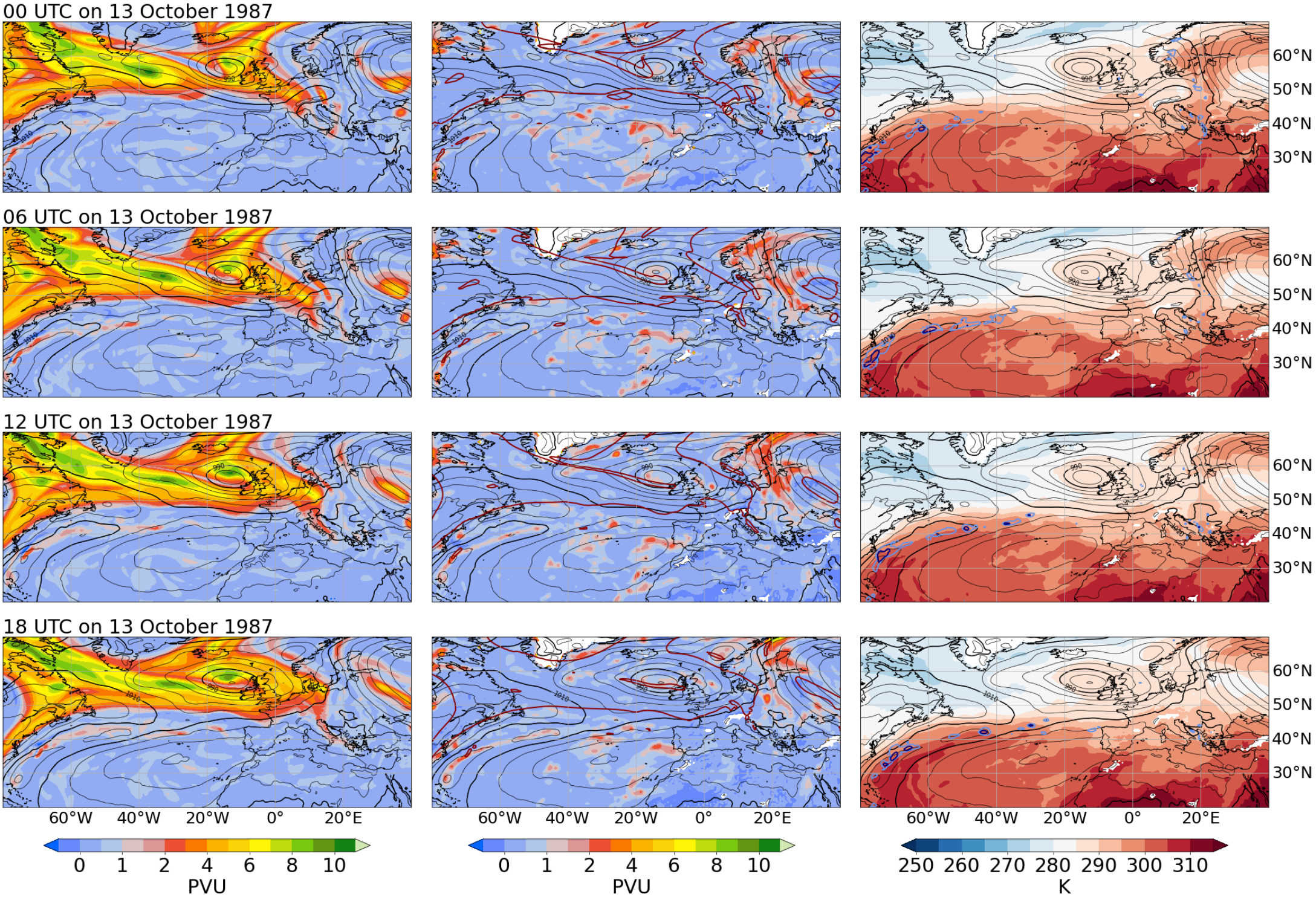

PVU
0 1 2 4 6 8 10
PVU
0 1 2 4 6 8 10

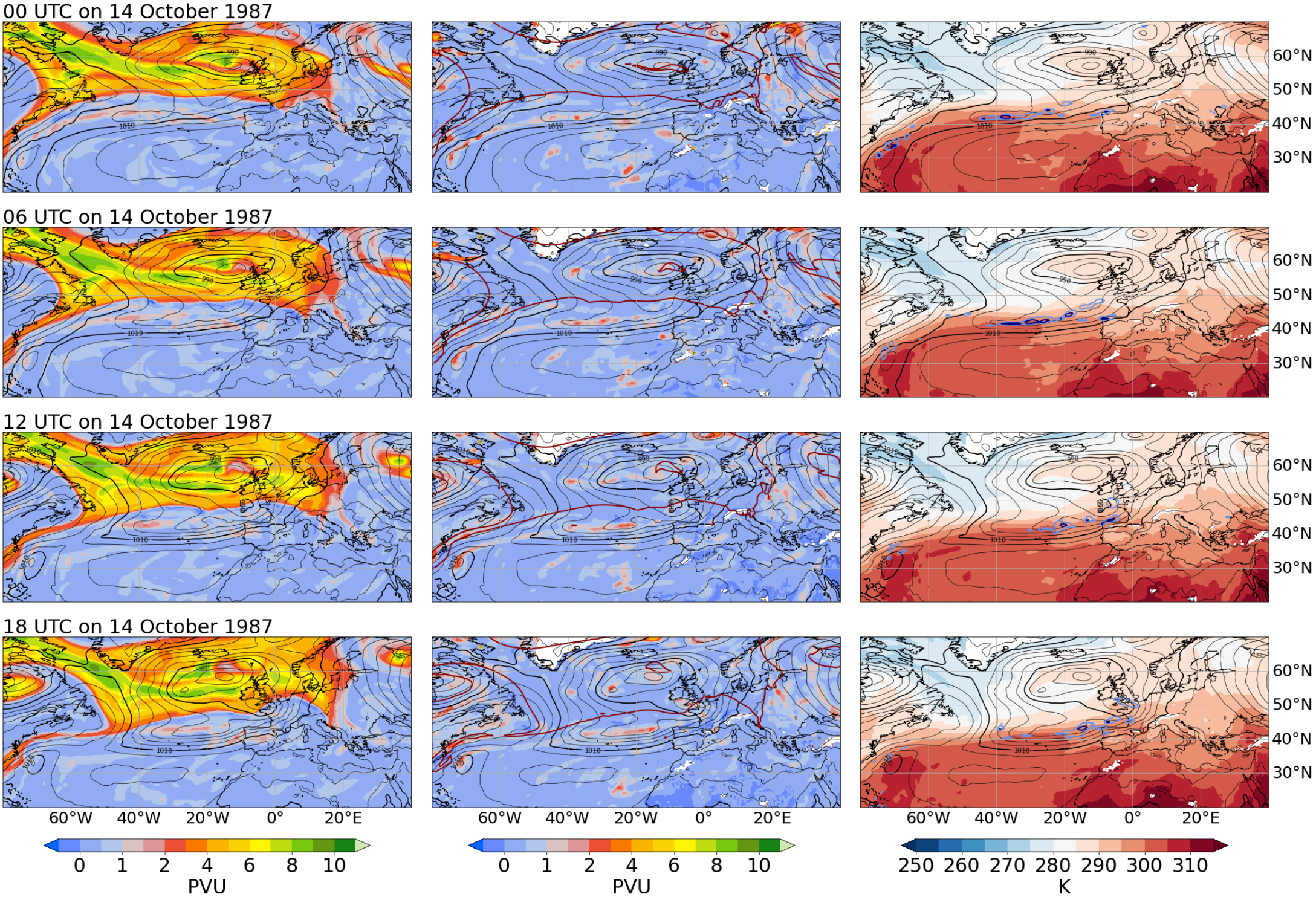

PVU
0 1 2 4 6 8 10
PVU
0 1 2 4 6 8 10

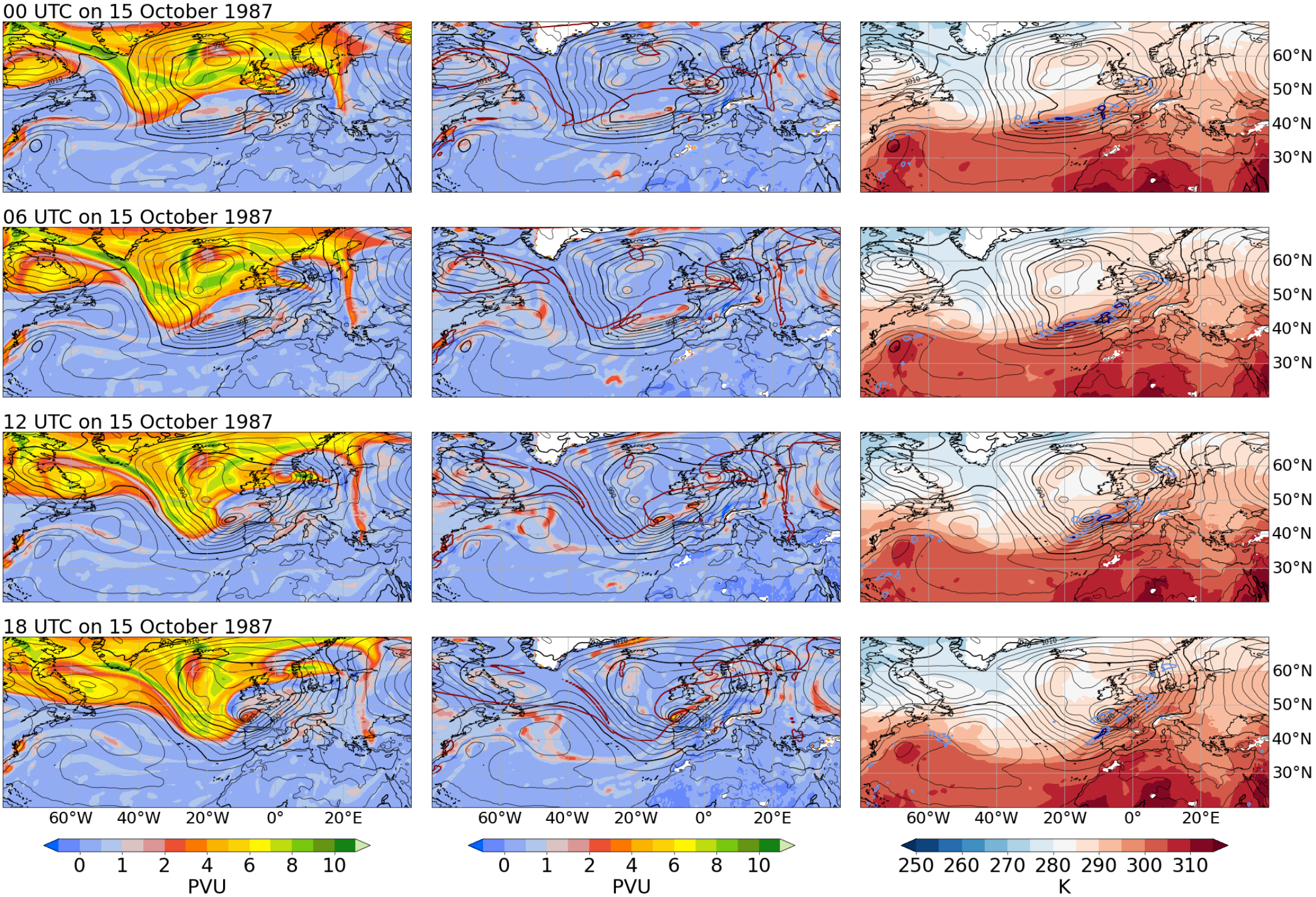
# U.K. Great October storm

Horizontal maps from 00 UTC on 13 October – 18 UTC on 18 October 1987

Vertical cross sections from 12 UTC on 15 October – 06 UTC on 16 October 1987


00 UTC on 13 October 1987
06 UTC on 13 October 1987
12 UTC on 13 October 1987
18 UTC on 13 October 1987
60°N
50°N
40°N
30°N
60°W
40°W
20°W
0°
20°E
0
1
2
4
6
8
10
PVU
250
260
270
280
290
300
310
K


