Intense Arctic Cyclones in June 2018

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Case Overview

- Two sequential intense Arctic cyclones, AC1 and AC2, occurred in early June 2018
- AC1 forms northeast of the Caspian Sea within a frontal trough
- AC2 forms east of Greenland and may be linked to the remnants of Tropical Storm (TS) Alberto
- AC1 and AC2 strengthen over western Eurasia as they interact with tropopause polar vortices (TPVs)
- AC1 and AC2 undergo a cyclonic rotation over the Arctic Ocean, during which AC2 absorbs AC1

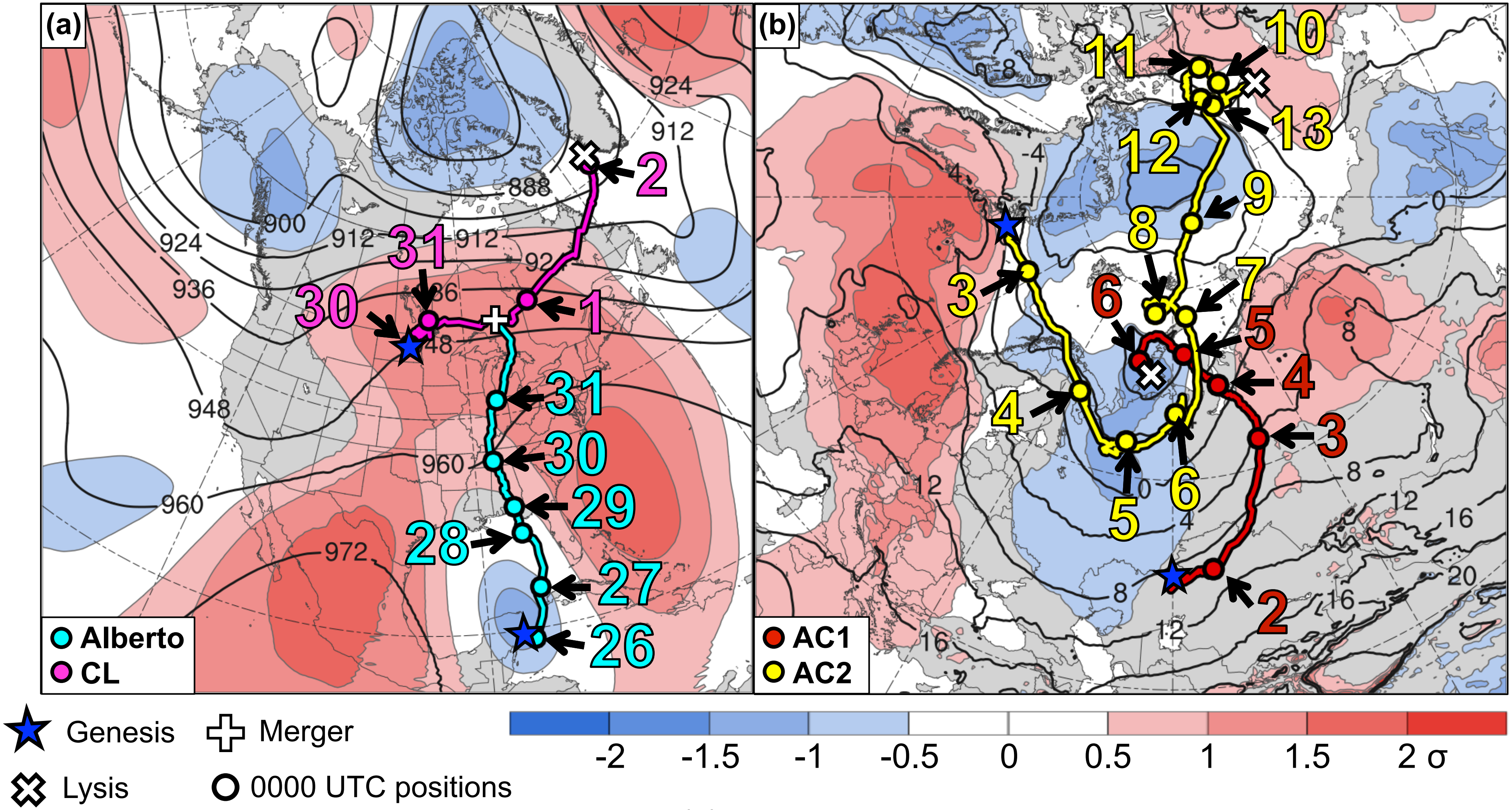
Data and Methods

- **Obtained gridded analyses from ERA-5 (Hersbach and Dee 2016) at 0.25° resolution**
- **Tracked cyclones manually by following locations of minimum sea level pressure (SLP)**
- **Identified and tracked TPVs objectively by utilizing a TPV tracking algorithm (Szapiro and Cavallo 2018)**
- **Computed backward trajectories by using NOAA HYSPLIT trajectory model**

Big Picture

- **Depict AC1 and AC2 tracks and intensities**
- **Show relevant TPV tracks**
- **Illustrate large-scale flow evolution**

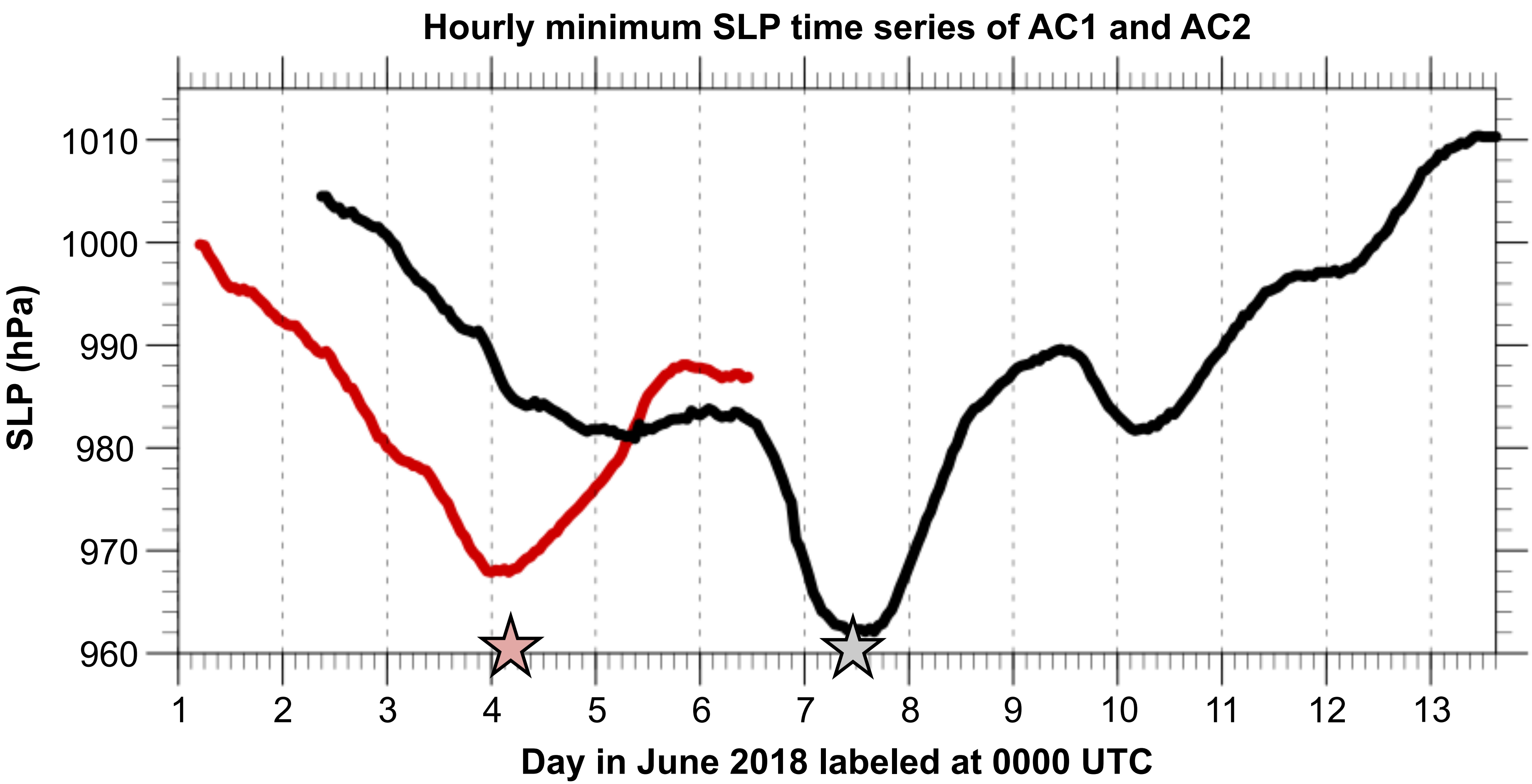
Track and Intensity of Cyclones



Cyclone	Genesis	Lysis	Lifetime
AC1	1 June	6 June	~5 d
AC2	2 June	13 June	~11 d

(a) 26 May–1 June 2018 time-mean 300-hPa geopotential height (dam, black) and standardized geopotential height anomalies (σ, shaded); (b) 1–7 June 2018 time-mean 850-hPa temperature (°C, black) and standardized temperature anomalies (σ, shaded).

Track and Intensity of Cyclones



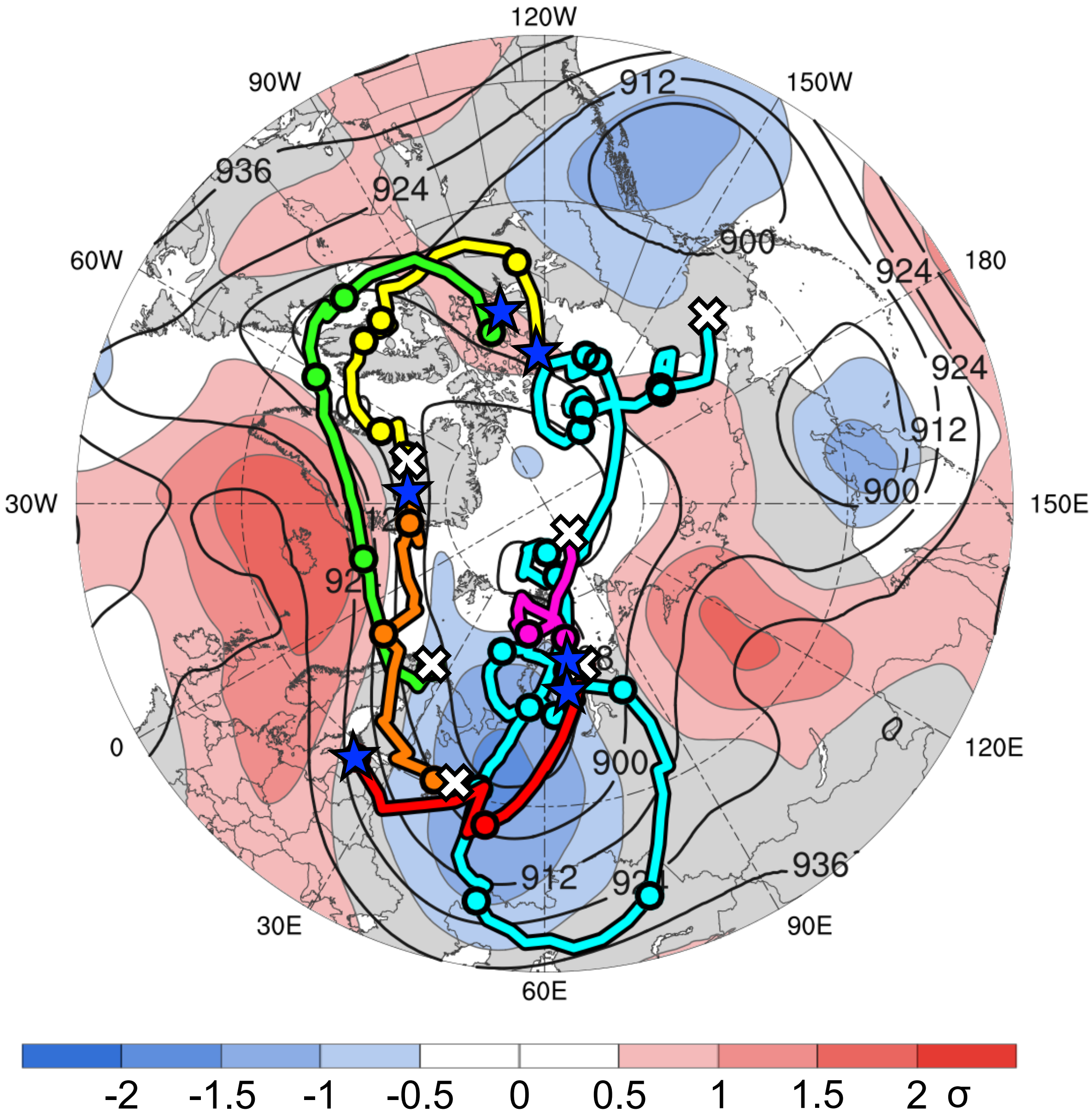
AC1

AC2

Peak intensity of AC1 at
0400 UTC 4 June 2018 (967.9 hPa)

Peak intensity of AC2 at
1100 UTC 7 June 2018 (962.0 hPa)

Tracks of TPVs



TPV	Genesis	Lysis	Lifetime
TPV 1a	29 May	3 June	~5.4 d
TPV 1b	2 June	5 June	2.5 d
TPV 1c	5 June	7 June	~2.4 d
TPV 1d	6 June	8 June	2 d
TPV 2	30 May	4 June	~4.4 d
TPV 3	30 May	15 June	~17 d

TPV 1a
TPV 1b
TPV 1c
TPV 1d
TPV 2
TPV 3

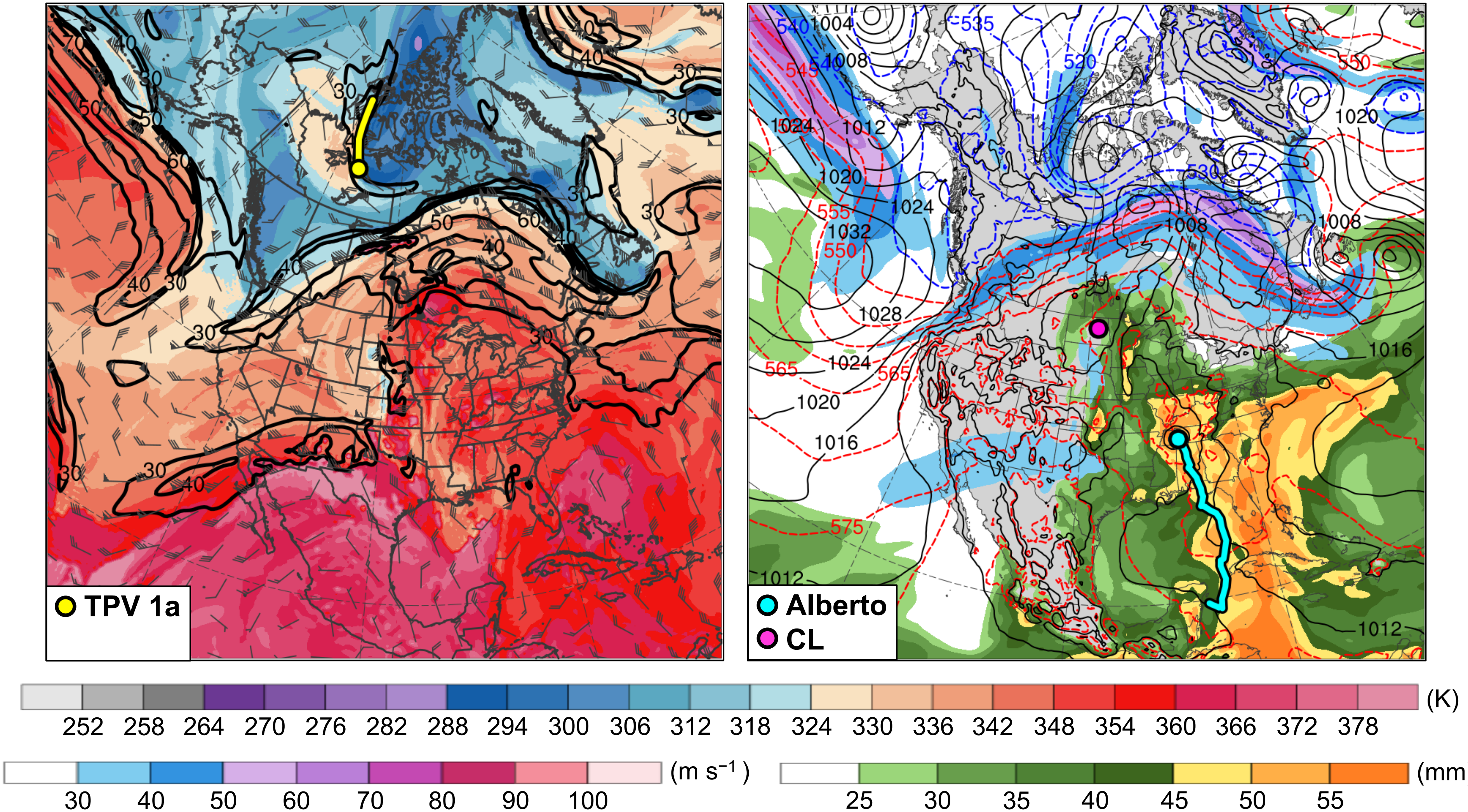
Genesis
Lysis

0000 UTC positions

1–7 June 2018 time-mean 300-hPa geopotential height (dam, black) and standardized geopotential height anomalies (σ, shaded)

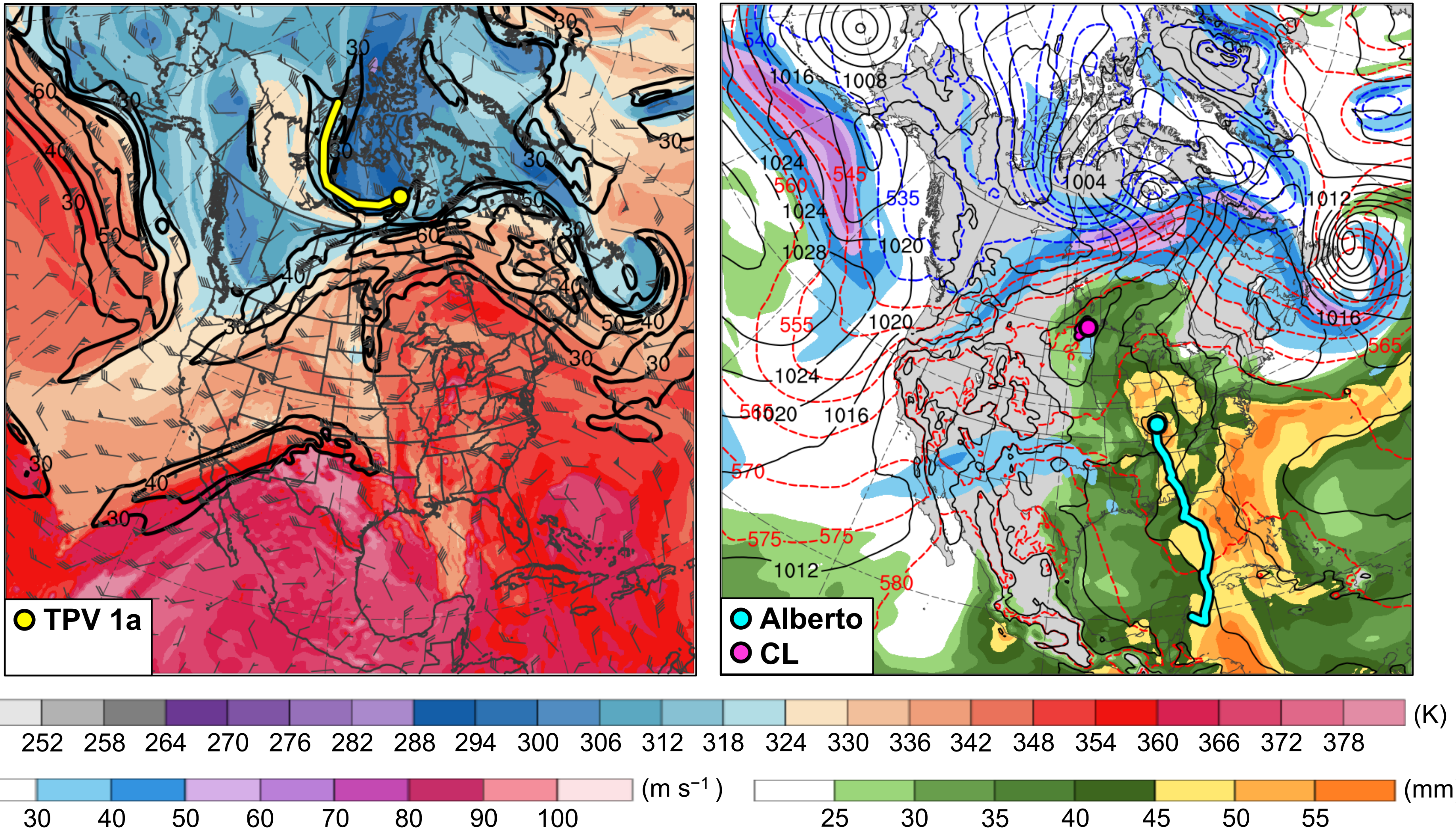
Synoptic-Scale Flow Evolution: North America 30 May–2 June 2018

0000 UTC 30 May 2018



Potential temperature (K, shaded), wind speed (black, every 10 m s^{-1} starting at 30 m s^{-1}), and wind (m s^{-1}, flags and barbs) on 2-PVU surface	300-hPa wind speed (m s^{-1}, shaded), 1000–500-hPa thickness (dam, blue/red), SLP (hPa, black), and PW (mm, shaded)

1200 UTC 30 May 2018



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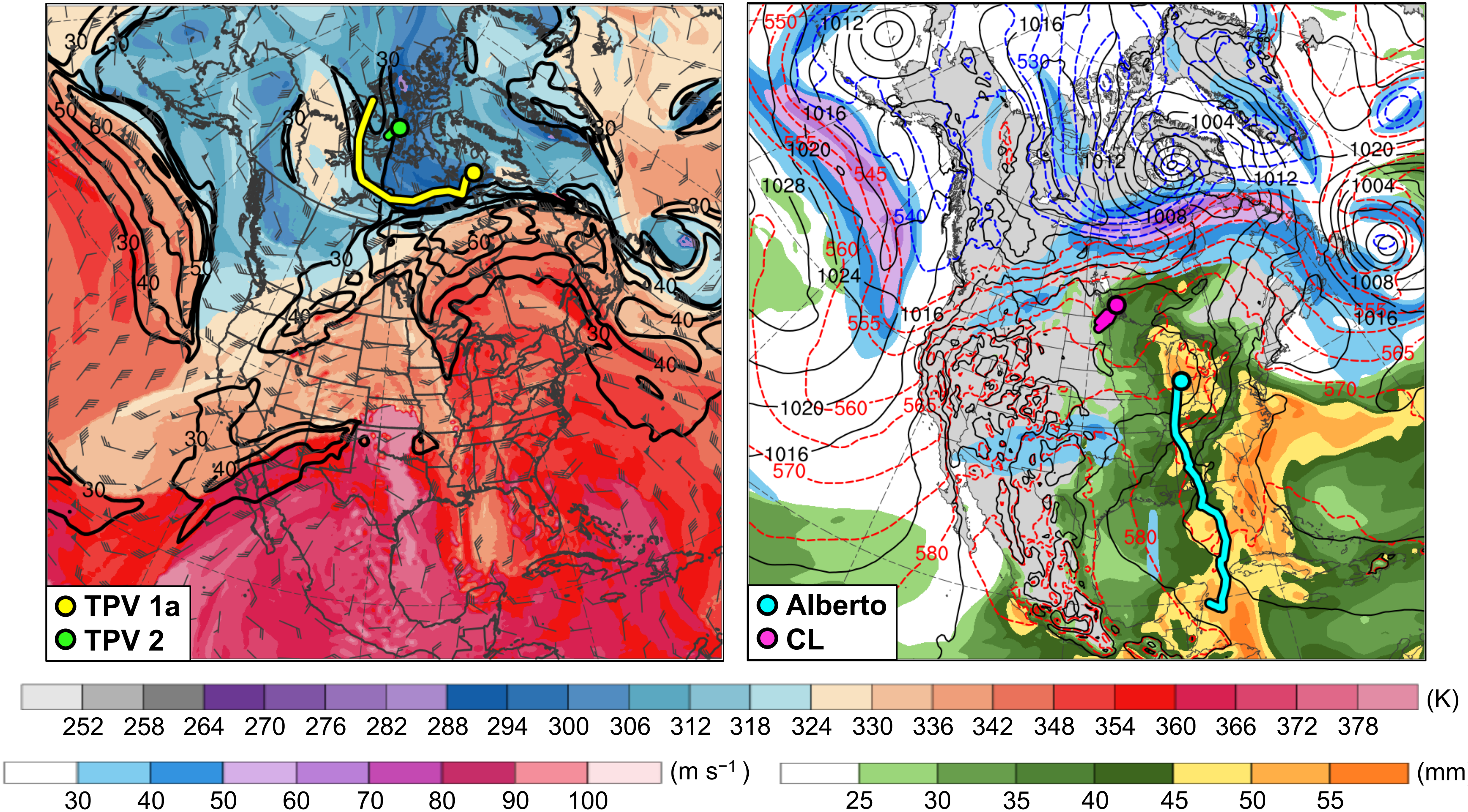
0000 UTC 31 May 2018



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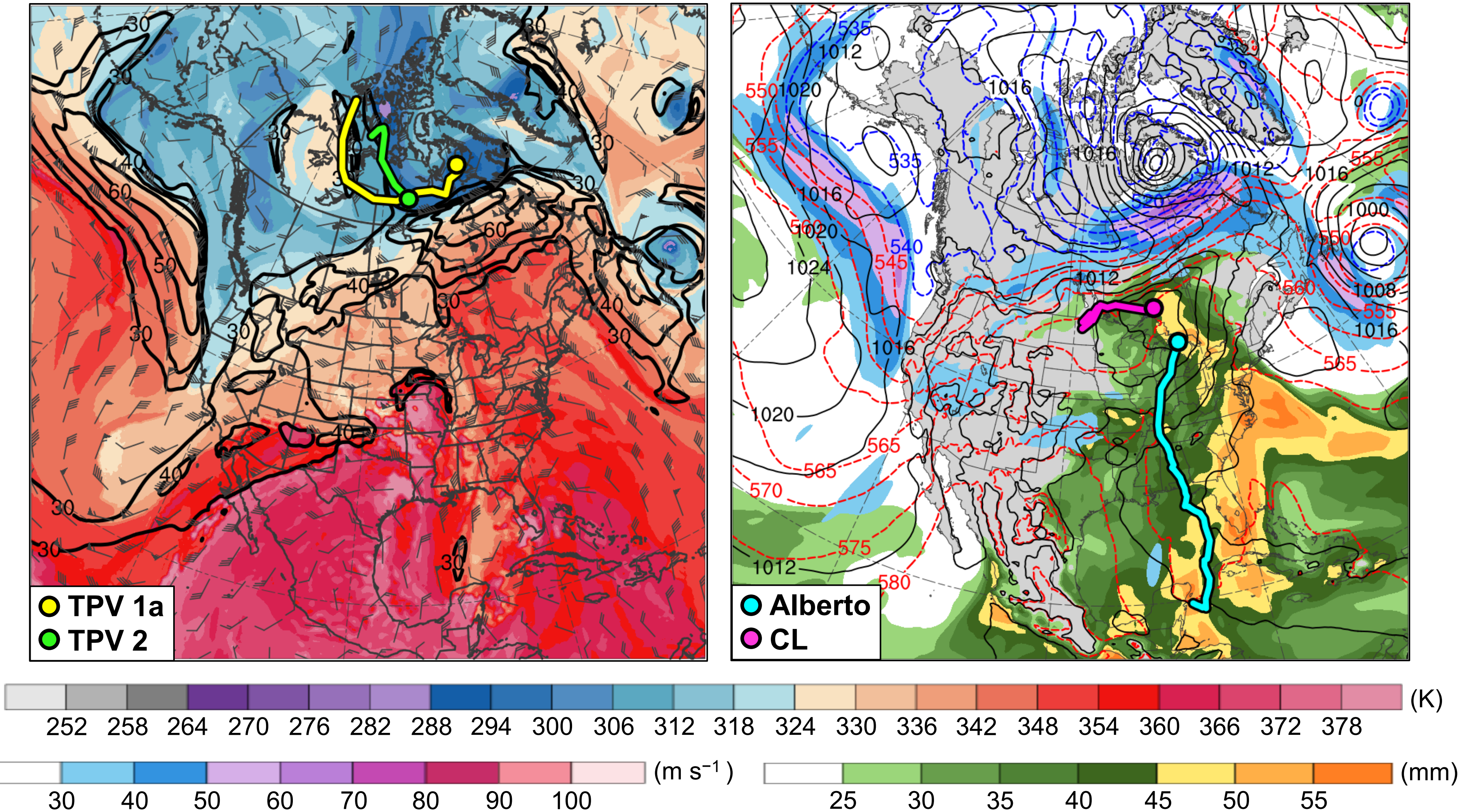

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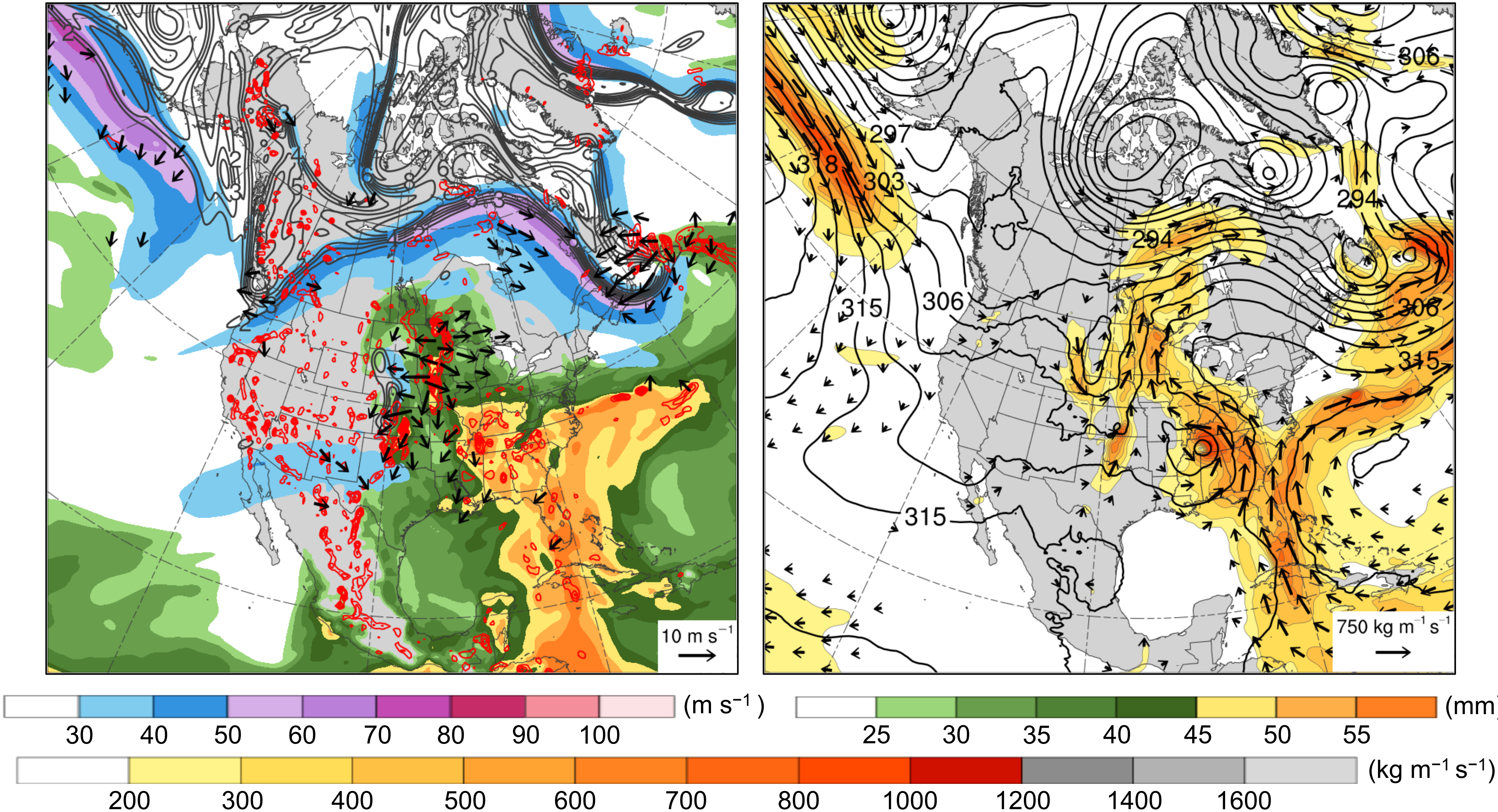
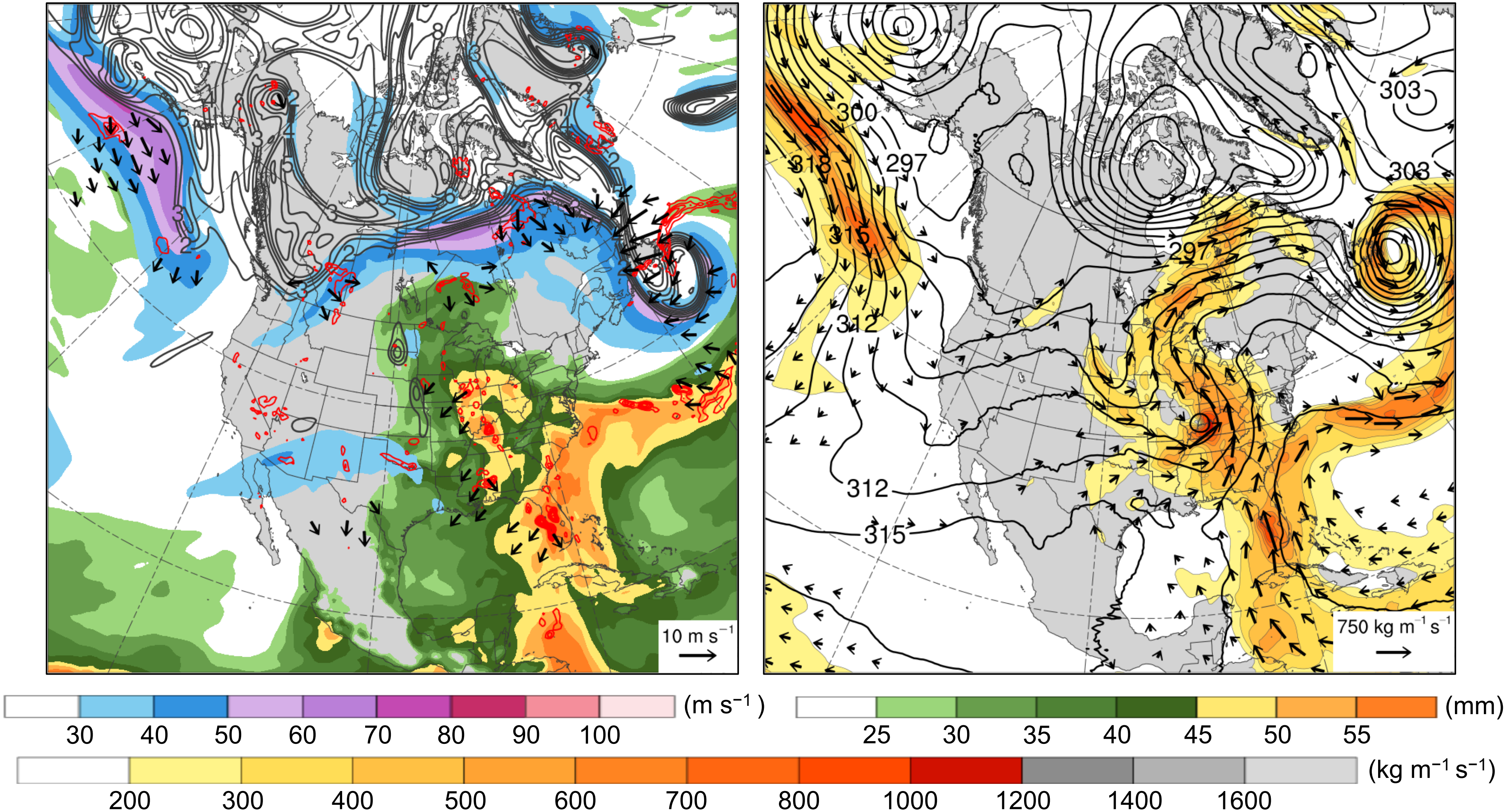


350–250-hPa PV (PVU, gray) and irrotational wind (m s^{-1}, vectors), 300-hPa wind speed (m s^{-1}, shading), 800–600-hPa ascent (every 3 × 10^{-3} hPa s^{-1}, red), and PW (mm, shading)	IVT (kg m^{-1} s^{-1}, shaded and vectors) and 700-hPa geopotential height (dam, black)

