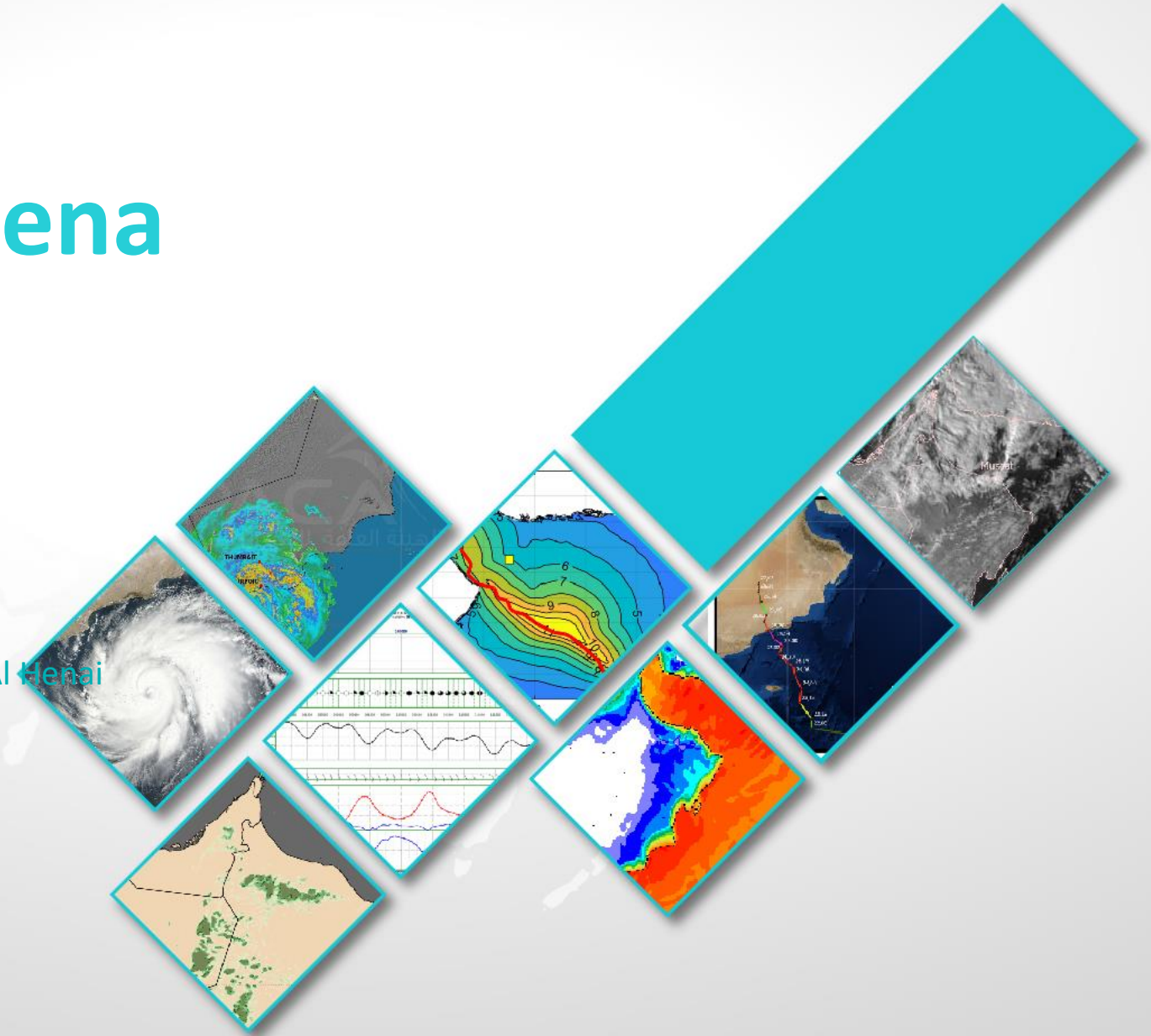
Weather Phenomena

Local convection/Summer Monsoon



Contect creator: Zamzam Al Rawahi, Jamal Al Henai and Bushra Al Saadi

Lecturer: Bushra Al Saadi

Content

1. Cloud’s formation
2. Local Convection
3. Summer Monsoon

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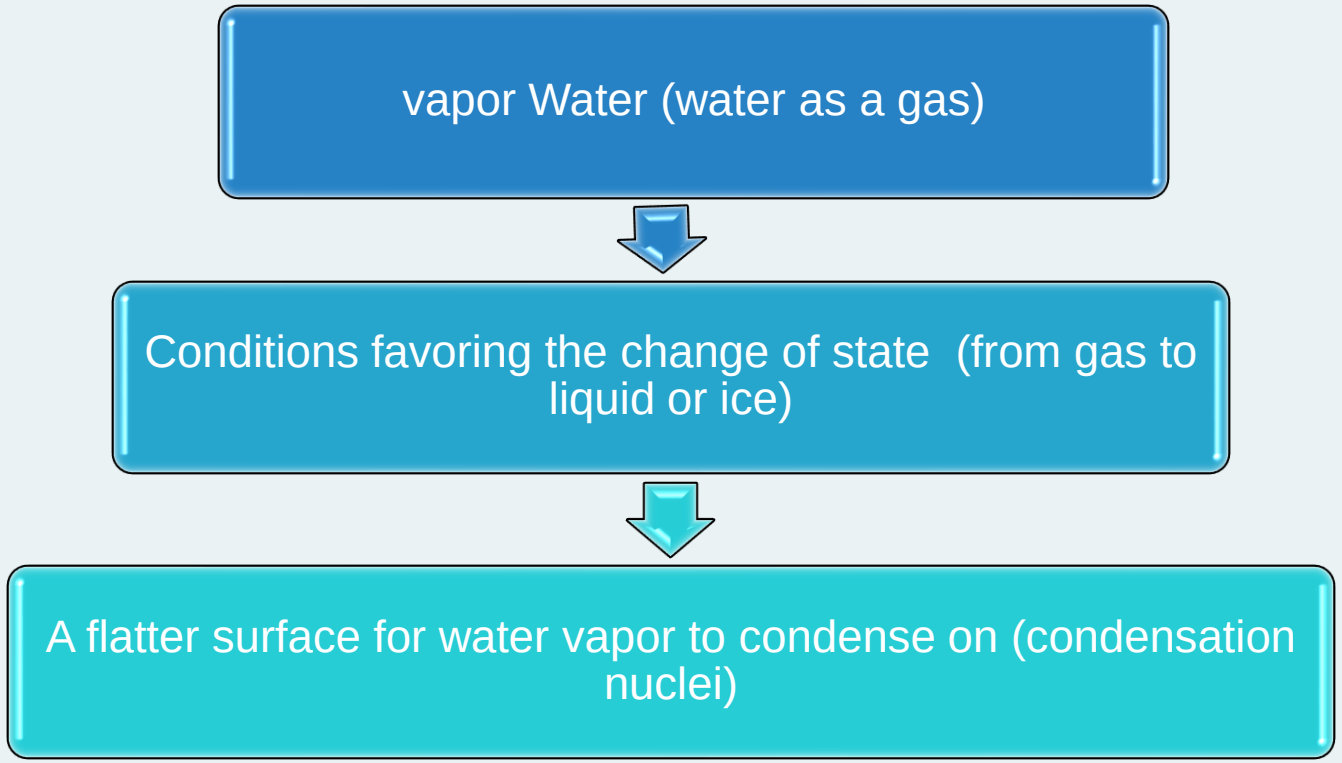
Cloud’s formation

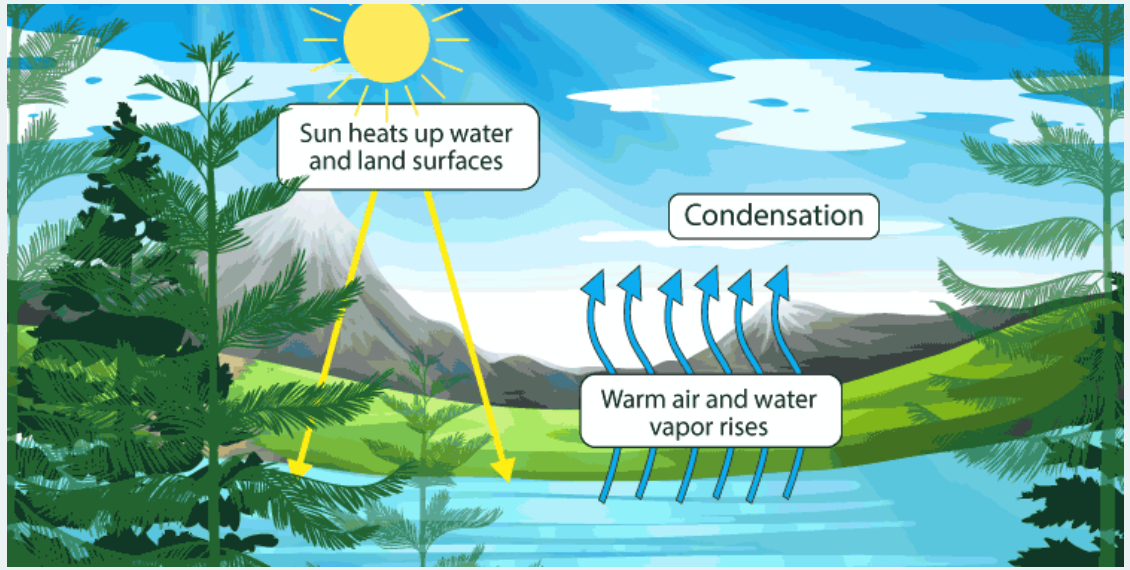
- Ingredients needed for cloud to form
- How does water vapour get’s into the air?
- Cloud formation mechanism

Ingredients needed for cloud to form



How does water vapour get's into the air?

Cloud formation mechanis



Air rises and the water vapour within it cools.

water vapour collides with and sticks to tiny particles floating in the air - condensation nuclei forms- which include aerosols such as salt and dust.

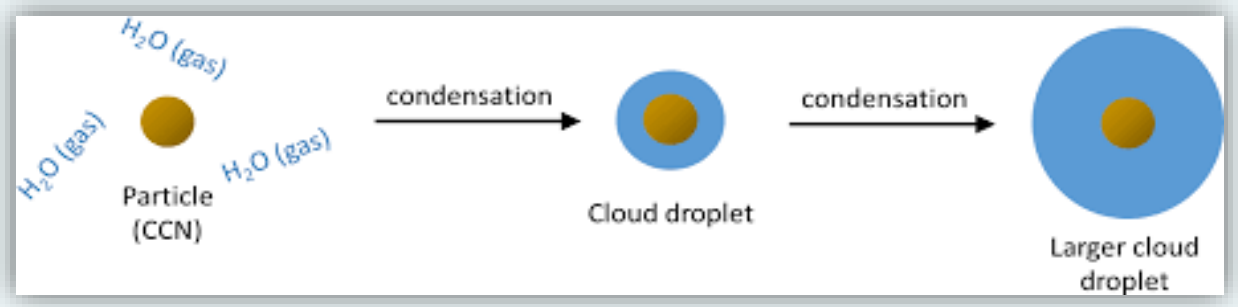
As vapour rises and cools, these nuclei provide the surface for the vapour to condense onto.

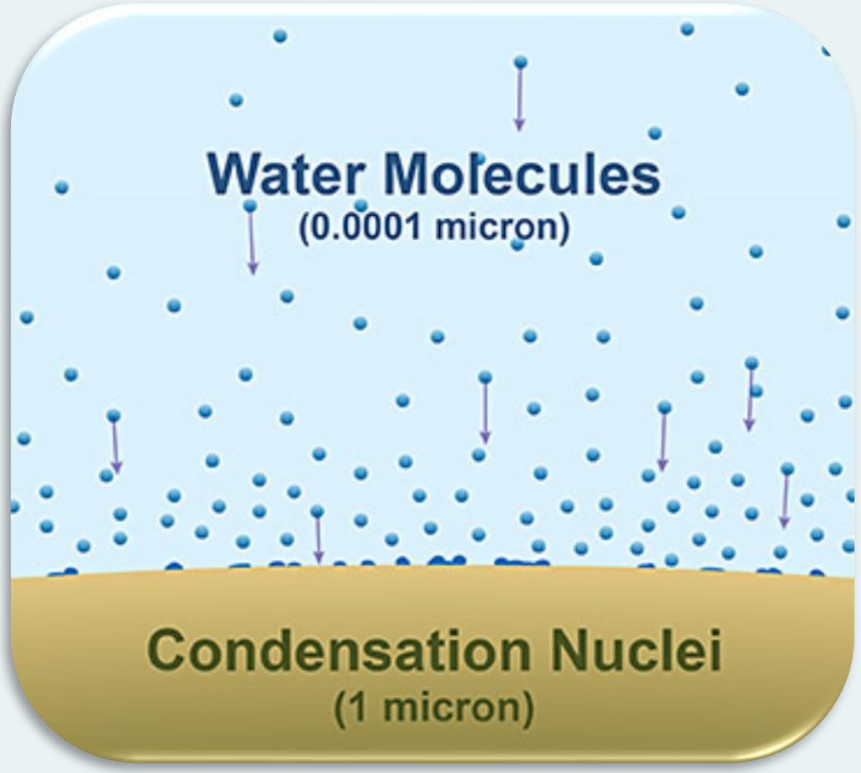
When enough vapour condenses around the nuclei, a cloud droplet is formed.

Then combined to make a cumulus cloud.

Sometimes these water droplets combine to become larger drops or crystals.

If they become large enough and too heavy, they will gradually fall from the sky as " precipitation".





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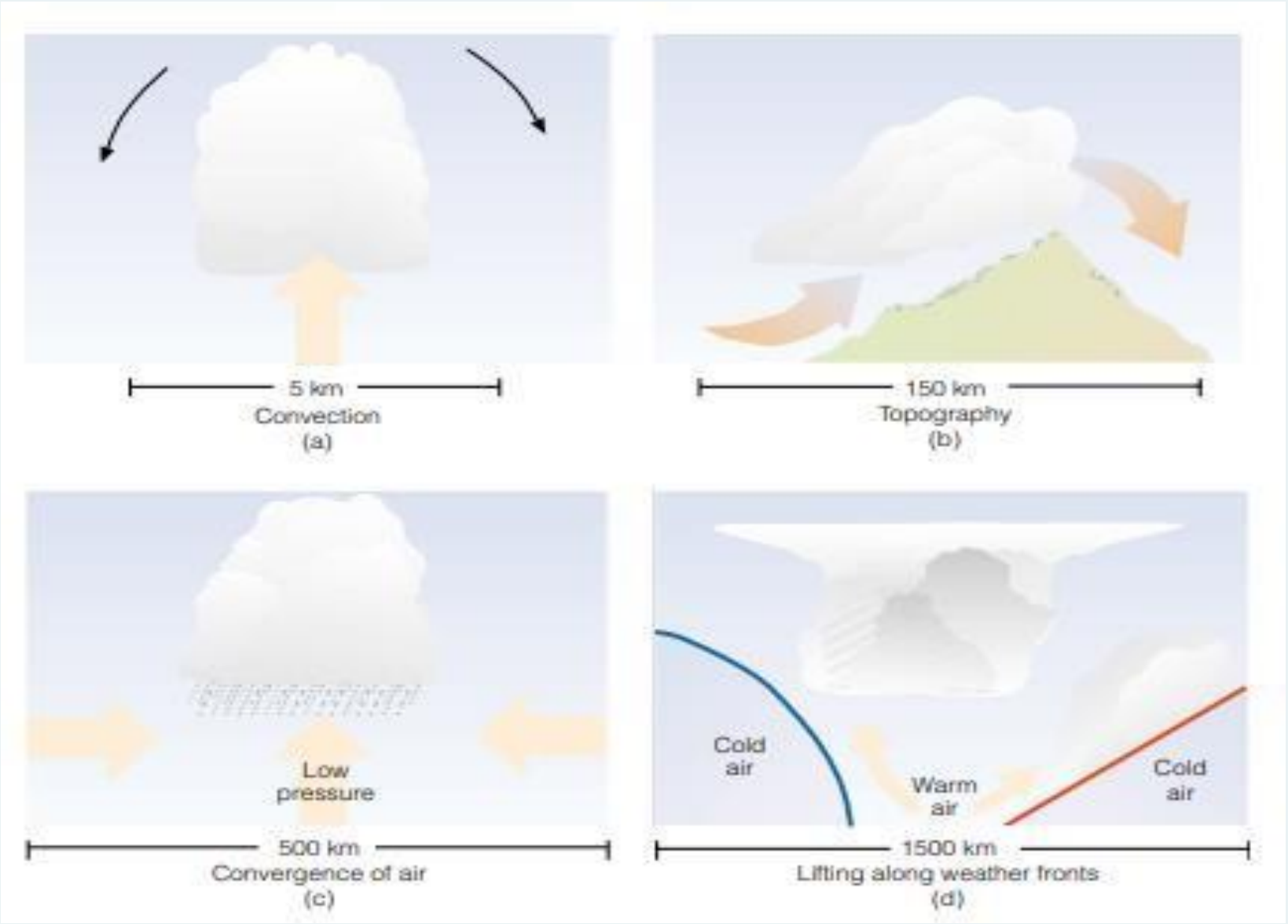
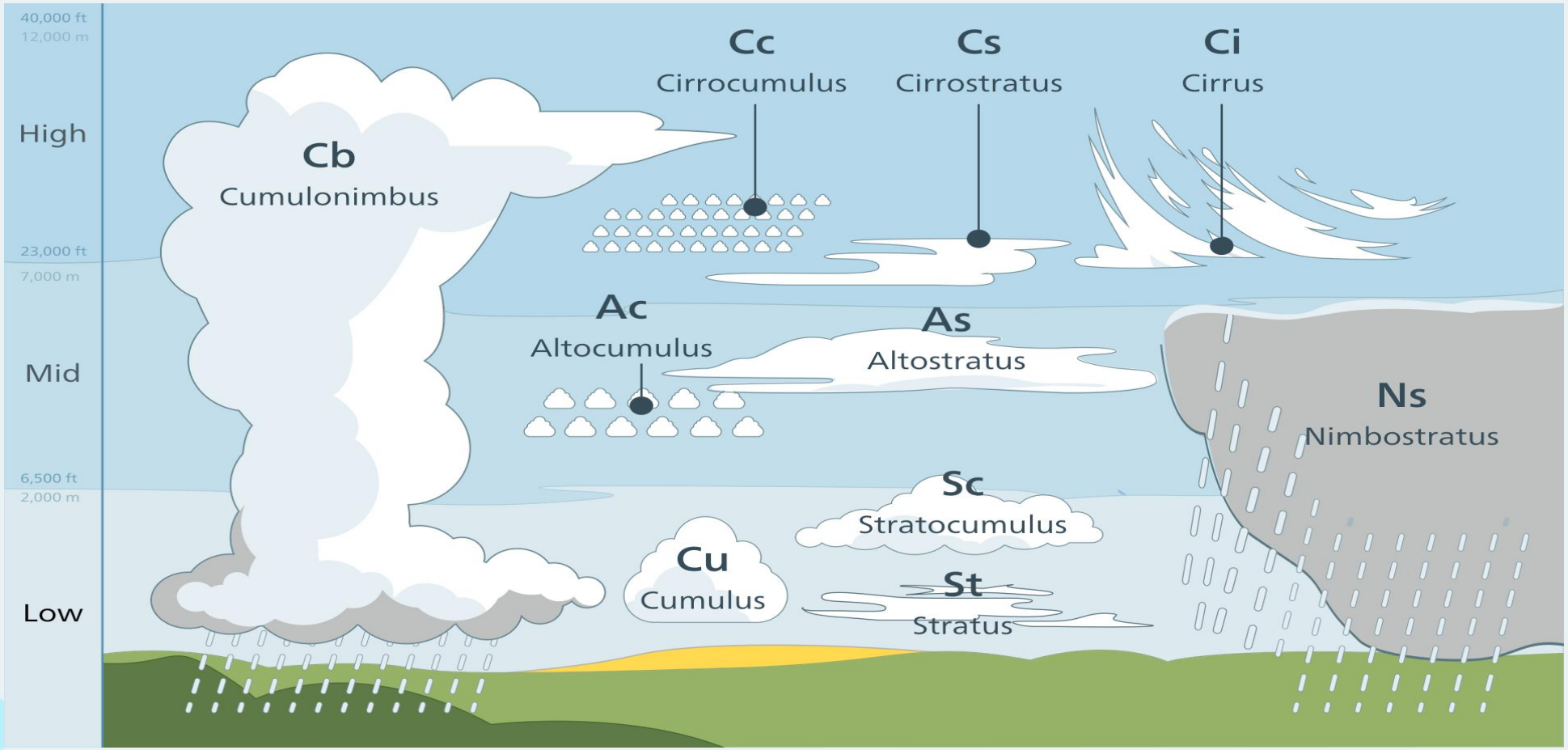
What causes the air to rise?

The sun	• The sun heats the ground, which then heats the air just above it, causing it to rise upwards in the sky (warm air rises). This tends to produce cumulus clouds.
Hills and mountains	• When air is travelling towards a mountain or hill, it cannot go into the hill and so it rises upwards along the terrain. Stratus clouds are often produced this way.
Weather front	• A weather 'front' is where warm air meets cold air. The warm air rises up and over the cold air (warm air rises). This produces nimbostratus clouds, amongst others.
Convergence	• Streams of air flowing towards each other from different directions are forced to rise when they meet, or converge. This can cause cumulus cloud and showery conditions
Turbulence	• A sudden change in wind speed high up can create circulations in the air which can bring the air at the surface high up into the sky.


5 km
Convection
(a)
150 km
Topography
(b)
Low
pressure
500 km
Convergence of air
(c)
Cold
air
Warm
air
Cold
air
1500 km
Lifting along weather fronts
(d)

Clouds Types



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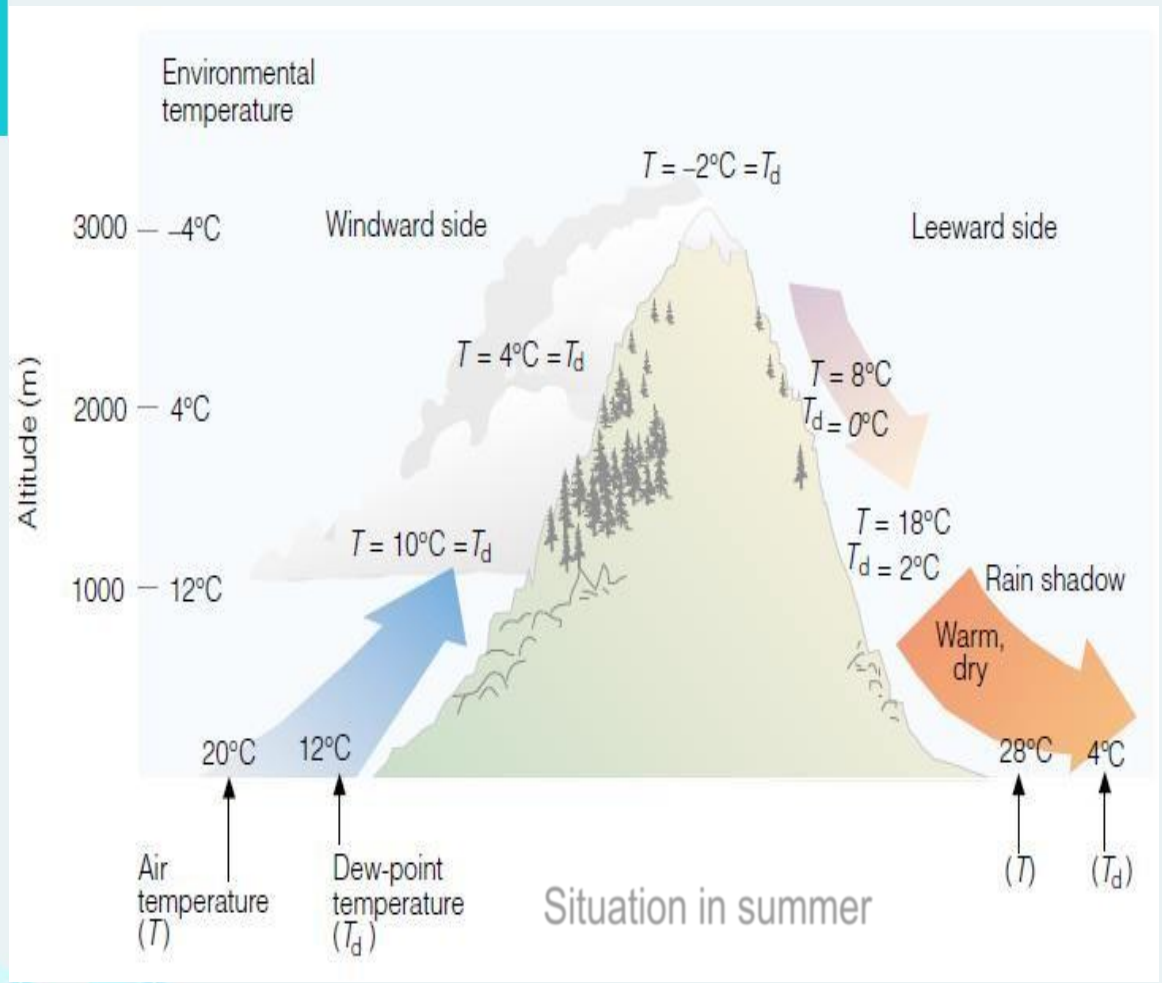
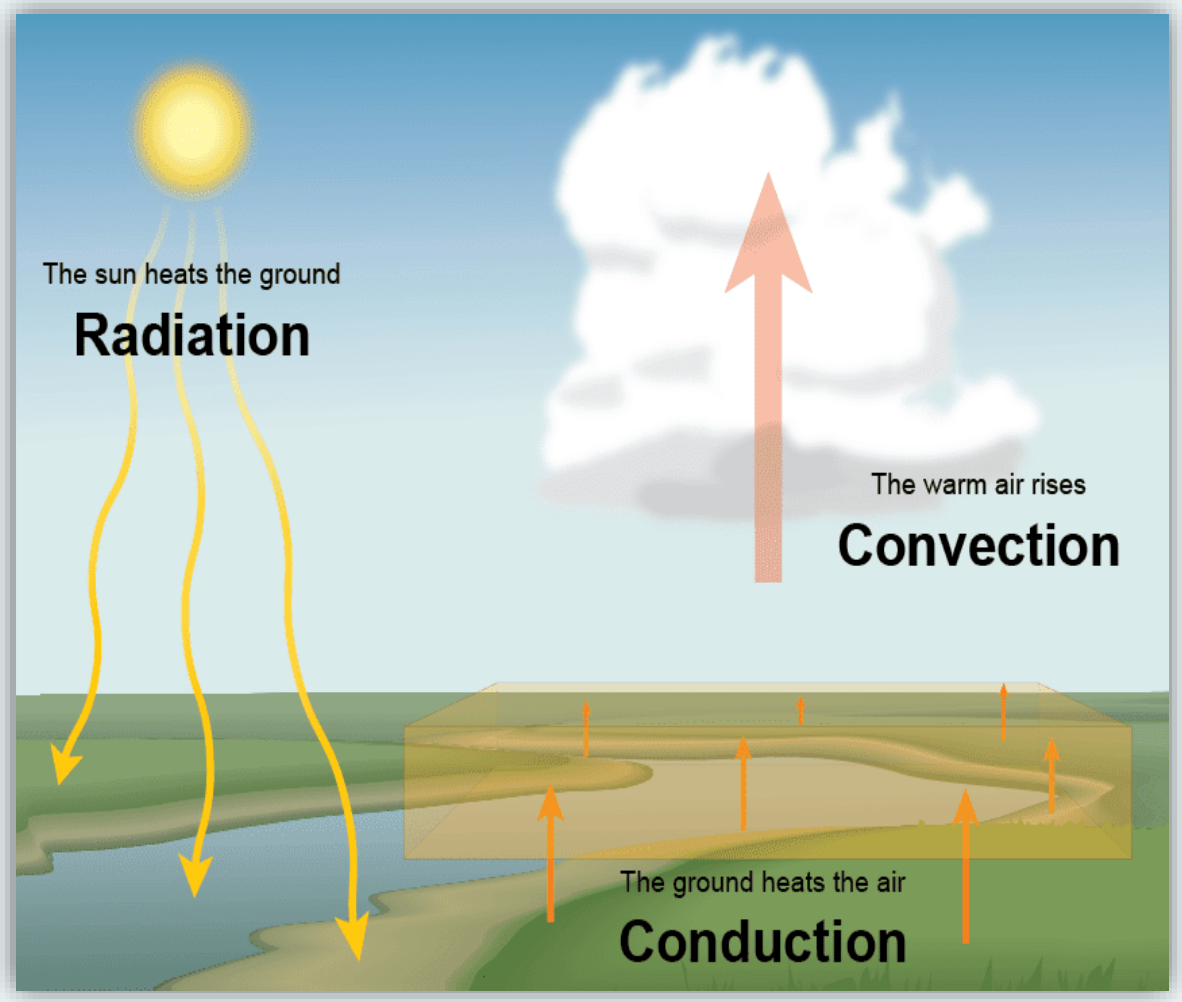
Local Convection

- How convection clouds form?
- 23rd – 28th July 2022(Local event)
- 26th -28th June 2023(Local event)
- 28th July 2023(Local event)

How convection clouds form?





