



Low level humidity – ingredient for cloud formation

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*Training and Satellite Application Expert
EUMETSAT Training Team*

12 December 2022, EUMeTrain WV Event Week, Online

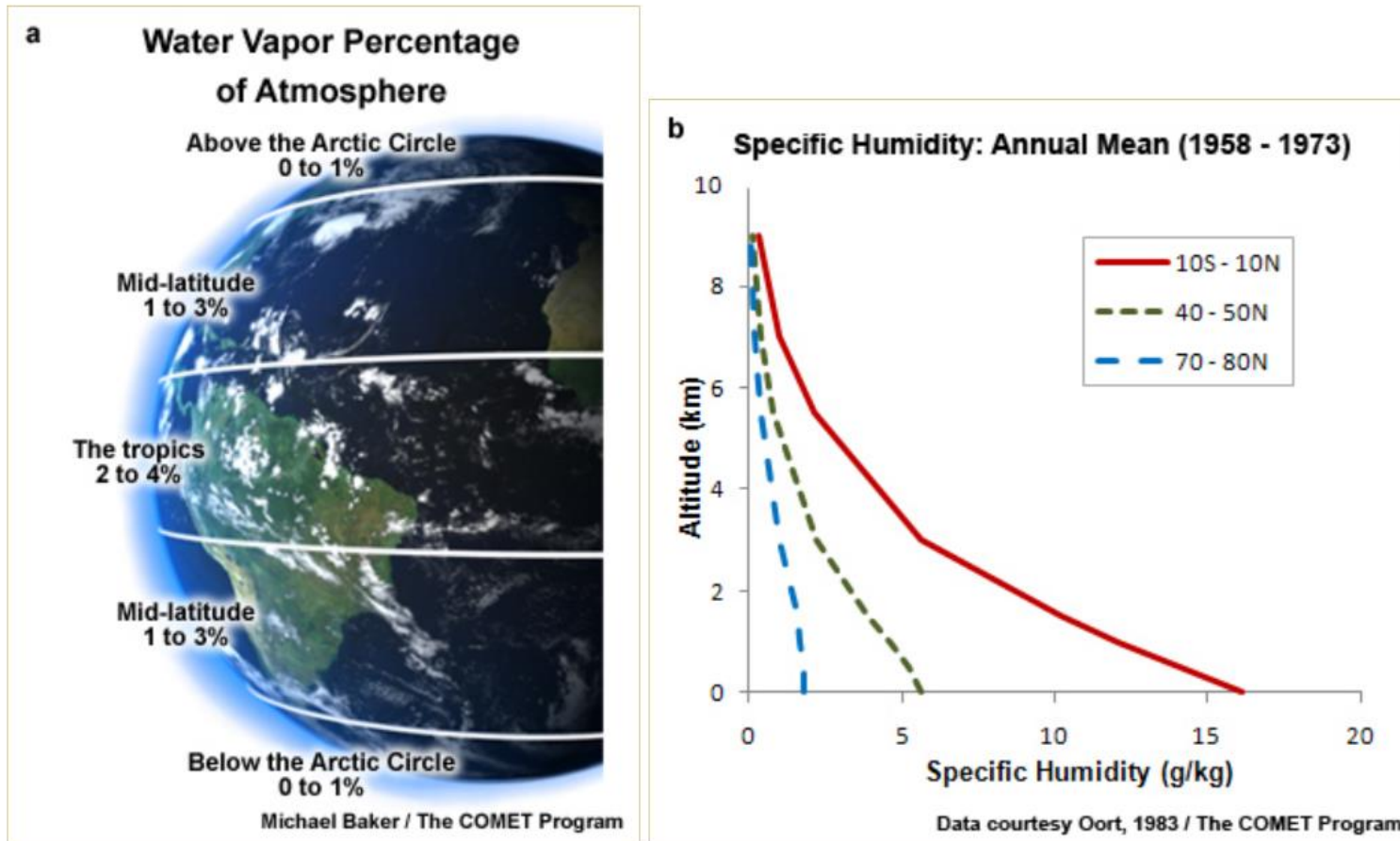


Fig. 1.19. (a) The distribution of surface water vapor percentage by latitude and (b) annual mean water vapor content (specific humidity) profile. Data in (b) from Oort (1983)²¹

Credit: [COMET Program](#)



Why do we want to know about atmospheric moisture?

Unstable atmosphere supports upward motion
– rising moist air can lead to **severe weather**



Stable atmosphere resists rising motion
– usually **low clouds or fog** are produced





Low level humidity detection

Ways to detect the low level moisture with imager.

Imagery/products for LL moisture

What kind of imagery best to use.

Examples

Examples of LL moisture/ cloud detection.



Low level humidity detection

Ways to detect the low level moisture with imager.

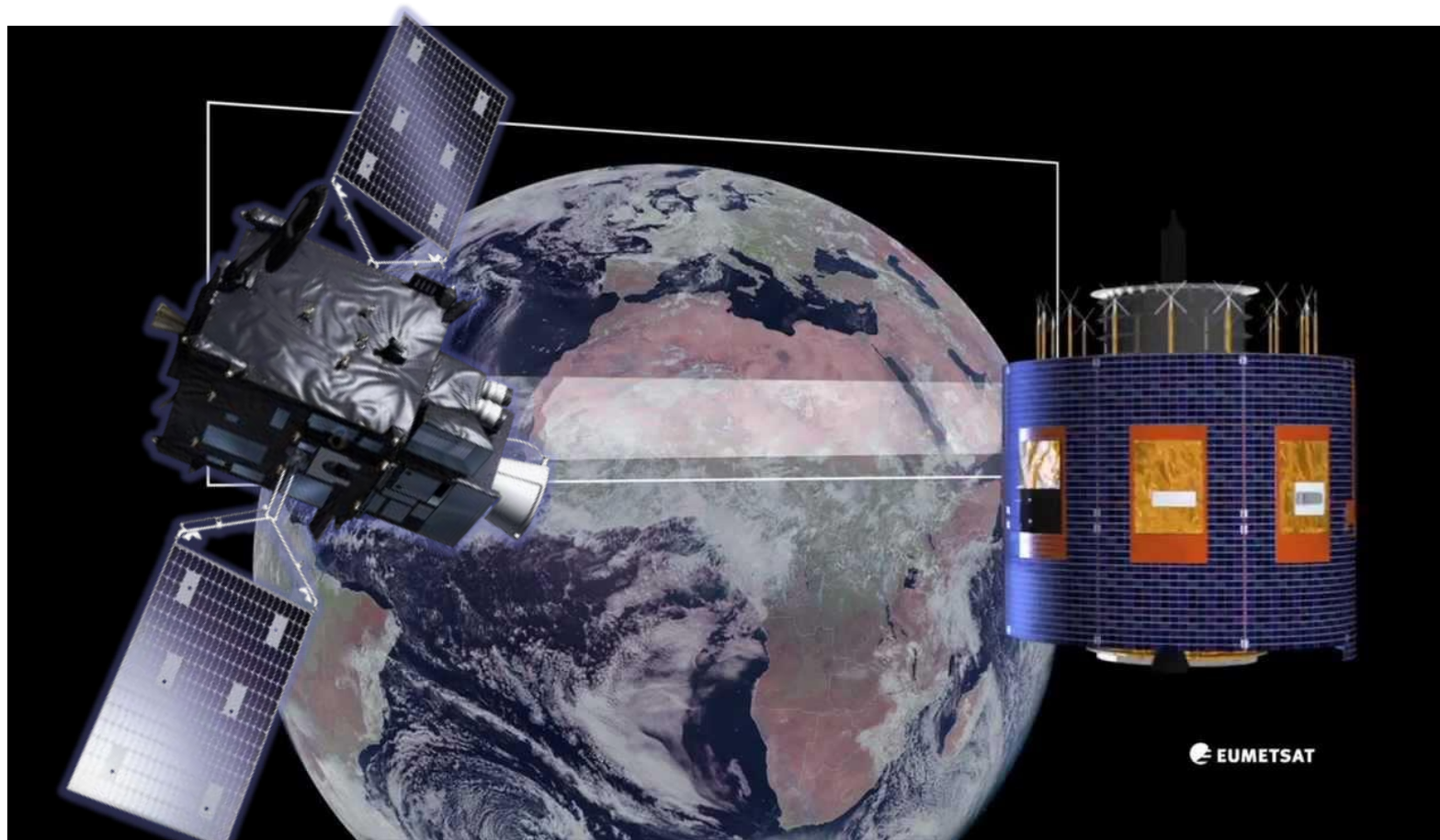
Imagery/products for LL moisture

What kind of imagery best to use.

Examples

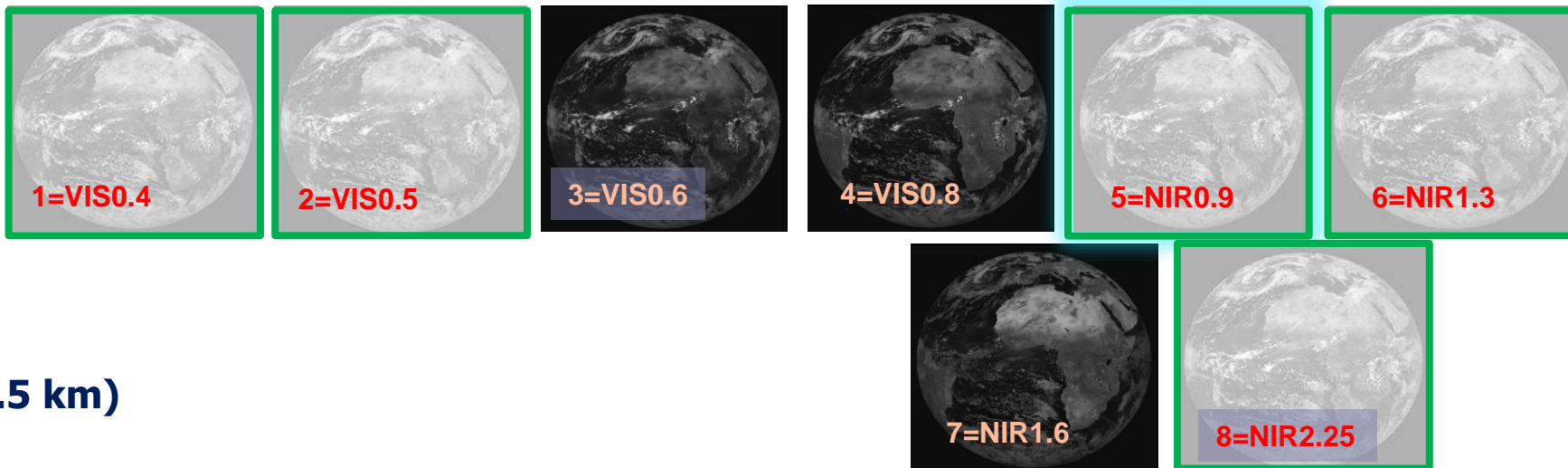
Examples of LL moisture/cloud detection.

- What kind of satellite data?



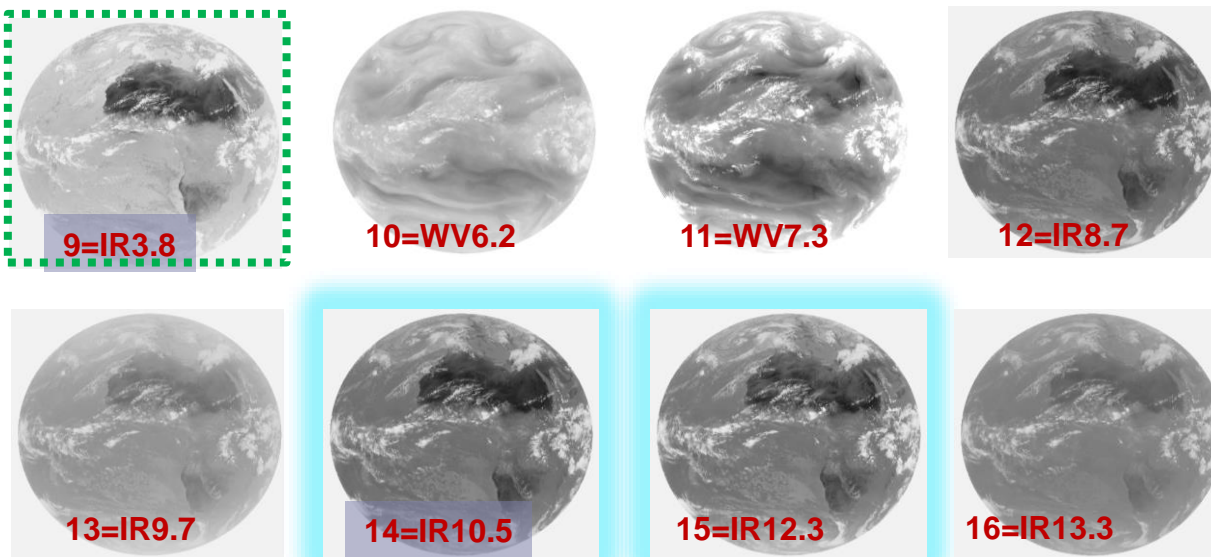


FCI vs SEVIRI

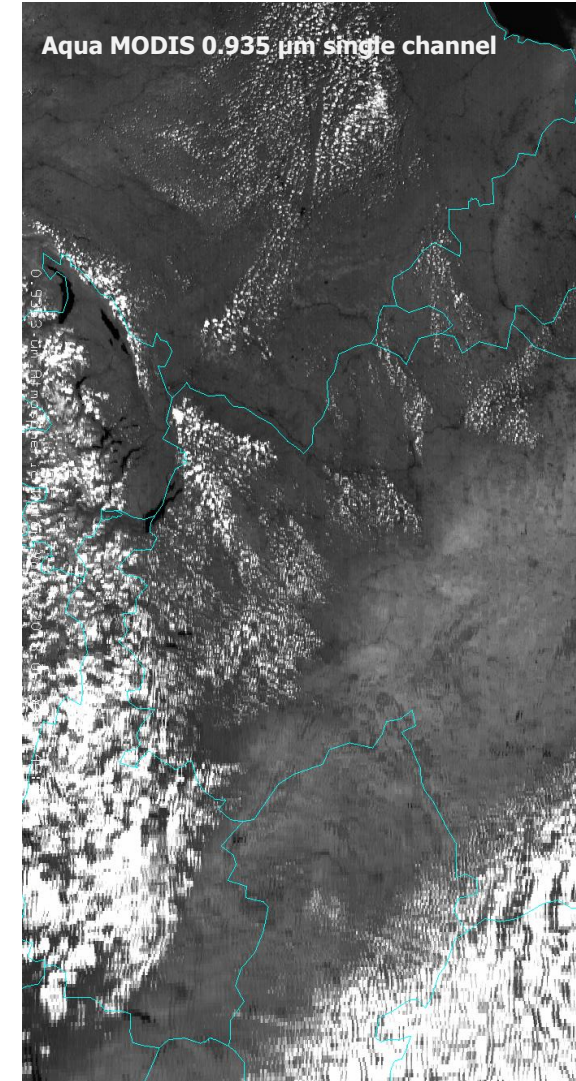
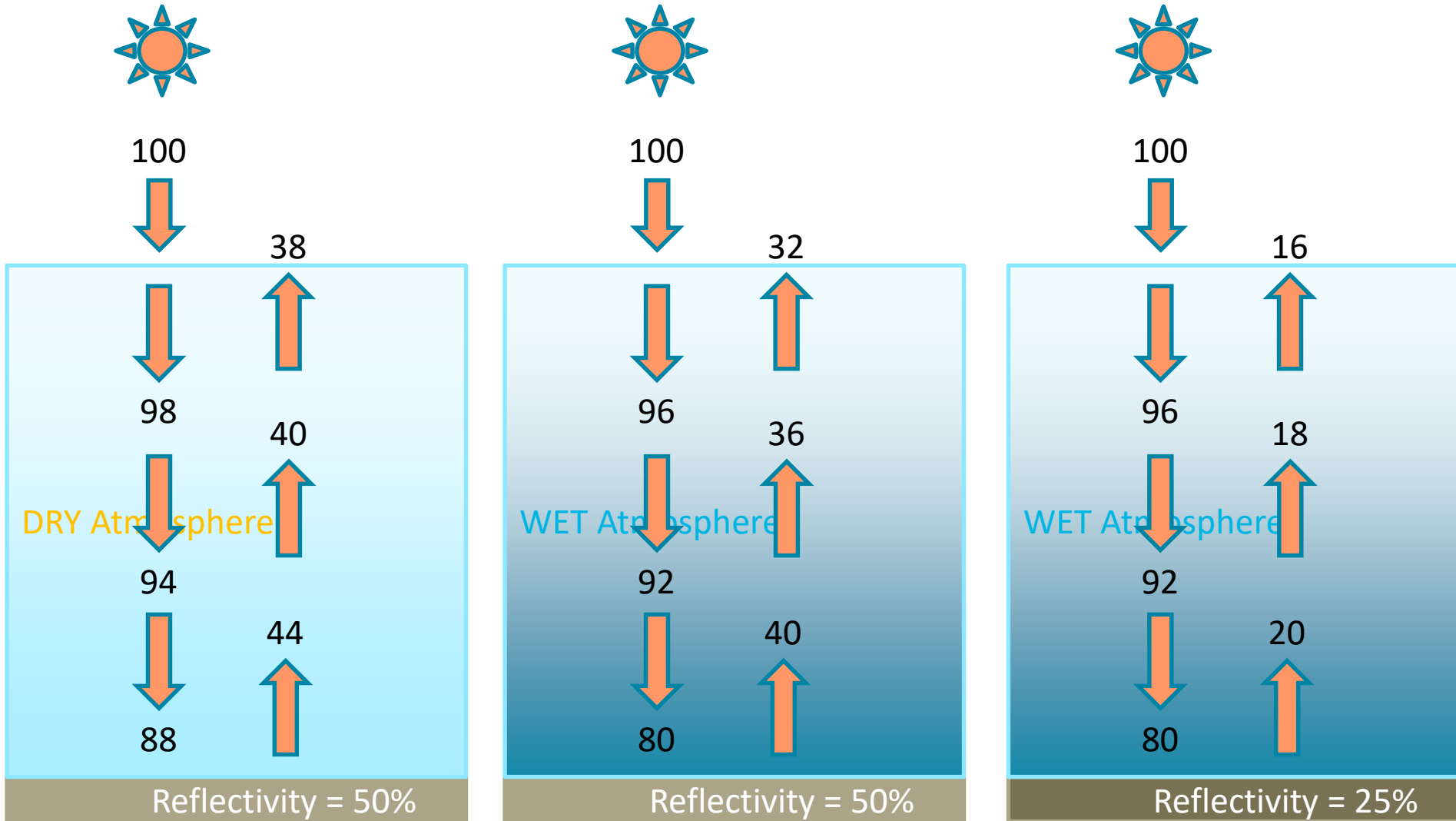