1200 UTC 30 May 2018



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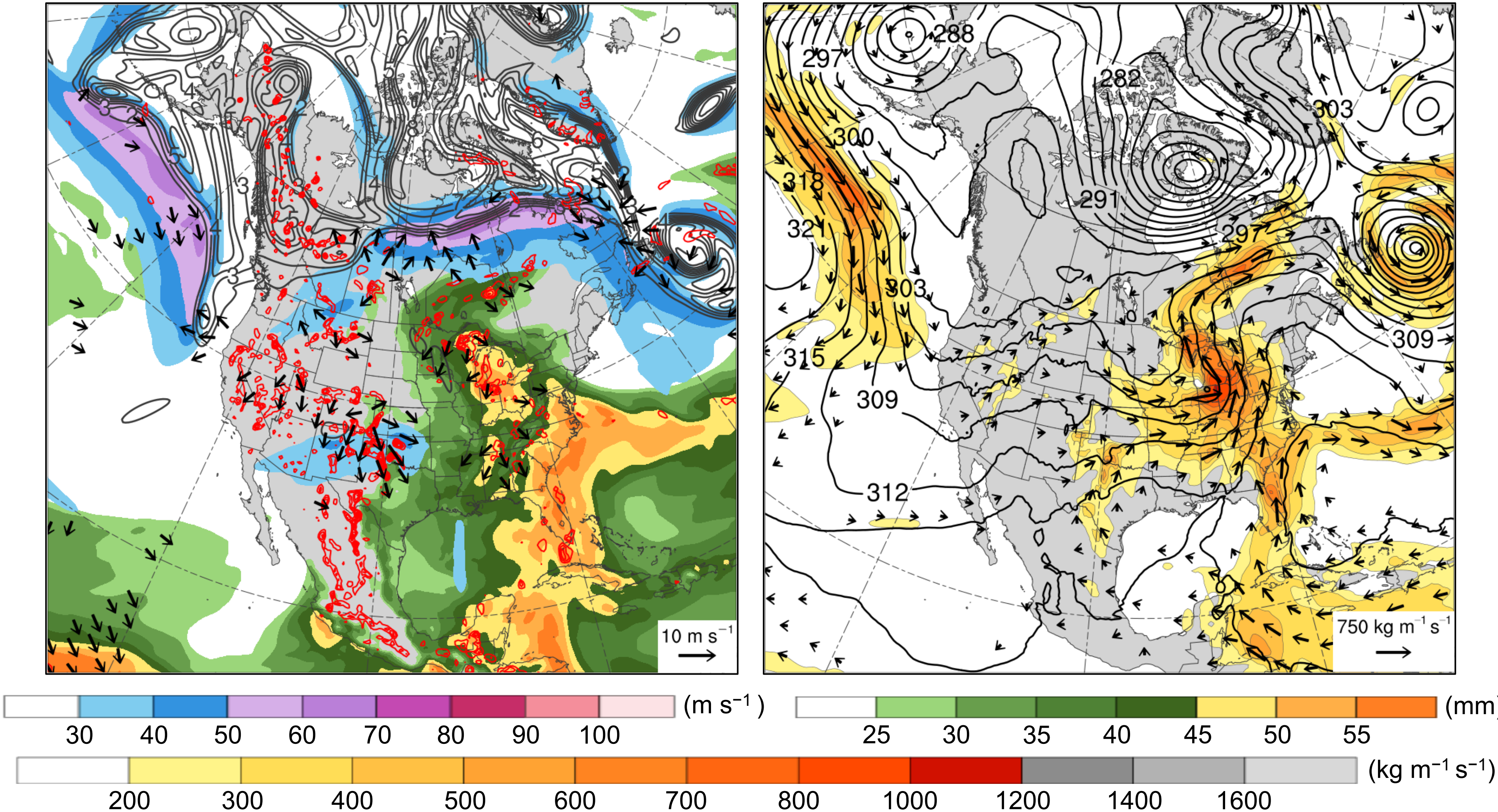
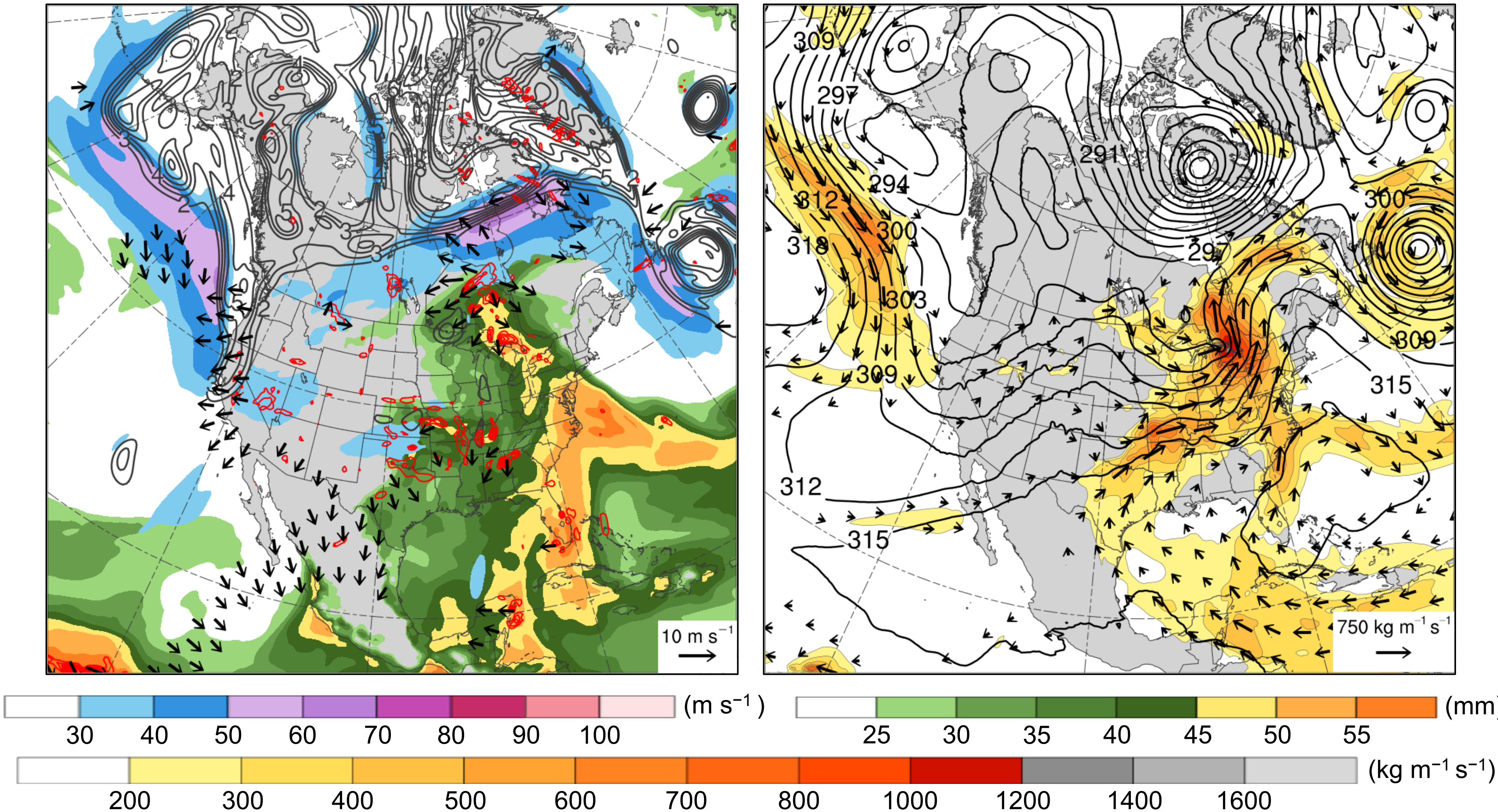


350–250-hPa PV (PVU, gray) and irrotational wind ($m\ s^{-1}$, vectors), 300-hPa wind speed ($m\ s^{-1}$, shading), 800–600-hPa ascent (every 3×10^{-3} hPa s^{-1}, red), and PW (mm, shading)

IVT ($kg\ m^{-1}\ s^{-1}$, shaded and vectors) and 700-hPa geopotential height (dam, black)

1200 UTC 31 May 2018



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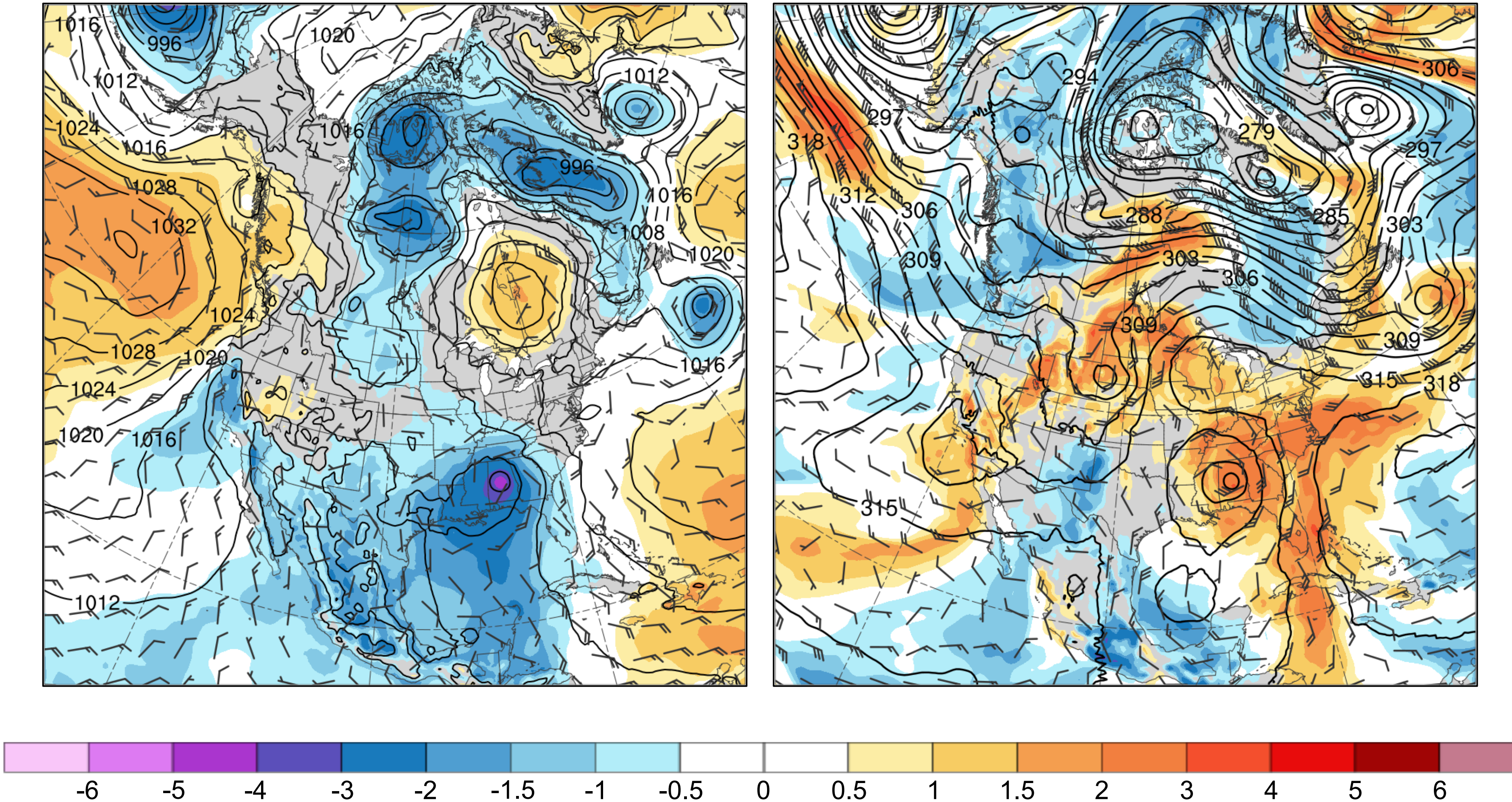
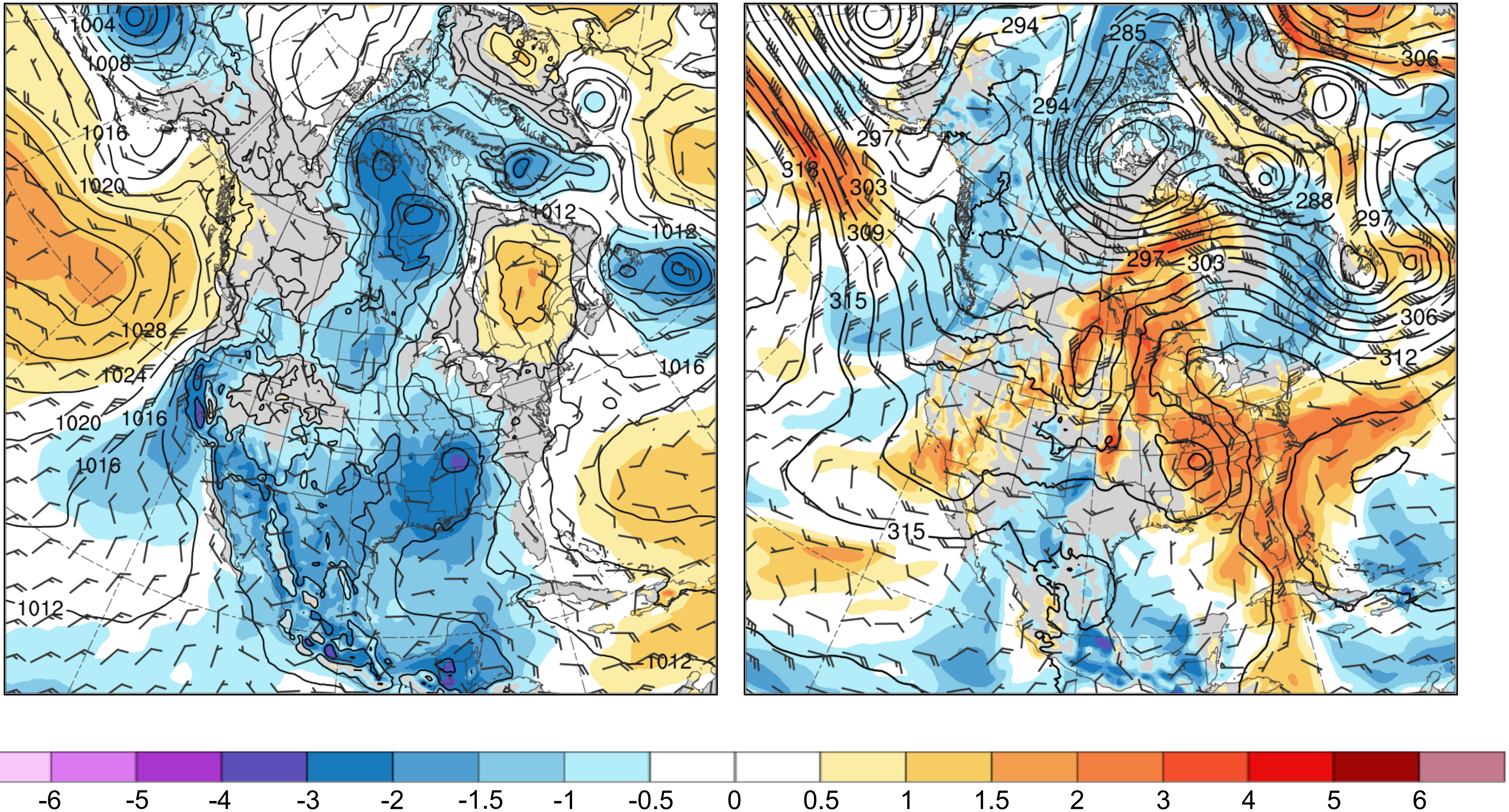
1200 UTC 29 May 2018



SLP (hPa, black), 10-m winds (m s^{-1}, flags and barbs), and standardized SLP anomalies (σ, shaded)	700-hPa geopotential height (dam, black) and winds (m s^{-1}, flags and barbs), and standardized PW anomalies (σ, shaded)

0000 UTC 30 May 2018



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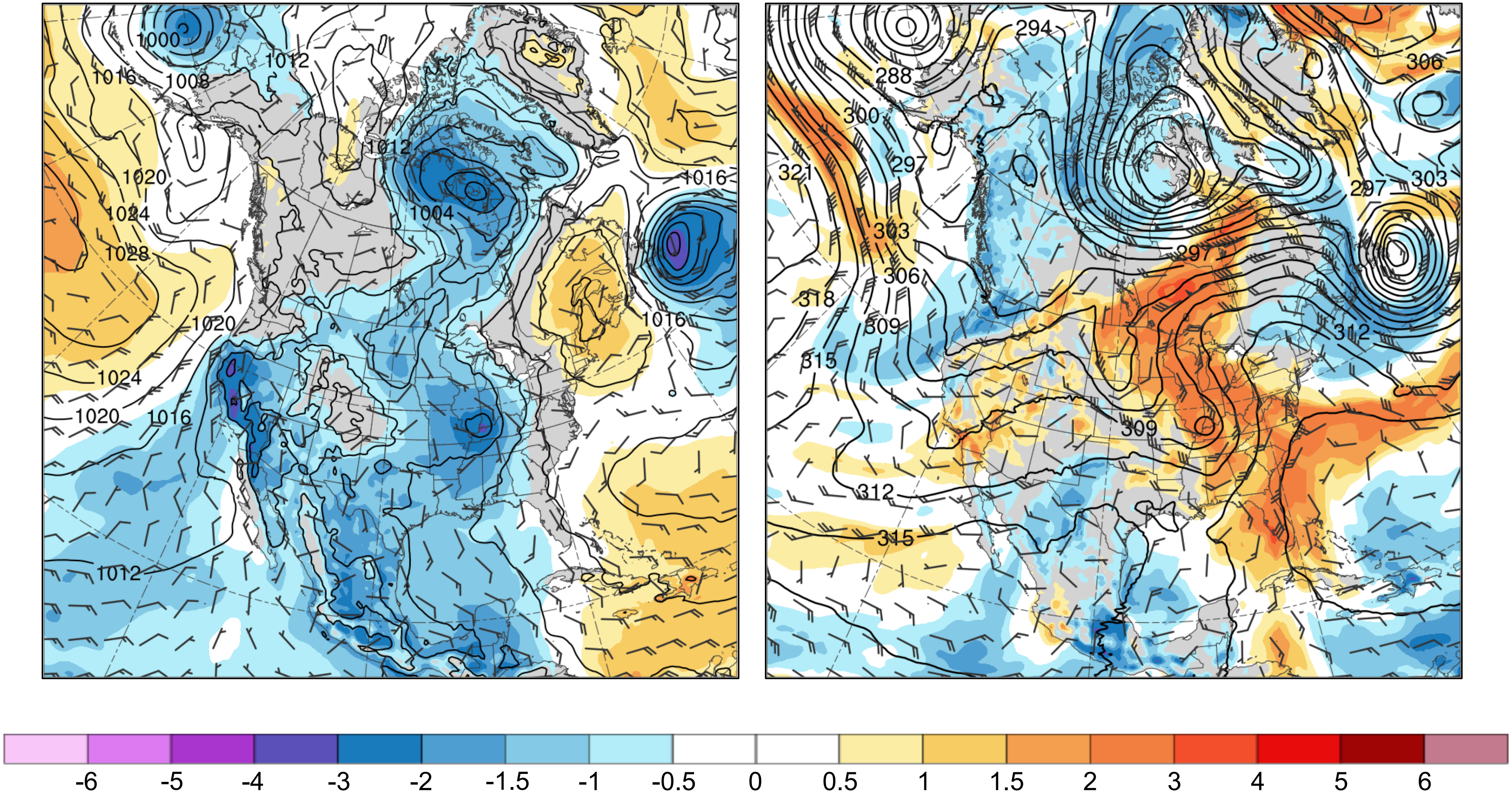

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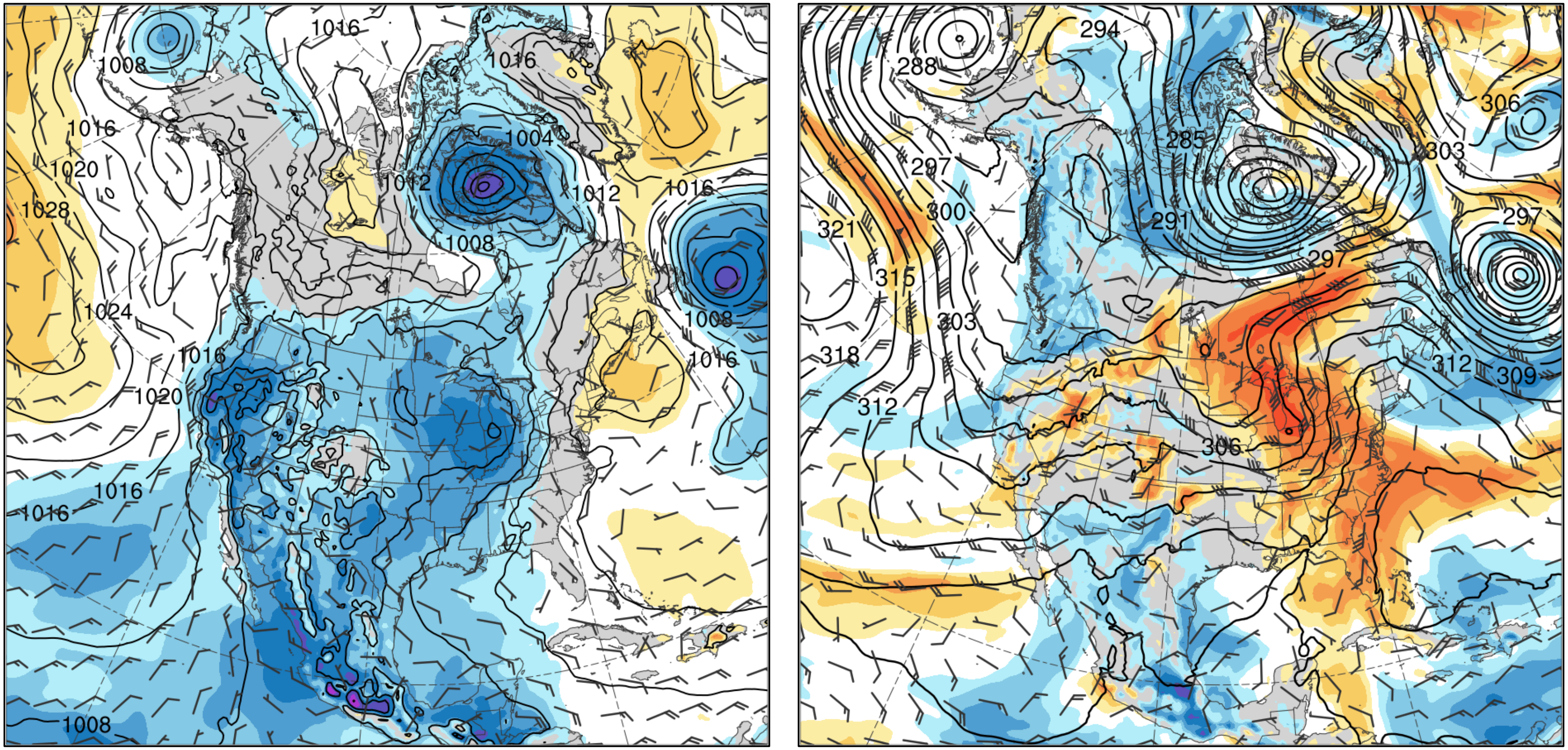
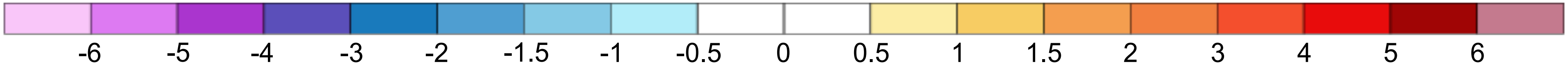
0000 UTC 31 May 2018





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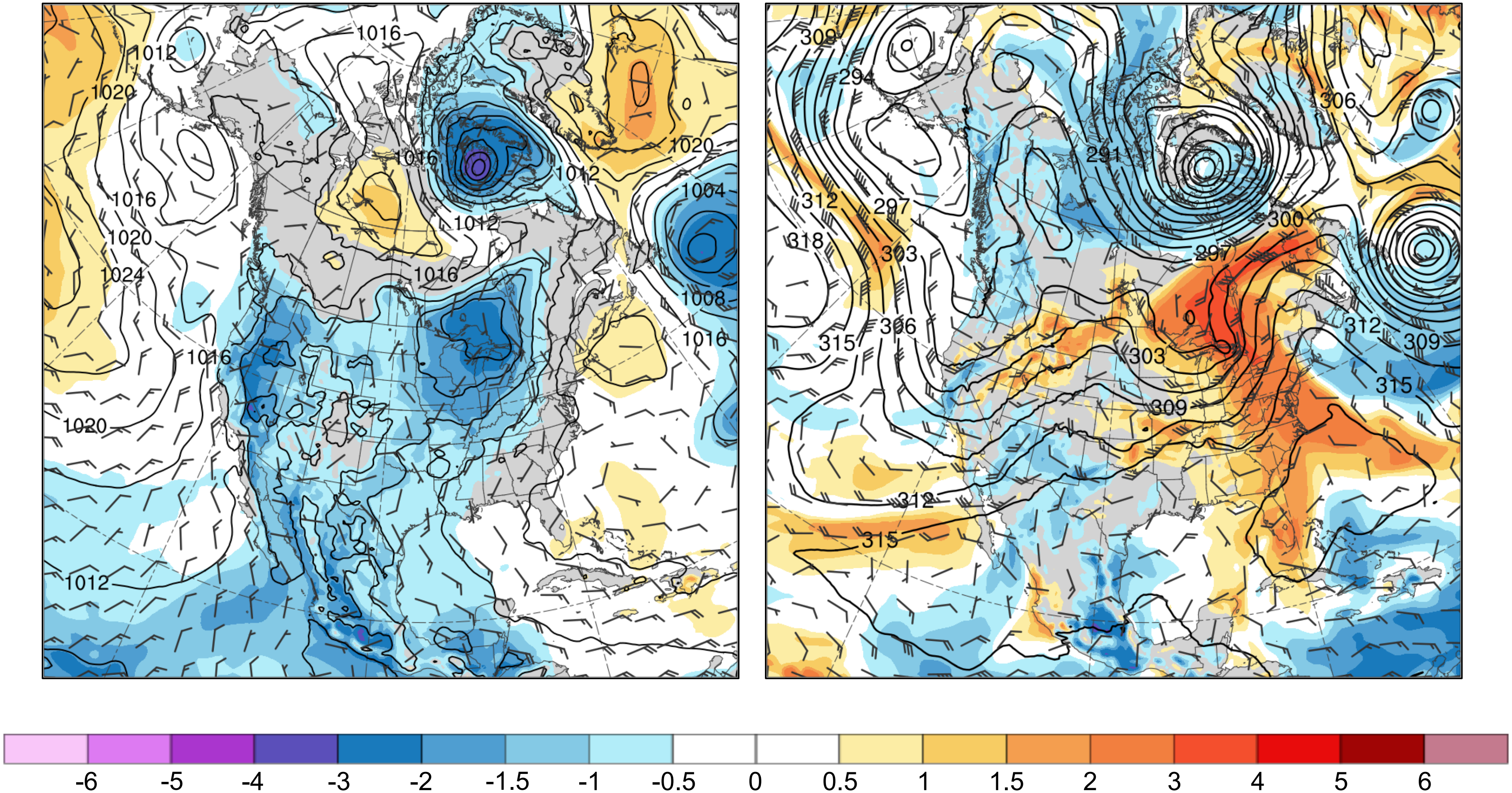
1200 UTC 31 May 2018



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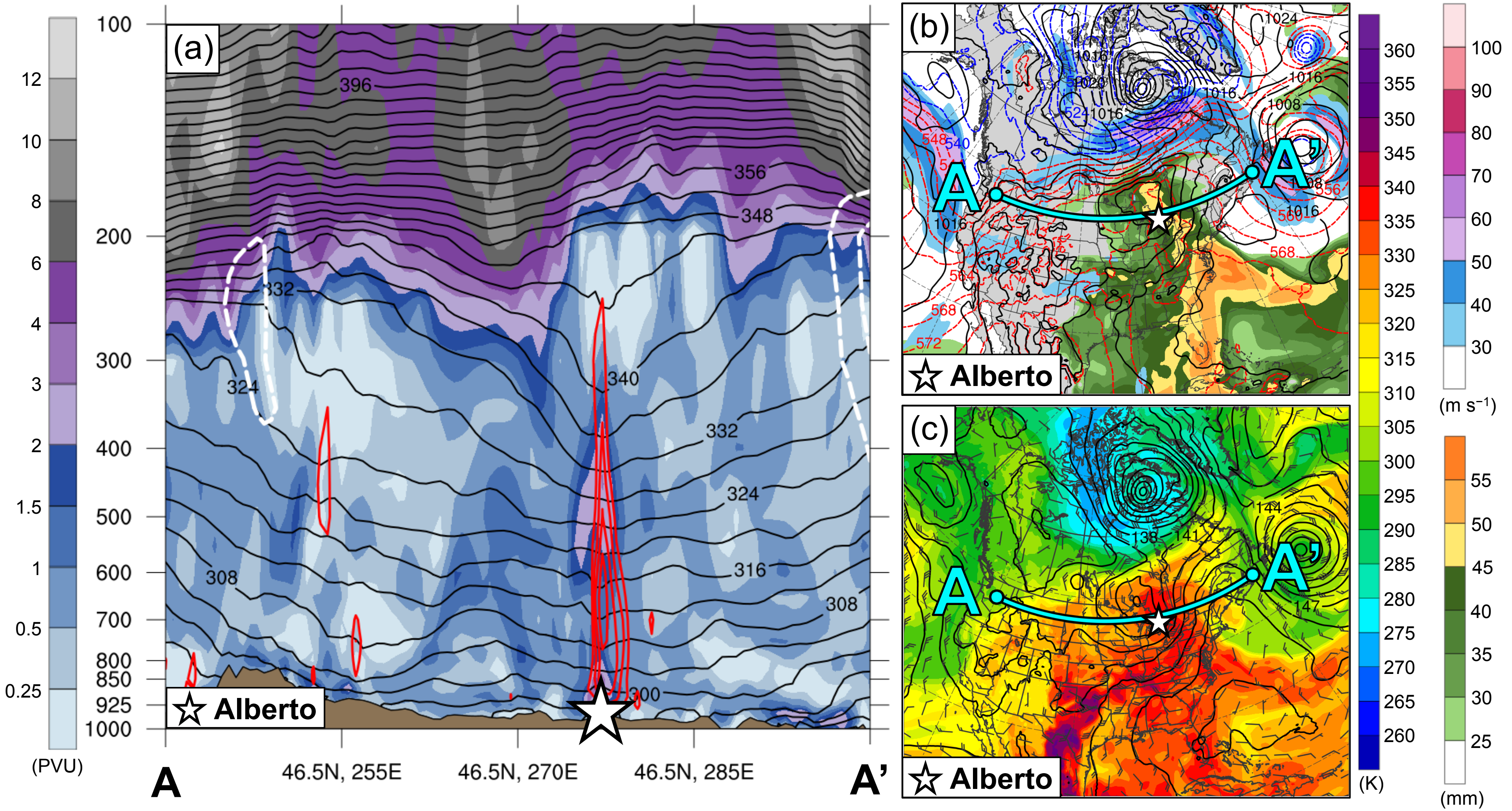
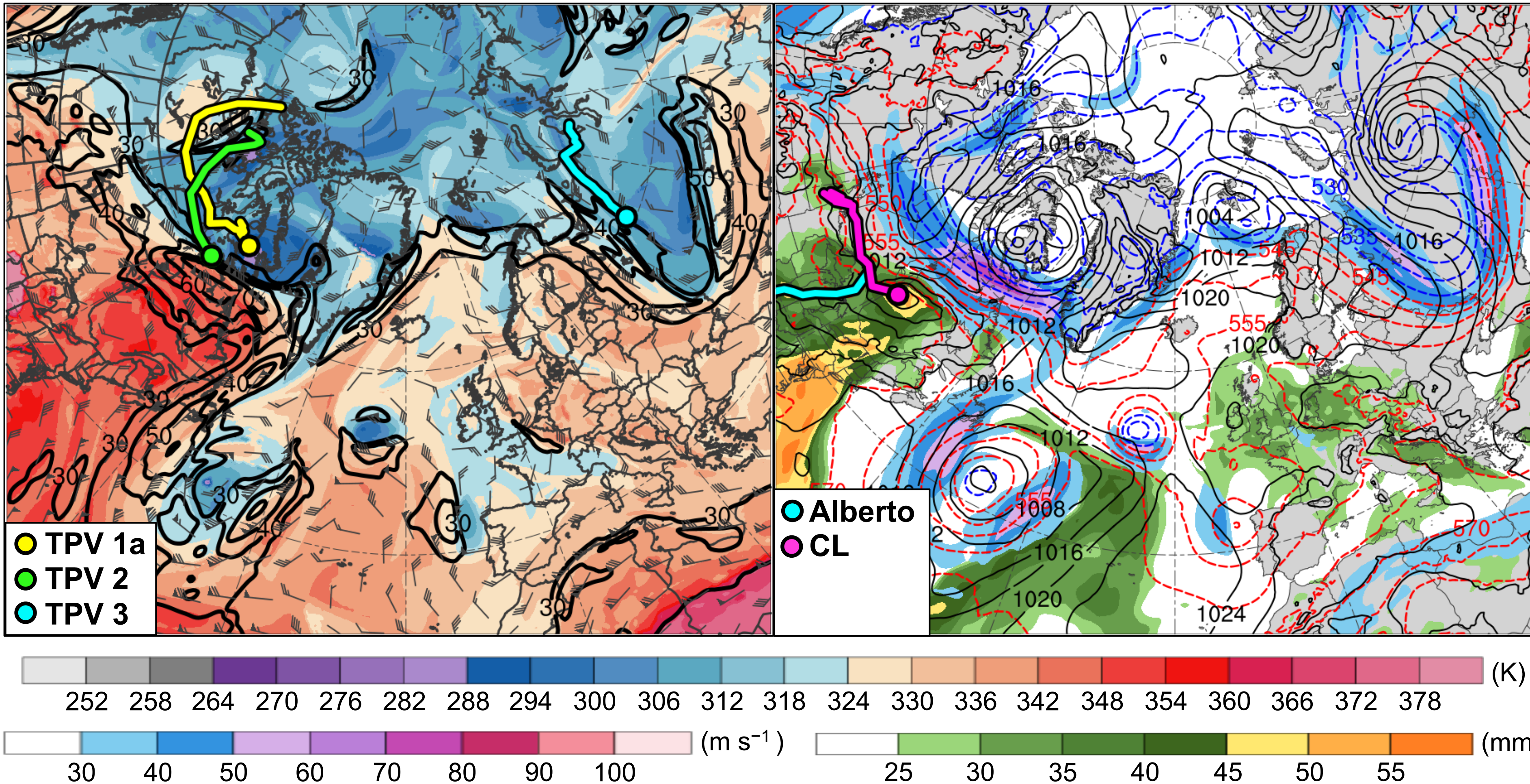


(a) PV (PVU, shaded), θ (K, black), ascent (red, every 5 × 10^{-3} hPa s^{-1}), and wind speed (white, every 10 m s^{-1} starting at 30 m s^{-1}); (b) 300-hPa wind speed (m s^{-1}, shaded),1000–500-hPa thickness (dam, blue/red), SLP (hPa, black), and PW (mm, shaded); (c) 850-hPa θ_e (K, shaded), geopotential height (dam, black), and wind (m s^{-1}, flags and barb)

0000 UTC 1 Jun 2018



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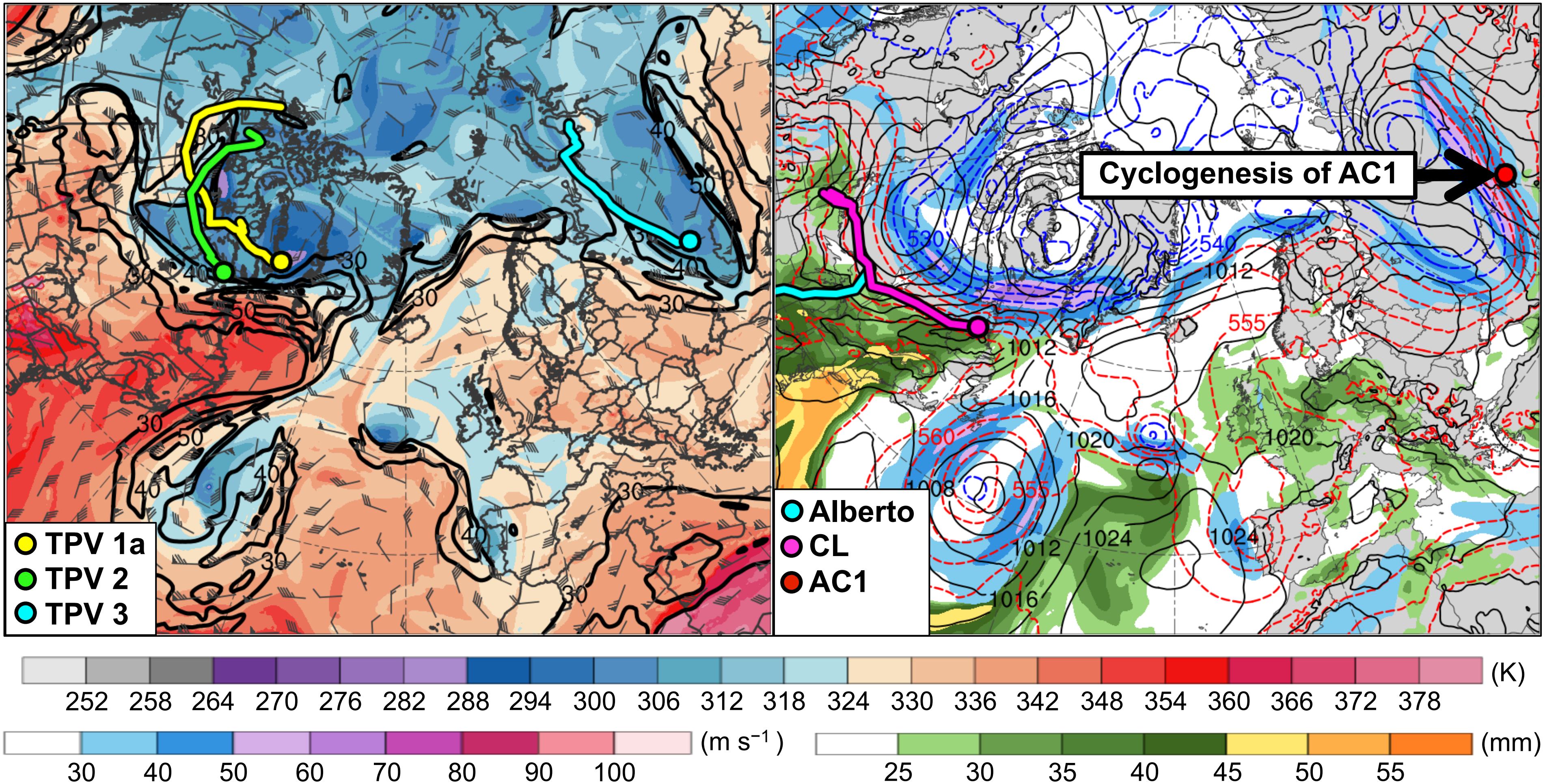

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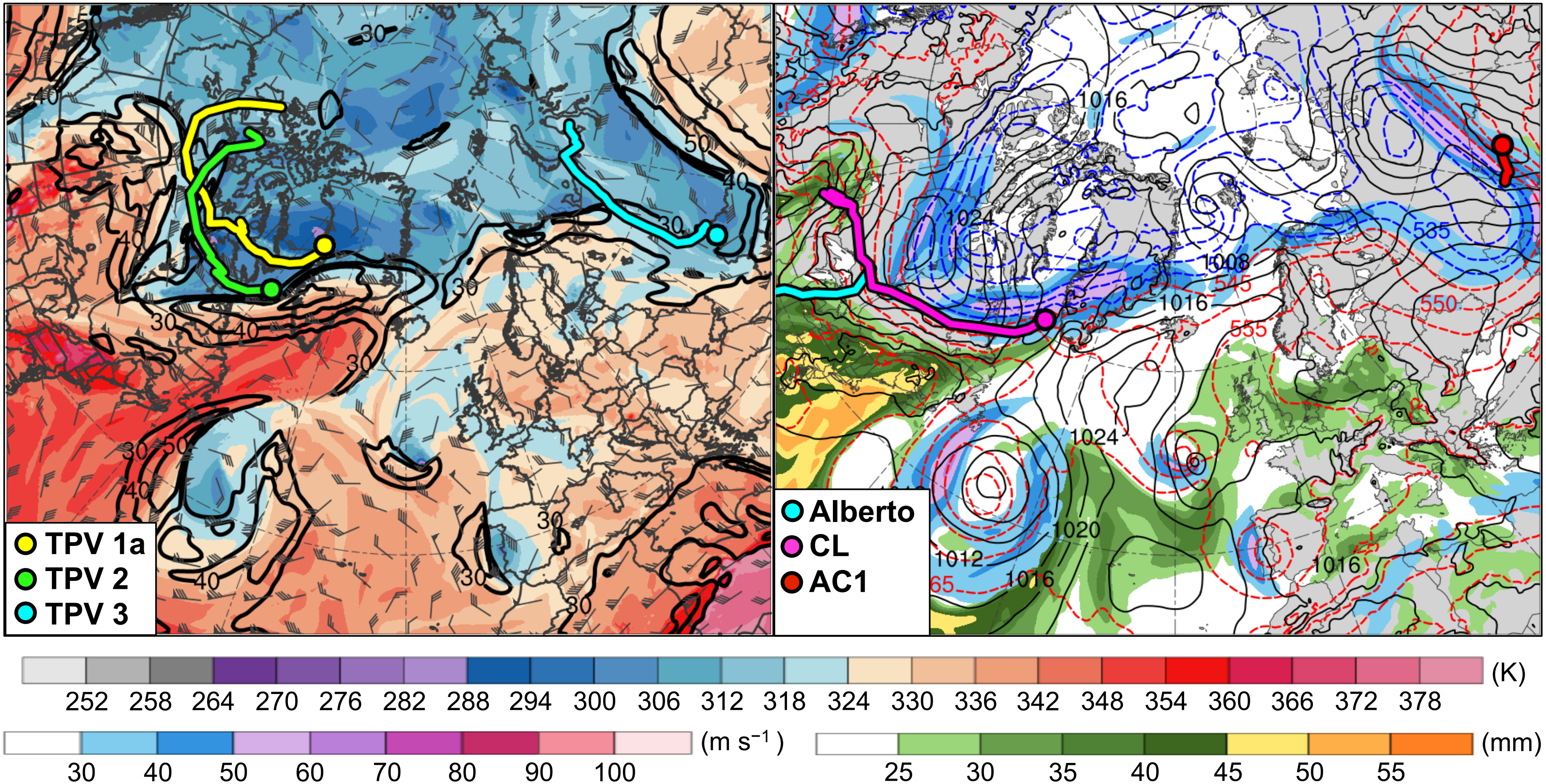
0000 UTC 2 Jun 2018



