Case.1 : Storms over UAE & North Oman

Part 1: General Situation (Model Data)

Tool: Earth Null School

Set up: Set the date to **2024-04-14**.

1. **Low-Level Analysis:** Check **Total Precipitable Water (TPW) (amount of water vapour in the atmosphere column)**.

    - *Task:* Identify the moisture tongue. Is there a low-level feeding to the area?

2. **Upper & Middle Level Support:** Select **500 hPa**.

    - *Task:* Any trigger by the upper layer? (check. Is there any upper-level trough (500hpa) or jet stream at 300hpa?

Part 2: The Trigger (from Satellite)

Tool: EUMETView

Product : MSG-0 / Airmass RGB

1. **Observation:** create an animation
2. **Detection:** the advances of red airmass

Part 1: General Situation (Model Data)

Tool: Earth Null School

Set up: Date: 2024-04-14

1. Low-Level Analysis: Total Precipitable Water (TPW)

- **Moisture Sources:** Trace the moisture "tongue." Discuss whether the high TPW values originate from the tropical Indian Ocean.

    (Atmospheric "Fuel": TPW represents the total water available. Discuss how the high humidity levels (the "deep blue" shades seen later in the Dust RGB) act as the primary fuel for the thunderstorms that hit the UAE and Oman.)

2. Upper & Middle Level Support (500 hPa & 250 hPa)

- **The Trough-Surface Connection:** Identify the 500 hPa trough.
- **Jet Stream Positioning:** At 250 hPa, locate the jet streak. Discuss the role of "divergence"

Part 2: The Trigger & Features (Satellite)

Tool: EUMETView

Product: MSG-0 / Dust RGB & Airmass RGB

1. Detection: The Dust RGB "Deep Blue" and "Magenta"

- **Pre-Storm Environment:** In the Dust RGB, identify the **Deep Blue** shades over Saudi Arabia and Oman. Discuss why identifying low-level moisture *before* clouds form is critical for predicting where the most intense storms will ignite.

3. Detection: The Airmass RGB "Red" Advance

- Create an animation to observe the advances of the cold airmass (Red colour) with the system.

Part 3: High-Resolution Analysis (Cloud Top Features)

Tool: EUMETView

Product: HRV (High Resolution Visible) Composite

Timeframe: 2024-04-16 0400UTC

1. Task: Shadow Analysis & Cloud Verticality

- **Observation:** Locate the primary storm core near Abu Dhabi. Identify the cloud overshooting top.

  Discussion Point: Since the sun is rising in the East (right side of the image), discuss how the **length of the shadow** helps meteorologists estimate the height of the storm. Is a longer shadow in the early morning a sign that the storm has already reached the top of the troposphere?

- Identify the cloud top height by determining the temperature:

  Open the hyperlink: Temperature

  Discussion: The severity and the significance of the storm based on the overshooting top from HRV and cloud Top Temperature.

2. Task: Identifying the "Above Anvil Cirrus Plume" (AACP)

- **Observation:** Find the elongated, V-shaped plume stretching from the UAE toward Iran.
- **Discussion Point:** This plume is a signature of a **supercell** or an extremely intense updraft. Discuss the physics: how can a storm be so powerful that it injects ice crystals *above* its own "ceiling" (the anvil) and into the stratosphere?

3. Task: Detecting Gravity Waves

- **Observation:** Look downstream along the left side of the V-shaped plume. Identify the "ripple" patterns in the clouds.
- **Discussion Point:** These are **Gravity Waves**. What does the presence of these waves tell us about the strength of the interaction between the storm and the stable layer of the atmosphere?

3. **Identify the cloud top temperature:**

   Open the hyperlink: Temperature

   Discussion: Discuss the severity of the Thunderstorm based on cloud features on HRV and cloud Top Temperature.

Part 5 : Post-Event Surface Analysis

Tool: EUMETView

Product: MSG-0 / Natural Colour RGB

Comparison Dates: 2024-01-14 (Baseline) vs. 2024-04-17 (Post-Event)

1. Task: Identifying "Downpour Tracks"(rain marks on earth)

- **Observation:** Compare the desert region along the UAE-Saudi Arabia border between the two dates. Look for narrow, elongated lines that are a **darker shade of brown** than the surrounding light-brown sand.

- **Discussion Point:** These are called **Downpour Tracks**. Discuss the physics behind this: Why does wet sand appear darker? (Hint: Water between sand grains reduces the amount of light reflected back to the satellite). How do these tracks help us reconstruct the exact path of individual thunderstorm cells?

2. Task: Coastal Inundation & Soil Saturation

- **Observation:** Look at the coastal areas of the UAE. Note the significant increase in "water-like" surfaces, which appear as a darker, muddy brown/black shade compared to January.
- Discussion Point: In the Natural Colour RGB, deep water usually looks black/dark blue, while shallow flooding over desert soil looks like darker brown patches. Discuss the social impact by looking at these darker patches.

Case Study 2: Severe Convective Event (KSA)

Date: 7 December 2025
Region: Kingdom of Saudi Arabia (KSA)
Analysis Tools: EUMETView (Satellite Data) and Earth Null School (Model Data)

Part 1: Model Data Analysis

Tool: Earth Null School

Part 2: Satellite Data Analysis

Tool: EUMETView
Product: Sandwich Product

Note: MTG data (both imagery and Lightning Imager) are available for this case.

Task: As a group, assess the severity of the thunderstorm by identifying and discussing all associated severe convective features.
Some features may be evident only through animated imagery.

Case Study 3: Severe Convective Event (Qatar)

Date: 18 December 2025
Region: Qatar
Analysis Tools: EUMETView (Satellite Data) and Earth Null School (Model Data)

Part 1: Model Data Analysis

Tool: Earth Null School

Part 2: Satellite Data Analysis

Tool: EUMETView
Product: Sandwich Product

Note:MTG data (both imagery and Lightning Imager) are available for this case.

Task: As a group, assess the severity of the thunderstorm by identifying and discussing all associated severe convective features.
Some features may be evident only through animated imagery.