Solar
1.0 km (0.5 km)

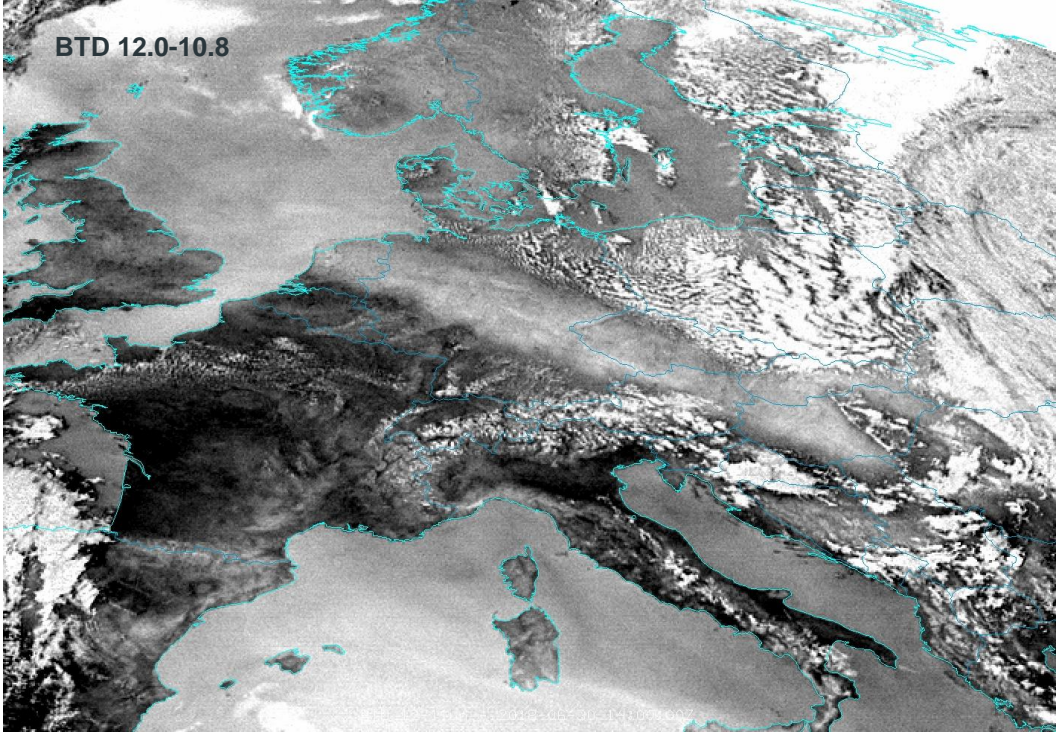
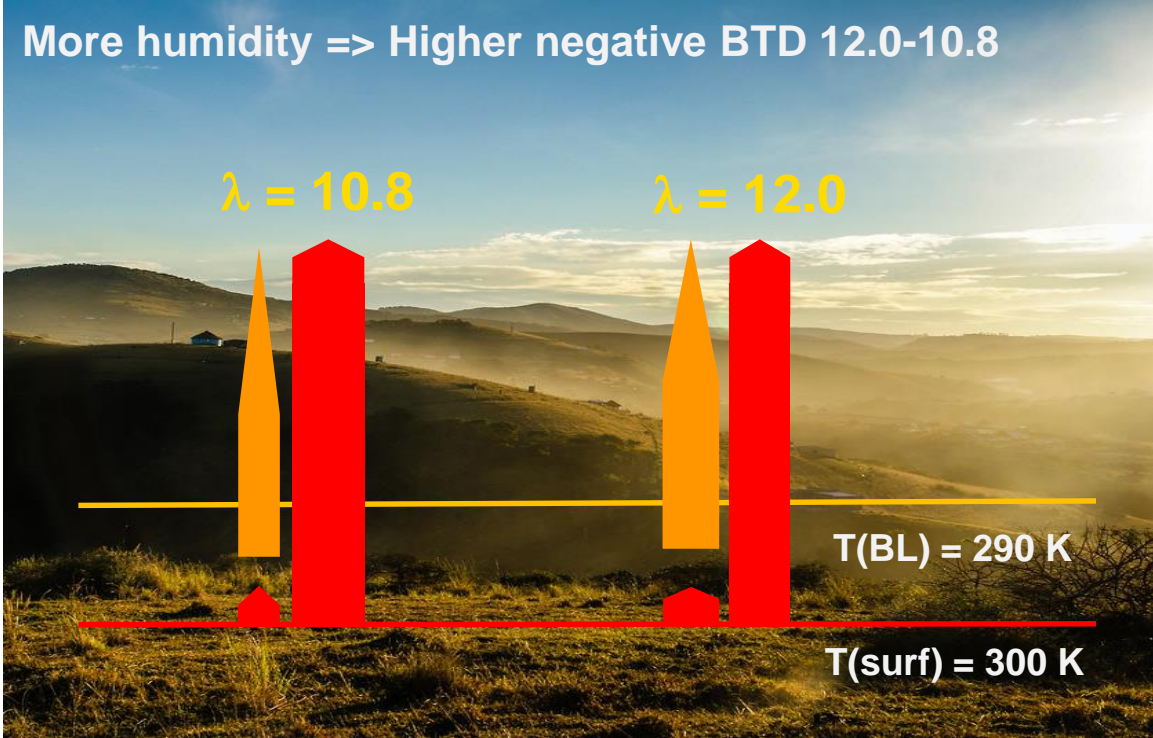
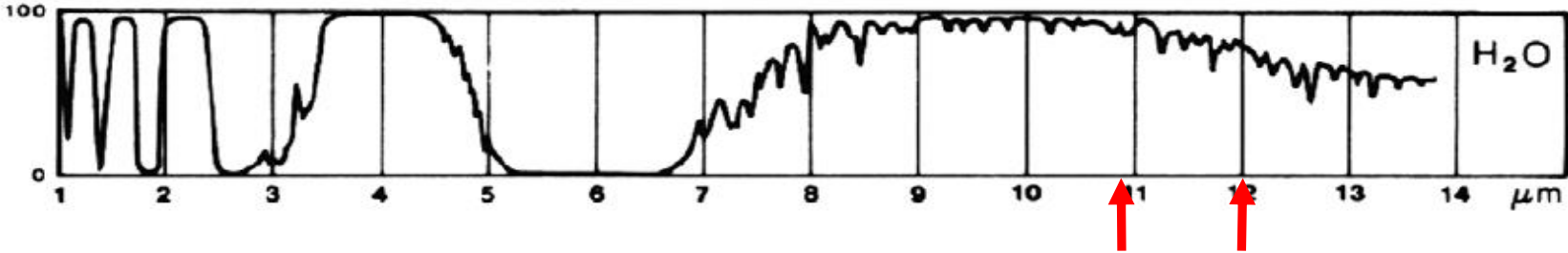
Thermal
2.0 km (1.0 km)



Absorption: what does it mean in NIR0.9 region?



IR window region split difference:





Low level humidity detection

Ways to detect the low level moisture with imager.

Imagery/products for LL moisture

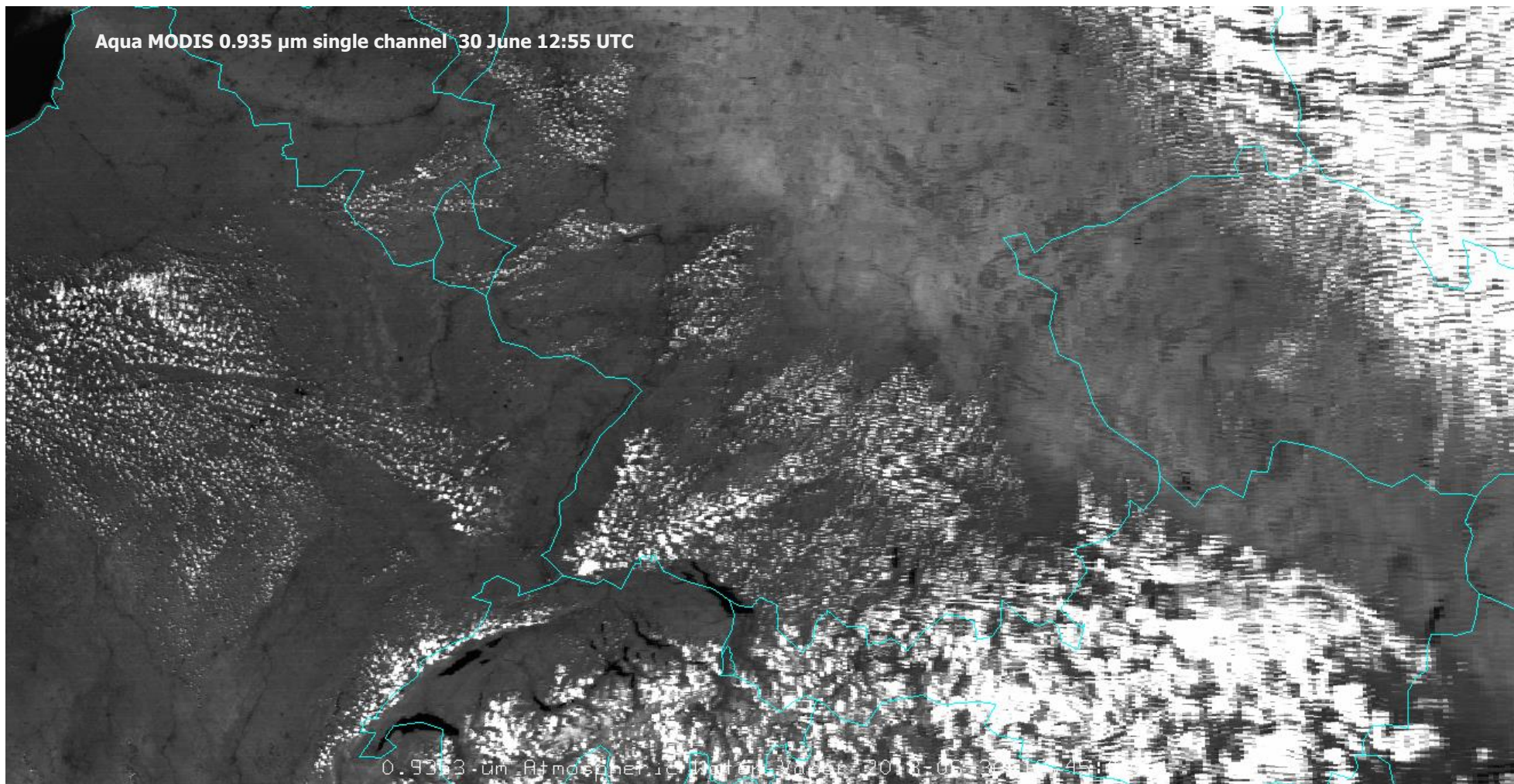
What kind of imagery best to use.

Examples

Examples of LL moisture/cloud detection.