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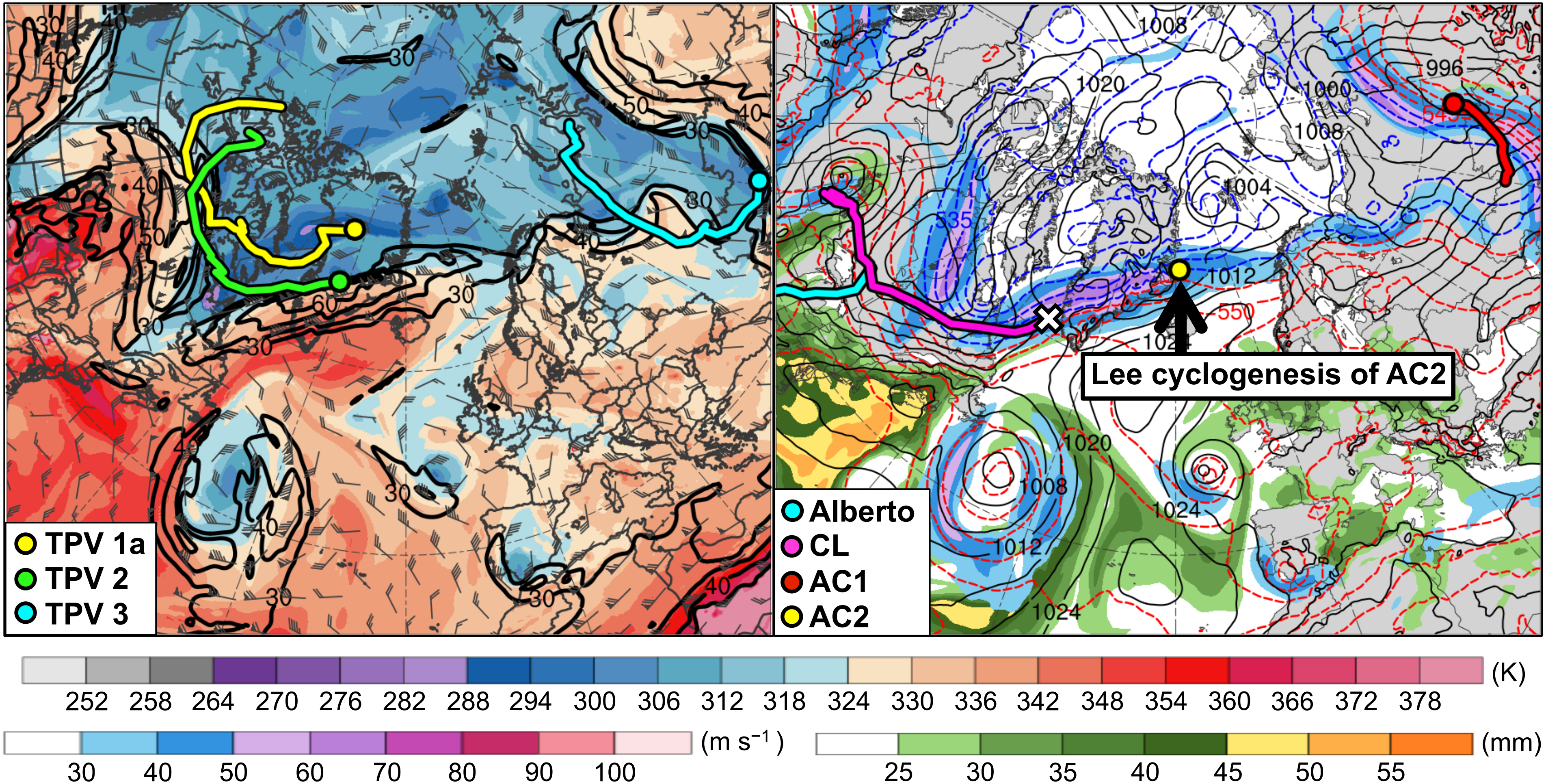

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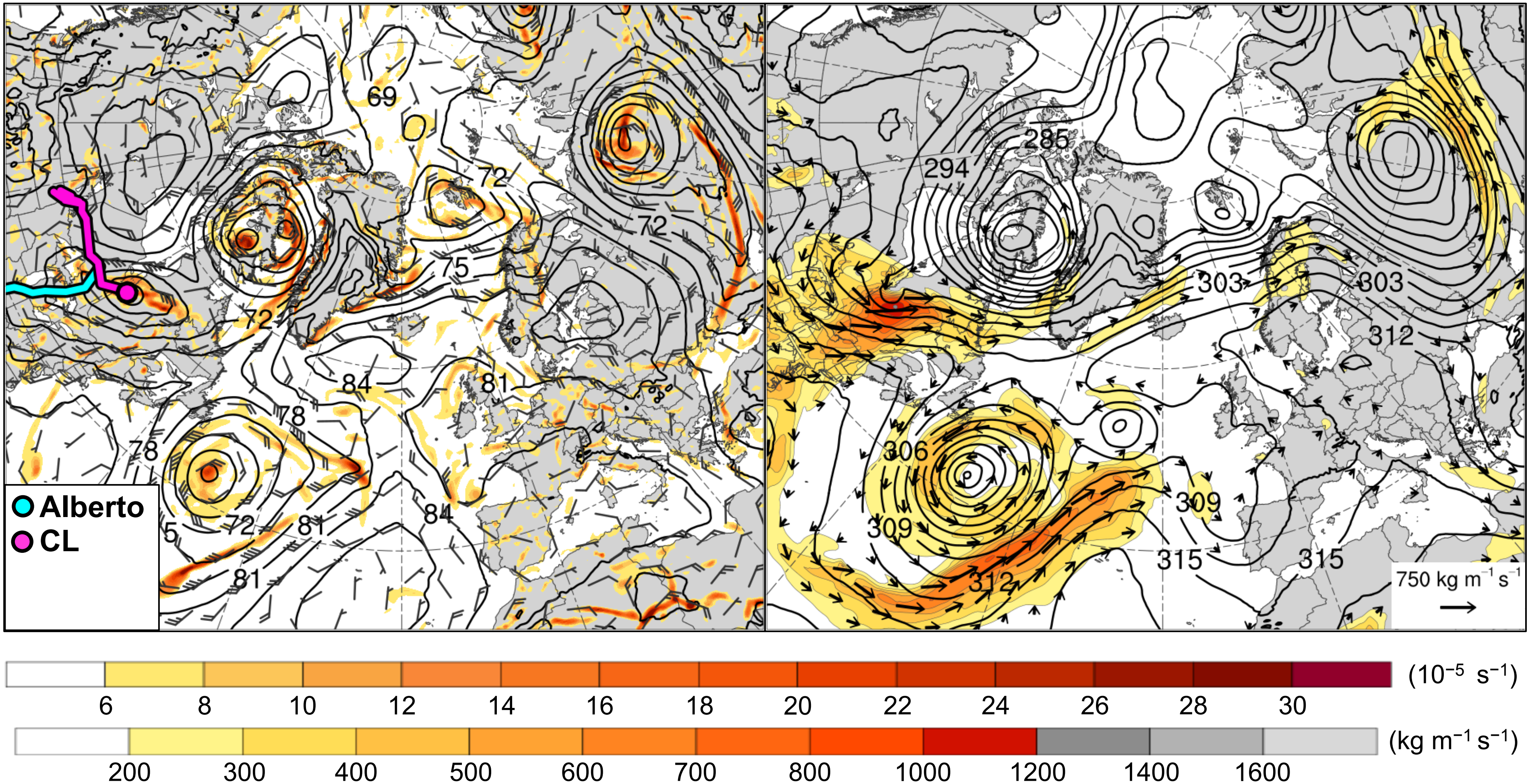
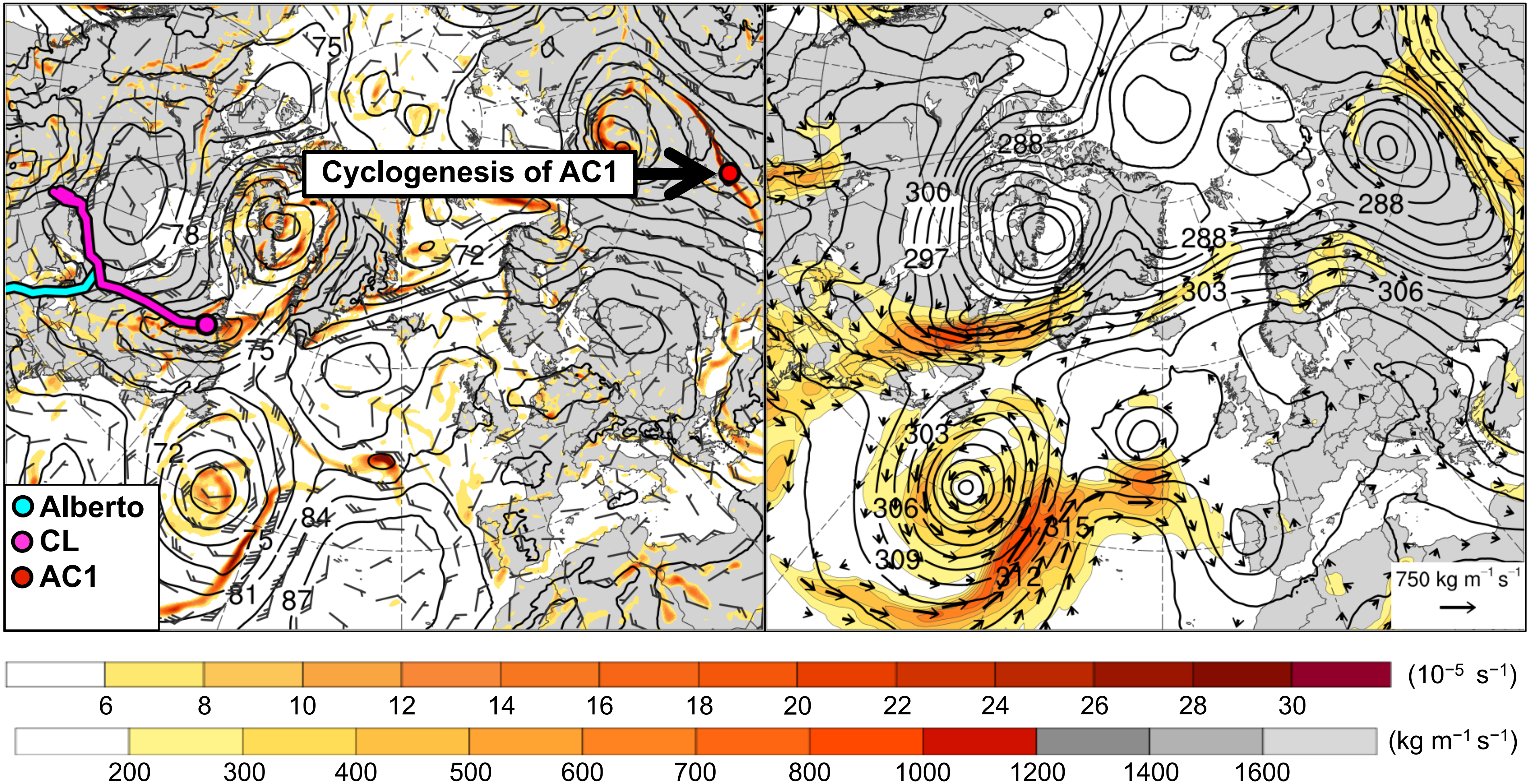


925-hPa relative vorticity (10^{-5} s^{-1}, shaded), geopotential height (dam, black), and winds (m s^{-1}, flags and barbs)	IVT (kg m^{-1} s^{-1}, shaded and vectors) and 700-hPa geopotential height (dam, black)

1200 UTC 1 Jun 2018



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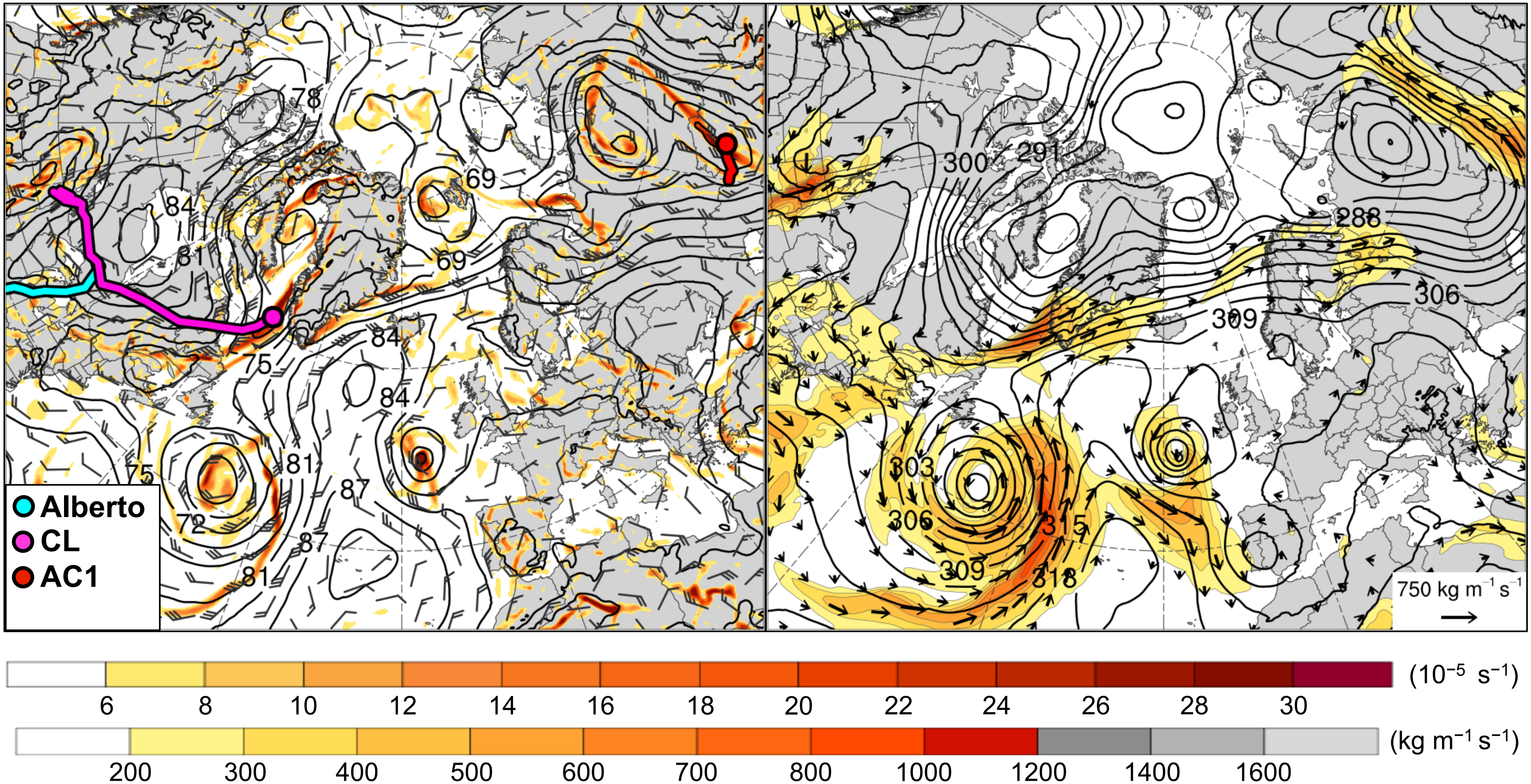

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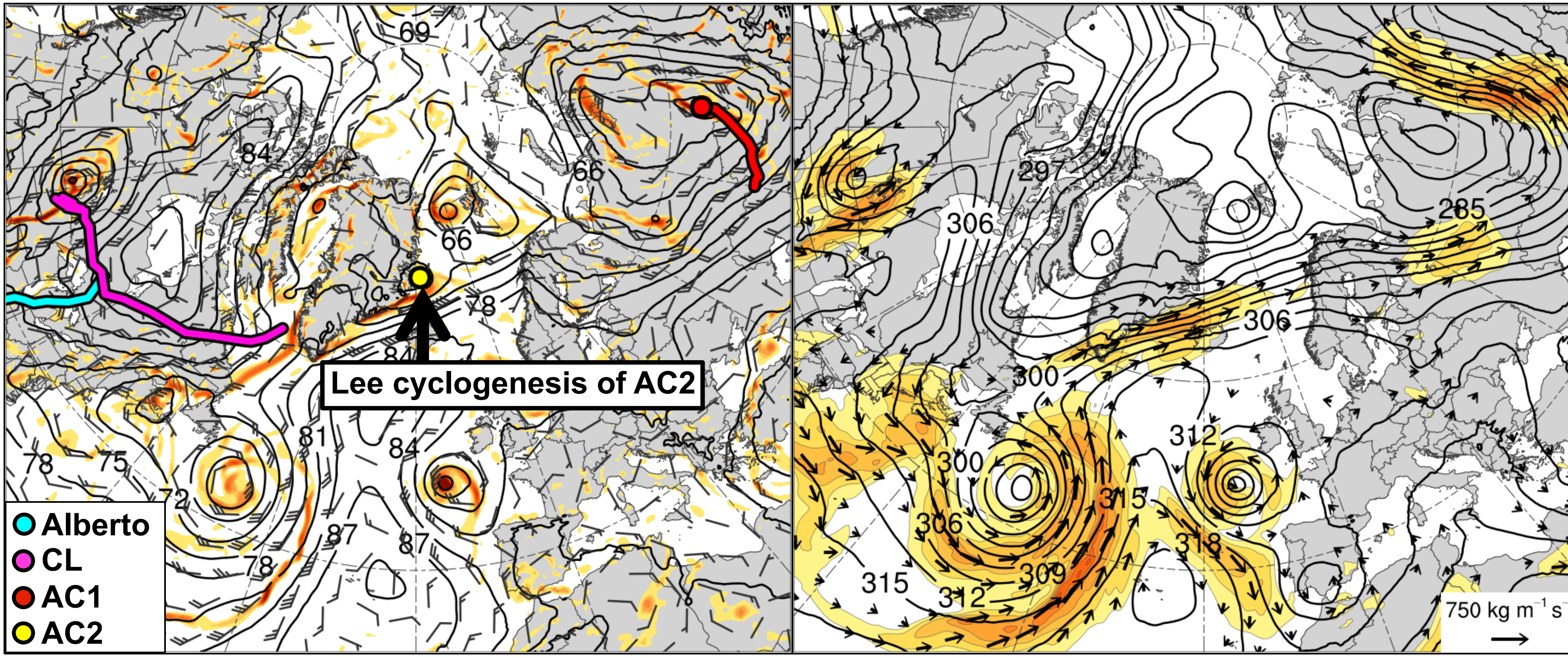


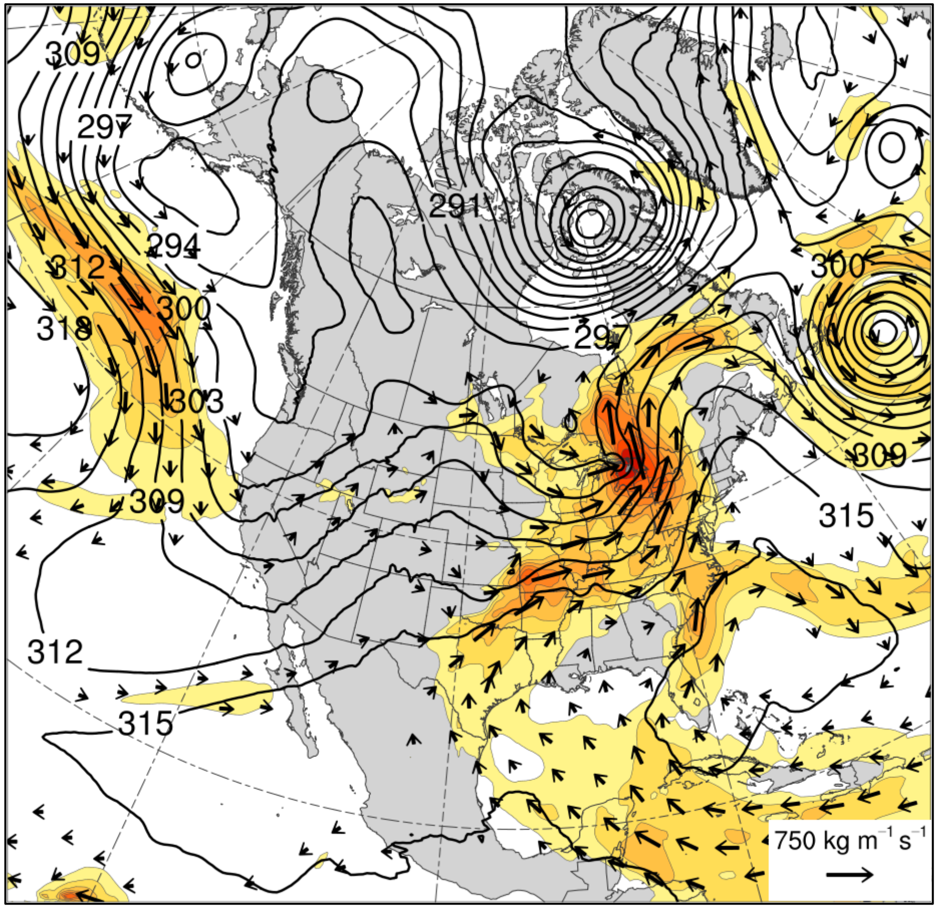
(10^{-5} s^{-1}) 6 8 10 12 14 16 18 20 22 24 26 28 30

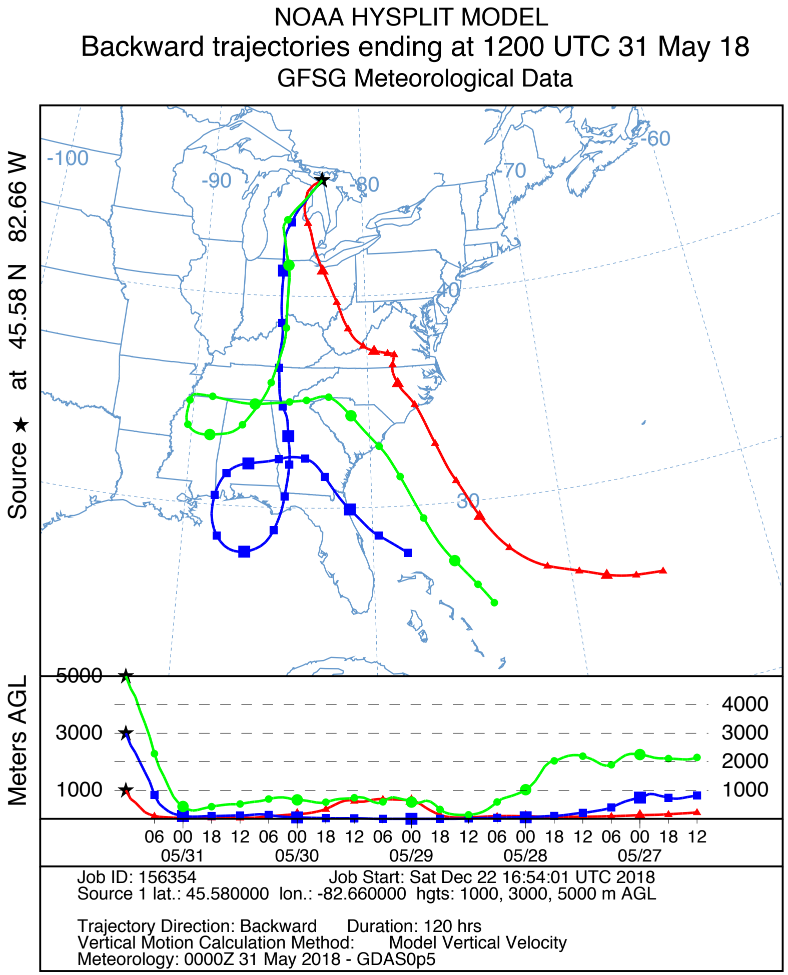
(kg m^{-1} s^{-1}) 200 300 400 500 600 700 800 1000 1200 1400 1600

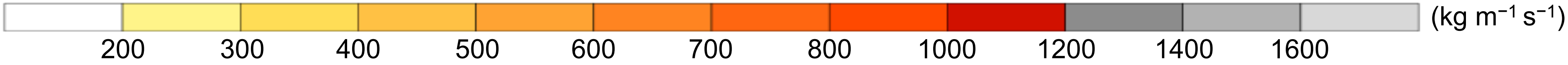
925-hPa relative vorticity (10^{-5} s^{-1}, shaded), geopotential height (dam, black), and winds (m s^{-1}, flags and barbs)	IVT (kg m^{-1} s^{-1}, shaded and vectors) and 700-hPa geopotential height (dam, black)

Lagrangian Perspective: Selected Trajectories (Pre-AC2)

1200 UTC 31 May 2018

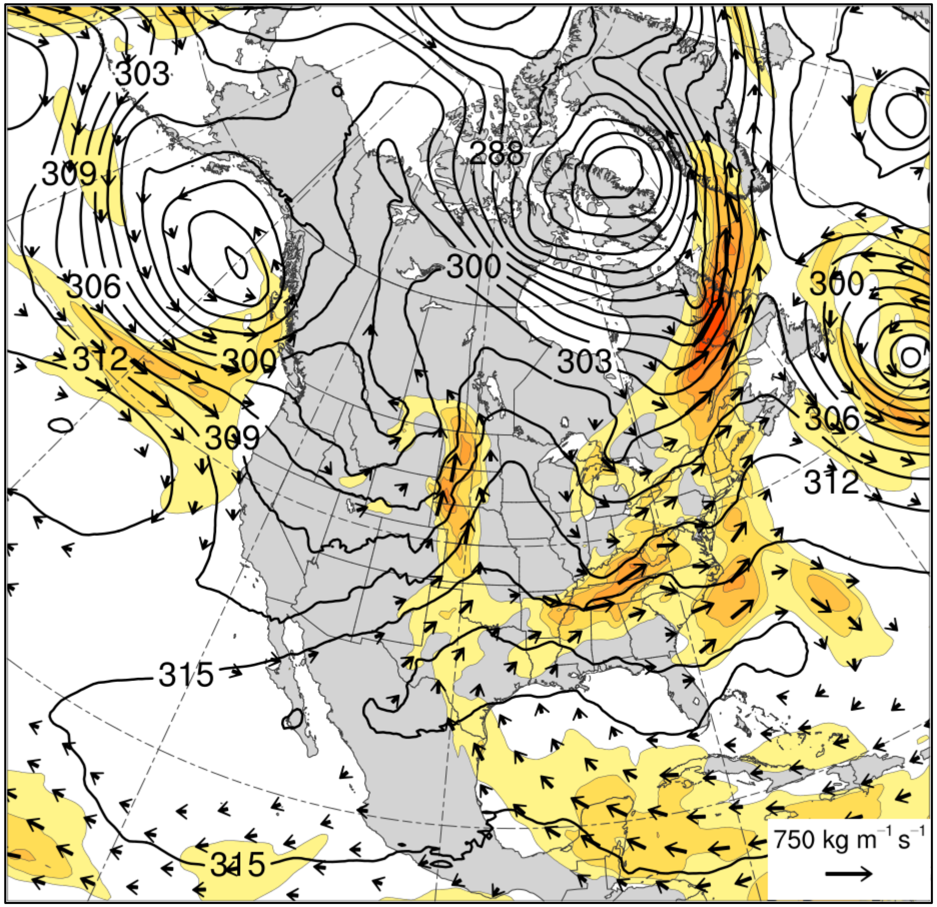


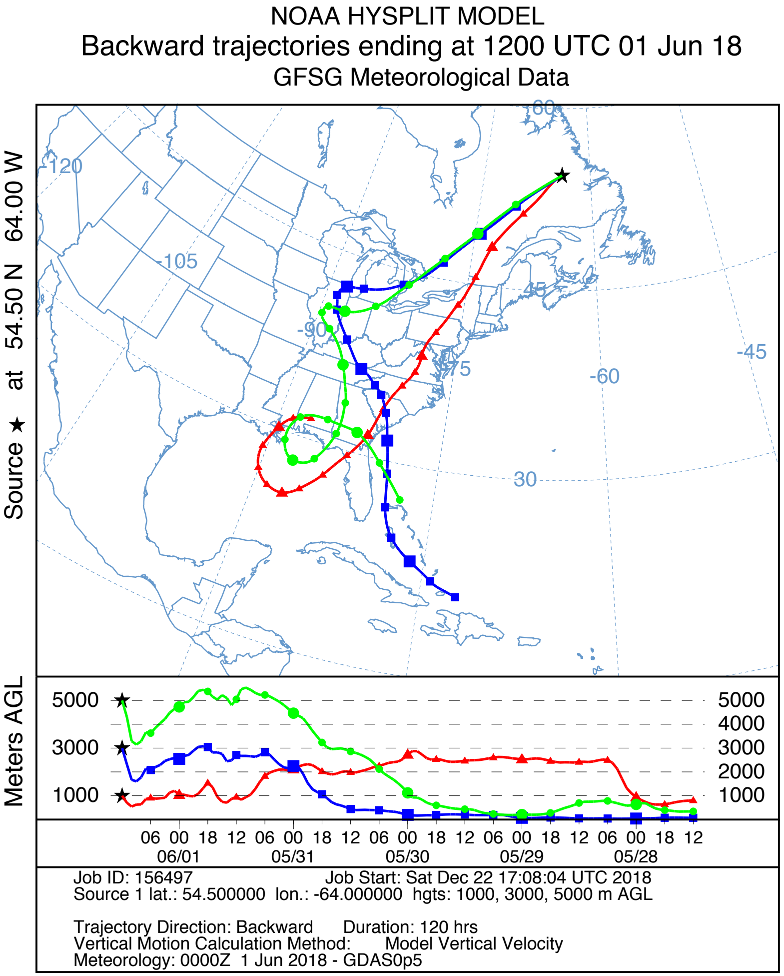




IVT (kg m^{-1} s^{-1}, shaded and vectors) and 700-hPa geopotential height (dam, black)	NOAA HYSPLIT 5-d backward trajectories ending at 1200 UTC 31 May 2018

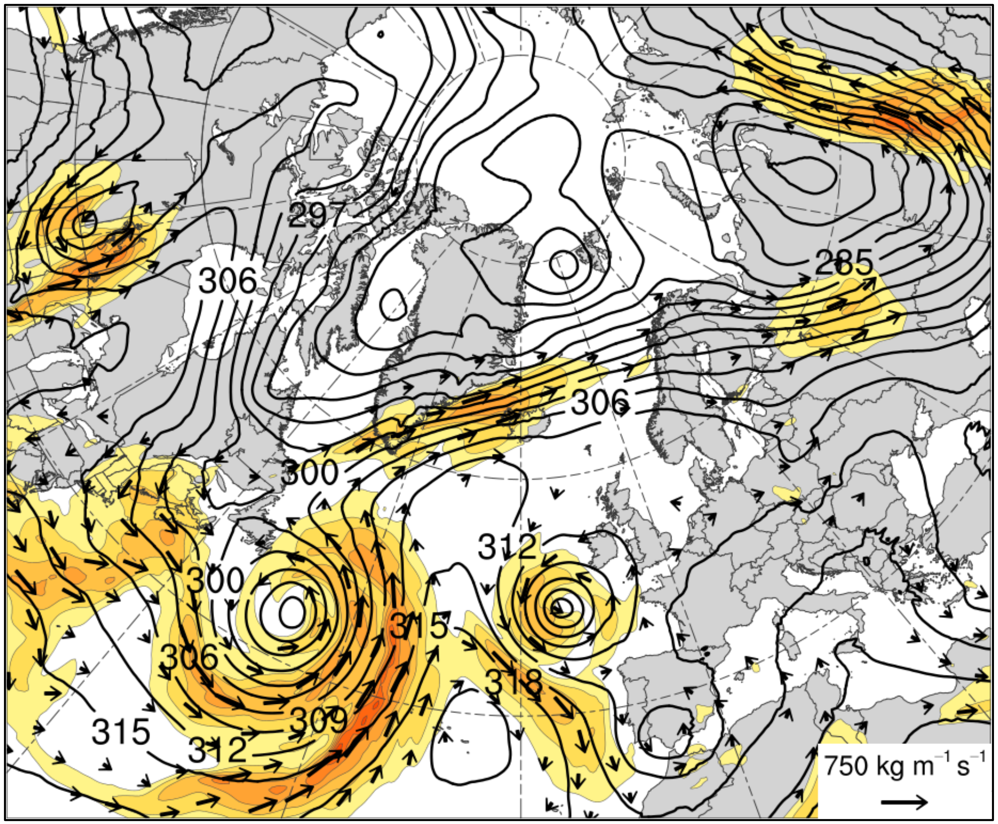
1200 UTC 1 Jun 2018

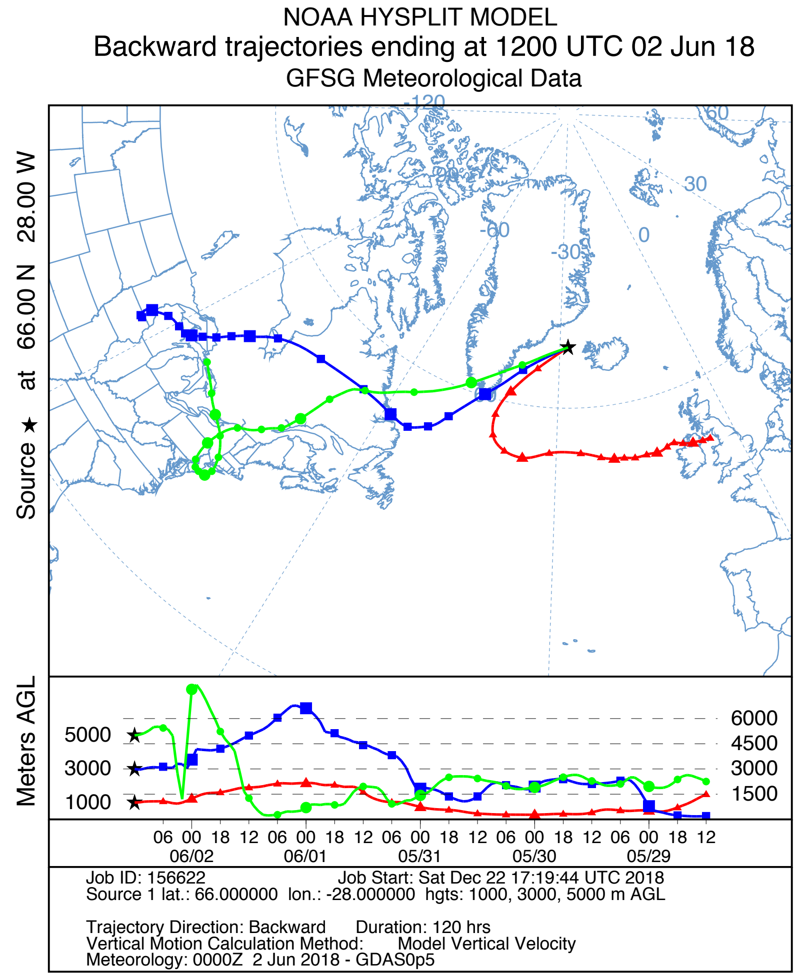


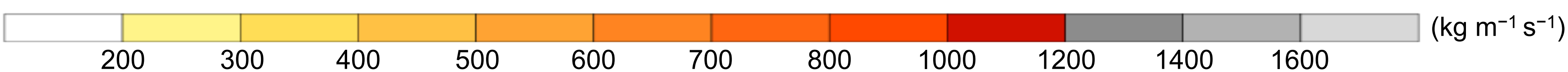


IVT (kg m^{-1} s^{-1}, shaded and vectors) and 700-hPa geopotential height (dam, black)	NOAA HYSPLIT 5-d backward trajectories ending at 1200 UTC 1 June 2018

1200 UTC 2 Jun 2018





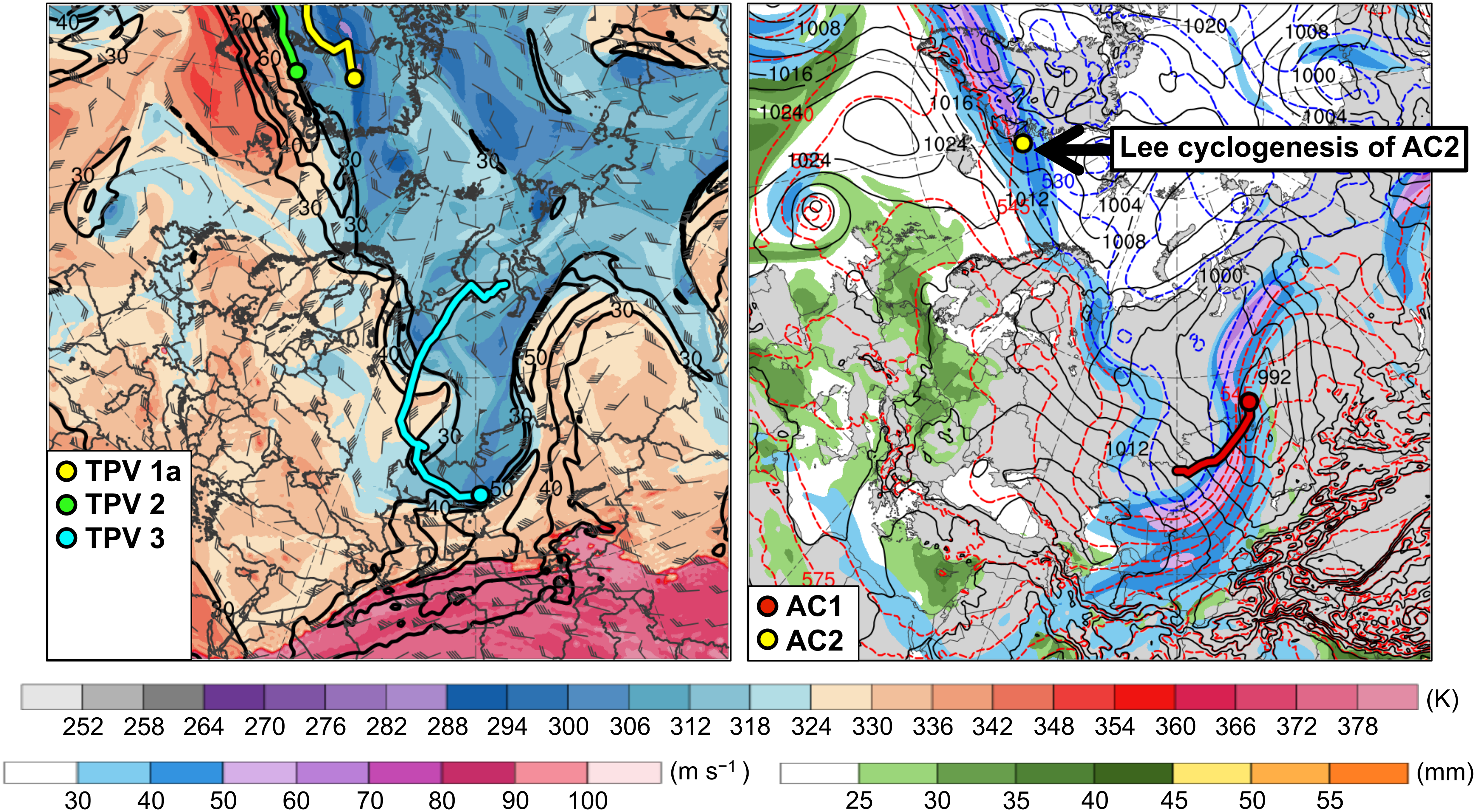


IVT (kg m^{-1} s^{-1}, shaded and vectors) and 700-hPa geopotential height (dam, black)