00 UTC on 14 October 1987
06 UTC on 14 October 1987
12 UTC on 14 October 1987
18 UTC on 14 October 1987
990
1010
60°N
50°N
40°N
30°N
60°W
40°W
20°W
0°
20°E
0
1
2
4
6
8
10
PVU
250
260
270
280
290
300
310
K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18 UTC on 15 October 1987
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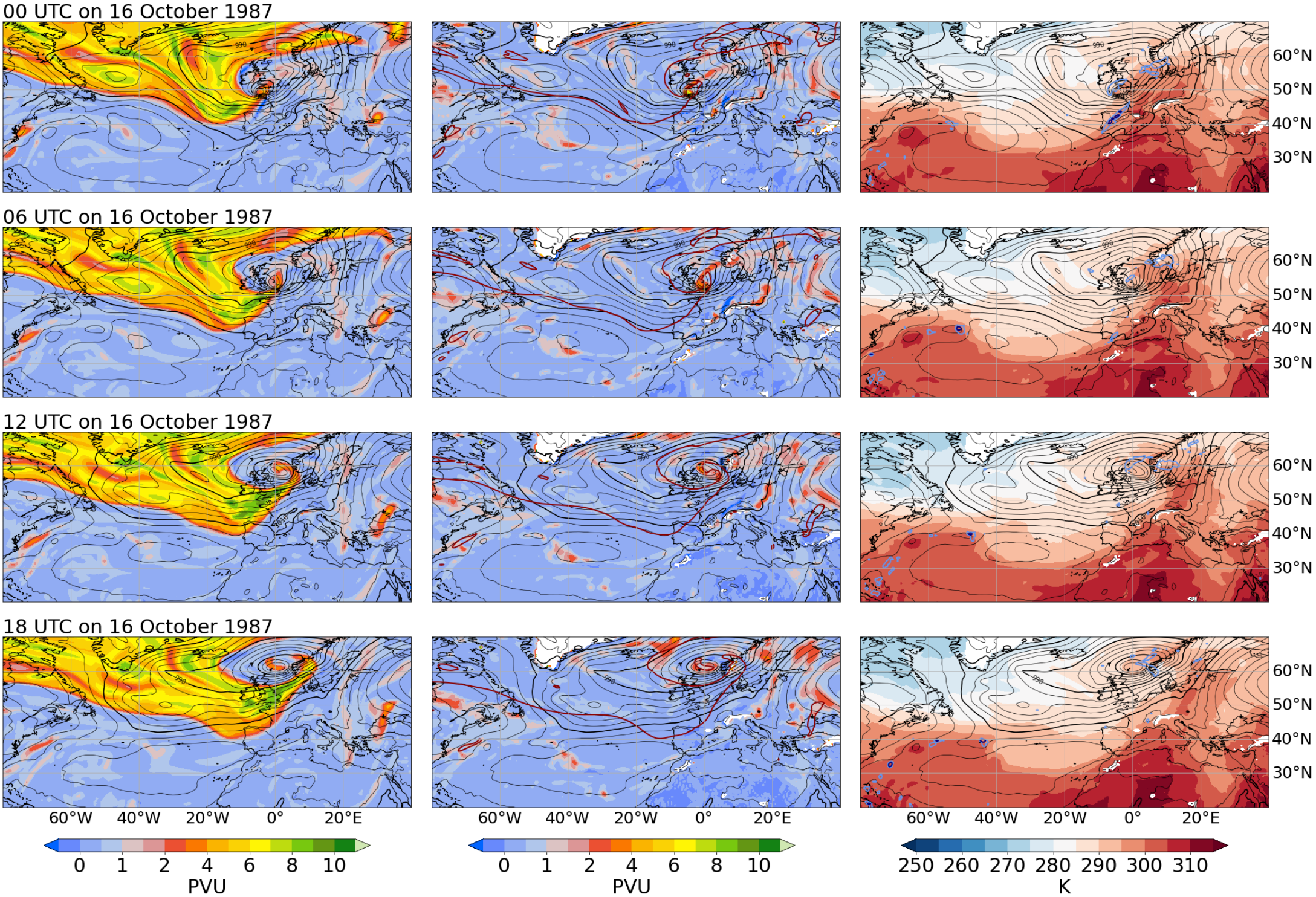
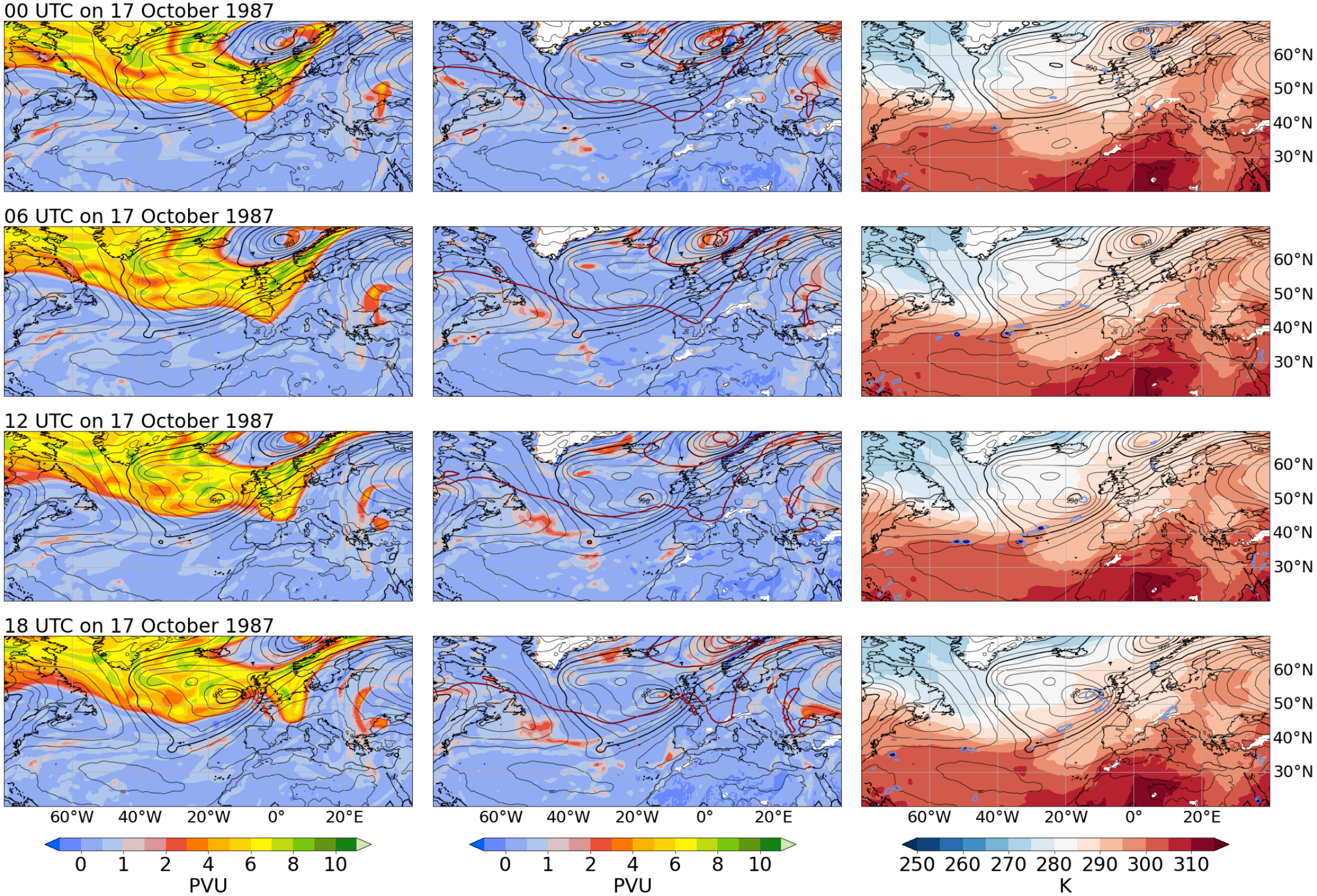
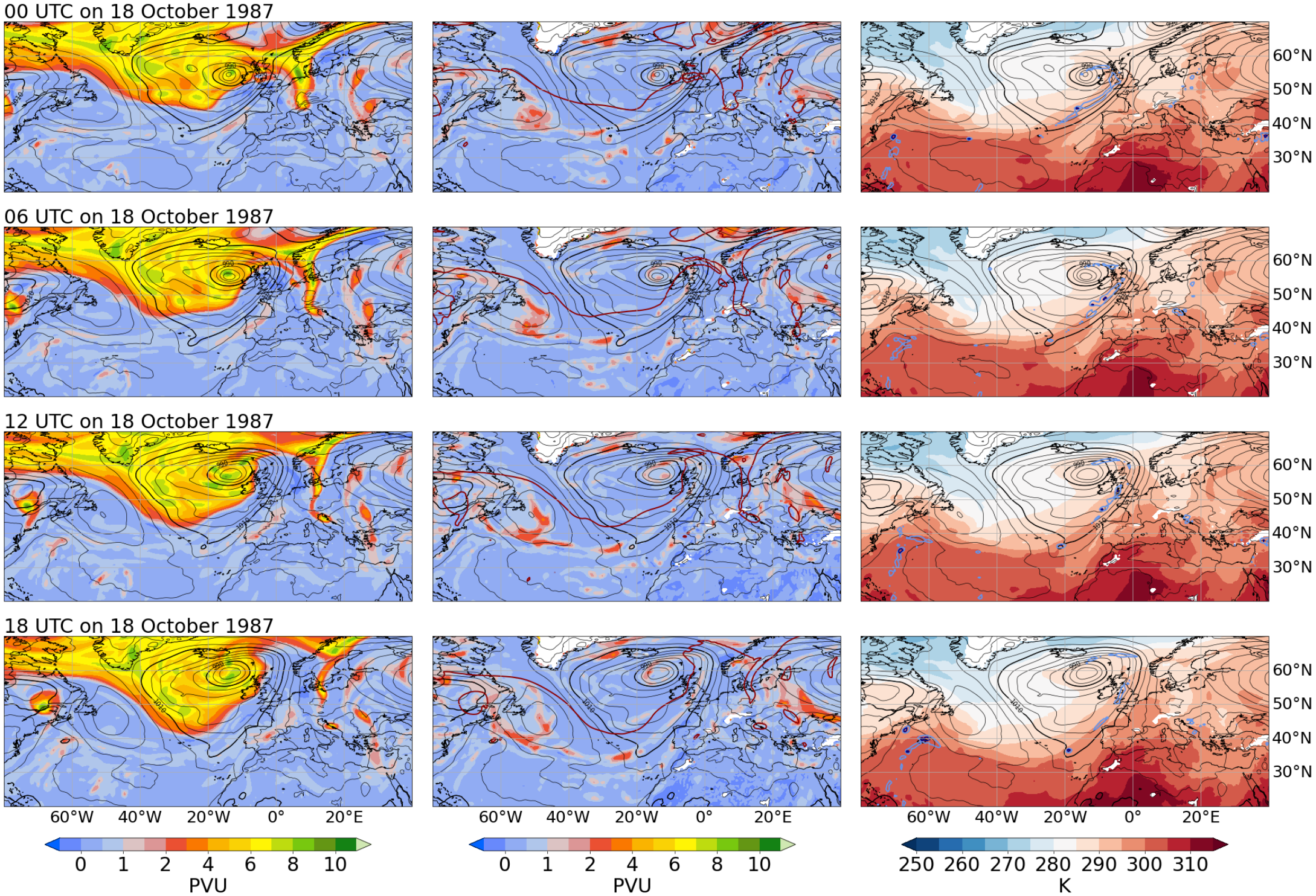
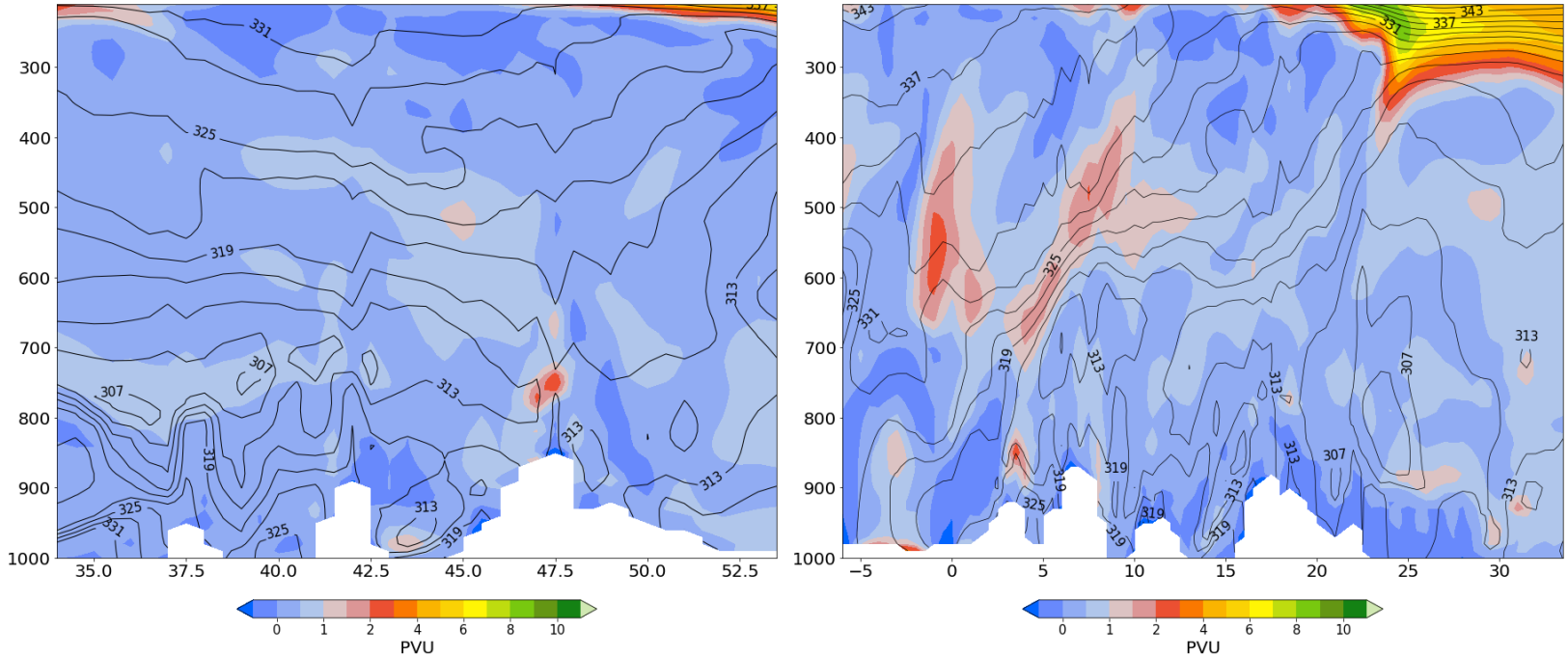
50°N
40°N
30°N
60°W
40°W
20°W
0°
20°E
0
1
2
4
6
8
10
PVU
250
260
270
280
290
300
310
K