(Low-level) moisture products

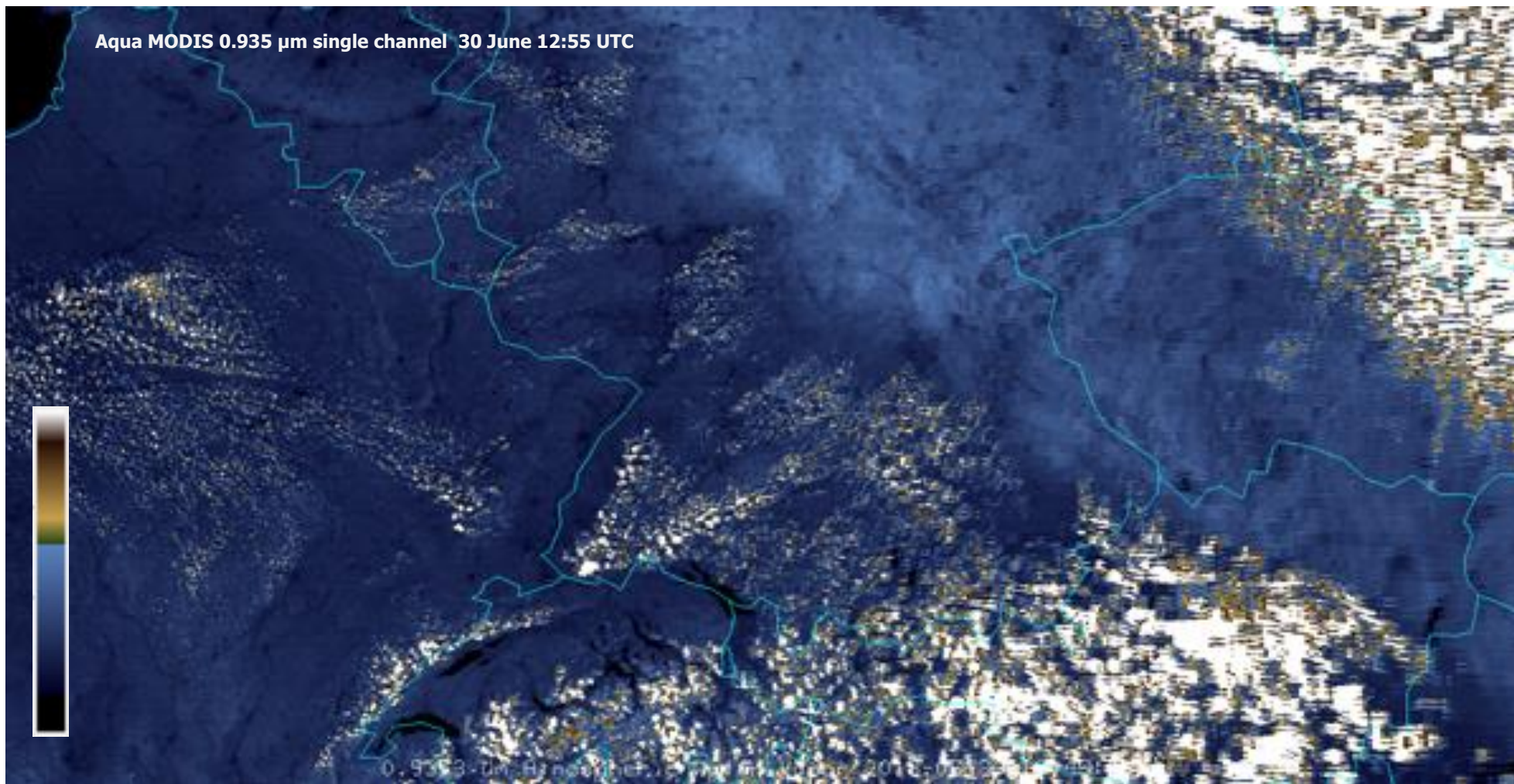


- **NIR0.91**
single
channel
 - B&W

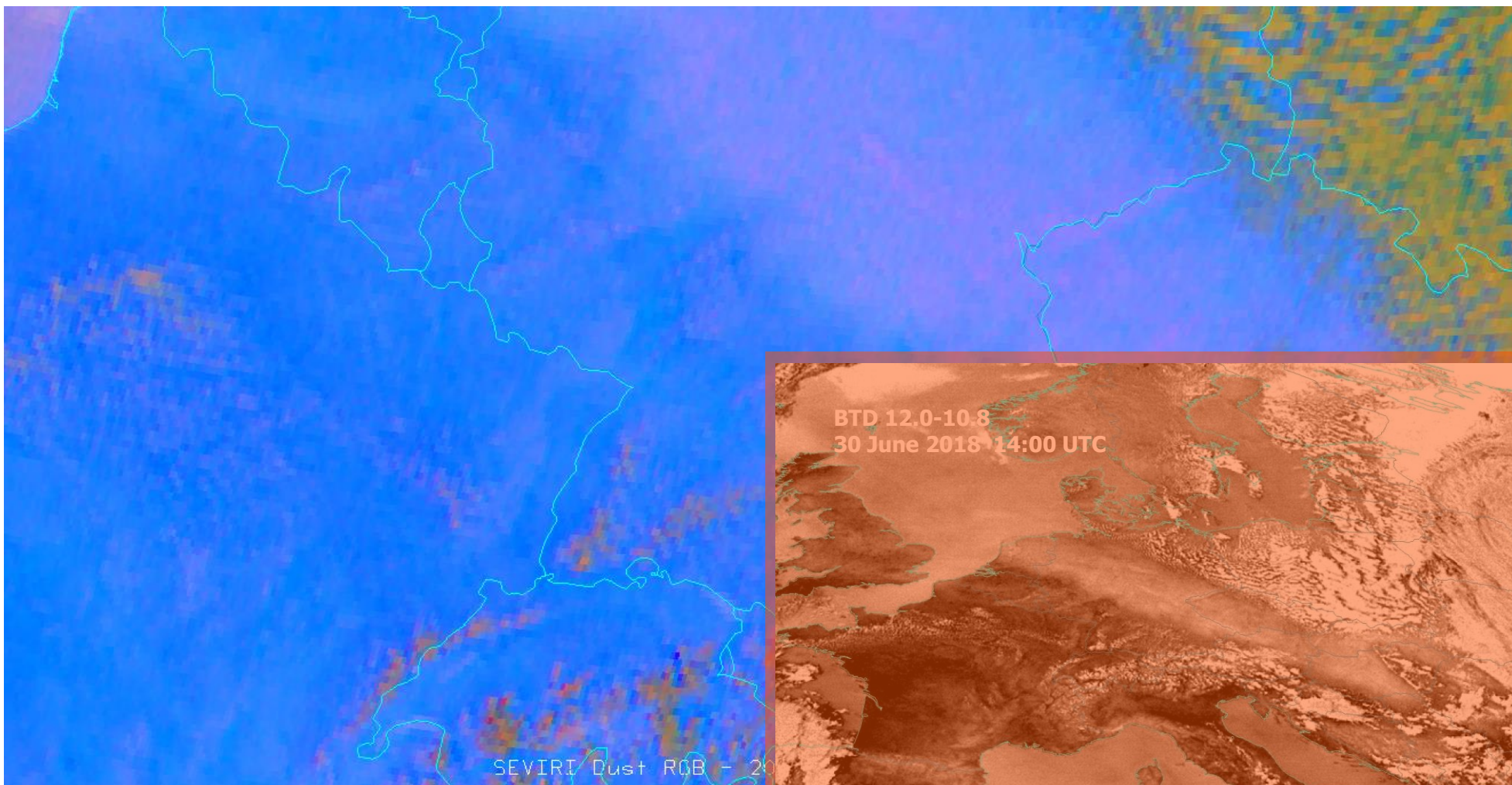


(Low-level) moisture products

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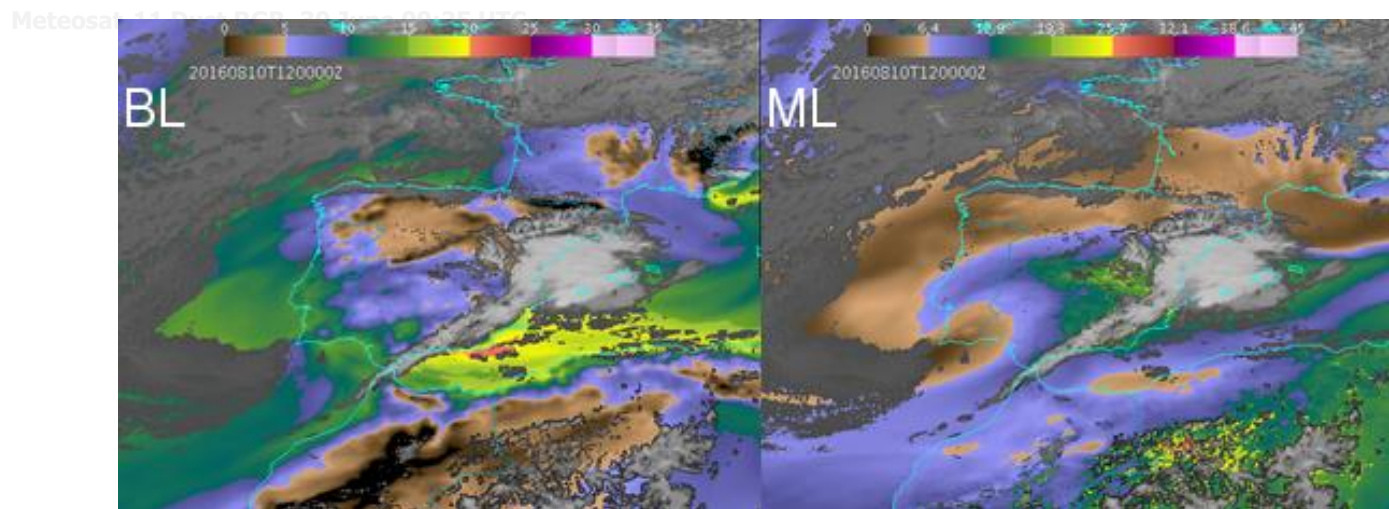


- NIRO.91
single
channel
 - Coloured

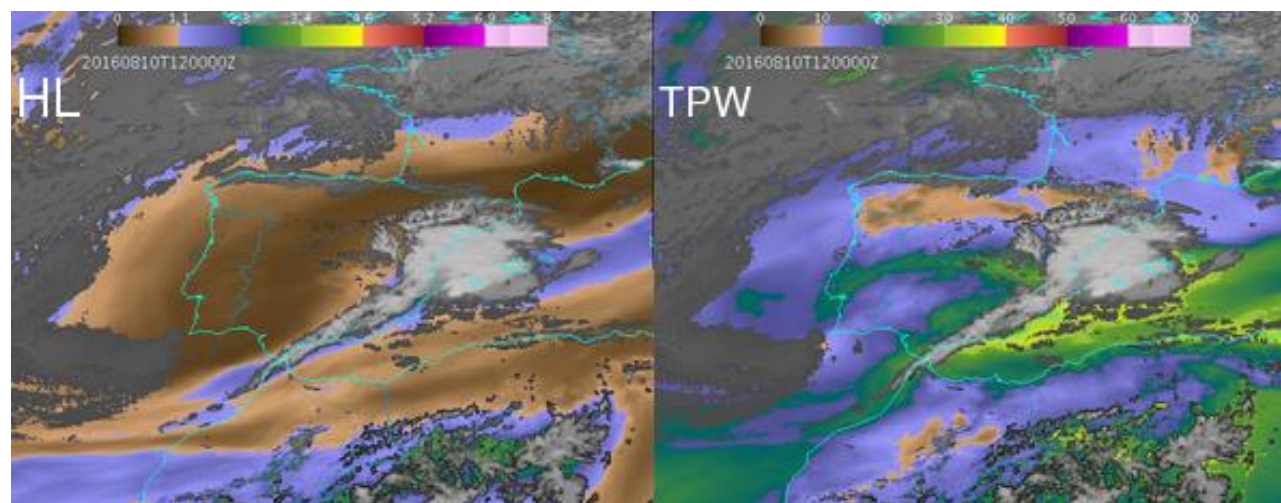


- (Dust) RGB product(s)

Colour	Channel [μm]
Red	IR12.0–IR10.8
Green	IR10.8–IR8.7
Blue	IR10.8



NWCSAF iSHAI Precipitable Water



- L2+ geophysical product(s)



Low level humidity detection

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Imagery/products for LL moisture

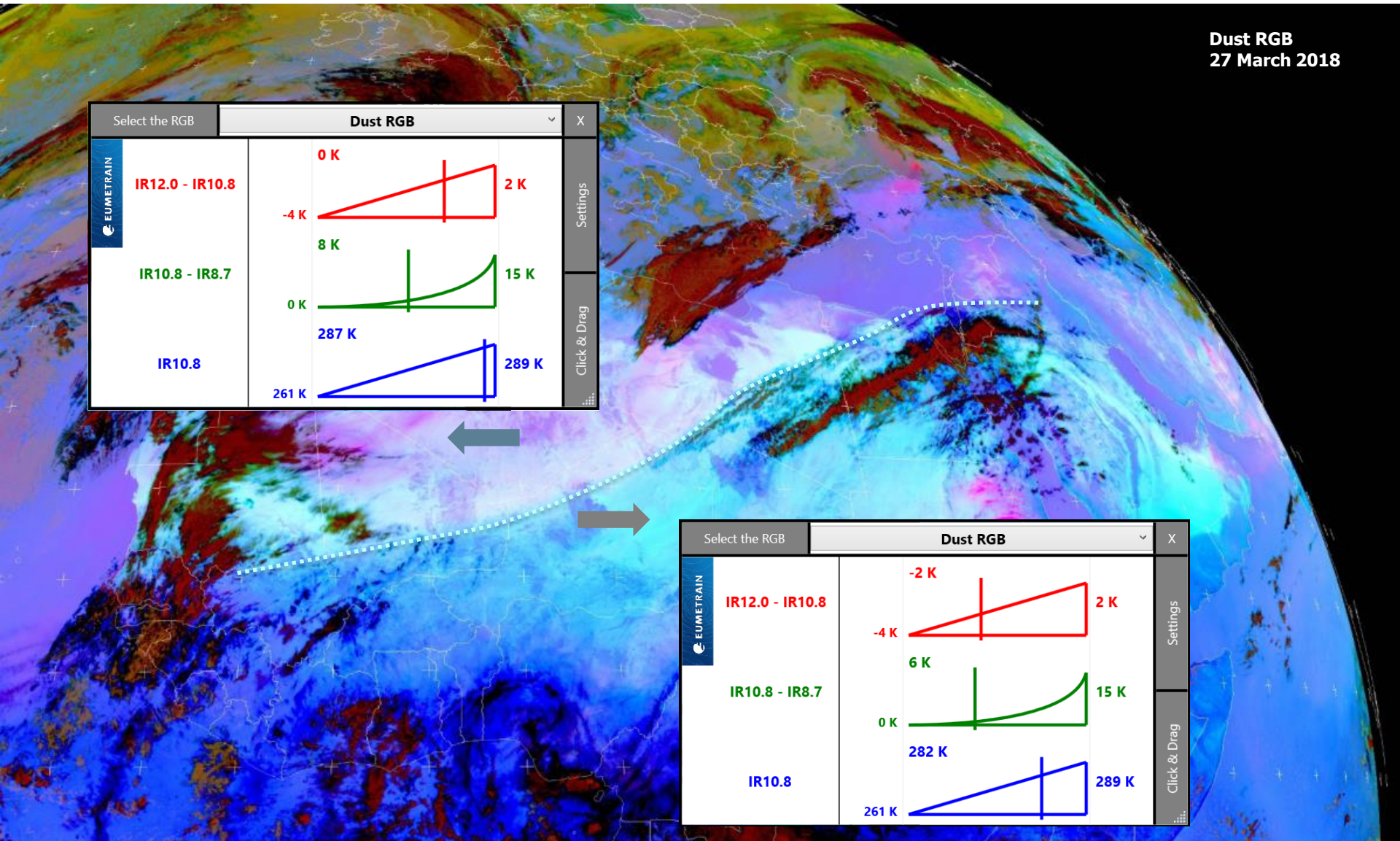
What kind of imagery best to use.

Examples

Examples of LL moisture/ cloud detection.



Examples of LL moisture/ cloud detection



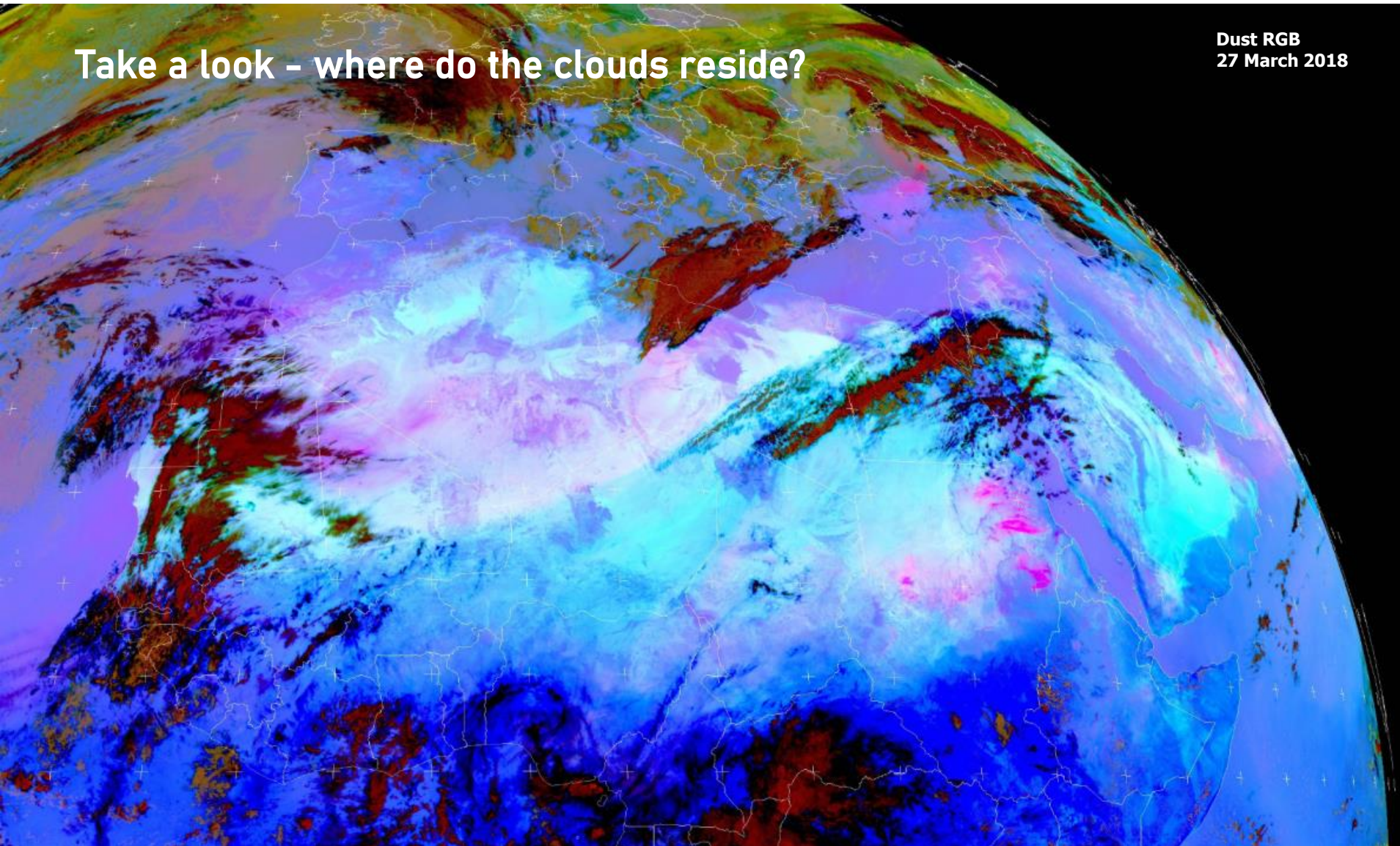
Colour	Channel [μm]
Red	IR12.0-IR10.8
Green	IR10.8-IR8.7
Blue	IR10.8



Examples of LL moisture/ cloud detection

Take a look - where do the clouds reside?

Dust RGB
27 March 2018



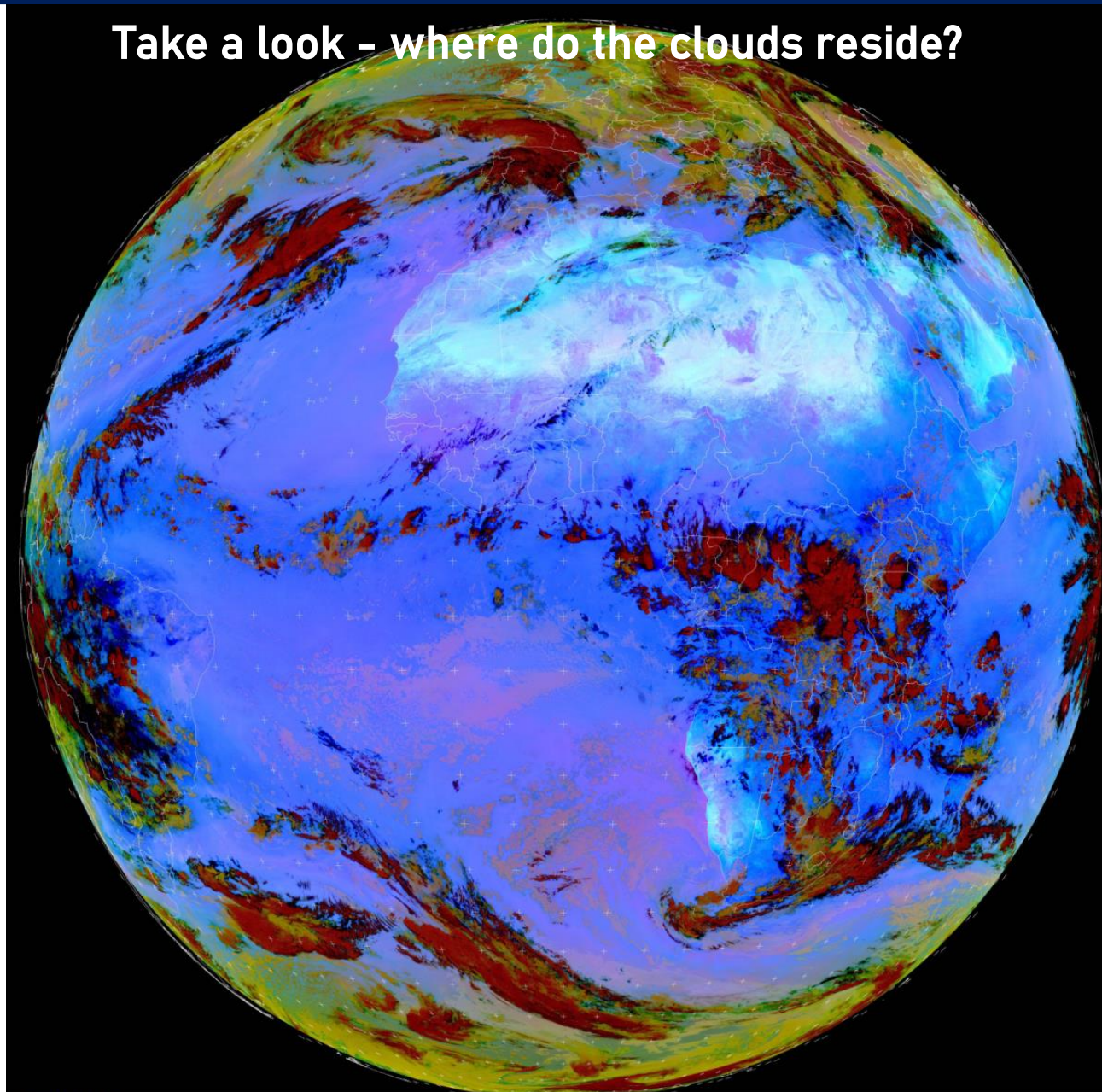
Colour	Channel [μm]
Red	IR12.0-IR10.8
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Examples of LL moisture/ cloud detection

