

Storm Juliette sweeping across the island of Mallorca

28 February 2023
Copernicus Sentinel-3 satellites
Image of the day



PROGRAMME OF THE
EUROPEAN UNION



A numerical analysis with TRAM of the many facets of Storm Juliette

Maria del Mar Vich

mar.vich@uib.es

2nd TRAMPAS meeting

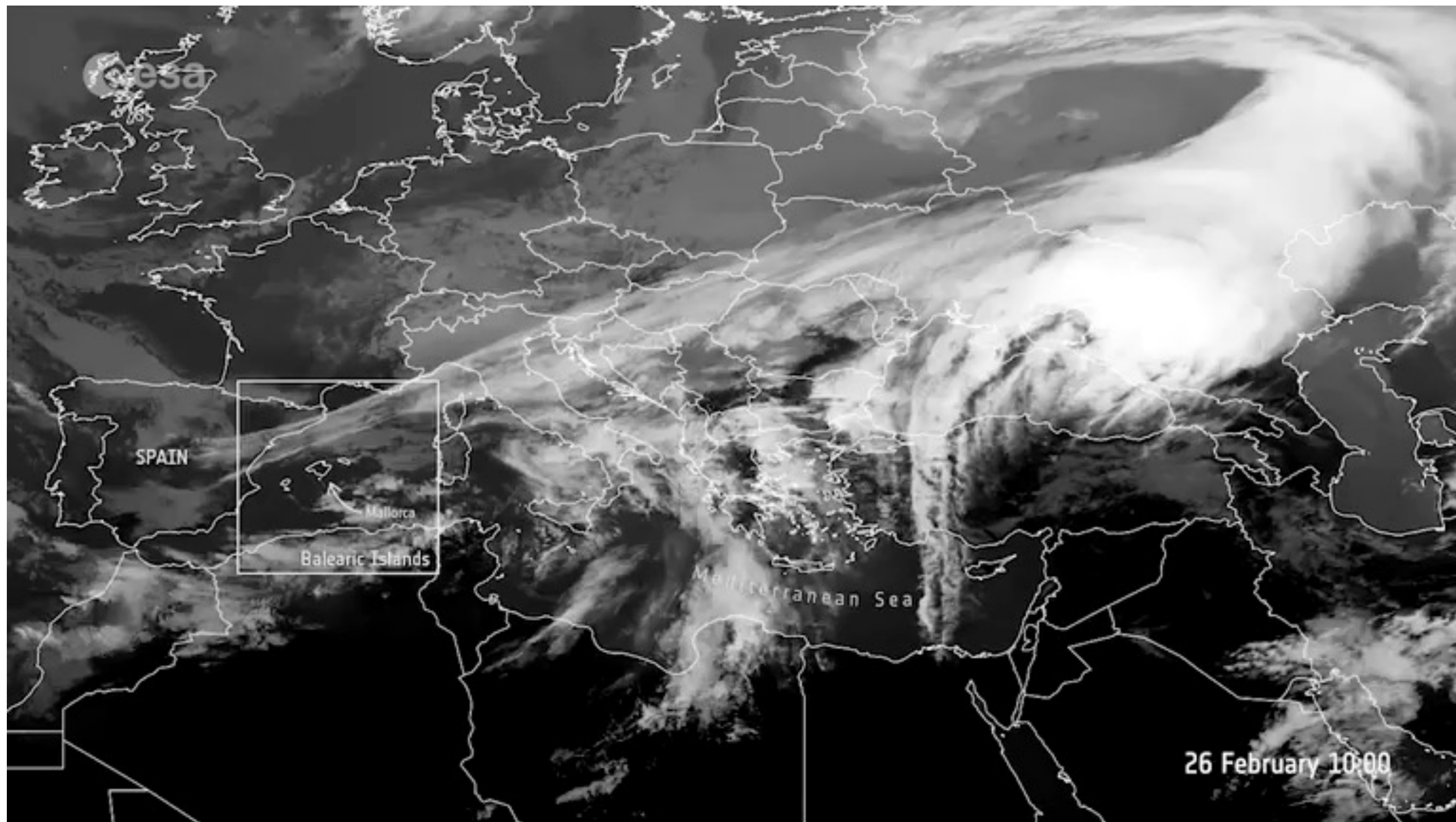


PID2020-113036RB-I00 / AEI / 10.13039/501100011033

<https://www.copernicus.eu/en/media/image-day-gallery/storm-juliette-raging-over-balearic-islands>

#TempsExtremIB3





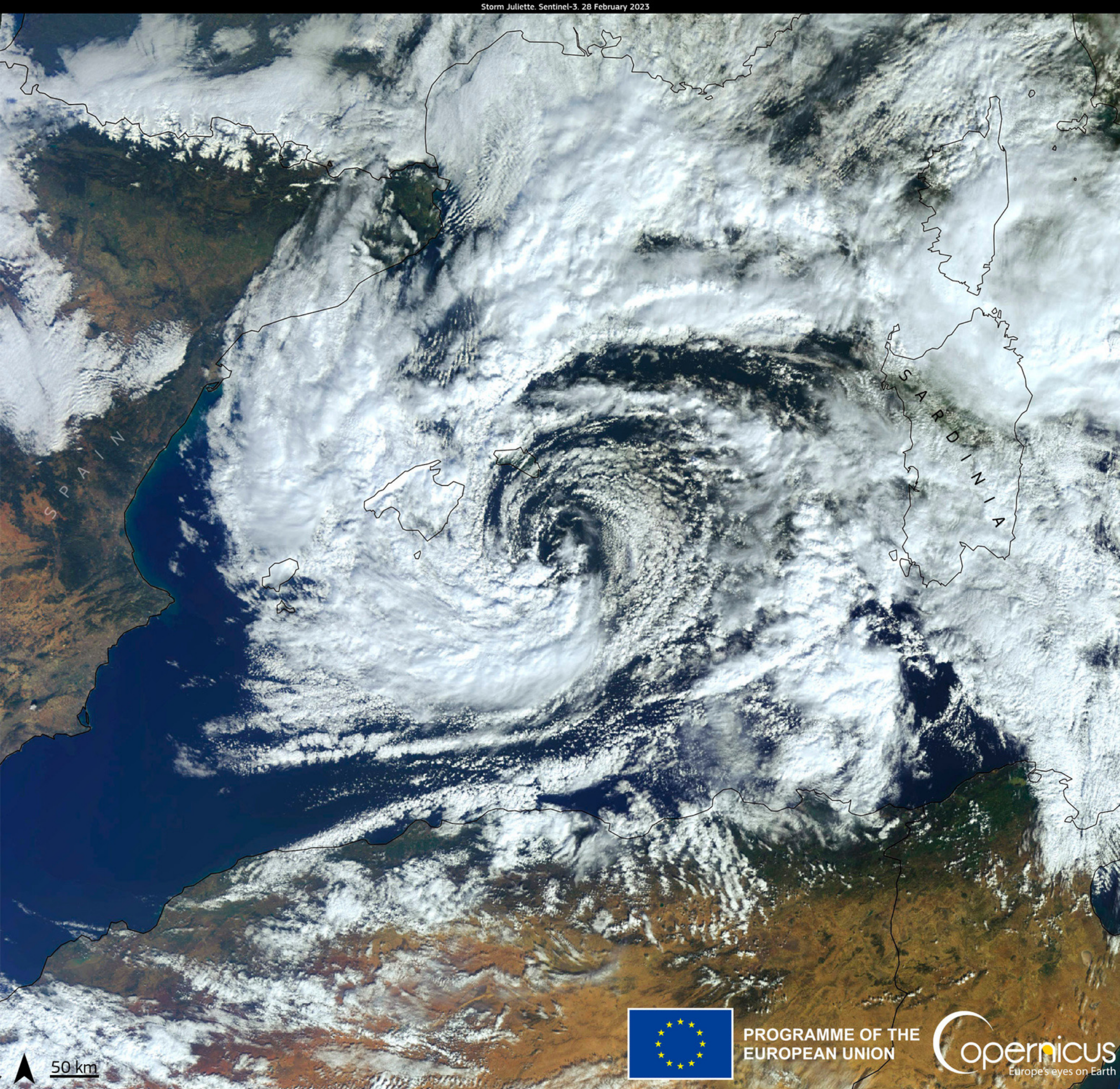
#TempsExtremIB3

EUMETSAT





- Intense and small cyclone that transitions to a nearly tropical cyclone as it leaves the Balearic Islands
- Unusual drop in theoretical snow level, with snow almost at sea level and significant accumulations in the Serra de Tramontana
- Extreme precipitation in the Balearic Islands

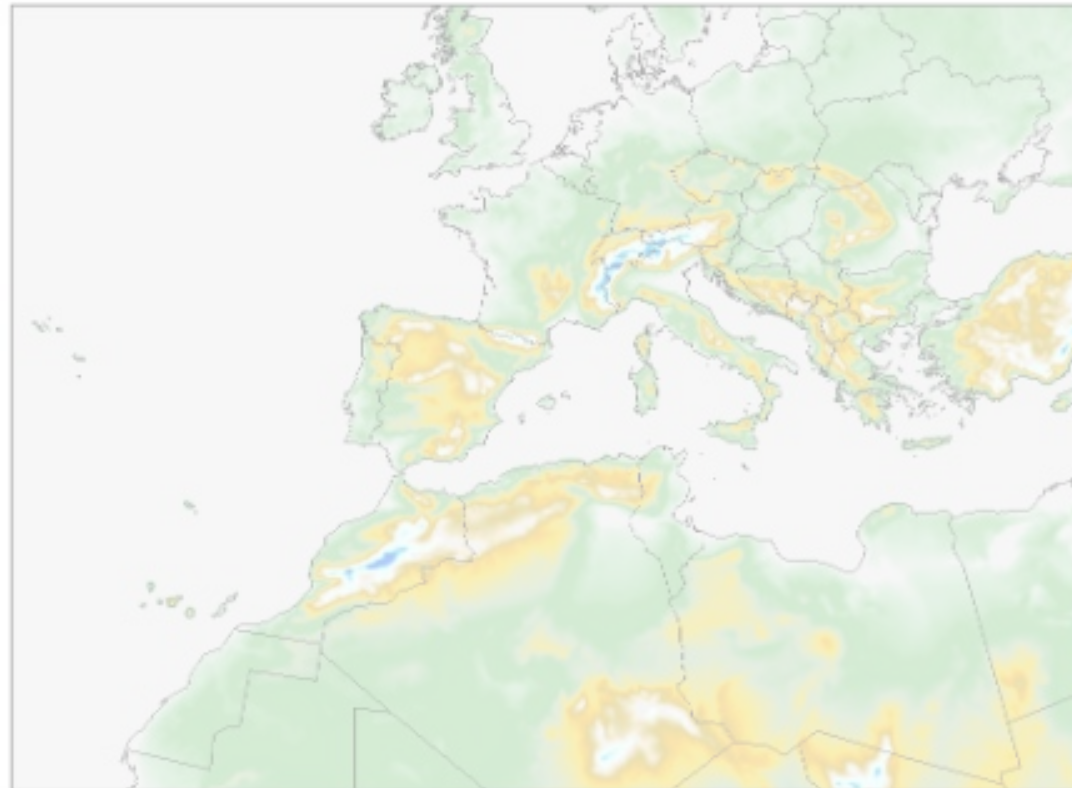


- Intense and small cyclone that transitions to a nearly tropical cyclone as it leaves the Balearic Islands
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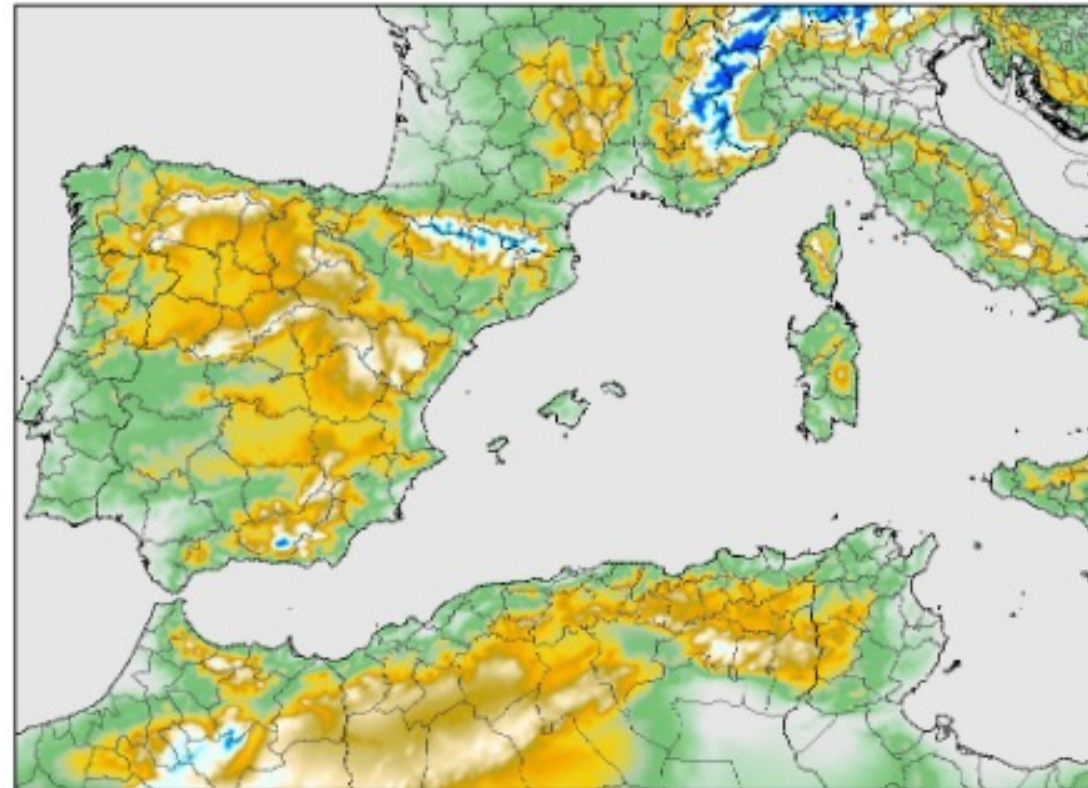
Intense and small cyclone that transitions to a nearly tropical cyclone as it leaves the Balearic Islands

- TRAM simulation
- Operation HR domain
- Kain-Fritsch 2 convective scheme activated
- Initialized with GFS from 26/02/2023 at 00 UTC

MR (17 km)



HR (6 km)



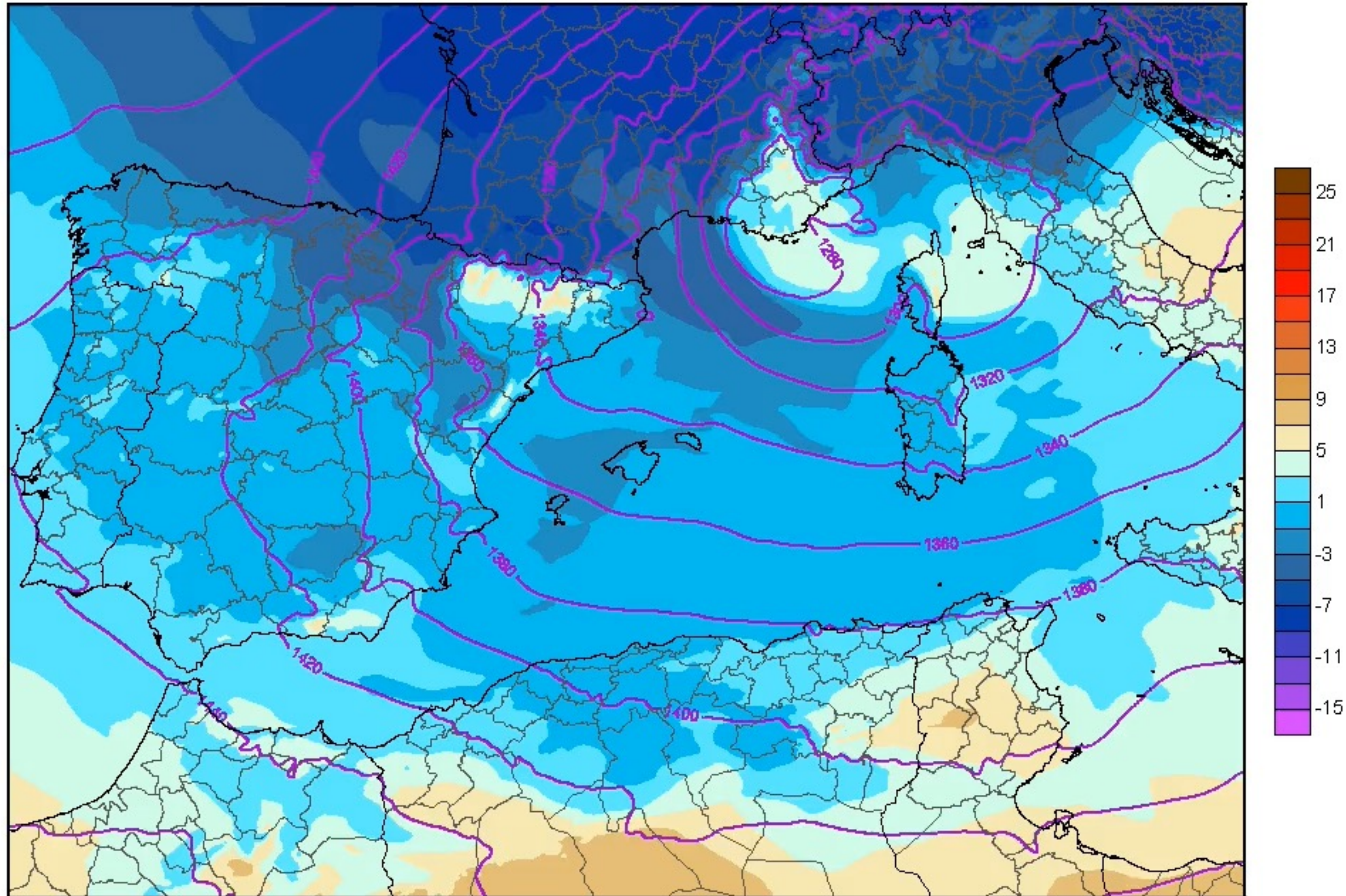
SR (2 km)