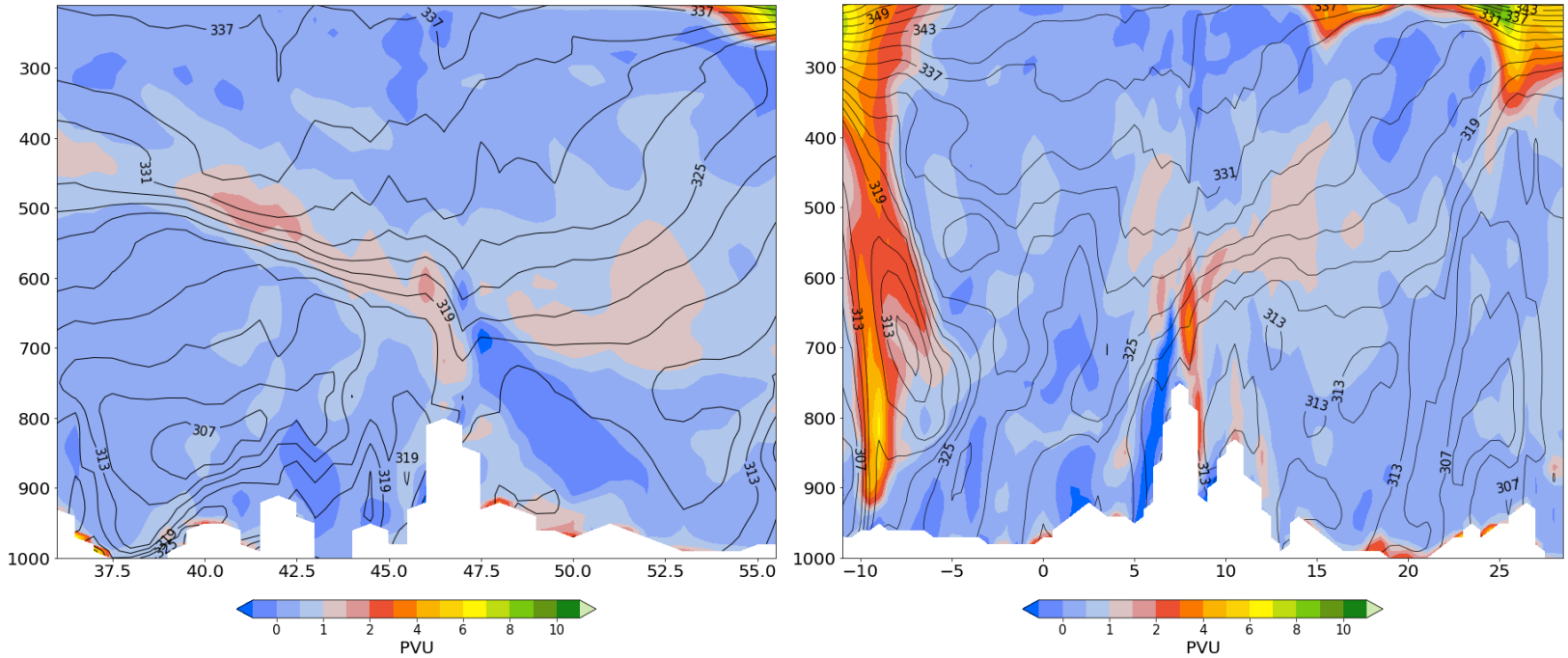

00 UTC on 16 October 1987
06 UTC on 16 October 1987
12 UTC on 16 October 1987
18 UTC on 16 October 1987
60°N
50°N
40°N
30°N
60°W
40°W
20°W
0°
20°E
0
1
2
4
6
8
10
PVU
250
260
270
280
290
300
310
K