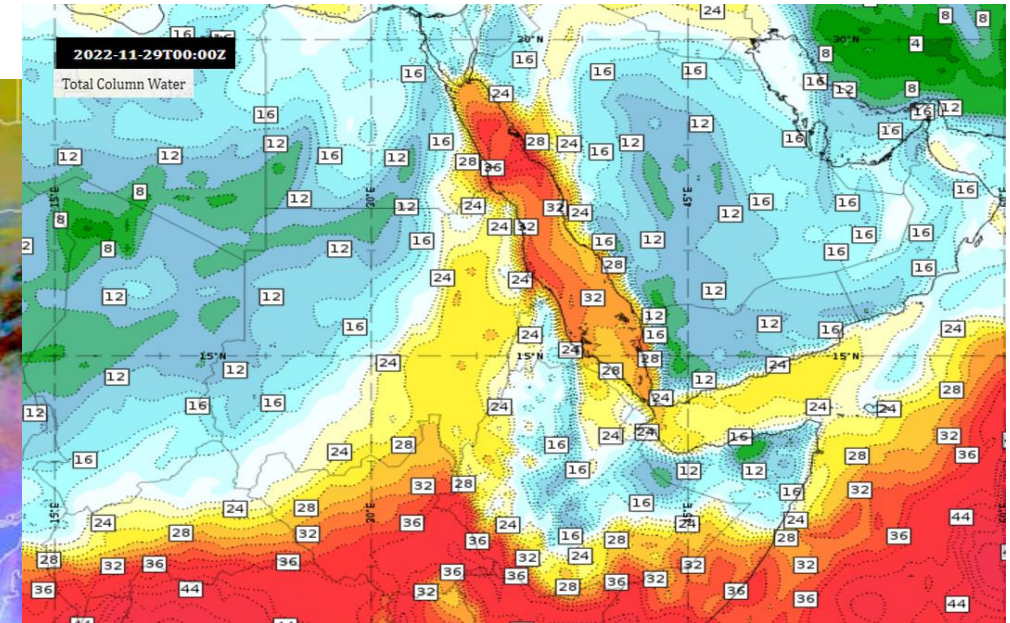
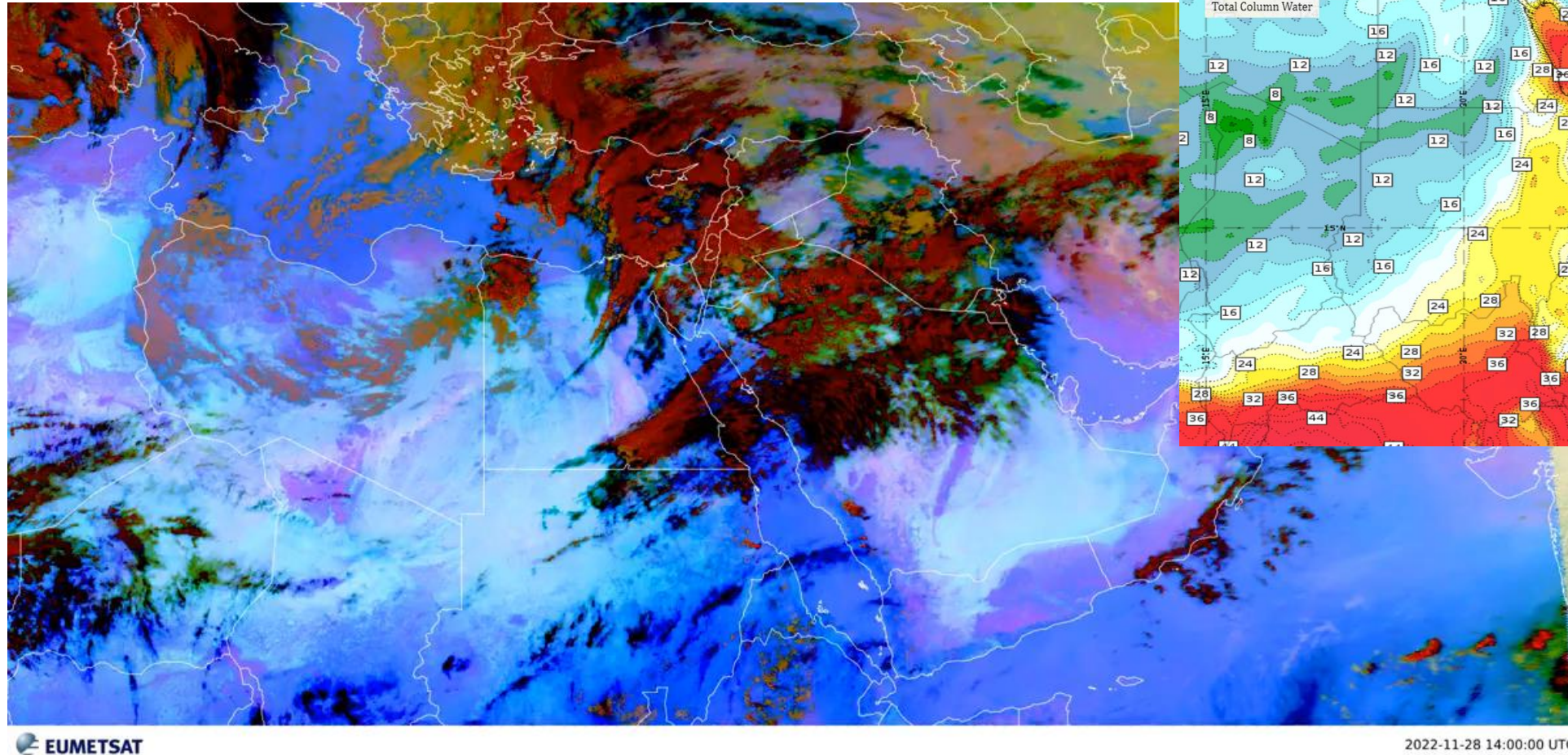
Take a look - where do the clouds reside?

www.eumetsat.int





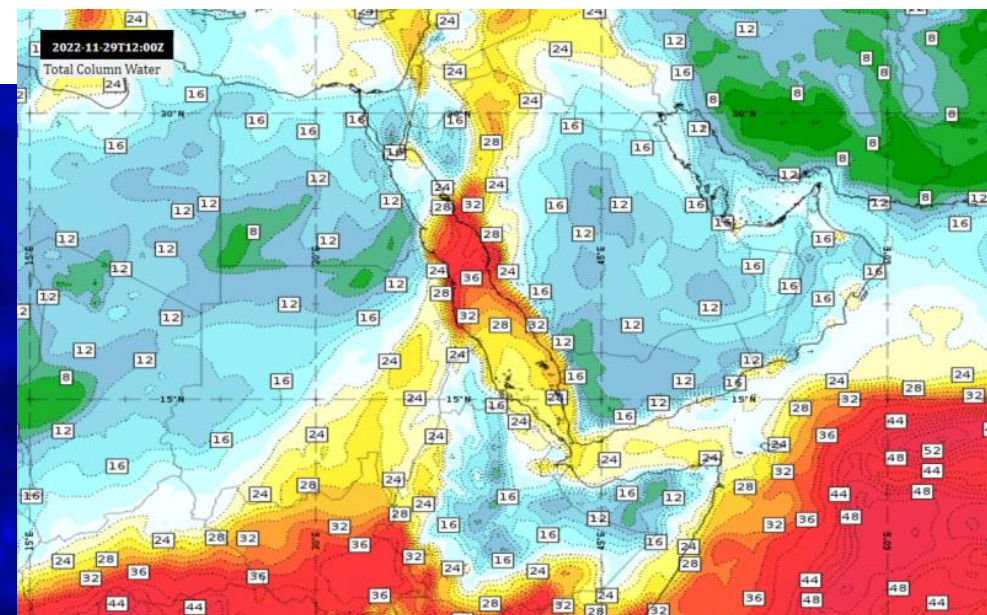
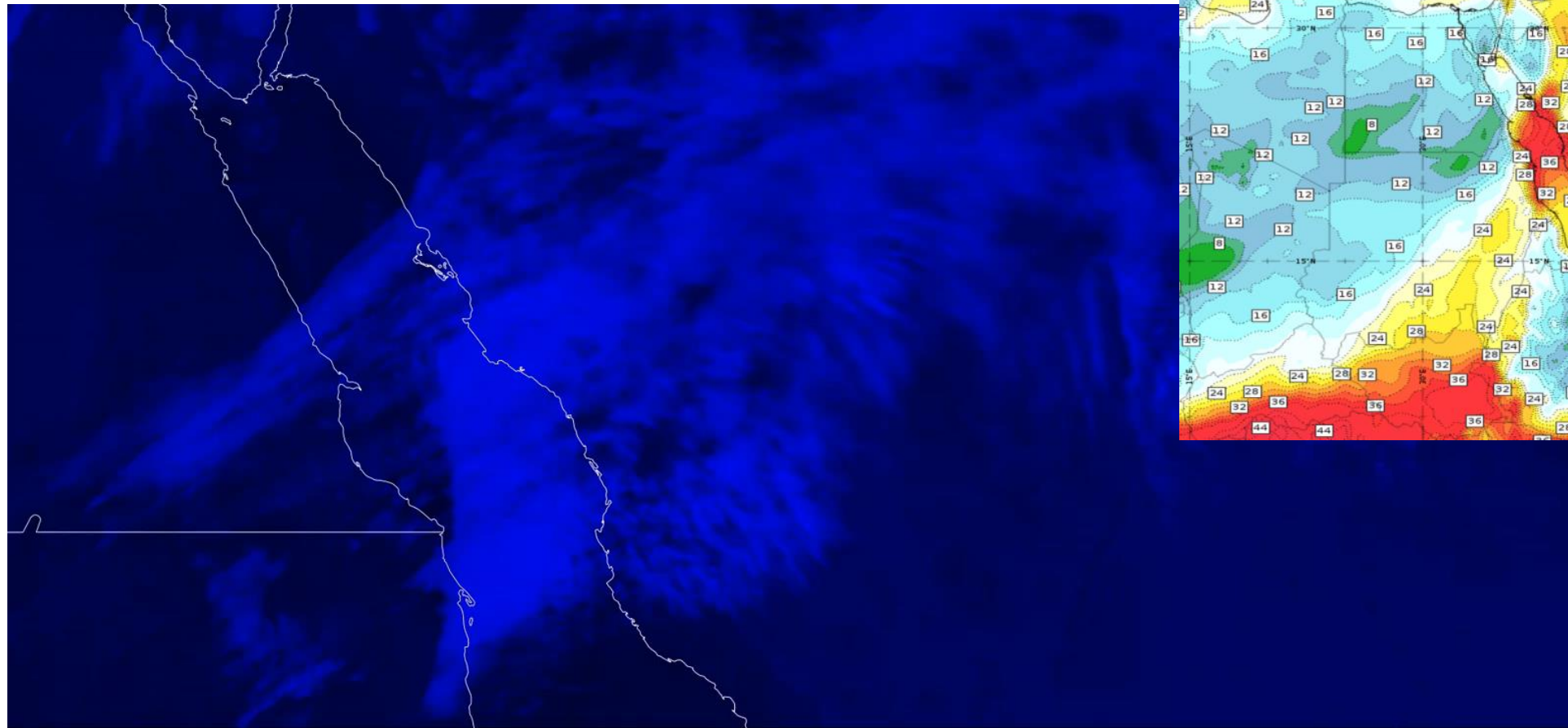
Examples of LL moisture/ cloud detection



- Red Sea Severe convection – embedded in the moisture stream



Examples of LL moisture/ cloud detection

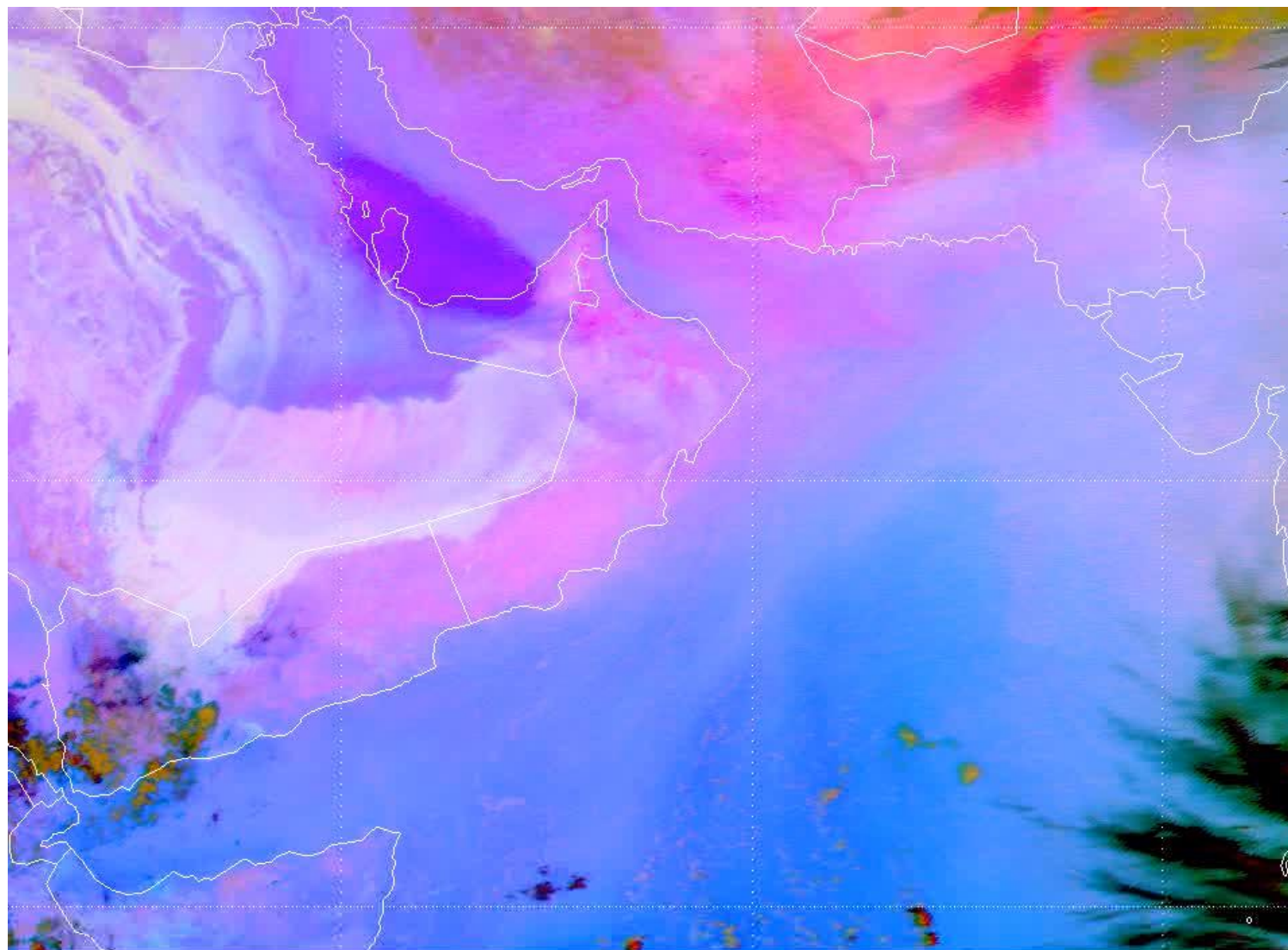


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Examples of LL moisture/ cloud detection

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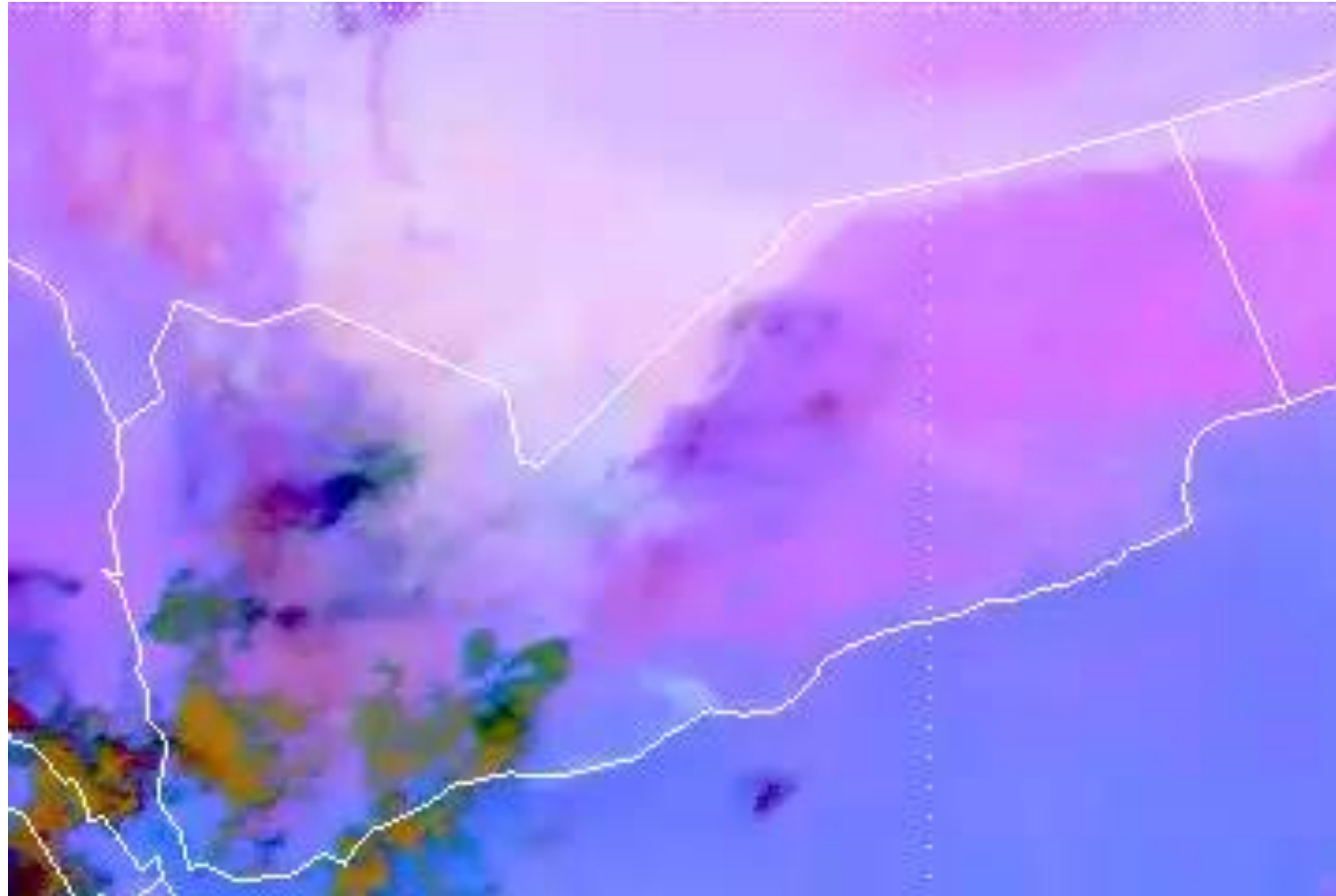
m9 DUST - 2012-05-25 00:00UTC