NOAA HYSPLIT 5-d backward trajectories ending at 1200 UTC 2 June 2018

Synoptic-Scale Flow Evolution: Eurasia 2–7 June 2018

1200 UTC 2 Jun 2018



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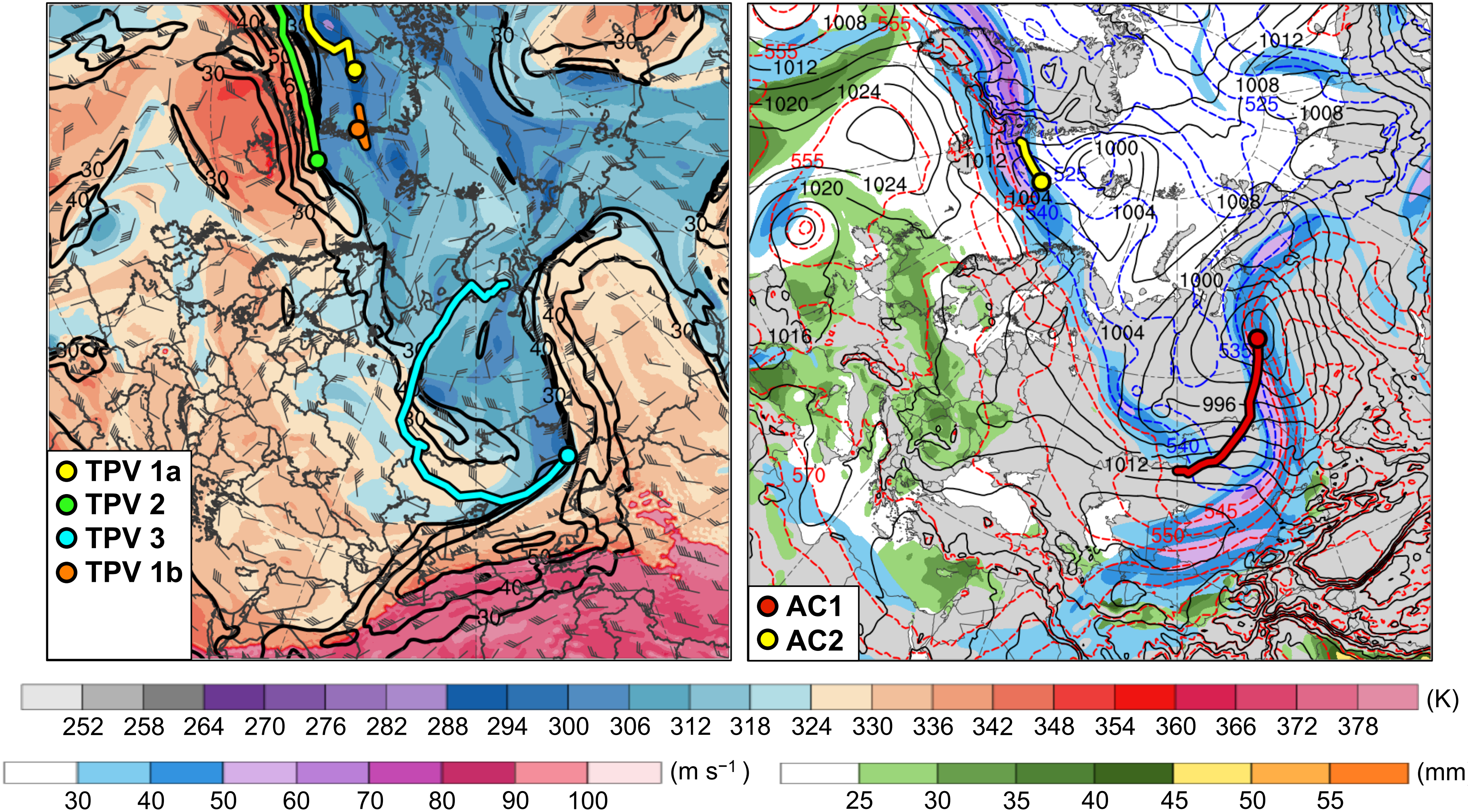
0000 UTC 3 Jun 2018



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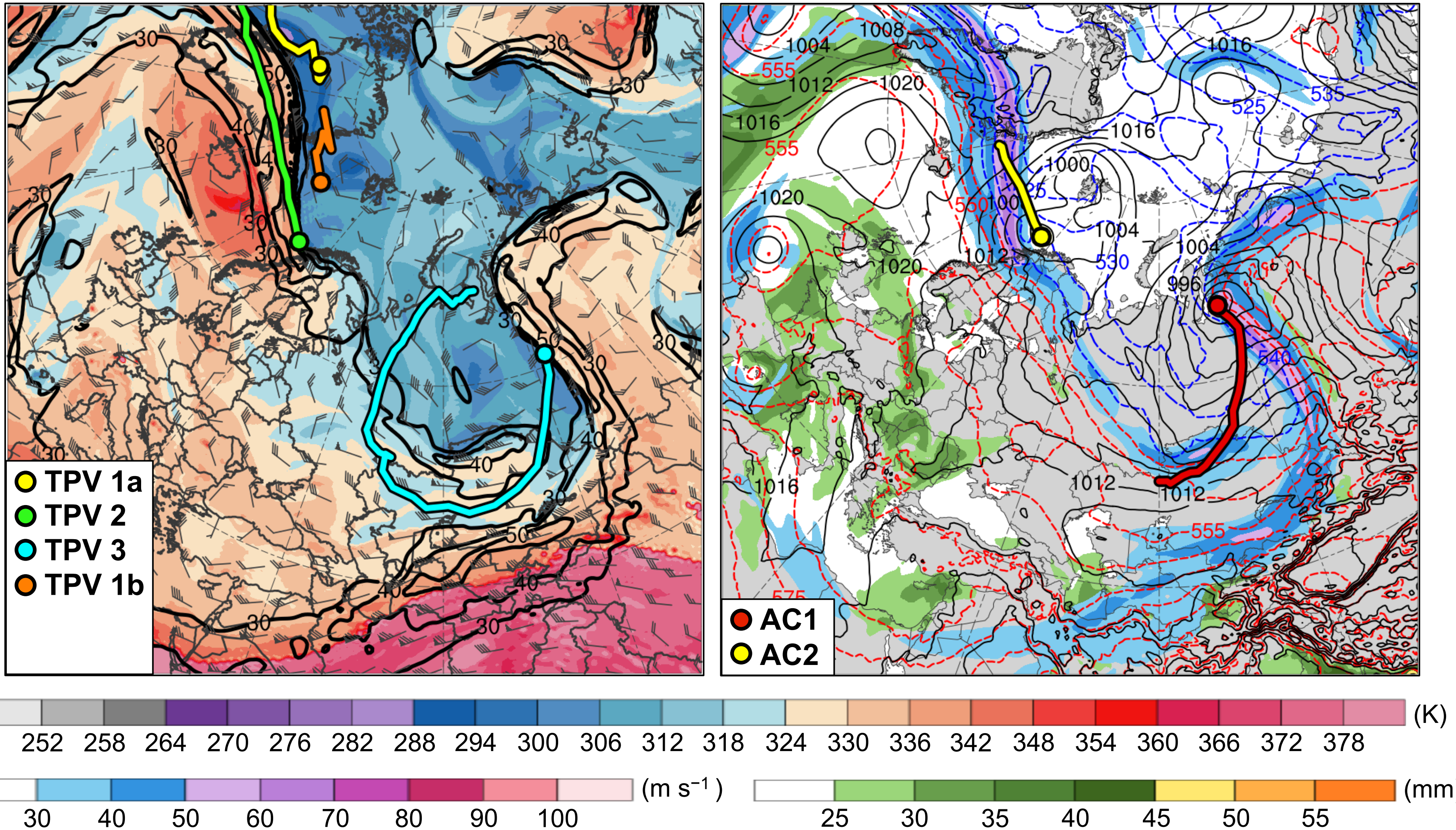
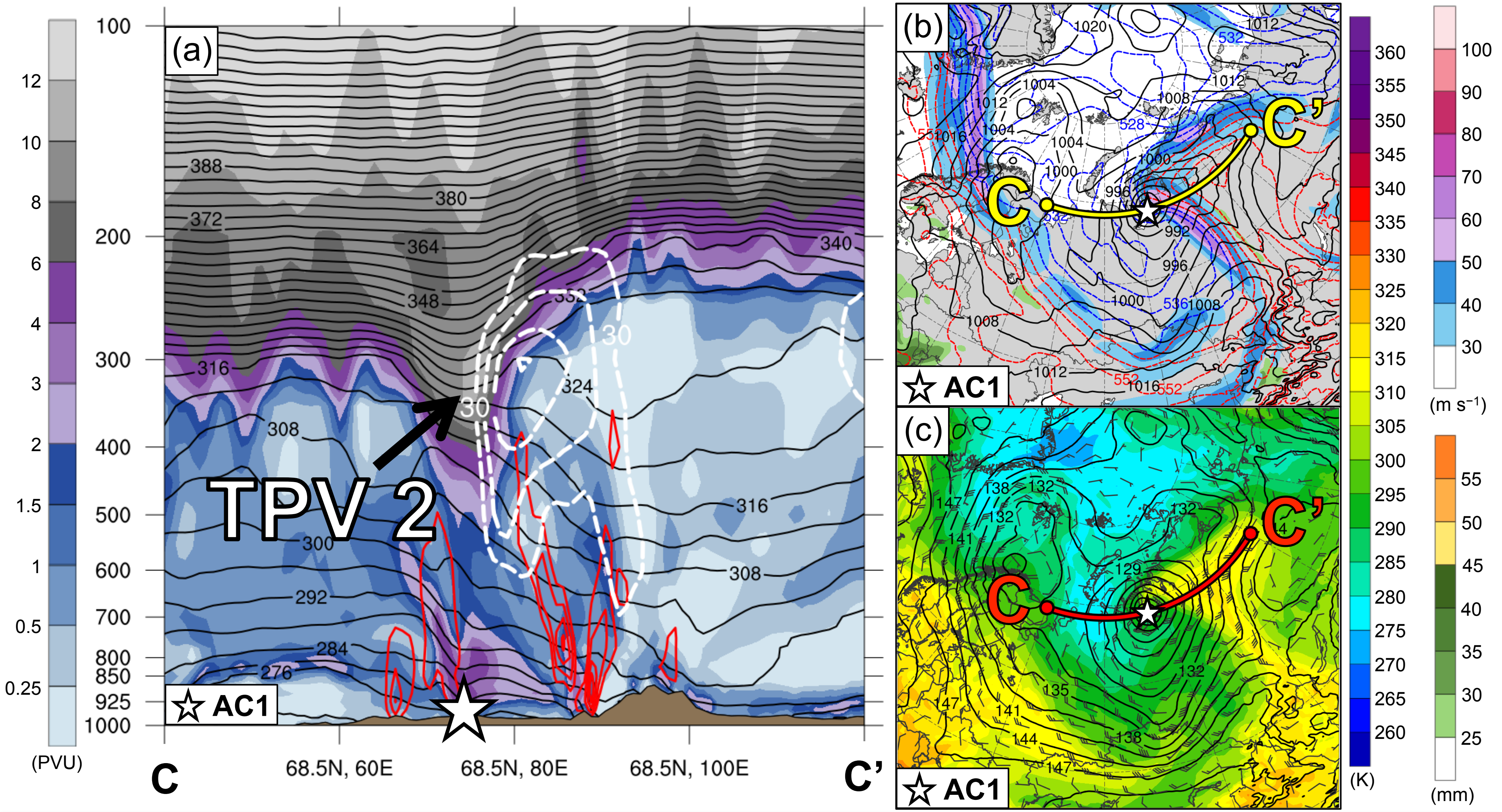
1200 UTC 3 Jun 2018



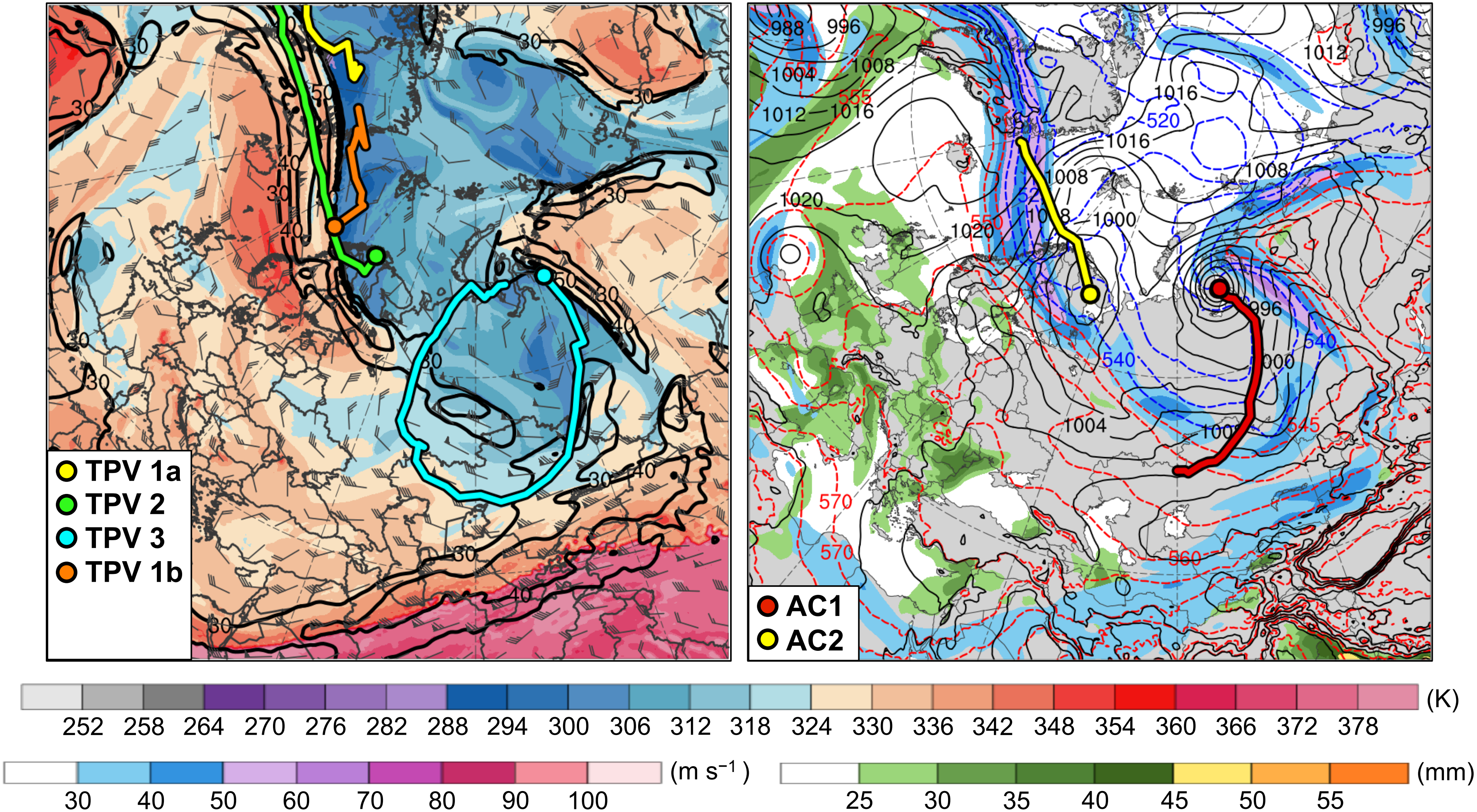
Potential temperature (K, shaded), wind speed (black, every 10 m s^{-1} starting at 30 m s^{-1}), and wind (m s^{-1}, flags and barbs) on 2-PVU surface	300-hPa wind speed (m s^{-1}, shaded), 1000–500-hPa thickness (dam, blue/red), SLP (hPa, black), and PW (mm, shaded)

1800 UTC 3 Jun 2018



(a) PV (PVU, shaded), θ (K, black), ascent (red, every 5 × 10^{-3} hPa s^{-1}), and wind speed (white, every 10 m s^{-1} starting at 30 m s^{-1}); (b) 300-hPa wind speed (m s^{-1}, shaded),1000–500-hPa thickness (dam, blue/red), SLP (hPa, black), and PW (mm, shaded); (c) 850-hPa θ_e (K, shaded), geopotential height (dam, black), and wind (m s^{-1}, flags and barb)

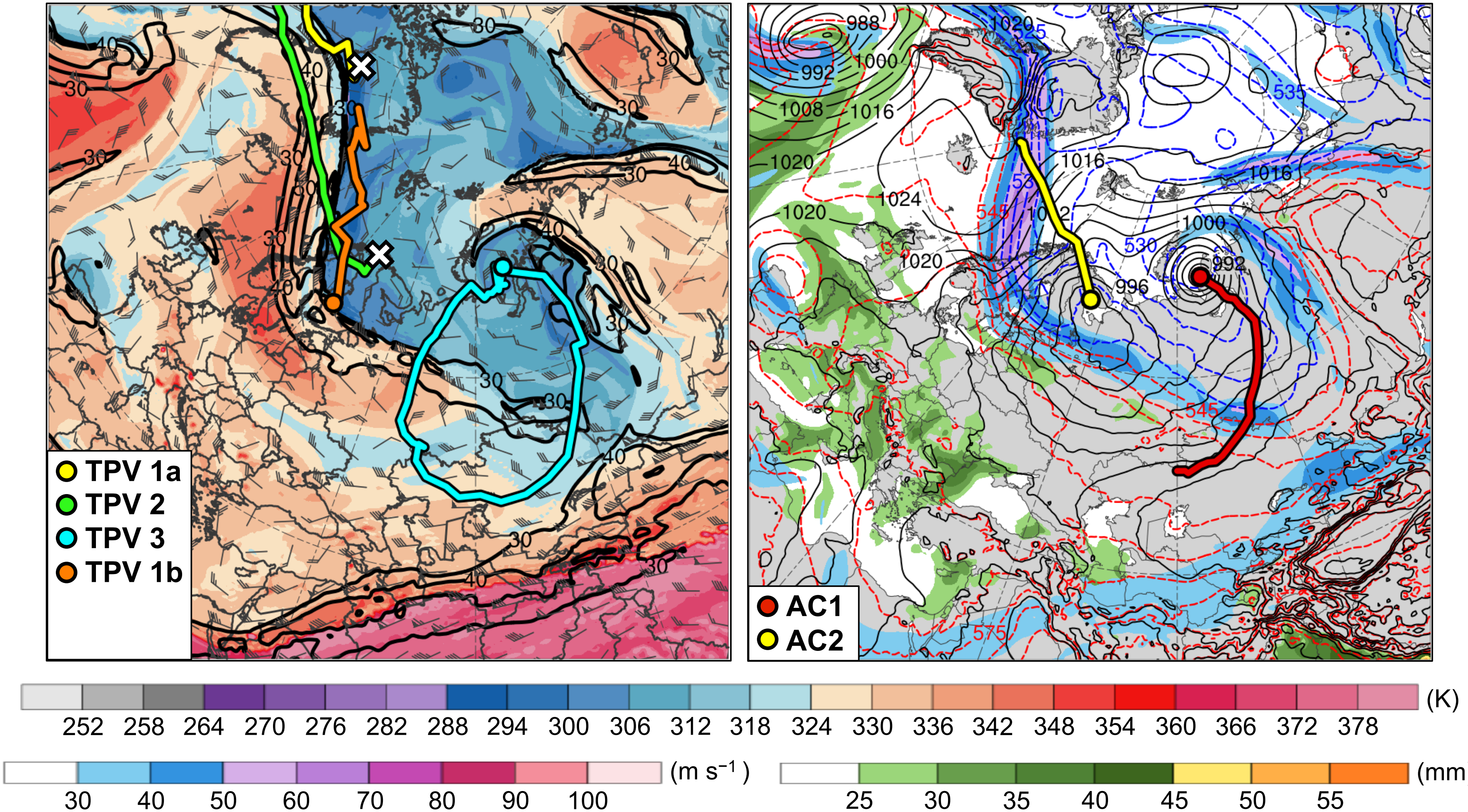
0000 UTC 4 Jun 2018



Potential temperature (K, shaded), wind speed (black, every 10 m s^{-1} starting at 30 m s^{-1}), and wind (m s^{-1}, flags and barbs) on 2-PVU surface

300-hPa wind speed (m s^{-1}, shaded), 1000–500-hPa thickness (dam, blue/red), SLP (hPa, black), and PW (mm, shaded)

1200 UTC 4 Jun 2018



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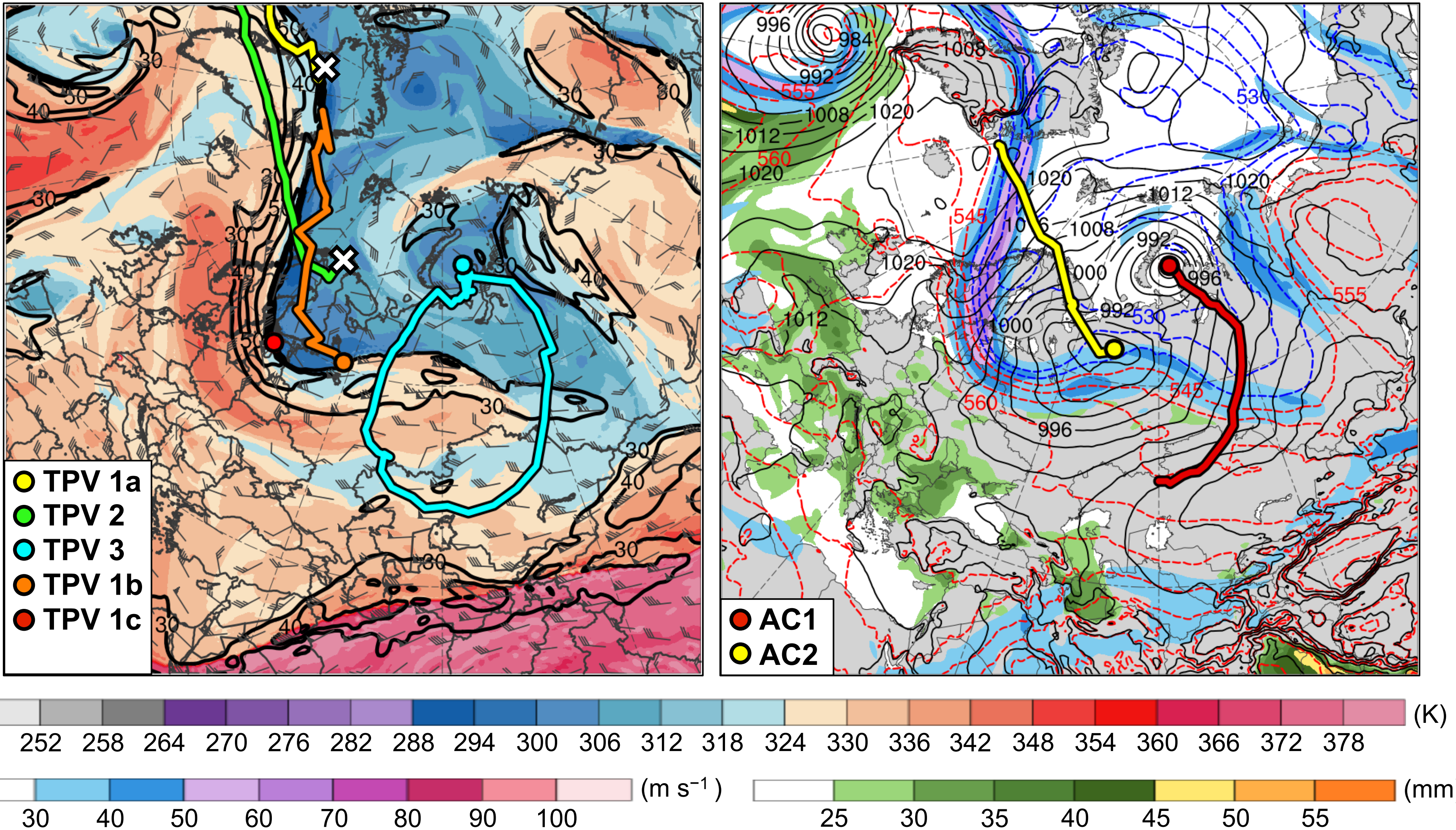
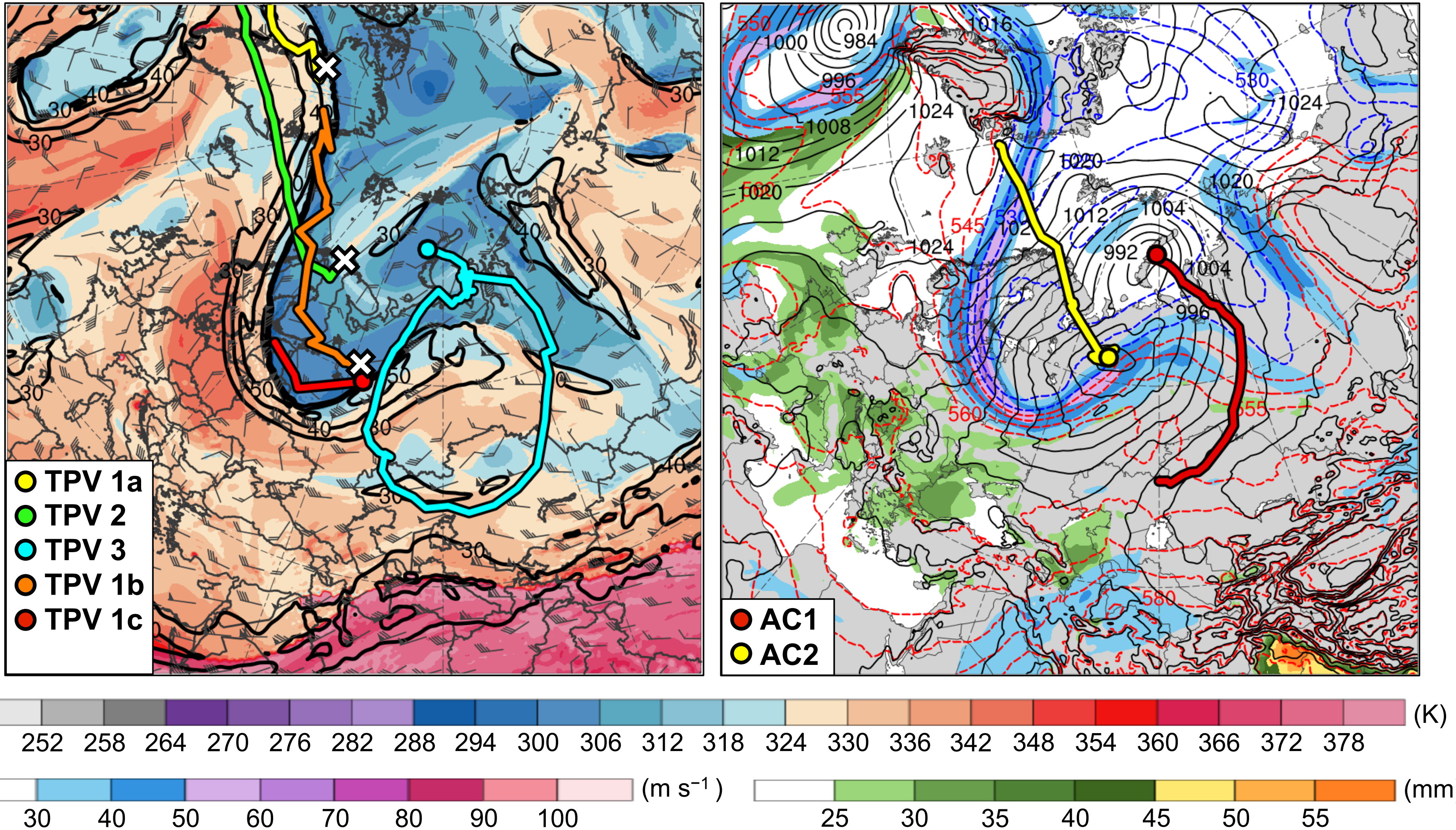
0000 UTC 5 Jun 2018



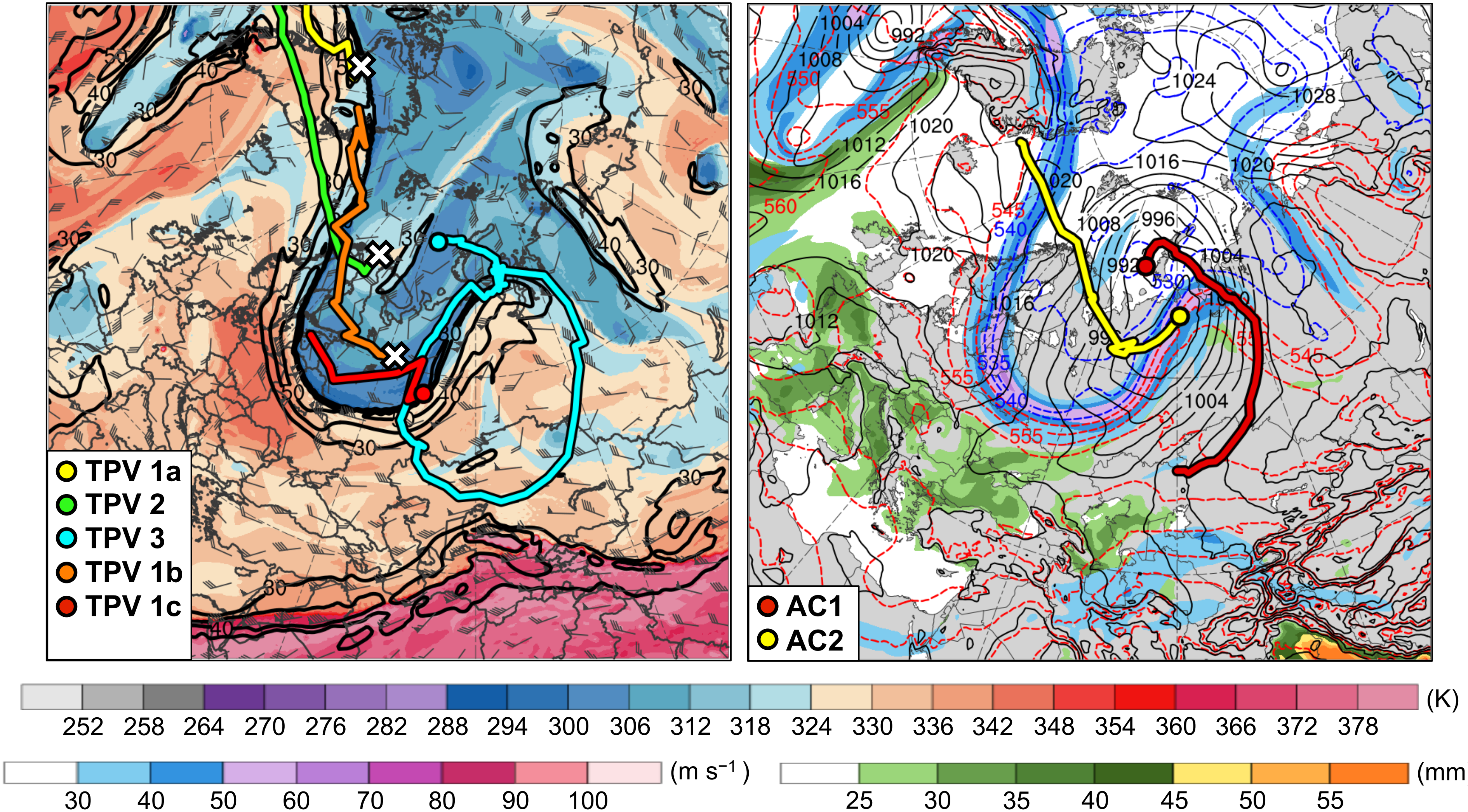
Potential temperature (K, shaded), wind speed (black, every 10 m s^{-1} starting at 30 m s^{-1}), and wind (m s^{-1}, flags and barbs) on 2-PVU surface	300-hPa wind speed (m s^{-1}, shaded), 1000–500-hPa thickness (dam, blue/red), SLP (hPa, black), and PW (mm, shaded)

1200 UTC 5 Jun 2018



Potential temperature (K, shaded), wind speed (black, every 10 m s^{-1} starting at 30 m s^{-1}), and wind (m s^{-1}, flags and barbs) on 2-PVU surface	300-hPa wind speed (m s^{-1}, shaded), 1000–500-hPa thickness (dam, blue/red), SLP (hPa, black), and PW (mm, shaded)

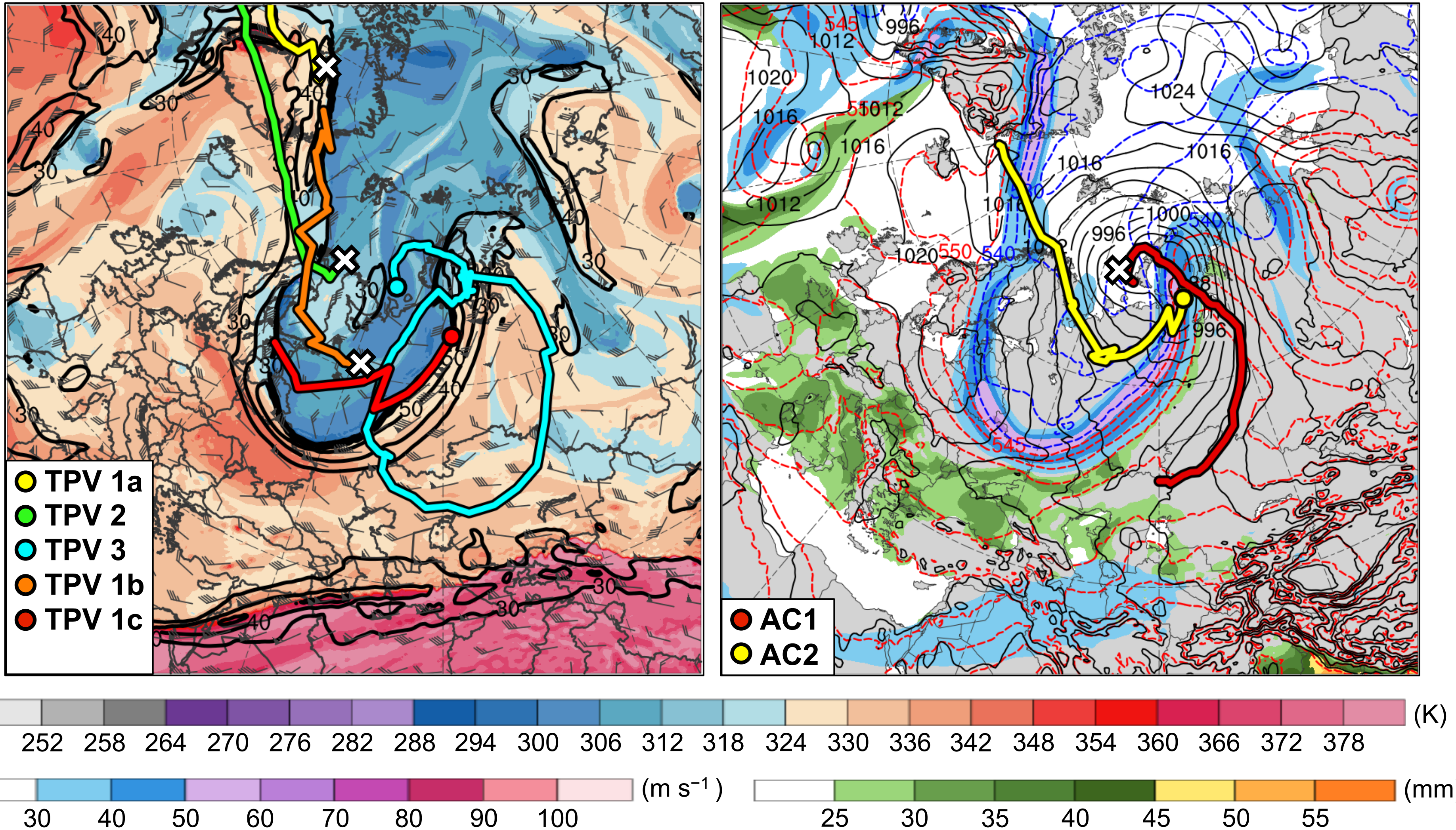
0000 UTC 6 Jun 2018



Potential temperature (K, shaded), wind speed (black, every 10 m s^{-1} starting at 30 m s^{-1}), and wind (m s^{-1}, flags and barbs) on 2-PVU surface

300-hPa wind speed (m s^{-1}, shaded), 1000–500-hPa thickness (dam, blue/red), SLP (hPa, black), and PW (mm, shaded)

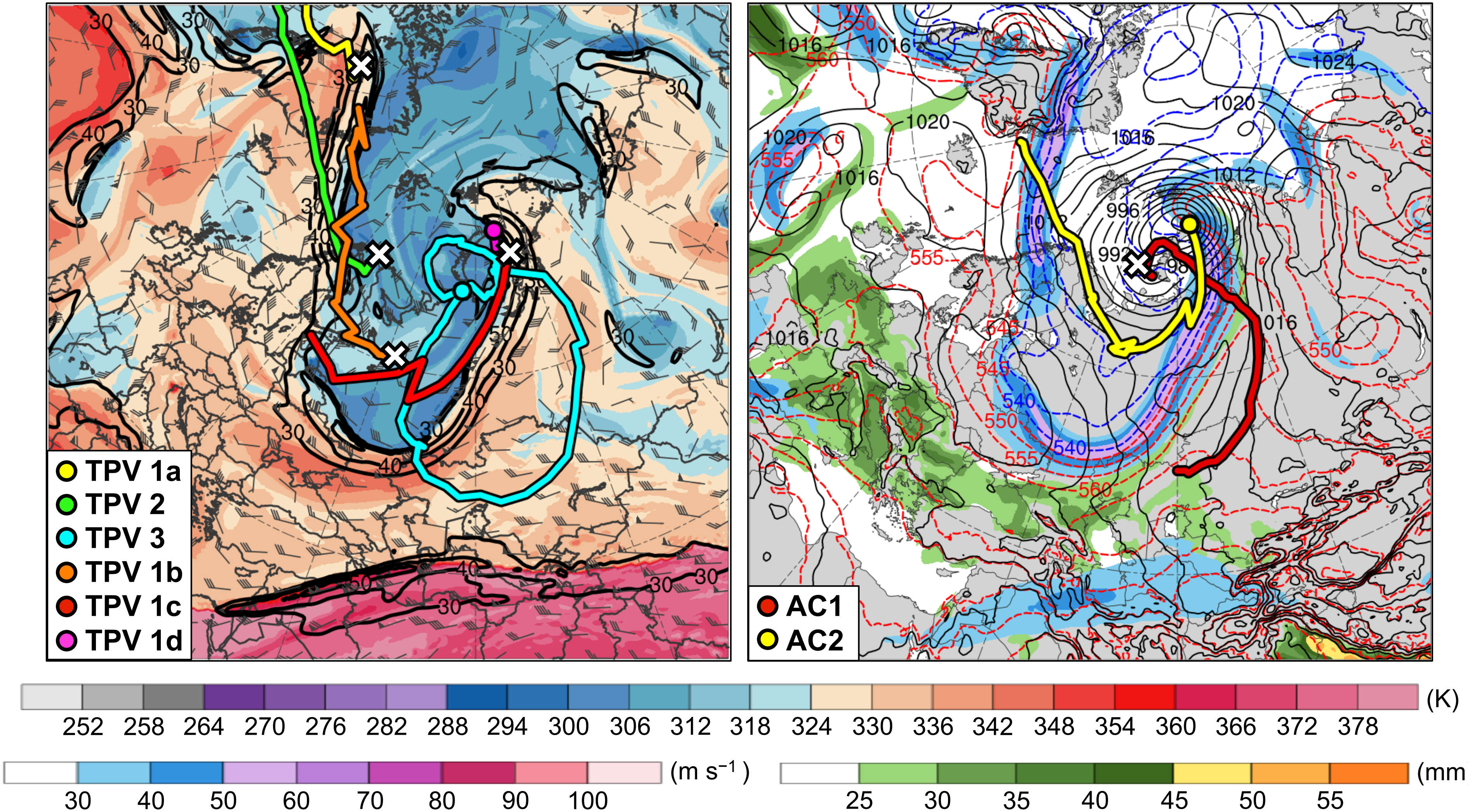
1200 UTC 6 Jun 2018



Potential temperature (K, shaded), wind speed (black, every 10 m s^{-1} starting at 30 m s^{-1}), and wind (m s^{-1}, flags and barbs) on 2-PVU surface