Intense and small cyclone that transitions to a nearly tropical cyclone as it leaves the Balearic Islands

850 mb: HEIGHT (m) & TEMPERATURE (°C)

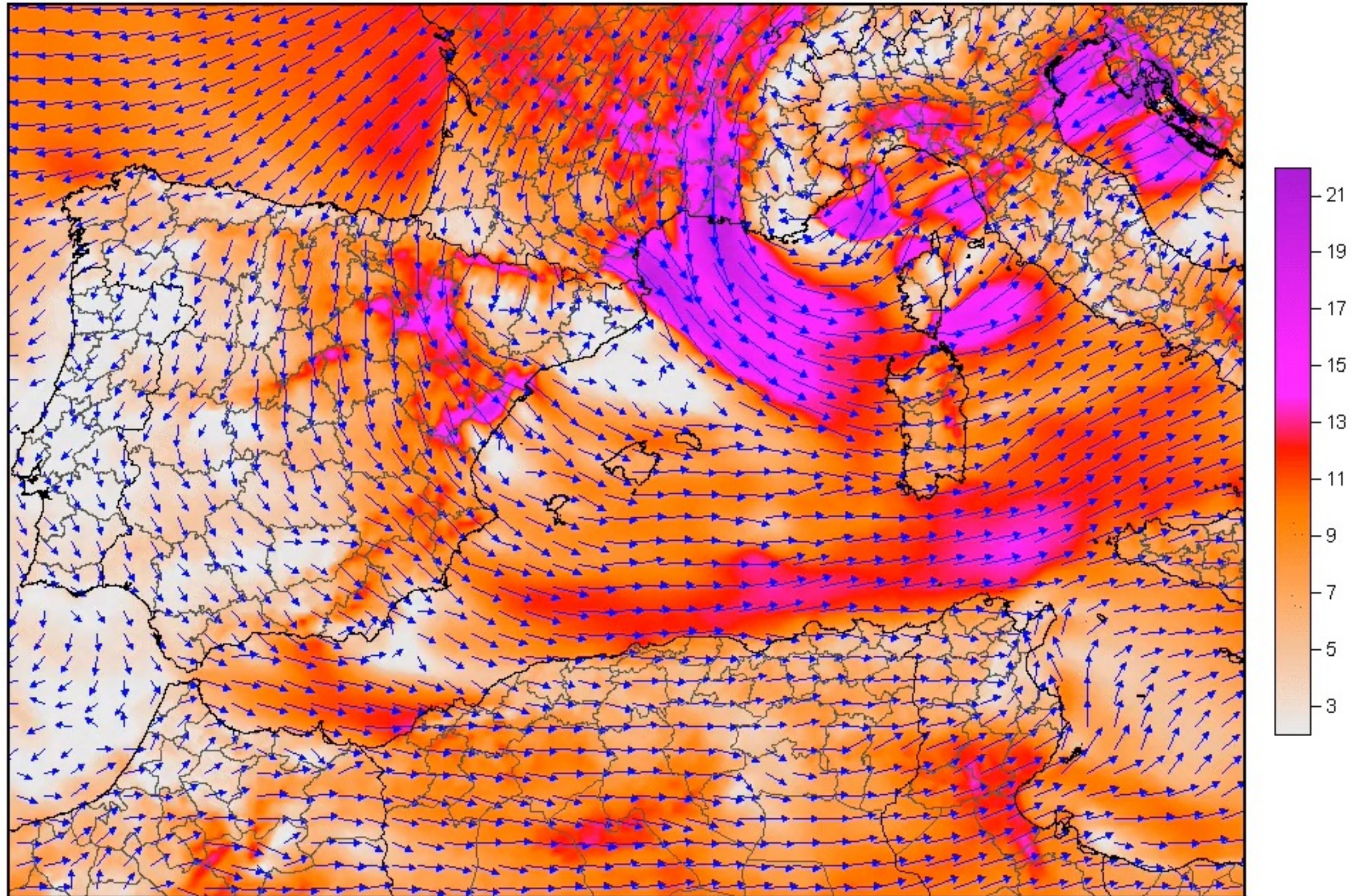
Forecast: 00:00h / Valid: 12:00z Sun, 26 Feb 2023



Intense and small cyclone that transitions to a nearly tropical cyclone as it leaves the Balearic Islands

10m WIND SPEED (m/s)

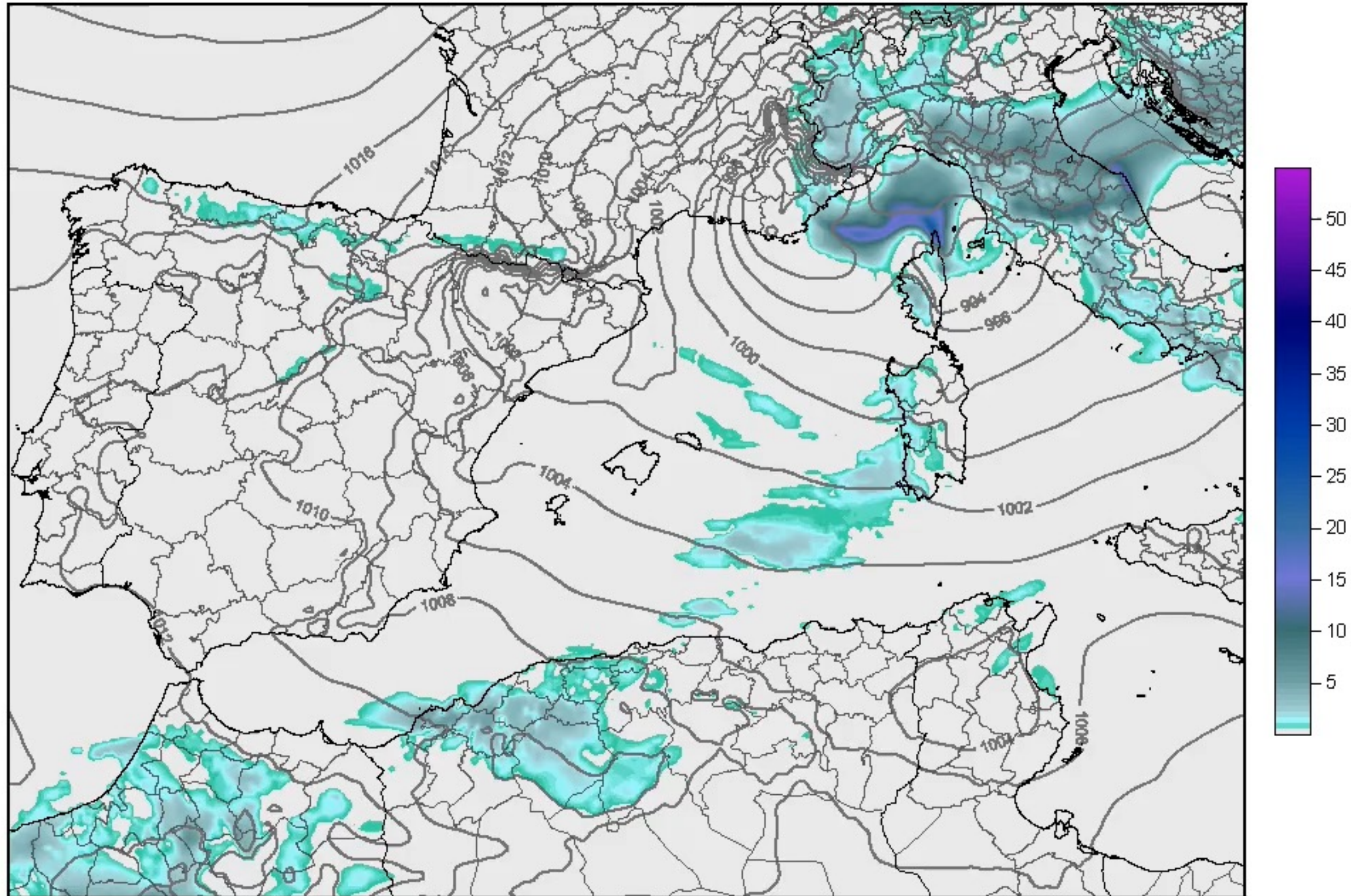
Forecast: 00:00h / Valid: 12:00z Sun, 26 Feb 2023

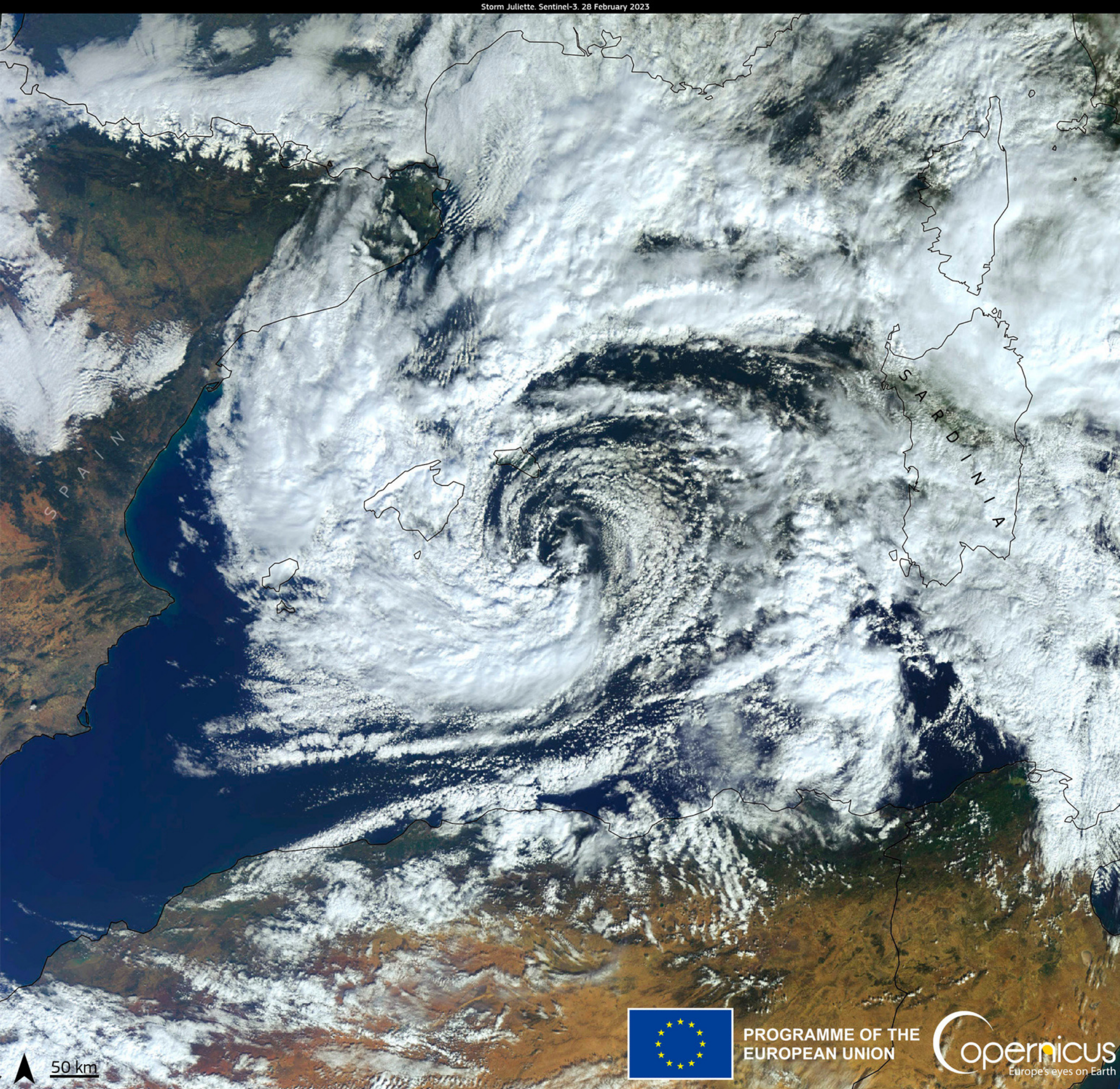


Intense and small cyclone that transitions to a nearly tropical cyclone as it leaves the Balearic Islands

MSL PRESSURE (hPa) & 3h PRECIP (mm)

Forecast: 00:00h / Valid: 12:00z Sun, 26 Feb 2023





- Intense and small cyclone that transitions to a nearly tropical cyclone as it leaves the Balearic Islands
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Unusual drop in theoretical snow level, with snow almost at sea level and significant accumulations in the Serra de Tramontana



Journals

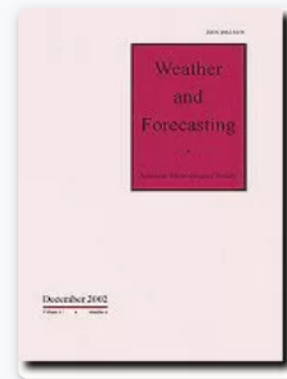
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Weather and
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Editorial Type: **Article**

Article Type: **Research Article**

The Melting Effect as a Factor in Precipitation-Type Forecasting

John S. Kain, Stephen M. Goss, and Michael E. Baldwin

Print Publication: **01 Dec 2000**

DOI: [https://doi.org/10.1175/1520-0434\(2000\)015<0700:TMEAAF>2.0.CO;2](https://doi.org/10.1175/1520-0434(2000)015<0700:TMEAAF>2.0.CO;2)

Page(s): **700–714**

[https://doi.org/10.1175/1520-0434\(2000\)015%3C0700:TMEAAF%3E2.0.CO;2](https://doi.org/10.1175/1520-0434(2000)015%3C0700:TMEAAF%3E2.0.CO;2)

Unusual drop in theoretical snow level, with snow almost at sea level and significant accumulations in the Serra de Tramontana