- **Diurnal development of the sea breeze front all along the coast(s)**
- **Strong moisture advection – area of local convection development (if other conditions met!)**



Examples of LL moisture/ cloud detection

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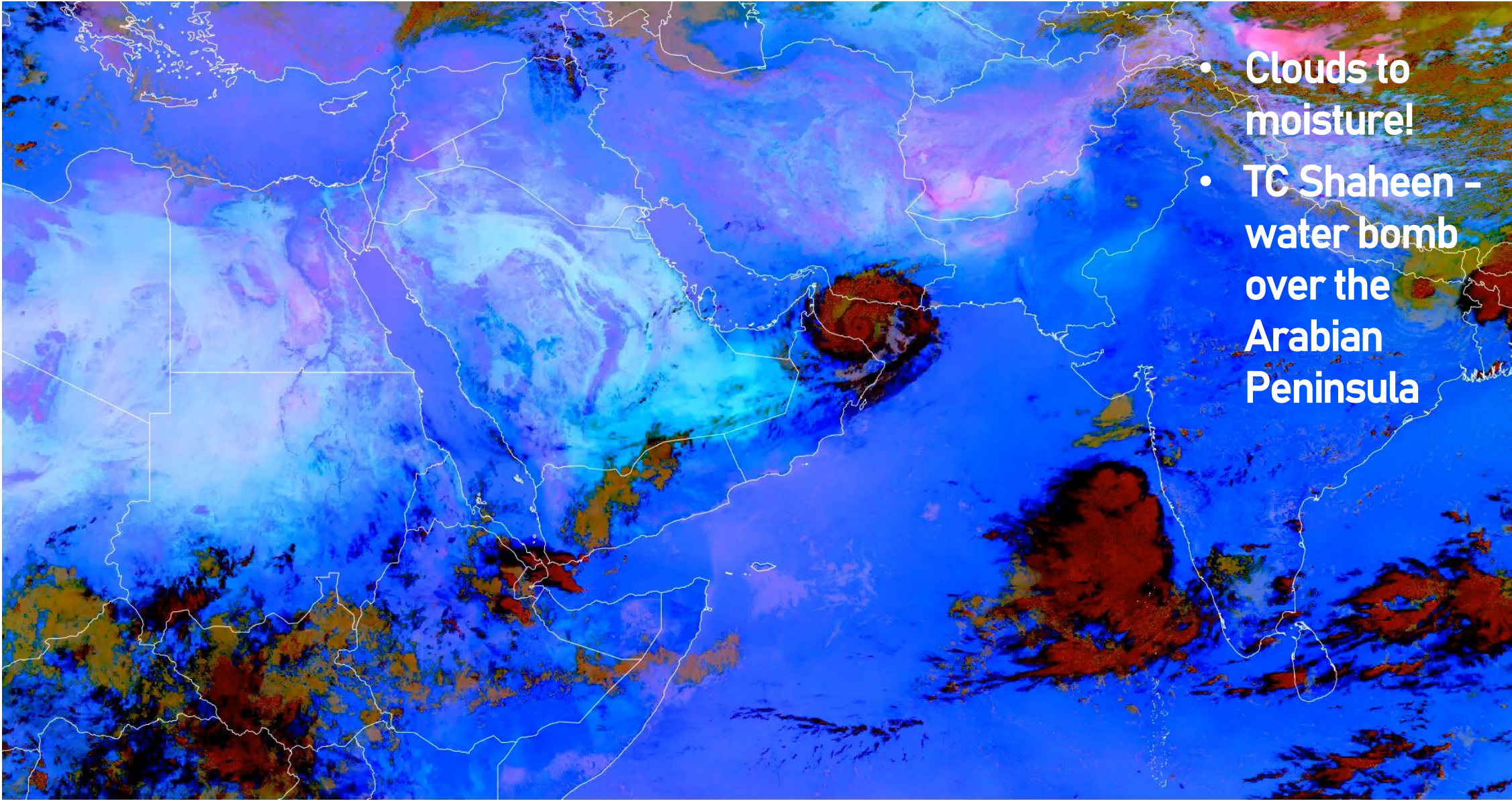


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Examples of LL moisture/ cloud detection

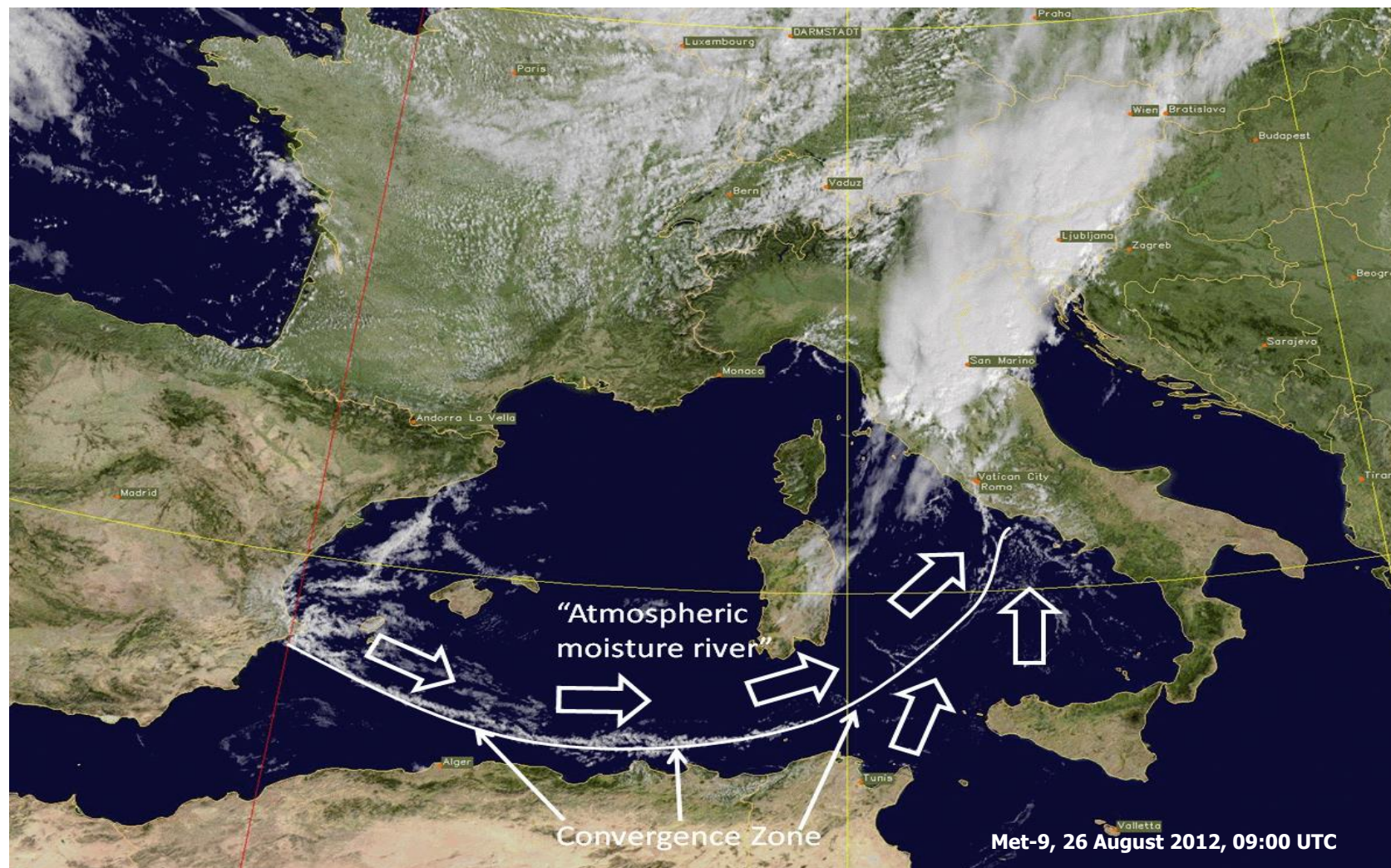
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- Clouds to moisture!
- TC Shaheen - water bomb over the Arabian Peninsula



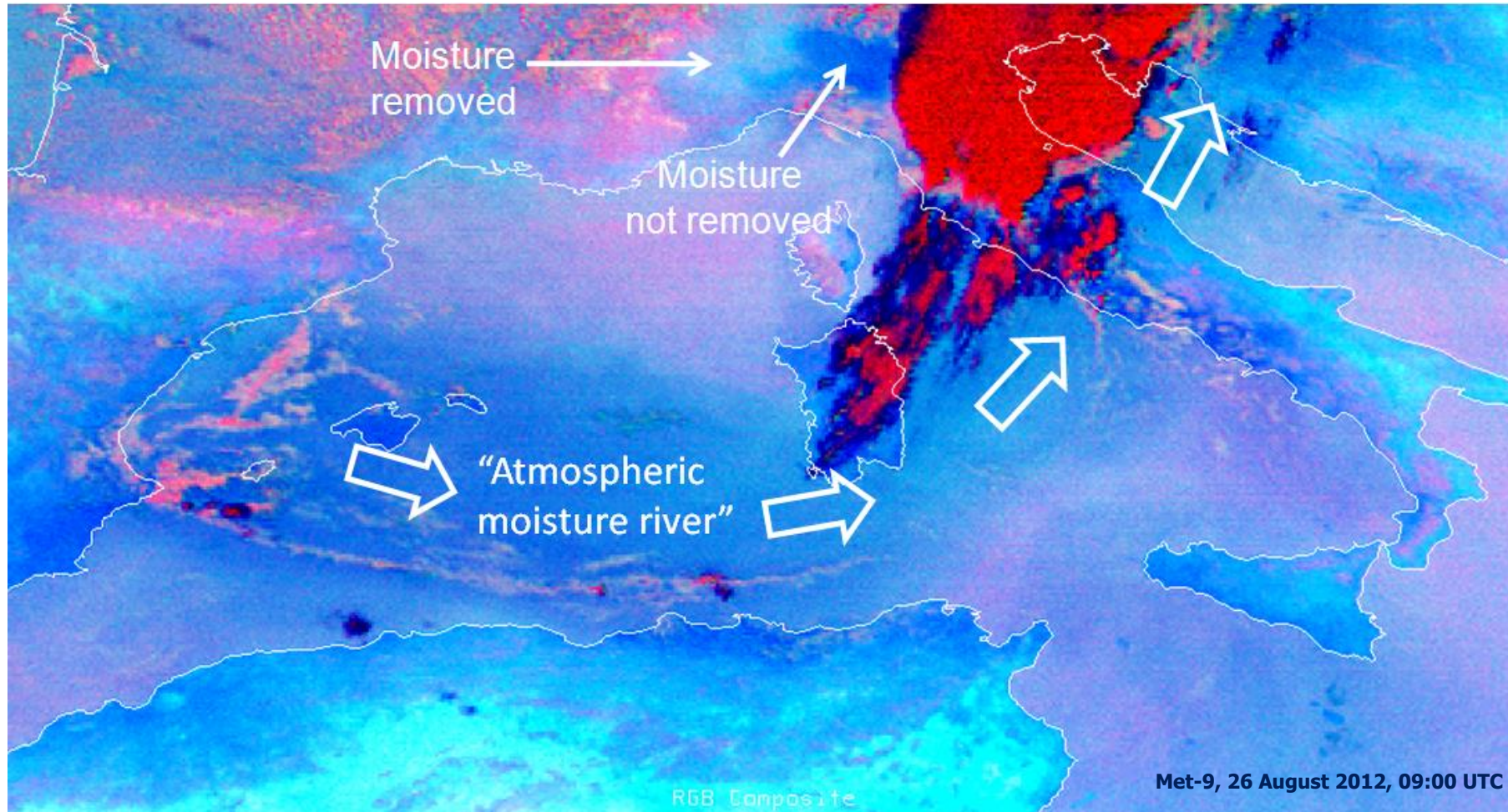
Examples of LL moisture/ cloud detection