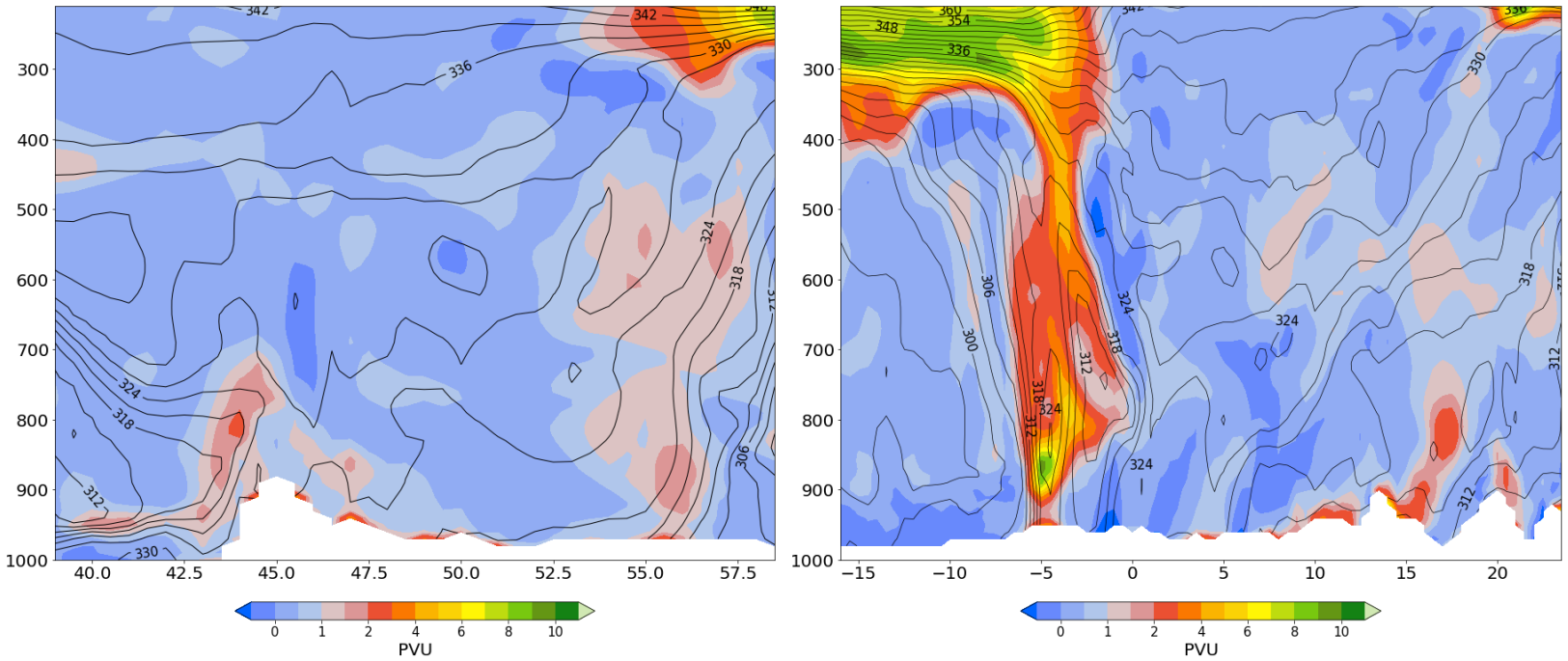

00 UTC on 17 October 1987
06 UTC on 17 October 1987
12 UTC on 17 October 1987
18 UTC on 17 October 1987
60°N
50°N
40°N
30°N
60°W
40°W
20°W
0°
20°E
0
1
2
4
6
8
10
PVU
250
260
270
280
290
300
310
K

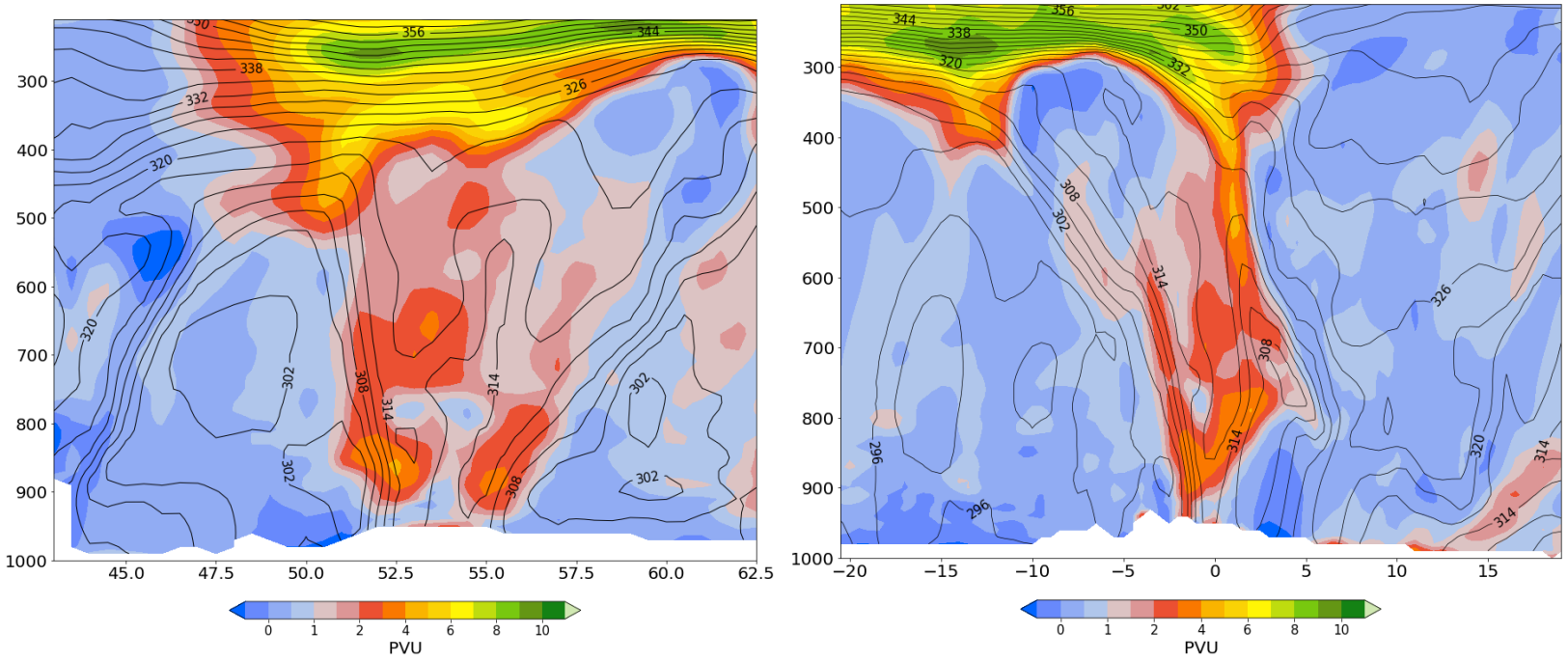

00 UTC on 18 October 1987
06 UTC on 18 October 1987
12 UTC on 18 October 1987
18 UTC on 18 October 1987
60°N
50°N
40°N
30°N
60°W
40°W
20°W
0°
20°E
0
1
2
4
6
8
10
PVU
250
260
270
280
290
300
310
K