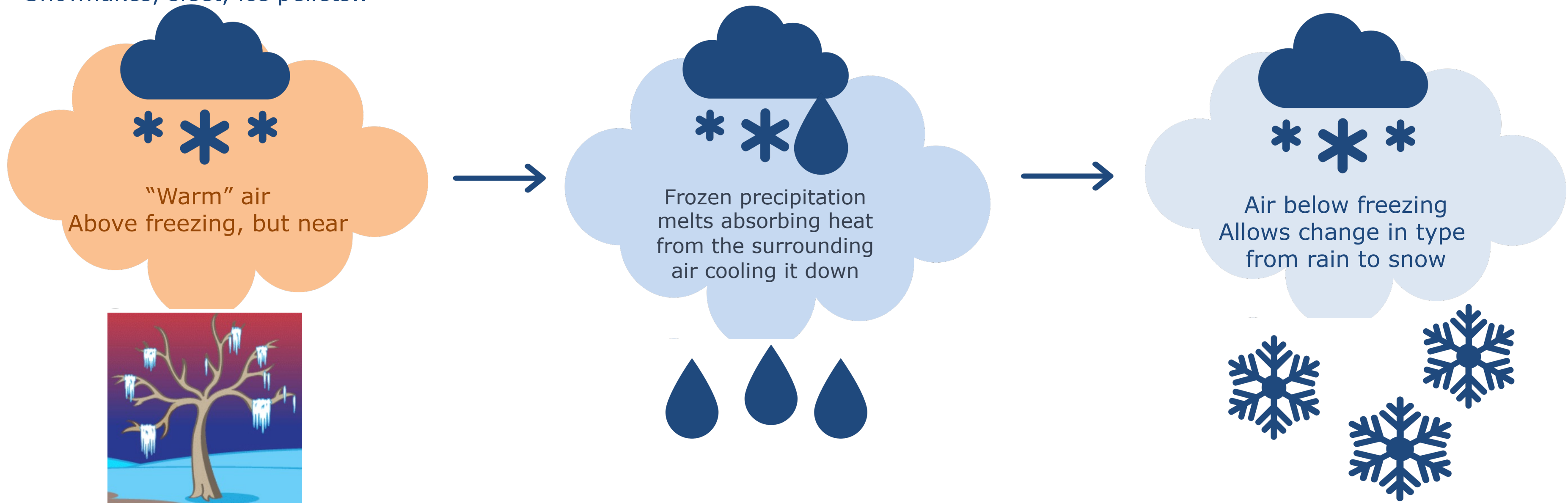
The melting effect

a second-order process that becomes relevant when temperature advection is weak

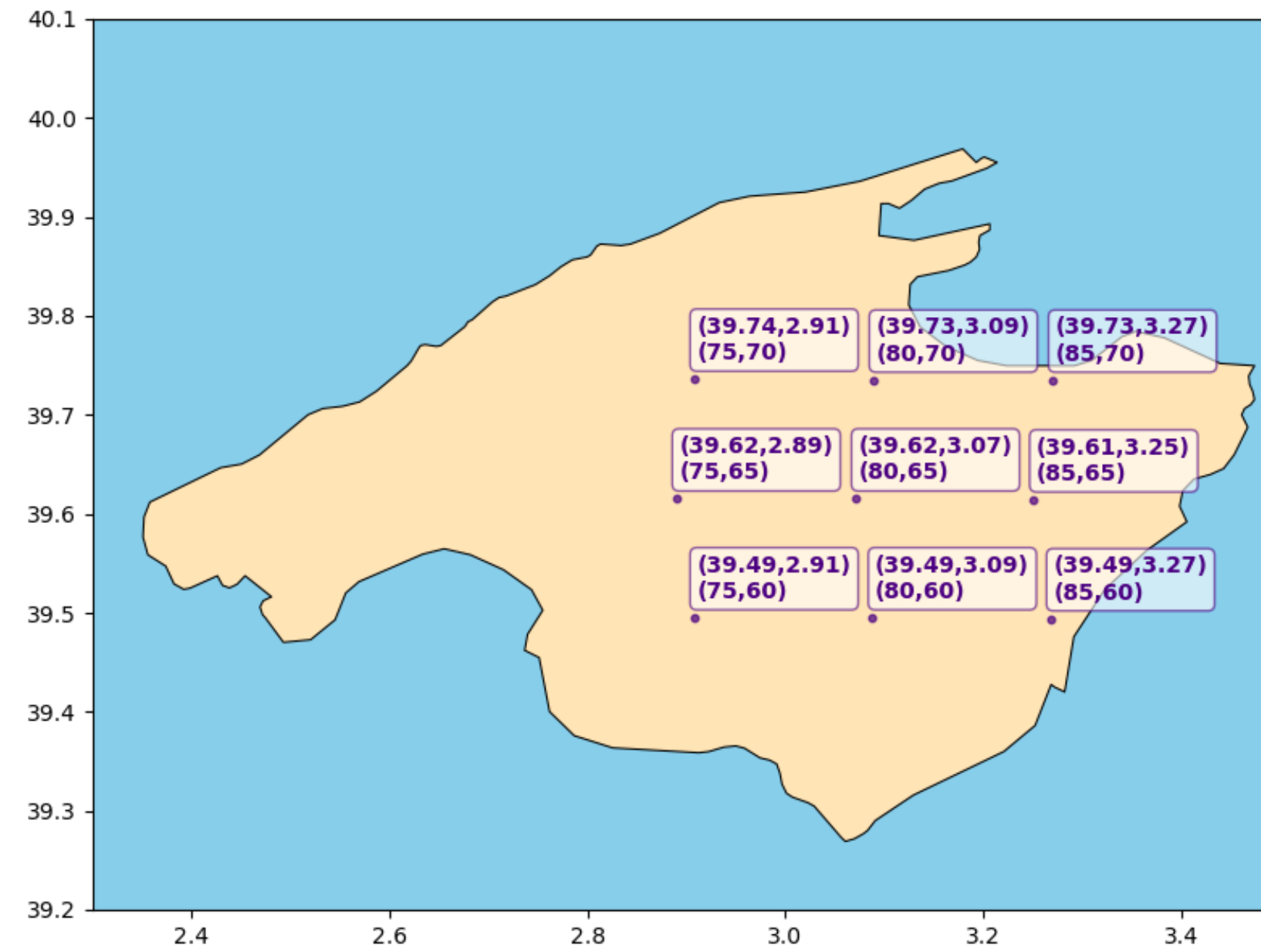
Keeps active as long as frozen precipitation encounters warmer air

Frozen precipitation

Snowflakes, sleet, ice pellets..

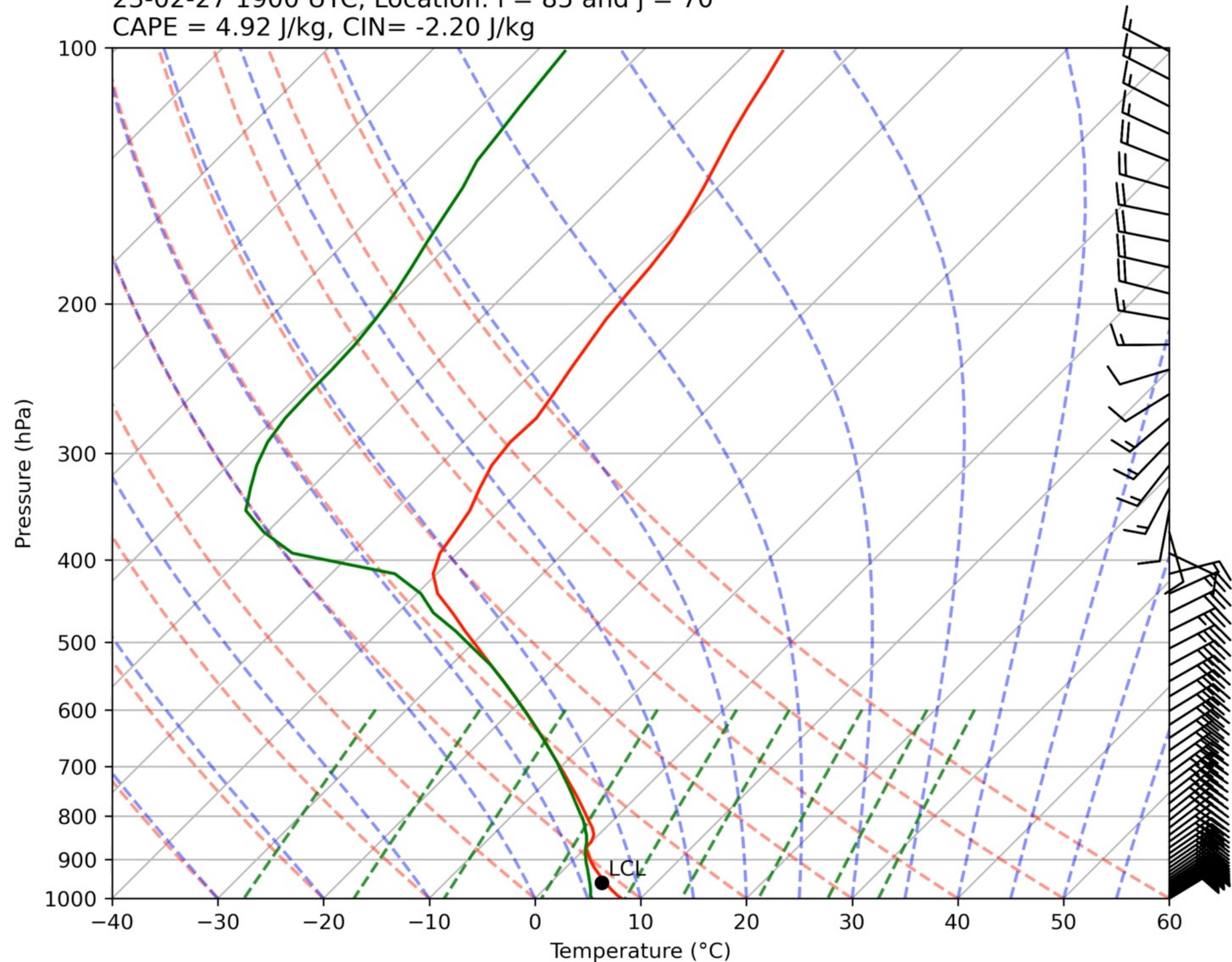


Unusual drop in theoretical snow level, with snow almost at sea level and significant accumulations in the Serra de Tramontana

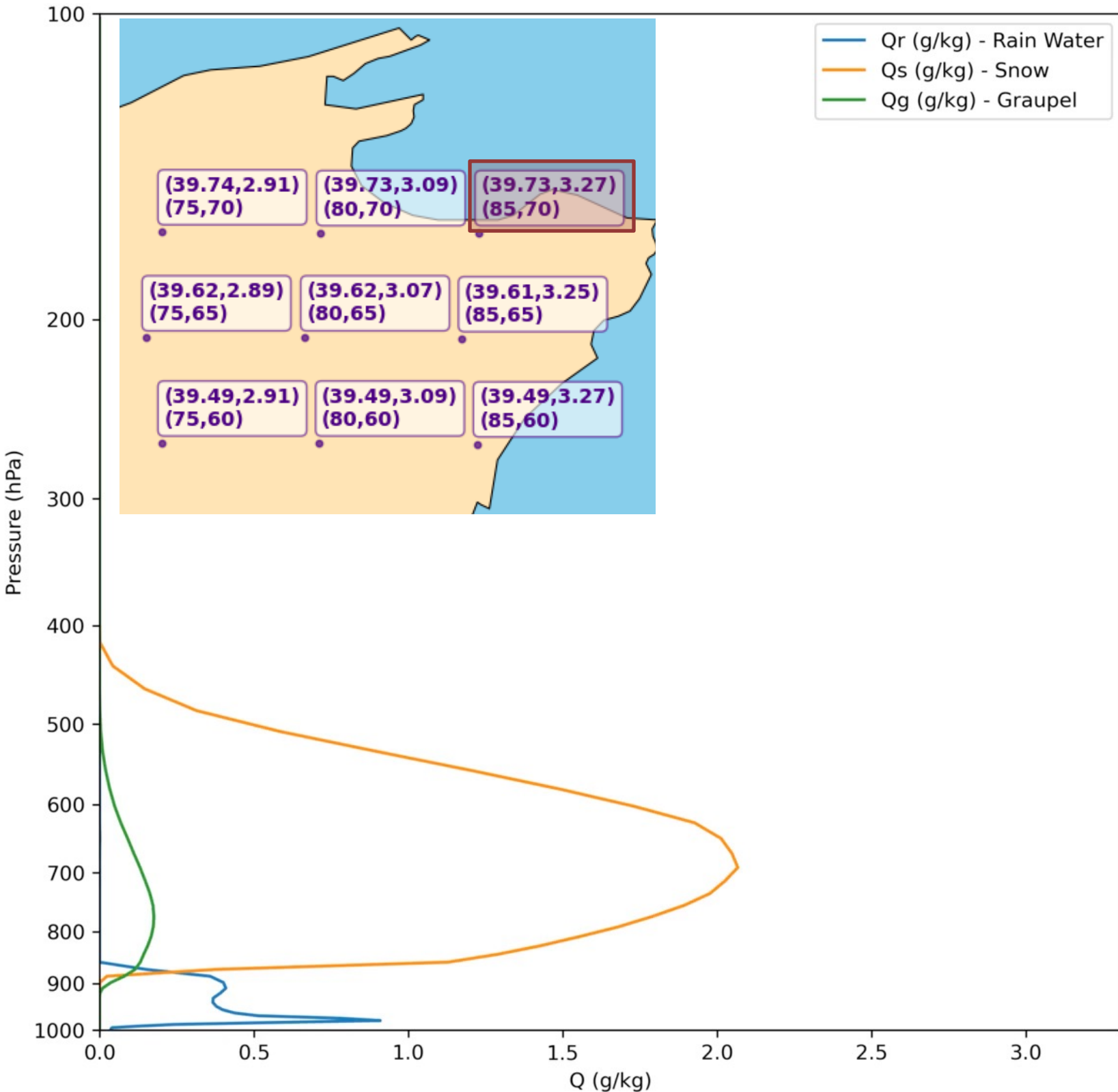


Unusual drop in theoretical snow level, with snow almost at sea level and significant accumulations in the Serra de Tramontana

23-02-27 1900 UTC, Location: i = 85 and j = 70
CAPE = 4.92 J/kg, CIN = -2.20 J/kg

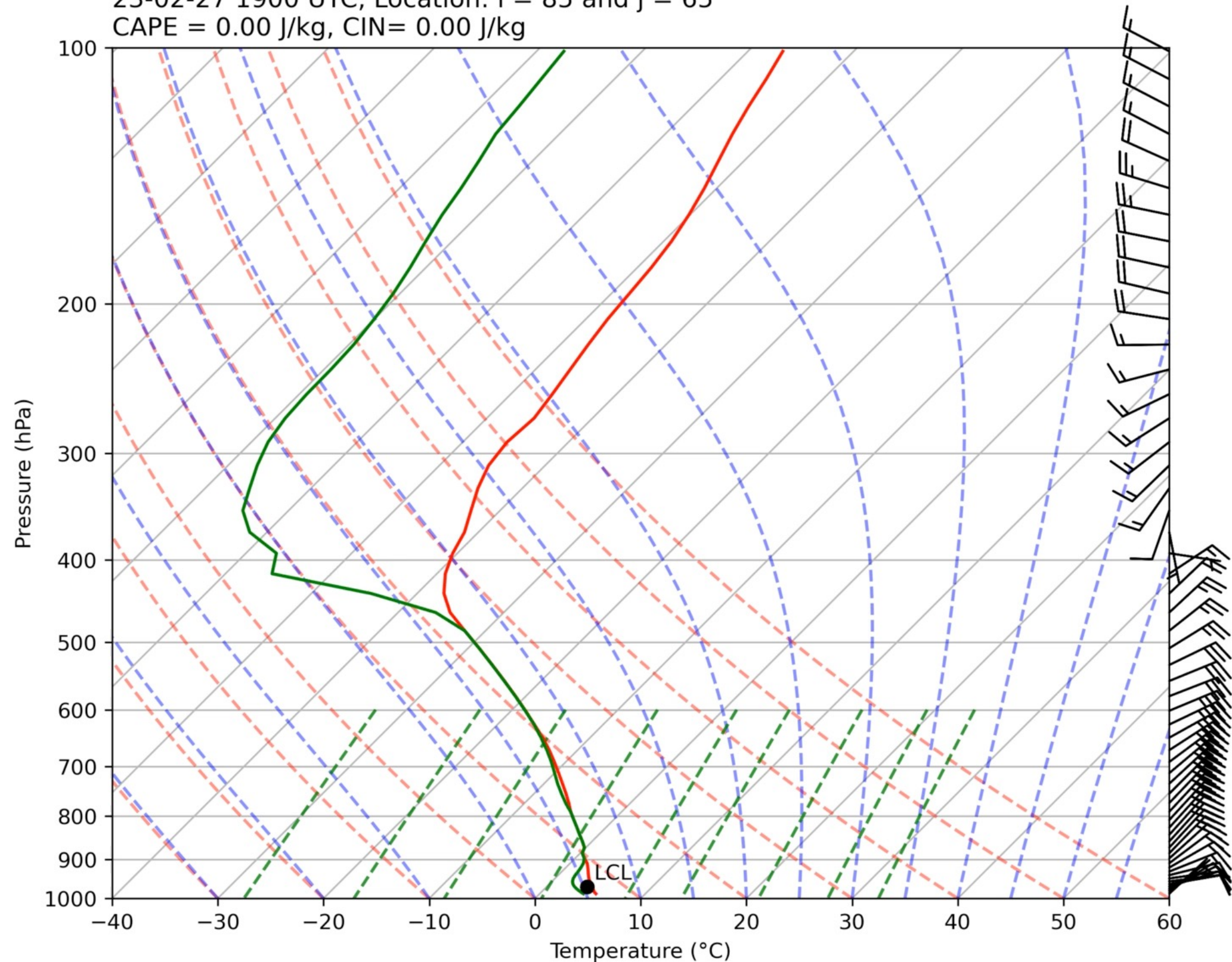


23-02-27 1900 UTC, Location: i = 85 and j = 70

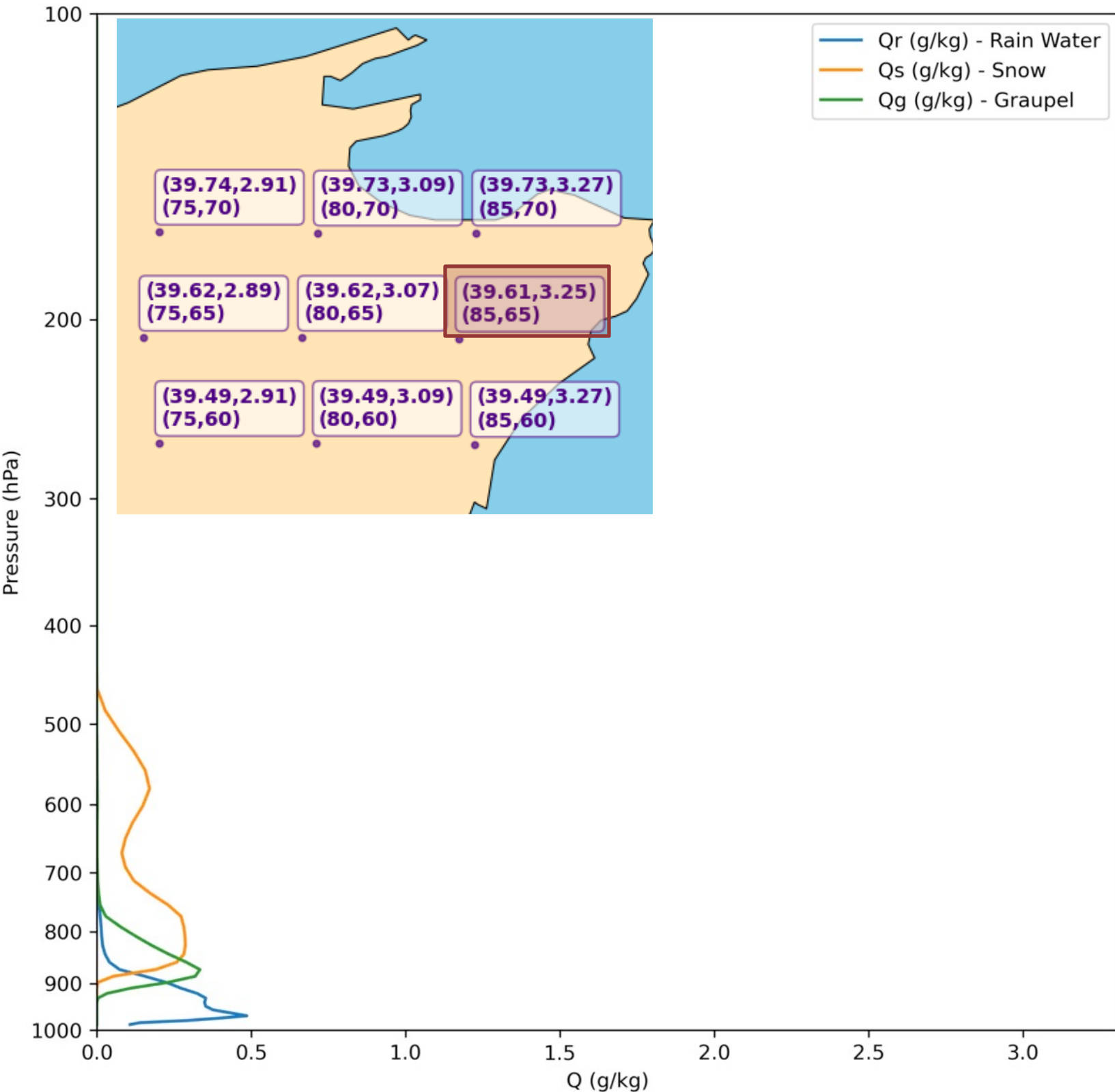


Unusual drop in theoretical snow level, with snow almost at sea level and significant accumulations in the Serra de Tramontana