- Atmospheric rivers – feeding the convection



Examples of LL moisture/ cloud detection

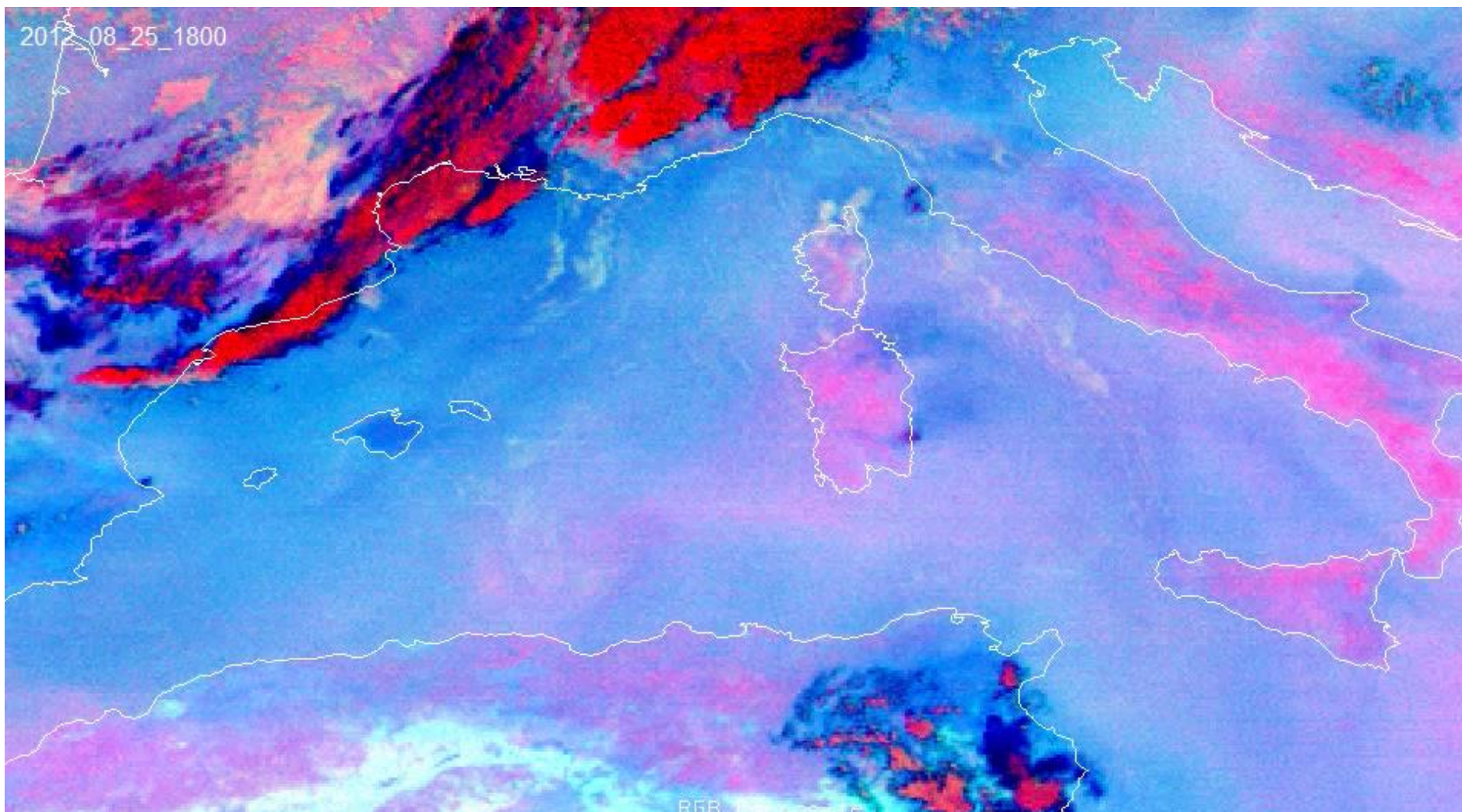


- **Atmospheric rivers – feeding the convection**



Examples of LL moisture/ cloud detection

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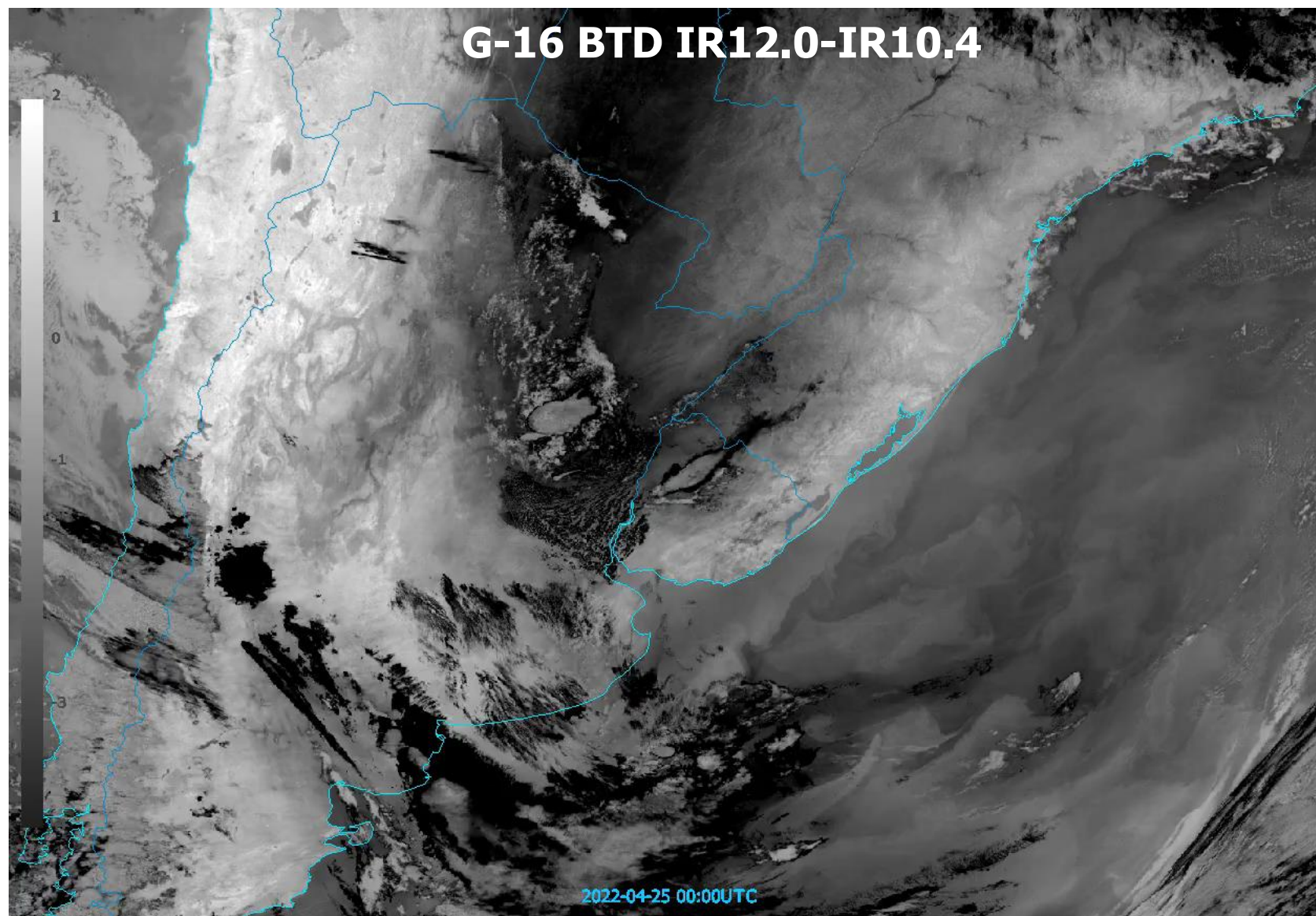


- **Atmospheric rivers – feeding the convection (constrained mostly to a moist band)**



Examples of LL moisture/ cloud detection

www.eumetsat.int

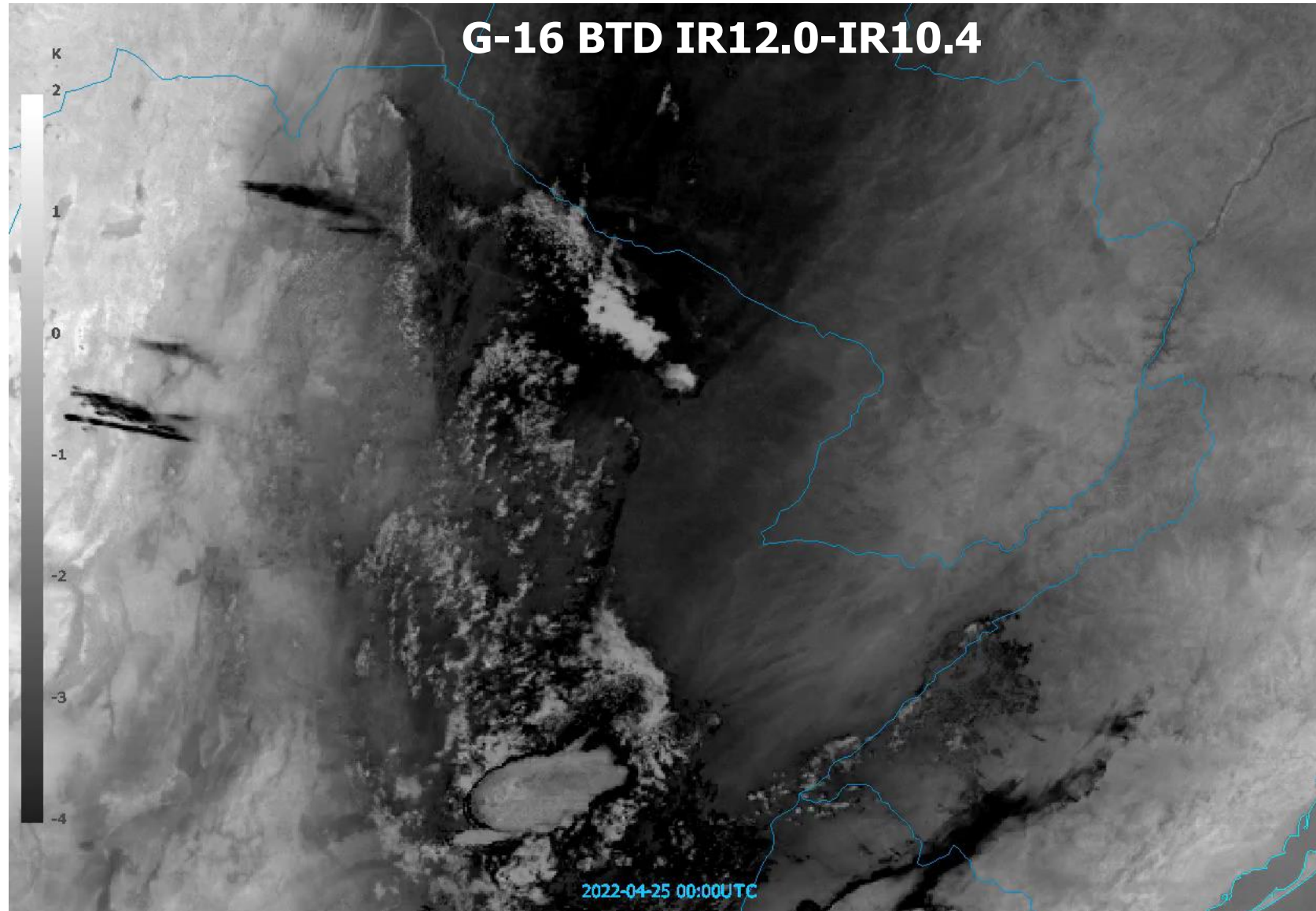


- **BTD difference**
- **Strong convection from the tropical moisture tongue**

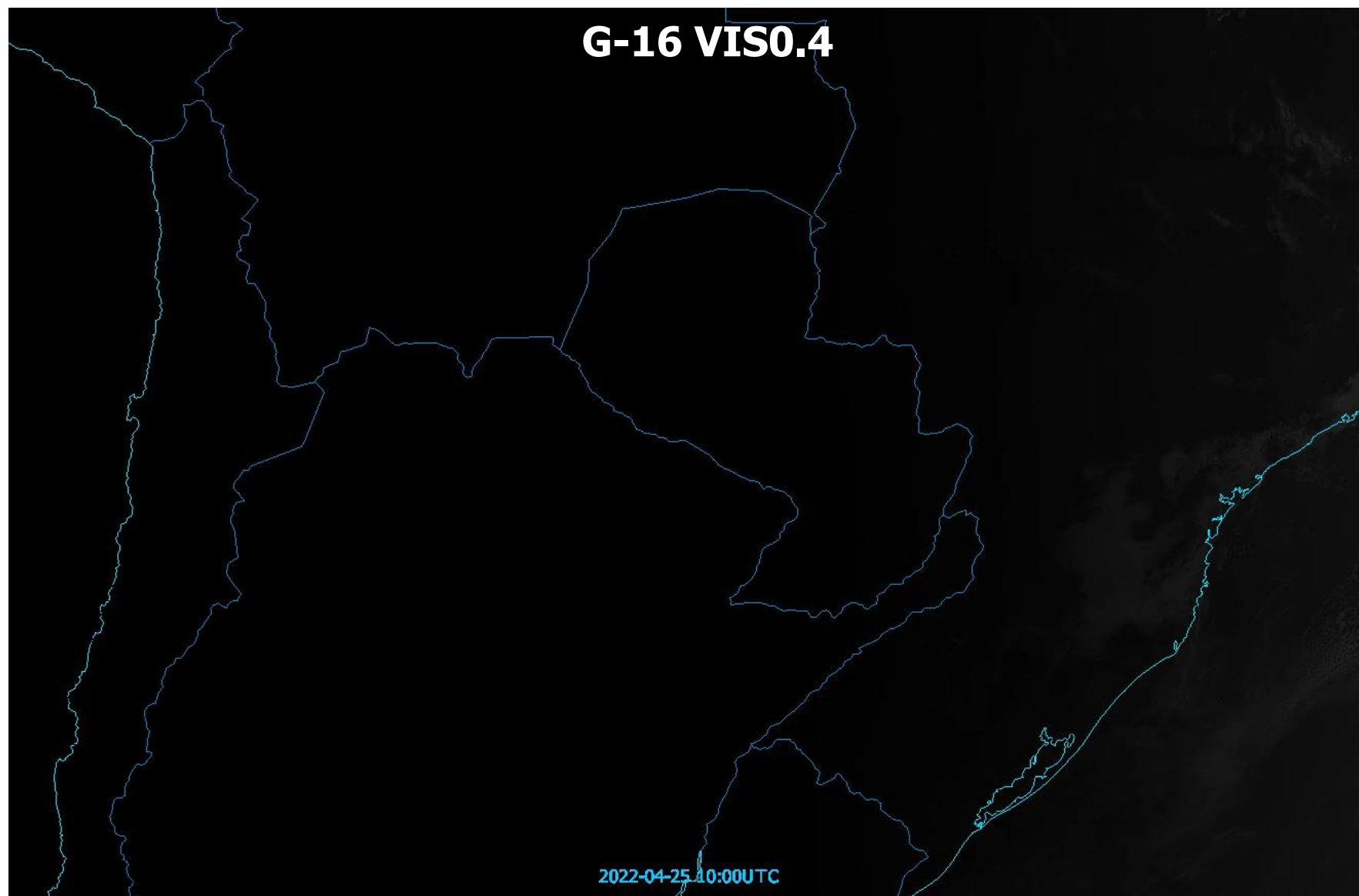


Examples of LL moisture/ cloud detection

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- **BTD difference**
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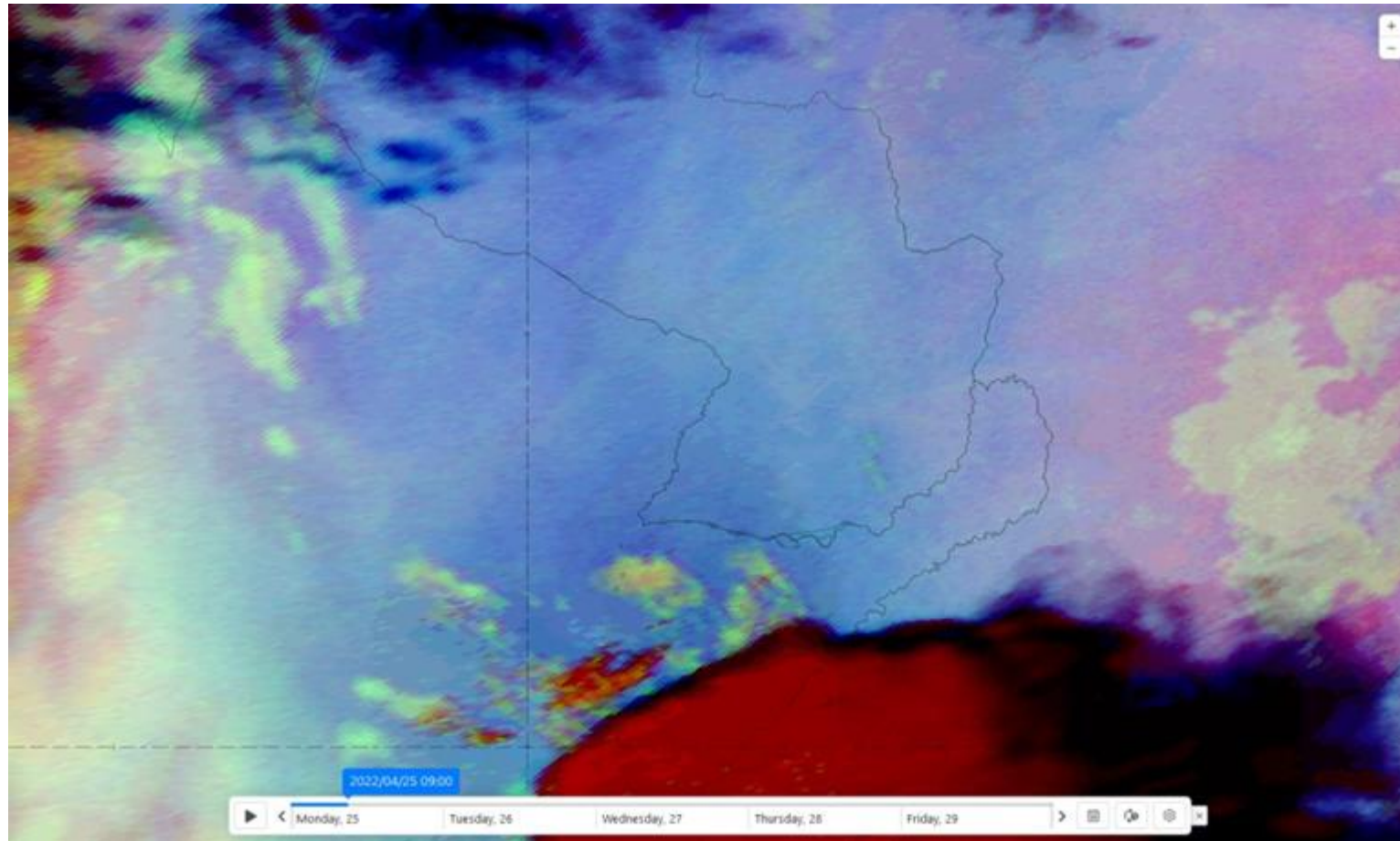


- **Convective development in the region of high LL moisture**



Examples of LL moisture/ cloud detection

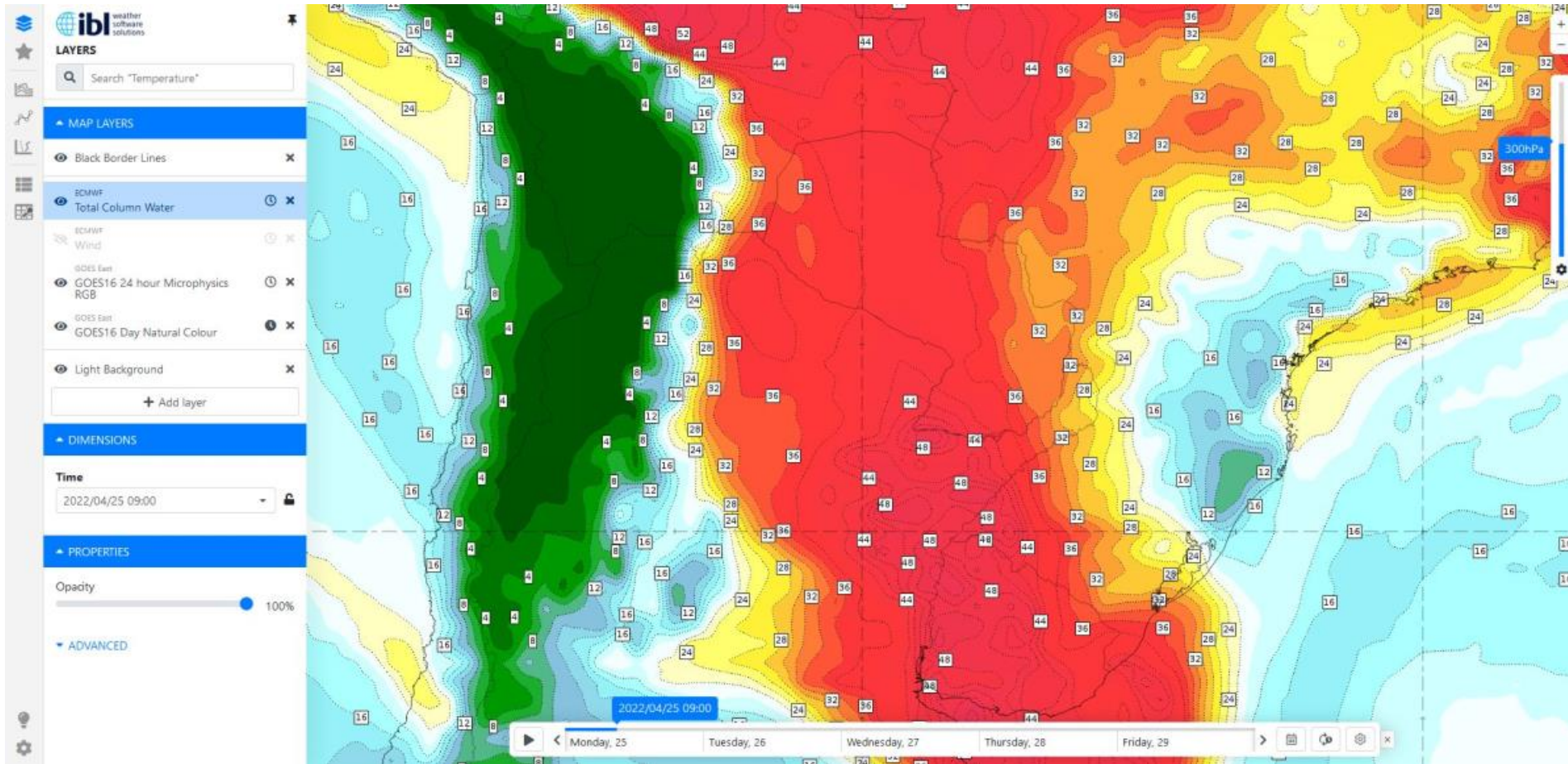
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- **Confirmation from Dust RGB**
- **Slant Meteosat SEVIRI view over S. America**