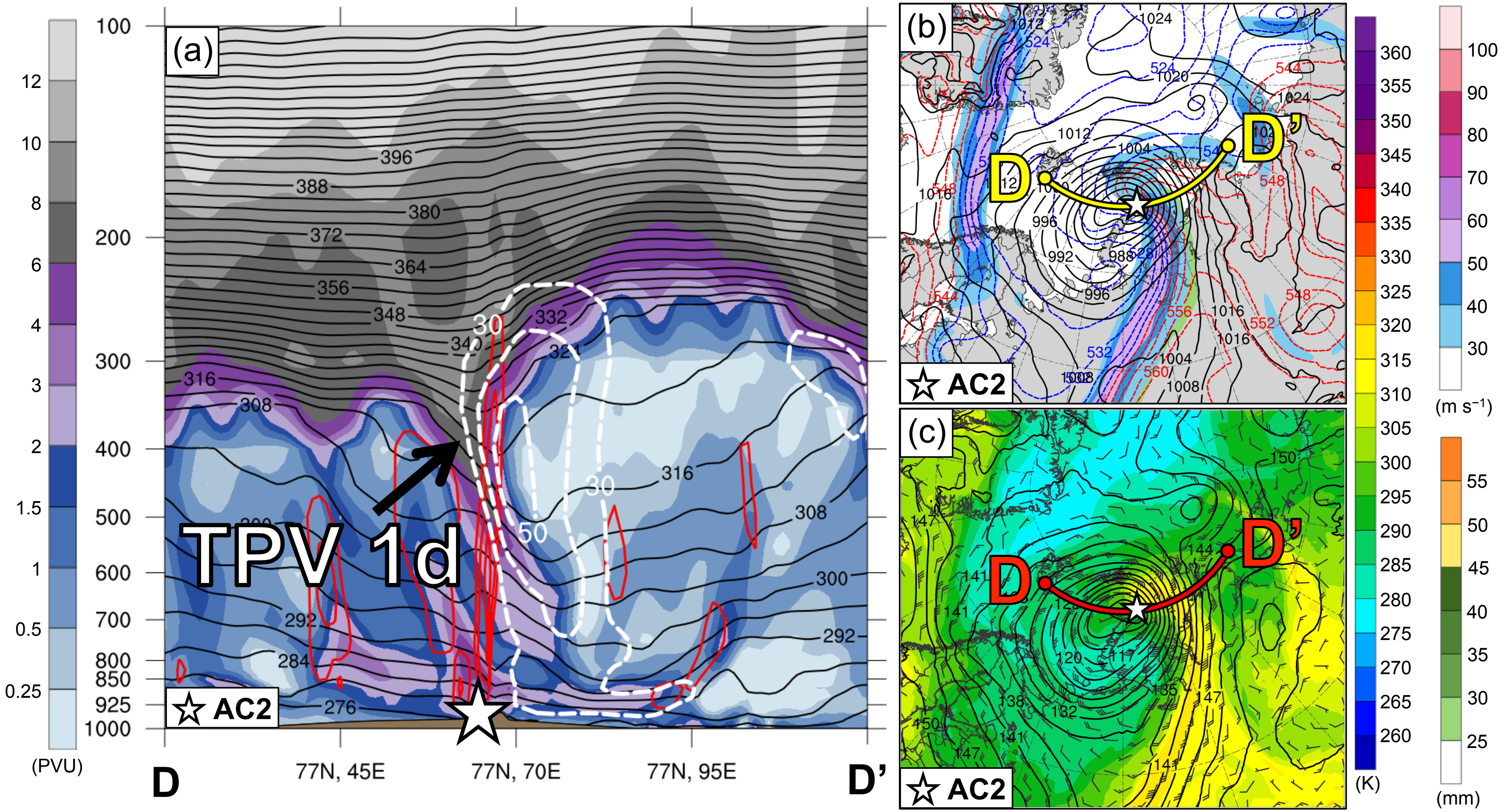
300-hPa wind speed (m s^{-1}, shaded), 1000–500-hPa thickness (dam, blue/red), SLP (hPa, black), and PW (mm, shaded)

0000 UTC 7 Jun 2018



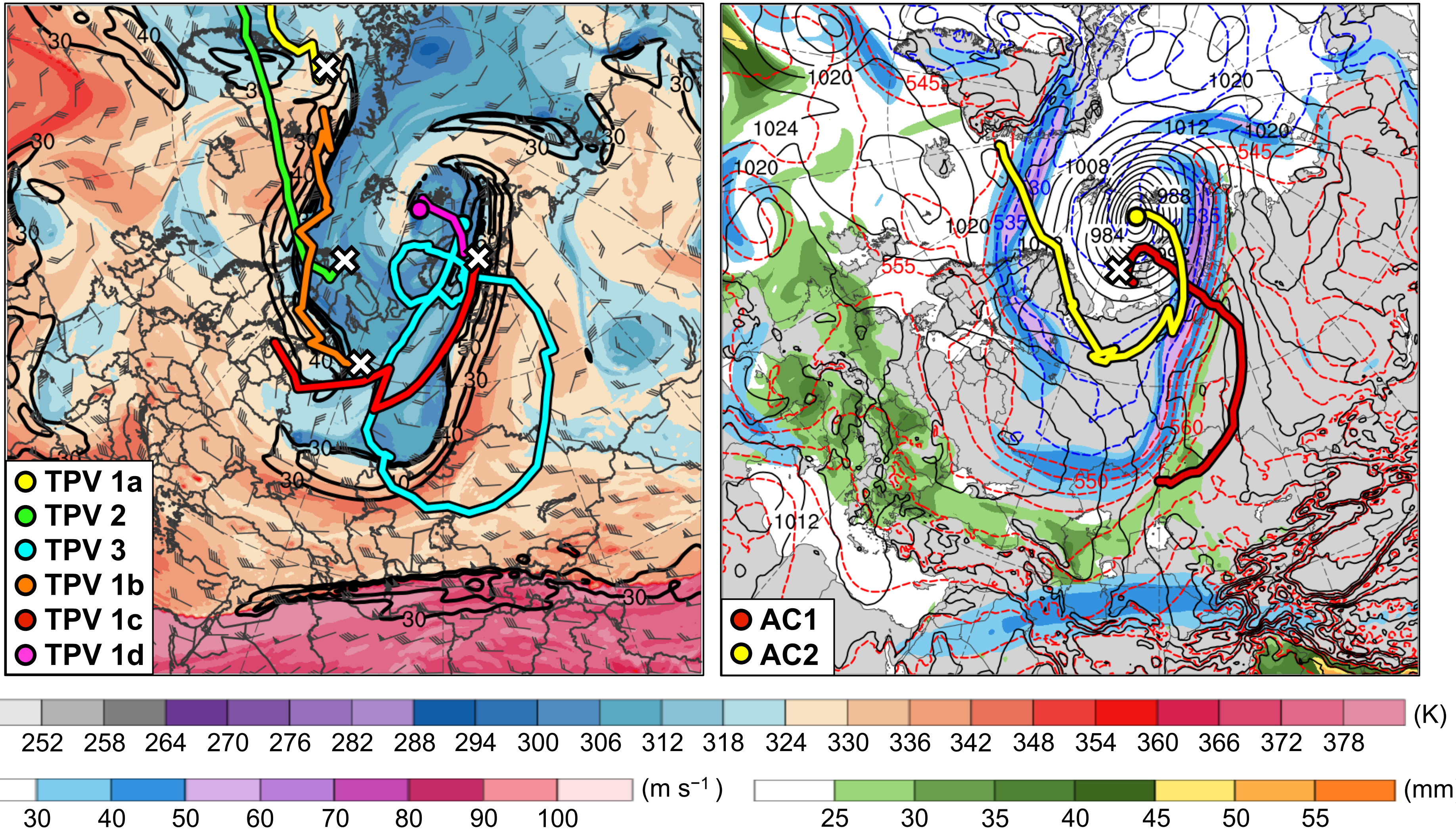
Potential temperature (K, shaded), wind speed (black, every 10 m s^{-1} starting at 30 m s^{-1}), and wind (m s^{-1}, flags and barbs) on 2-PVU surface	300-hPa wind speed (m s^{-1}, shaded), 1000–500-hPa thickness (dam, blue/red), SLP (hPa, black), and PW (mm, shaded)

0000 UTC 7 Jun 2018



(a) PV (PVU, shaded), θ (K, black), ascent (red, every 5 × 10^{-3} hPa s^{-1}), and wind speed (white, every 10 m s^{-1} starting at 30 m s^{-1}); (b) 300-hPa wind speed (m s^{-1}, shaded), 1000–500-hPa thickness (dam, blue/red), SLP (hPa, black), and PW (mm, shaded); (c) 850-hPa $θ_e$ (K, shaded), geopotential height (dam, black), and wind (m s^{-1}, flags and barb)

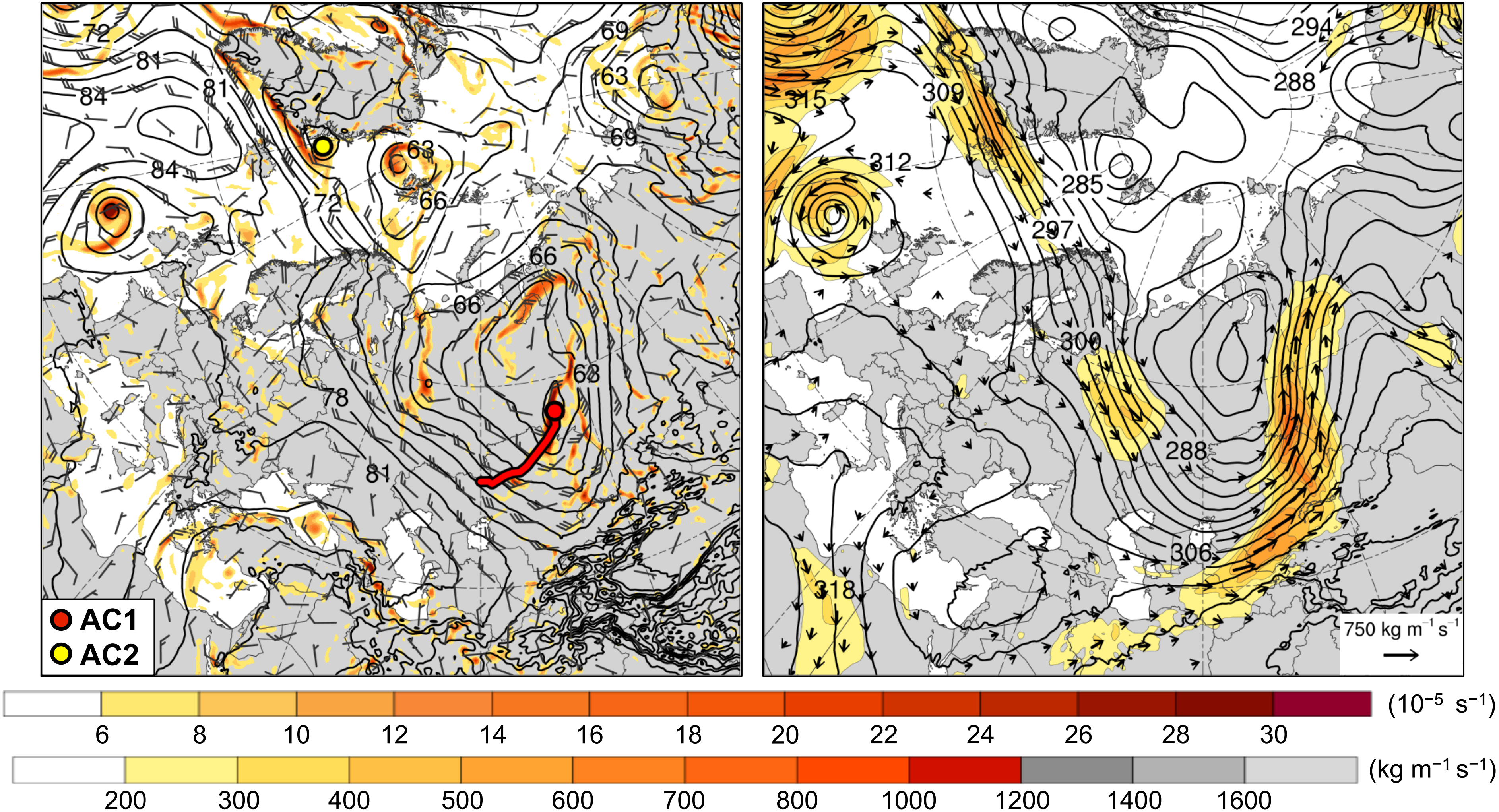
1200 UTC 7 Jun 2018



Potential temperature (K, shaded), wind speed (black, every 10 m s^{-1} starting at 30 m s^{-1}), and wind (m s^{-1}, flags and barbs) on 2-PVU surface

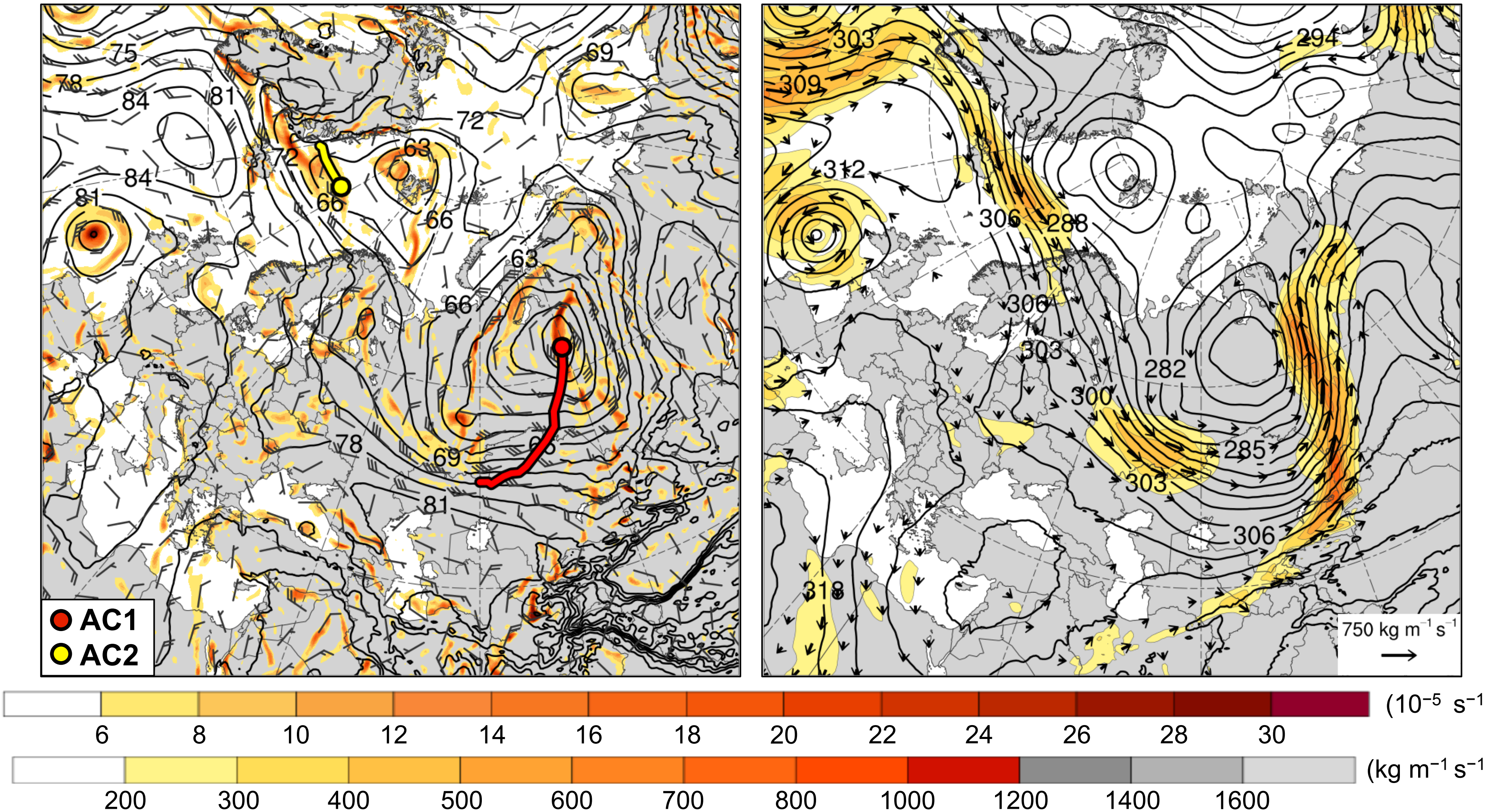
300-hPa wind speed (m s^{-1}, shaded), 1000–500-hPa thickness (dam, blue/red), SLP (hPa, black), and PW (mm, shaded)

1200 UTC 2 Jun 2018



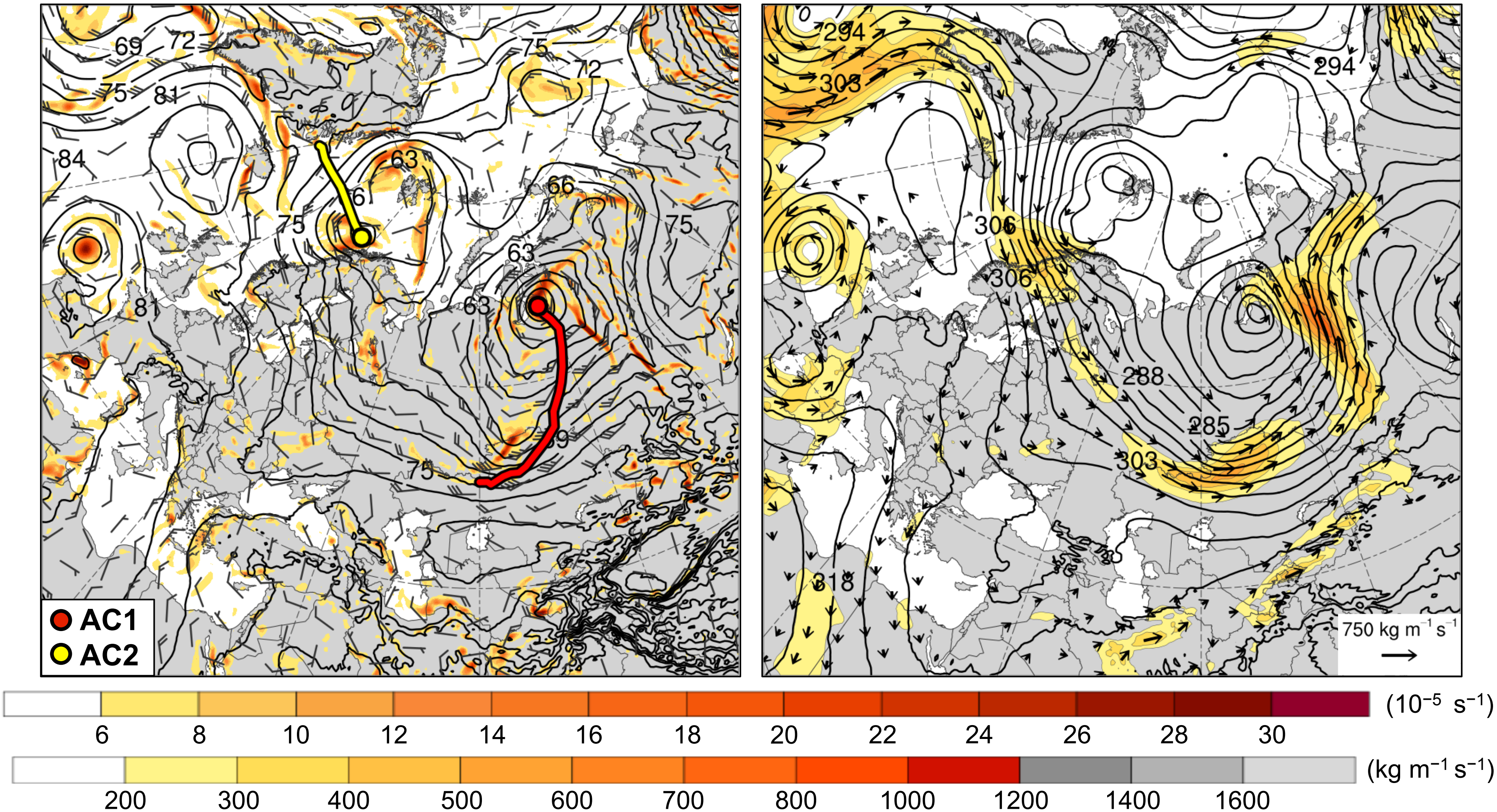
925-hPa relative vorticity (10^{-5} s^{-1}, shaded), geopotential height (dam, black), and winds (m s^{-1}, flags and barbs)	IVT (kg m^{-1} s^{-1}, shaded and vectors) and 700-hPa geopotential height (dam, black)

0000 UTC 3 Jun 2018



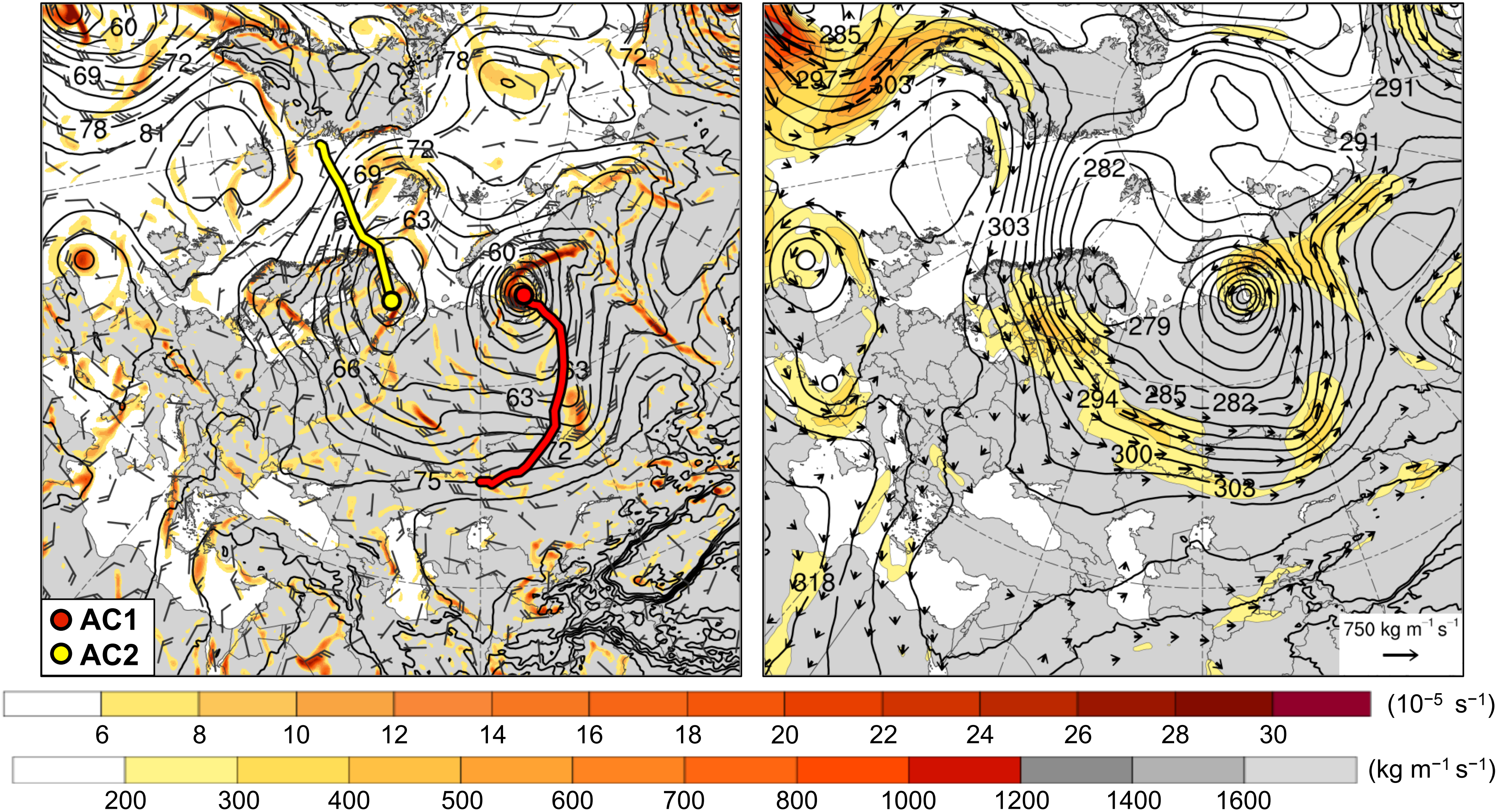
925-hPa relative vorticity (10^{-5} s^{-1}, shaded), geopotential height (dam, black), and winds (m s^{-1}, flags and barbs)	IVT (kg m^{-1} s^{-1}, shaded and vectors) and 700-hPa geopotential height (dam, black)

1200 UTC 3 Jun 2018



925-hPa relative vorticity (10^{-5} s^{-1}, shaded), geopotential height (dam, black), and winds (m s^{-1}, flags and barbs)	IVT (kg m^{-1} s^{-1}, shaded and vectors) and 700-hPa geopotential height (dam, black)

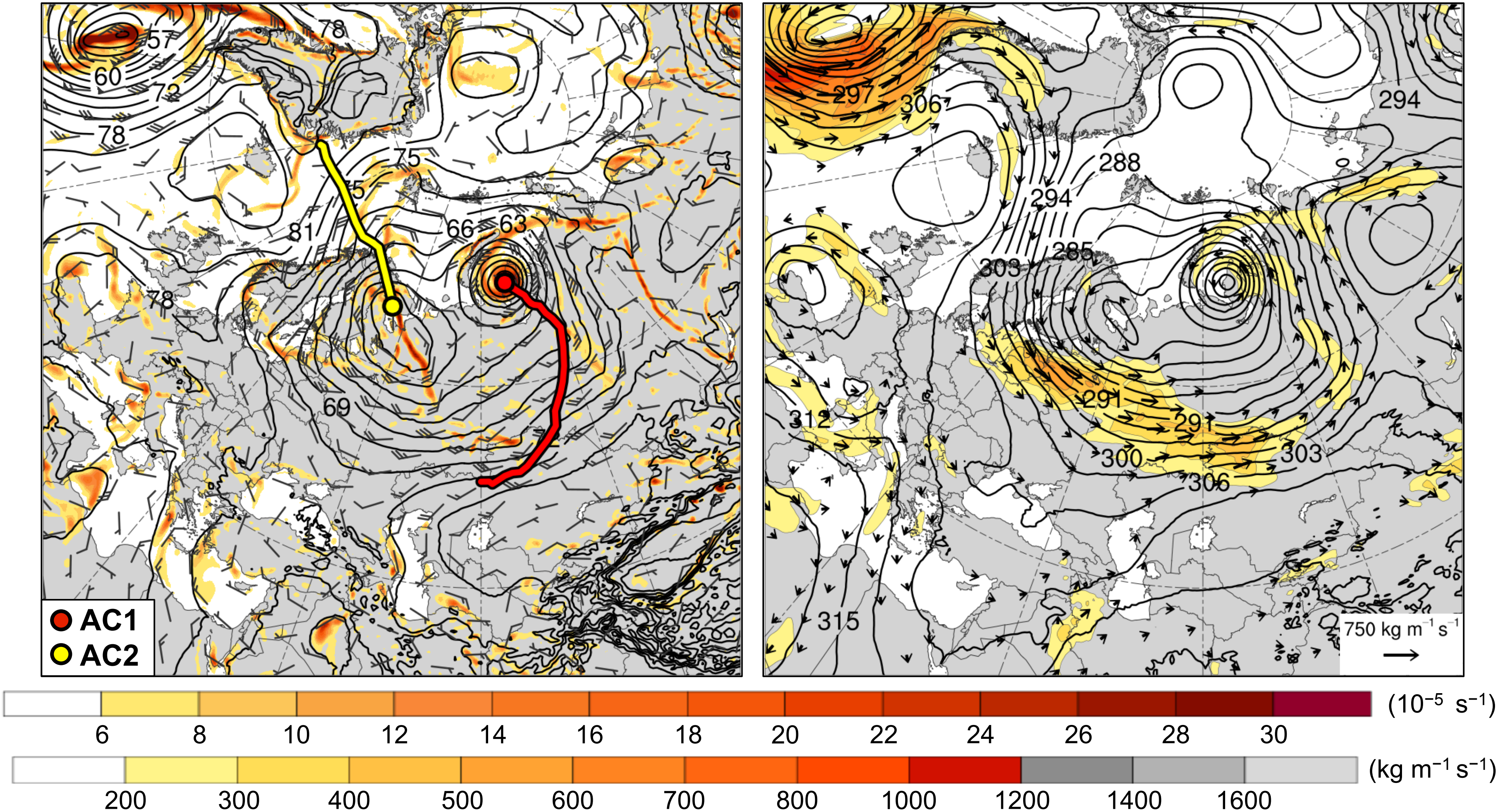
0000 UTC 4 Jun 2018



925-hPa relative vorticity (10^{-5} s^{-1}, shaded), geopotential height (dam, black), and winds (m s^{-1}, flags and barbs)

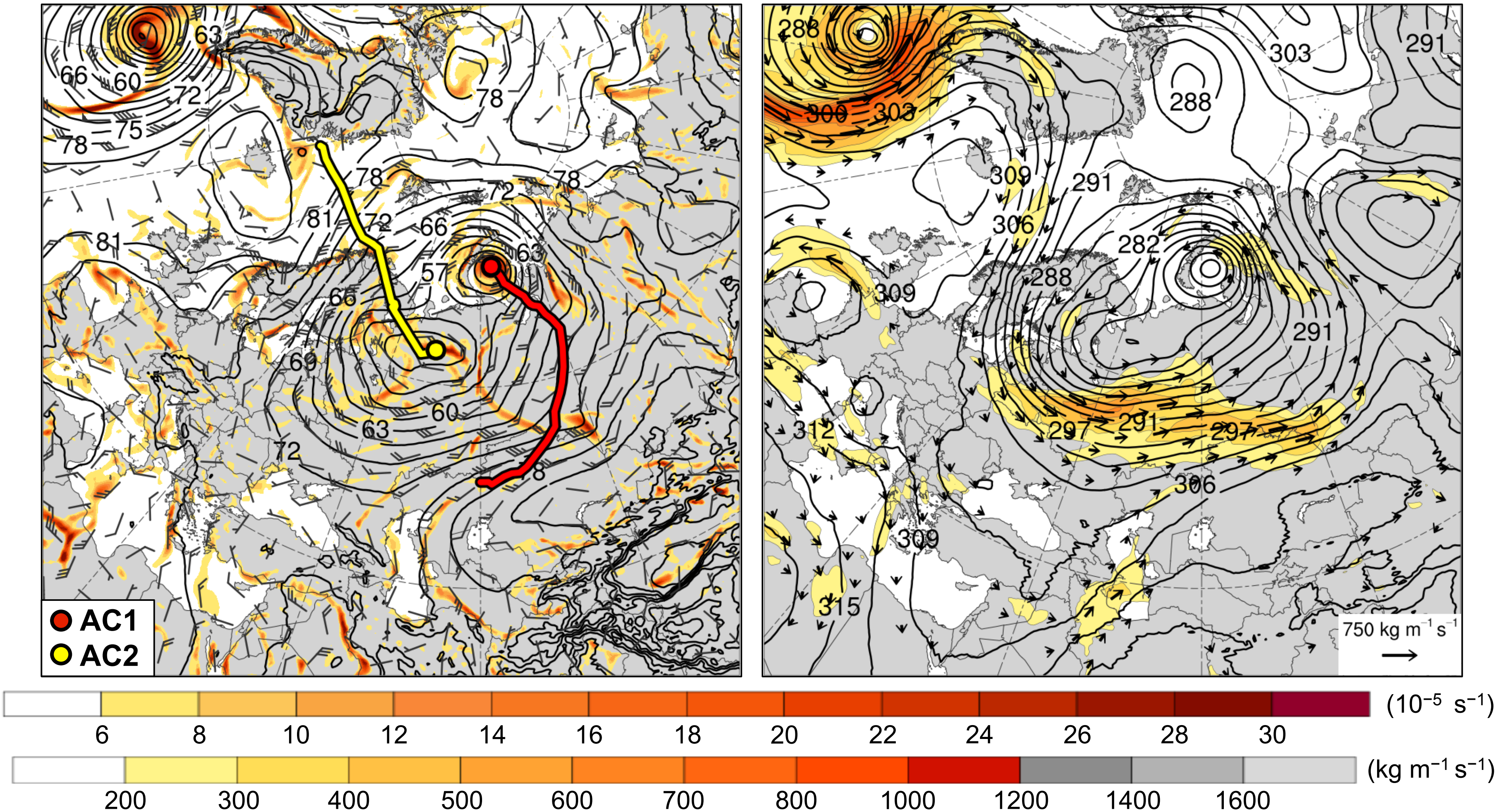
IVT (kg m^{-1} s^{-1}, shaded and vectors) and 700-hPa geopotential height (dam, black)

1200 UTC 4 Jun 2018



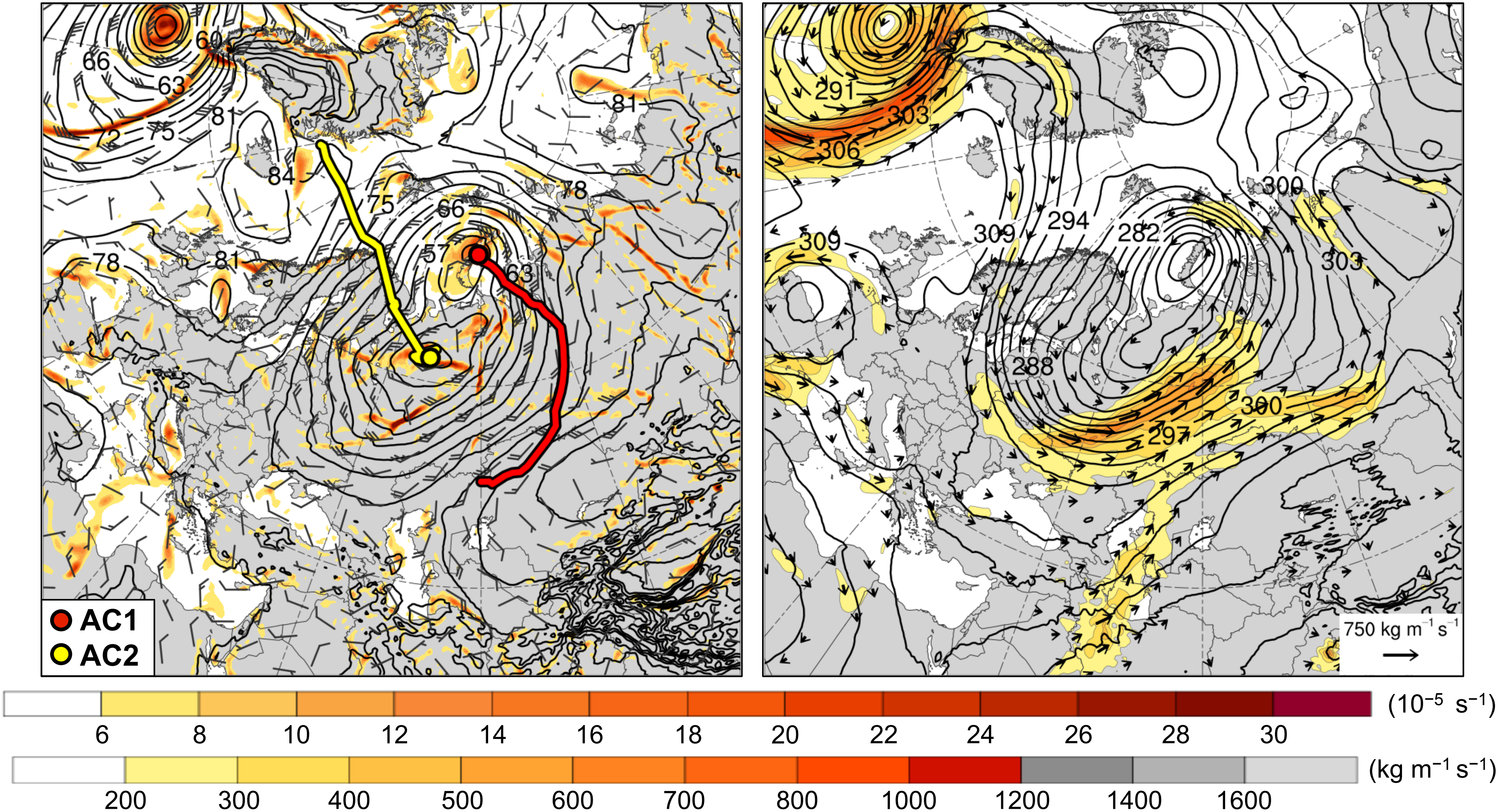
925-hPa relative vorticity (10^{-5} s^{-1}, shaded), geopotential height (dam, black), and winds (m s^{-1}, flags and barbs)	IVT (kg m^{-1} s^{-1}, shaded and vectors) and 700-hPa geopotential height (dam, black)