23-02-27 1900 UTC, Location: i = 85 and j = 65
CAPE = 0.00 J/kg, CIN = 0.00 J/kg

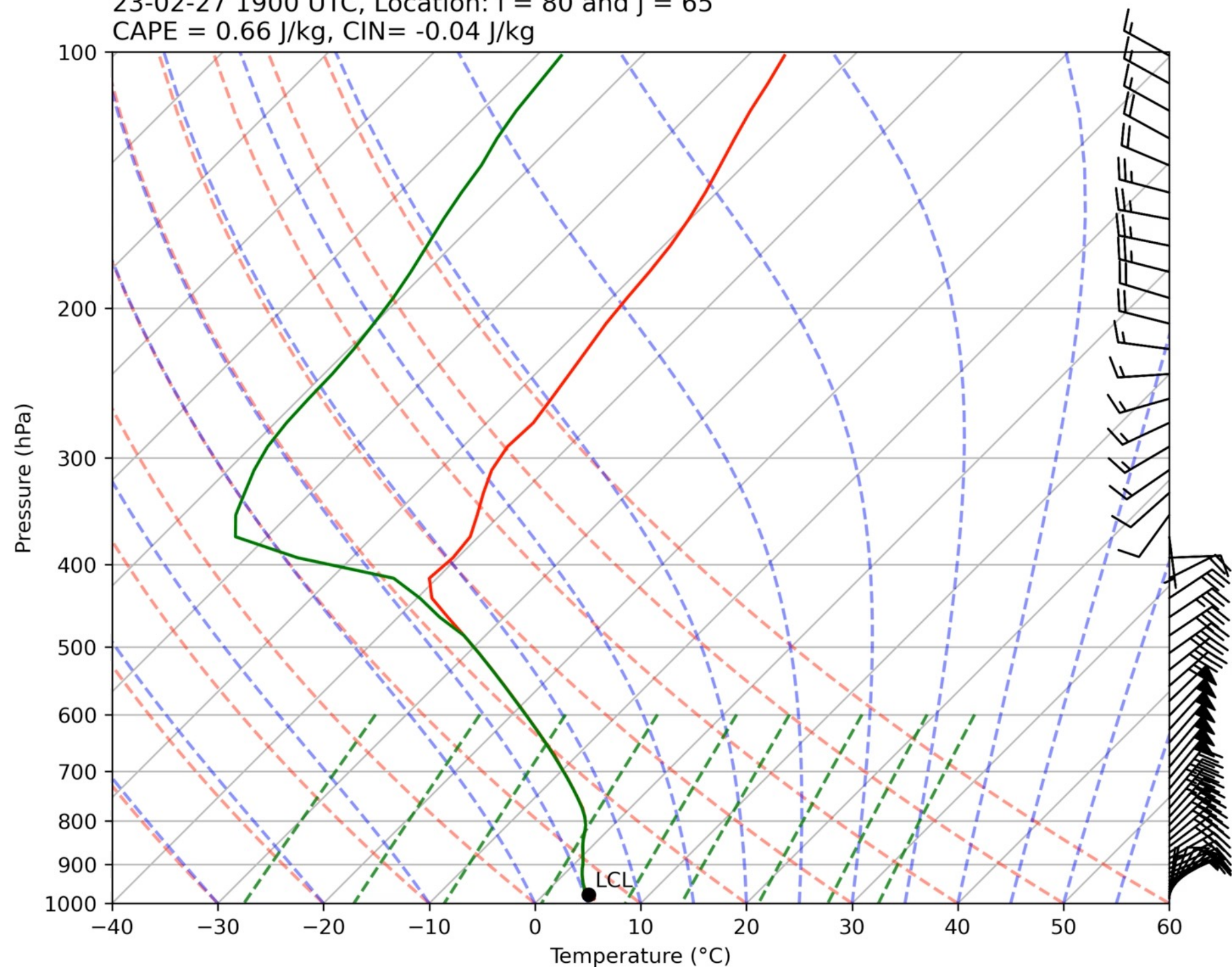


23-02-27 1900 UTC, Location: i = 85 and j = 65

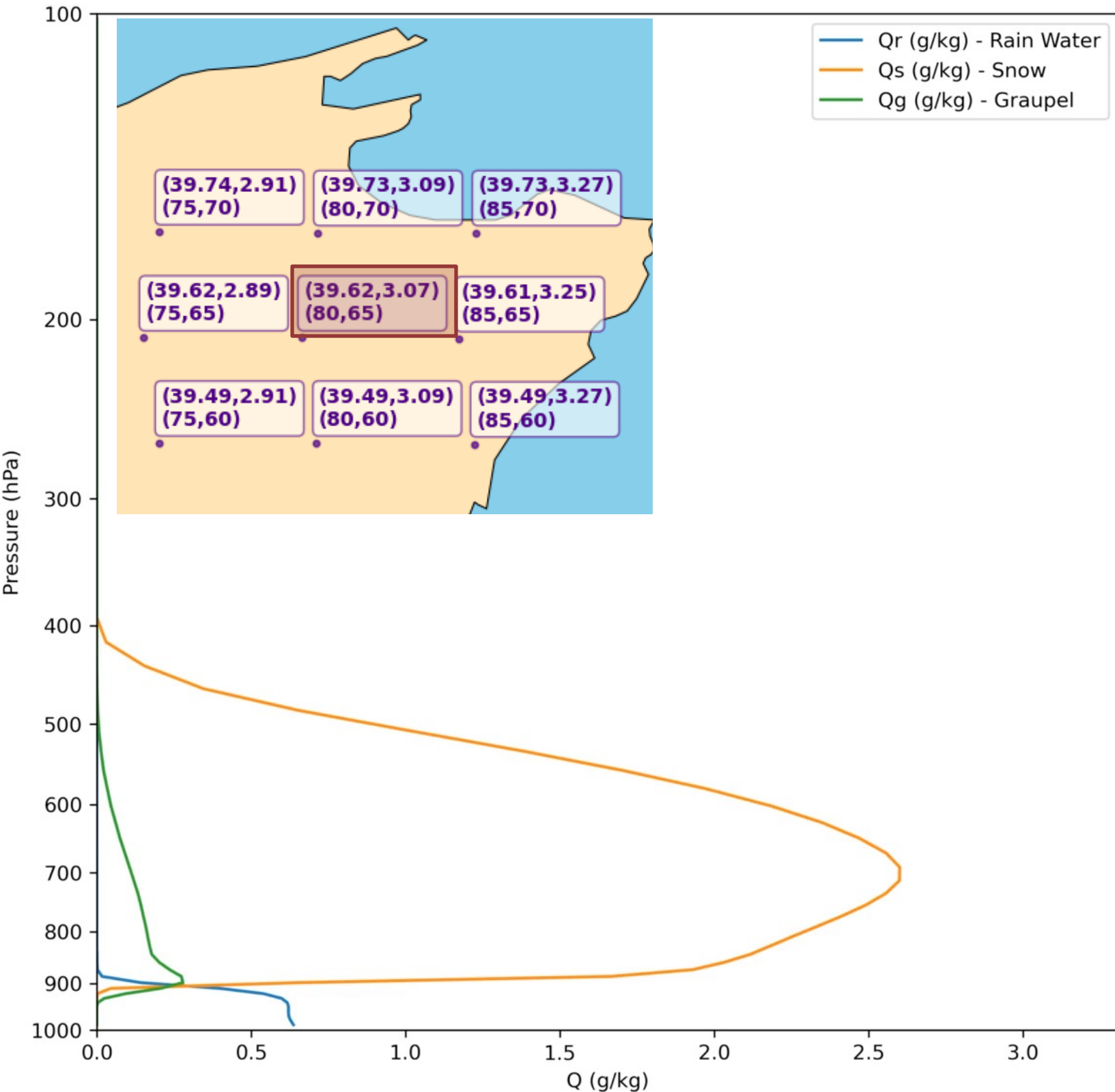


Unusual drop in theoretical snow level, with snow almost at sea level and significant accumulations in the Serra de Tramontana

23-02-27 1900 UTC, Location: i = 80 and j = 65
CAPE = 0.66 J/kg, CIN = -0.04 J/kg

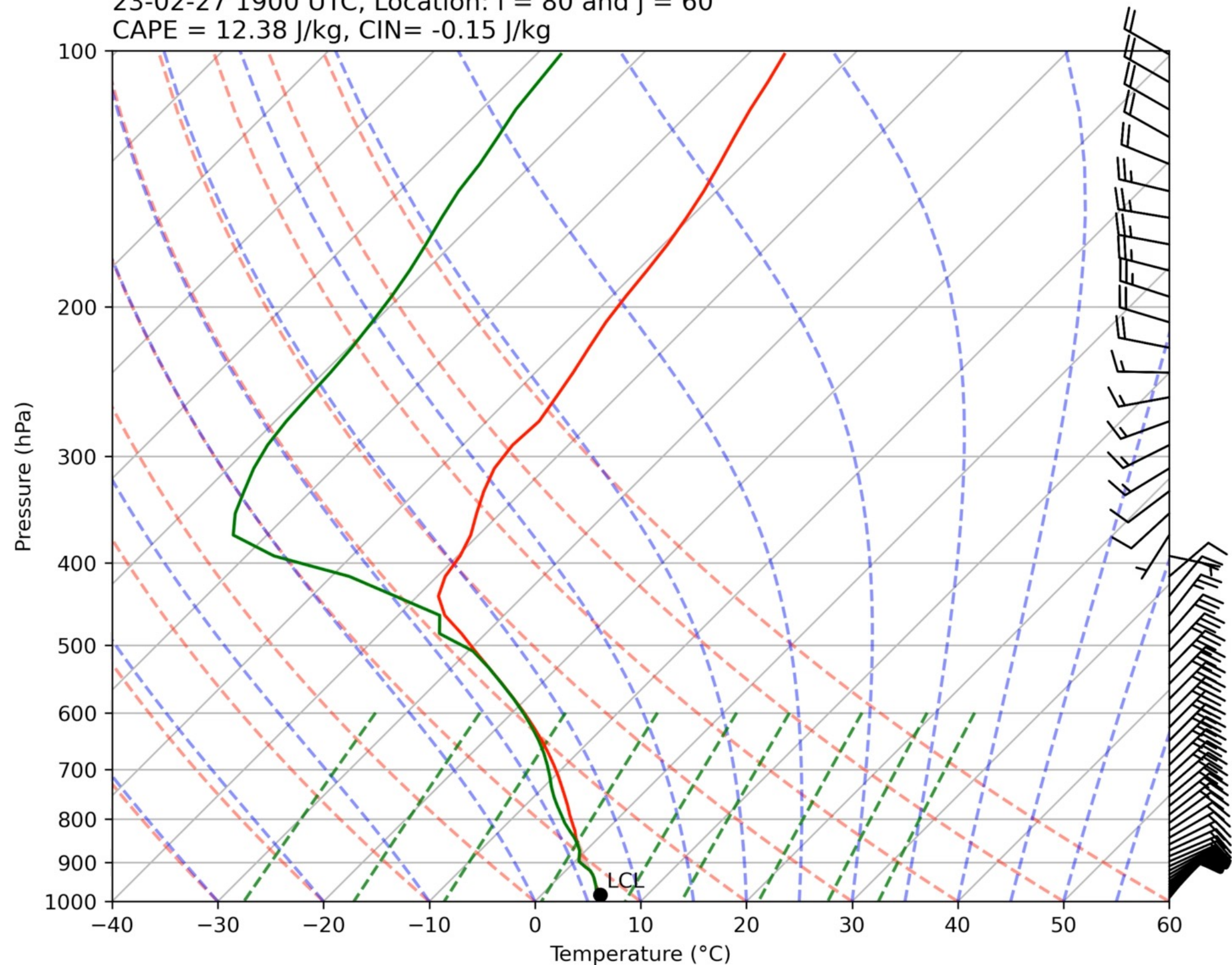


23-02-27 1900 UTC, Location: i = 80 and j = 65

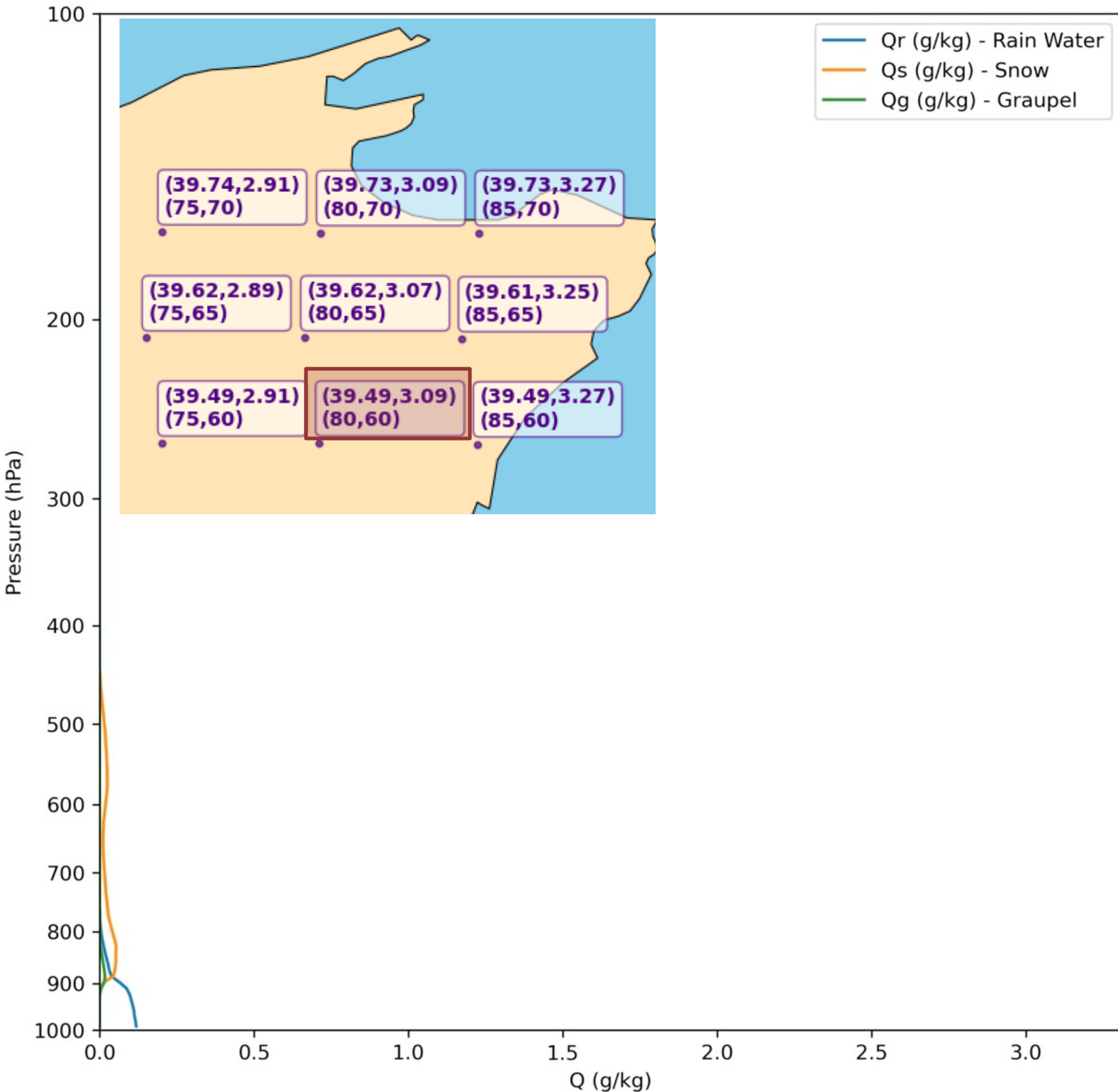


Unusual drop in theoretical snow level, with snow almost at sea level and significant accumulations in the Serra de Tramontana