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Main parameters:

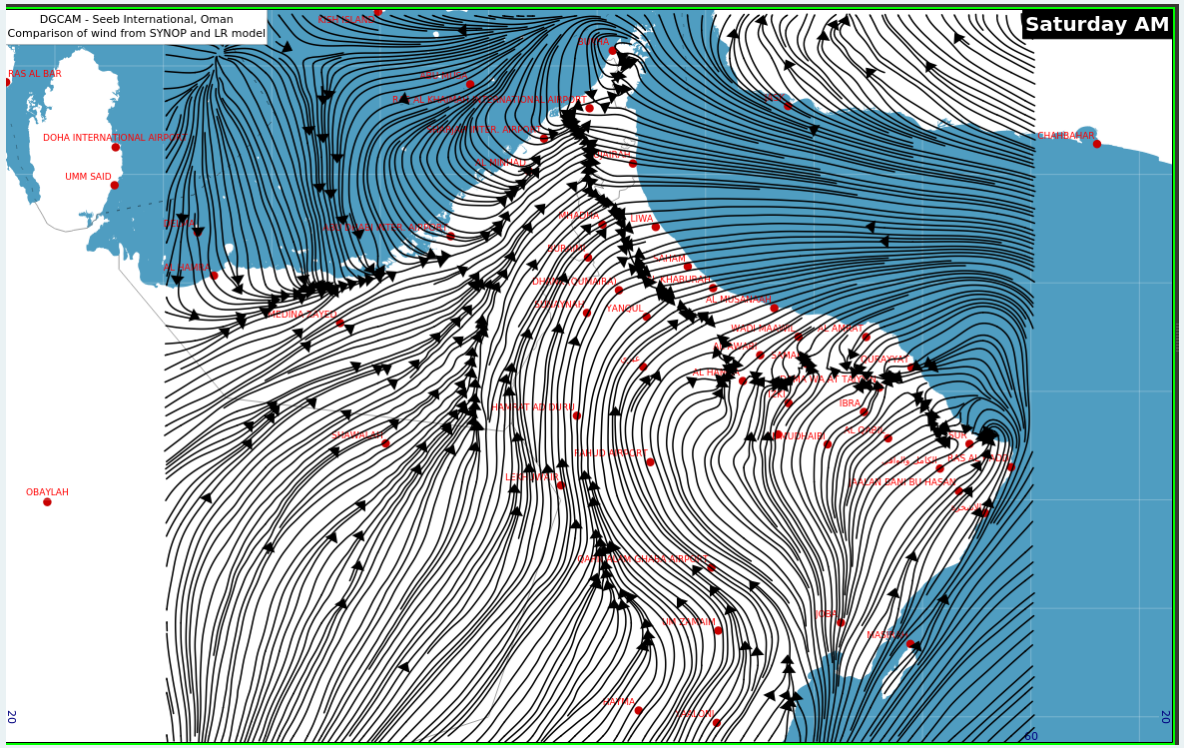
Lifting mechanism

High surface temperature (Heating)

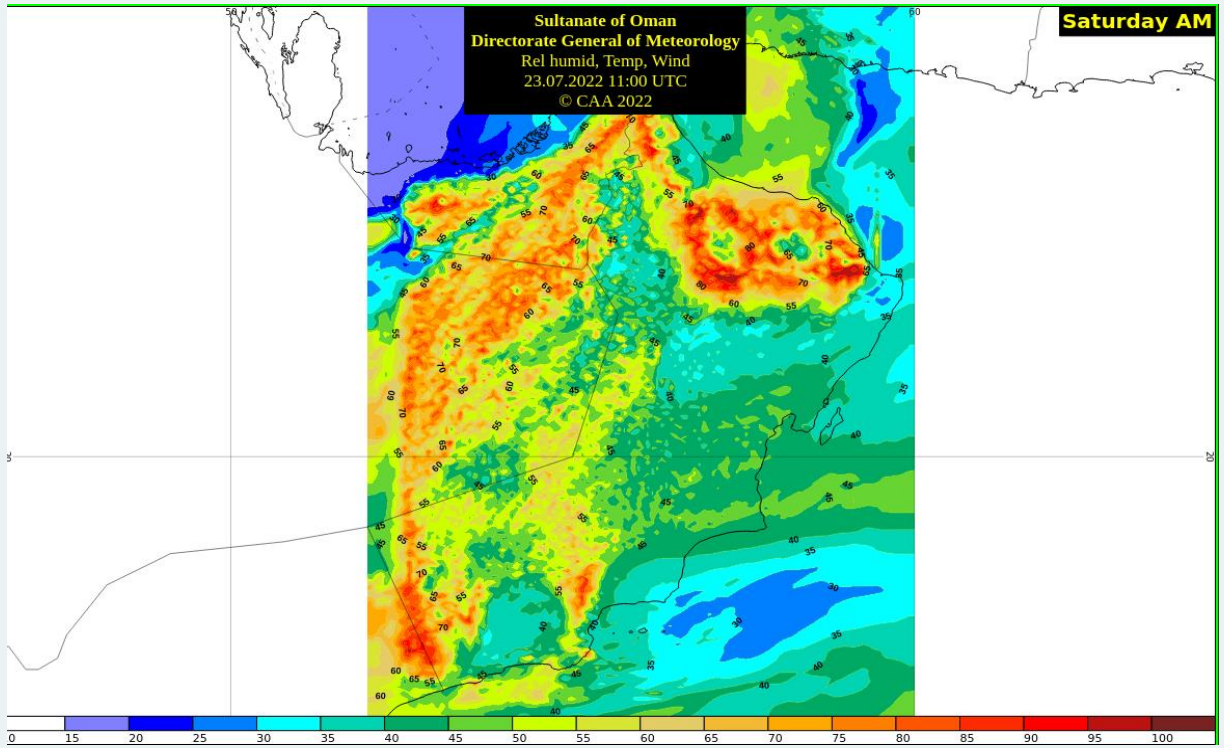
Humidity/ Sea breeze)

Low level convergence

23rd – 28th July 2022 (Local event)



Stream lines



RH(700 hpa)

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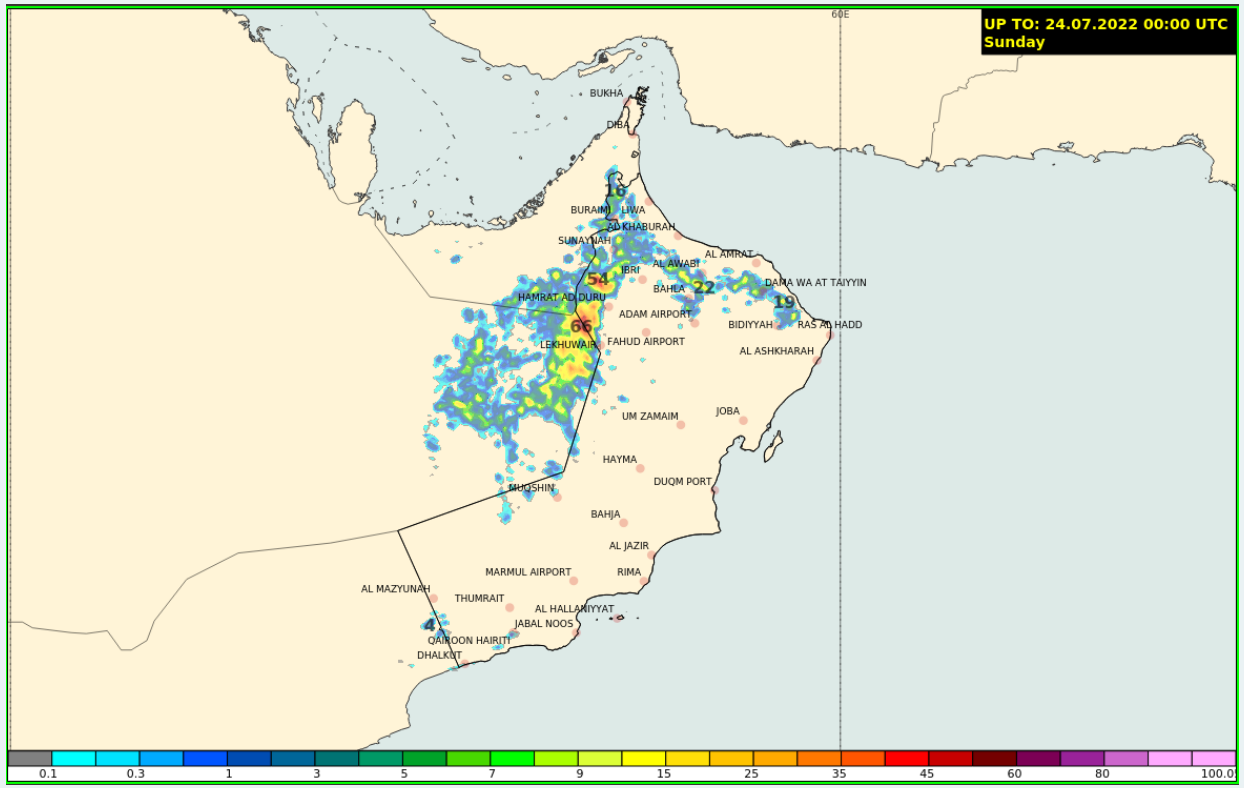
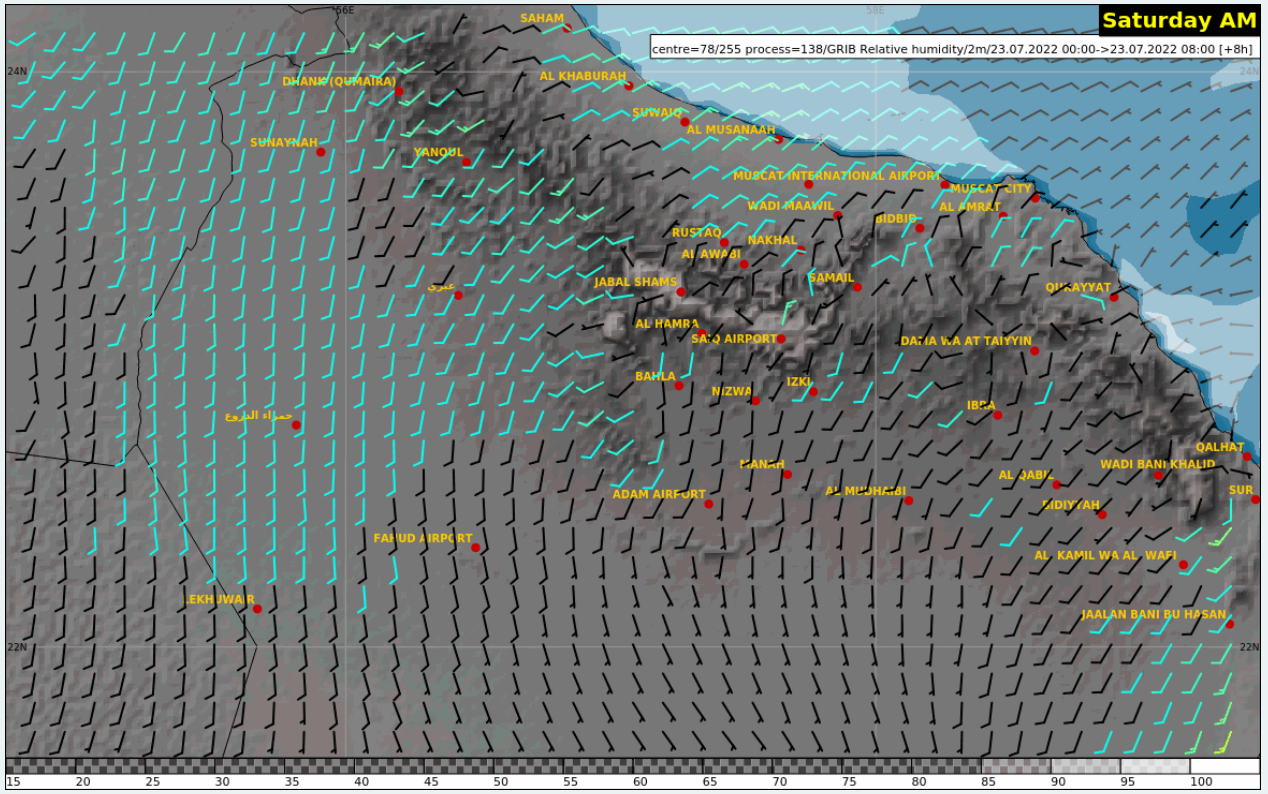


Rain 24hr

Winds



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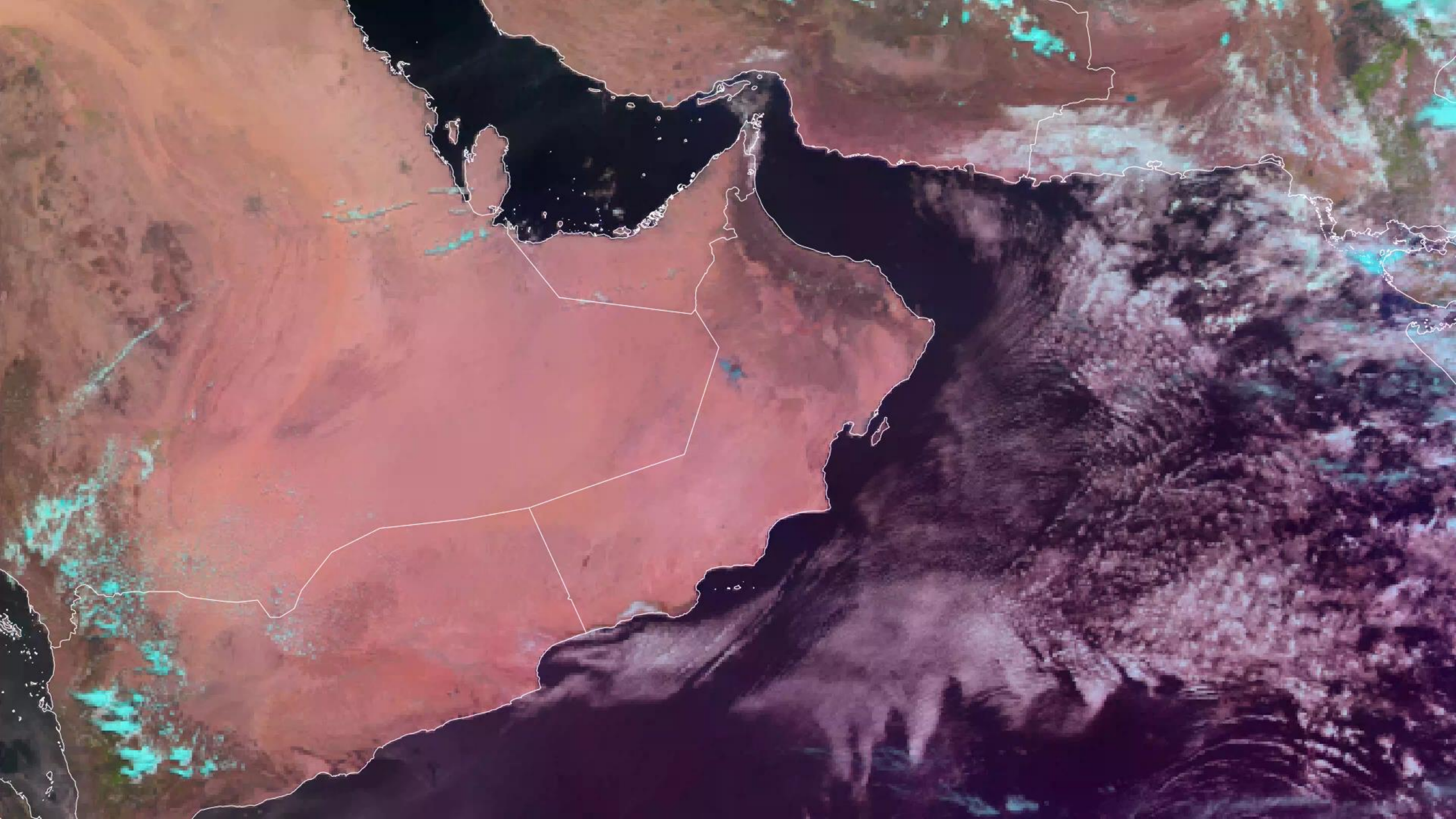
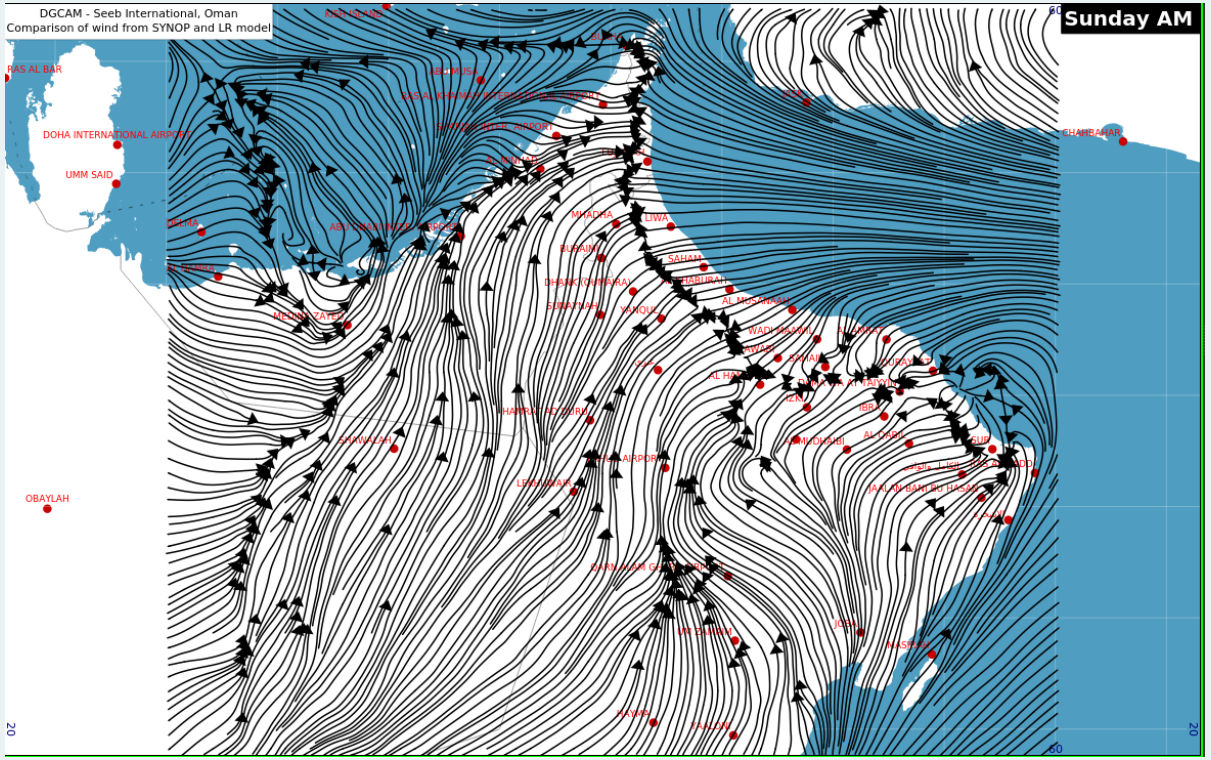
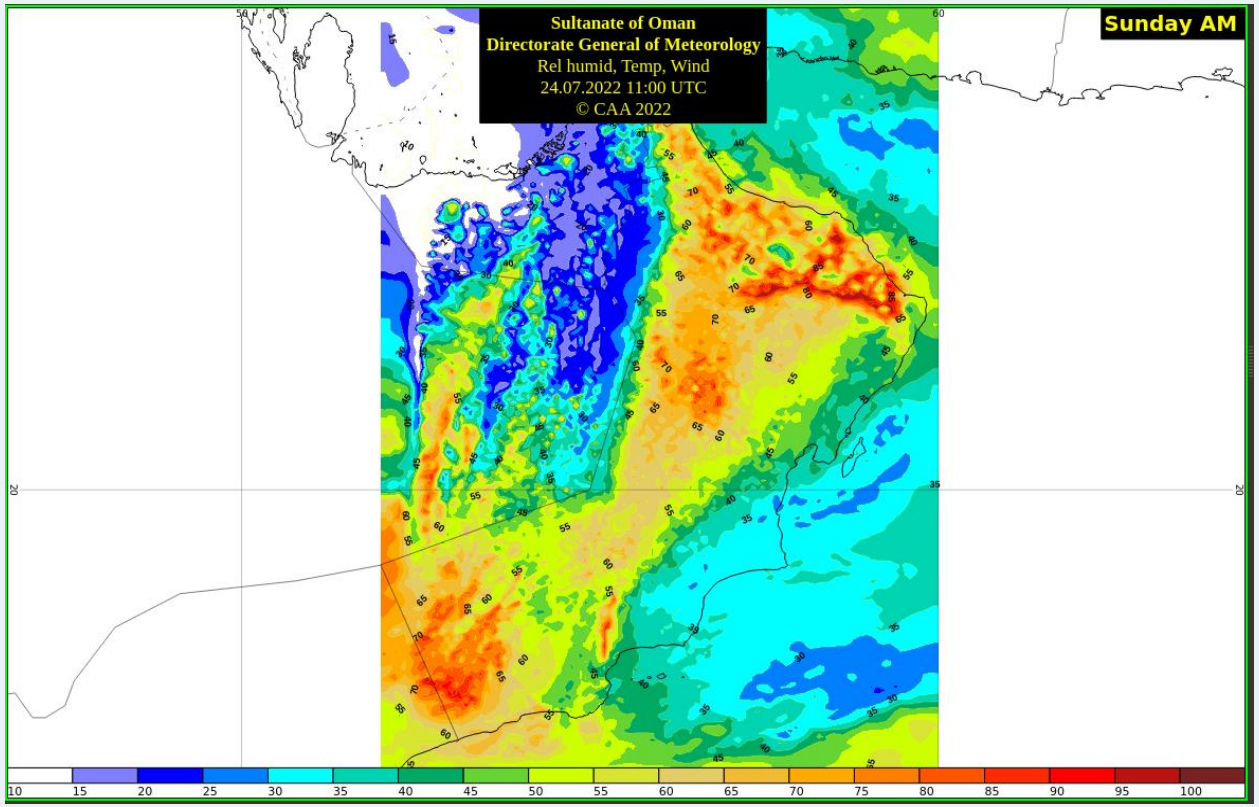
هيئة الطيران المدني





Stream lines

RH(700 hpa)