0000 UTC 5 Jun 2018



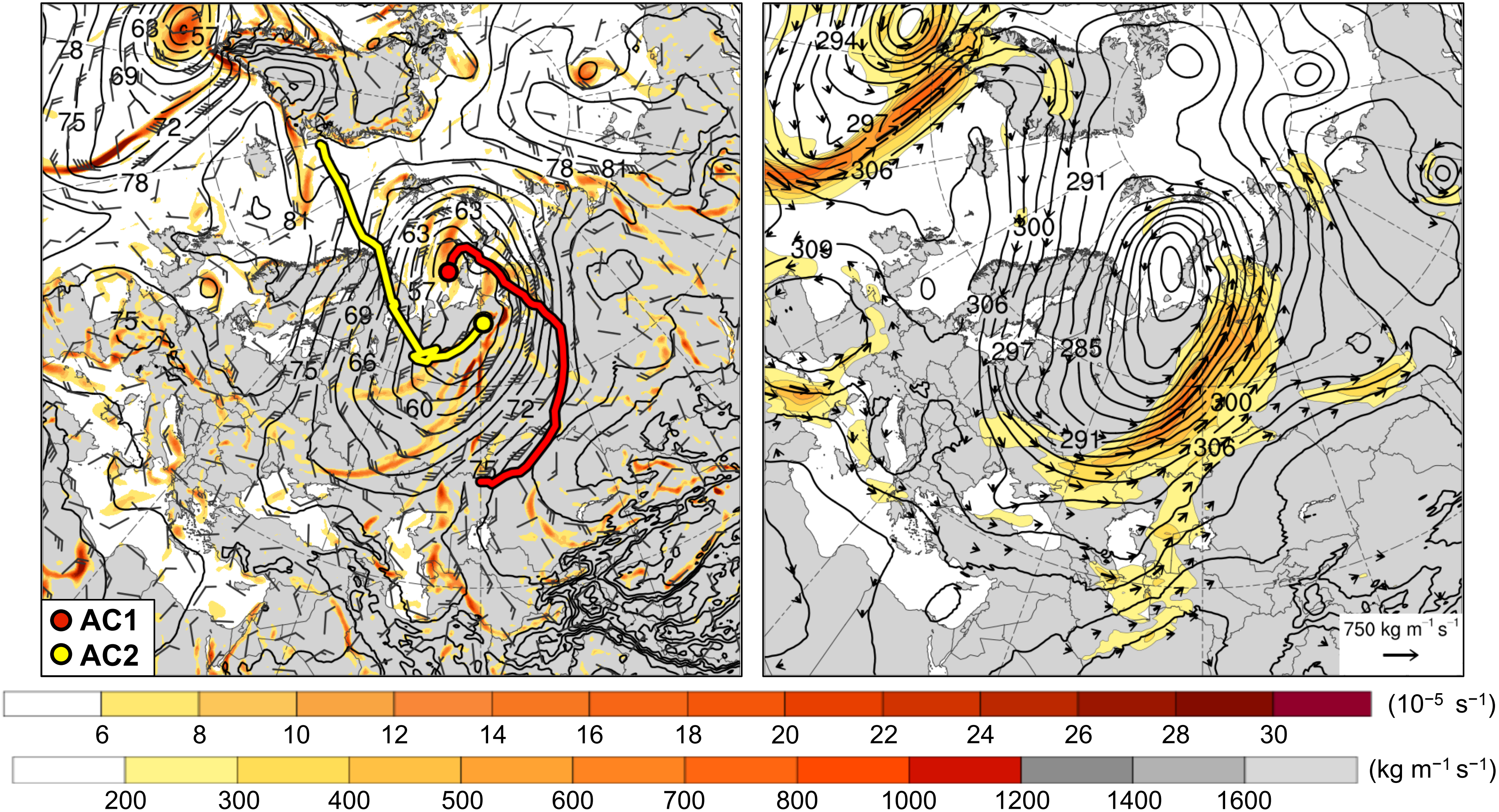
925-hPa relative vorticity (10^{-5} s^{-1}, shaded), geopotential height (dam, black), and winds (m s^{-1}, flags and barbs)	IVT (kg m^{-1} s^{-1}, shaded and vectors) and 700-hPa geopotential height (dam, black)

1200 UTC 5 Jun 2018



925-hPa relative vorticity (10^{-5} s^{-1}, shaded), geopotential height (dam, black), and winds (m s^{-1}, flags and barbs)	IVT (kg m^{-1} s^{-1}, shaded and vectors) and 700-hPa geopotential height (dam, black)

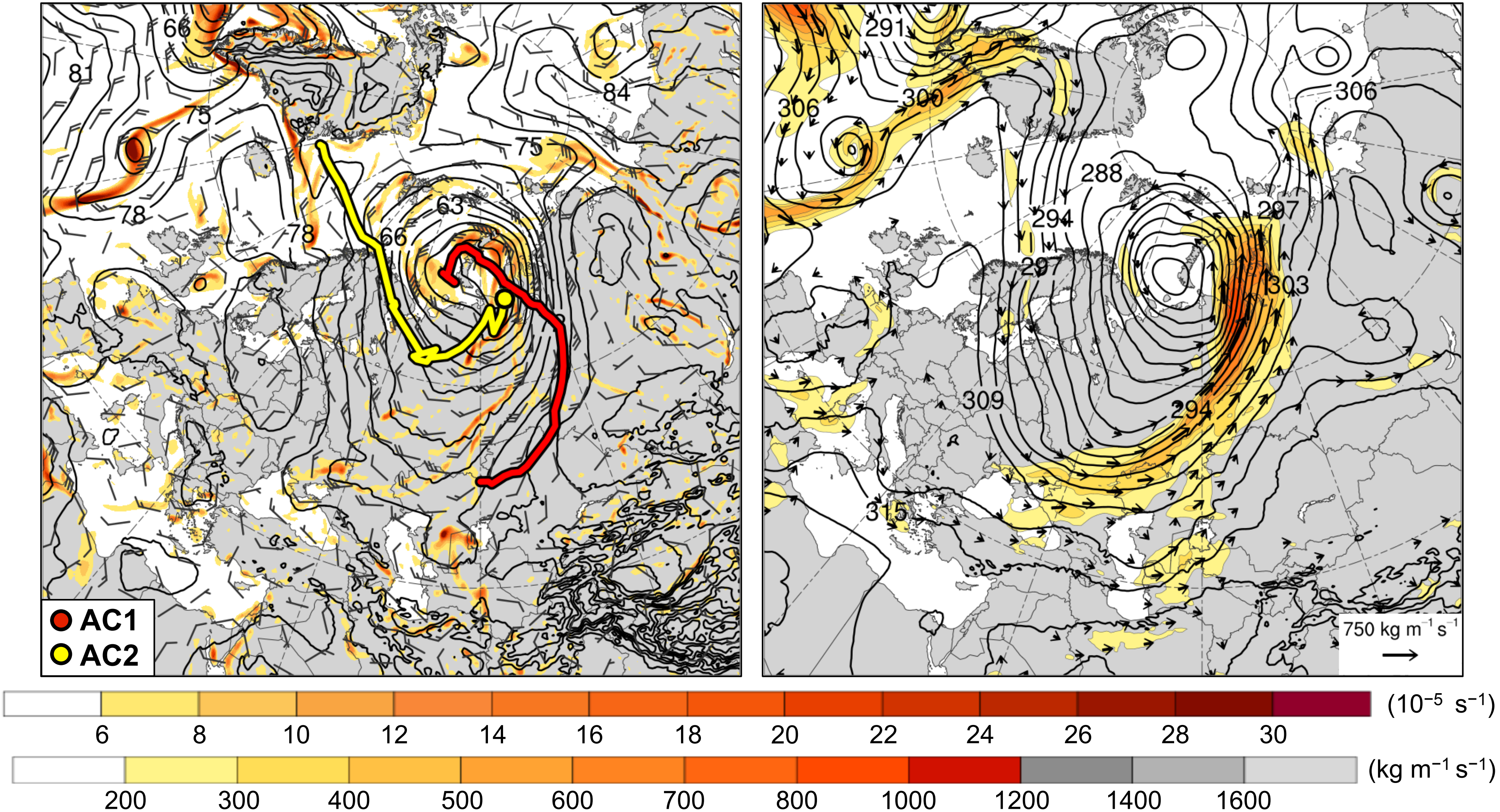
0000 UTC 6 Jun 2018



925-hPa relative vorticity (10^{-5} s^{-1}, shaded), geopotential height (dam, black), and winds (m s^{-1}, flags and barbs)

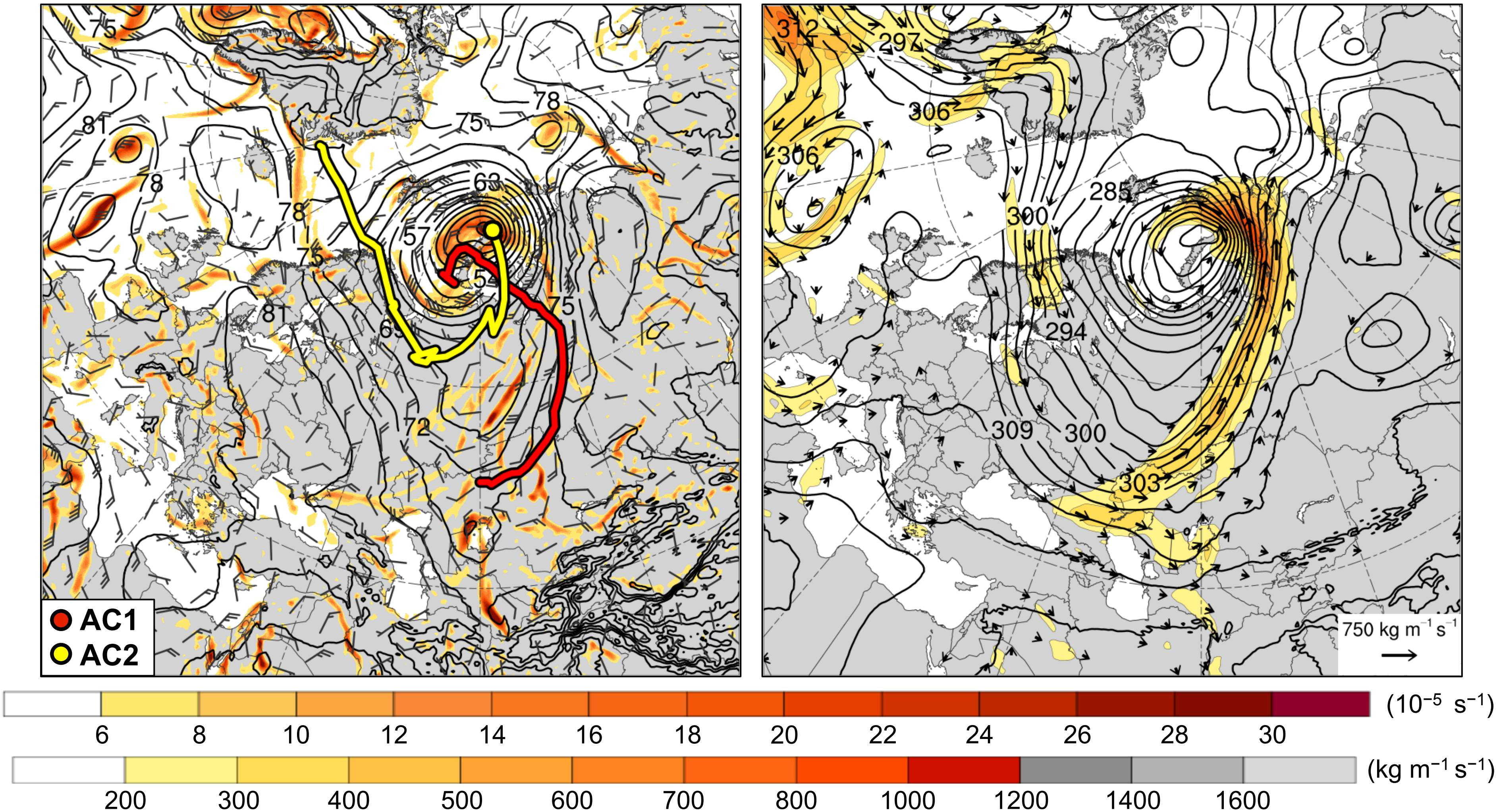
IVT (kg m^{-1} s^{-1}, shaded and vectors) and 700-hPa geopotential height (dam, black)

1200 UTC 6 Jun 2018



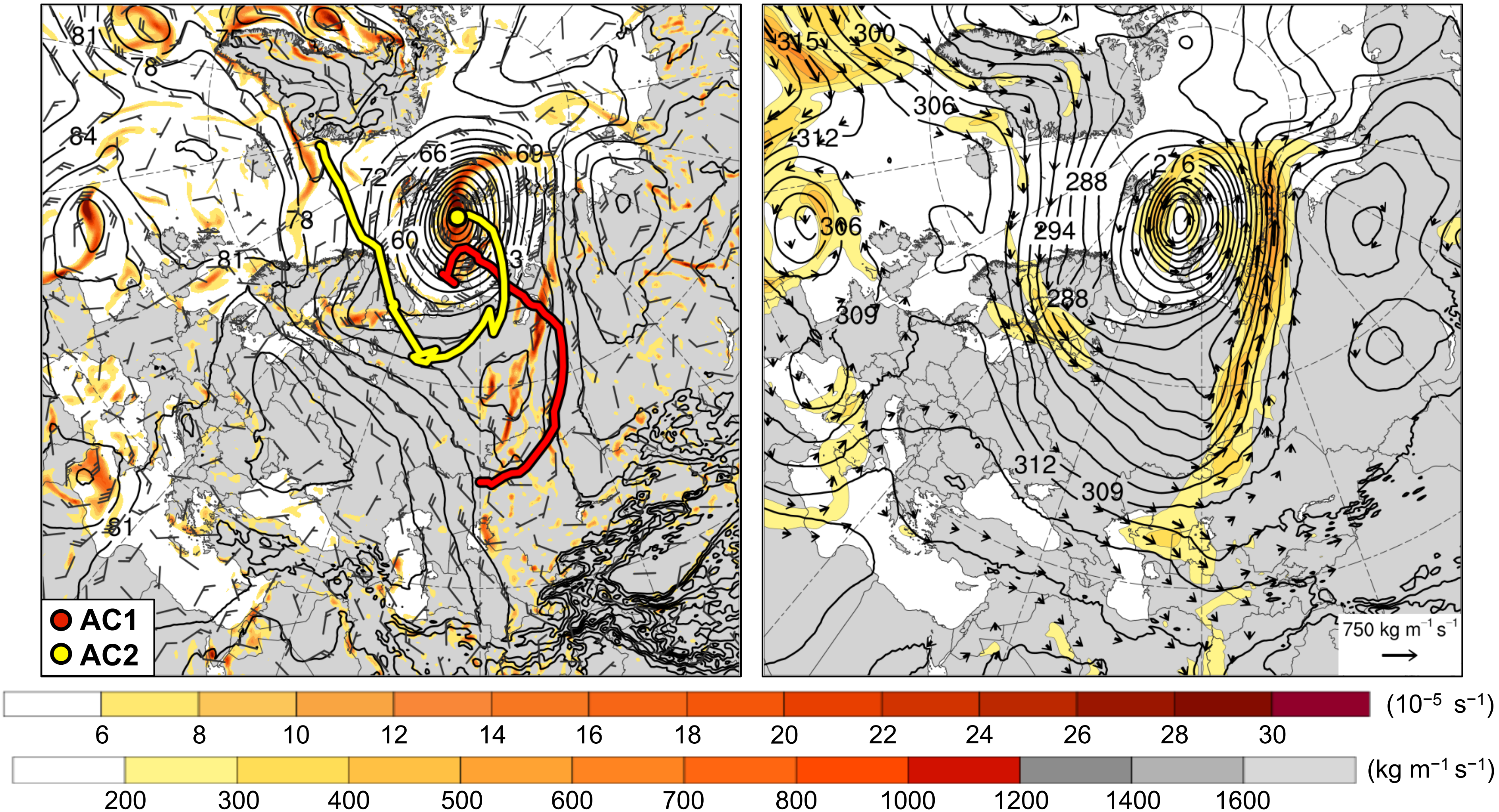
925-hPa relative vorticity (10^{-5} s^{-1}, shaded), geopotential height (dam, black), and winds (m s^{-1}, flags and barbs)	IVT (kg m^{-1} s^{-1}, shaded and vectors) and 700-hPa geopotential height (dam, black)

0000 UTC 7 Jun 2018



925-hPa relative vorticity (10^{-5} s^{-1}, shaded), geopotential height (dam, black), and winds (m s^{-1}, flags and barbs)	IVT (kg m^{-1} s^{-1}, shaded and vectors) and 700-hPa geopotential height (dam, black)

1200 UTC 7 Jun 2018

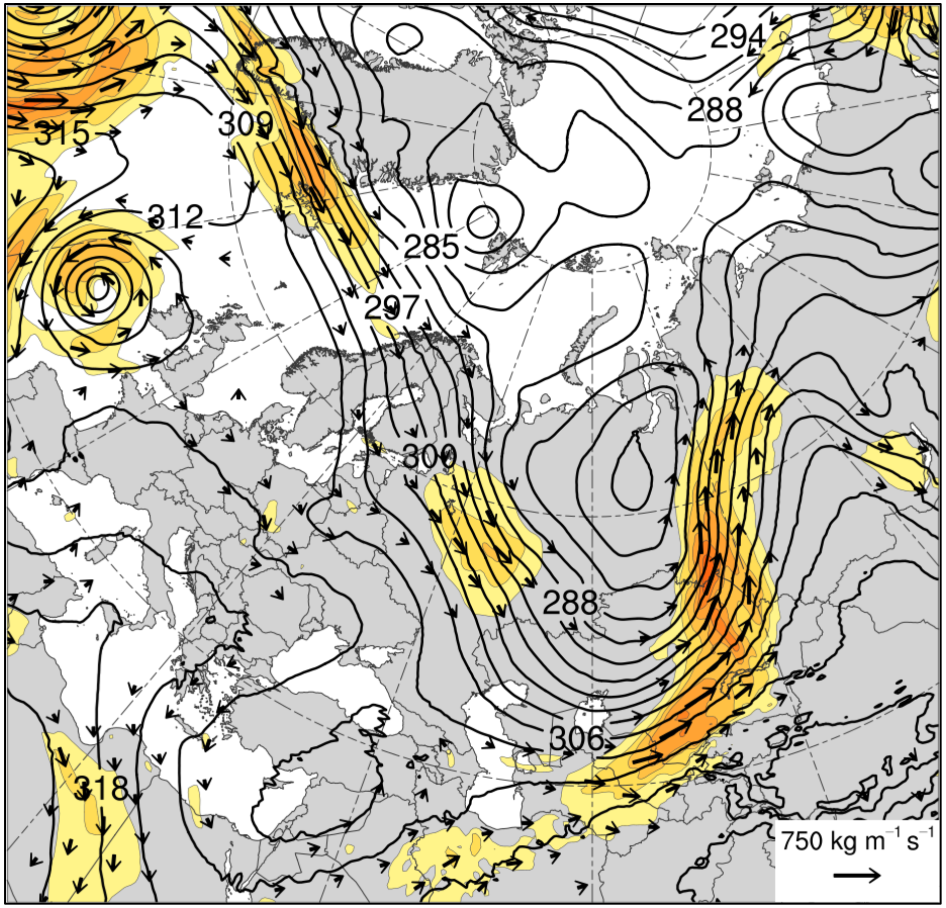


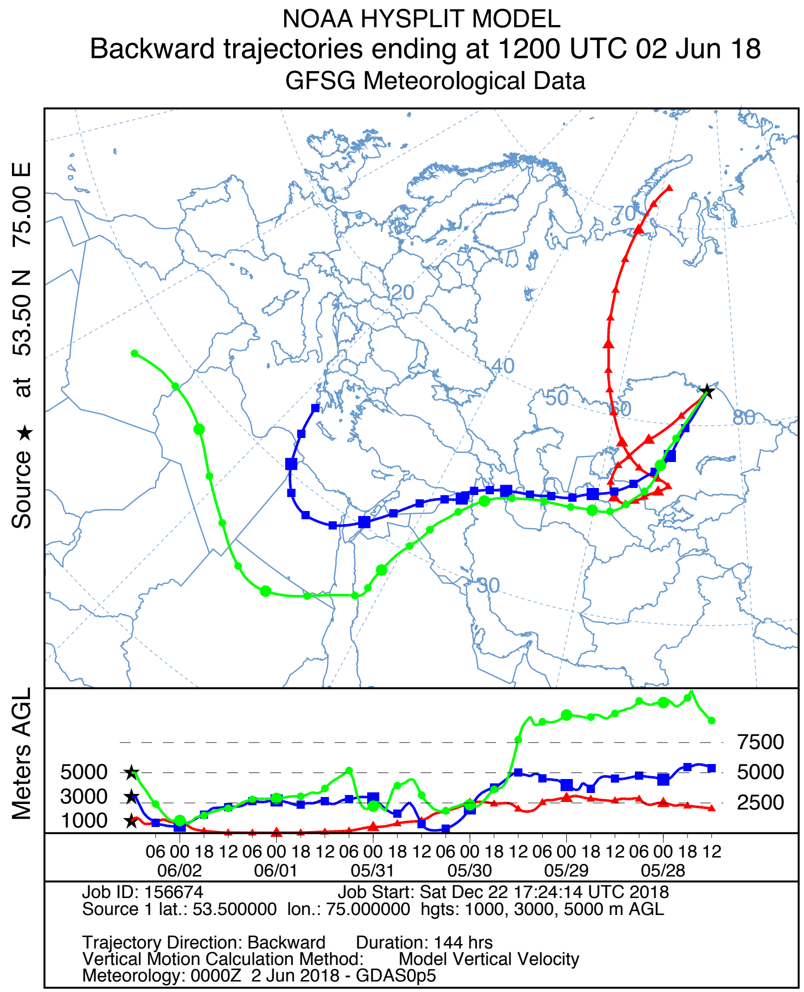
925-hPa relative vorticity (10^{-5} s^{-1}, shaded), geopotential height (dam, black), and winds (m s^{-1}, flags and barbs)

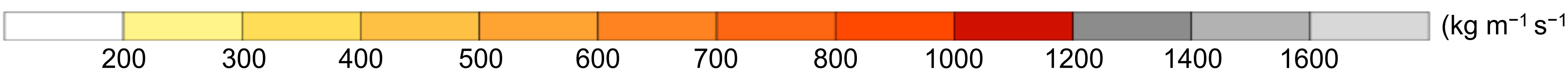
IVT (kg m^{-1} s^{-1}, shaded and vectors) and 700-hPa geopotential height (dam, black)

Lagrangian Perspective: Selected Trajectories (AC1)

1200 UTC 2 Jun 2018

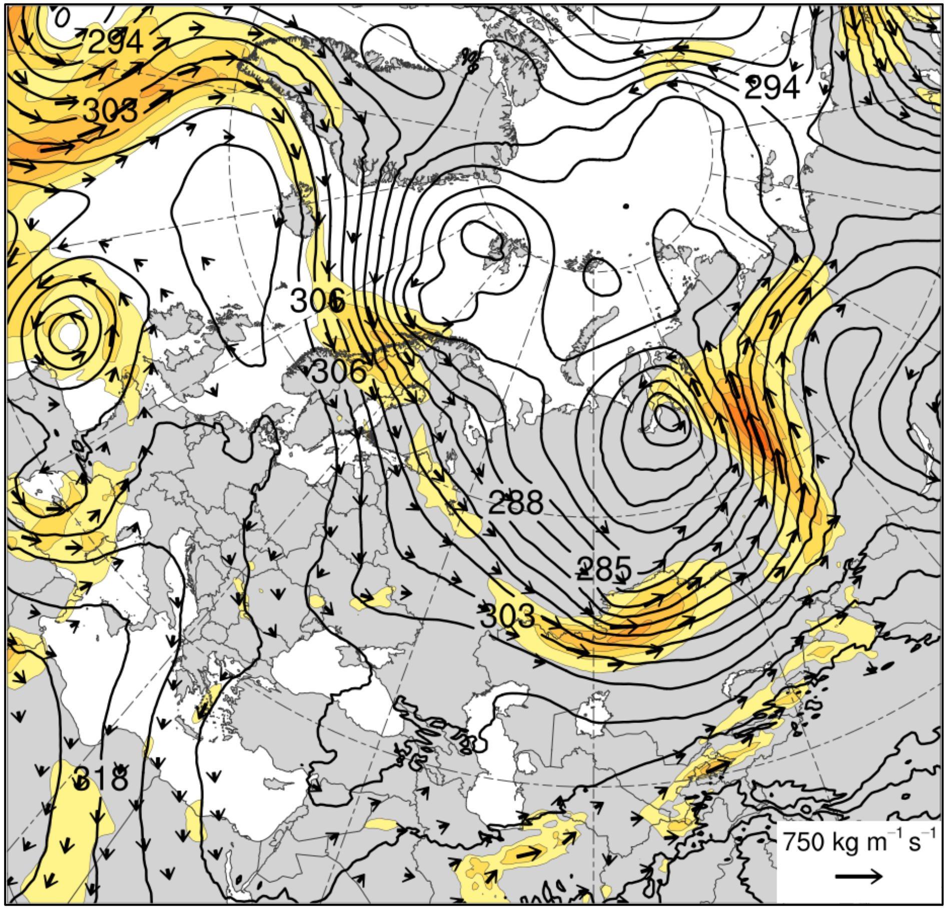


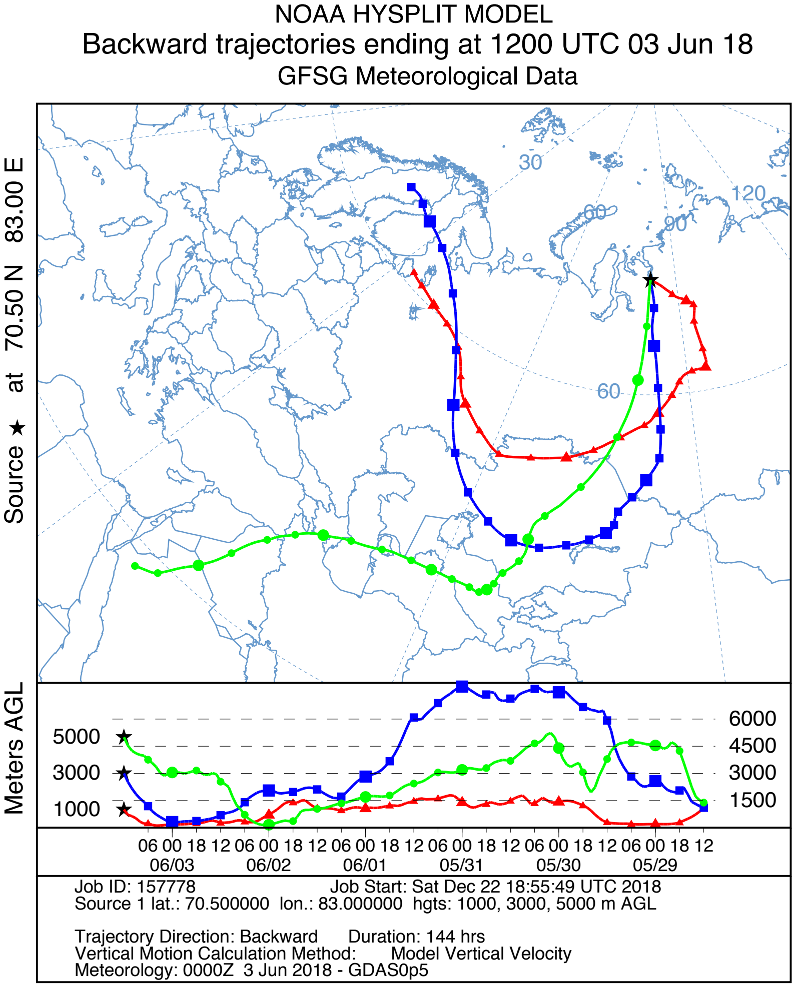


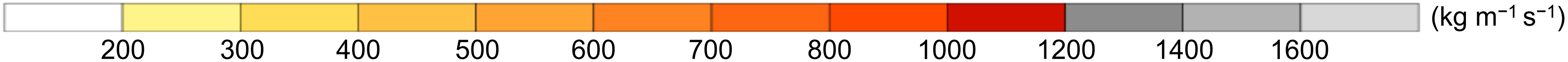


IVT (kg m^{-1} s^{-1}, shaded and vectors) and 700-hPa geopotential height (dam, black)	NOAA HYSPLIT 5-d backward trajectories ending at 1200 UTC 2 Jun 2018

1200 UTC 3 Jun 2018





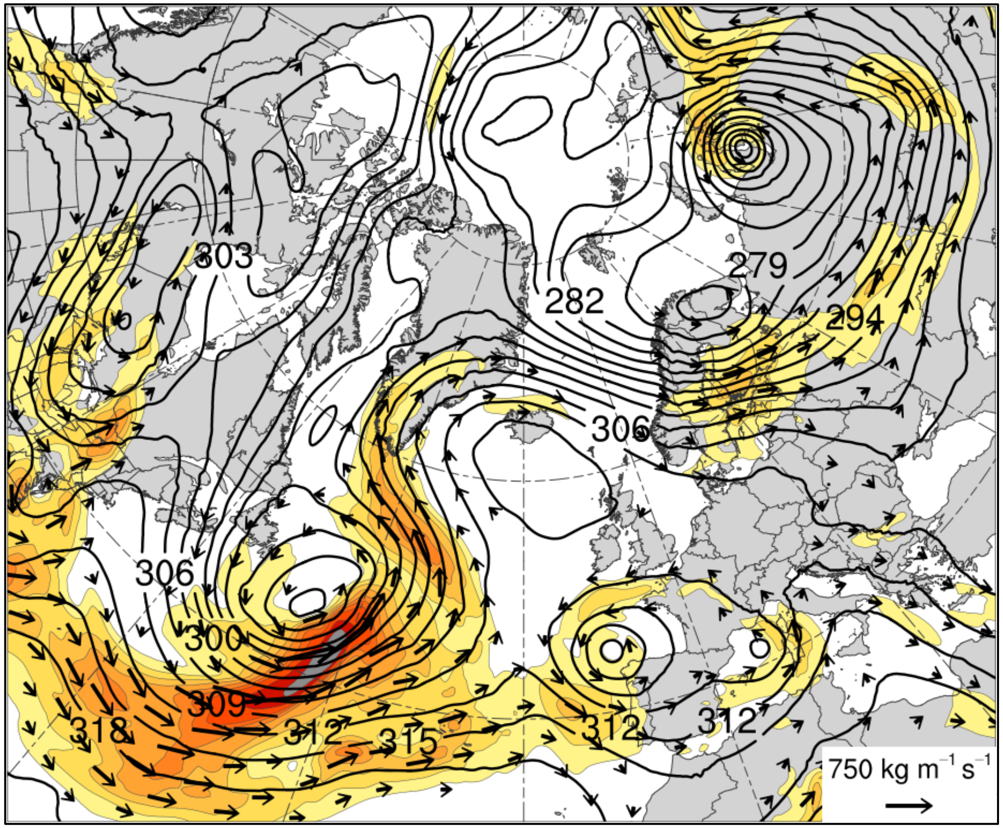


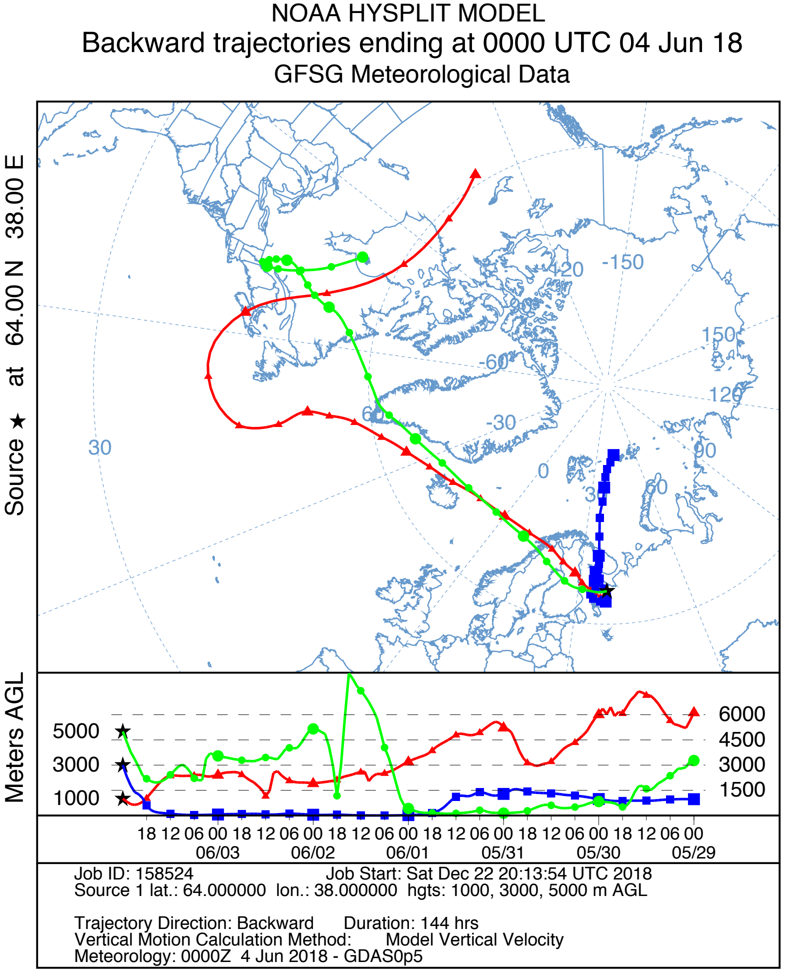
IVT (kg m^{-1} s^{-1}, shaded and vectors) and 700-hPa geopotential height (dam, black)

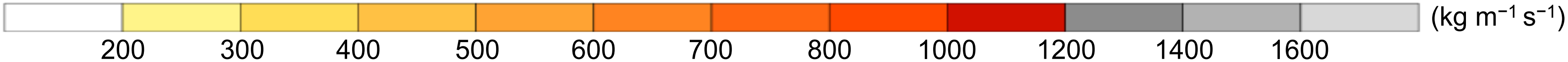
NOAA HYSPLIT 5-d backward trajectories ending at 1200 UTC 3 Jun 2018

Lagrangian Perspective: Selected Trajectories (AC2)

0000 UTC 4 Jun 2018

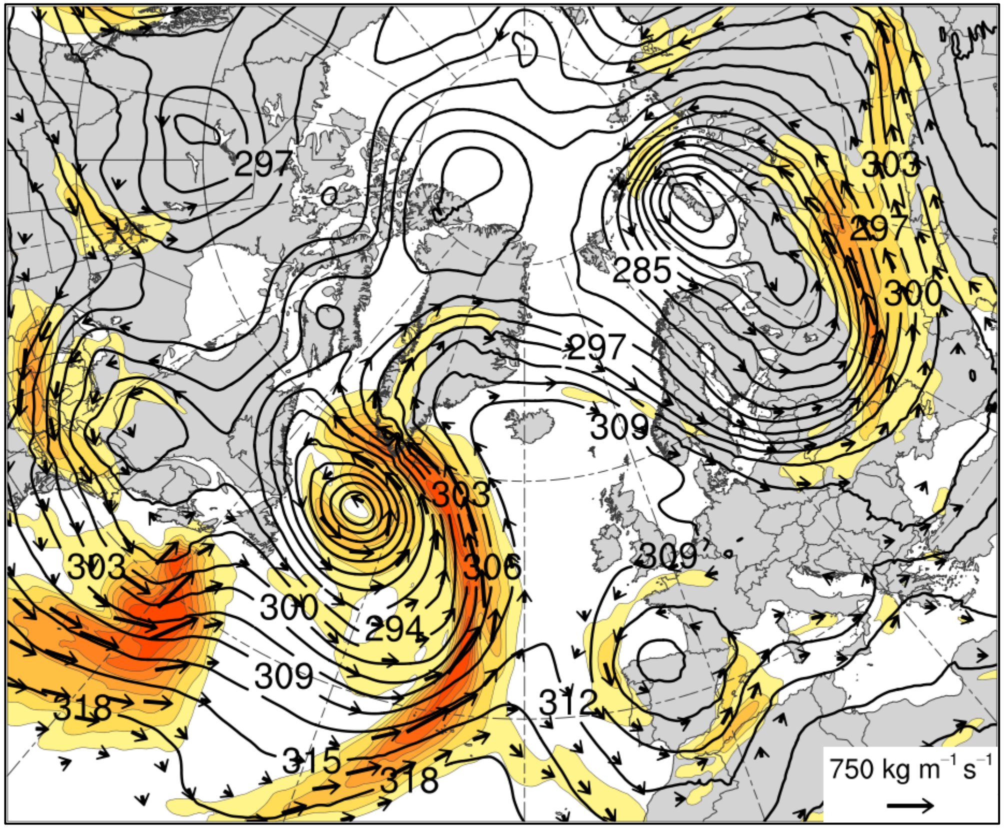


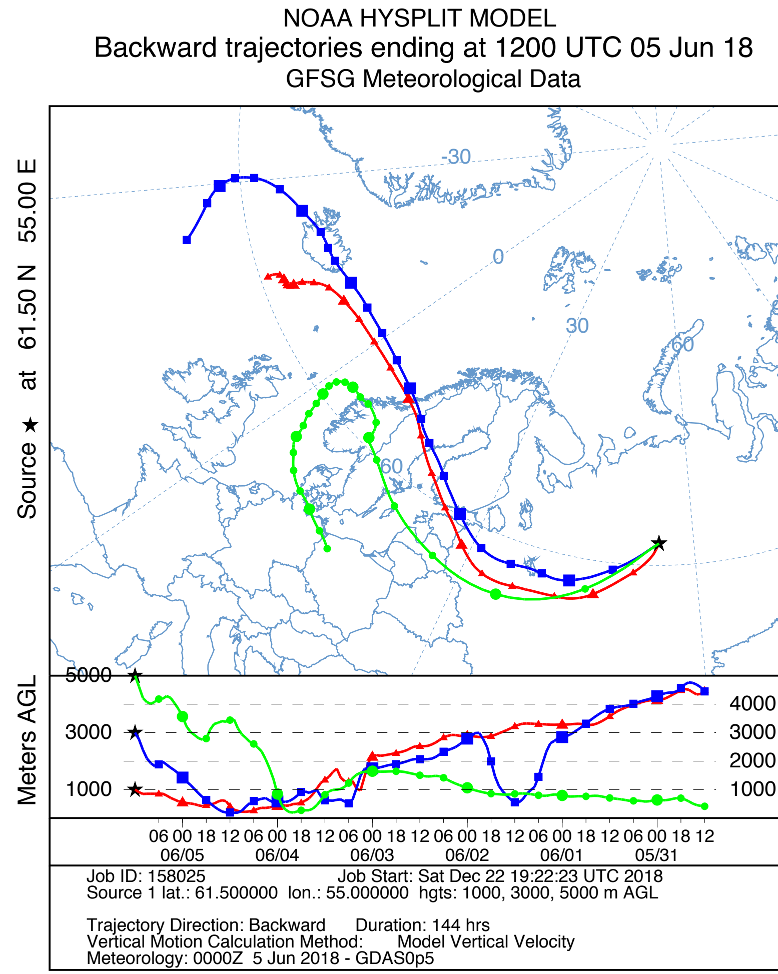


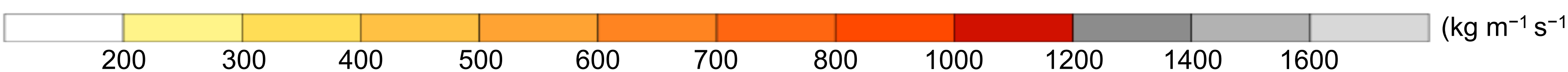


IVT (kg m^{-1} s^{-1}, shaded and vectors) and 700-hPa geopotential height (dam, black)	NOAA HYSPLIT 5-d backward trajectories ending at 0000 UTC 4 June 2018