23-02-27 1900 UTC, Location: i = 80 and j = 60
CAPE = 12.38 J/kg, CIN = -0.15 J/kg

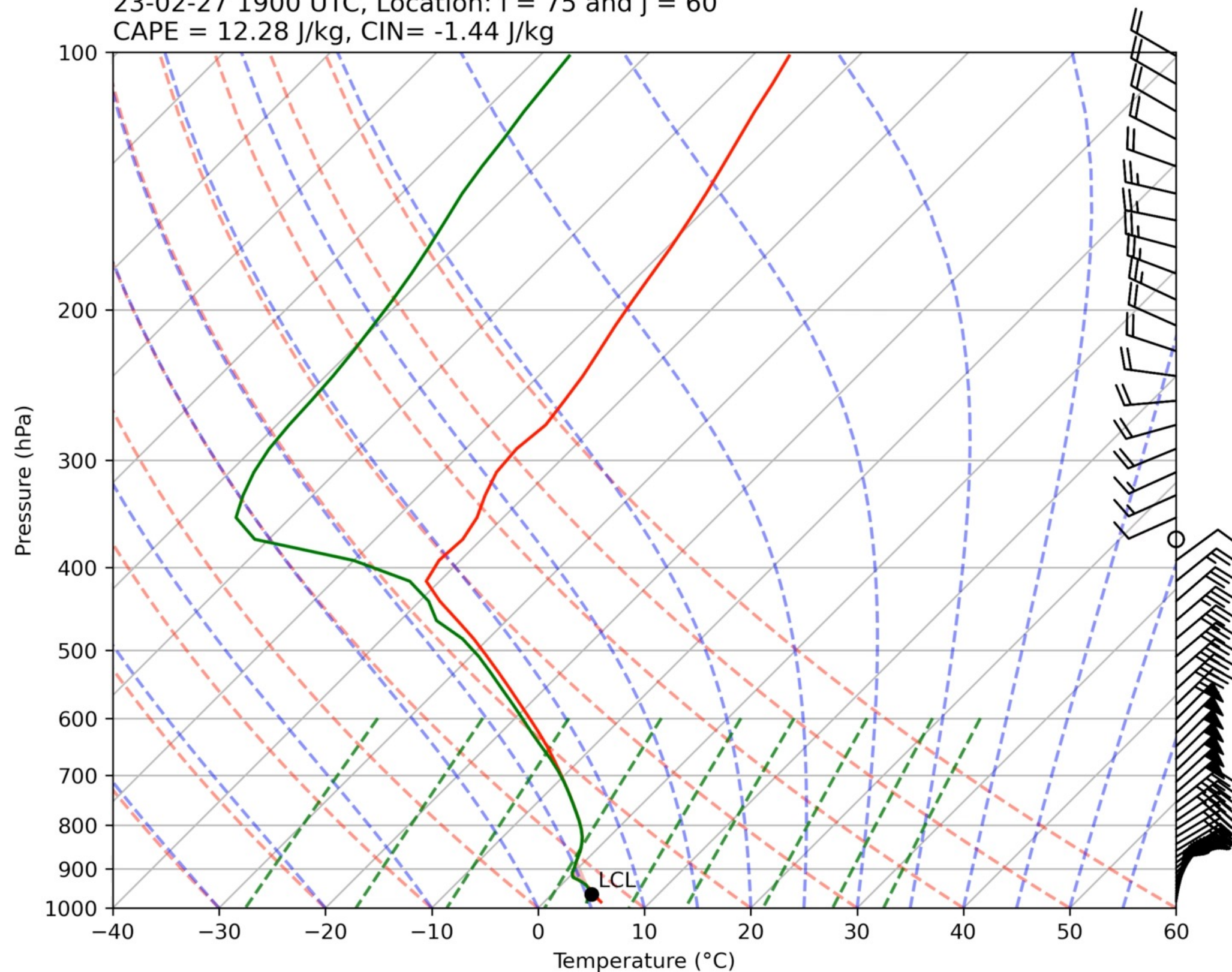


23-02-27 1900 UTC, Location: i = 80 and j = 60

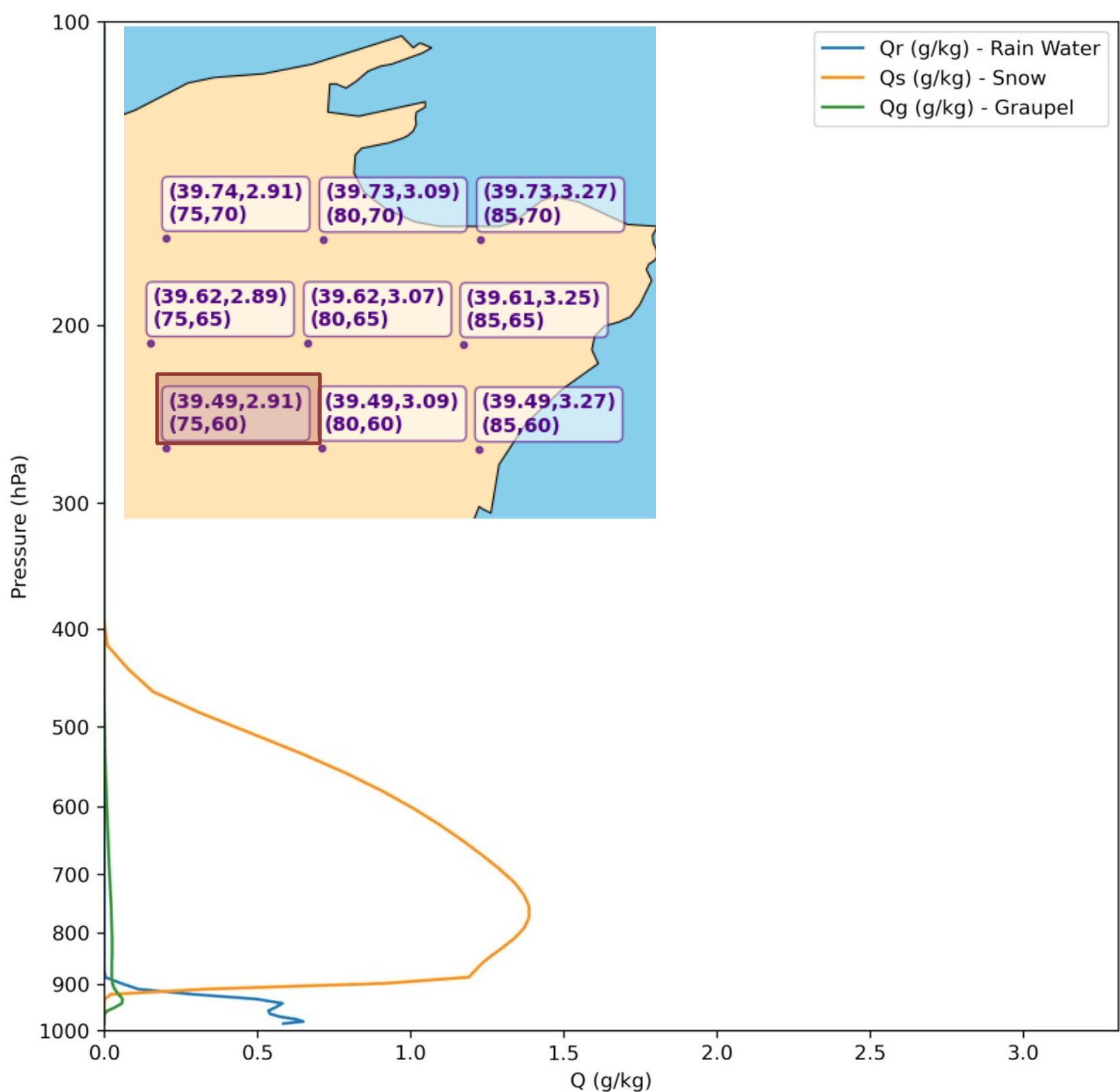


Unusual drop in theoretical snow level, with snow almost at sea level and significant accumulations in the Serra de Tramontana

23-02-27 1900 UTC, Location: i = 75 and j = 60
CAPE = 12.28 J/kg, CIN = -1.44 J/kg

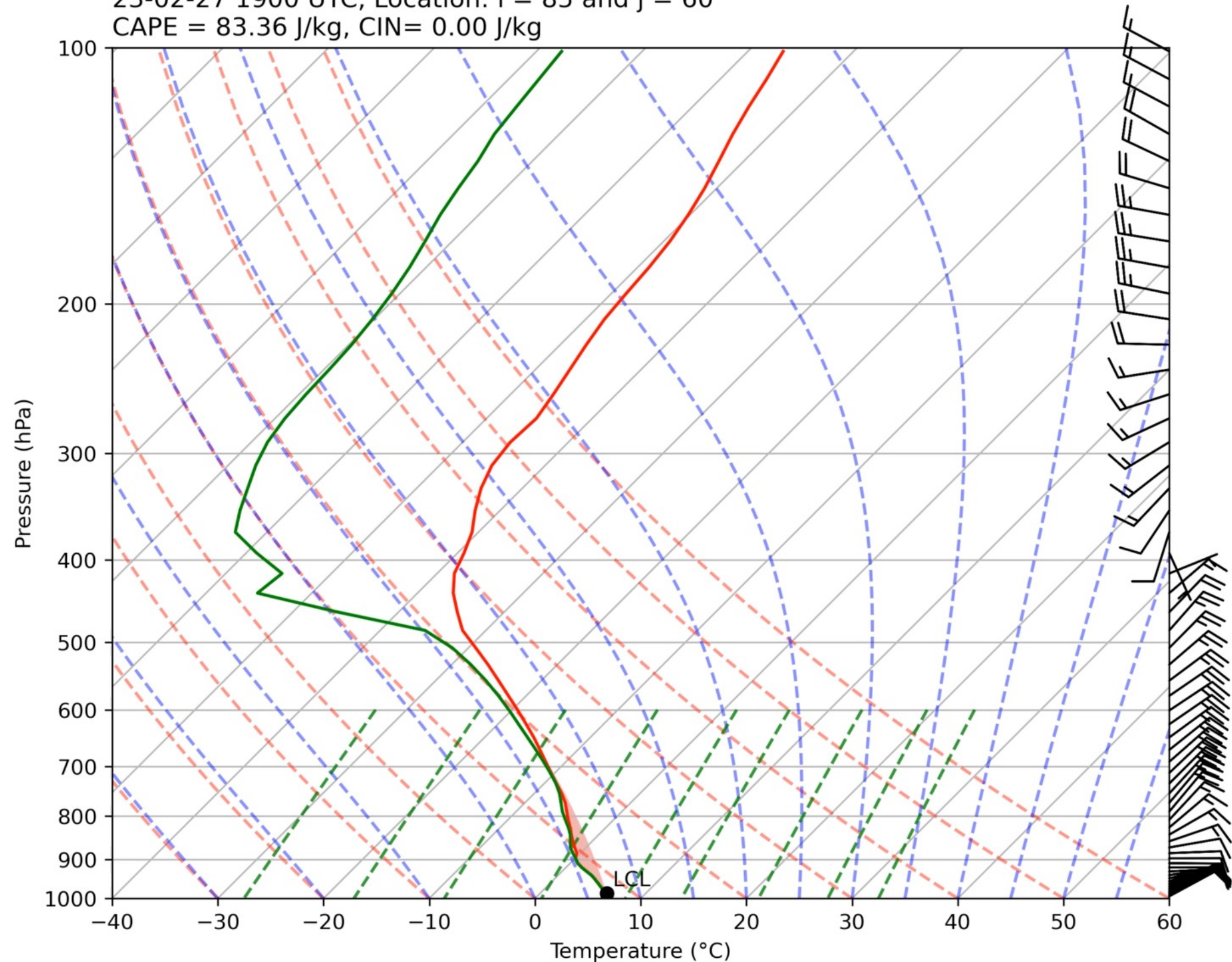


23-02-27 1900 UTC, Location: i = 75 and j = 60

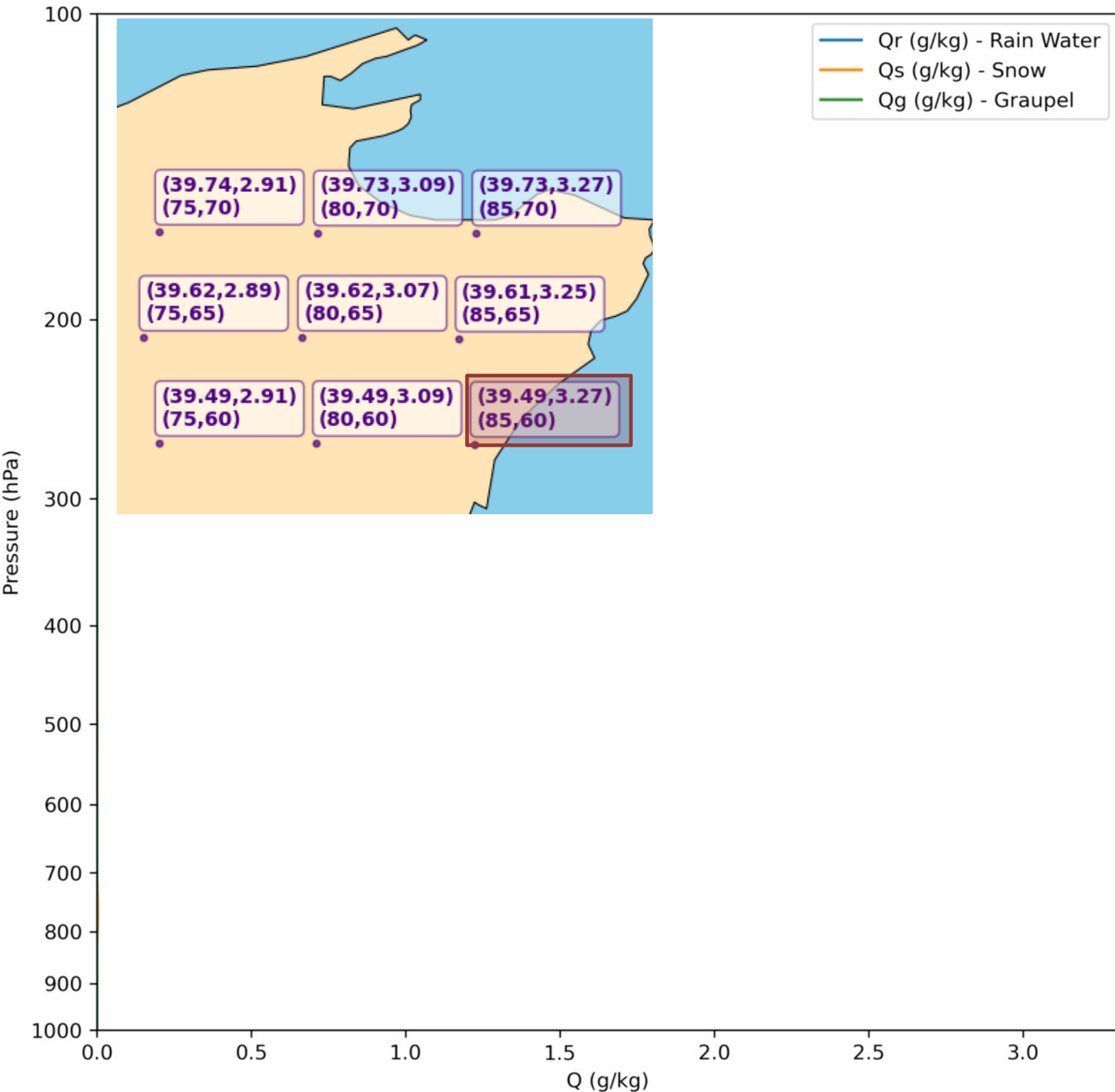


Unusual drop in theoretical snow level, with snow almost at sea level and significant accumulations in the Serra de Tramontana

23-02-27 1900 UTC, Location: i = 85 and j = 60
CAPE = 83.36 J/kg, CIN = 0.00 J/kg