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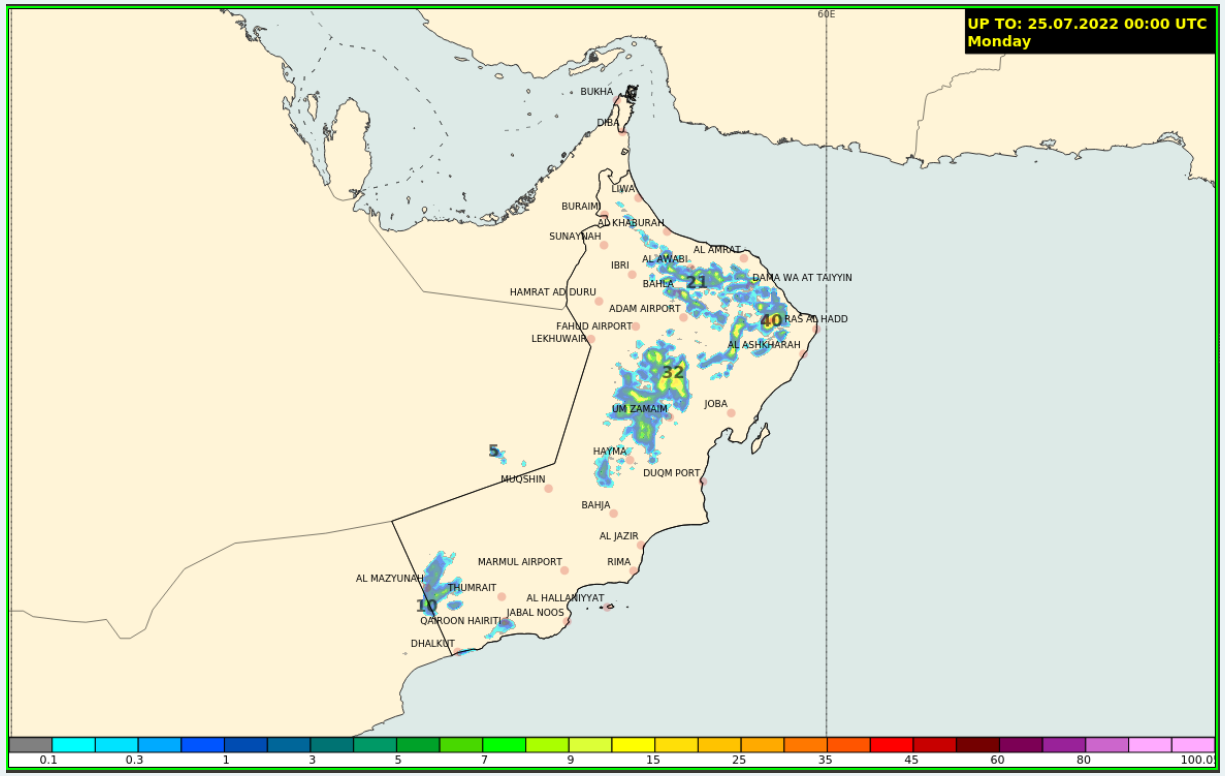
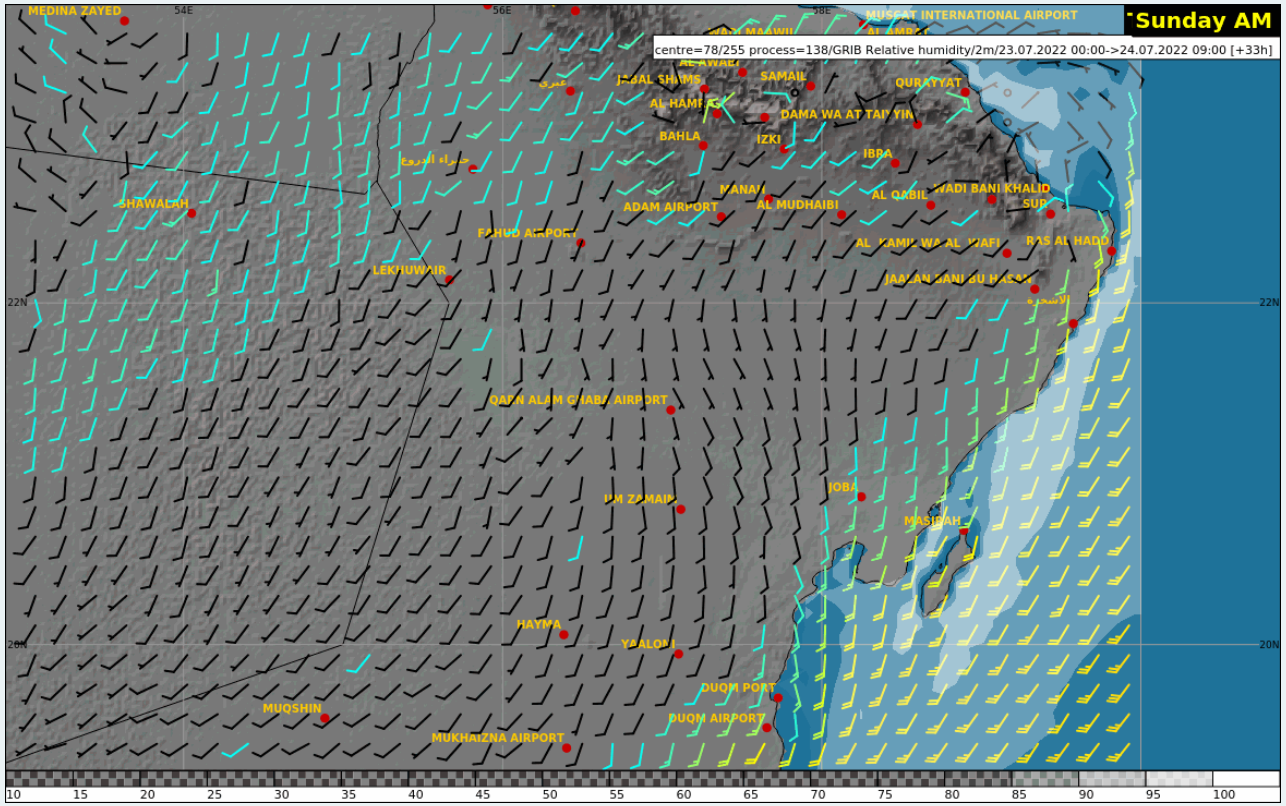
هيئة الطيران المدني



Rain 24hr

Winds



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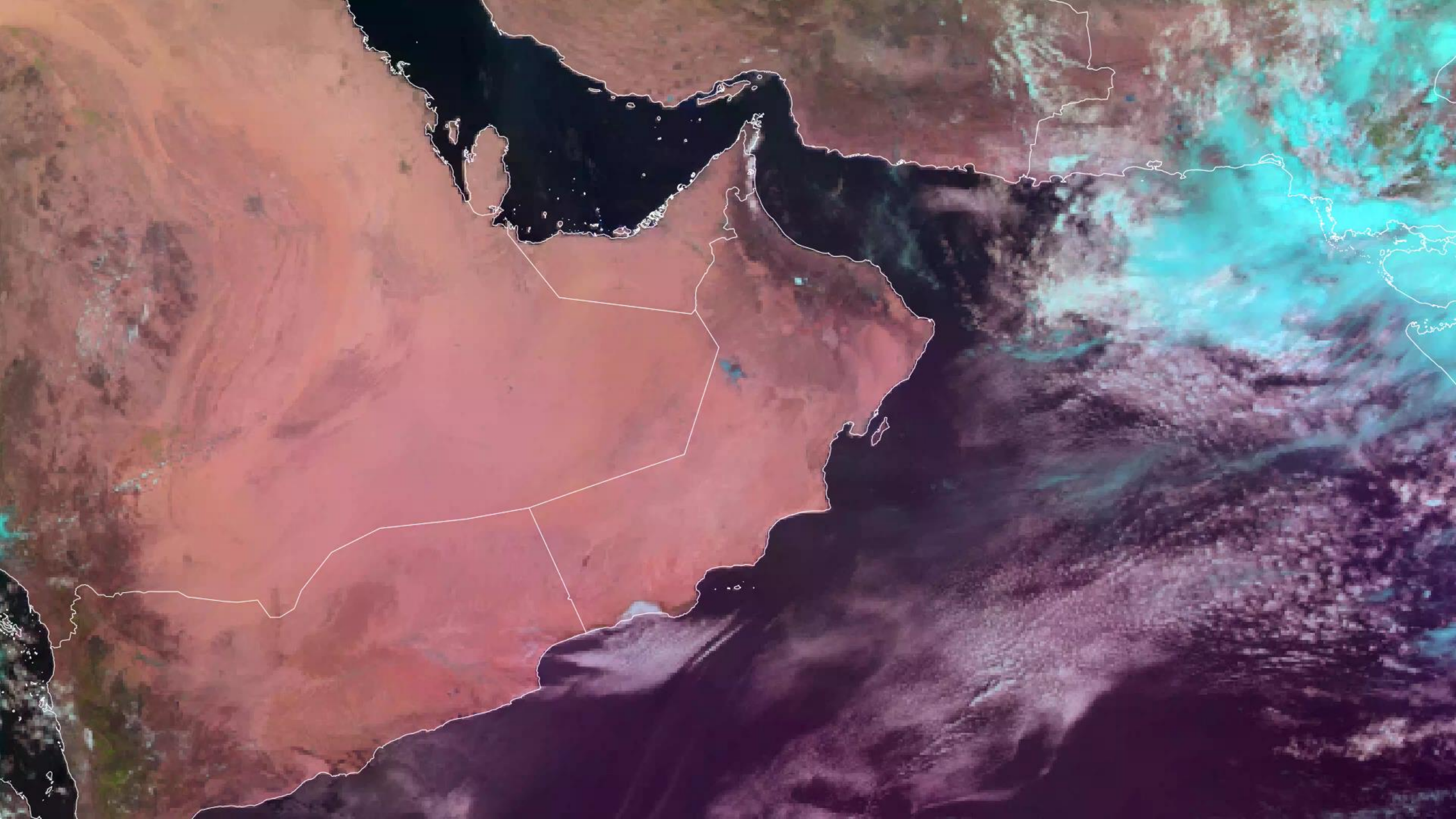
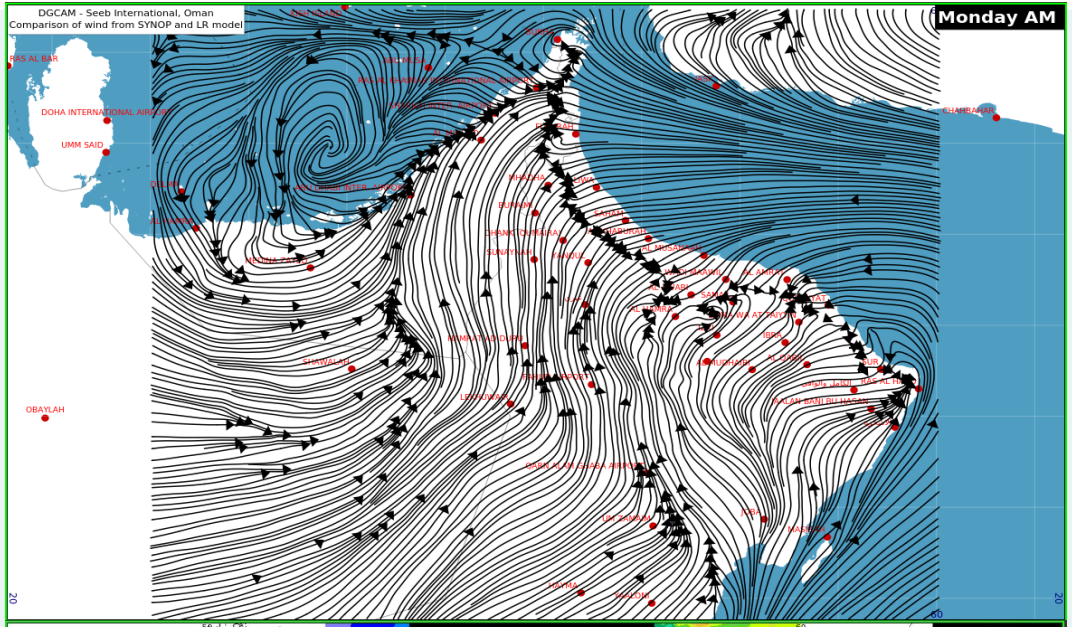
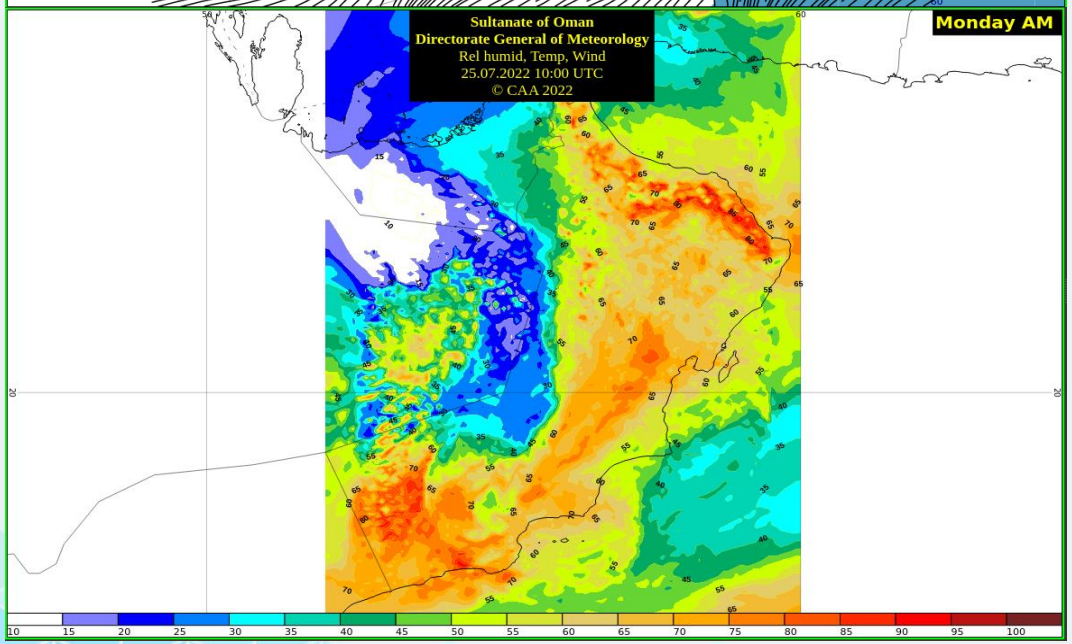
هيئة الطيران المدني

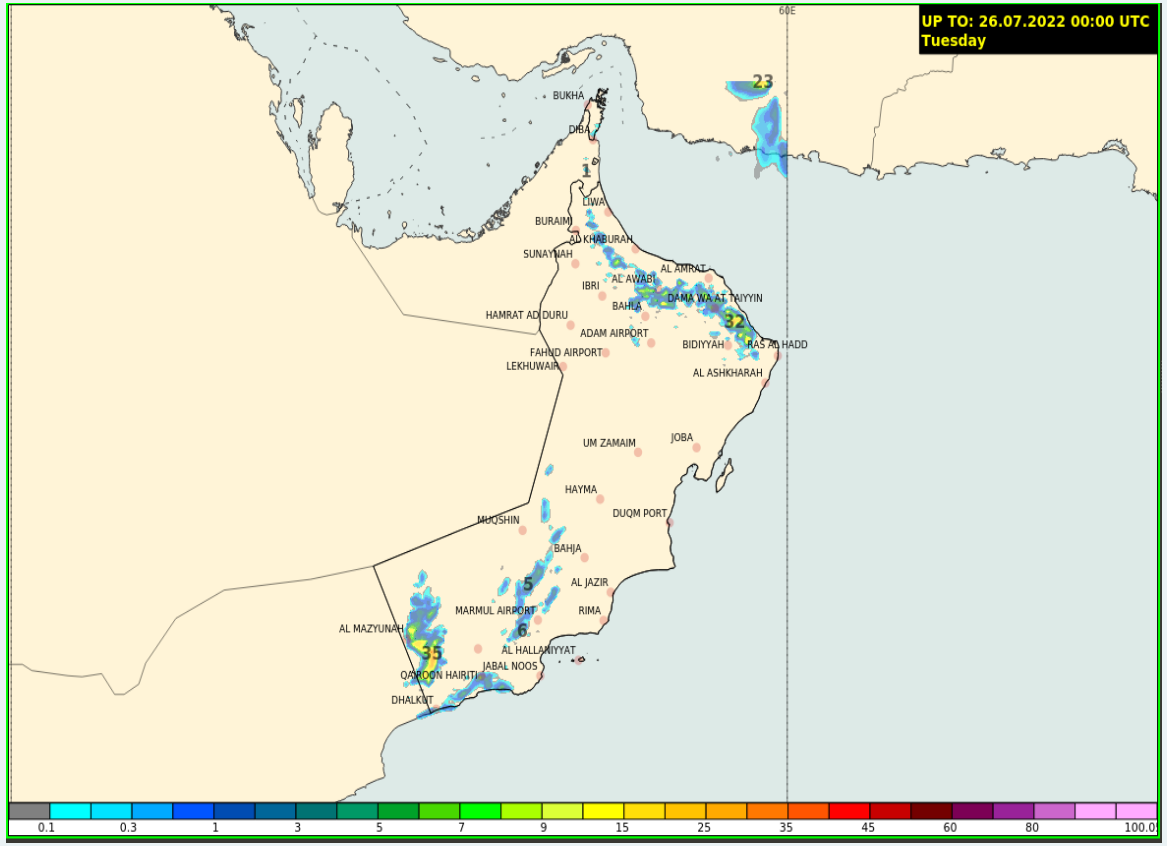




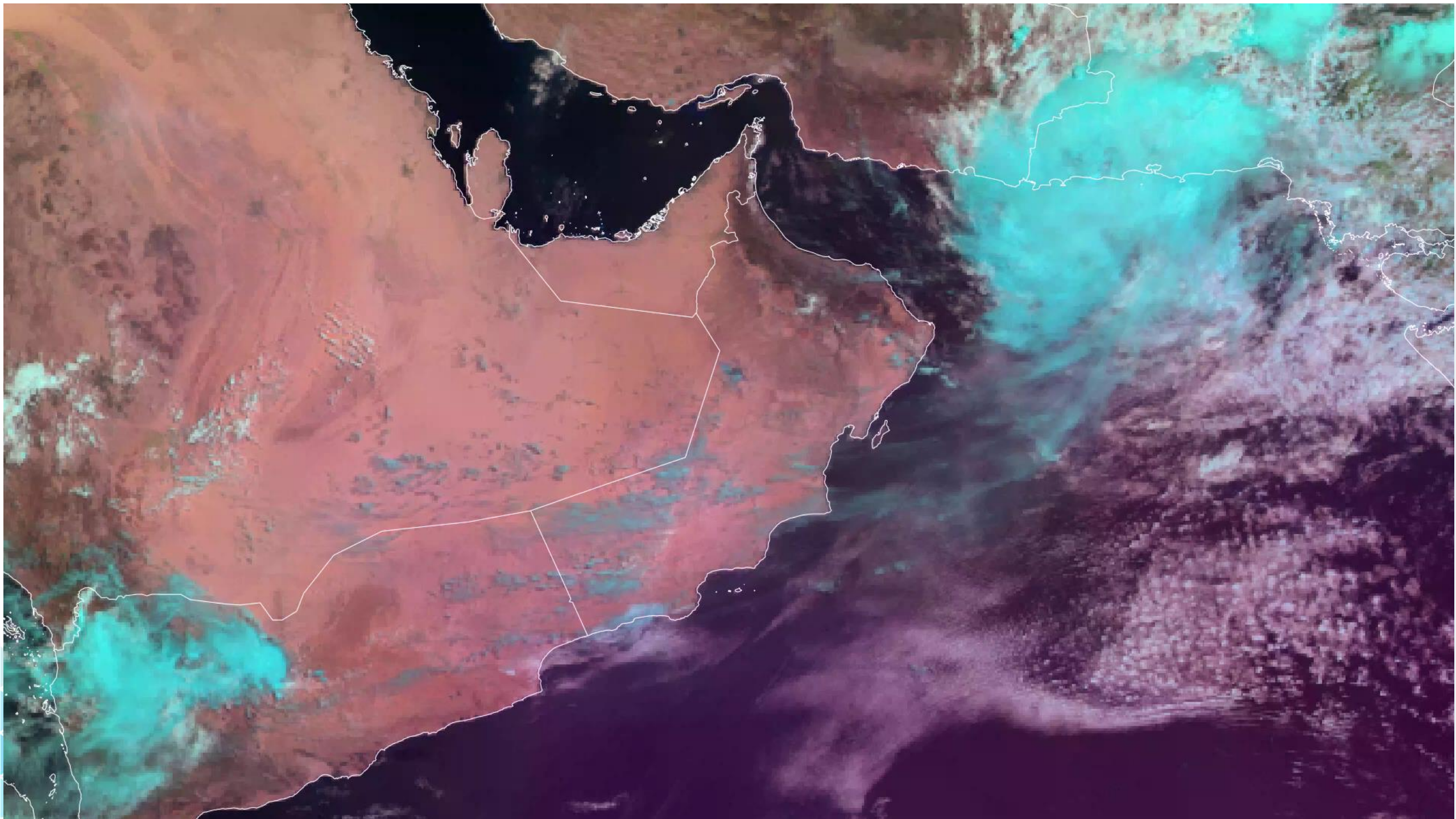
Stream lines

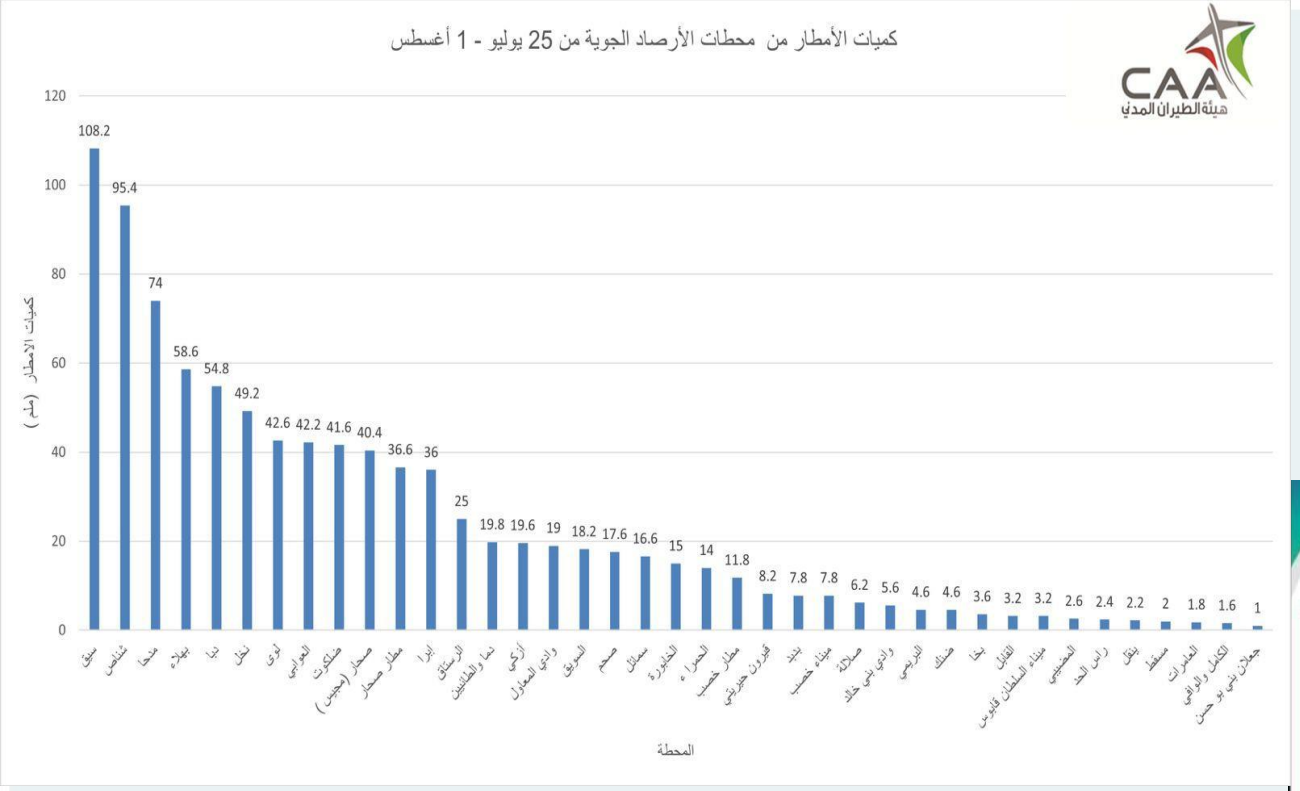


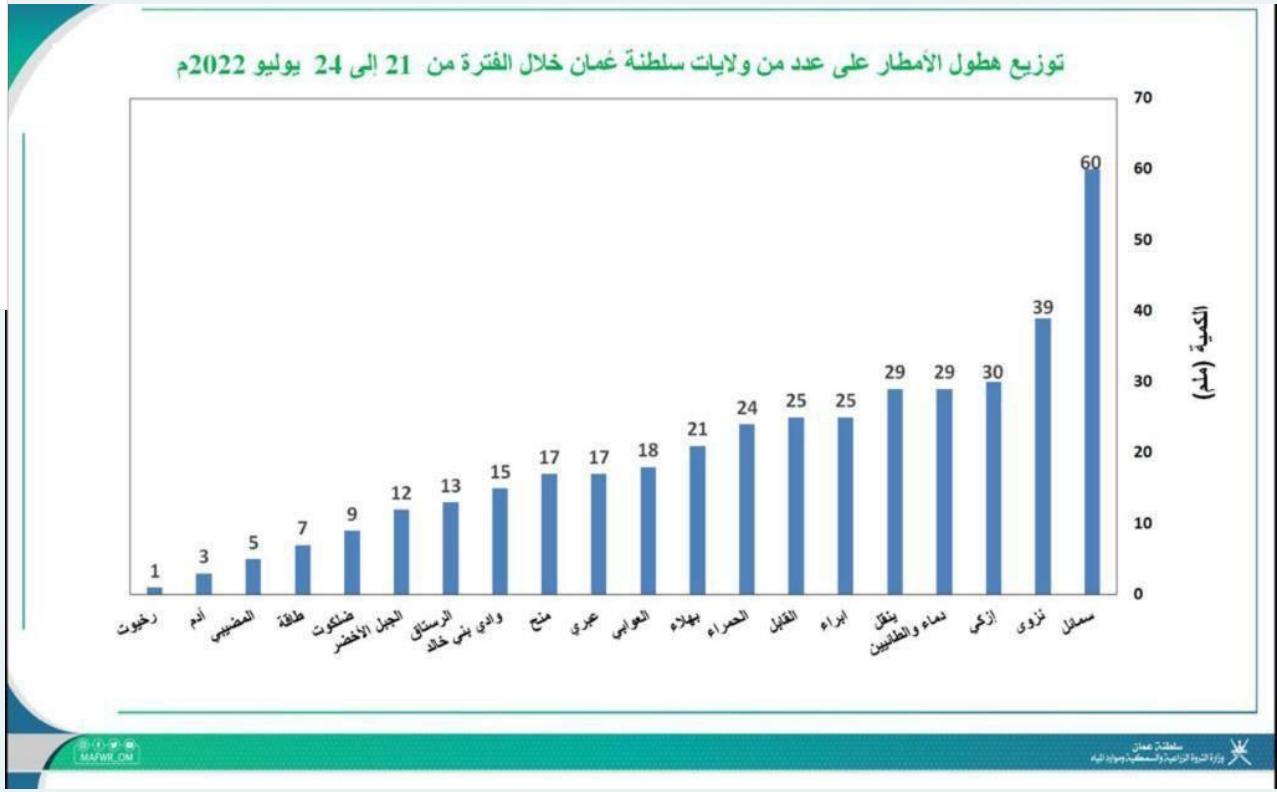
RH(700 hpa)