1200 UTC 5 Jun 2018



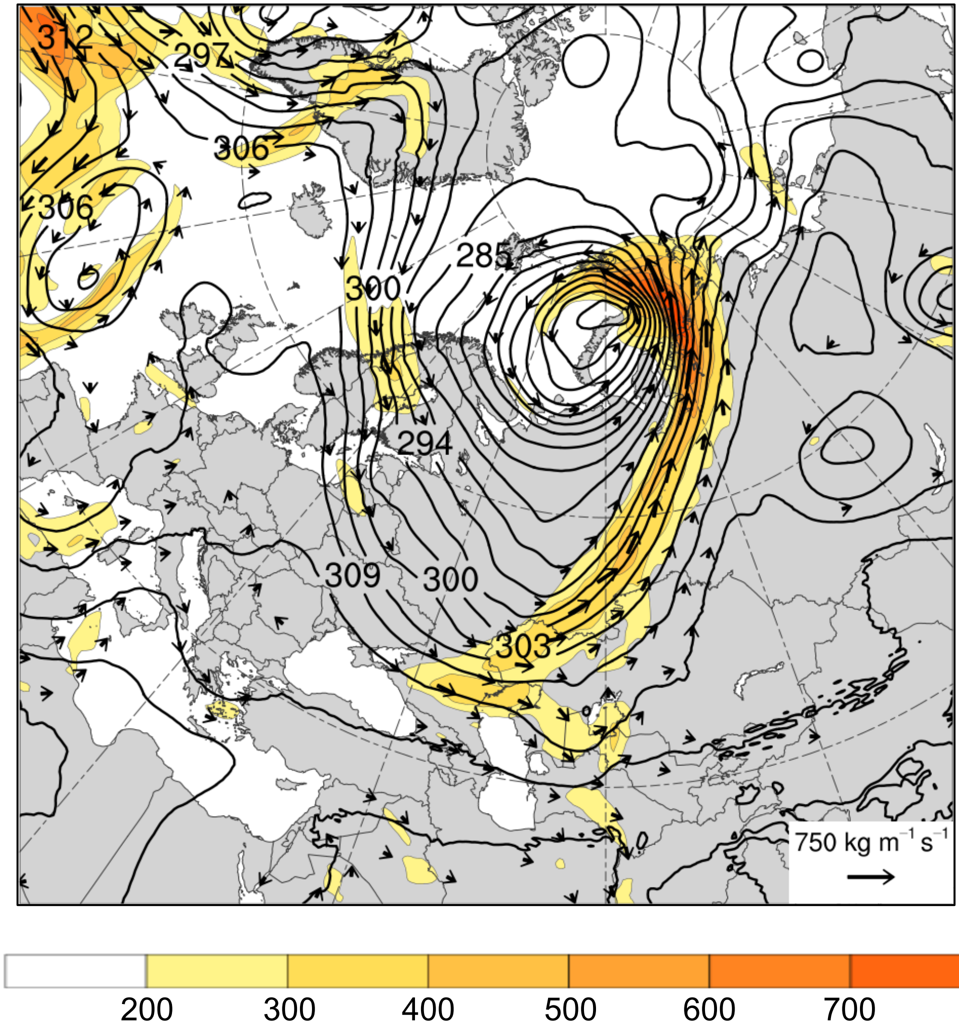


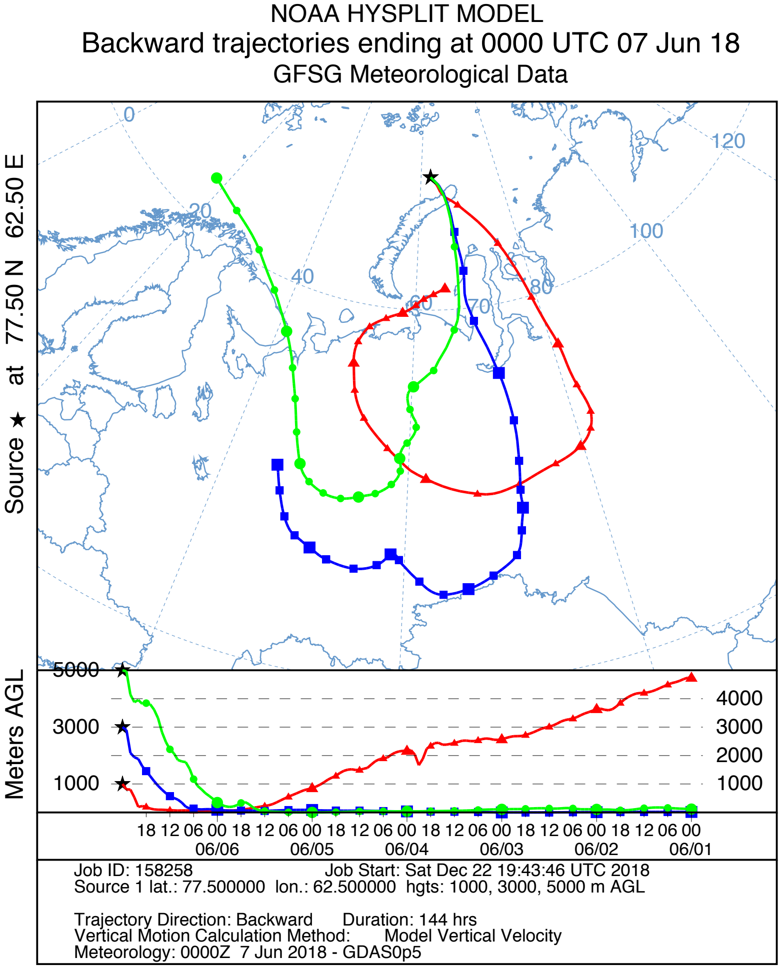


IVT (kg m^{-1} s^{-1}, shaded and vectors) and 700-hPa geopotential height (dam, black)

NOAA HYSPLIT 5-d backward trajectories ending at 1200 UTC 5 June 2018

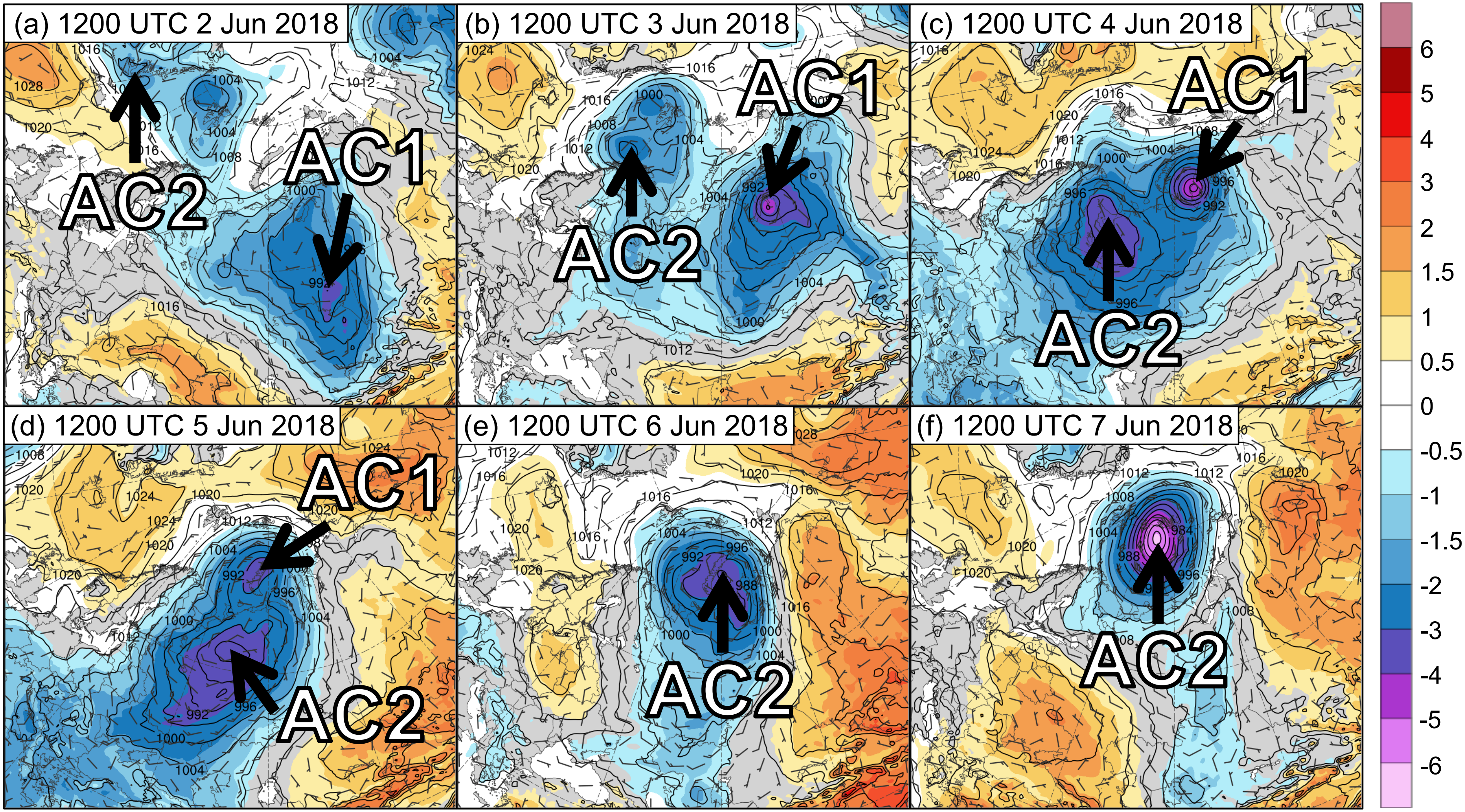
0000 UTC 7 Jun 2018





IVT (kg m^{-1} s^{-1}, shaded and vectors) and 700-hPa geopotential height (dam, black)	NOAA HYSPLIT 5-d backward trajectories ending at 0000 UTC 7 June 2018

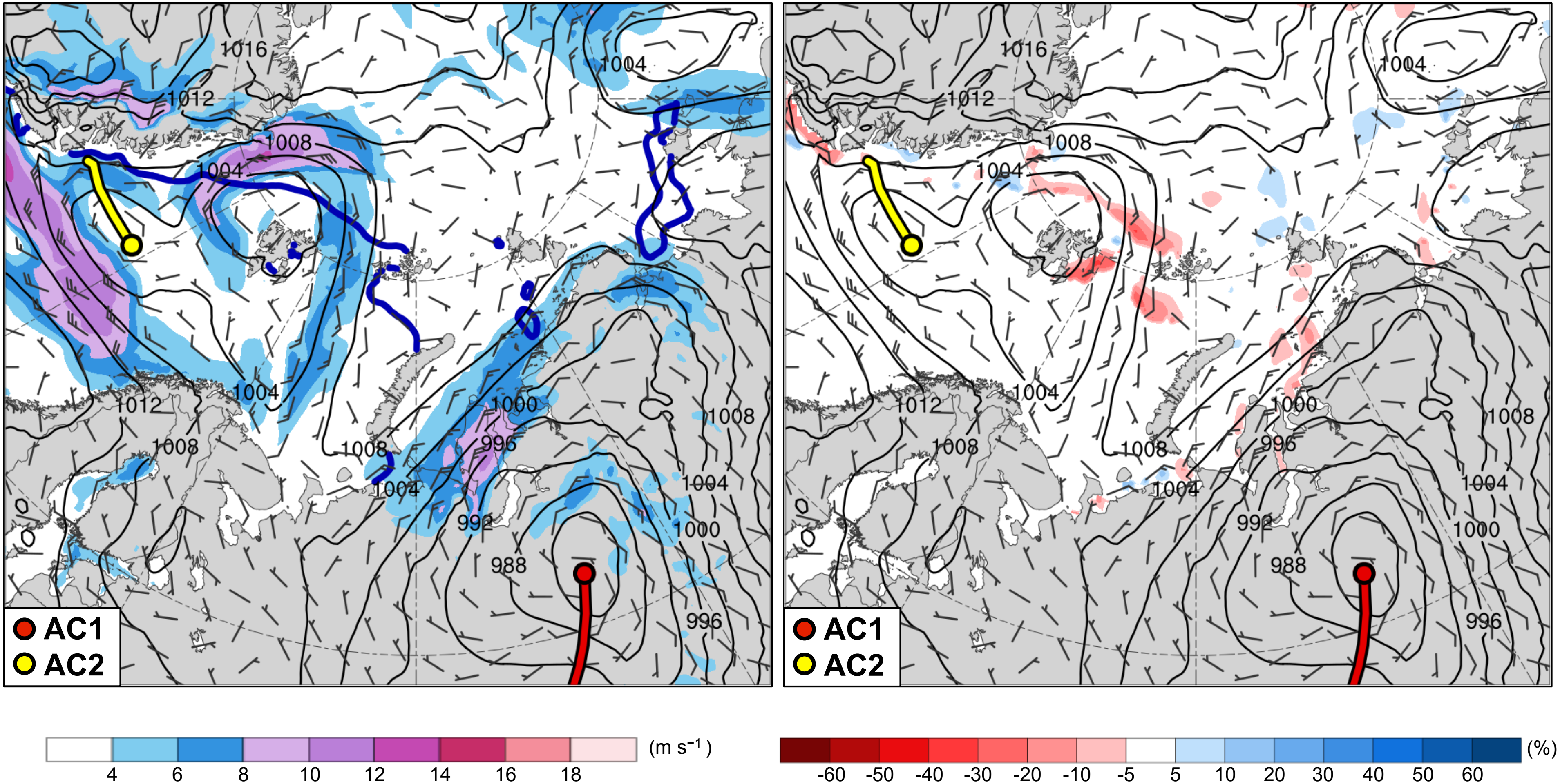
Interactions between Arctic Cyclones



SLP (hPa, black), 10-m winds (m s^{-1}, flags and barbs), and standardized SLP anomalies (σ, shaded)

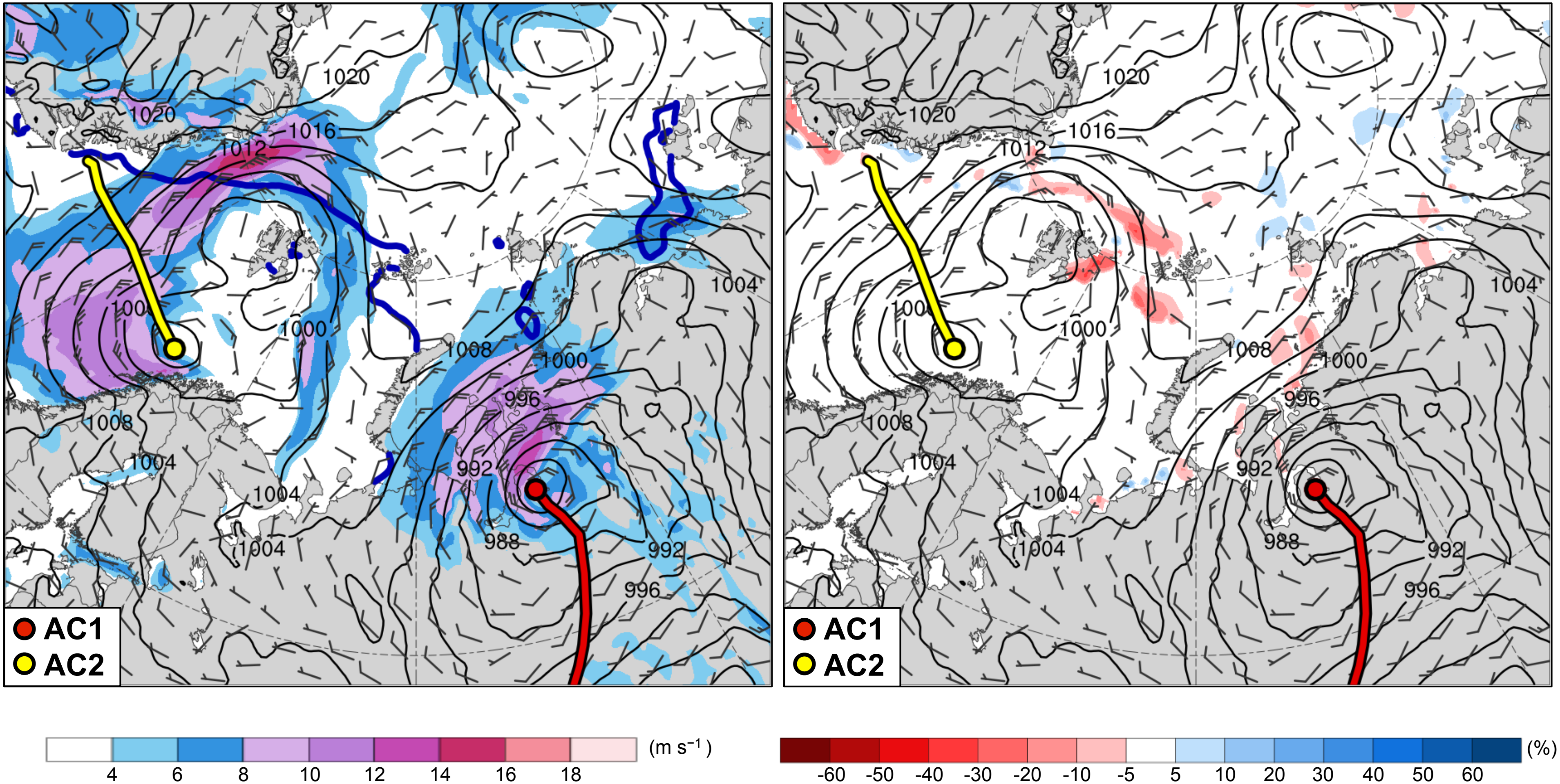
Impacts of AC1 and AC2 on Arctic Sea Ice

0000 UTC 3 Jun 2018



SLP (hPa, black), 10-m wind speed (m s^{-1}, shaded) and wind (m s^{-1}, barbs), and 50% contour of sea-ice concentration (thick blue)	Change in sea-ice concentration (%, shaded) since 0000 UTC 1 June 2018, SLP (hPa, black), and 10-m wind speed (m s^{-1}, shaded)

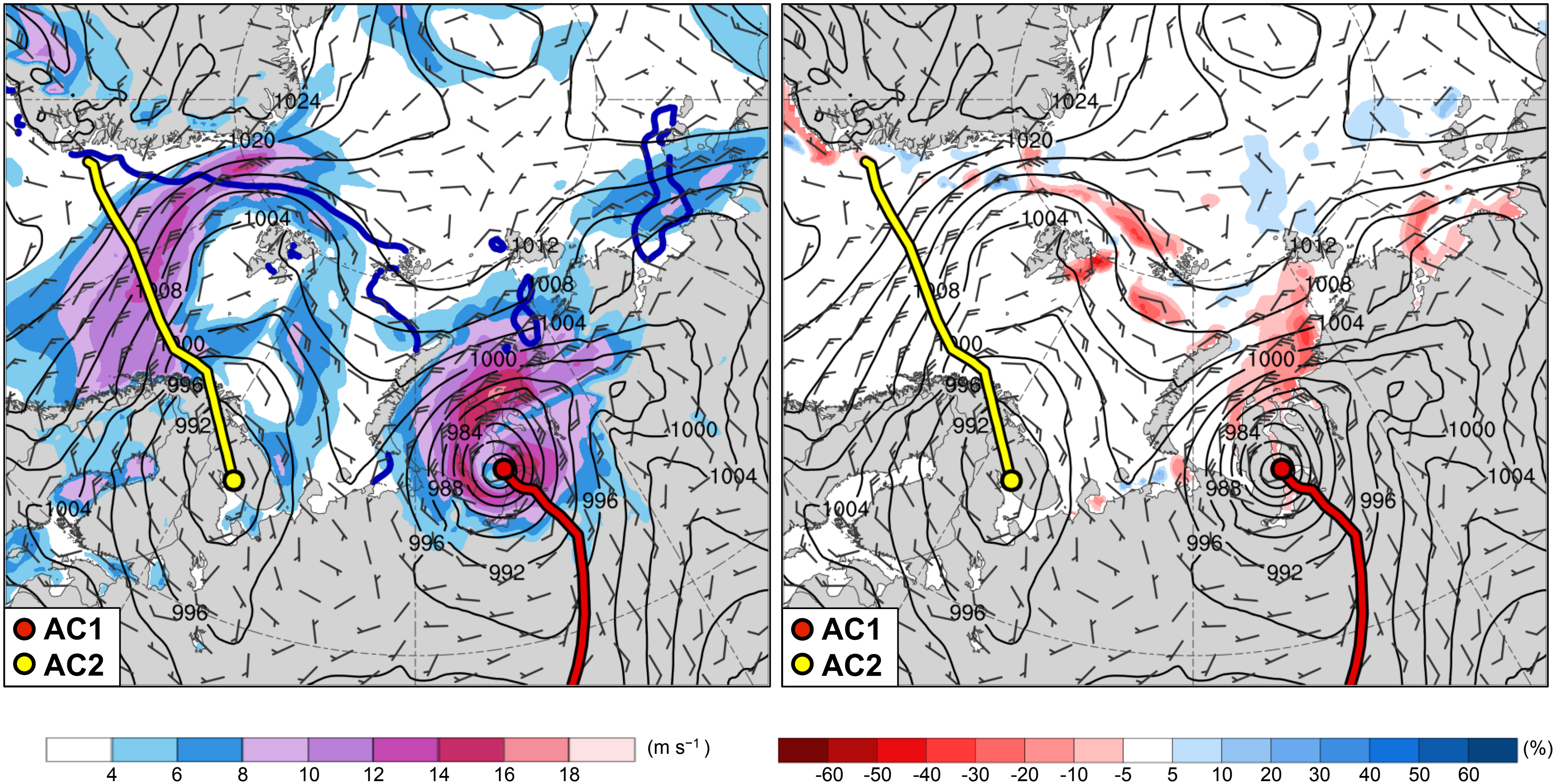
1200 UTC 3 Jun 2018



SLP (hPa, black), 10-m wind speed (m s^{-1}, shaded) and wind (m s^{-1}, barbs), and 50% contour of sea-ice concentration (thick blue)

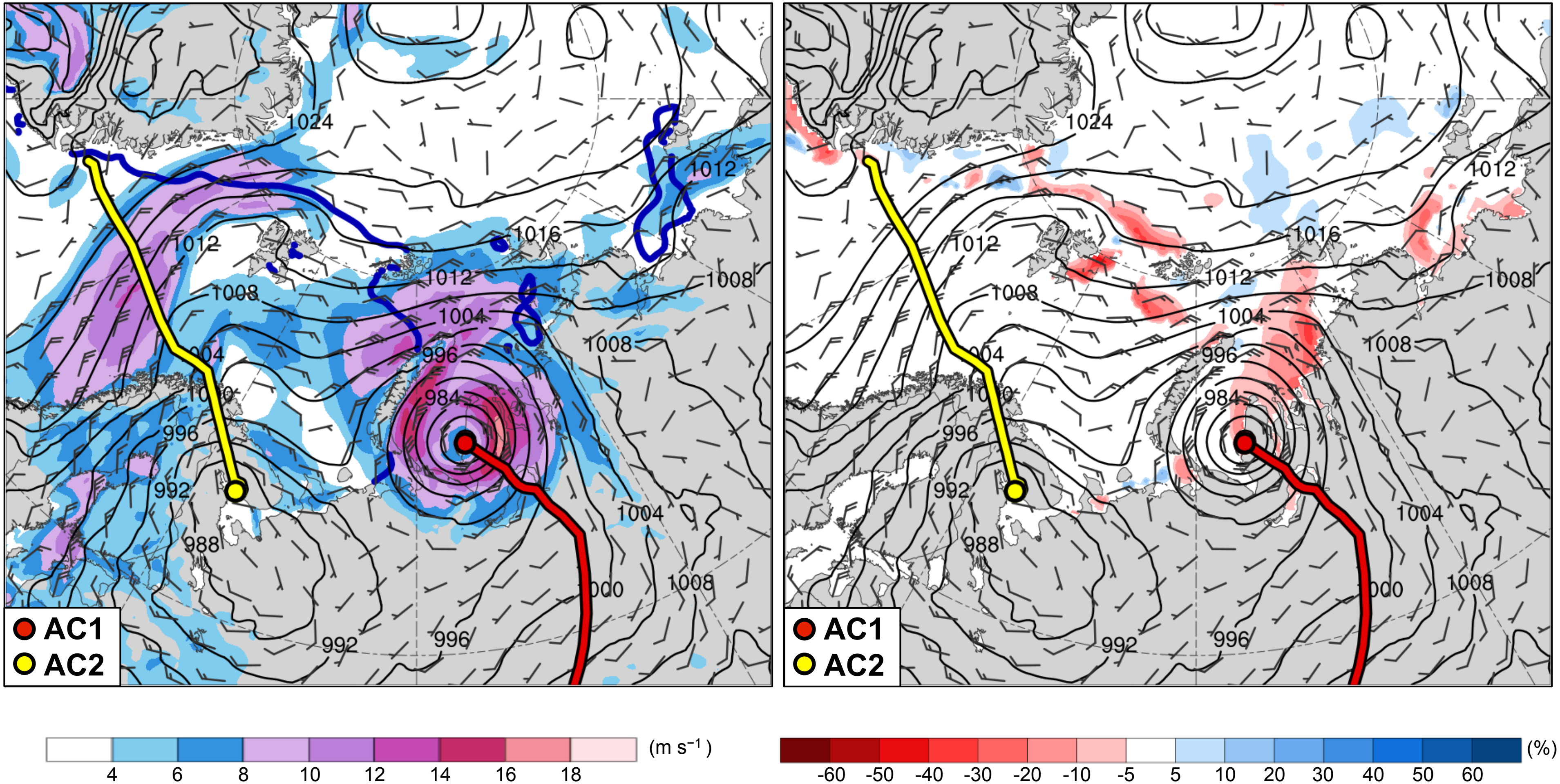
Change in sea-ice concentration (%, shaded) since 0000 UTC 1 June 2018, SLP (hPa, black), and 10-m wind speed (m s^{-1}, shaded)

0000 UTC 4 Jun 2018



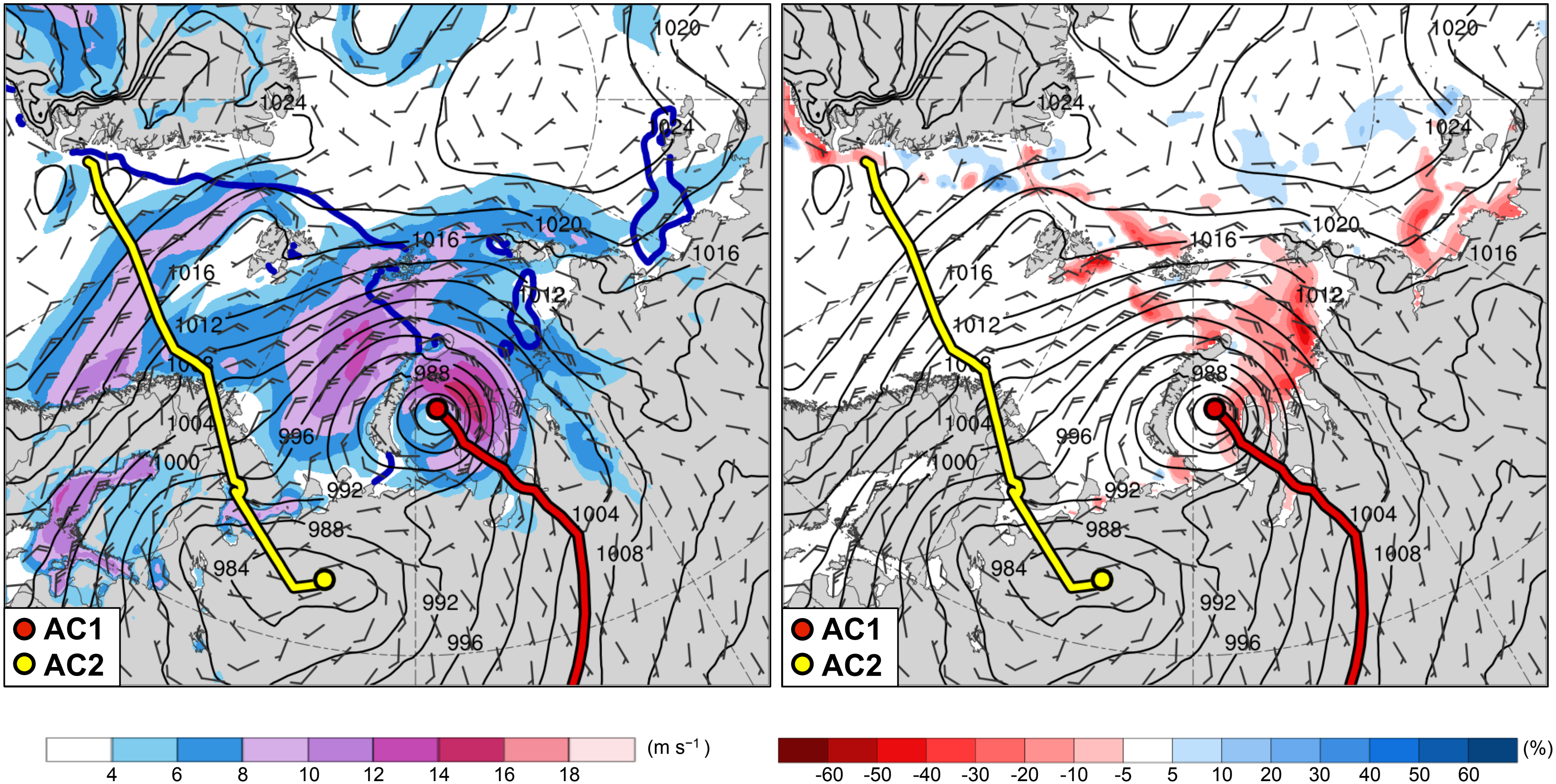
SLP (hPa, black), 10-m wind speed (m s^{-1}, shaded) and wind (m s^{-1}, barbs), and 50% contour of sea-ice concentration (thick blue)	Change in sea-ice concentration (%, shaded) since 0000 UTC 1 June 2018, SLP (hPa, black), and 10-m wind speed (m s^{-1}, shaded)

1200 UTC 4 Jun 2018



SLP (hPa, black), 10-m wind speed (m s^{-1}, shaded) and wind (m s^{-1}, barbs), and 50% contour of sea-ice concentration (thick blue)	Change in sea-ice concentration (%, shaded) since 0000 UTC 1 June 2018, SLP (hPa, black), and 10-m wind speed (m s^{-1}, shaded)

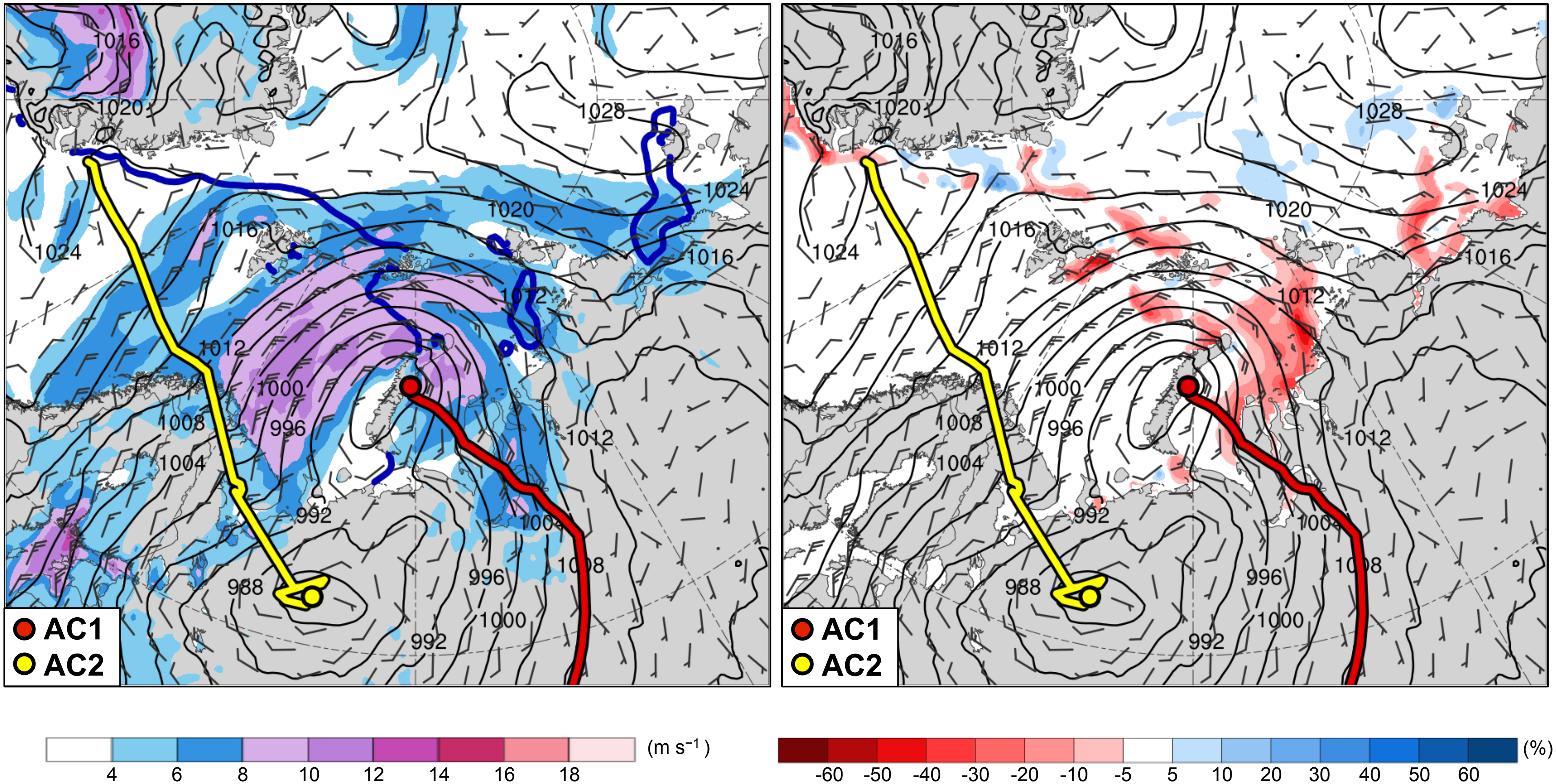
0000 UTC 5 Jun 2018



SLP (hPa, black), 10-m wind speed (m s^{-1}, shaded) and wind (m s^{-1}, barbs), and 50% contour of sea-ice concentration (thick blue)

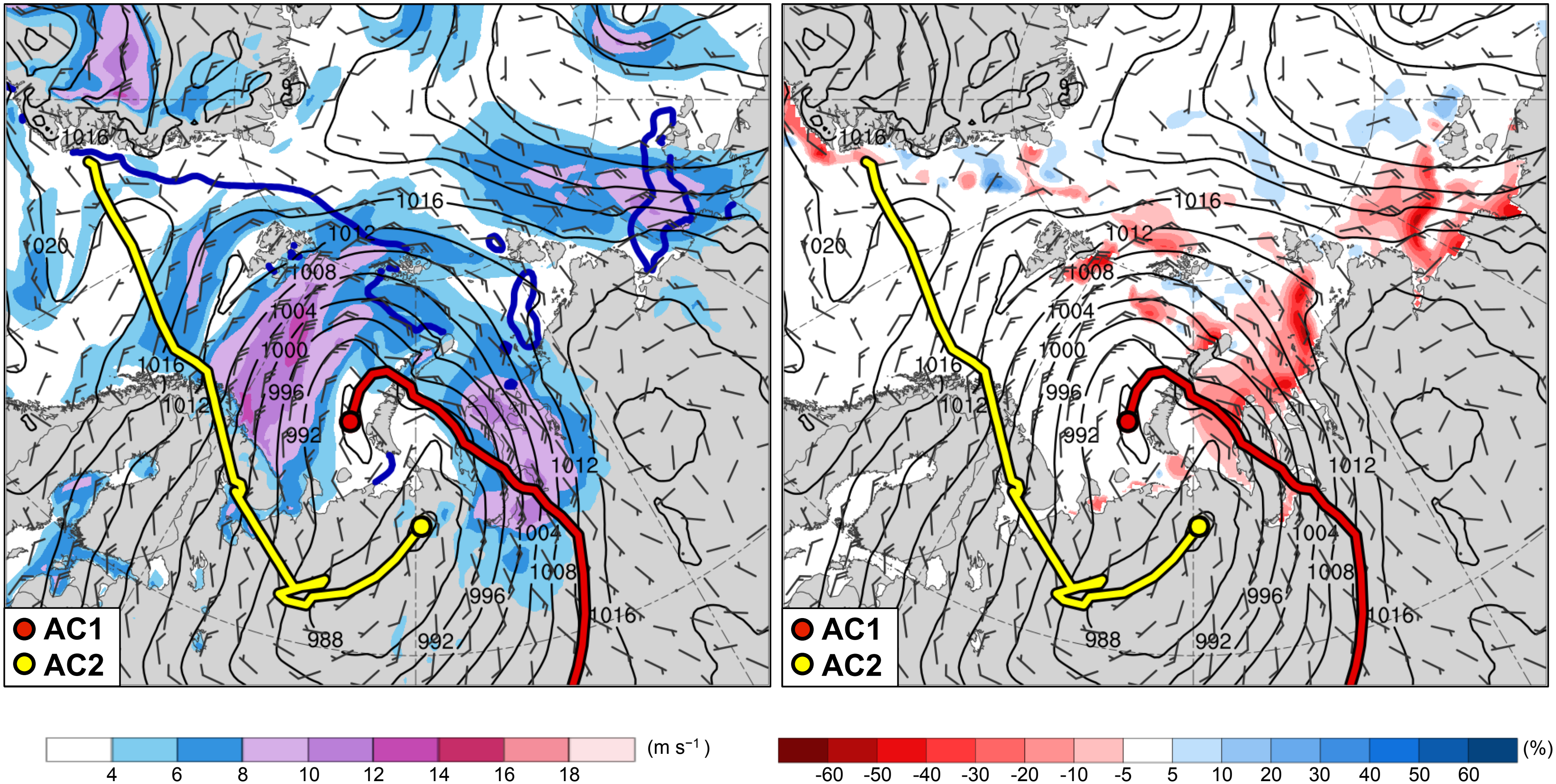
Change in sea-ice concentration (%, shaded) since 0000 UTC 1 June 2018, SLP (hPa, black), and 10-m wind speed (m s^{-1}, shaded)

1200 UTC 5 Jun 2018



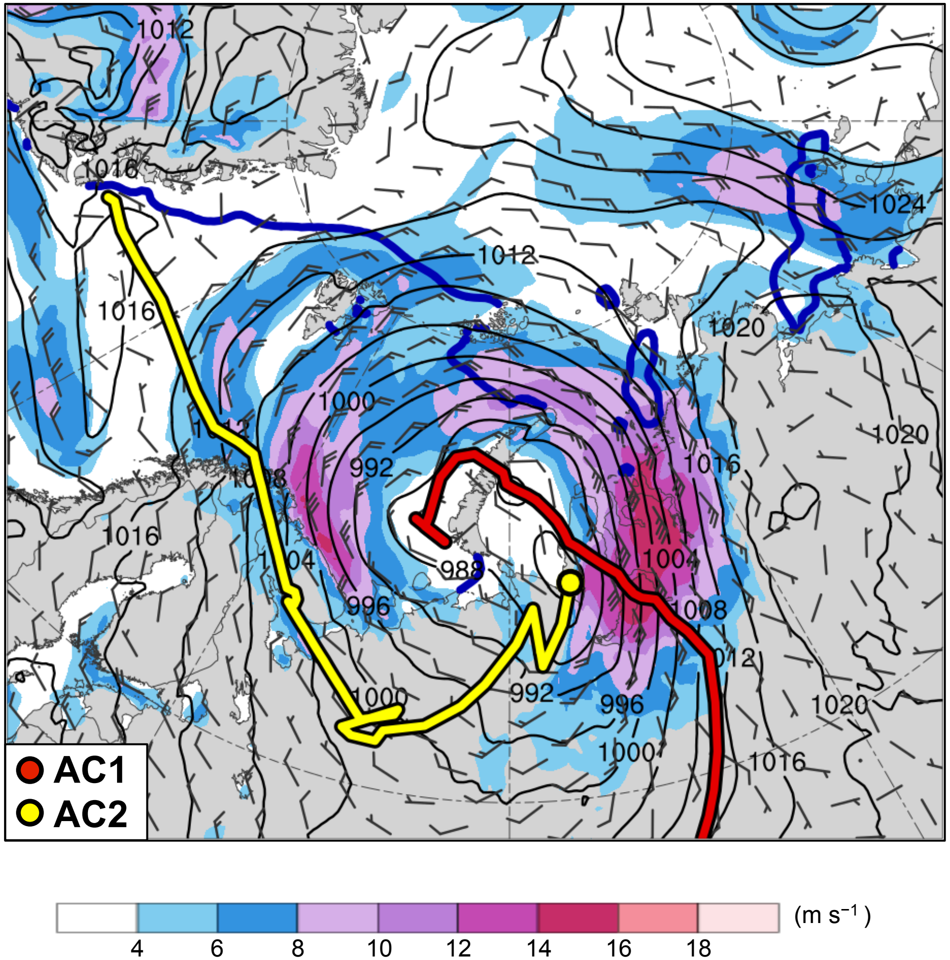
SLP (hPa, black), 10-m wind speed (m s^{-1}, shaded) and wind (m s^{-1}, barbs), and 50% contour of sea-ice concentration (thick blue)	Change in sea-ice concentration (%, shaded) since 0000 UTC 1 June 2018, SLP (hPa, black), and 10-m wind speed (m s^{-1}, shaded)