23-02-27 1900 UTC, Location: i = 85 and j = 60



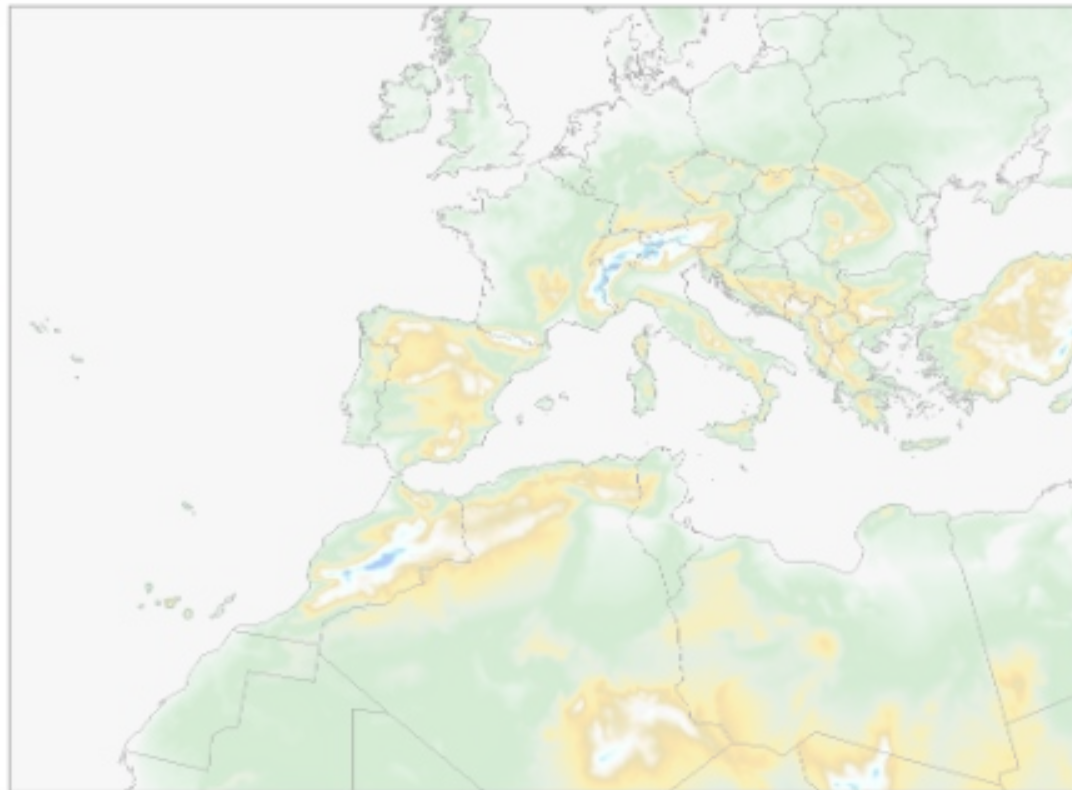


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- Unusual drop in theoretical snow level, with snow almost at sea level and significant accumulations in the Serra de Tramontana
- Extreme precipitation in the Balearic Islands

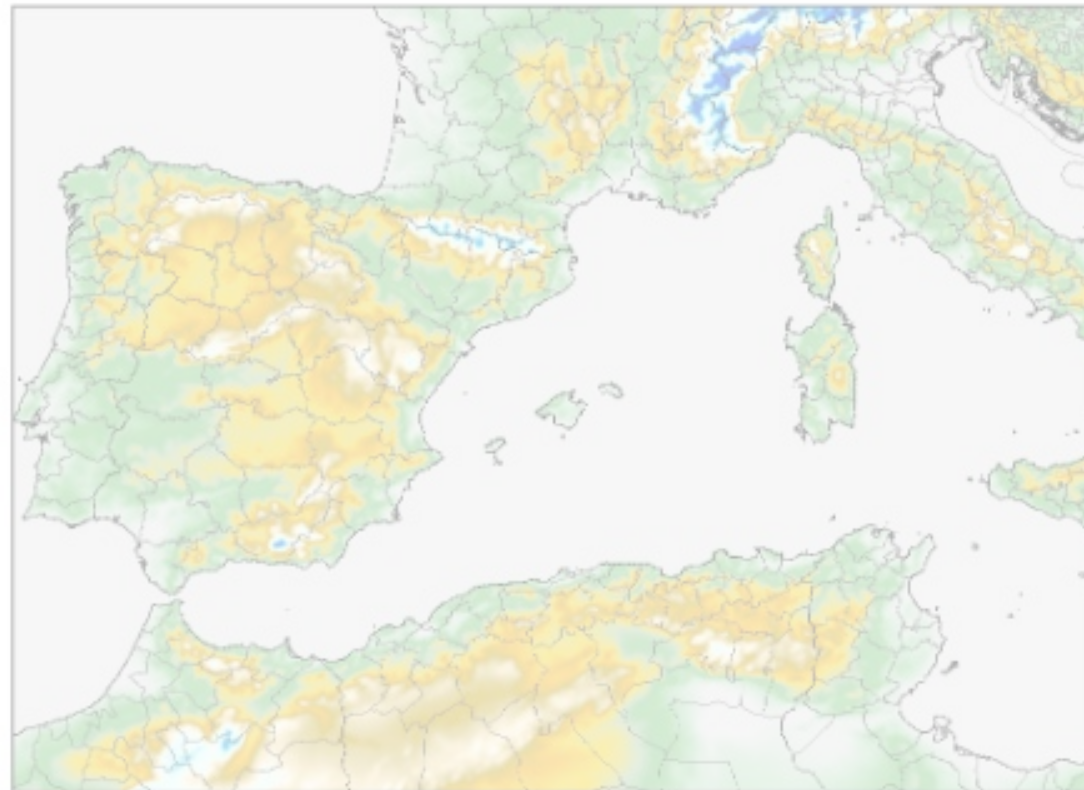
Extreme precipitation in the Balearic Islands

- TRAM simulation
- Operation SR domain
- Kain-Fritsch 2 convective scheme: ON and OFF

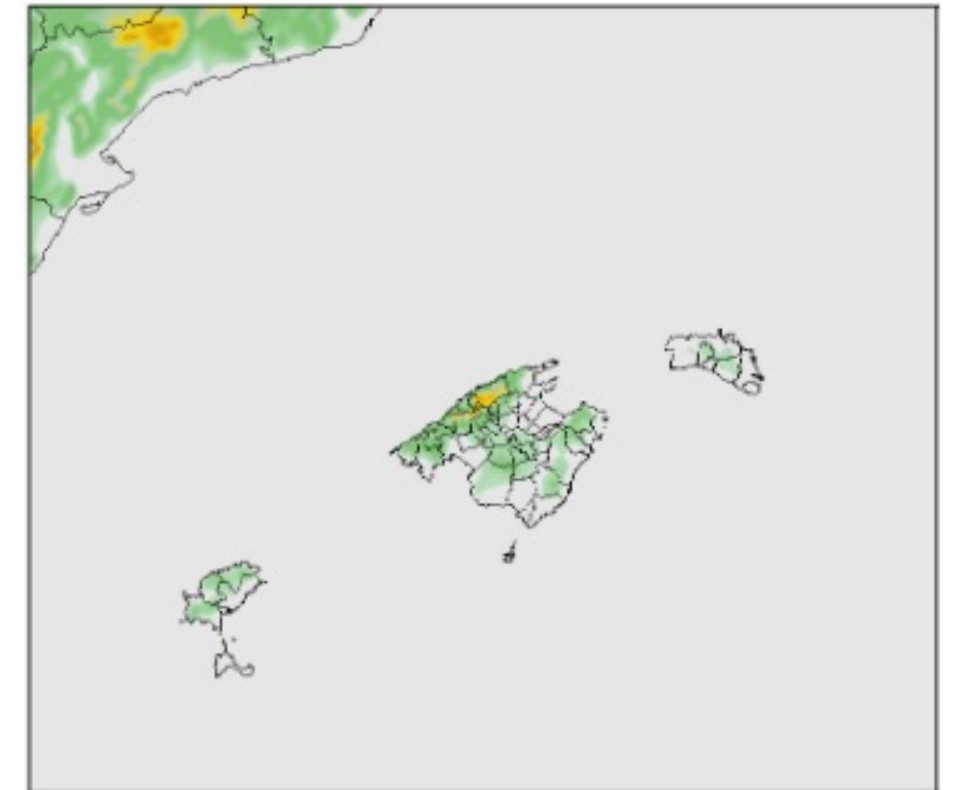
MR (17 km)



HR (6 km)



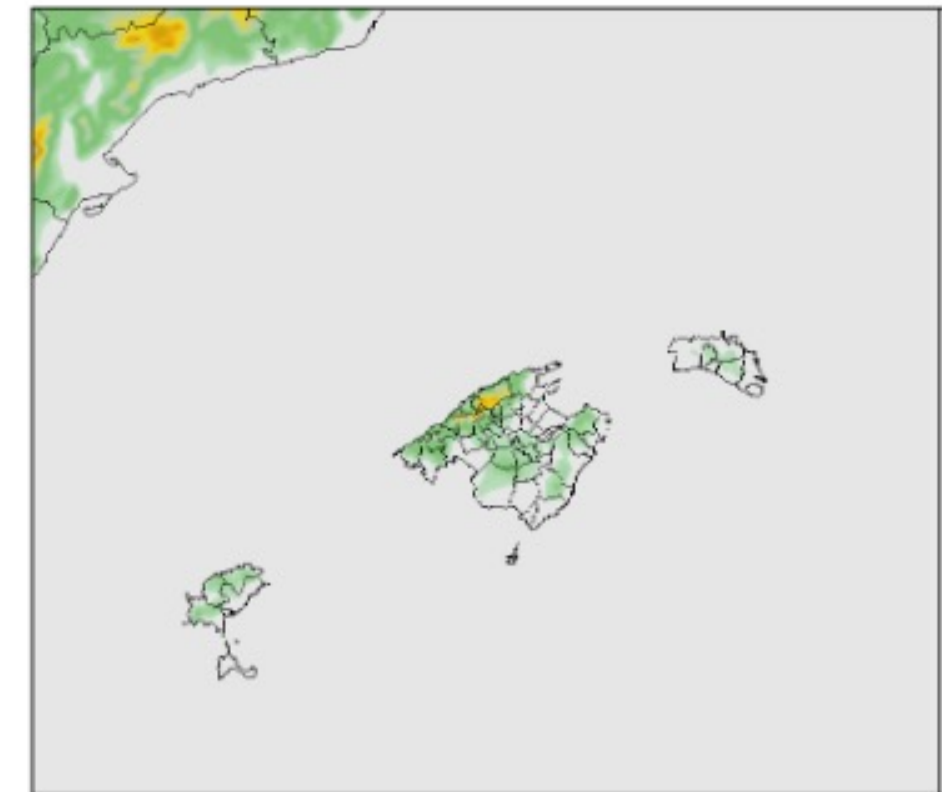
SR (2 km)



Extreme precipitation in the Balearic Islands

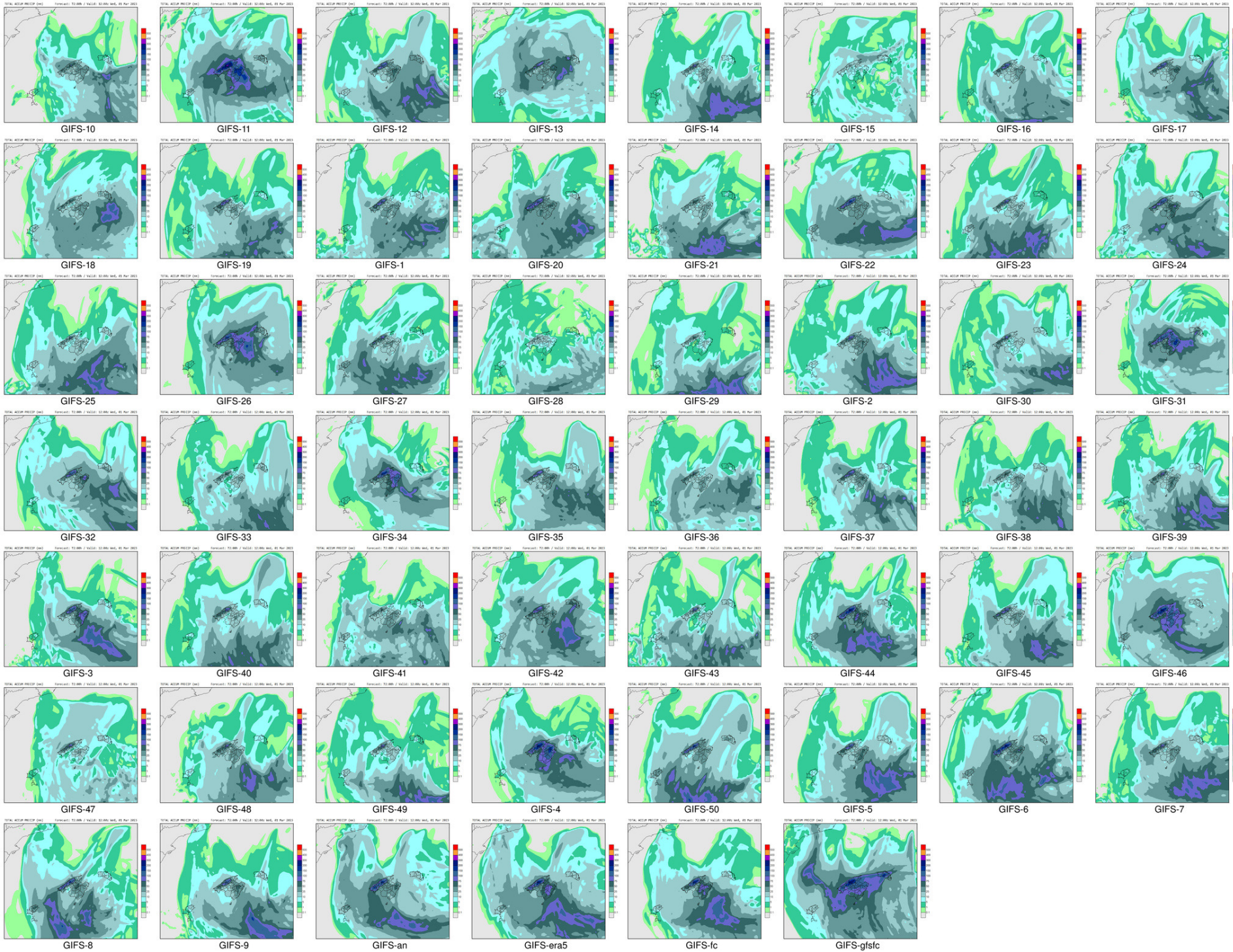
- TRAM simulation
- Operation SR domain
- Kain-Fritsch 2 convective scheme: ON and OFF
- Initialized with:
 - GFS generated on 26/02/2023 at 00 UTC from 0 to 96 simulation hour every 3 h
 - ECMWF analysis - 26/02/2023 to 01/03/2023 every 6 h
 - ECMWF 51 EPSs members generated on 26/02/2023 at 00 UTC from 0 to 96 simulation hour every 3 h

SR (2 km)