Rain 24hr




كميات الأمطار من محطات الأرصاد الجوية من 25 يوليو - 1 أغسطس
كميات الأمطار (ملم)
المحطة
108.2
95.4
74
58.6
54.8
49.2
42.6
42.2
41.6
40.4
36.6
36
25
19.8
19.6
19
18.2
17.6
16.6
15
14
11.8
8.2
7.8
7.8
6.2
5.6
4.6
4.6
3.6
3.2
3.2
2.6
2.4
2.2
2
1.8
1.6
1


توزيع هطول الأمطار على عدد من ولايات سلطنة عُمان خلال الفترة من 21 إلى 24 يوليو 2022م
الكمية (ملم)
رخيوت
أدم
المضيبي
طاقة
شاكوت
الجبل الأخضر
وادي بني خالد
الرستاق
منح
عبري
العوابي
بهلاء
الحمراء
القابل
ابراء
بدقل
نماء والطائيين
إزكي
نزوى
مسانل
1
3
5
7
9
12
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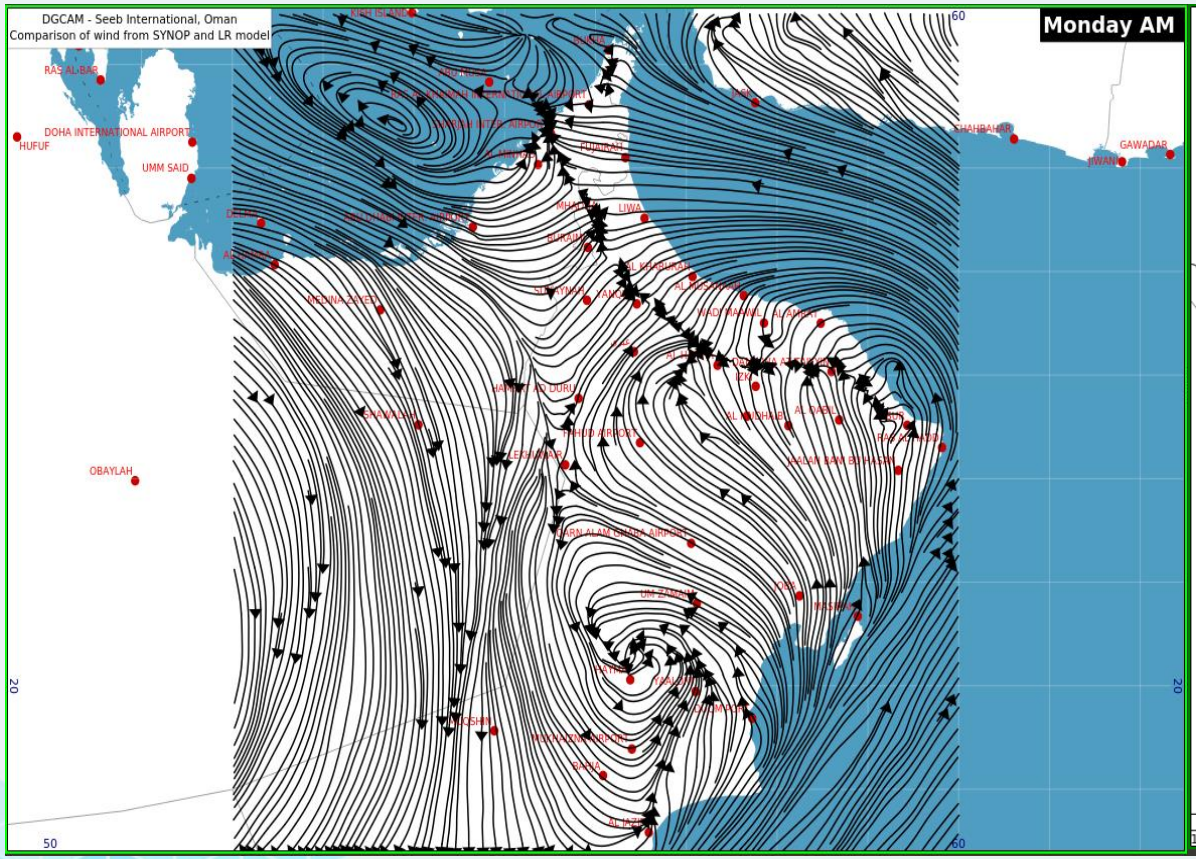
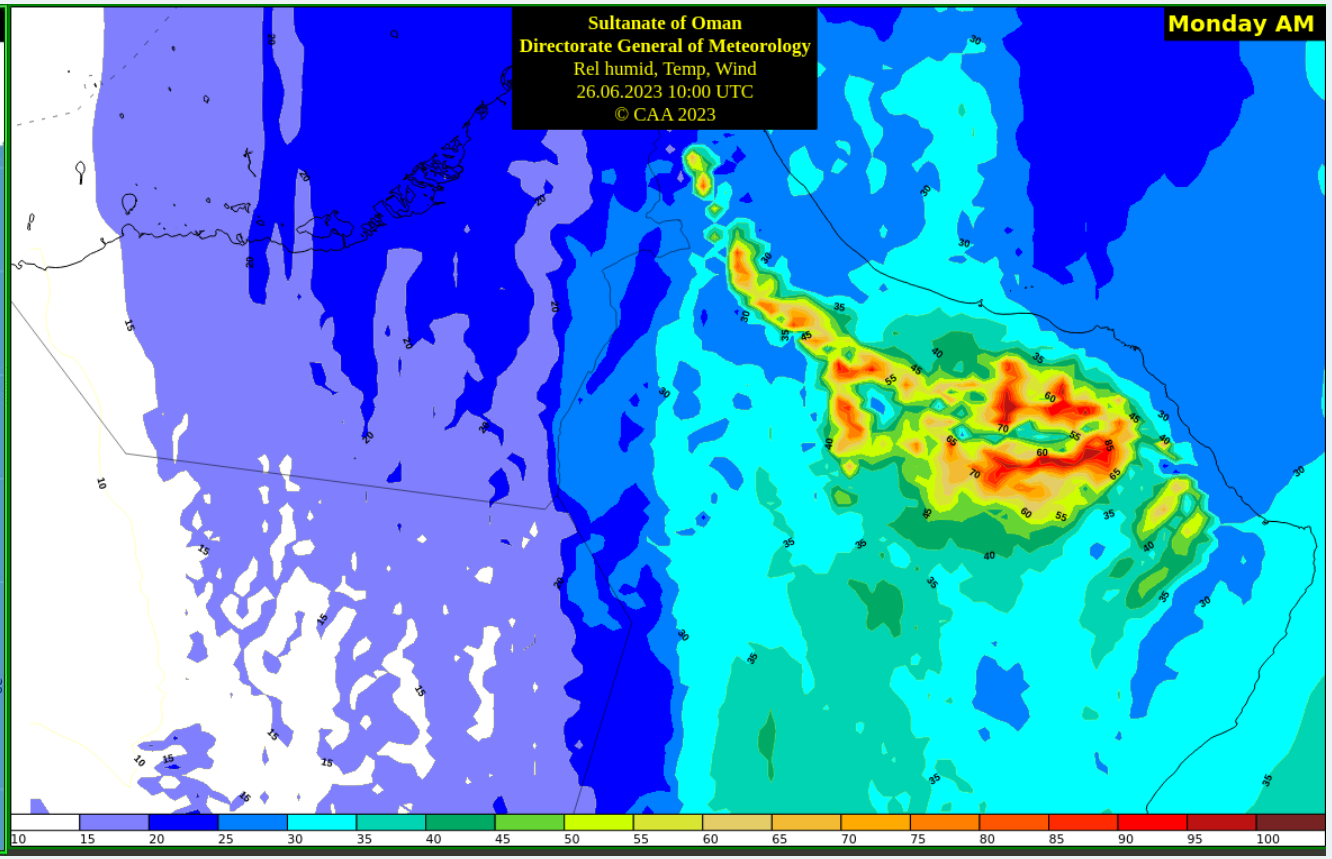
30
39
60

26th -28th June 2023(Local event)

RH (700 hpa)





Stream lines

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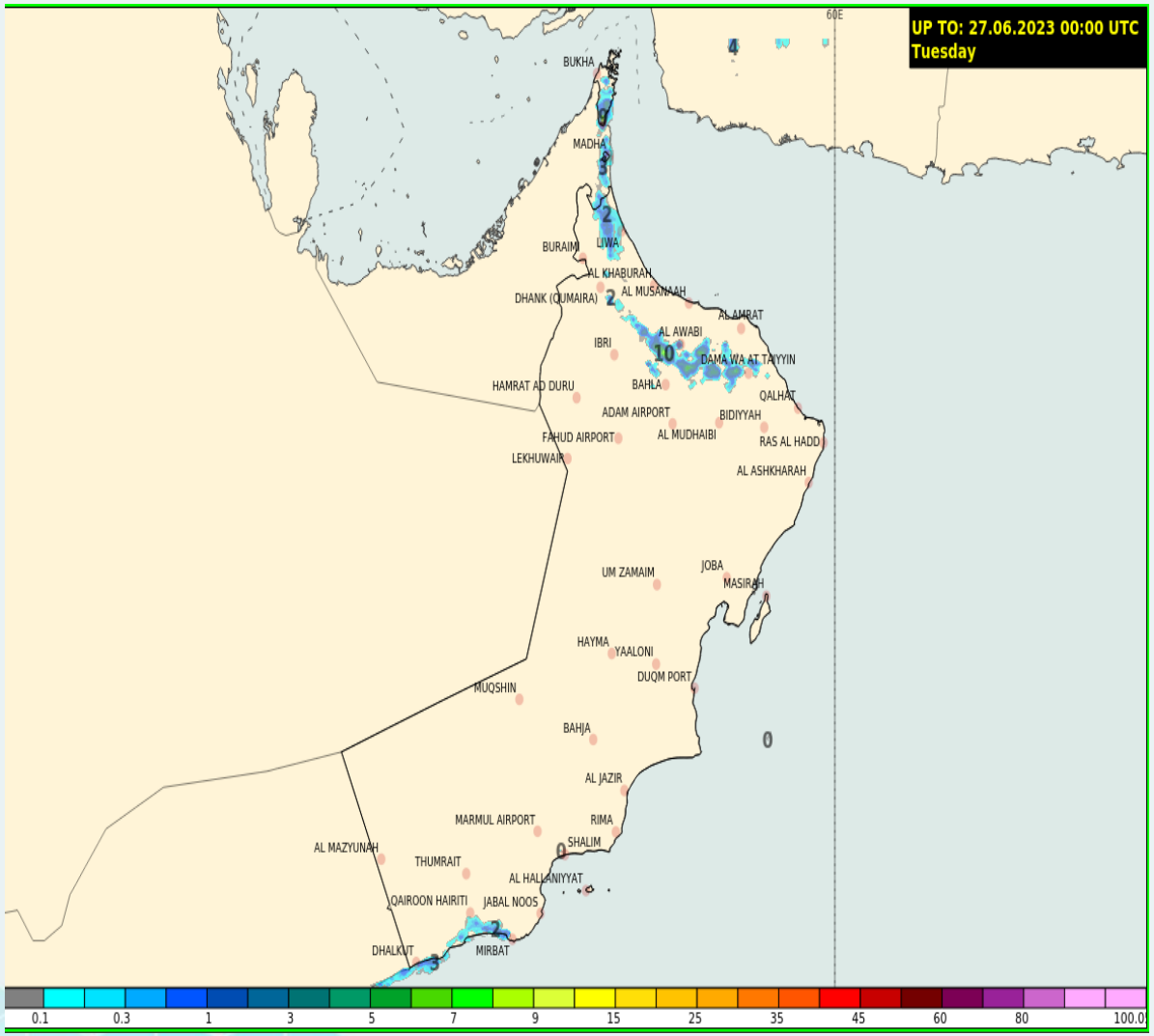
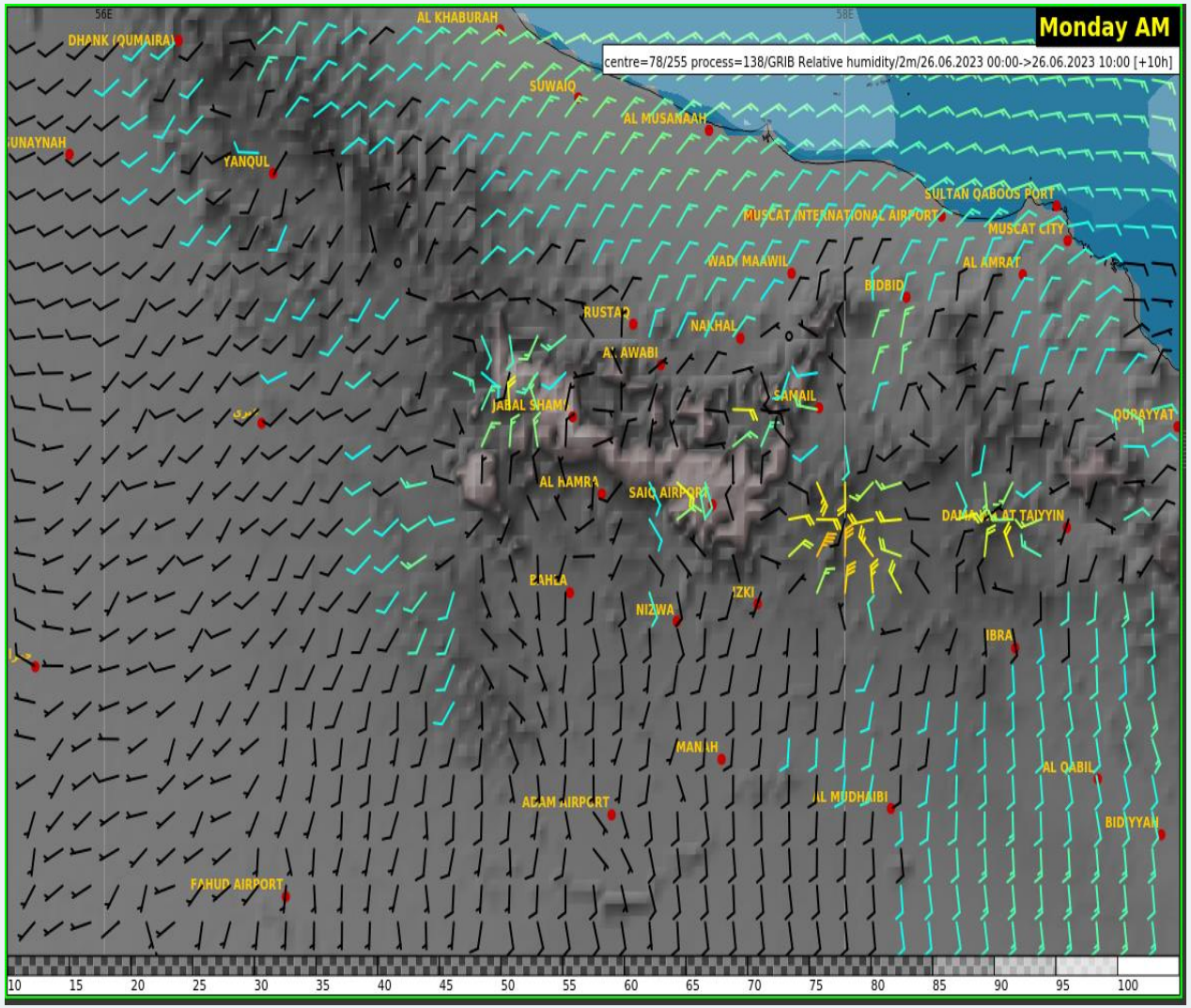
Rain 24hr



Winds



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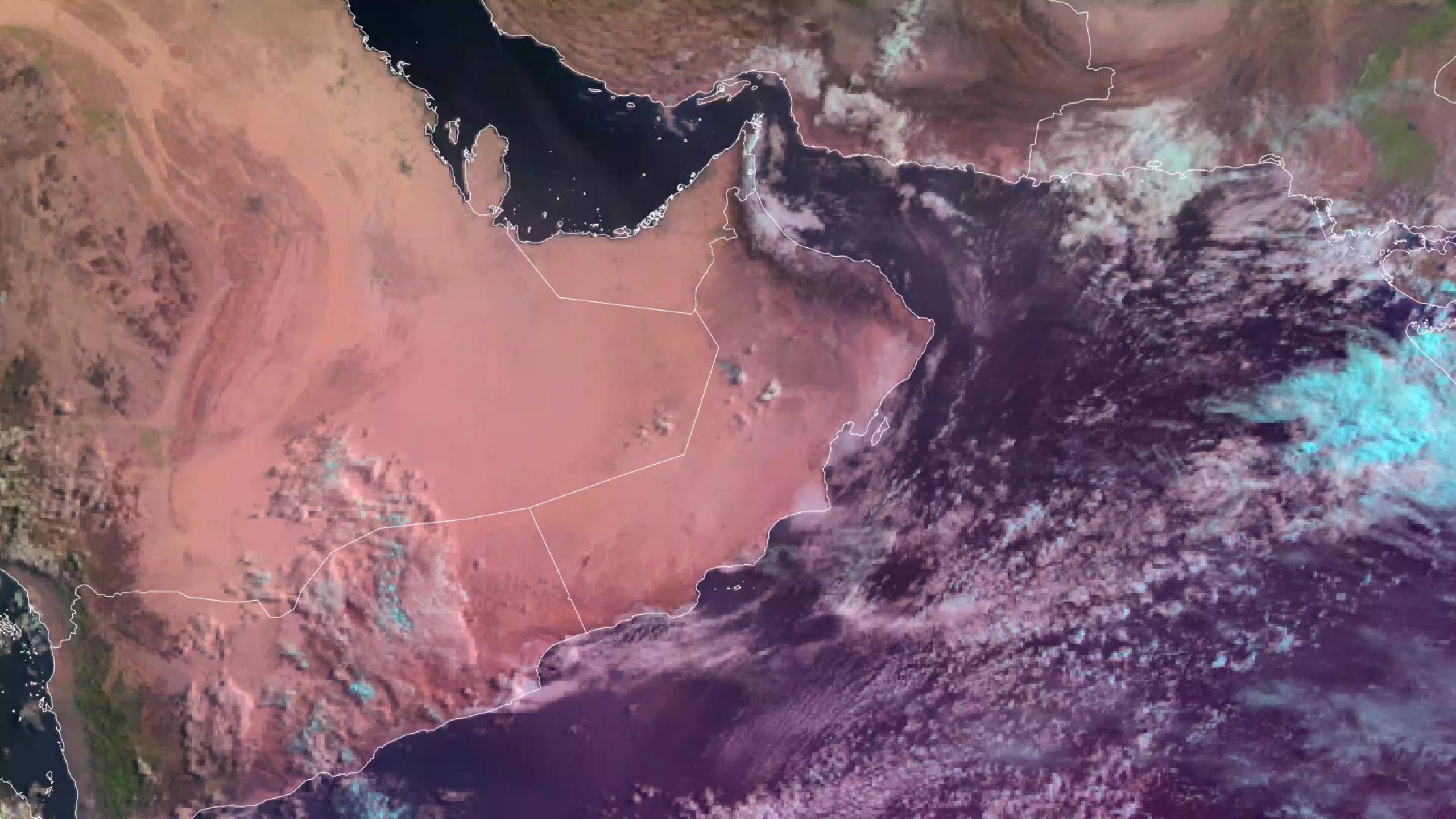
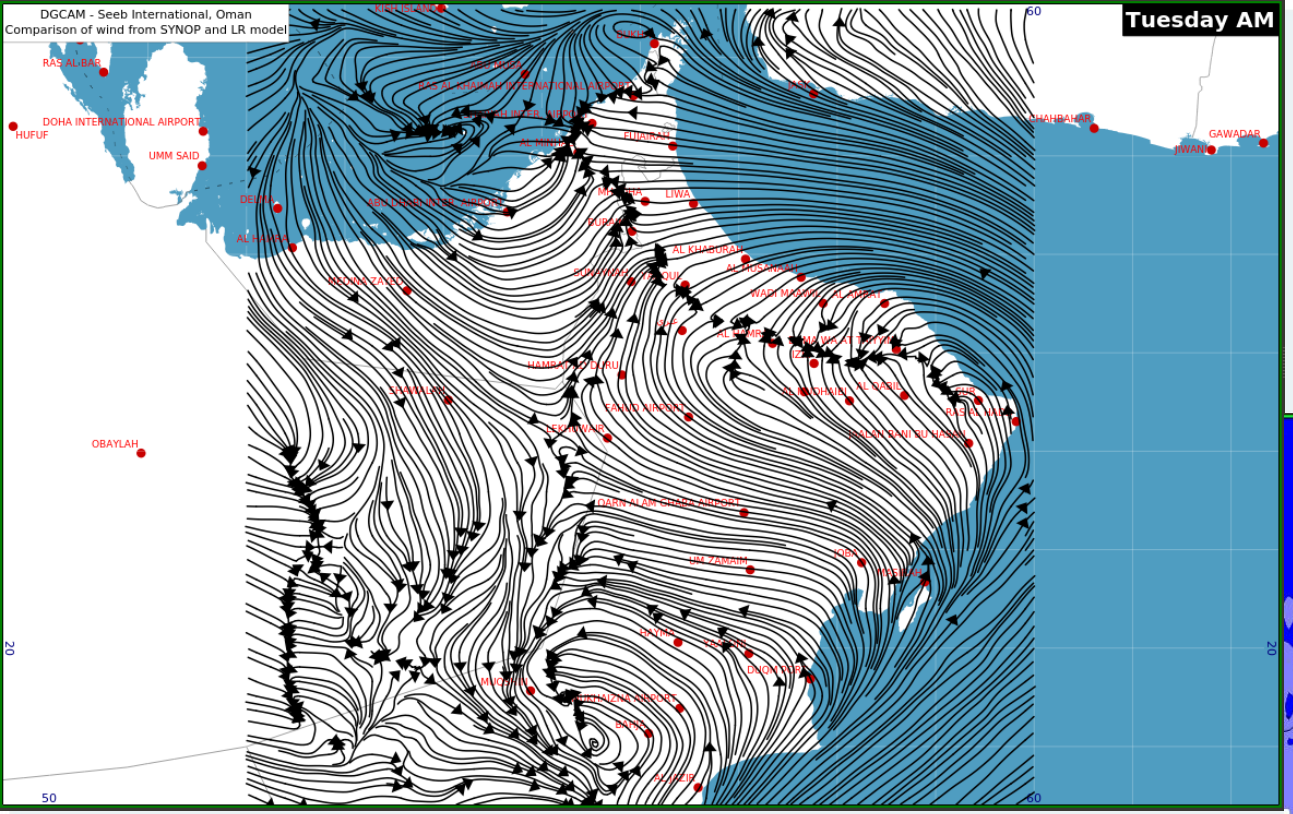
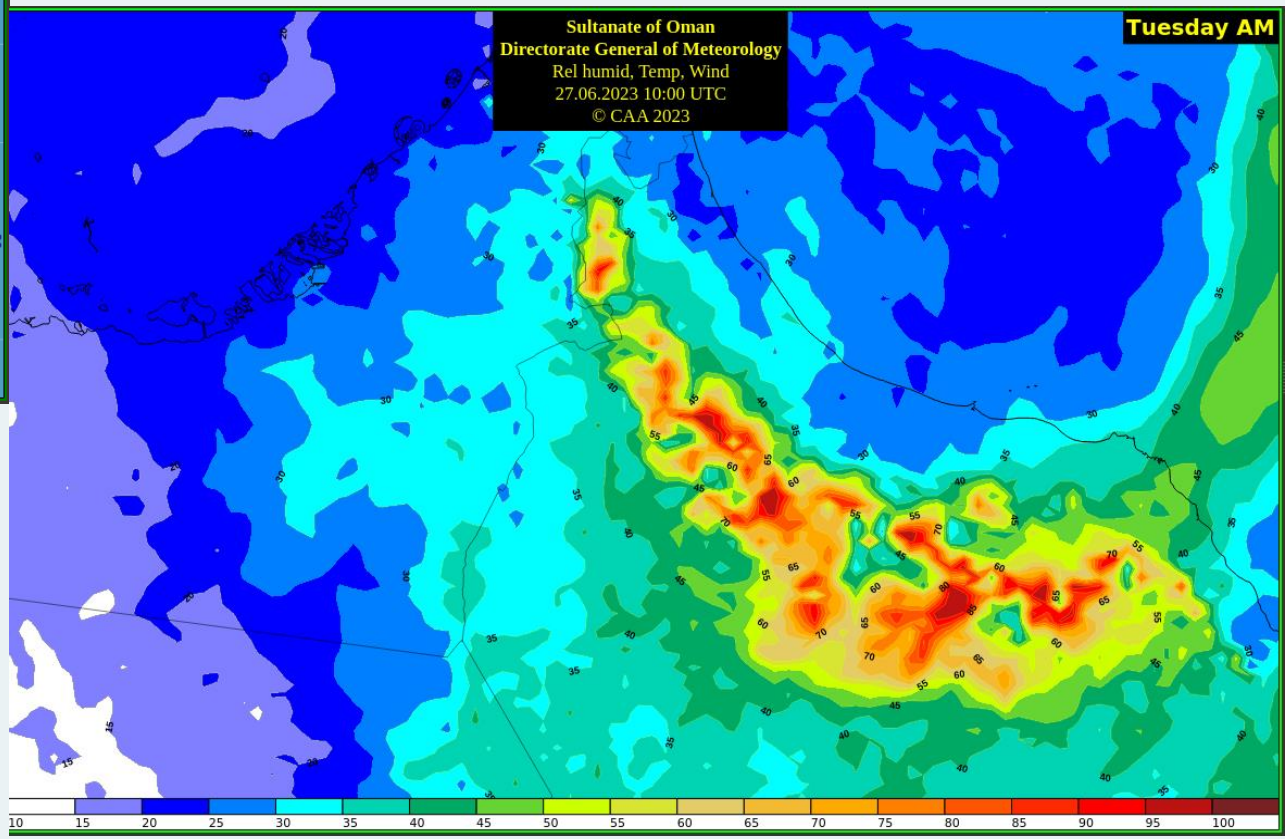