Examples of LL moisture/ cloud detection

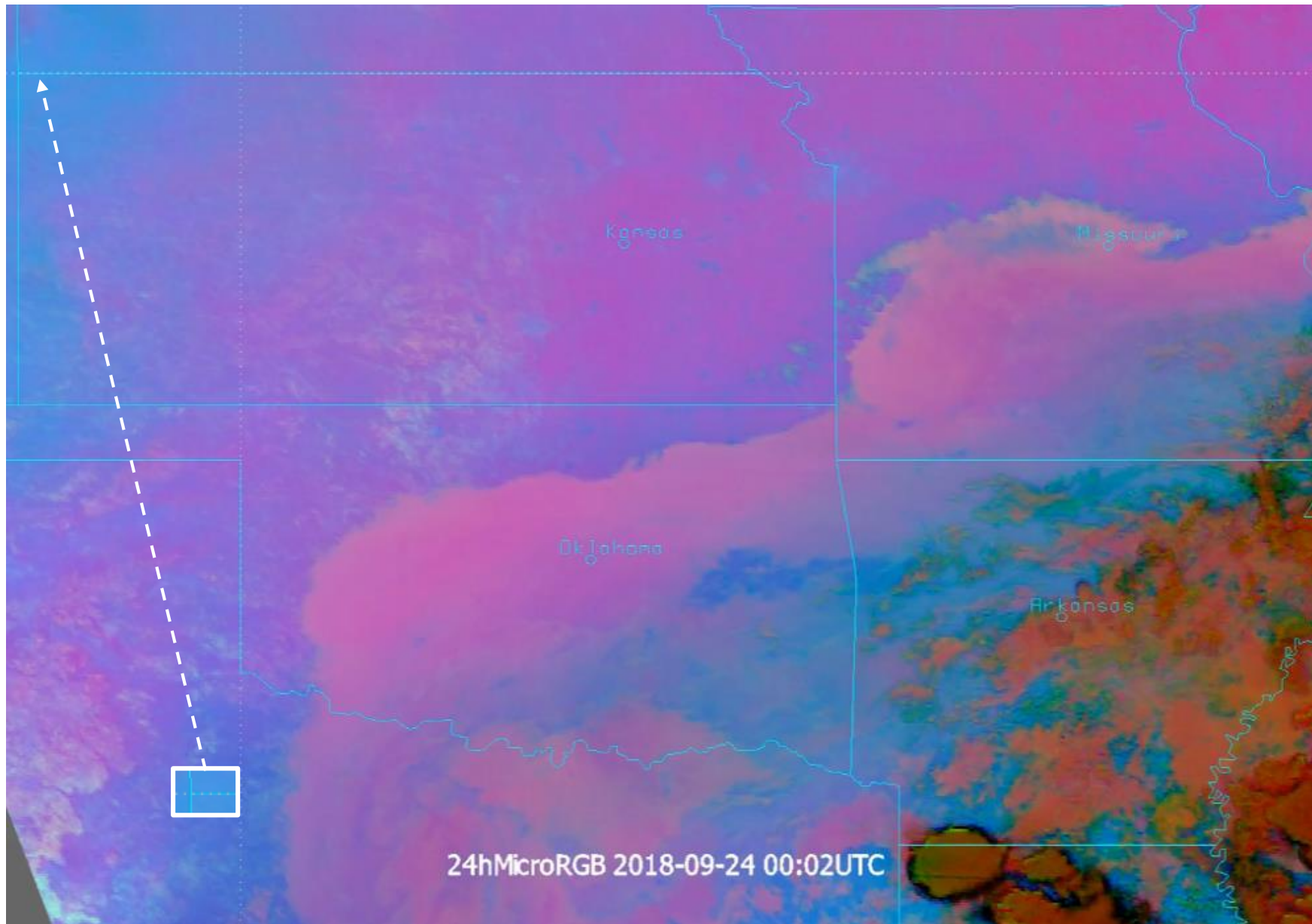


- Confirmation NWP TPW product



Examples of LL moisture/ cloud detection

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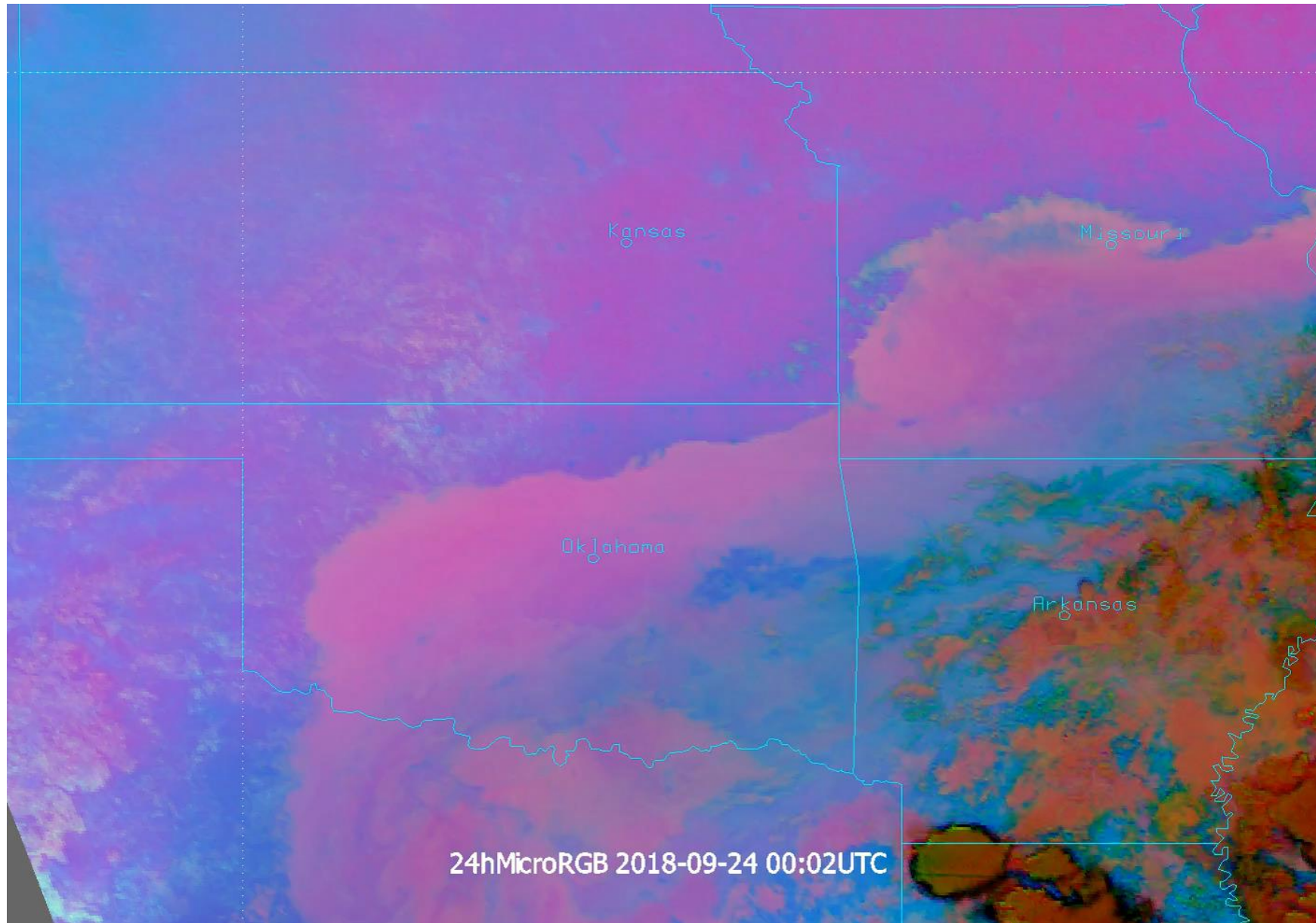


- Stratus – moisture dynamics
- Good overlap between the two



Examples of LL moisture/ cloud detection

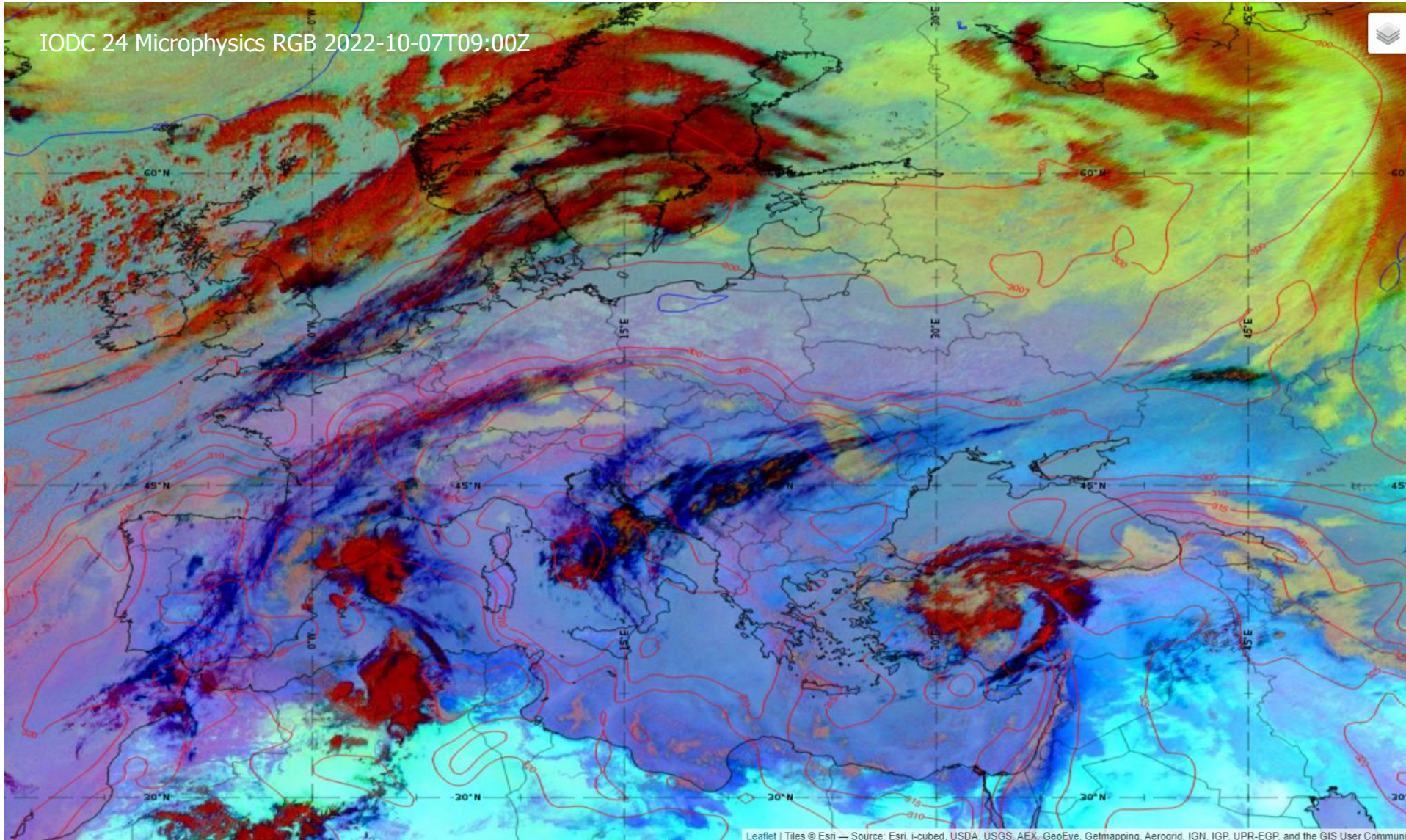
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Examples of LL moisture/ cloud detection

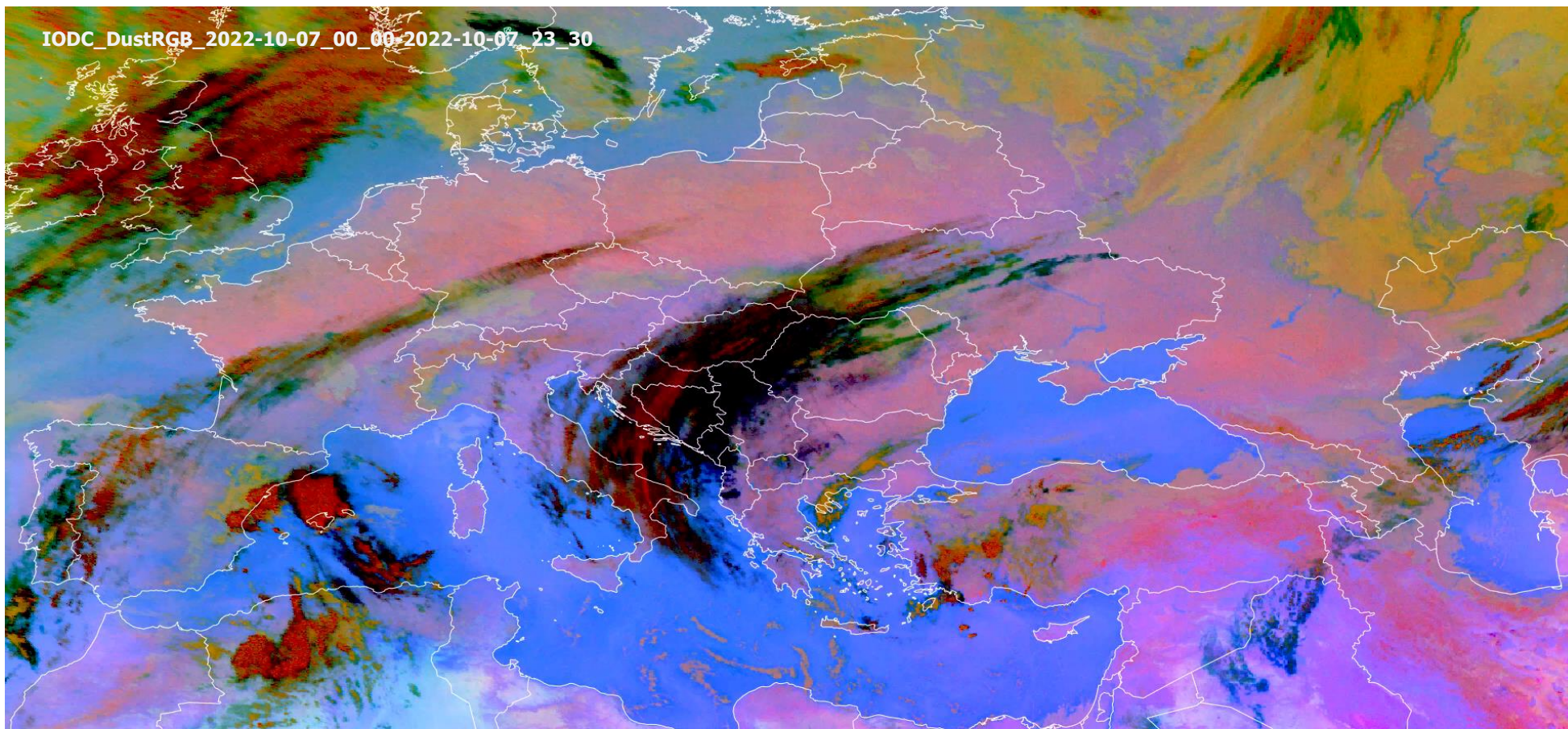


- Stratiform cloud formations mostly outside the dry line
- Moving along with the moisture boundary