Extreme precipitation in the Balearic Islands

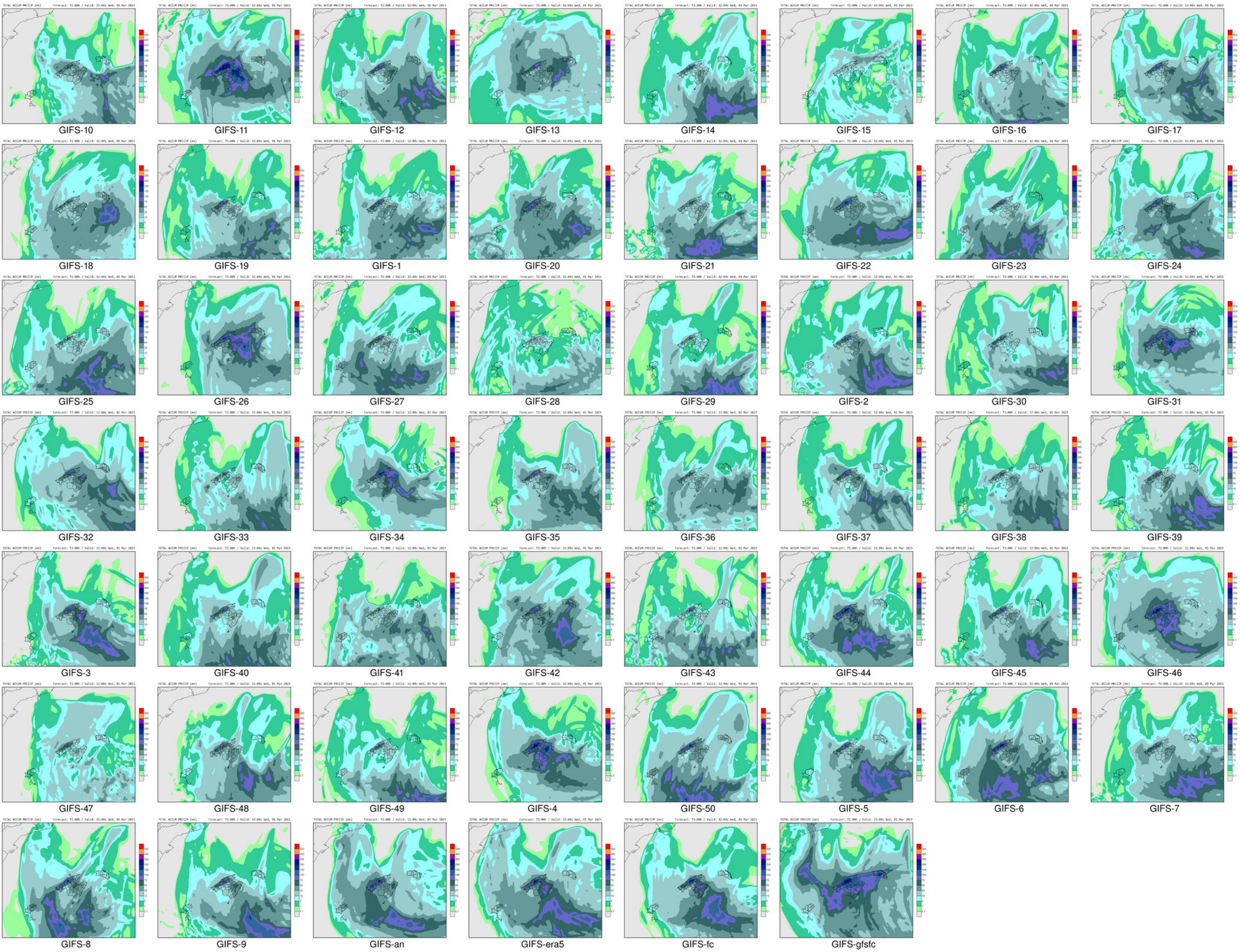
Juliette



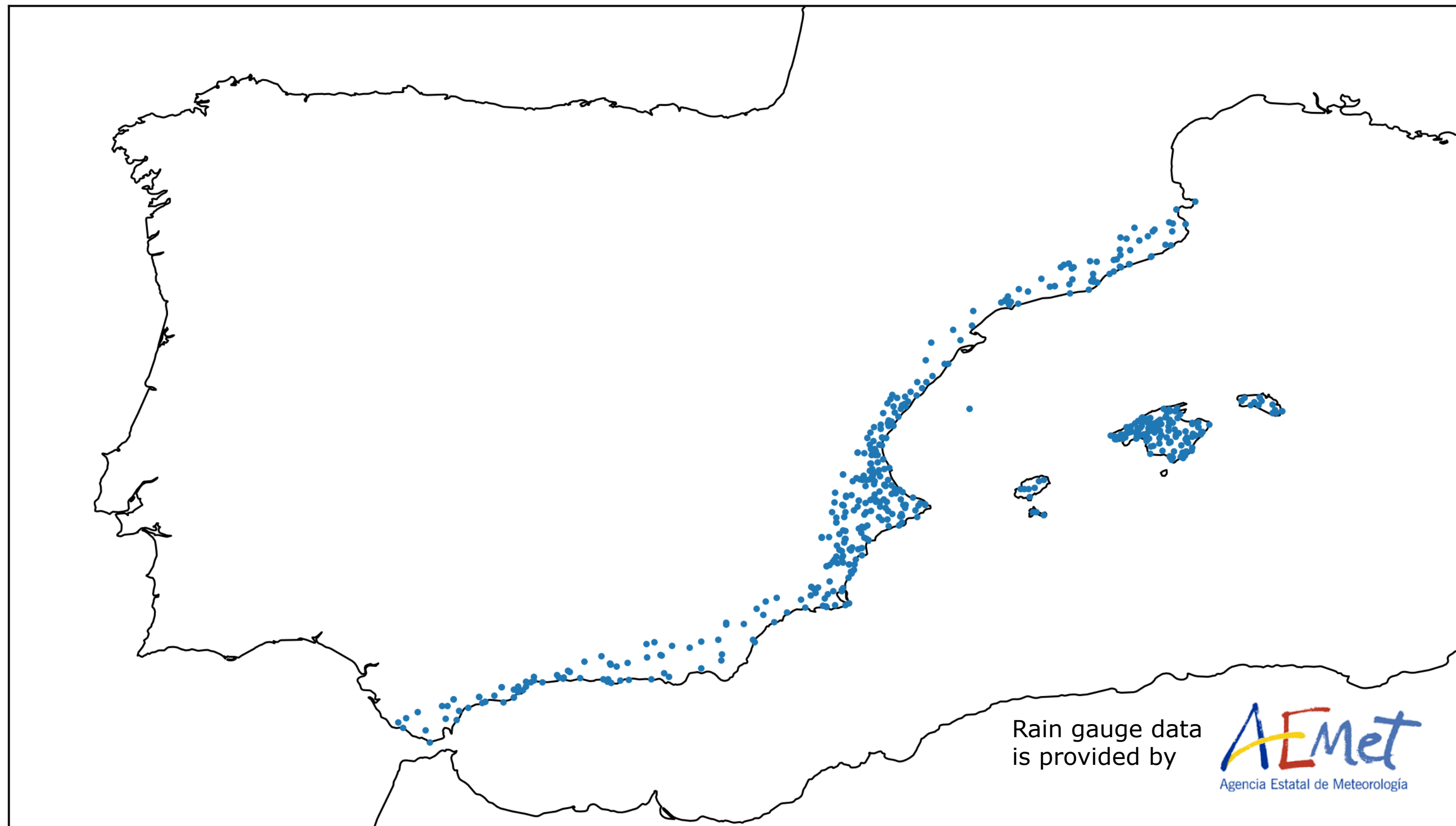
Juliette - KF



Juliette



Extreme precipitation in the Balearic Islands



Extreme precipitation in the Balearic Islands

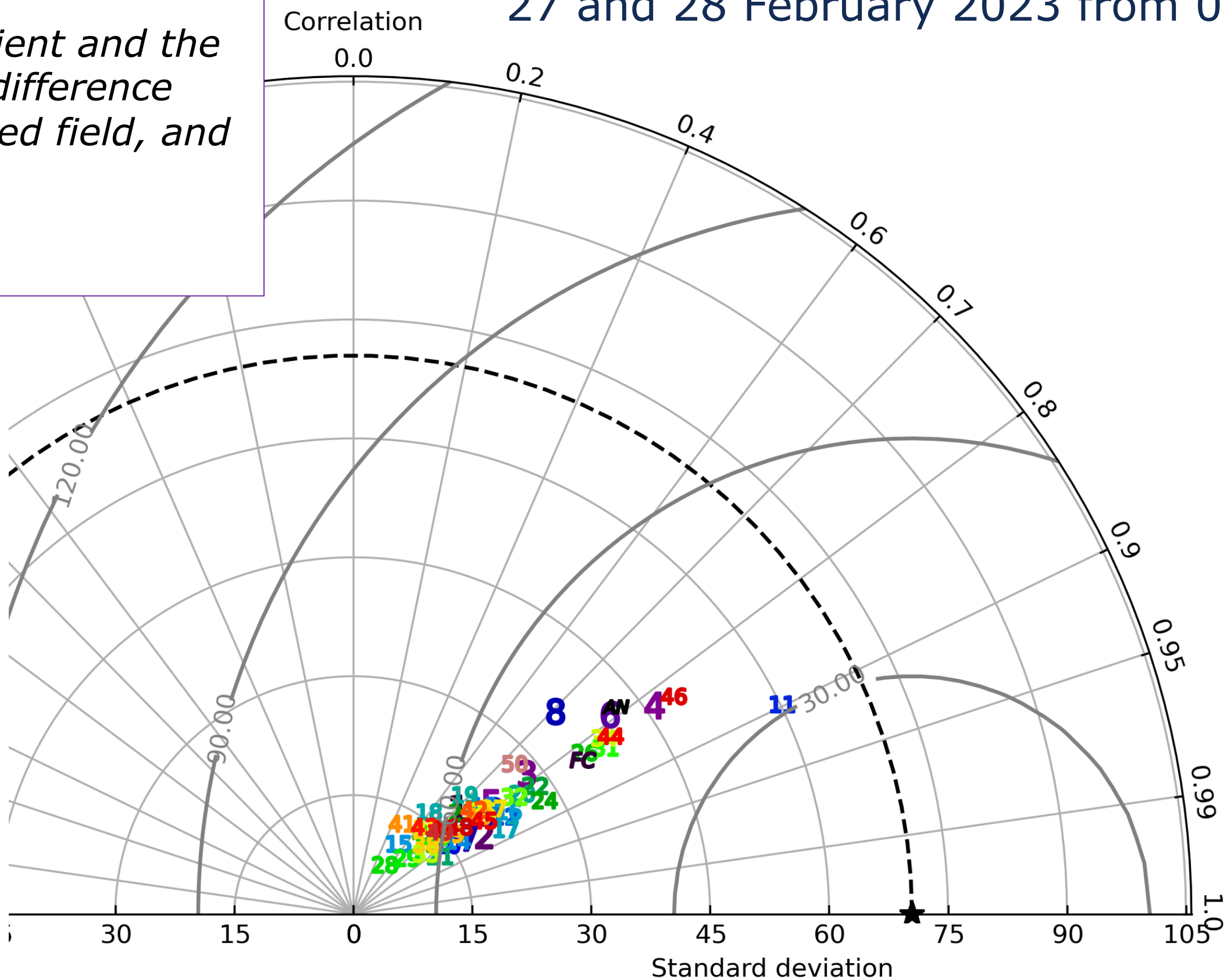
Taylor diagram

Plots in one graph correlation coefficient and the centered pattern root-mean-square difference between the forecast and the observed field, and the standard deviation of both fields

Perfect score: over the observation

27 and 28 February 2023 from 07 to 07 UTC

★	Observation	18	EPS-18	36	EPS-36
1	EPS-1	19	EPS-19	37	EPS-37
2	EPS-2	20	EPS-20	38	EPS-38
3	EPS-3	21	EPS-21	39	EPS-39
4	EPS-4	22	EPS-22	40	EPS-40
5	EPS-5	23	EPS-23	41	EPS-41
6	EPS-6	24	EPS-24	42	EPS-42
7	EPS-7	25	EPS-25	43	EPS-43
8	EPS-8	26	EPS-26	44	EPS-44
9	EPS-9	27	EPS-27	45	EPS-45
10	EPS-10	28	EPS-28	46	EPS-46
11	EPS-11	29	EPS-29	47	EPS-47
12	EPS-12	30	EPS-30	48	EPS-48
13	EPS-13	31	EPS-31	49	EPS-49
14	EPS-14	32	EPS-32	50	EPS-50
15	EPS-15	33	EPS-33	AN	AN
16	EPS-16	34	EPS-34	FC	FC
17	EPS-17	35	EPS-35		



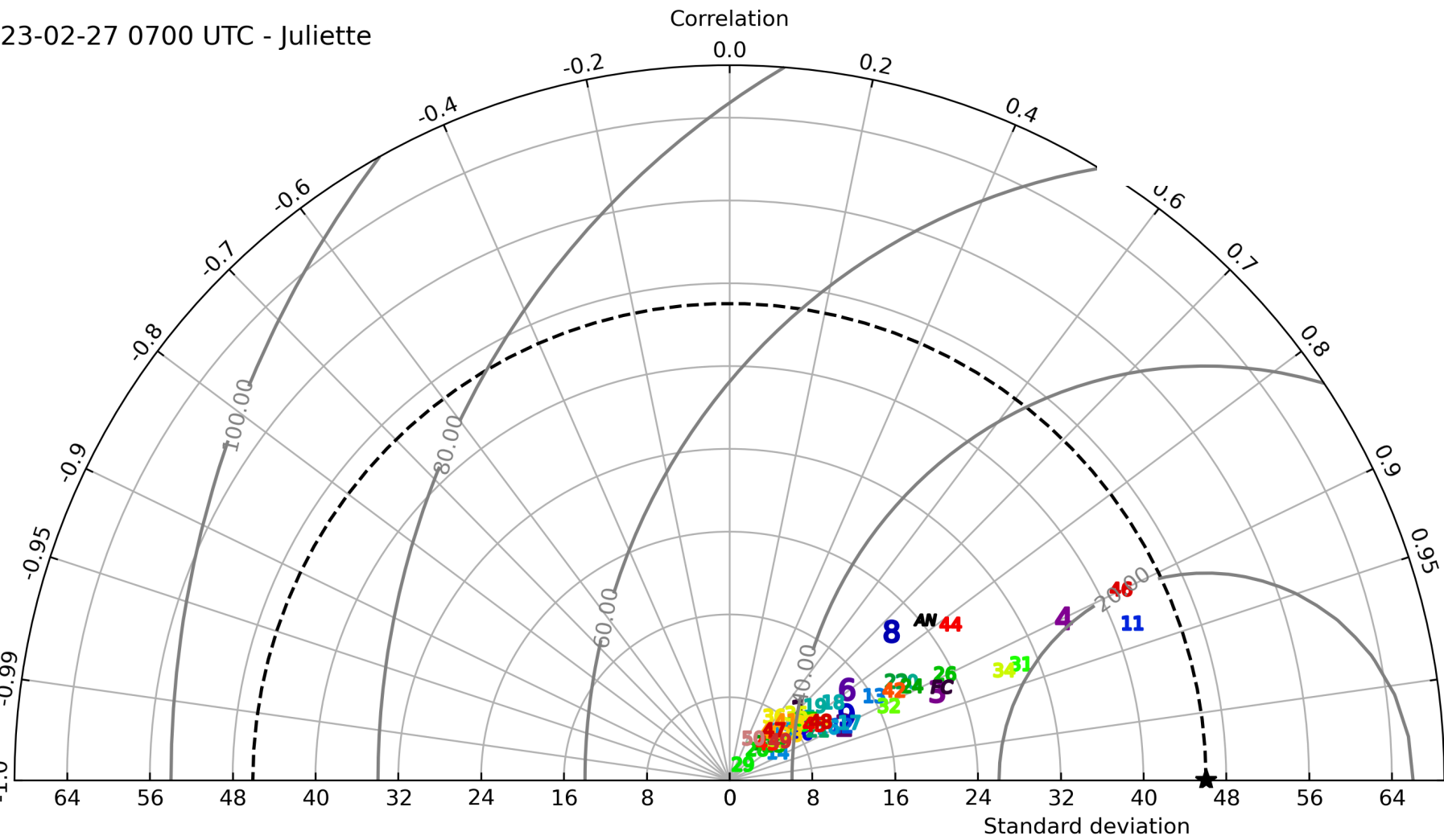
Extreme precipitation in the Balearic Islands

Taylor diagram

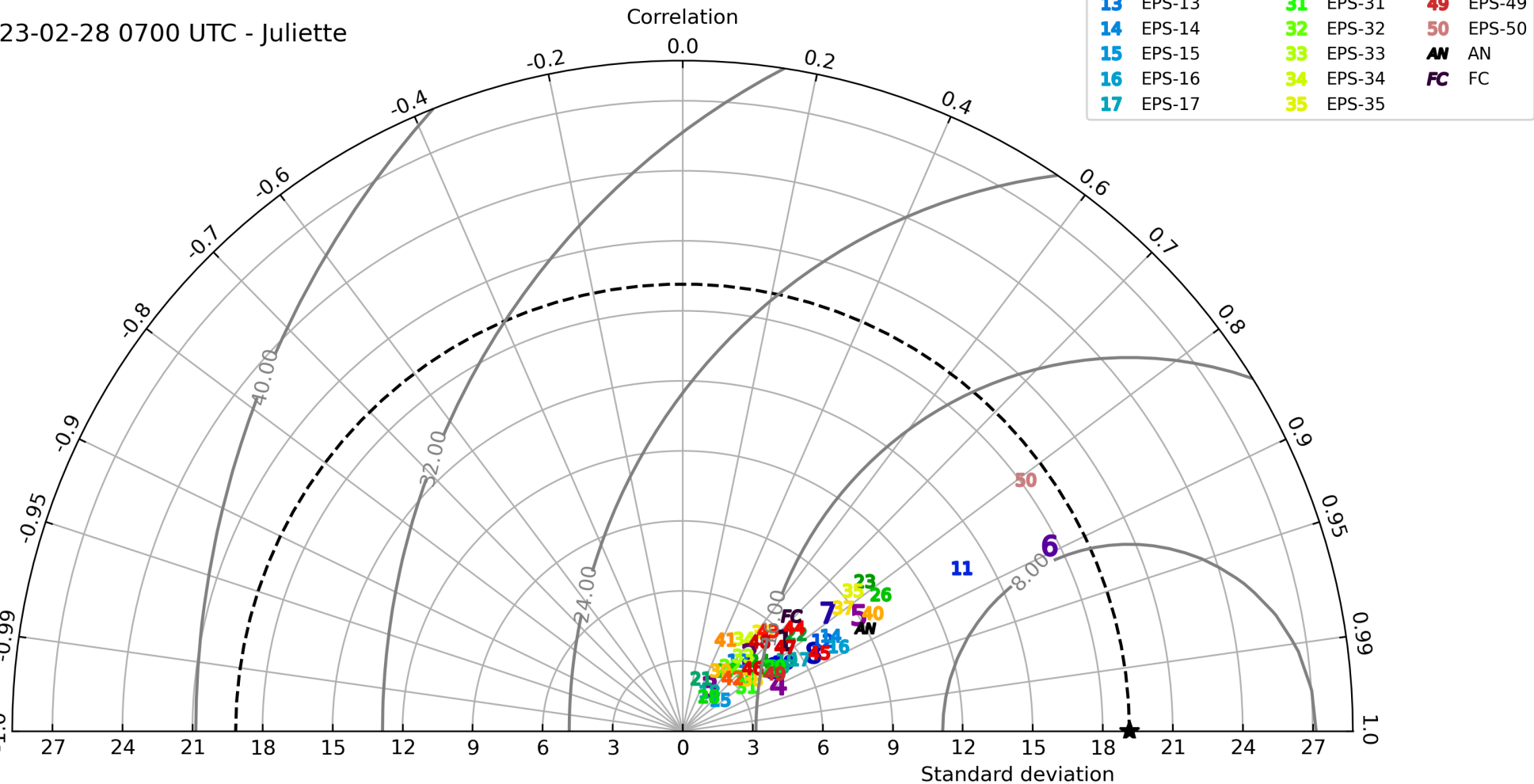
Plots in one graph correlation coefficient and the centered pattern root-mean-square difference between the forecast and the observed field, and the standard deviation of both fields