Stream lines

RH (700 hpa)



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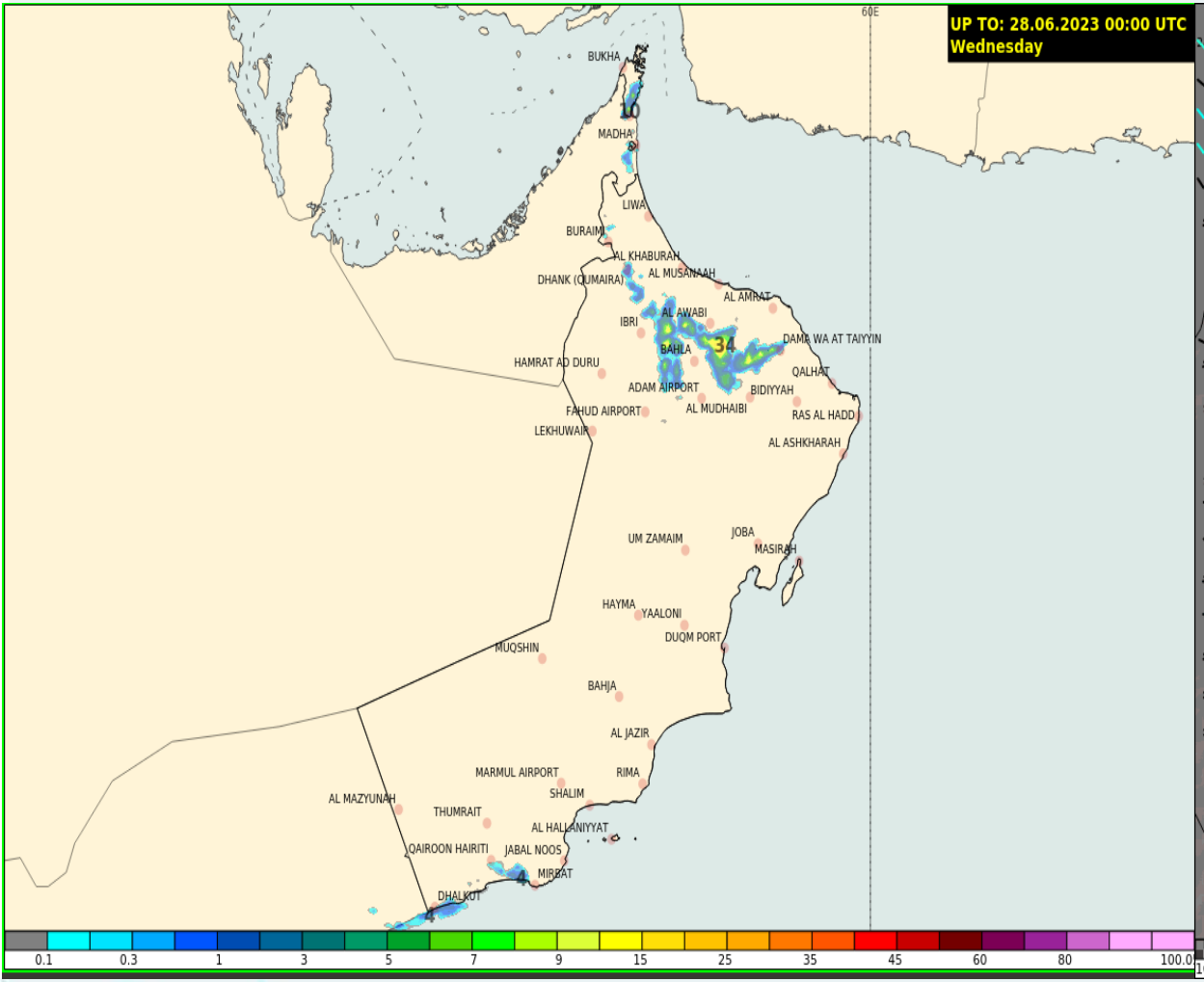
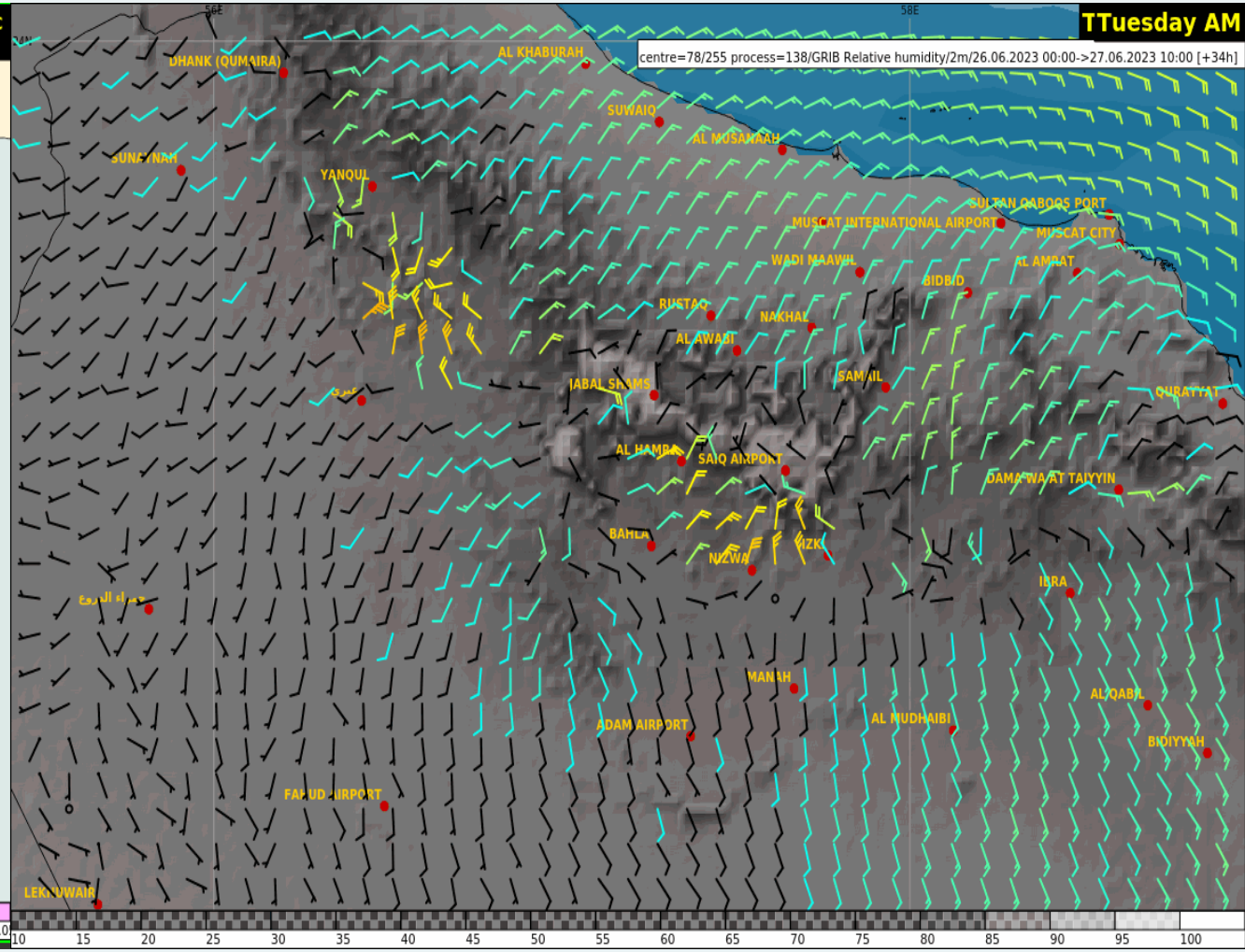
Rain 24hr



Winds



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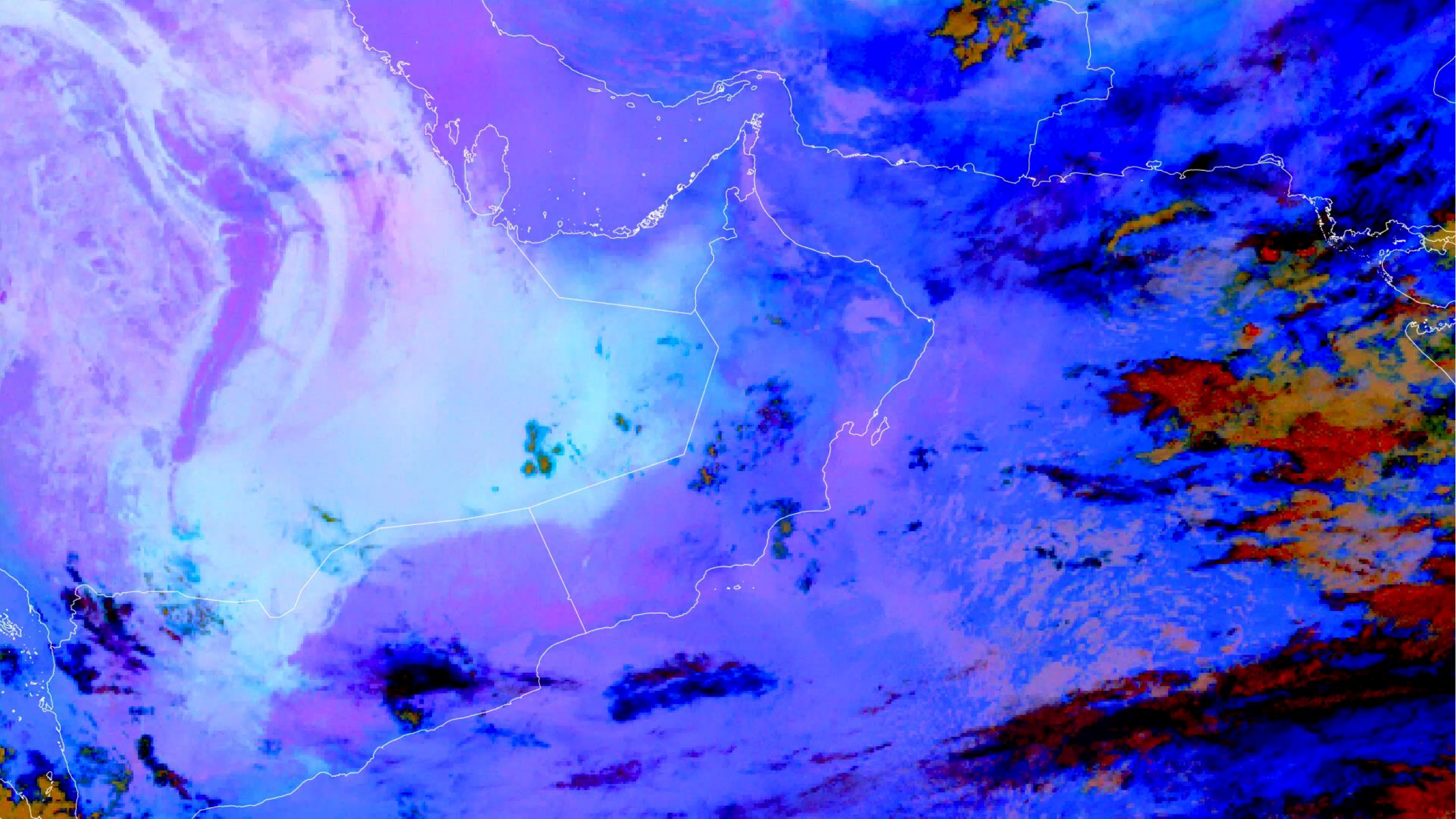
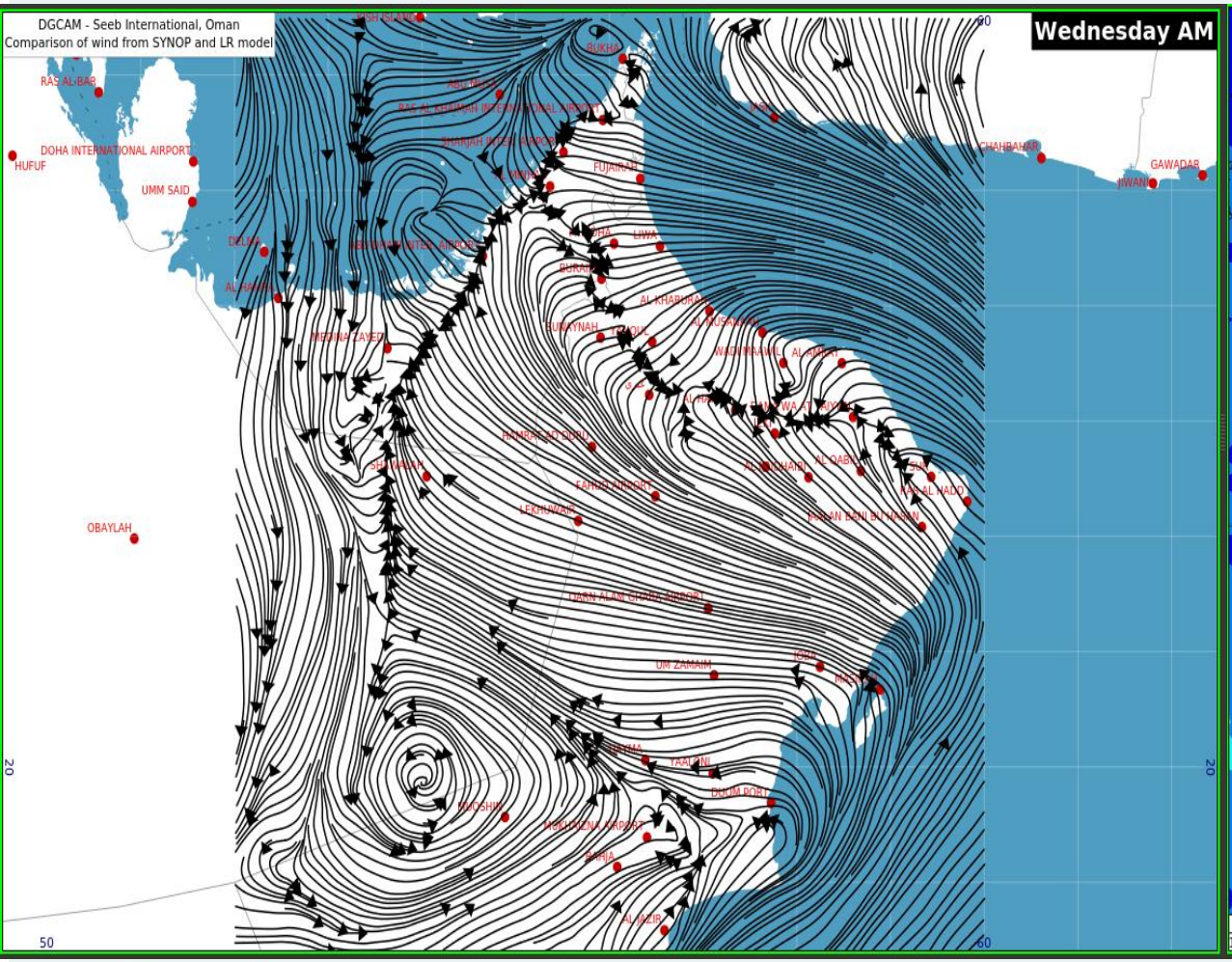
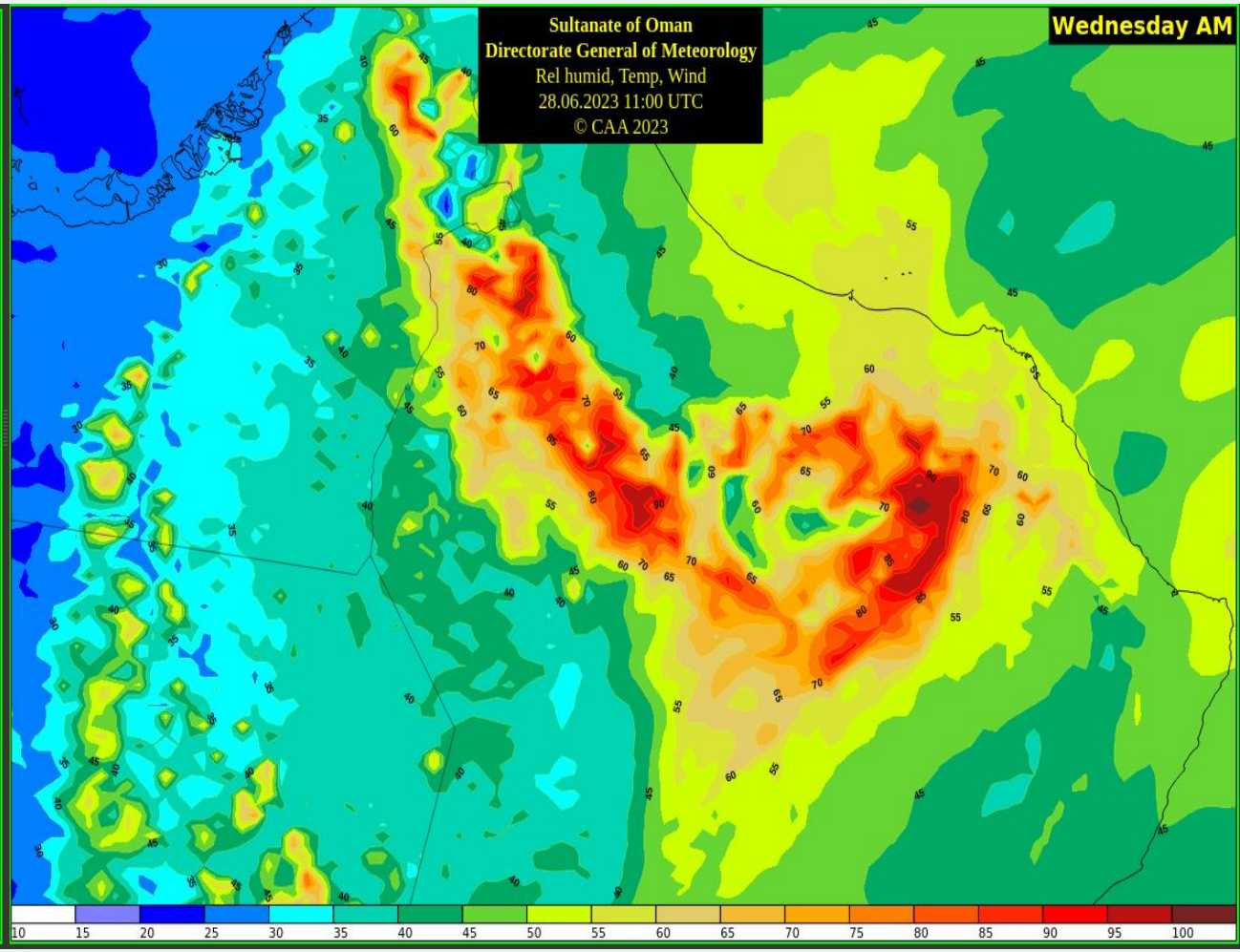




Stream lines



RH (700 hpa)

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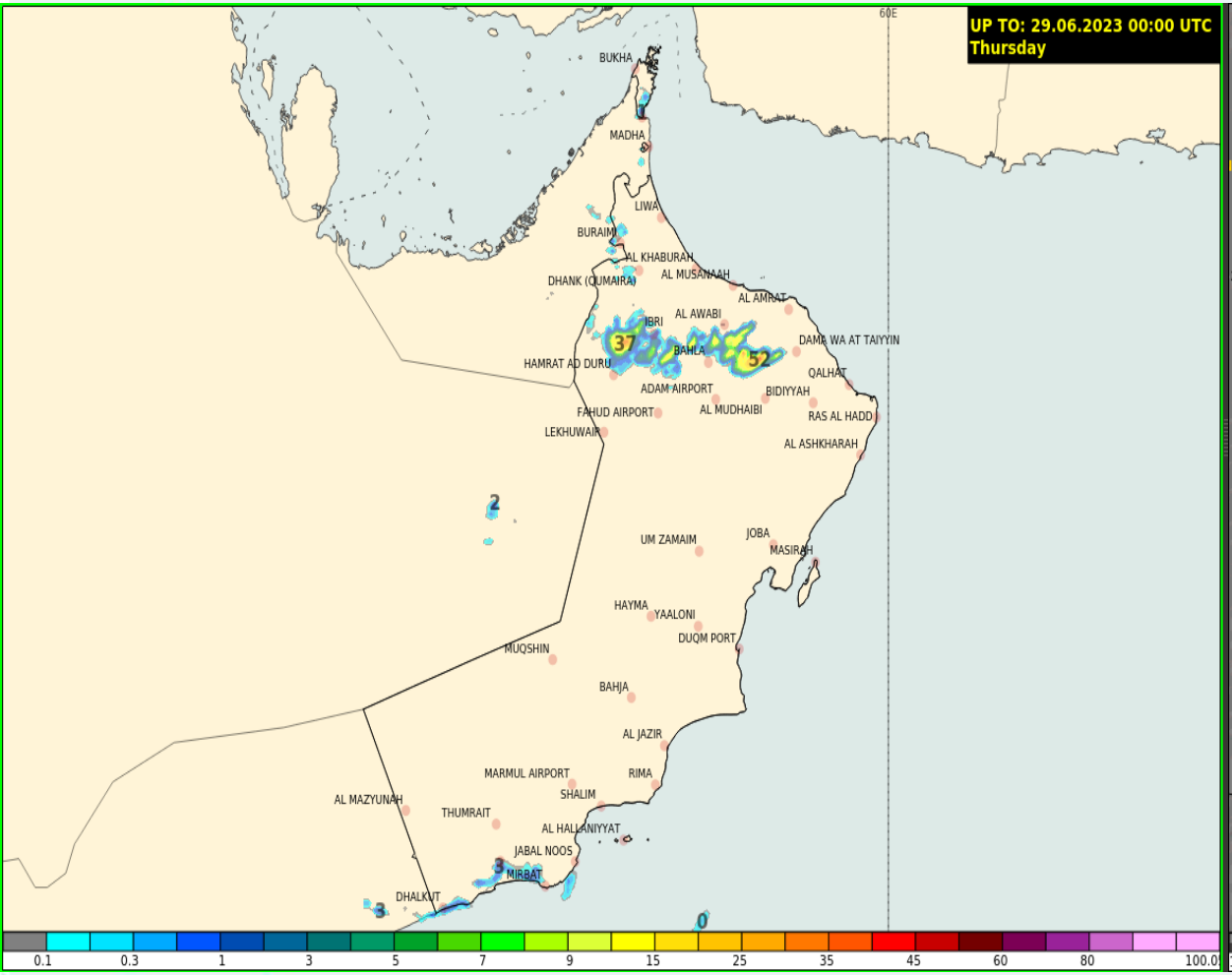
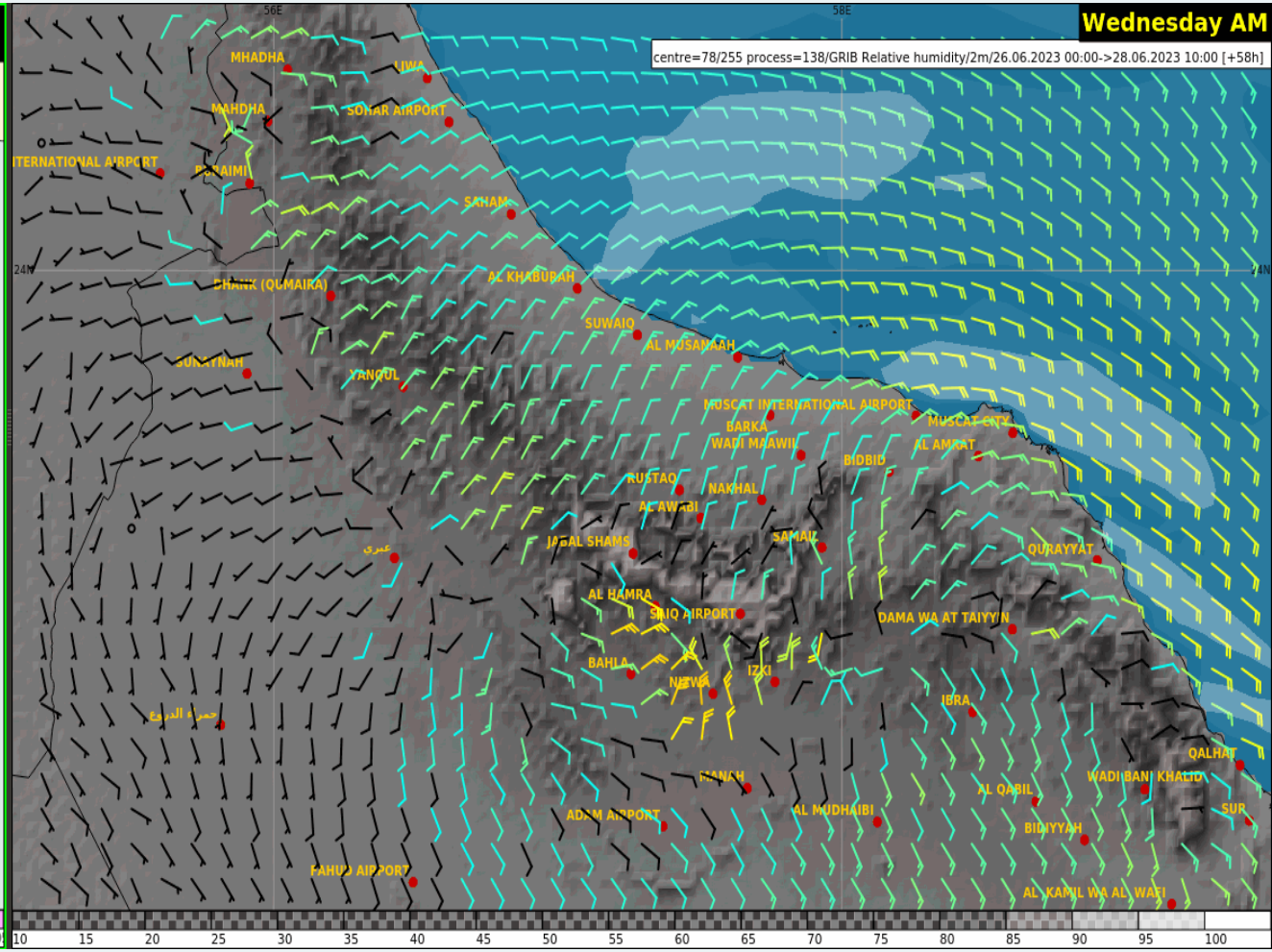
Rain 24hr