Great UK October Storm 12 UTC 15 Oct to 06 UTC 16 Oct 1987



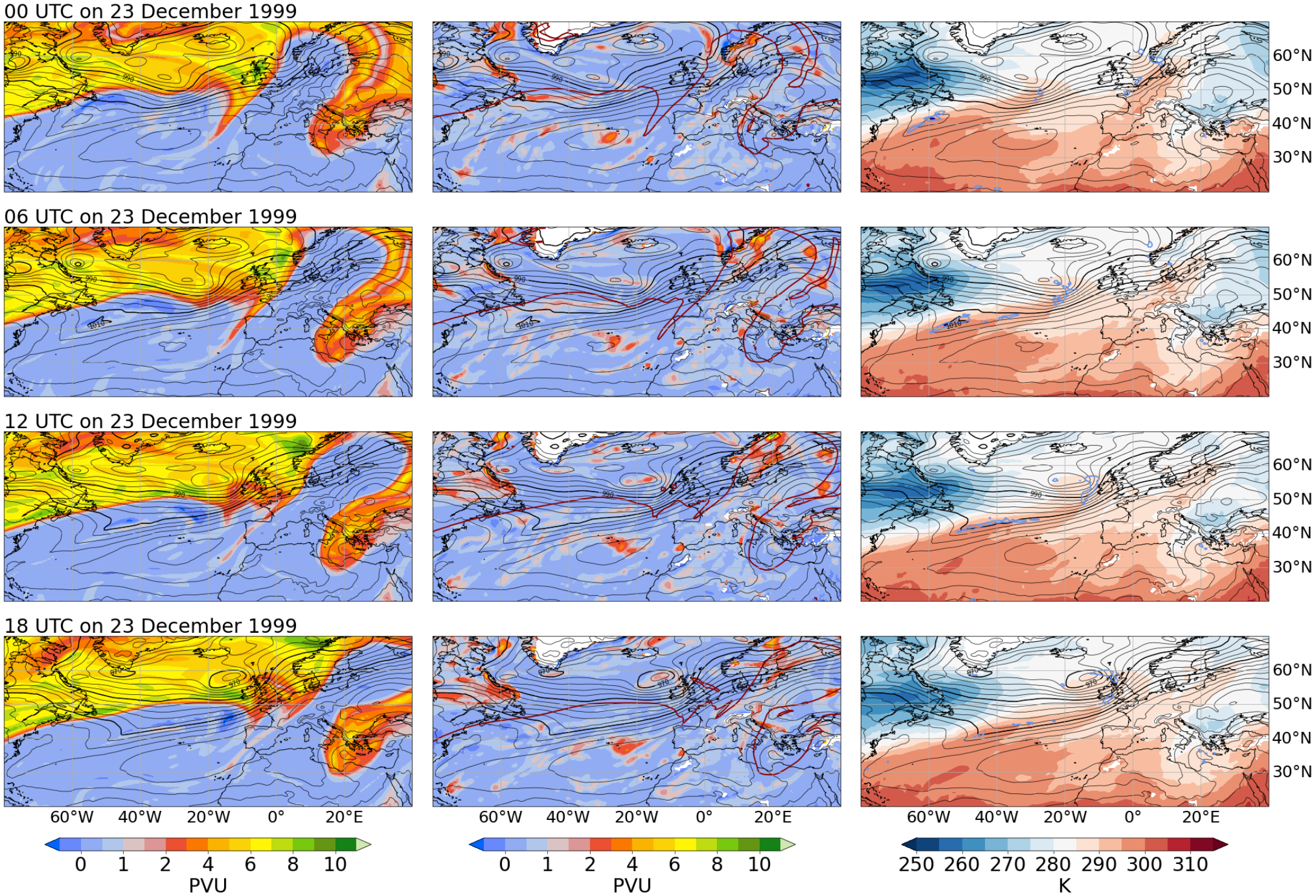

PVU
0 1 2 4 6 8 10
PVU
0 1 2 4 6 8 10

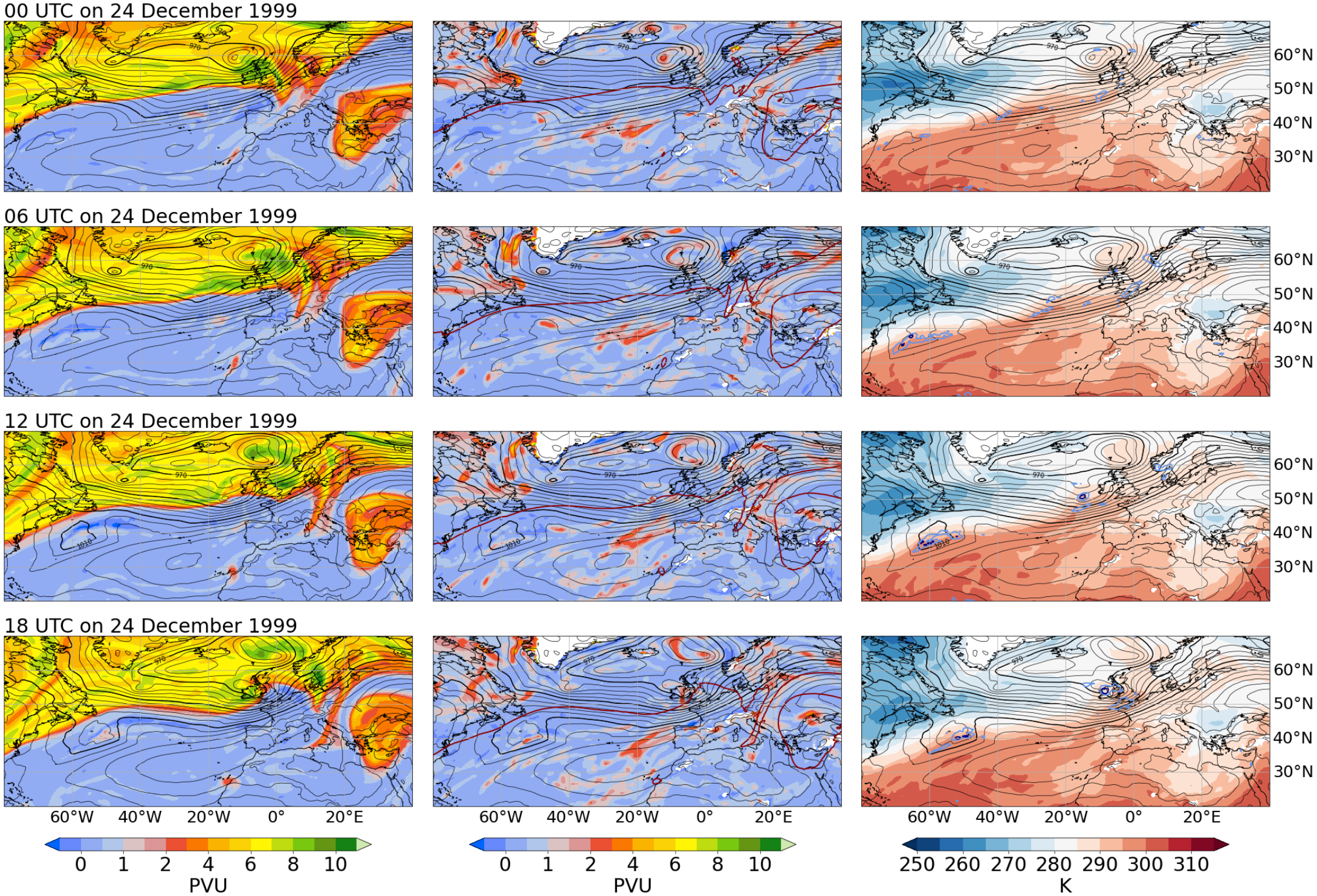

PVU
0 1 2 4 6 8 10
PVU
0 1 2 4 6 8 10

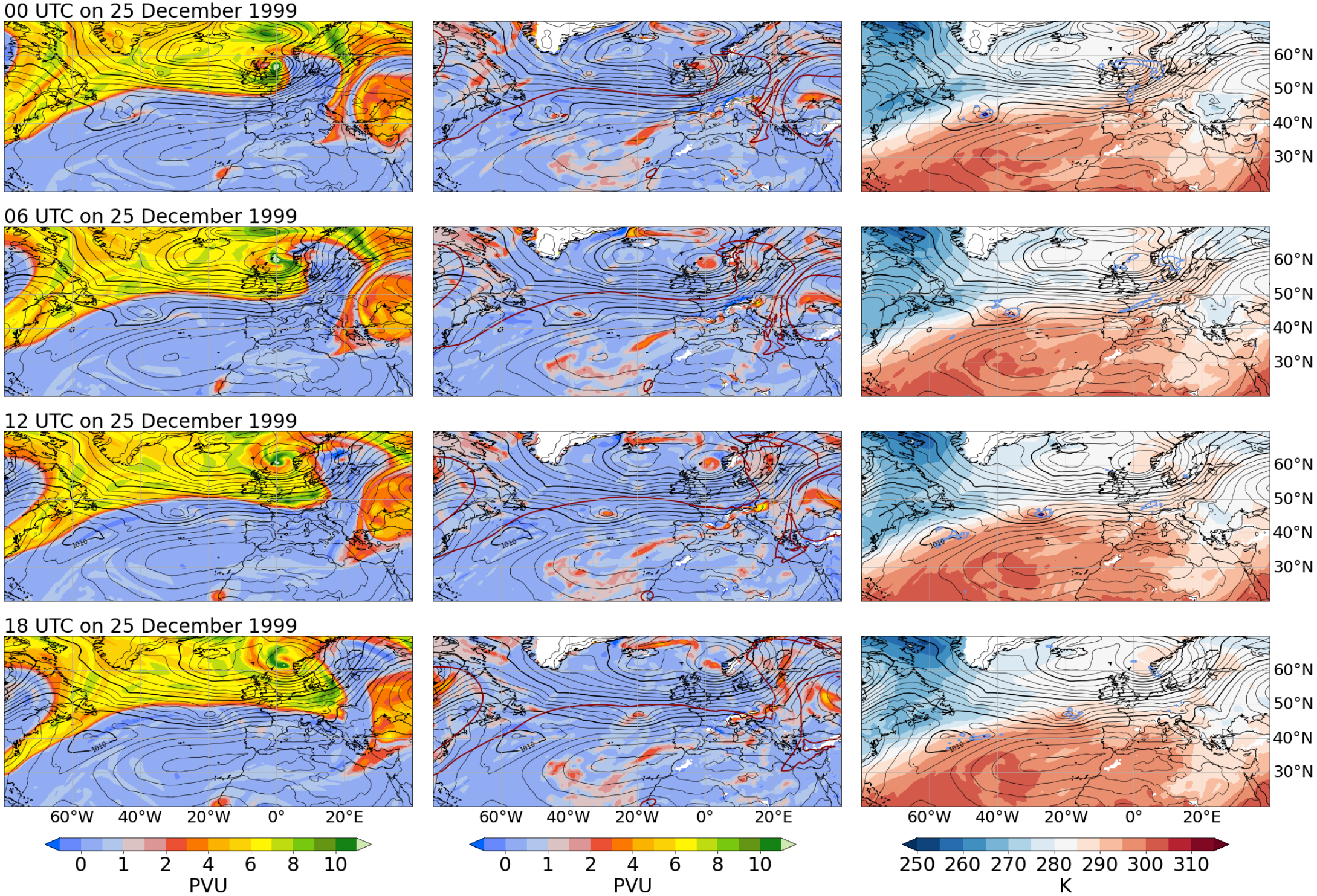
# Lothar

Horizontal maps from 00 UTC on 23 December – 18 UTC on 28 December 1999

Vertical cross sections from 06 UTC on 25 December – 12 UTC on 26 December 1999


00 UTC on 23 December 1999
06 UTC on 23 December 1999
12 UTC on 23 December 1999
18 UTC on 23 December 1999
60°N
50°N
40°N
30°N
60°W
40°W
20°W
0°
20°E
0
1
2
4
6
8
10
PVU
250
260
270
280
290
300
310
K