Perfect score: over the observation

23-02-27 0700 UTC - Juliette



23-02-28 0700 UTC - Juliette

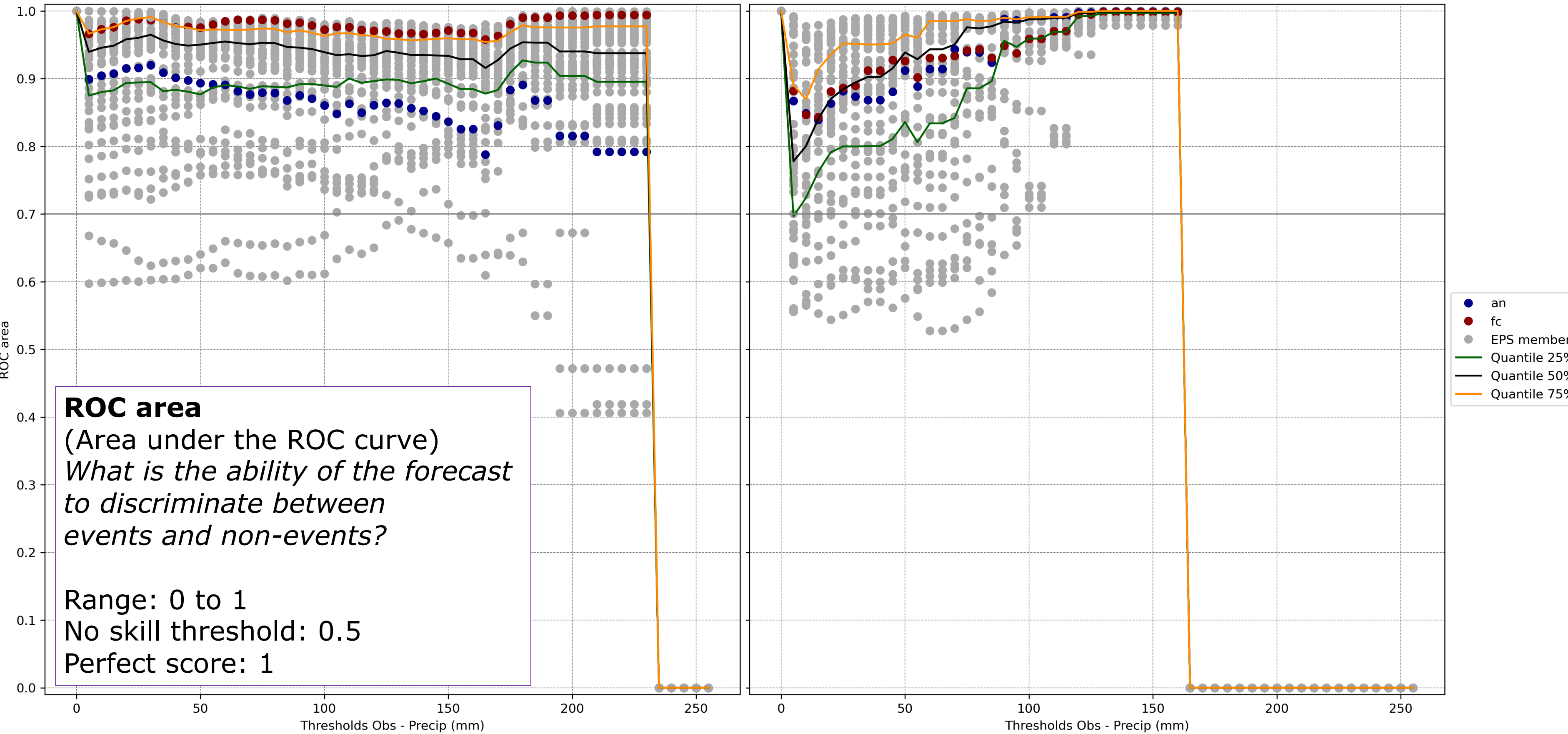


★	Observation	18	EPS-18	36	EPS-36
1	EPS-1	19	EPS-19	37	EPS-37
2	EPS-2	20	EPS-20	38	EPS-38
3	EPS-3	21	EPS-21	39	EPS-39
4	EPS-4	22	EPS-22	40	EPS-40
5	EPS-5	23	EPS-23	41	EPS-41
6	EPS-6	24	EPS-24	42	EPS-42
7	EPS-7	25	EPS-25	43	EPS-43
8	EPS-8	26	EPS-26	44	EPS-44
9	EPS-9	27	EPS-27	45	EPS-45
10	EPS-10	28	EPS-28	46	EPS-46
11	EPS-11	29	EPS-29	47	EPS-47
12	EPS-12	30	EPS-30	48	EPS-48
13	EPS-13	31	EPS-31	49	EPS-49
14	EPS-14	32	EPS-32	50	EPS-50
15	EPS-15	33	EPS-33	AN	AN
16	EPS-16	34	EPS-34	FC	FC
17	EPS-17	35	EPS-35		

Extreme precipitation in the Balearic Islands

Juliette - ROCarea - - 27-02-2023

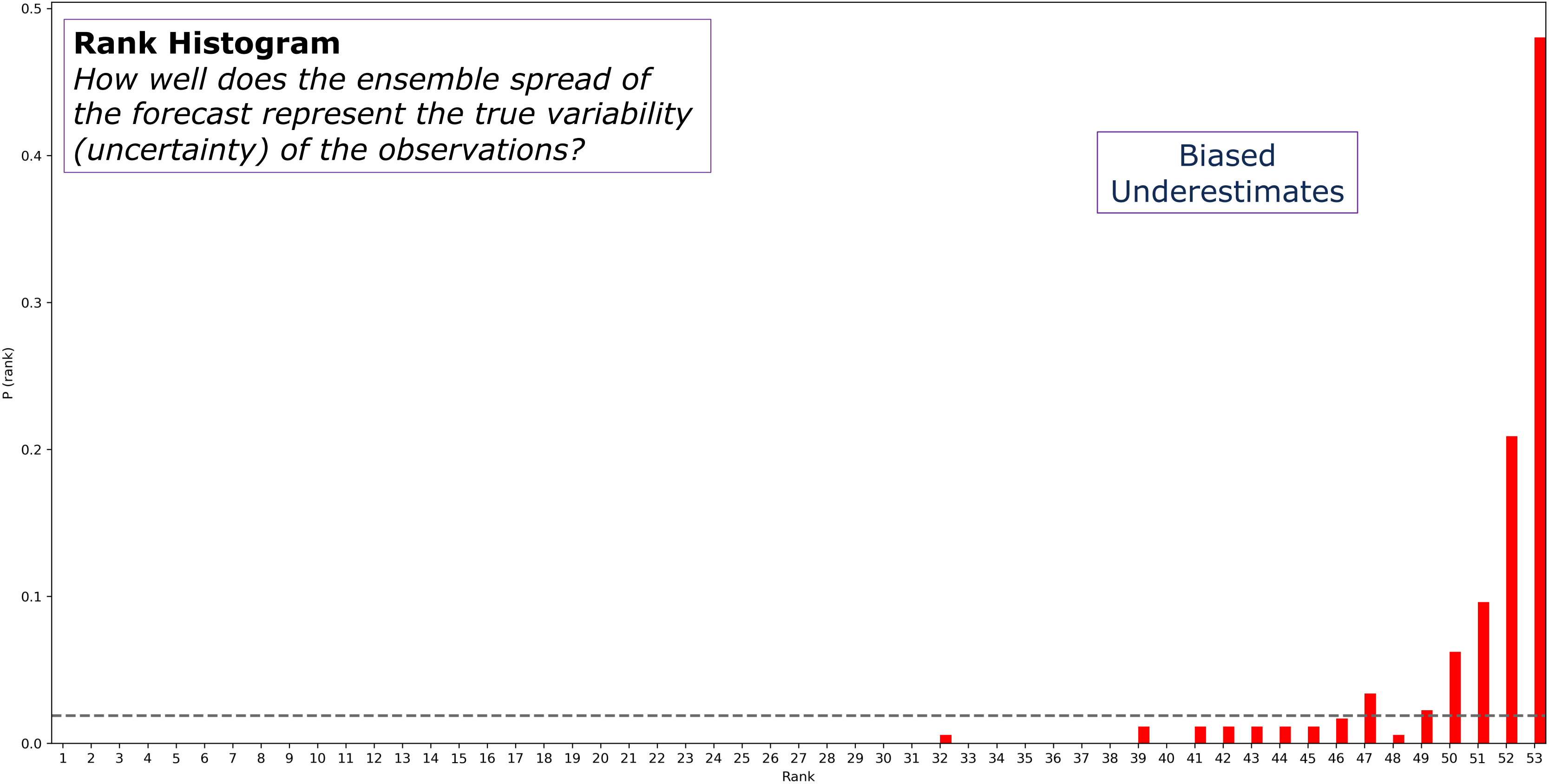
Juliette - ROCarea - - 28-02-2023



Extreme precipitation in the Balearic Islands

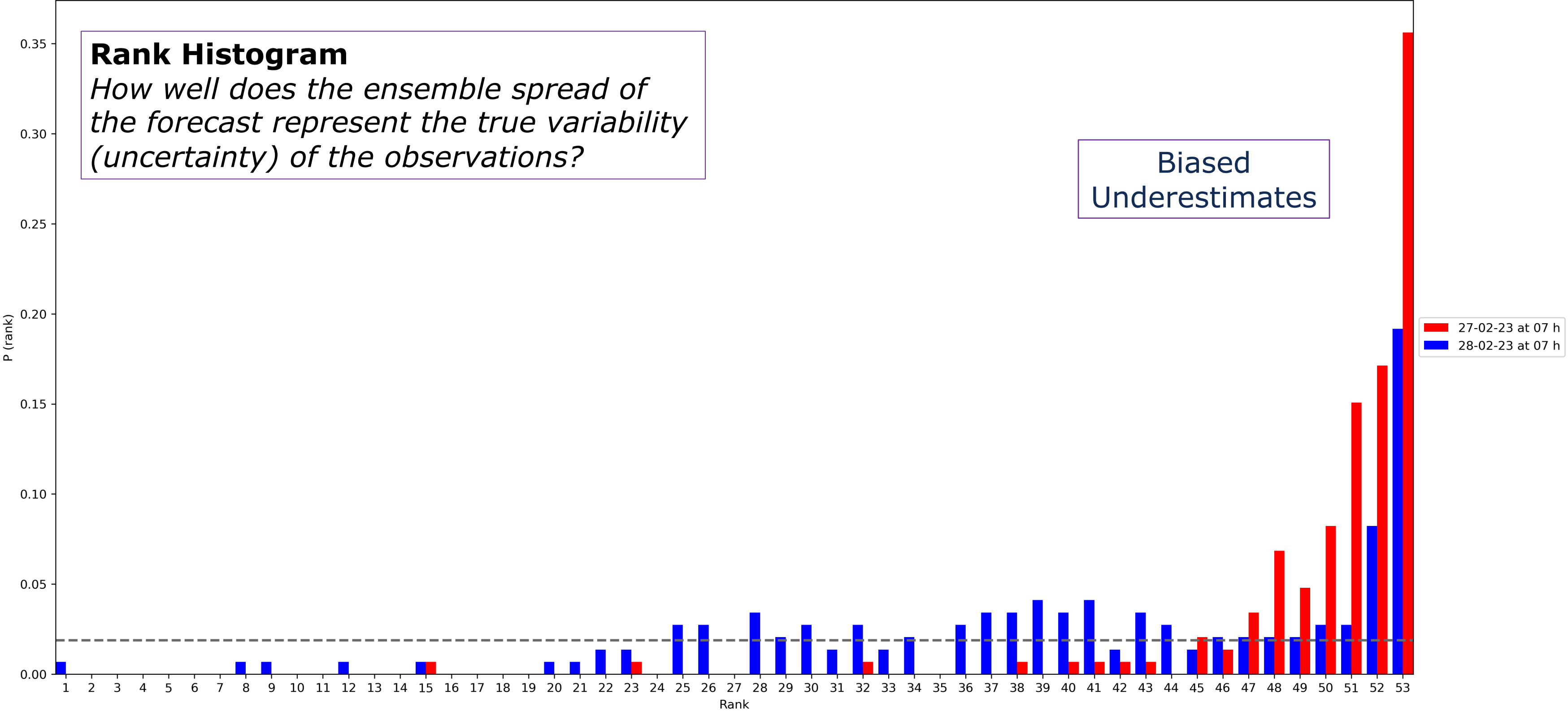
27 and 28 February 2023 from 07 to 07 UTC

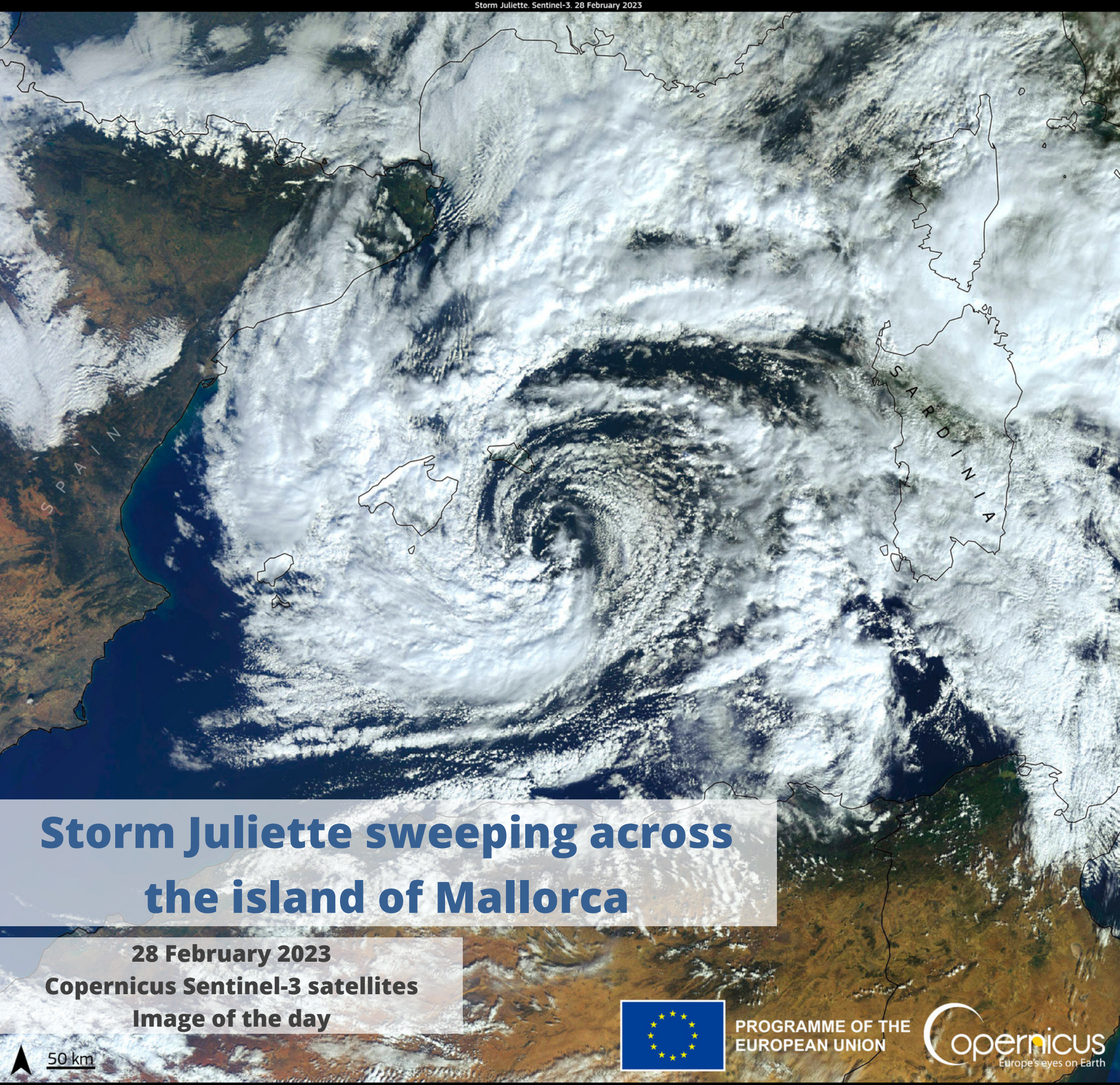
Juliette



Extreme precipitation in the Balearic Islands

Juliette





**Storm Juliette sweeping across
the island of Mallorca**

28 February 2023
Copernicus Sentinel-3 satellites
Image of the day

50 km



PROGRAMME OF THE
EUROPEAN UNION