Winds



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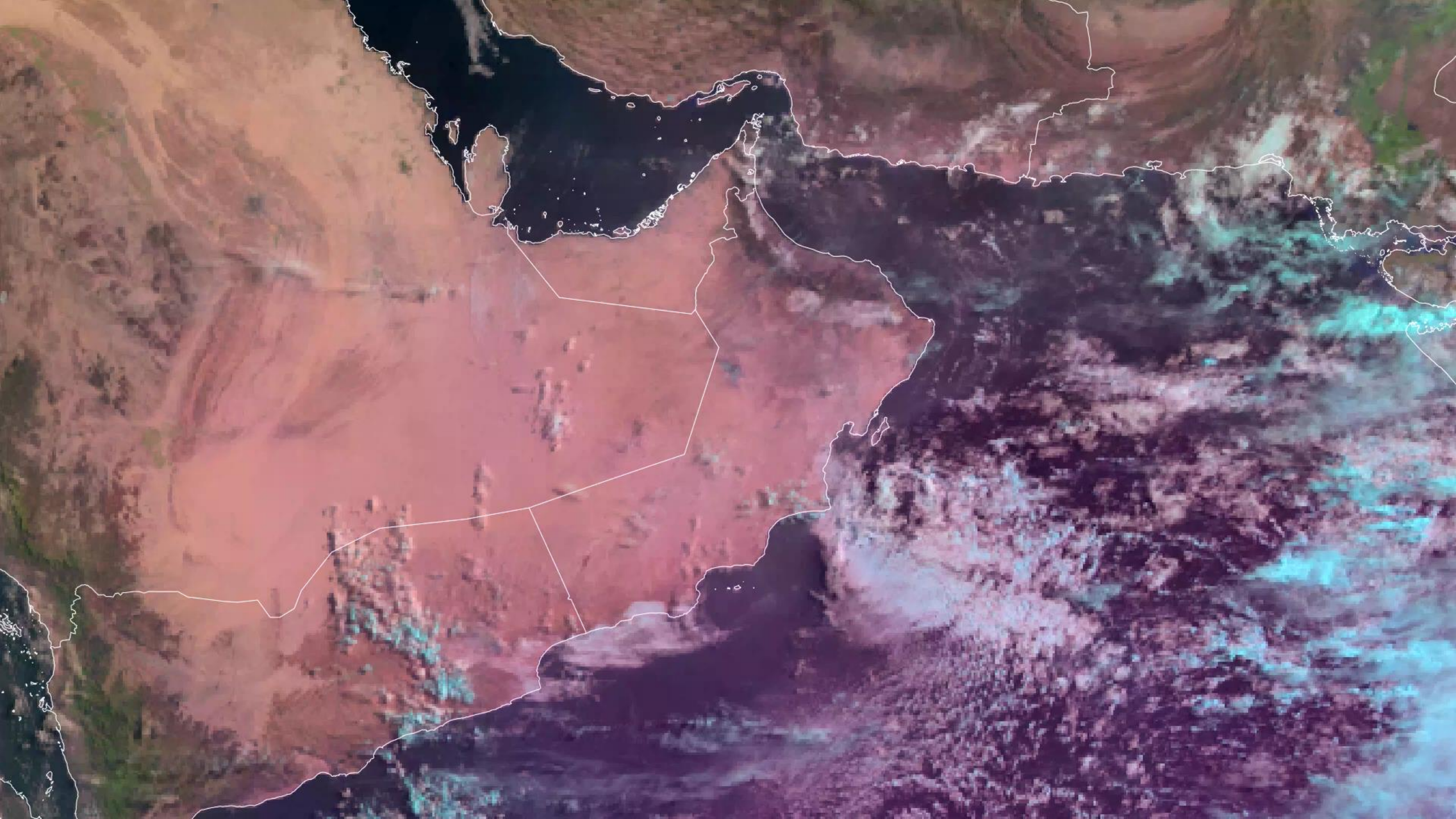
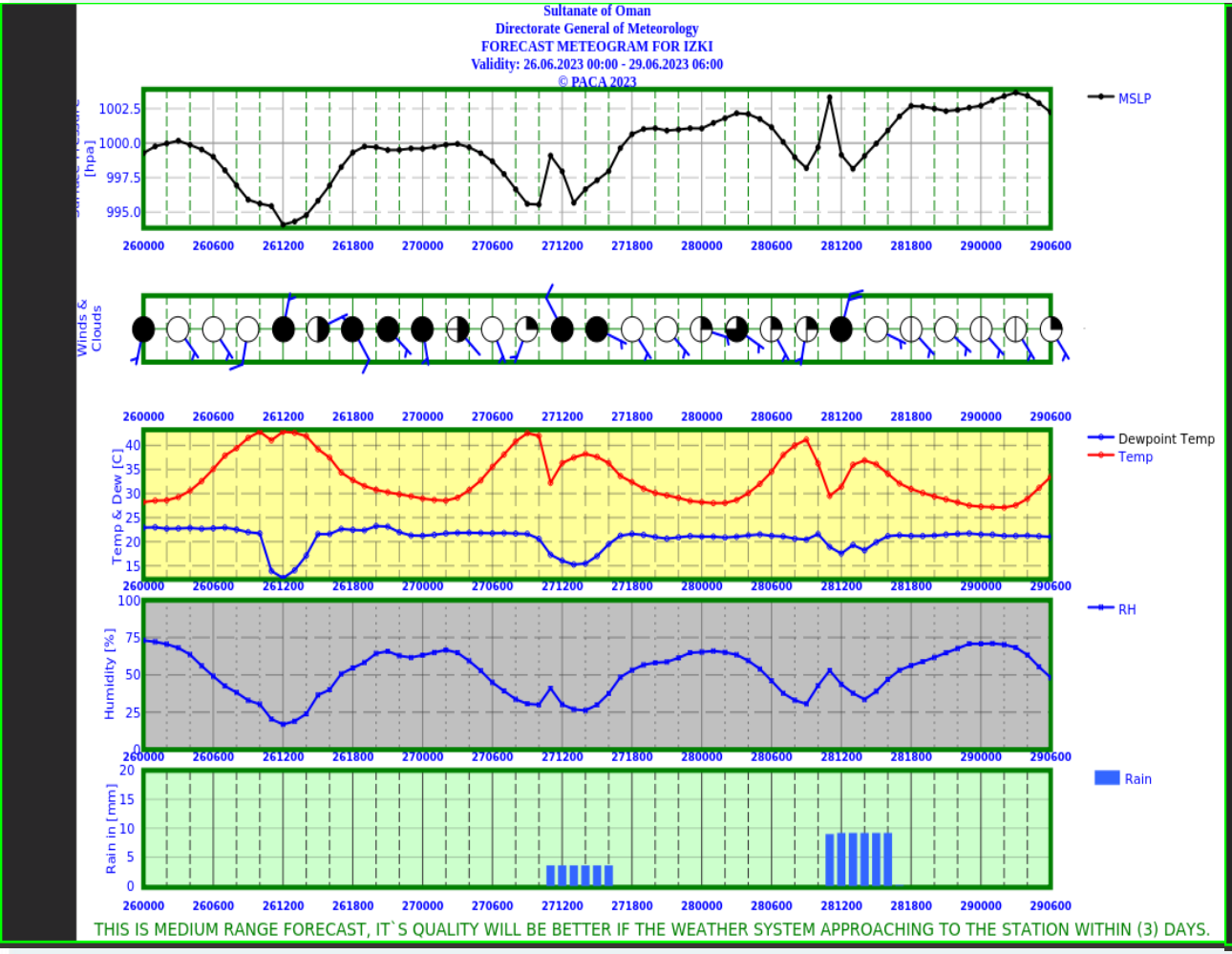
هيئة الطيران المدني





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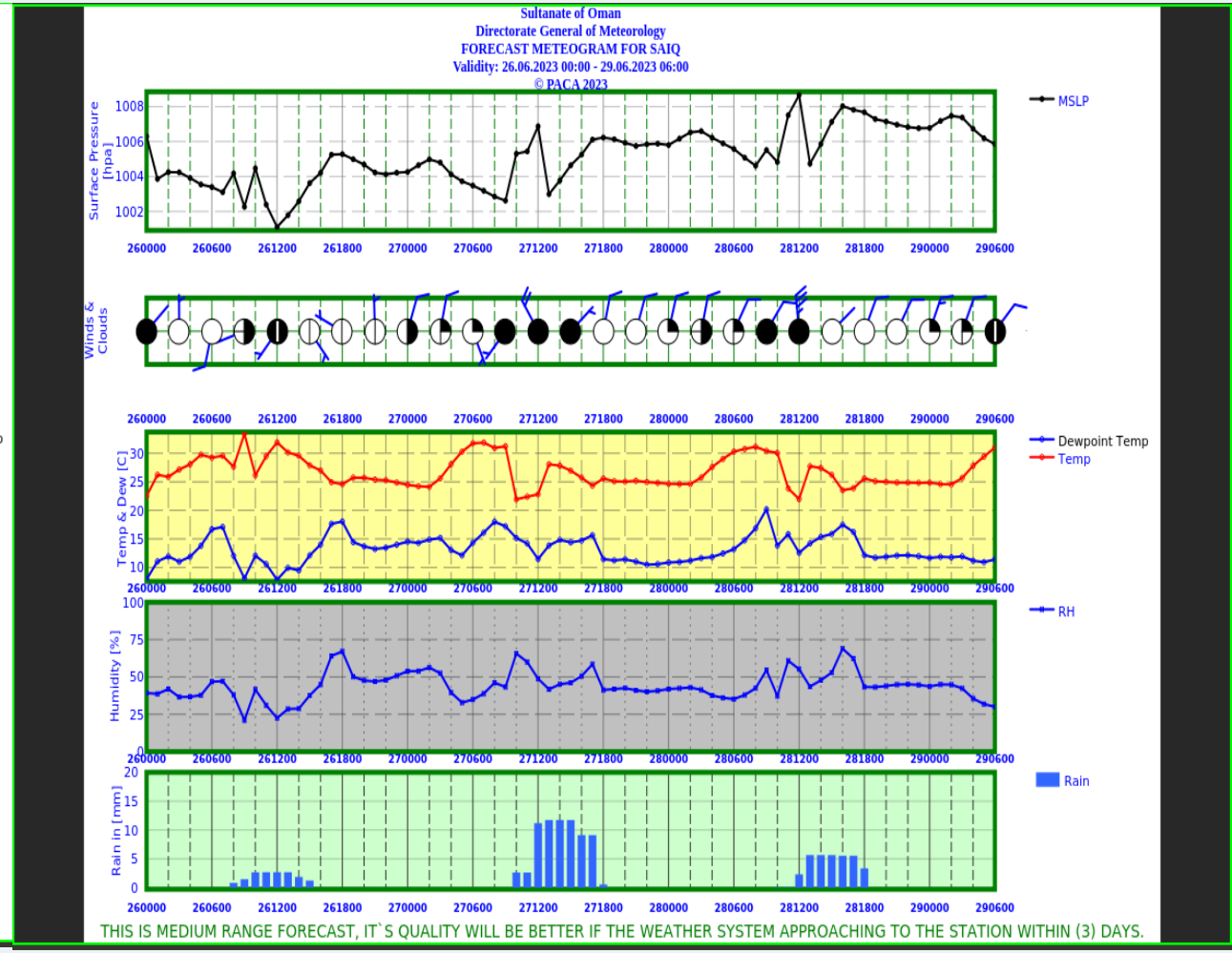

OOQQ

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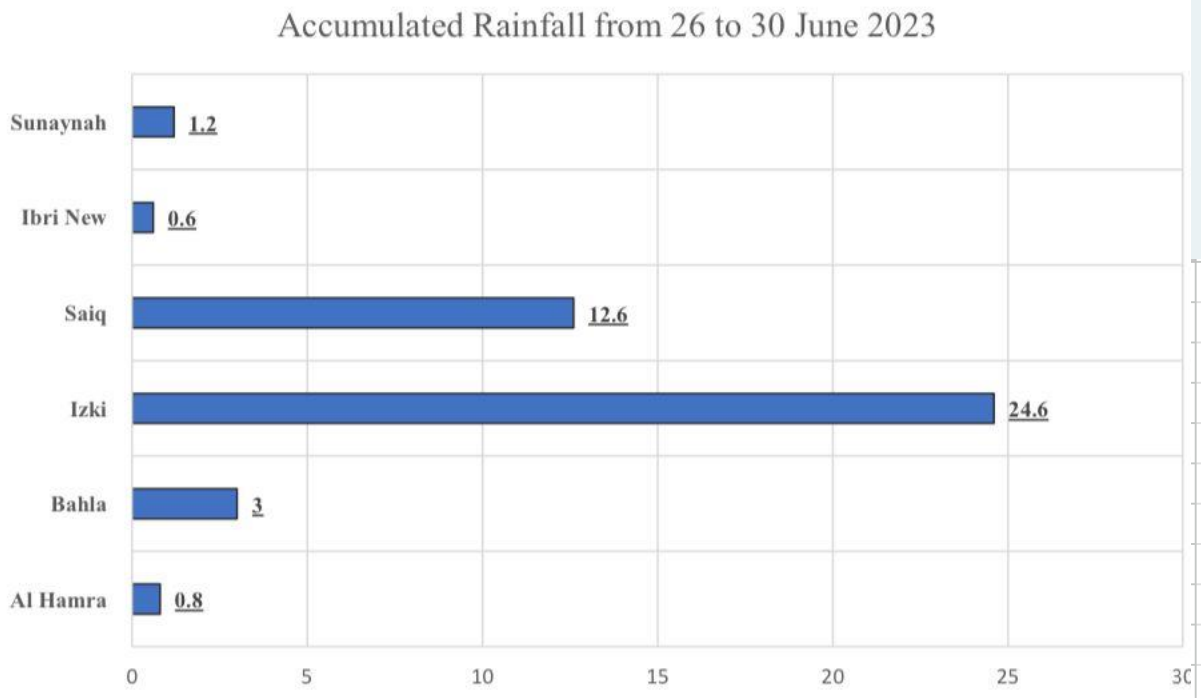
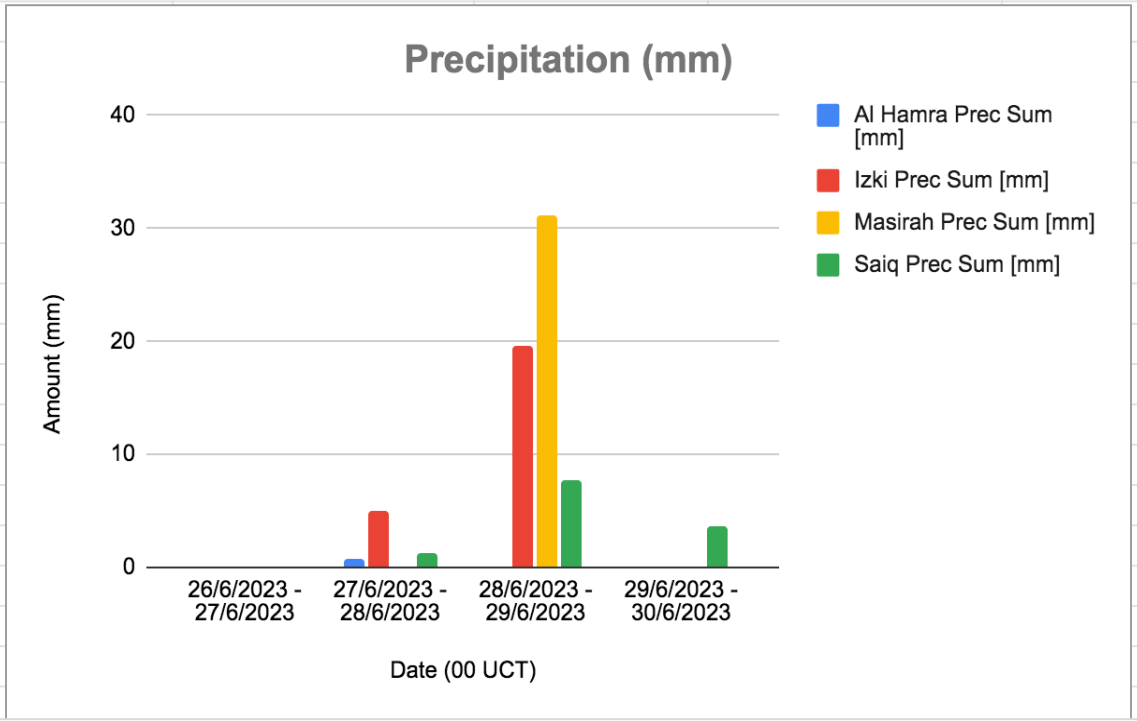
CAA هيئة الطيران المدني



Date (00UTC)	Al Hamra Prec Sum [mm]	Izki Prec Sum [mm]	Masirah Prec Sum [mm]	Saiq Prec Sum [mm]
26/6/2023 - 27/6/2023	0	0	0	0
27/6/2023 - 28/6/2023	0.8	5	0	1.2
28/6/2023 - 29/6/2023	0	19.6	31.2	7.8
29/6/2023 - 30/6/2023	0	0	0	3.6



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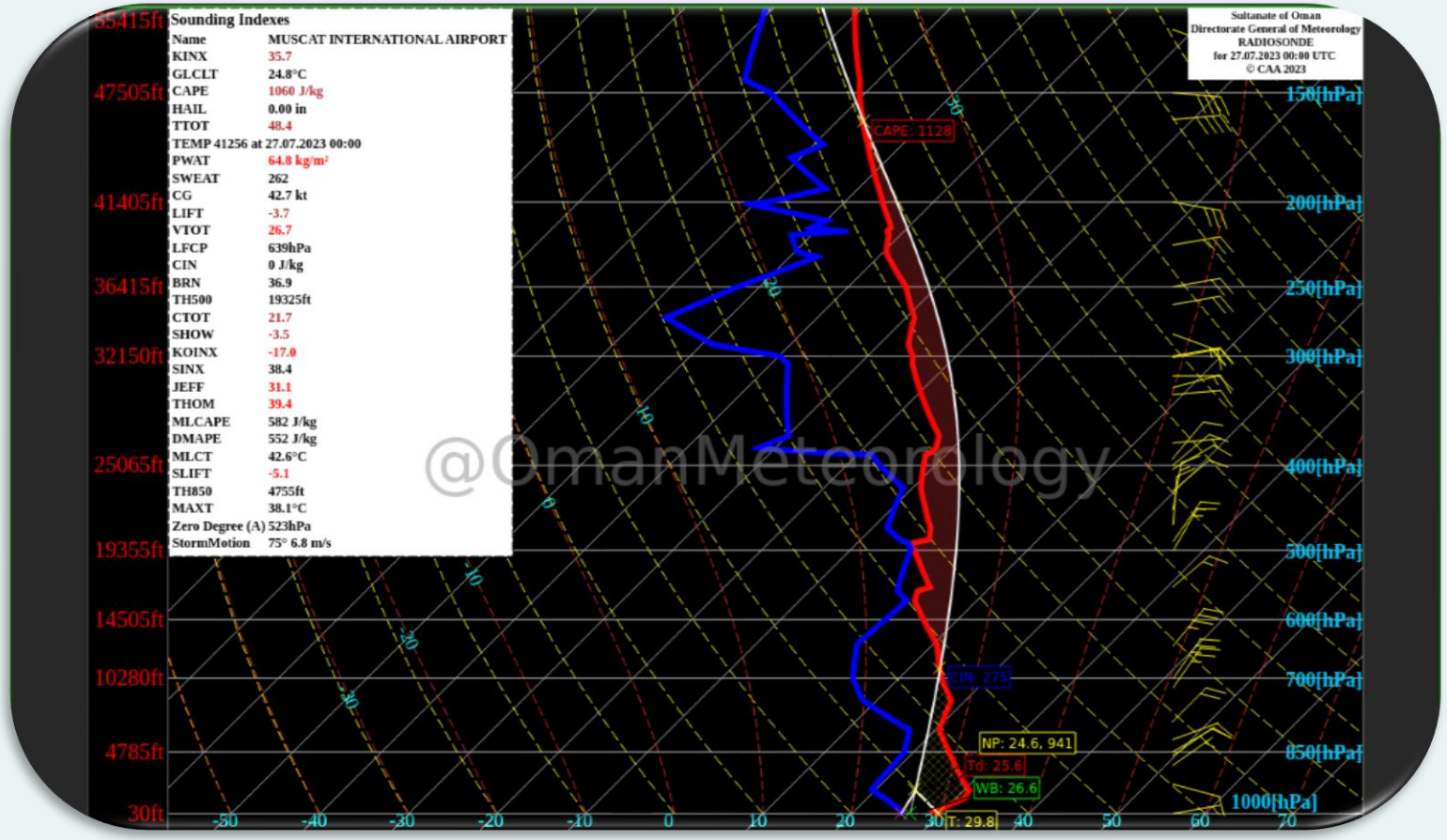
28th July 2023(Local event)



Radiosonde for Muscat 00 UTC

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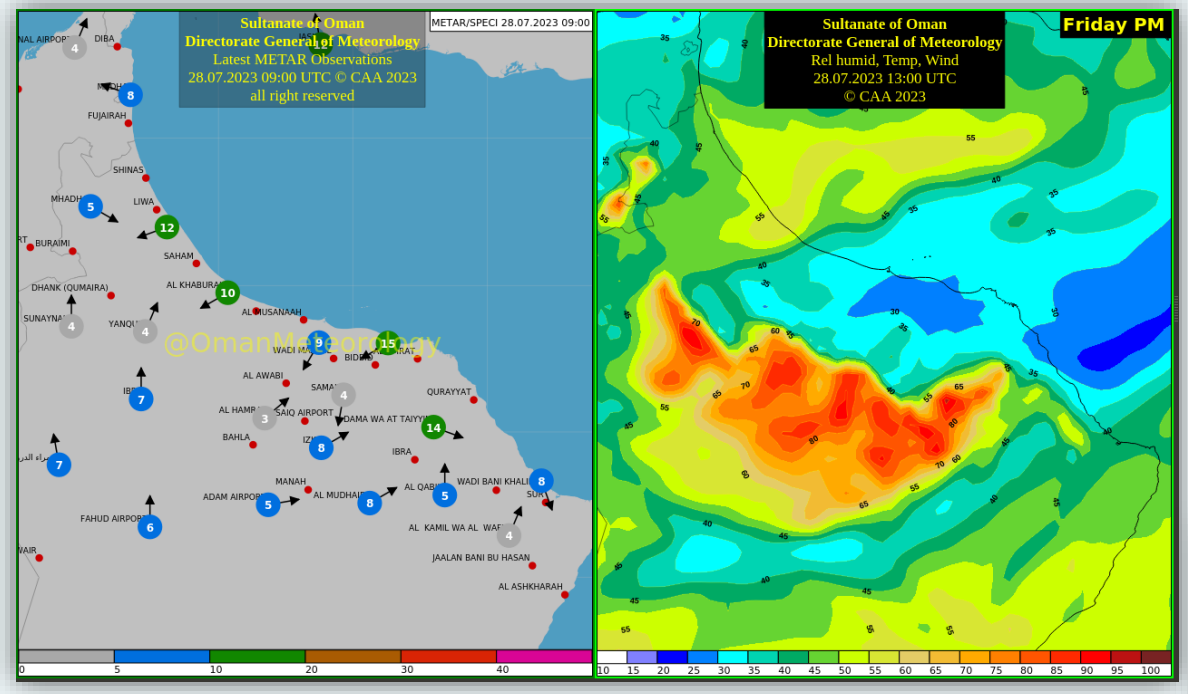
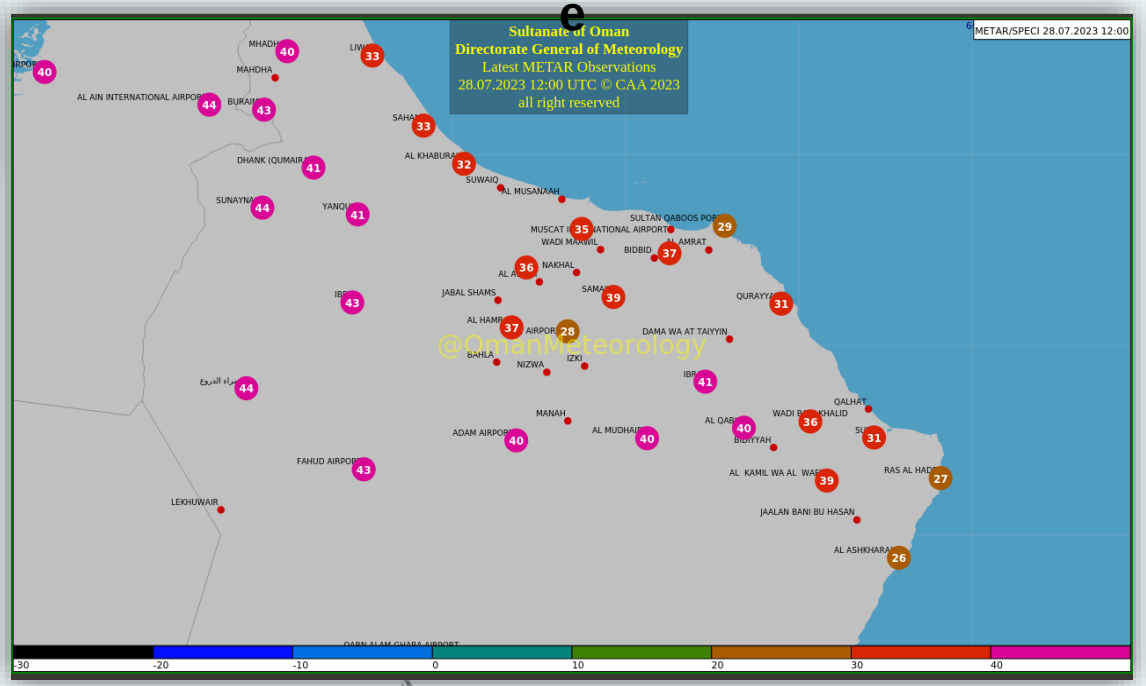