0000 UTC 6 Jun 2018

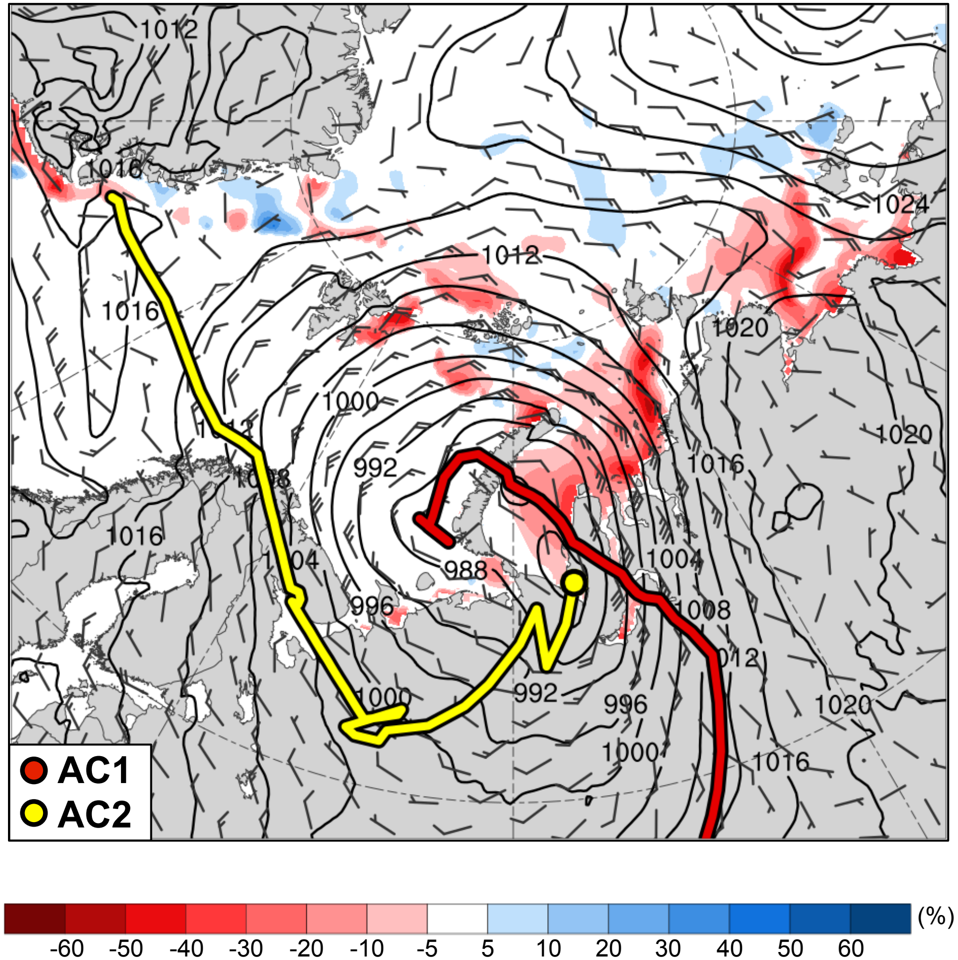


SLP (hPa, black), 10-m wind speed (m s^{-1}, shaded) and wind (m s^{-1}, barbs), and 50% contour of sea-ice concentration (thick blue)	Change in sea-ice concentration (%, shaded) since 0000 UTC 1 June 2018, SLP (hPa, black), and 10-m wind speed (m s^{-1}, shaded)

1200 UTC 6 Jun 2018

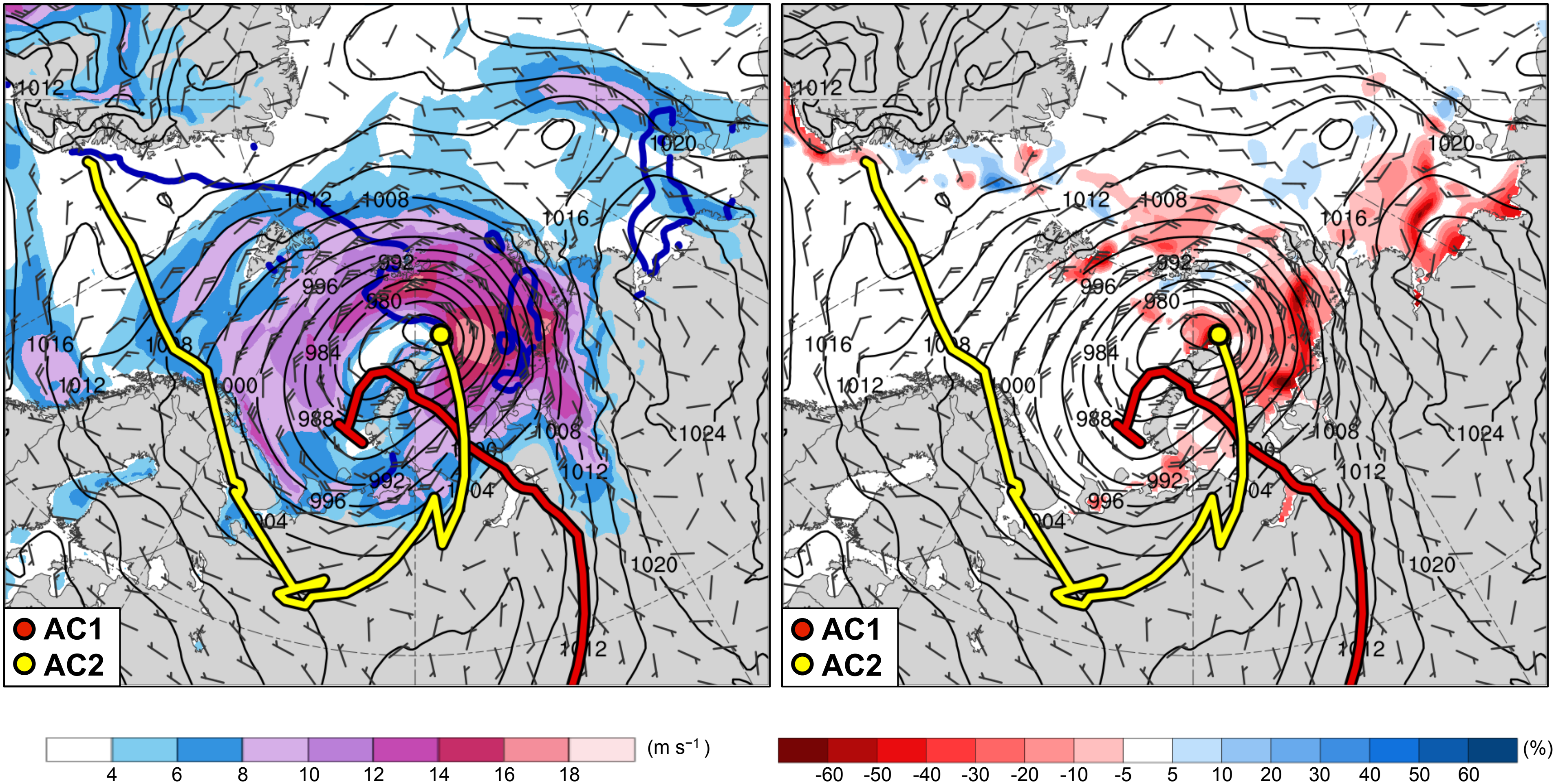


SLP (hPa, black), 10-m wind speed (m s^{-1}, shaded) and wind (m s^{-1}, barbs), and 50% contour of sea-ice concentration (thick blue)



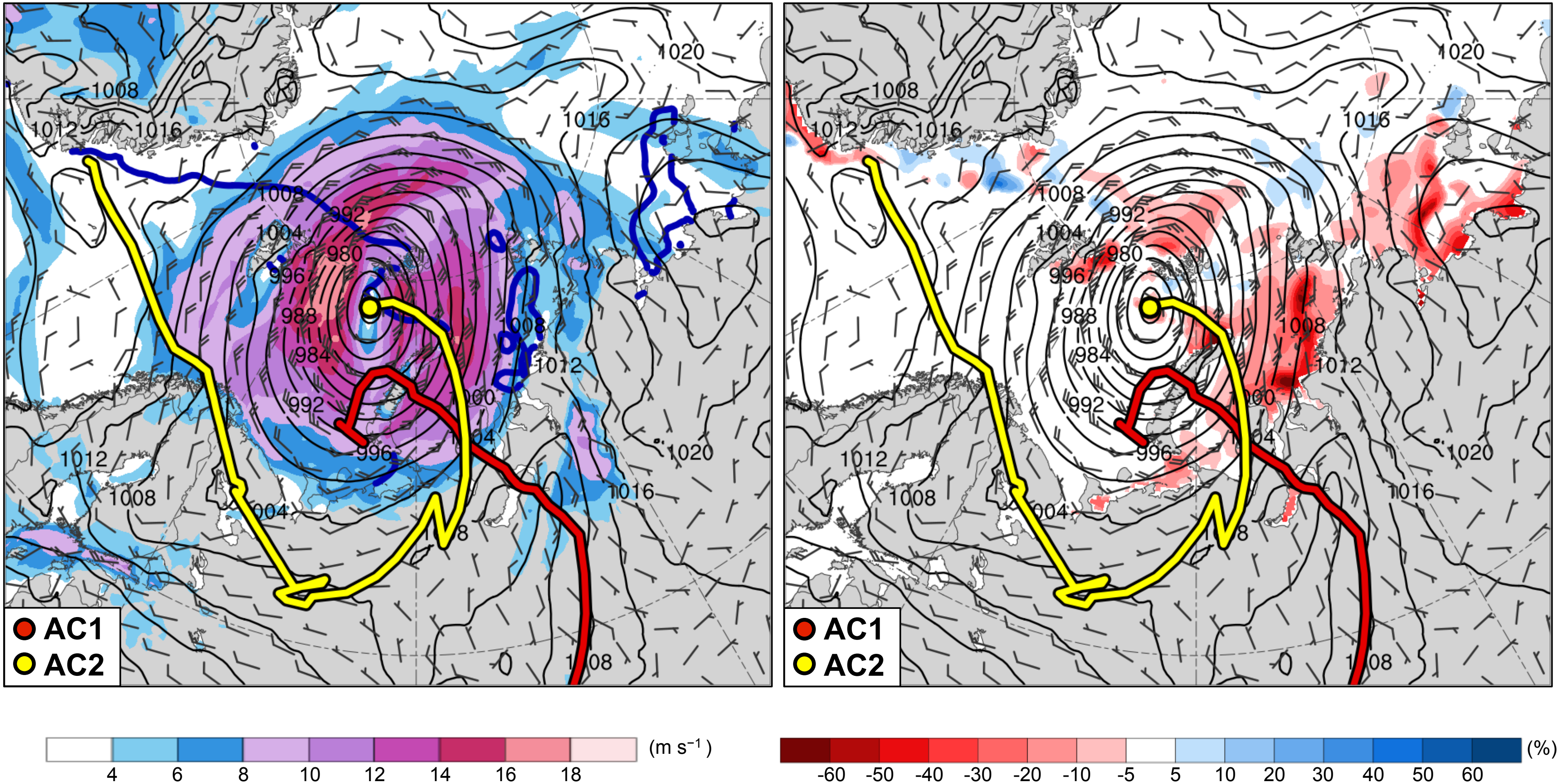
Change in sea-ice concentration (%, shaded) since 0000 UTC 1 June 2018, SLP (hPa, black), and 10-m wind speed (m s^{-1}, shaded)

0000 UTC 7 Jun 2018



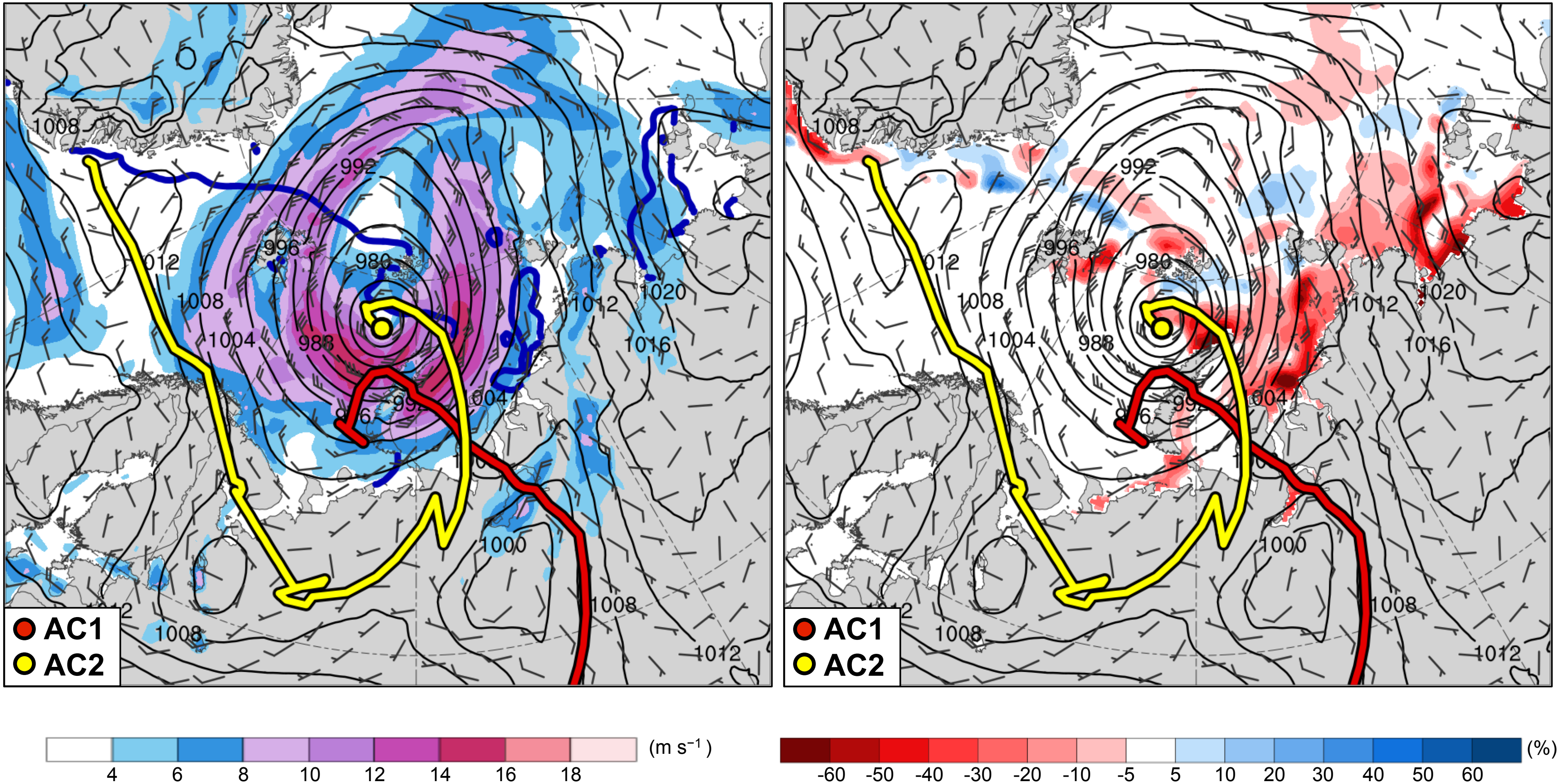
SLP (hPa, black), 10-m wind speed (m s^{-1}, shaded) and wind (m s^{-1}, barbs), and 50% contour of sea-ice concentration (thick blue)	Change in sea-ice concentration (%, shaded) since 0000 UTC 1 June 2018, SLP (hPa, black), and 10-m wind speed (m s^{-1}, shaded)

1200 UTC 7 Jun 2018



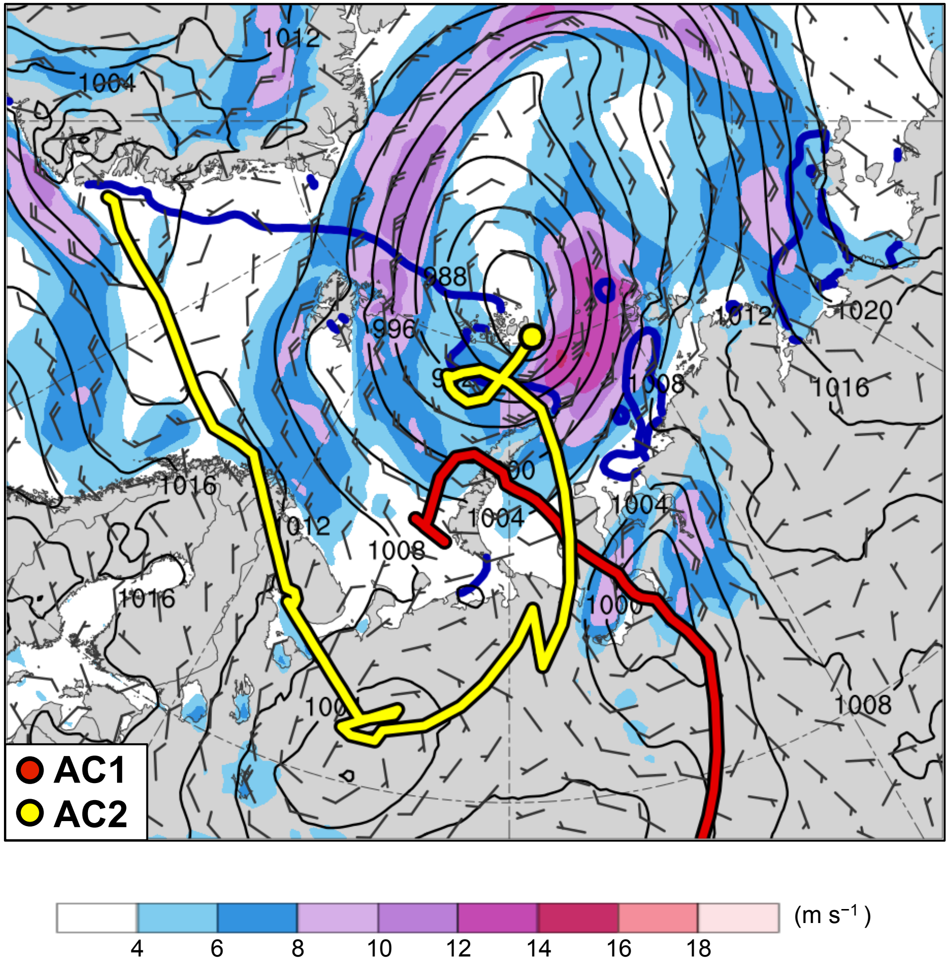
SLP (hPa, black), 10-m wind speed (m s^{-1}, shaded) and wind (m s^{-1}, barbs), and 50% contour of sea-ice concentration (thick blue)	Change in sea-ice concentration (%, shaded) since 0000 UTC 1 June 2018, SLP (hPa, black), and 10-m wind speed (m s^{-1}, shaded)

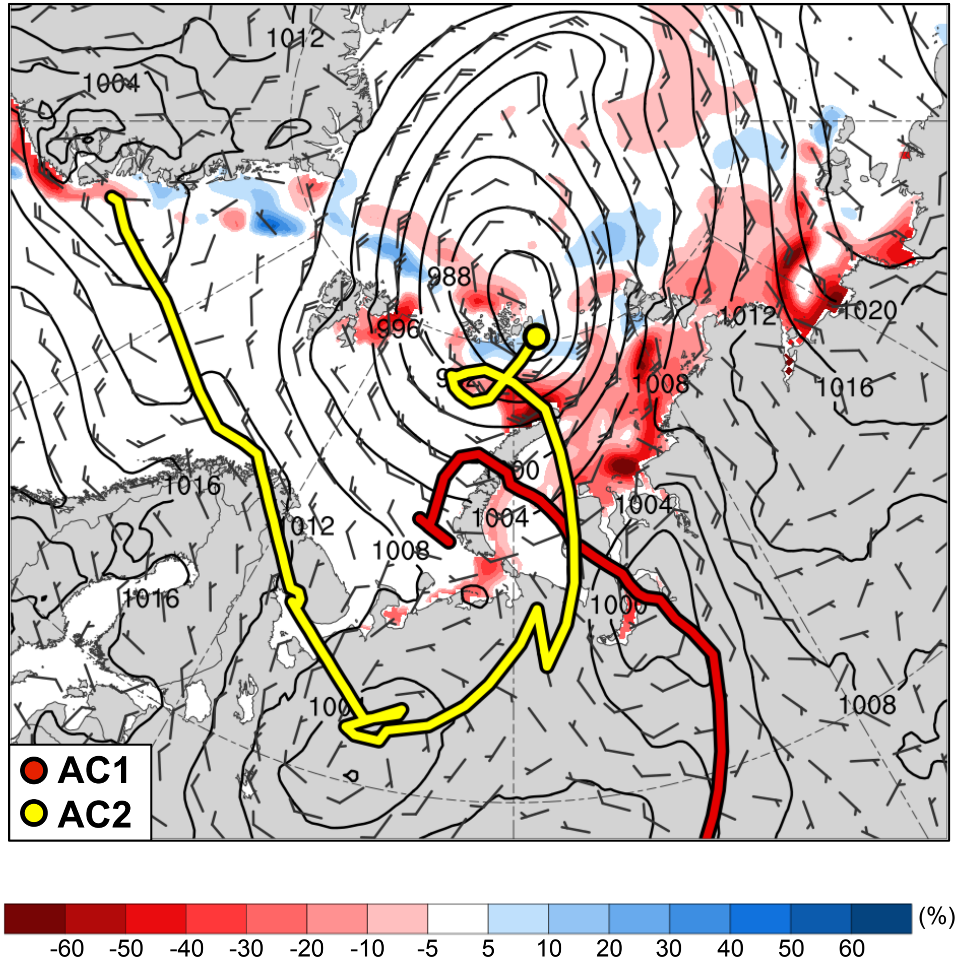
0000 UTC 8 Jun 2018



SLP (hPa, black), 10-m wind speed (m s^{-1}, shaded) and wind (m s^{-1}, barbs), and 50% contour of sea-ice concentration (thick blue)	Change in sea-ice concentration (%, shaded) since 0000 UTC 1 June 2018, SLP (hPa, black), and 10-m wind speed (m s^{-1}, shaded)

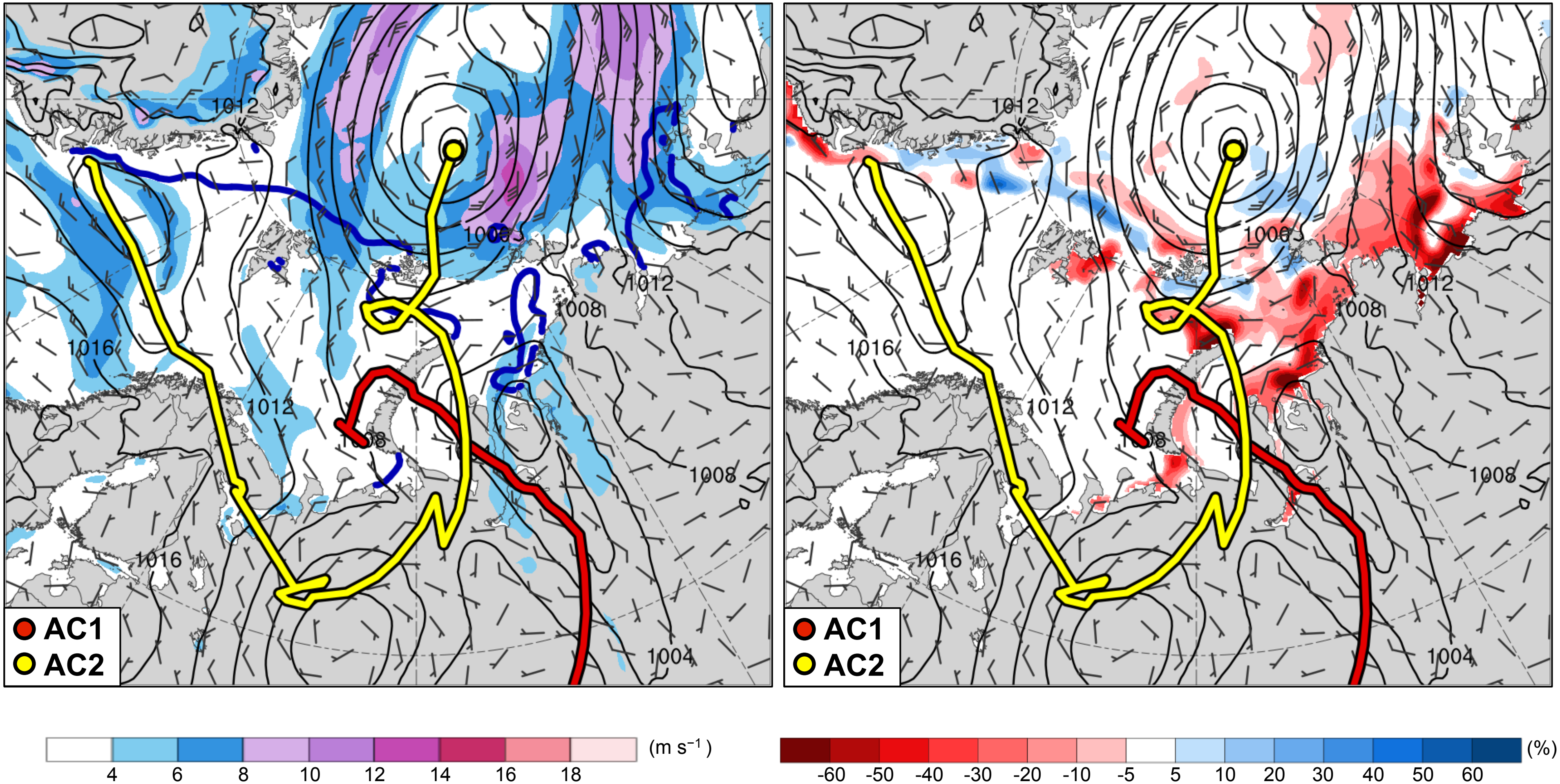
1200 UTC 8 Jun 2018





SLP (hPa, black), 10-m wind speed (m s^{-1}, shaded) and wind (m s^{-1}, barbs), and 50% contour of sea-ice concentration (thick blue)	Change in sea-ice concentration (%, shaded) since 0000 UTC 1 June 2018, SLP (hPa, black), and 10-m wind speed (m s^{-1}, shaded)

0000 UTC 9 Jun 2018



SLP (hPa, black), 10-m wind speed (m s^{-1}, shaded) and wind (m s^{-1}, barbs), and 50% contour of sea-ice concentration (thick blue)

Change in sea-ice concentration (%, shaded) since 0000 UTC 1 June 2018, SLP (hPa, black), and 10-m wind speed (m s^{-1}, shaded)

Conclusions:

- **Anomalously amplified flow from eastern North America to Europe permits midlatitude disturbances to reach the Arctic**
- **TS Alberto remnants merge with a Canadian cyclone, move northeastward, and weaken over the Davis Strait windward of Greenland**
- **AC2 forms leeward of Greenland near the nose of a strong upper-level jet and along a moisture axis linked back to the remnants of TS Alberto**
- **AC1 forms along a cold front near the Caspian Sea ahead of an amplified upper-level trough**

Conclusions:

- Anomalously amplifying flow over western and central Eurasia enables AC1 and AC2 to strengthen and move poleward

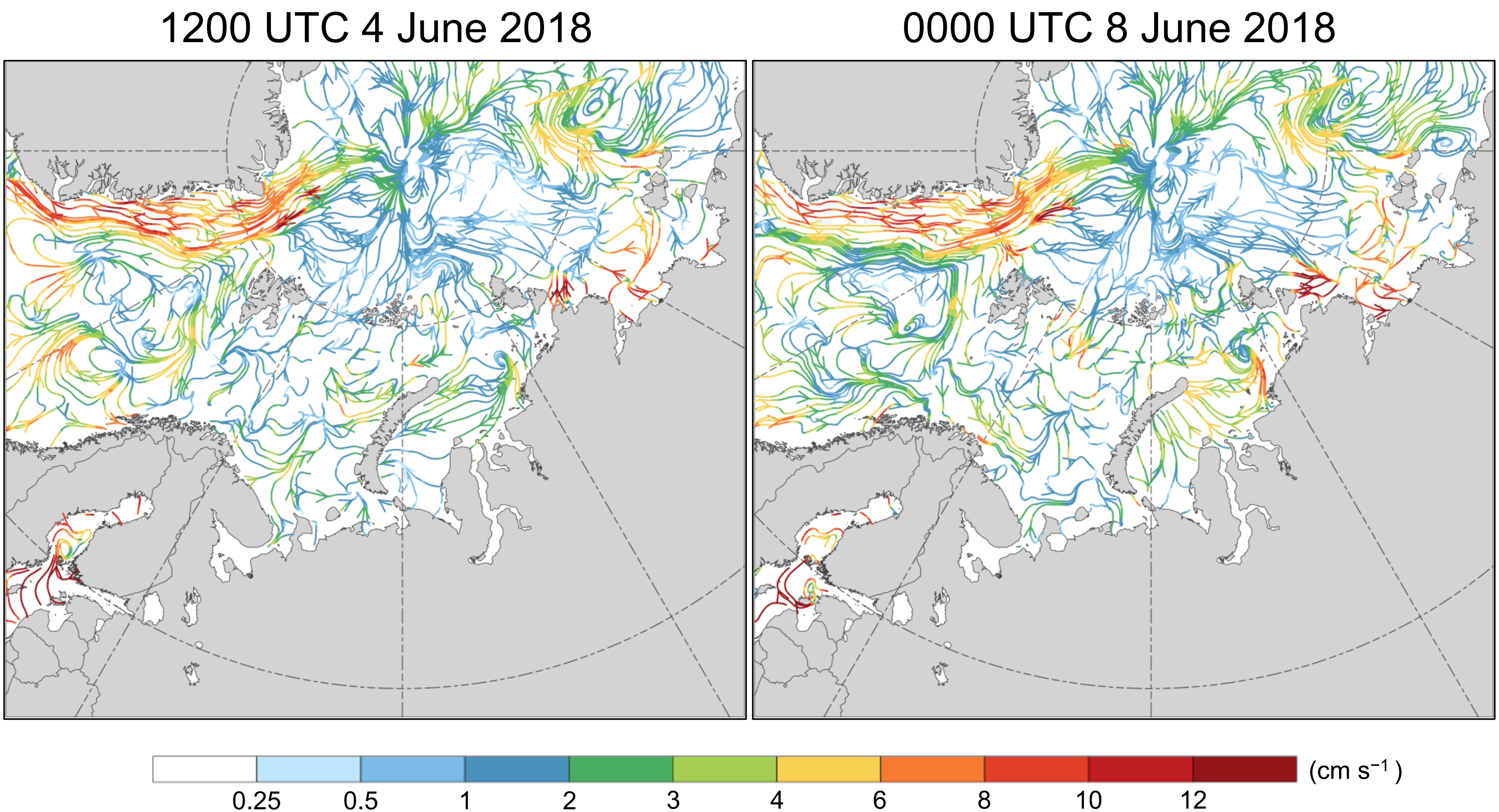
- TPVs embedded within amplified upper-level troughs foster rapid deepening of AC1 and AC2 in the left-exit regions of jet streaks

- AC2 absorbs AC1 after a Fujiwara cyclonic rotation and becomes the dominant Arctic cyclone, with a peak intensity of 962 hPa (SLP standardized anomaly of $< -6\ \sigma$)

- Warm, moist air and strong low-level winds associated with AC1 and AC2 may contribute to reductions in Arctic sea ice

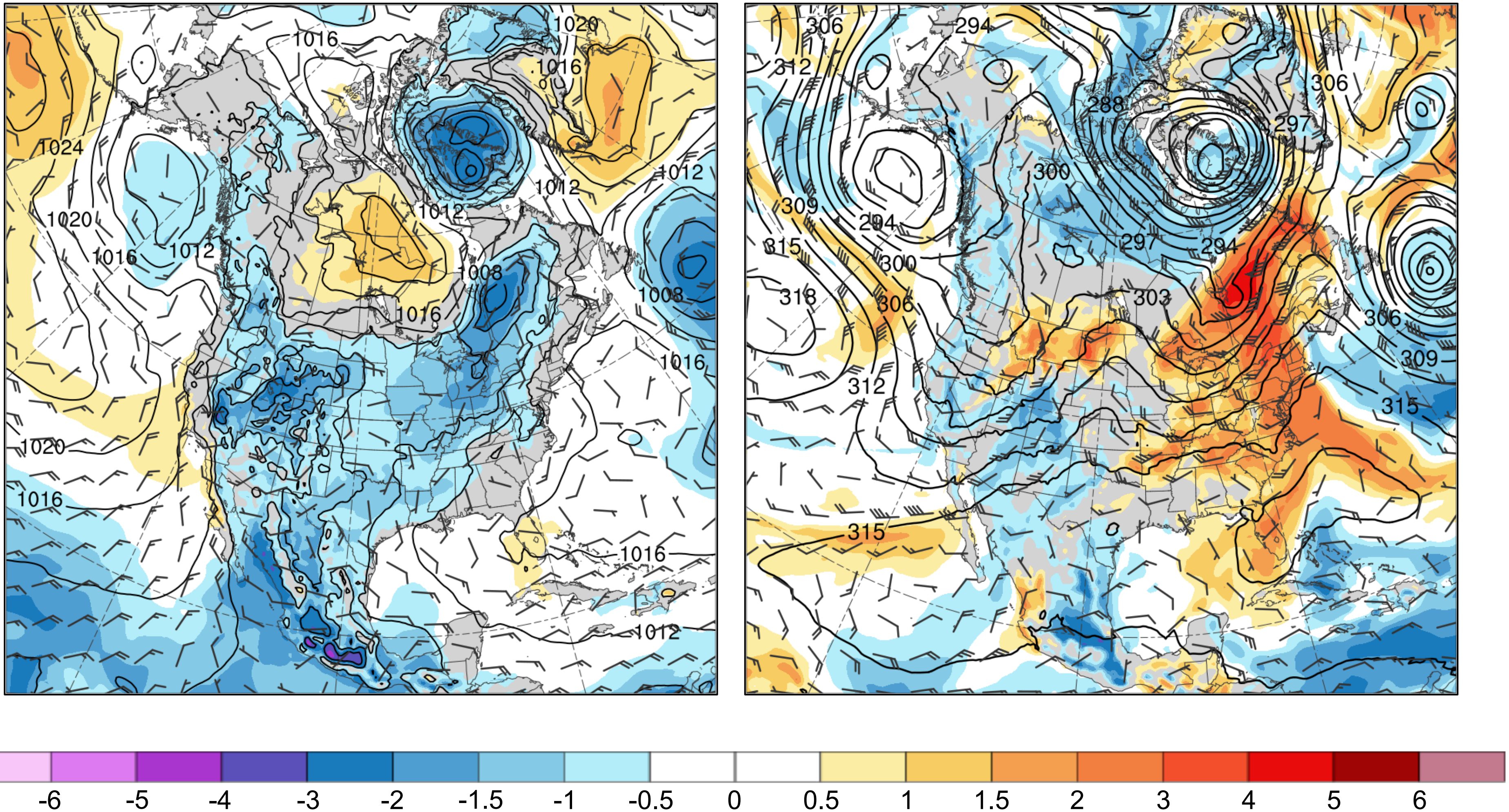
Extra Slides

Ocean Currents



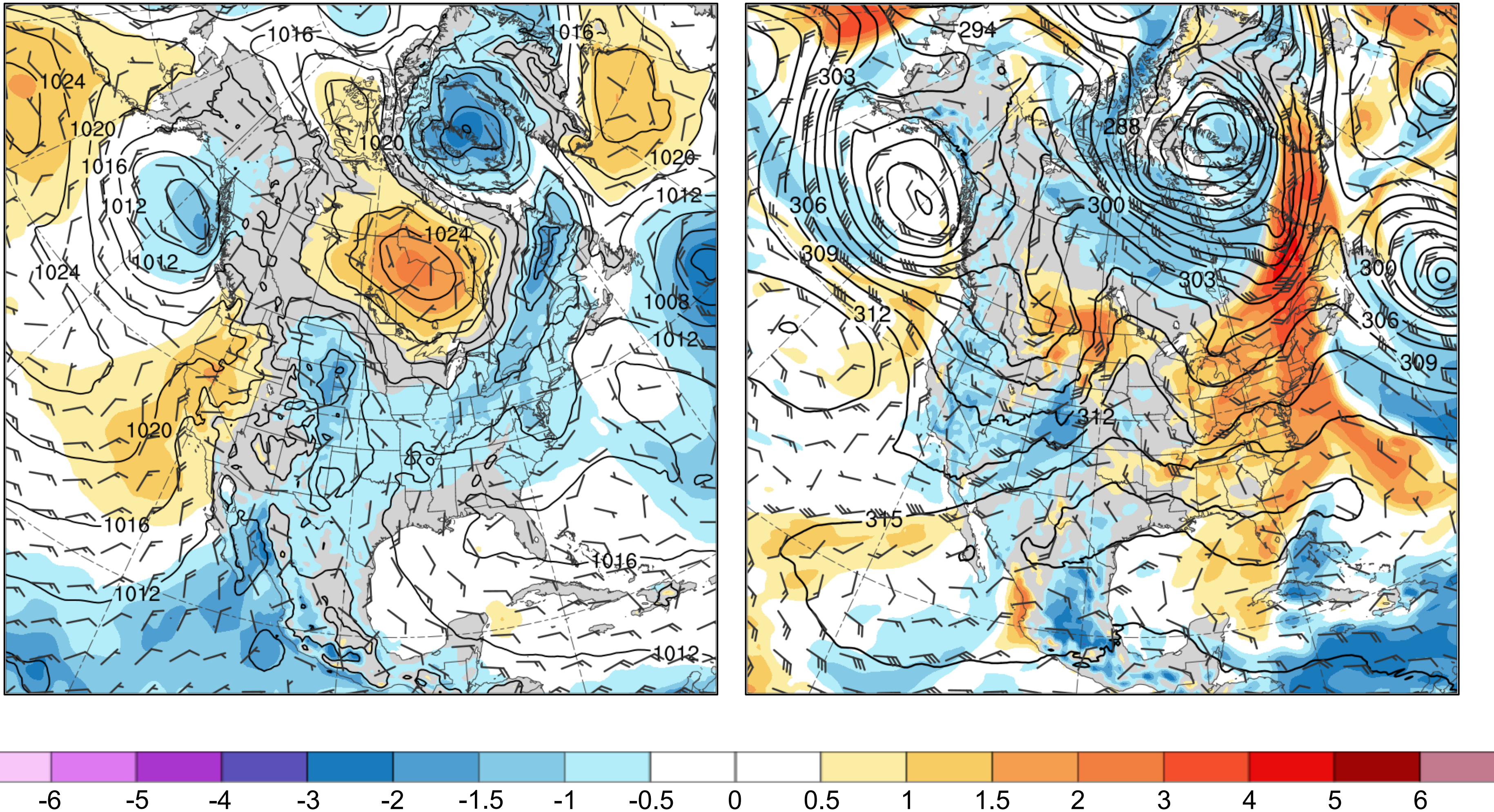
Ocean current speed and direction (cm s^{-1}, streamlines colored according to speed) at 5 m below sea level (Data source: CFSR)

0000 UTC 1 Jun 2018



SLP (hPa, black), 10-m winds (m s^{-1}, flags and barbs), and standardized SLP anomalies (σ, shaded)	700-hPa geopotential height (dam, black) and winds (m s^{-1}, flags and barbs), and standardized PW anomalies (σ, shaded)

1200 UTC 1 Jun 2018



SLP (hPa, black), 10-m winds (m s^{-1}, flags and barbs), and standardized SLP anomalies (σ, shaded)	700-hPa geopotential height (dam, black) and winds (m s^{-1}, flags and barbs), and standardized PW anomalies (σ, shaded)