00 UTC on 24 December 1999
06 UTC on 24 December 1999
12 UTC on 24 December 1999
18 UTC on 24 December 1999
970
1010
60°N
50°N
40°N
30°N
60°W
40°W
20°W
0°
20°E
0 1 2 4 6 8 10
PVU
0 1 2 4 6 8 10
PVU
250 260 270 280 290 300 310
K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12 UTC on 25 December 1999
18 UTC on 25 December 1999
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50°N
40°N
30°N
60°W
40°W
20°W
0°
20°E
0
1
2
4
6
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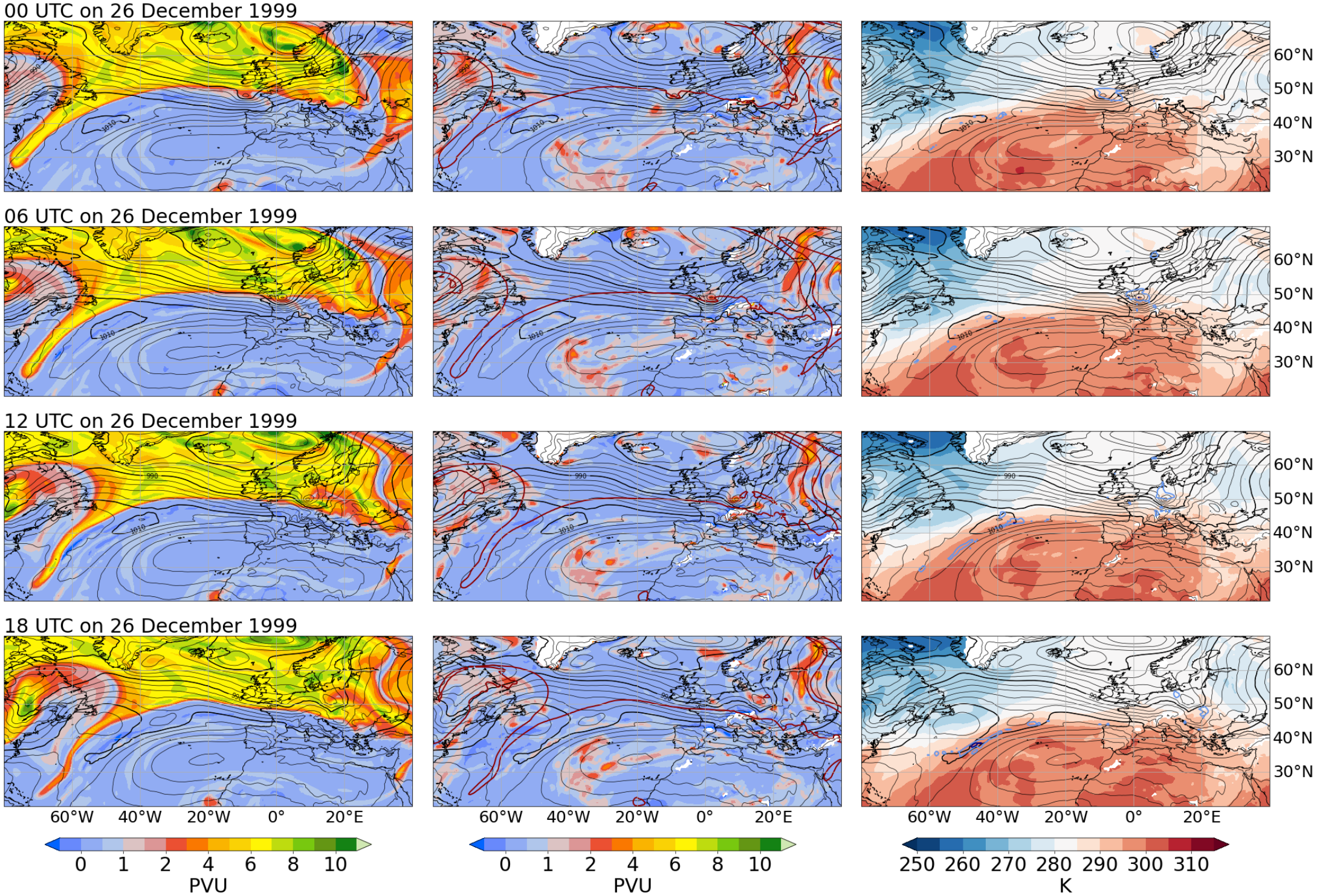
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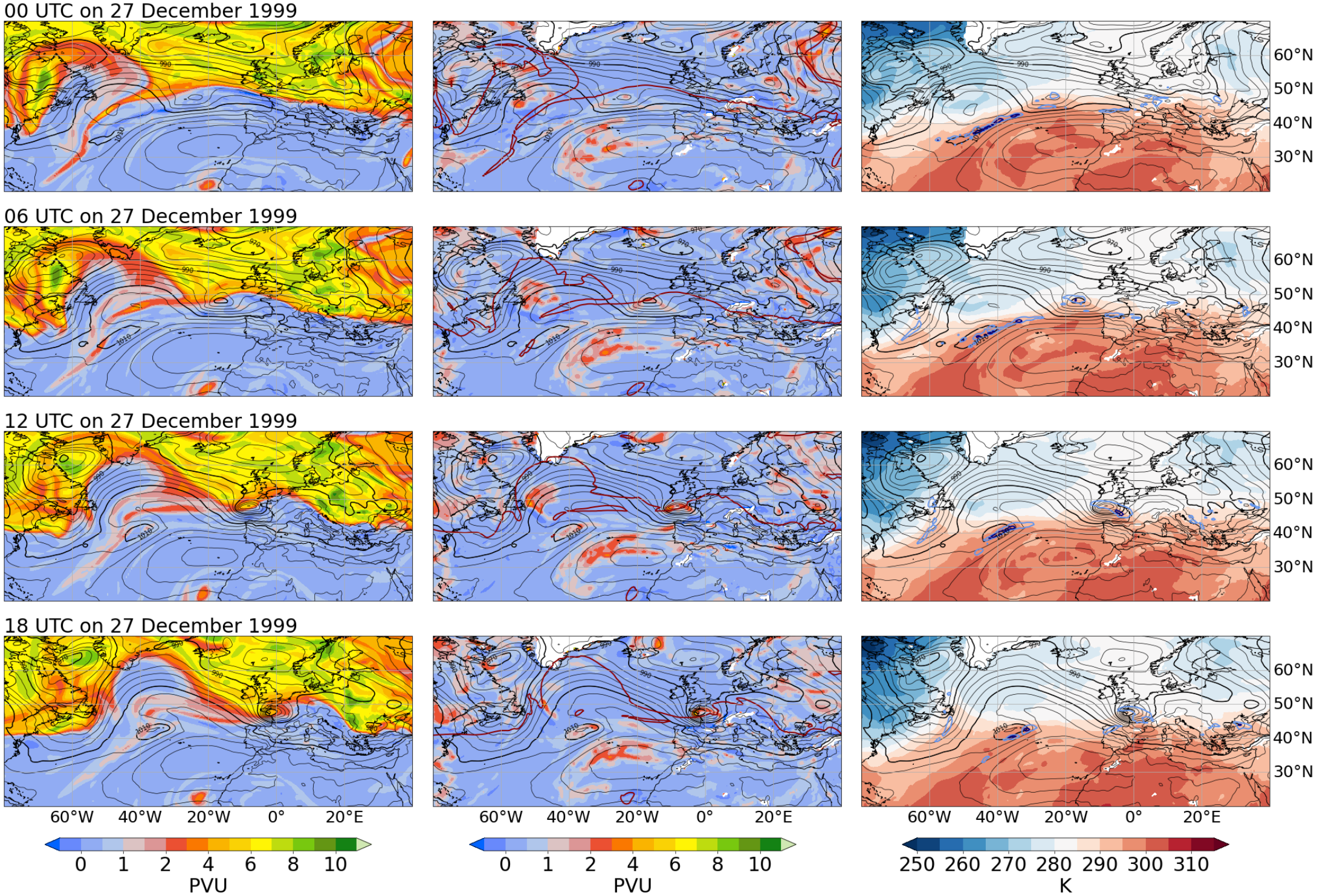
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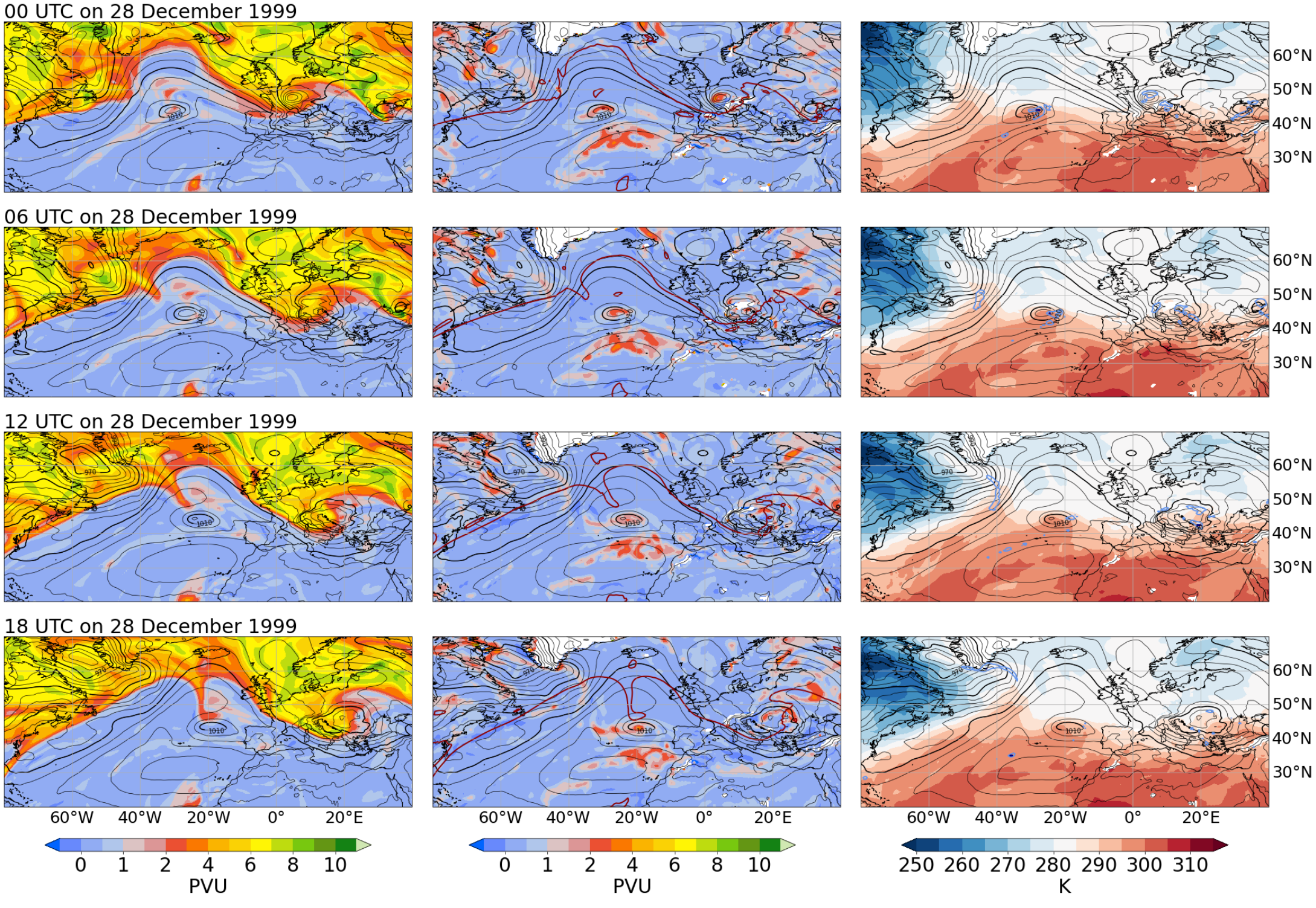
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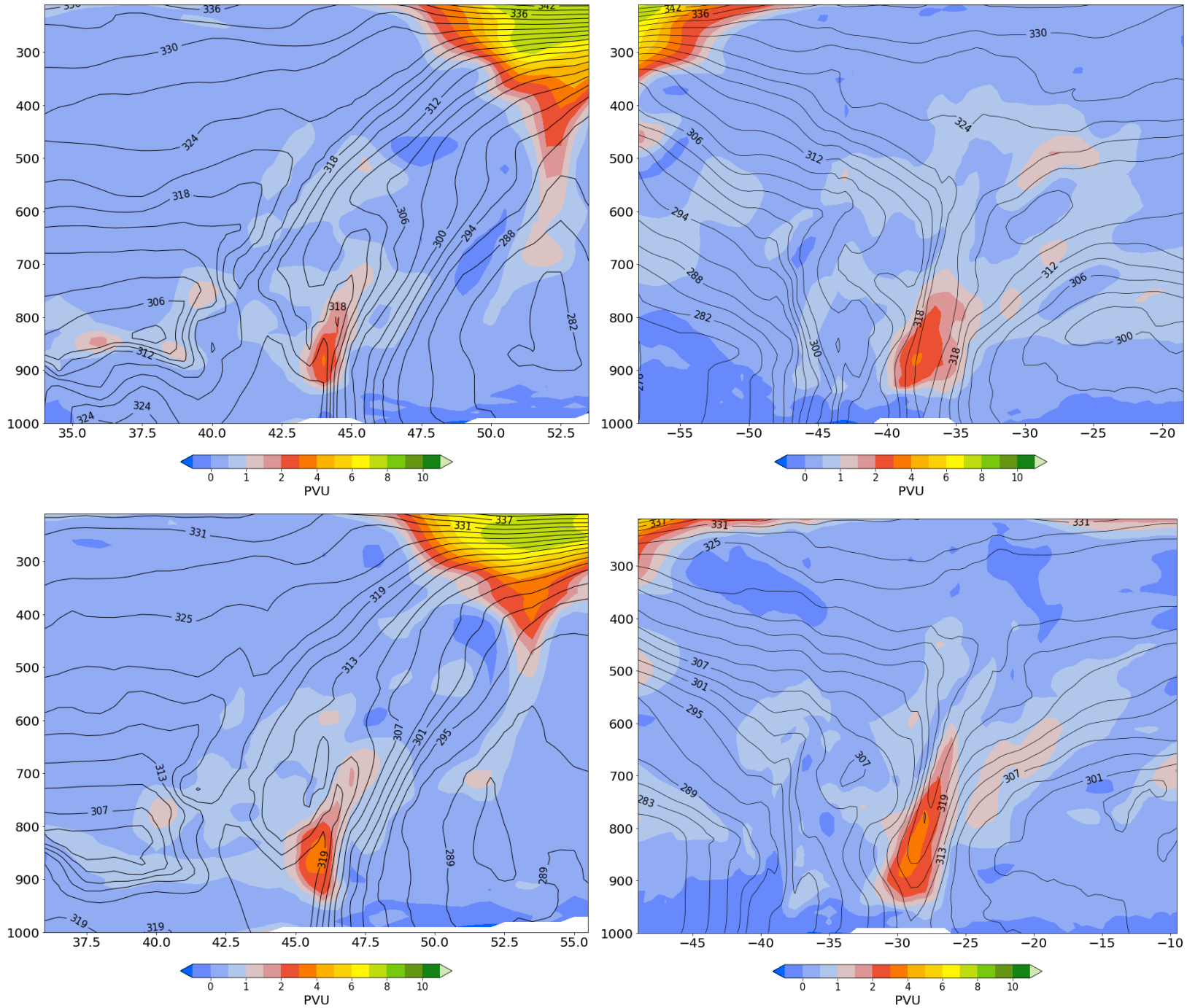
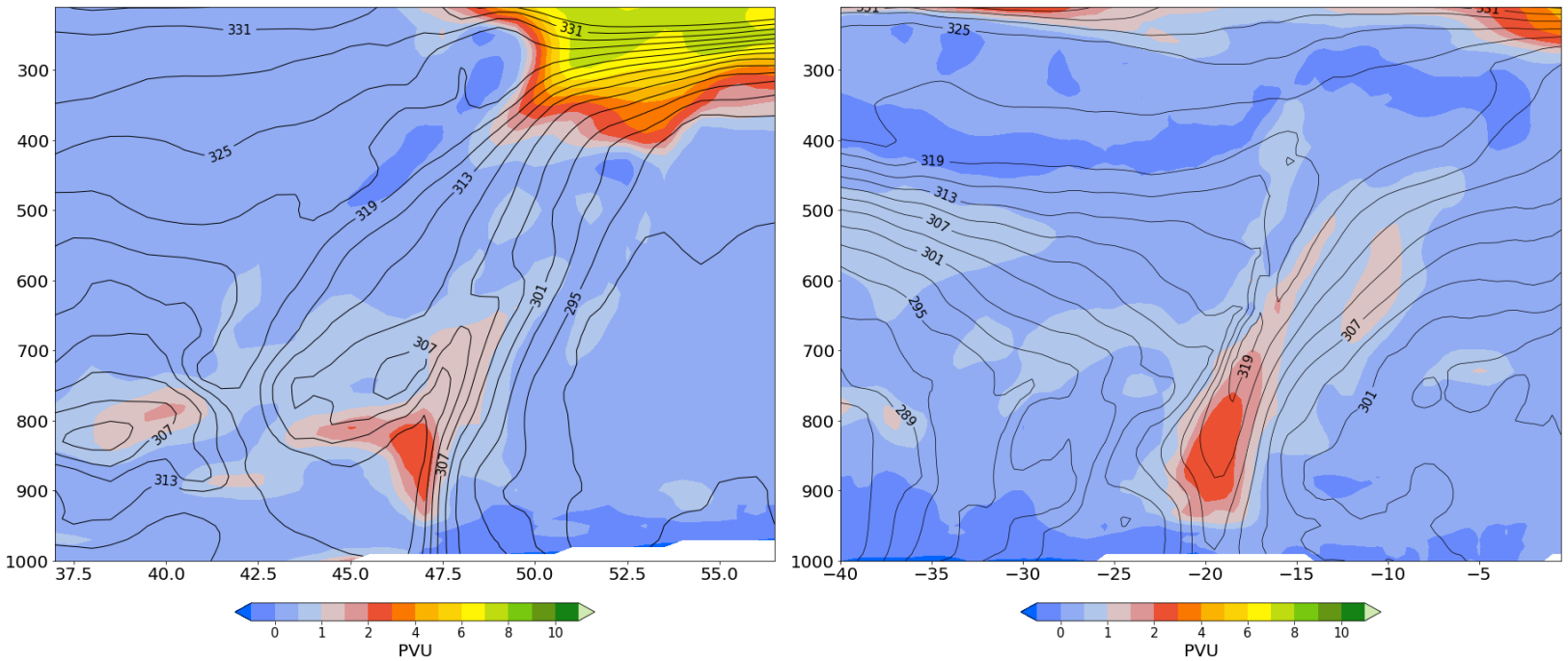
Lothar 06 UTC 25 Dec to 12 UTC 26 Dec 1999