Winds & RH

Temperature



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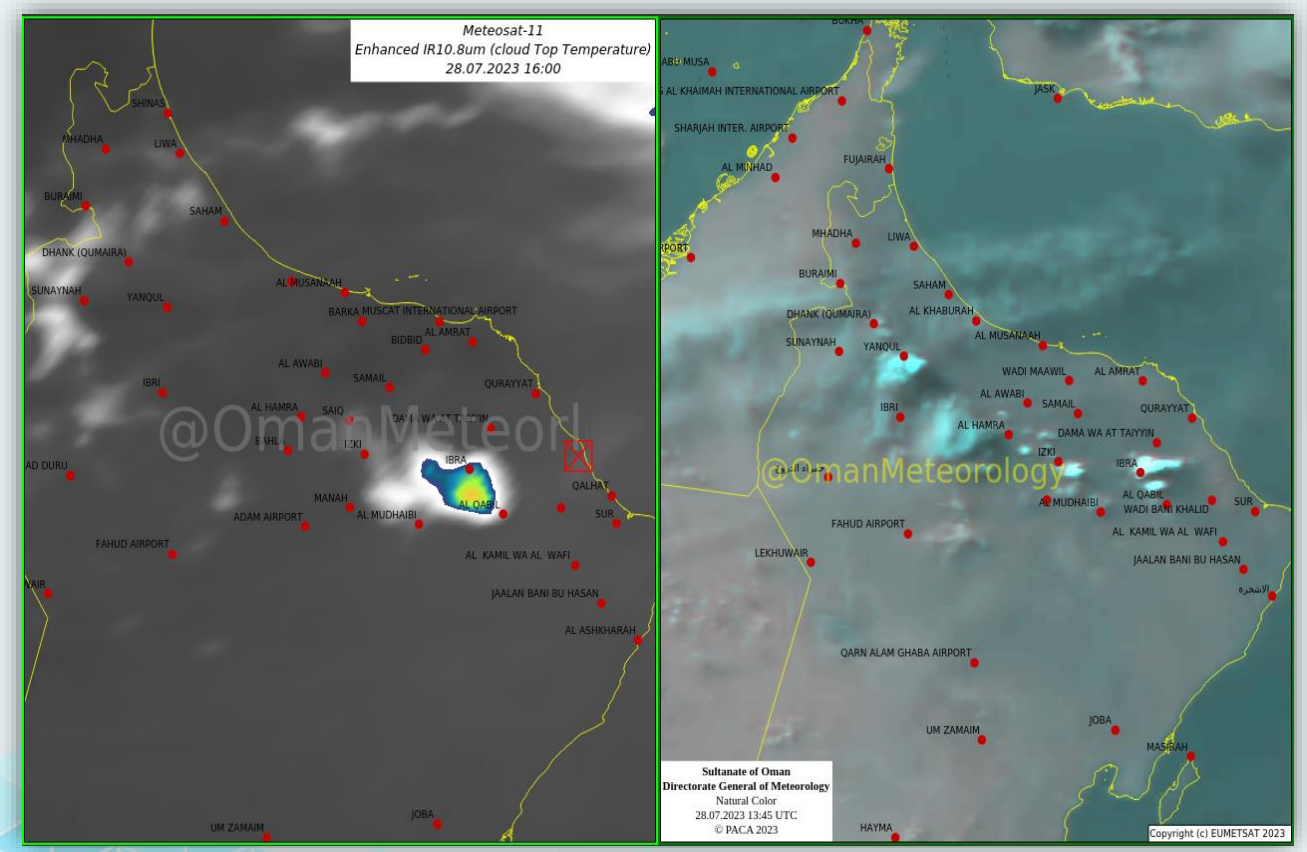
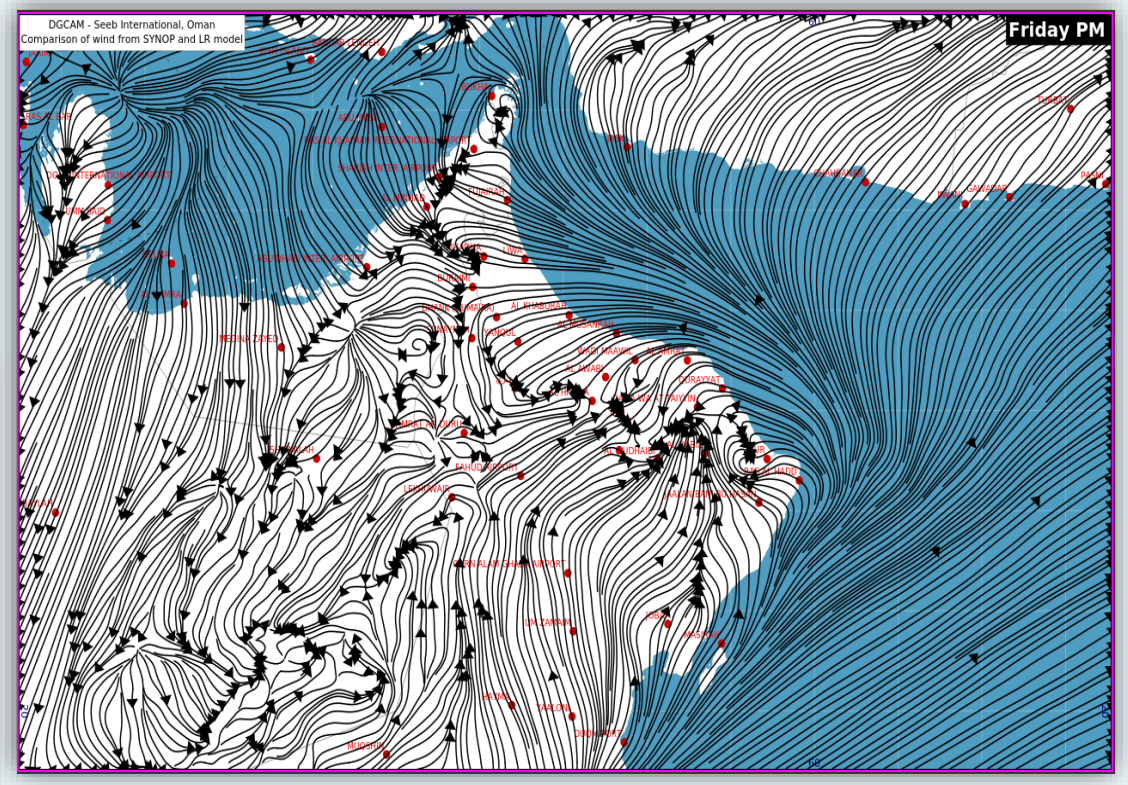
Satellite Images





Stream line

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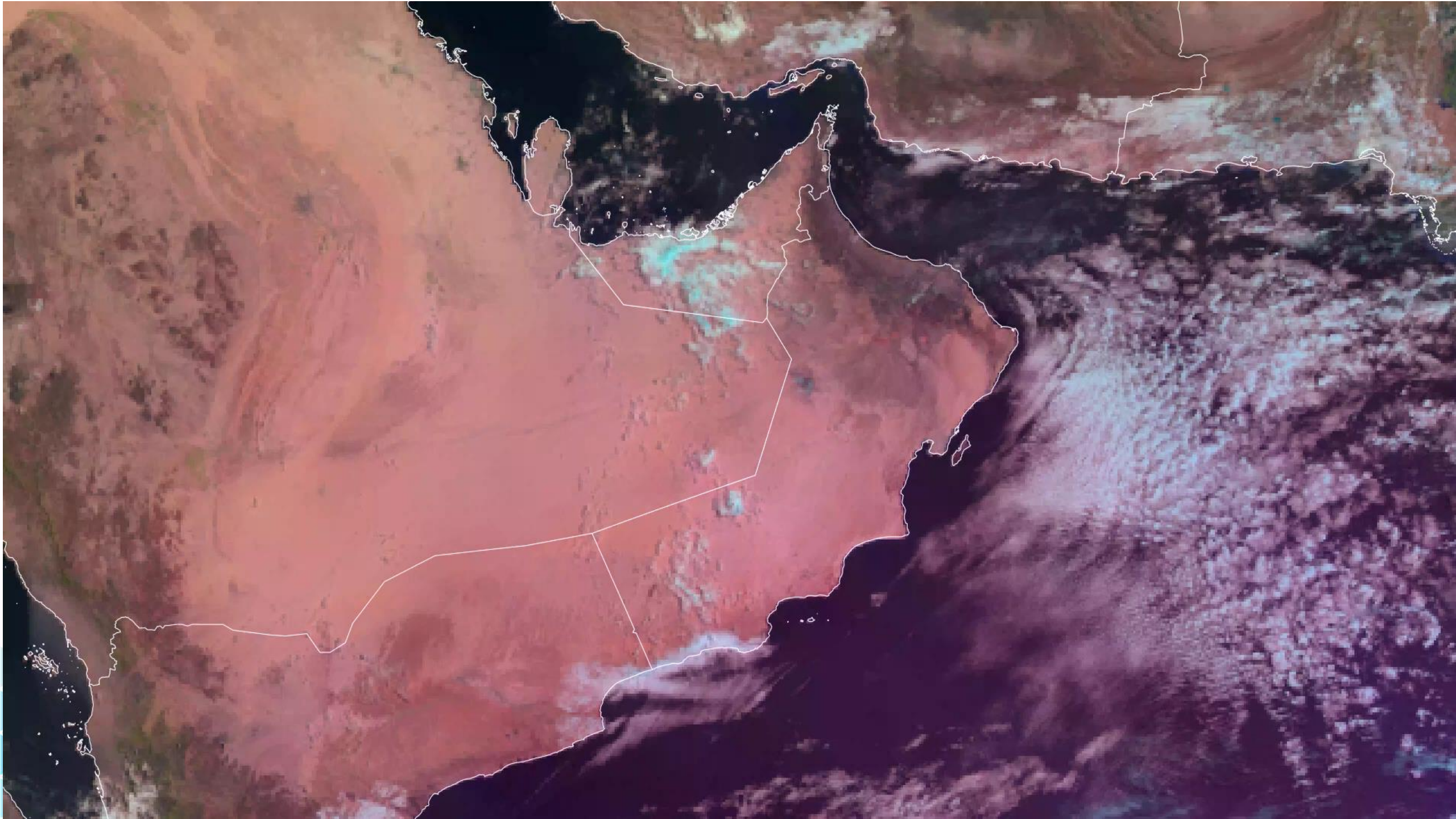


Monsoon

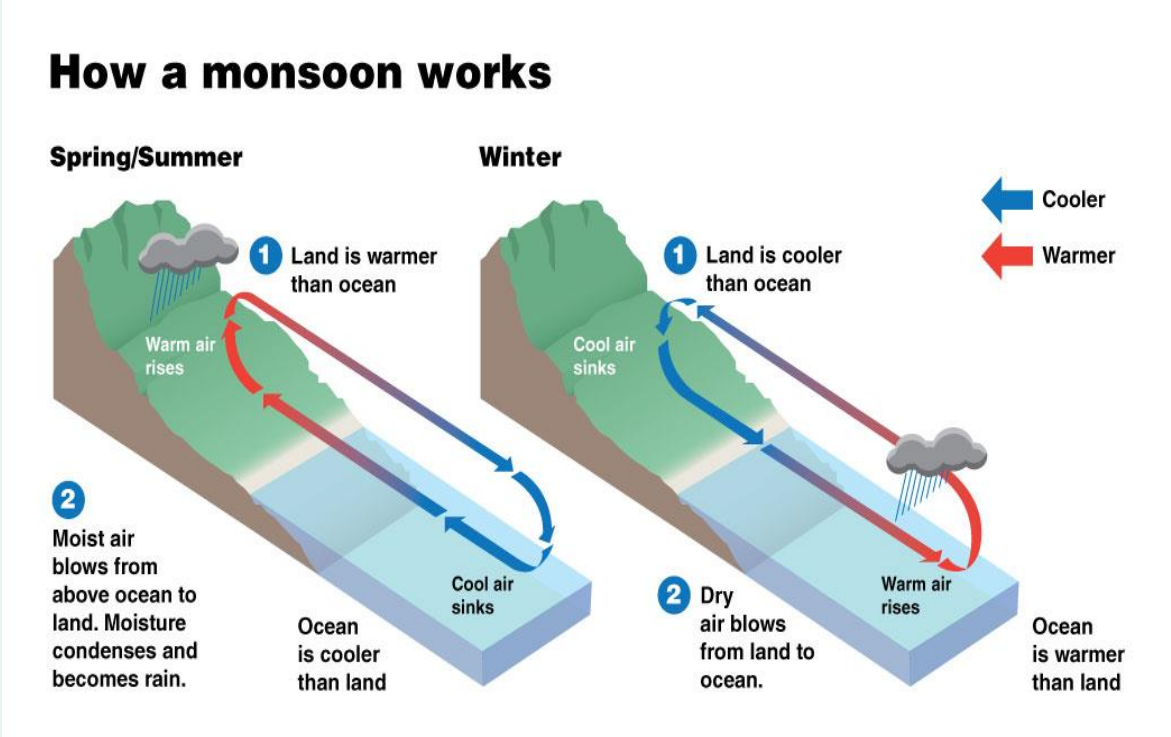
- Monsoon(Background)
- Summer monsoon
- Khareef

What is monsoon?

- A monsoon is a shift in winds that often causes a very rainy season or a very dry season. Although monsoons are usually associated with parts of Asia, they can happen in many tropical and subtropical regions.

What causes a monsoon?

- A monsoon is caused by a seasonal shift in the winds. The winds shift because the temperature of the land and the temperature of the water are different as seasons change. For example, at the beginning of summer, the land warms up faster than bodies of water. Monsoon winds always blow from cold to warm. In the summer, warm air rising off the land creates conditions that reverse the direction of the wind.



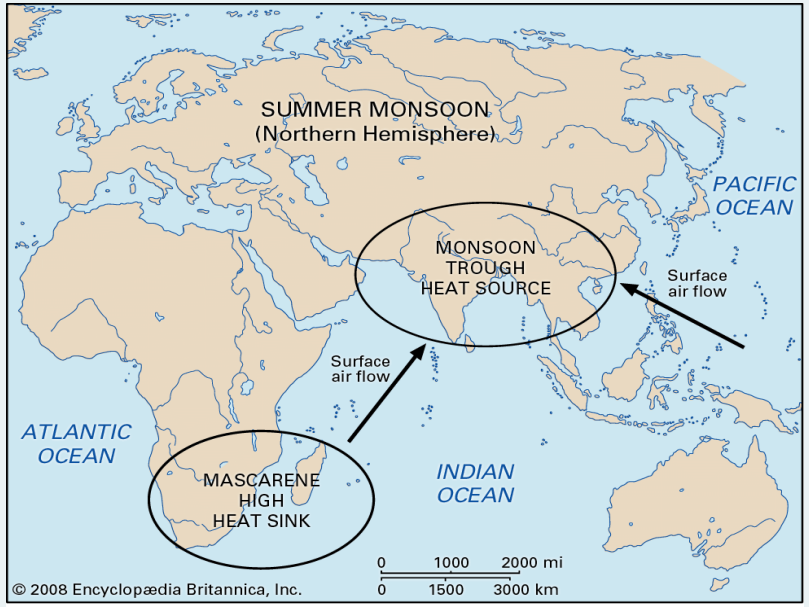
Why does a monsoon cause rain?

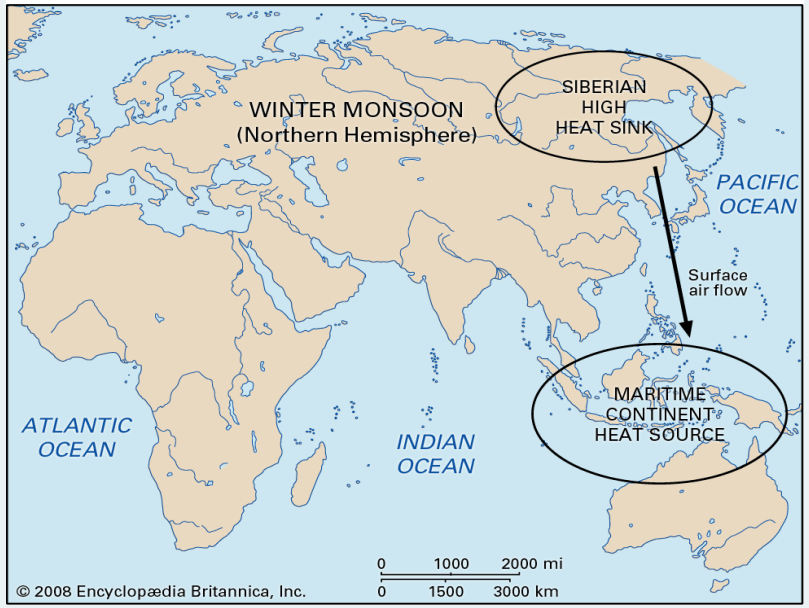
- The monsoons that cause heaviest rainfall are summer monsoons near the Indian Ocean. Warm water in the ocean evaporates, rising into the air. This causes the wind to change direction and moisture blows toward the land in countries such as India and Sri Lanka. The warm, moist air then condenses and becomes rain. The result is a period of humidity and heavy rainfall that can last for months.

- When the wind changes direction in the winter, it is called a winter monsoon. Winter monsoons in these regions near the Indian Ocean are usually dry.

Summer monsoon components:

- Monsoon Trough
- Mascarene High anti-cyclonic system
- The low level cross-equatorial jet
- The Tibetan high pressure system/Tropical easterly jet





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Monsoon Trough

- Formed over northern India.
- Northern Hemisphere Summer as part of the global ITCZ.
- Associated with **surface low pressure.**

Mascarene High anti-cyclonic system

- Situated over the south-east Indian Ocean(30^{o} S, 50^{o} E).
- Generates a **large outflow of air.**
- The air moves north over the equator where it becomes a south- westerly flow known as the **low level cross-equatorial jet.**

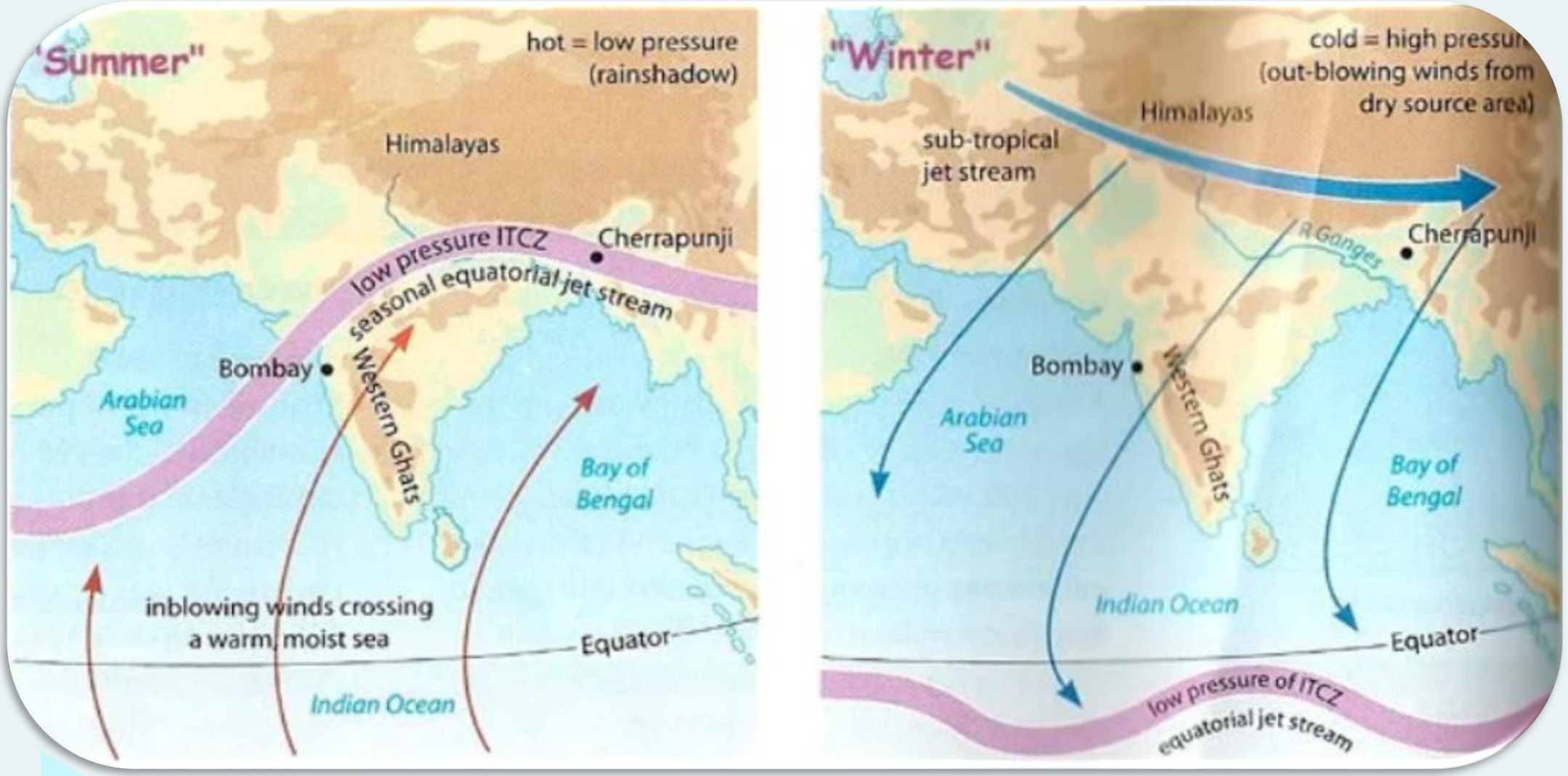
Low level cross-equatorial jet

- Maximum intensity from **June to August**.
- The jet splits in two branches at around **10^{o} N, 60^{o} E** at this time.
- Arrive over central west and southern coasts of India.
- Important **for rainfall amounts** over western India.

The Tibetan high pressure system/Tropical easterly jet

Upper level anticyclone.

- Located over northern India above the surface monsoon trough; (low level convergence matched by upper level divergence)
  - Well established during summer.
- Moves in a south-southeast direction following the zone of maximum surface heating and low pressure.
- The outflow of air from the southern flank of the Tibetan high gives rise to the **Tropical easterly jet**.
- **Tropical easterly jet** lasts from June to September.



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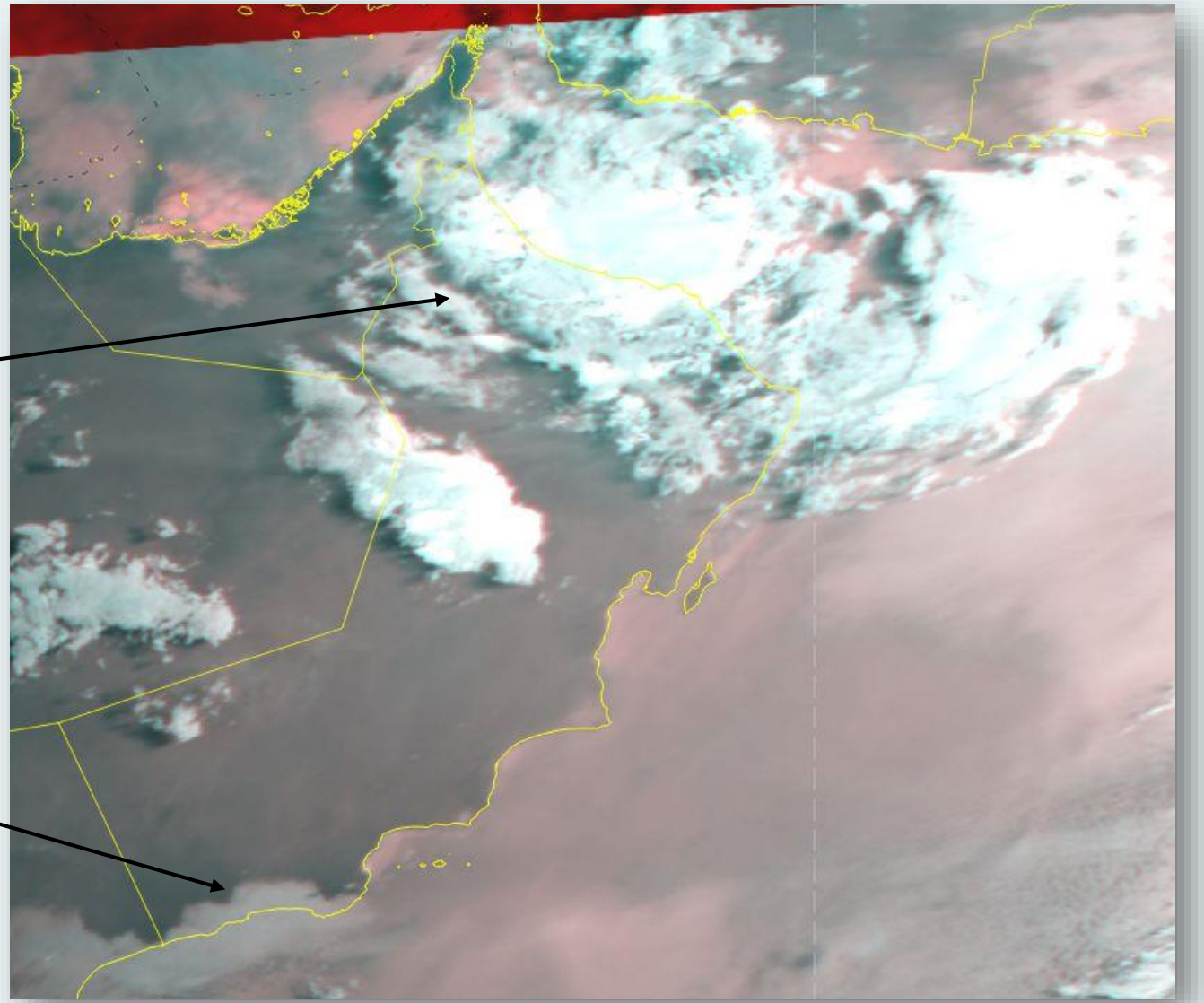
Weather associated with :

- Local Convection and Thunderstorm development towards afternoon(Al Hajar Mountains)

- Khareef at Salalah and adjoining mountain area (southern coast of Oman).



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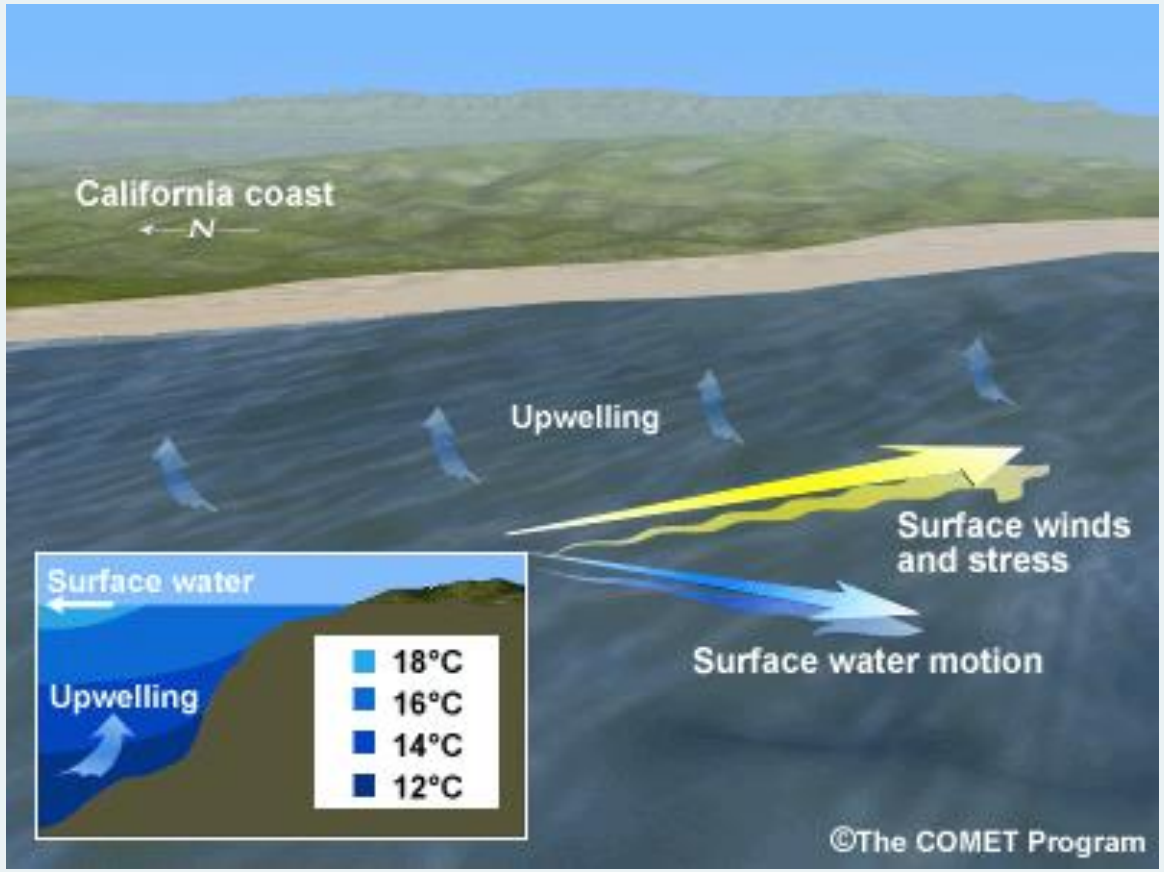
Al Khareef &Upwelling

- The SW winds on the ocean surface, water surface is forced to move in NE direction; and under the influence of Coriolis force (Kerman Effect) , the surface waters move to the east



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Main factors for Al Khareef

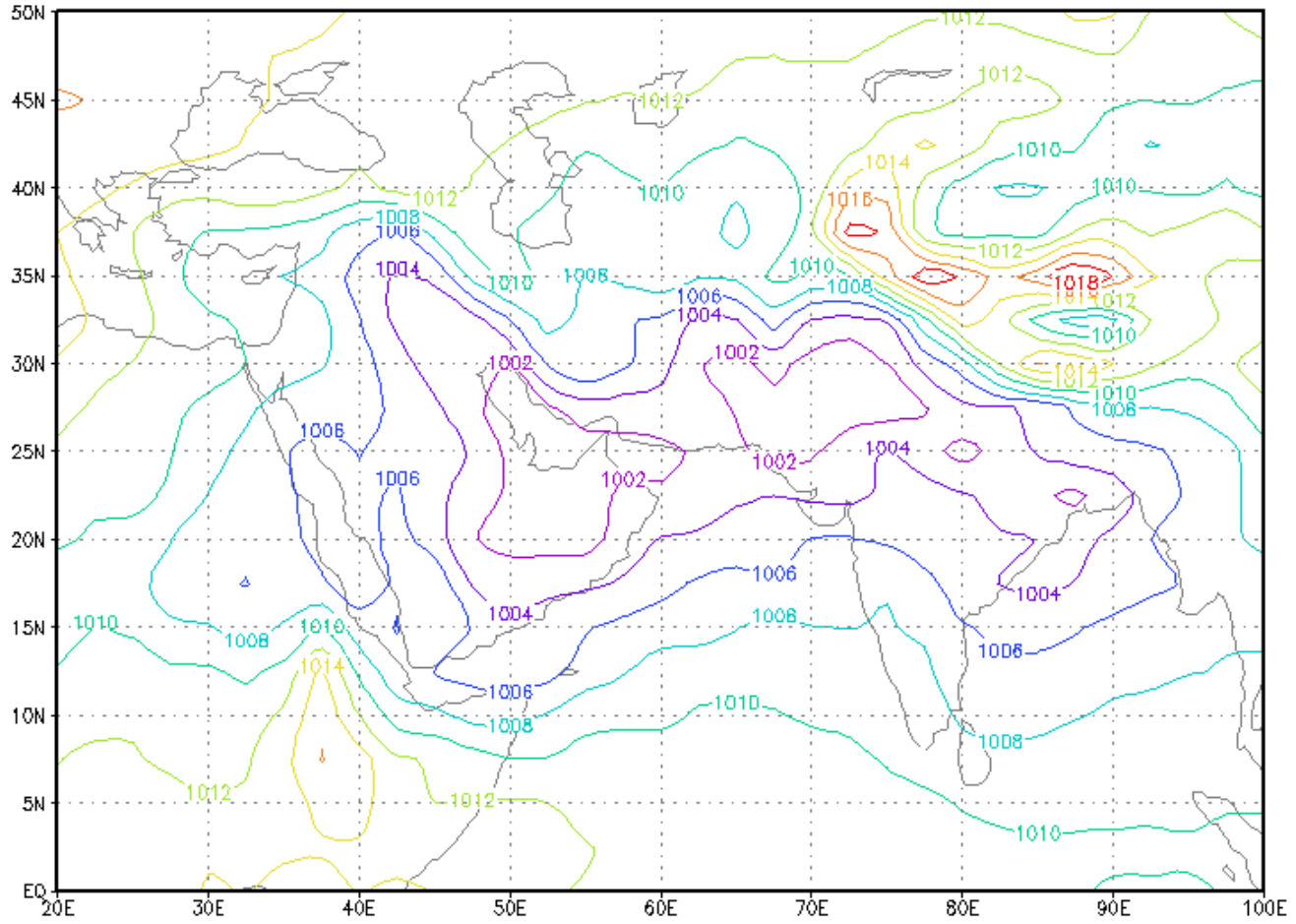
existing of thermal low over south east of Arabian peninsula.

Blowing northerly winds in 700 hpa layer.

Active SW monsoon winds.

Difference in pressure between OOTH station and OOSA station is around 4 mb.

Temperature and Dewpoint close to each other from surface till 850 hpa



Thermal lows are found across the region with centers over northwest-India, Pakistan, Baluchistan and the Empty Quarter of Oman and Saudi Arabia

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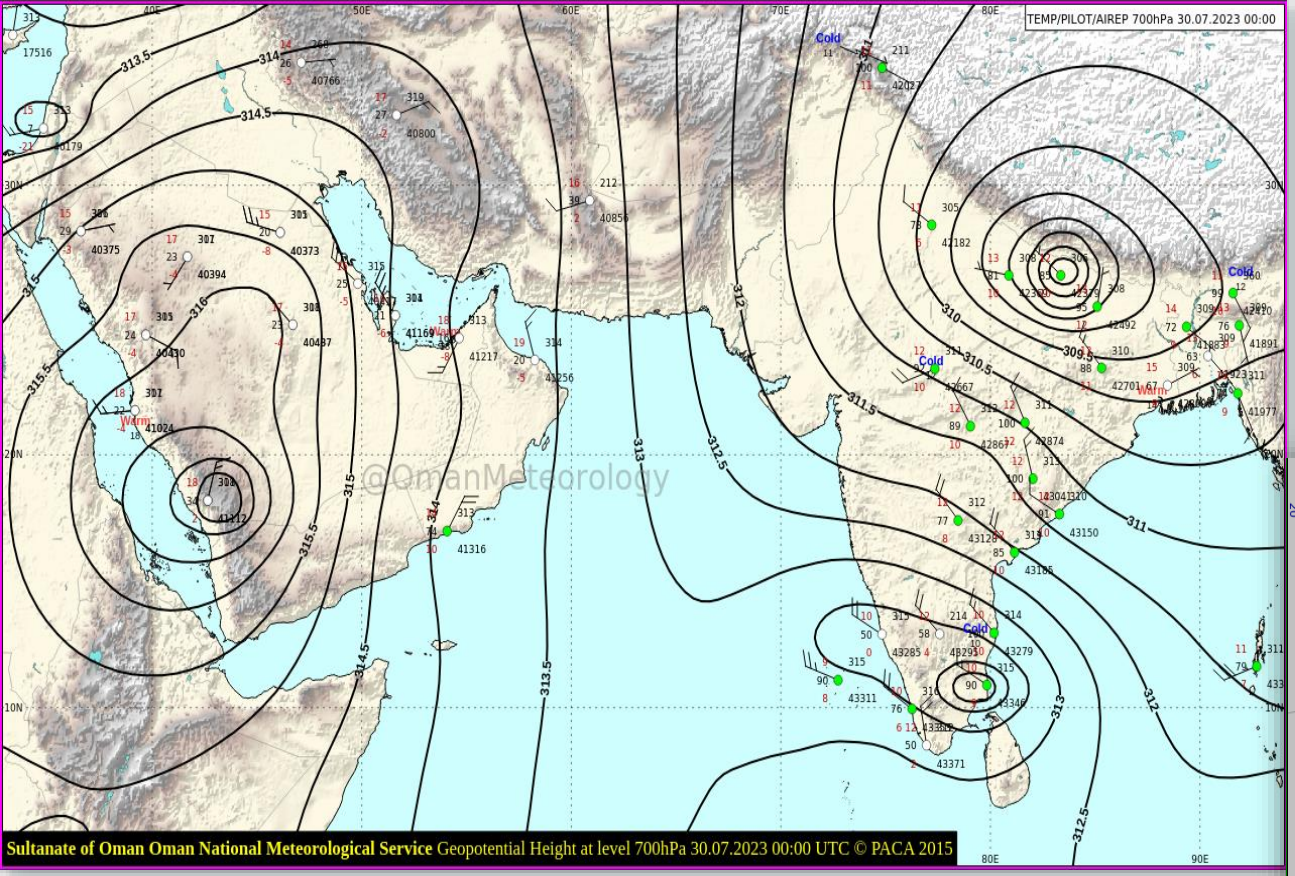
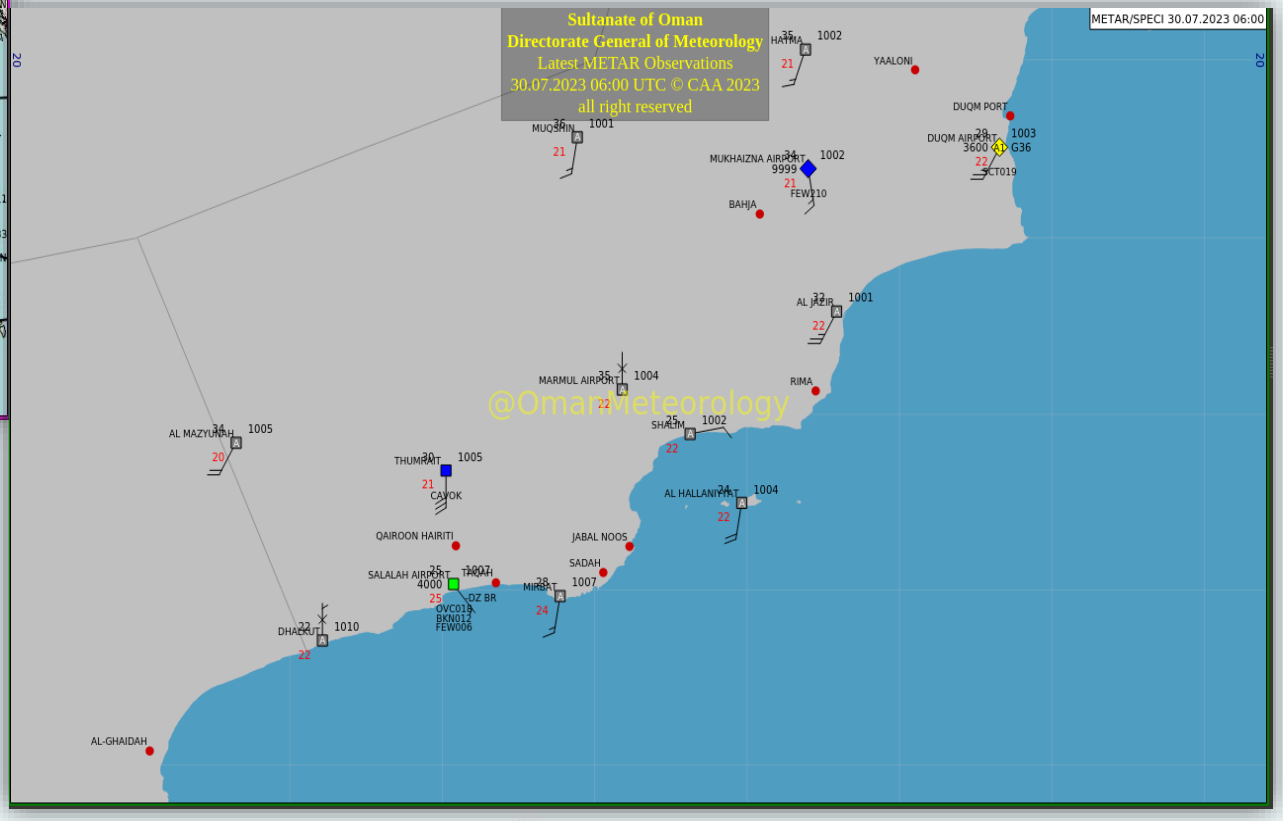


700 hpa actual

SW winds at sfc



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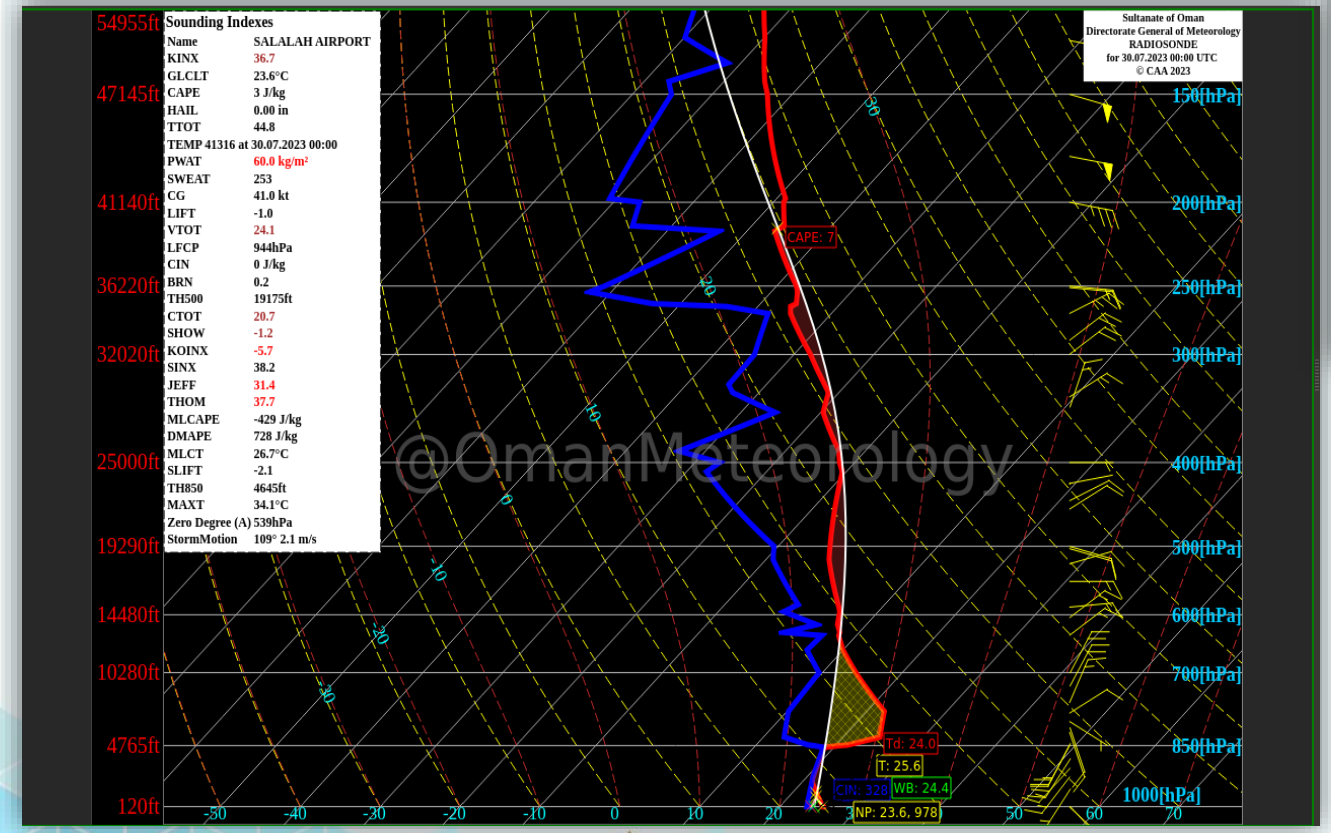
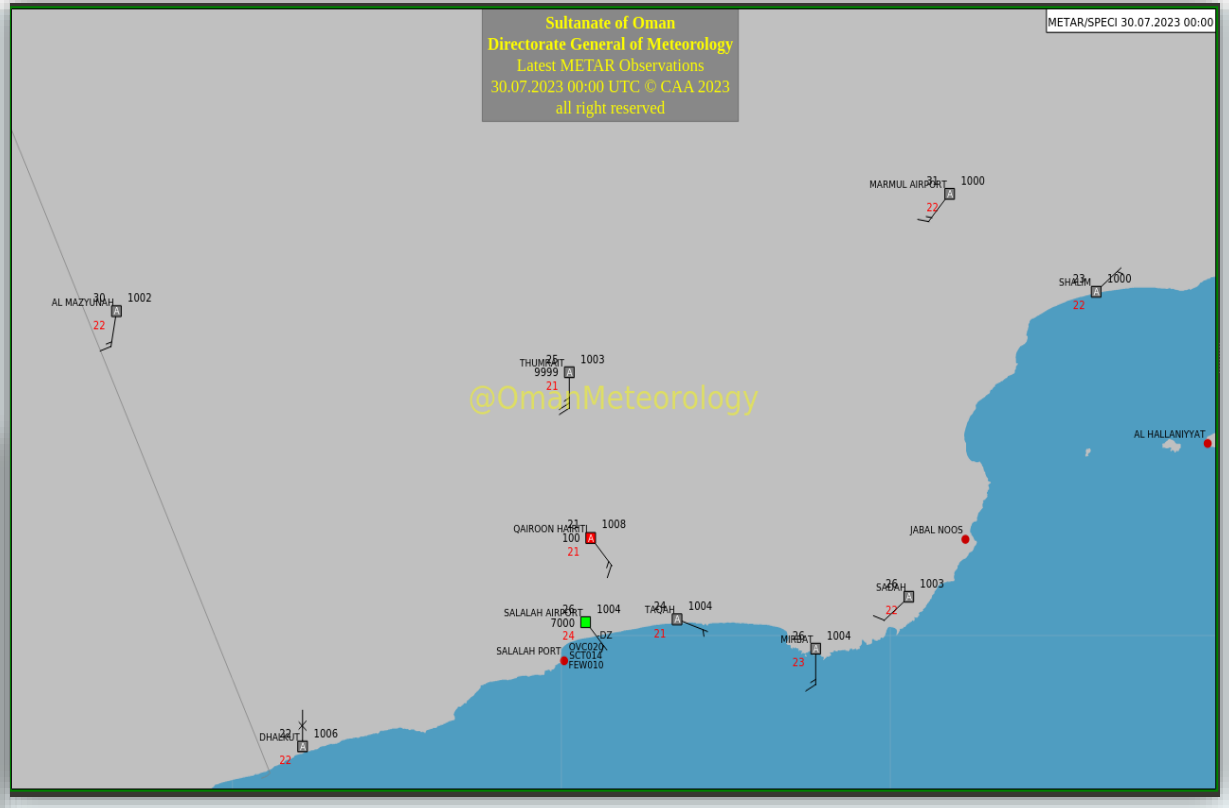
Radiosonde OOSA 00 UTC





OOTH &
OOSA

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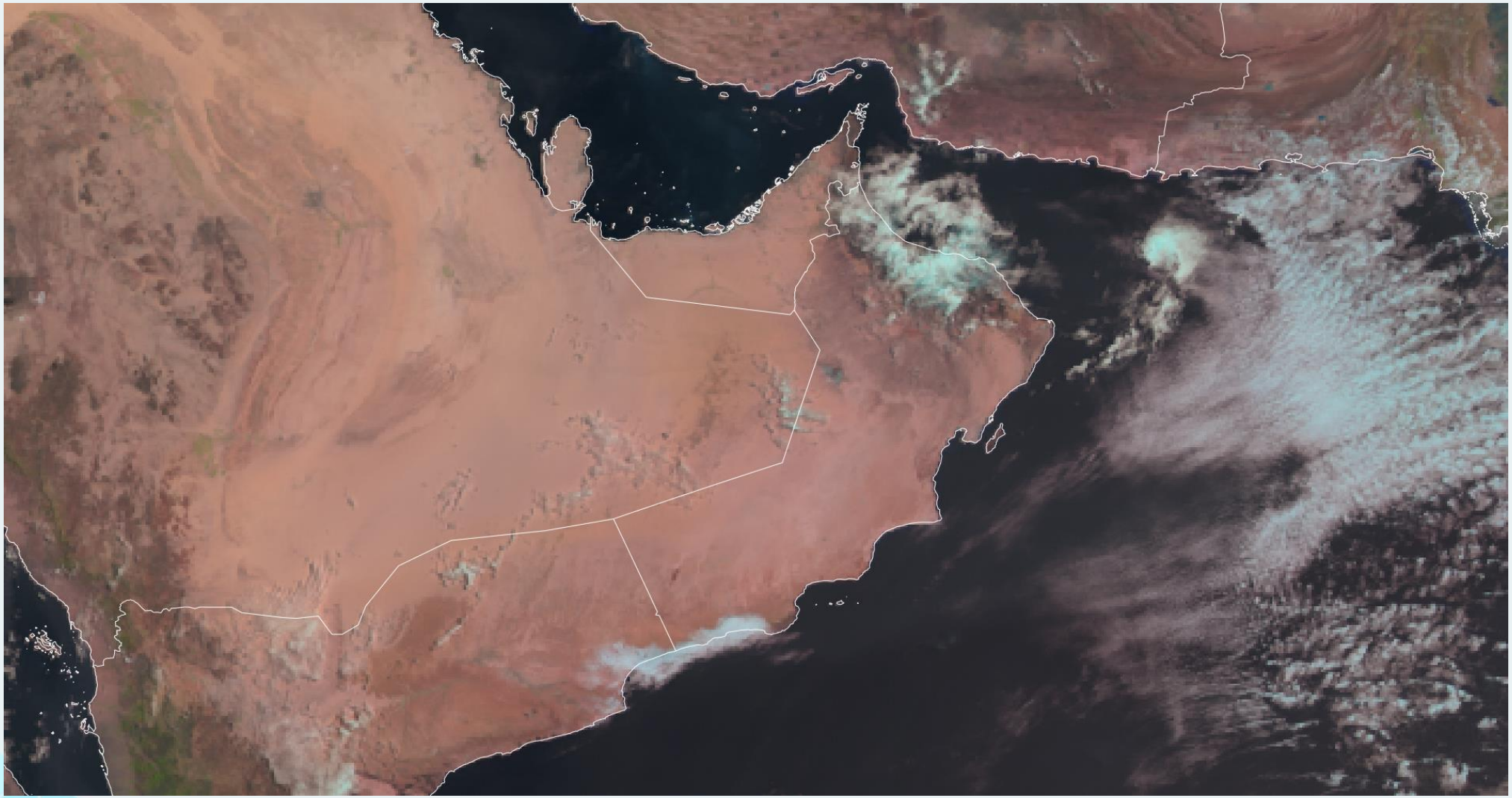

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