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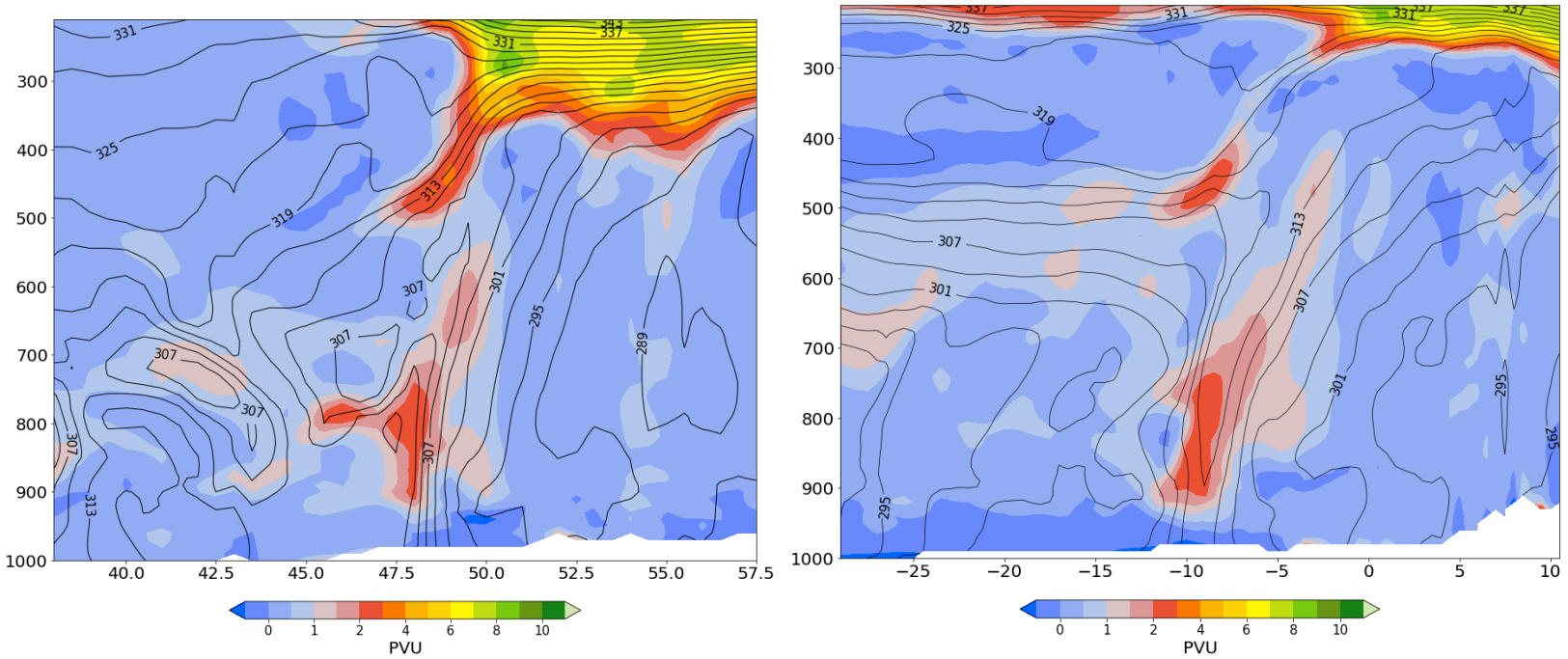
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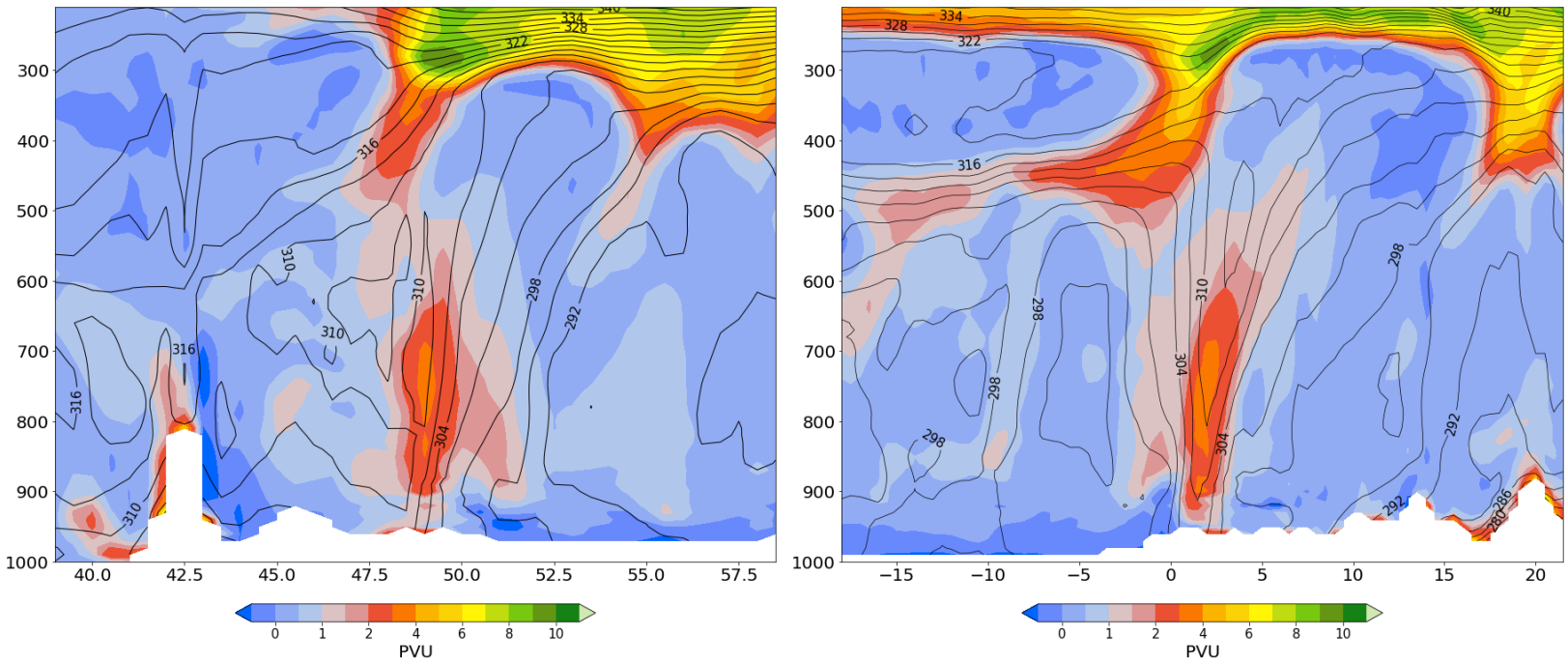
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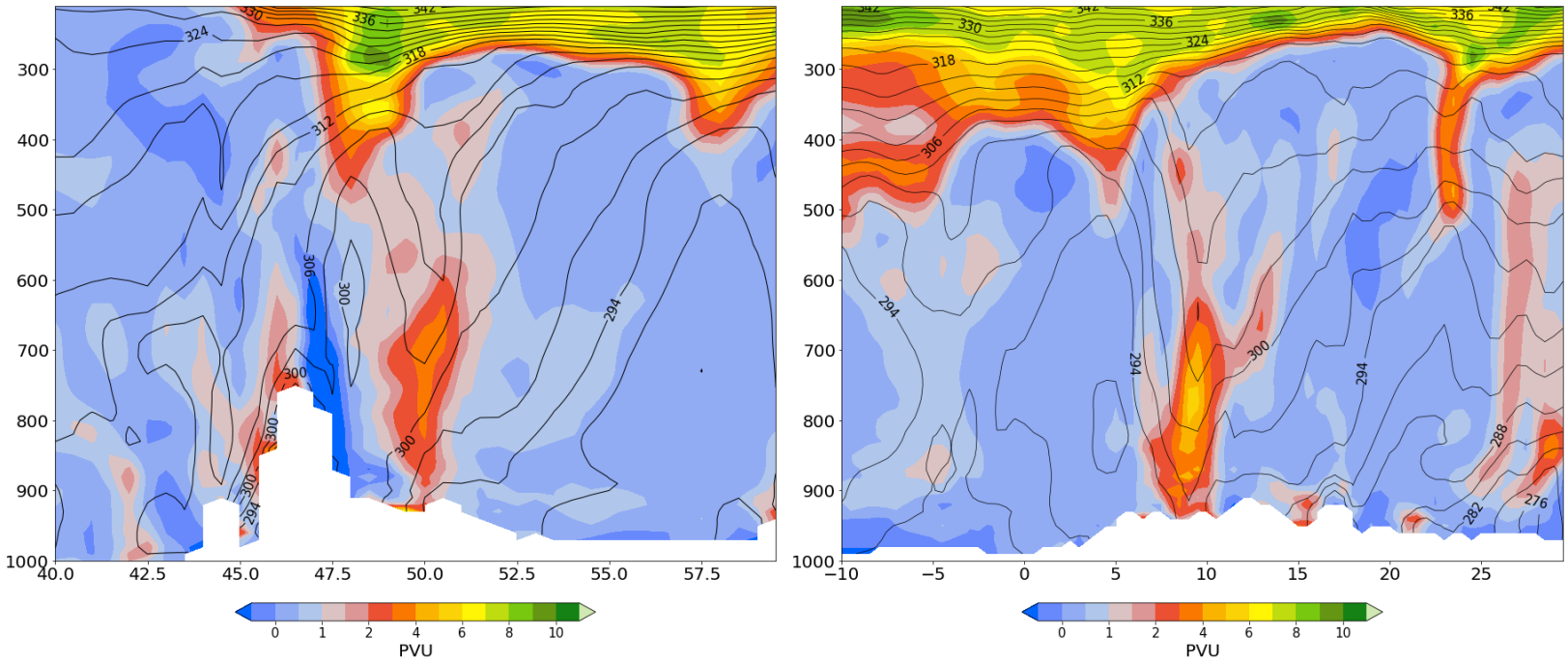
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