Examples of LL moisture/ cloud detection

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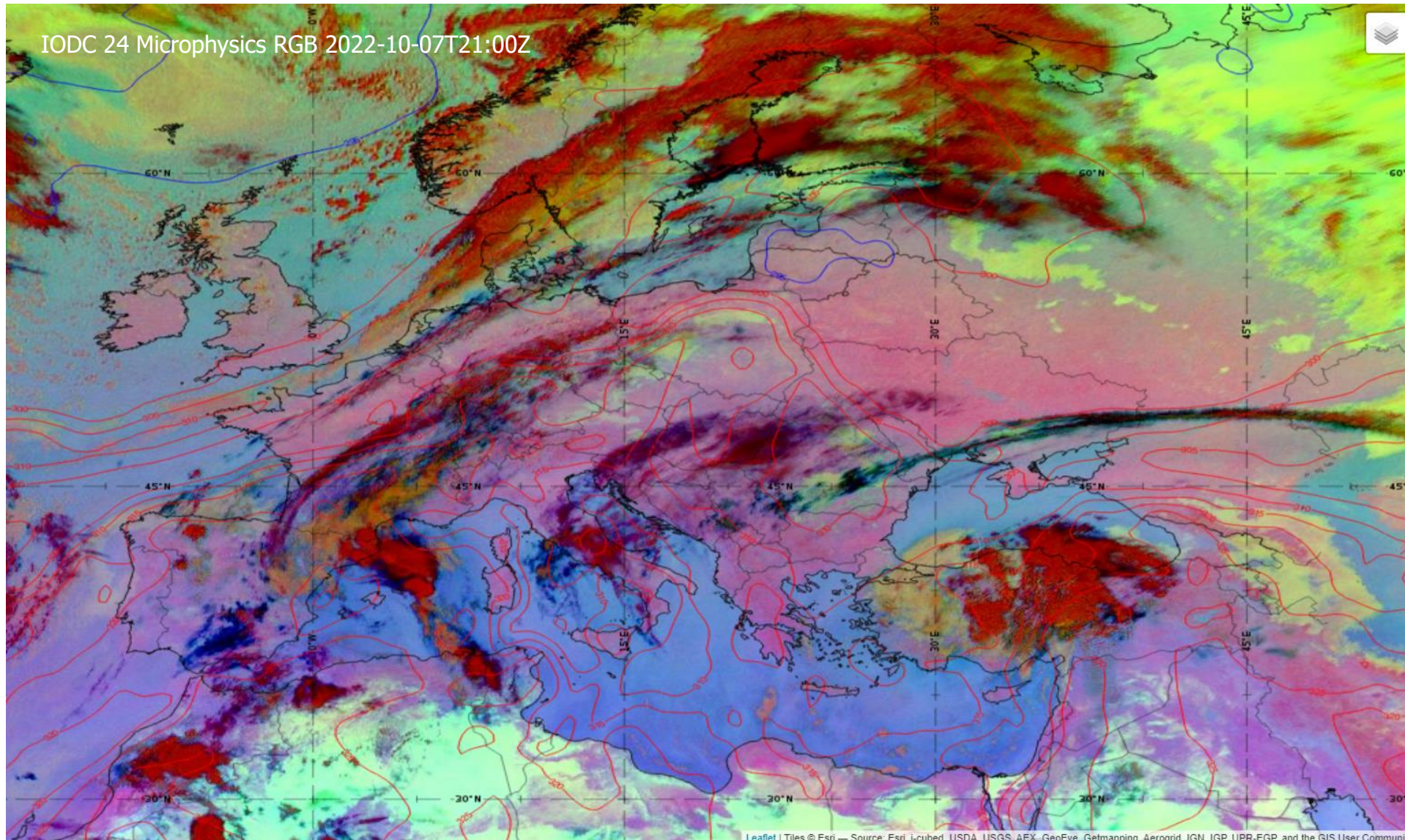
EUMETSAT

2022-10-07 00:00:00 UTC

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Examples of LL moisture/ cloud detection

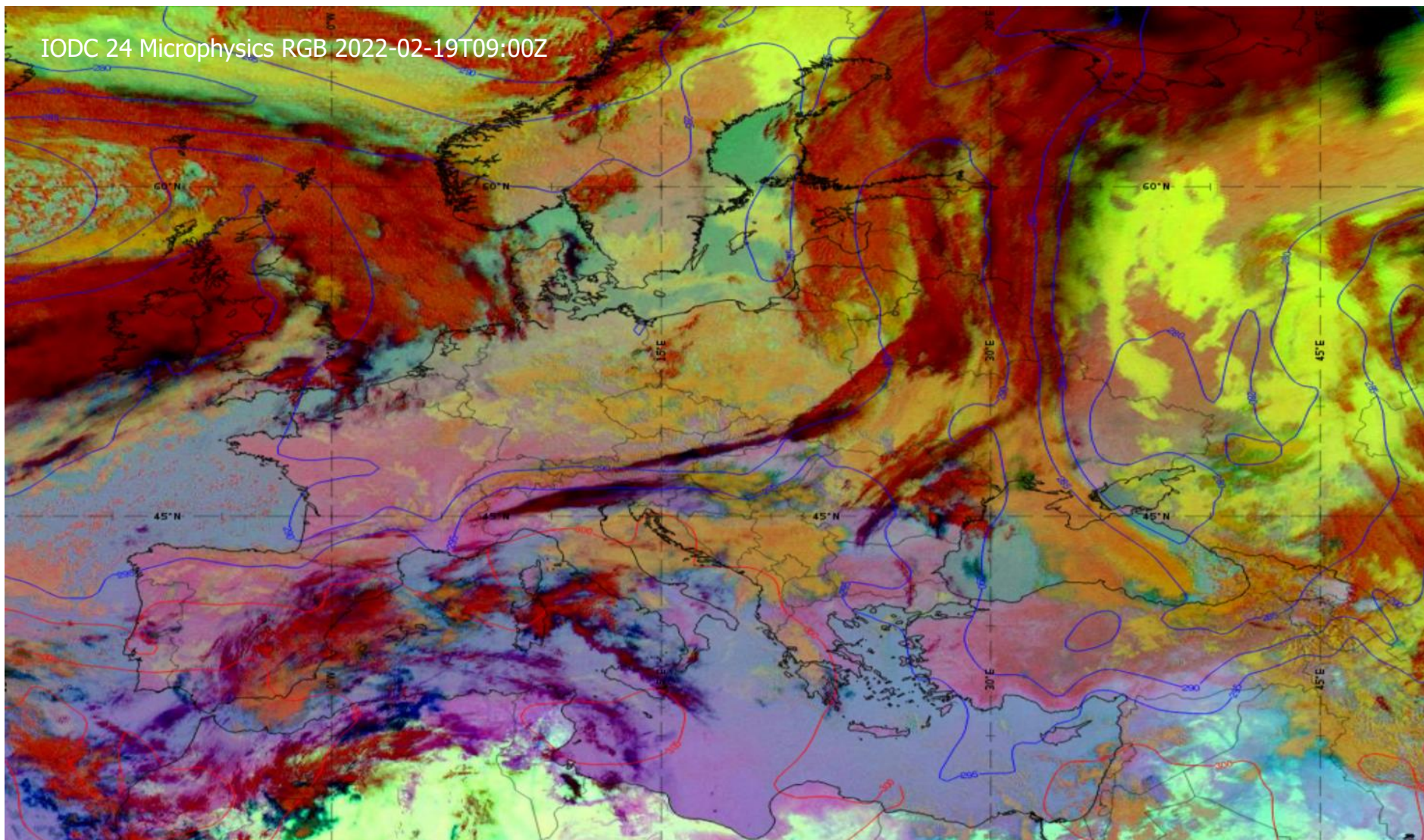


- Stratiform cloud formations mostly outside the dry line
- Moving along with the moisture boundary
- BTD temperature contrast low



Examples of LL moisture/ cloud detection

IODC 24 Microphysics RGB 2022-02-19T09:00Z

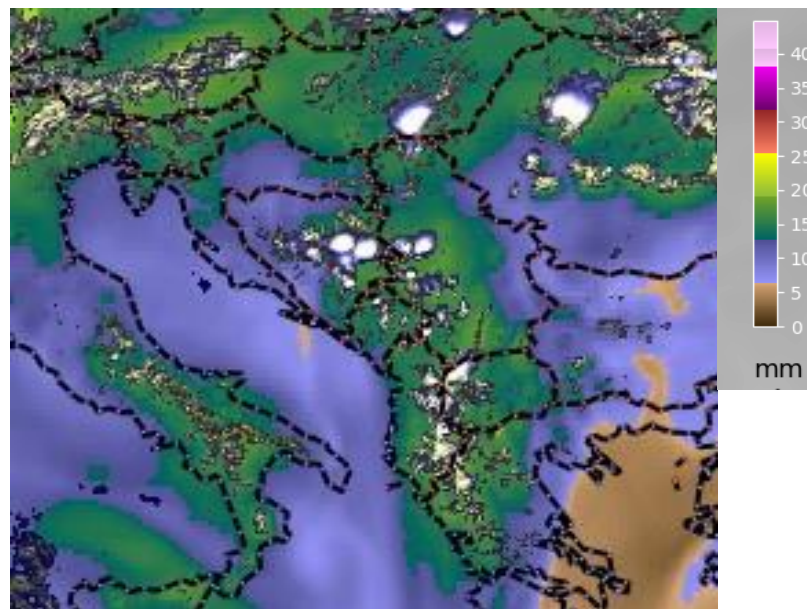
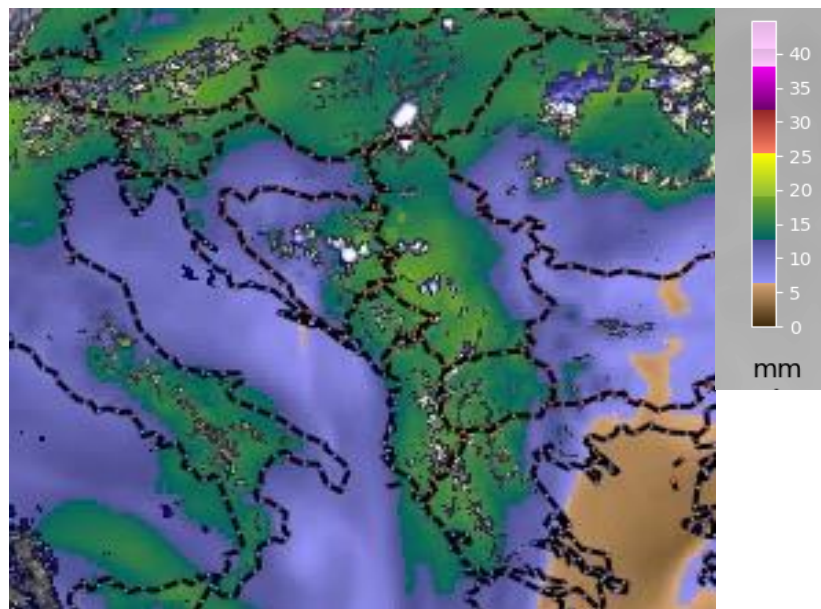
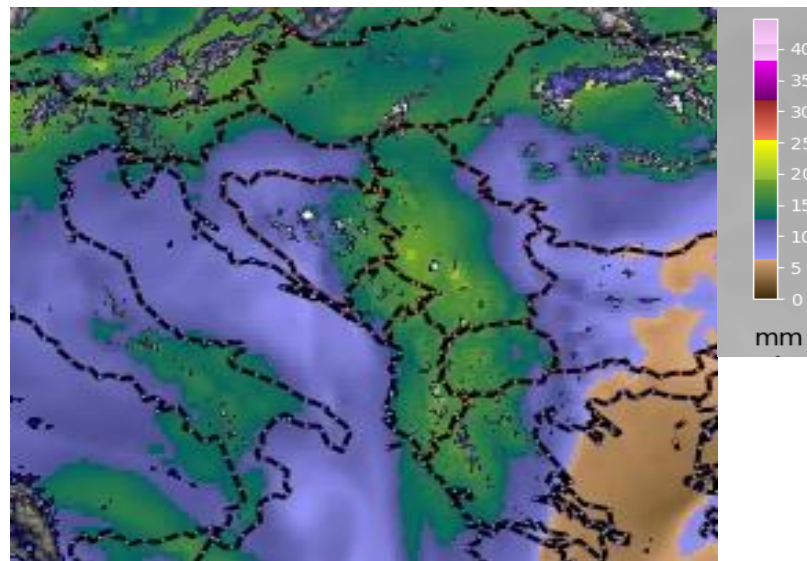
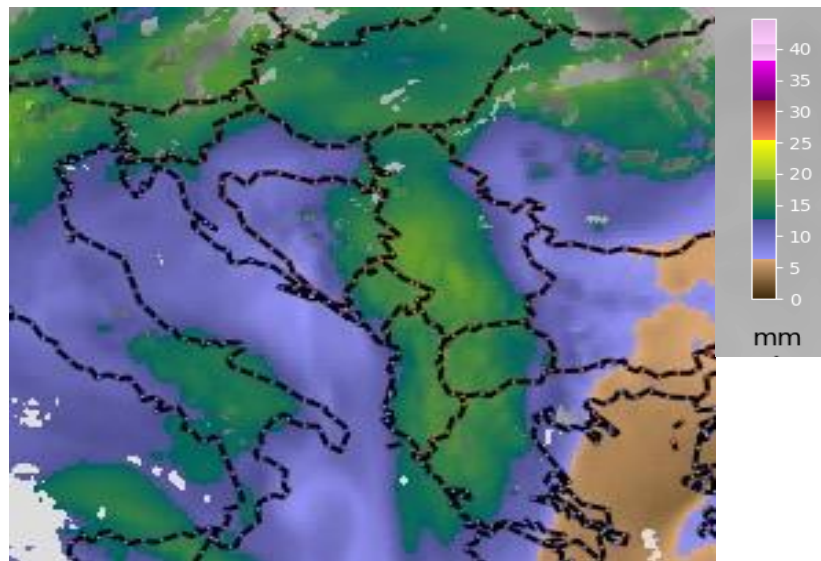


- BTDR temperature contrast low
- Lower moisture (gradients)
- High cloud cover
- Potential for NIR0.9 channel utility?



Examples of LL moisture/ cloud detection

28 June 2020 - 8-11 UTC



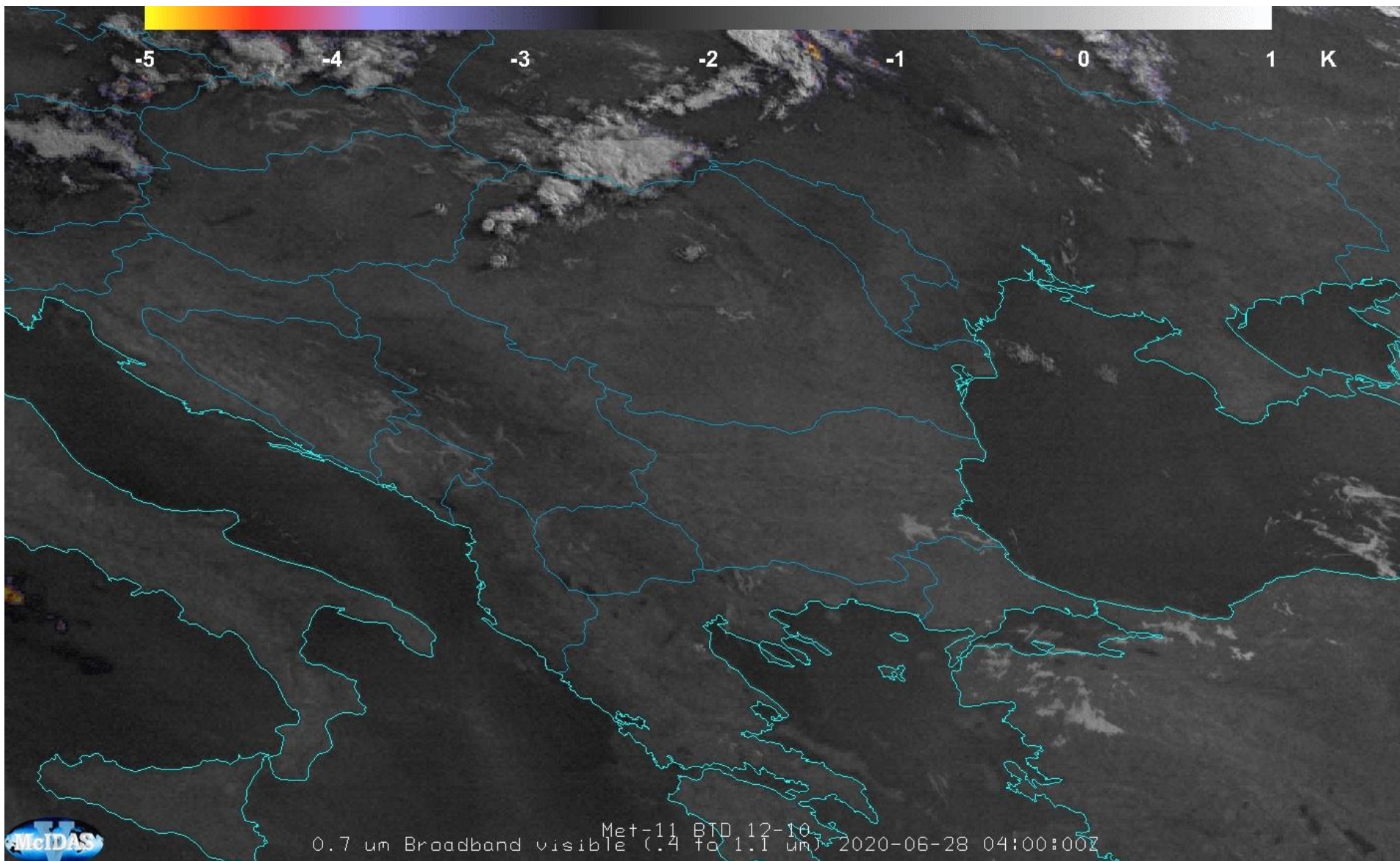
- L2 geophysical product (cloud overlay)



Examples of LL moisture/ cloud detection

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- L2 geophysical product (cloud overlay)
 - L1.5 confirmation (Sandwich product)

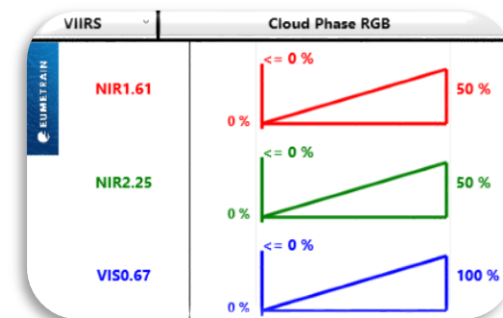
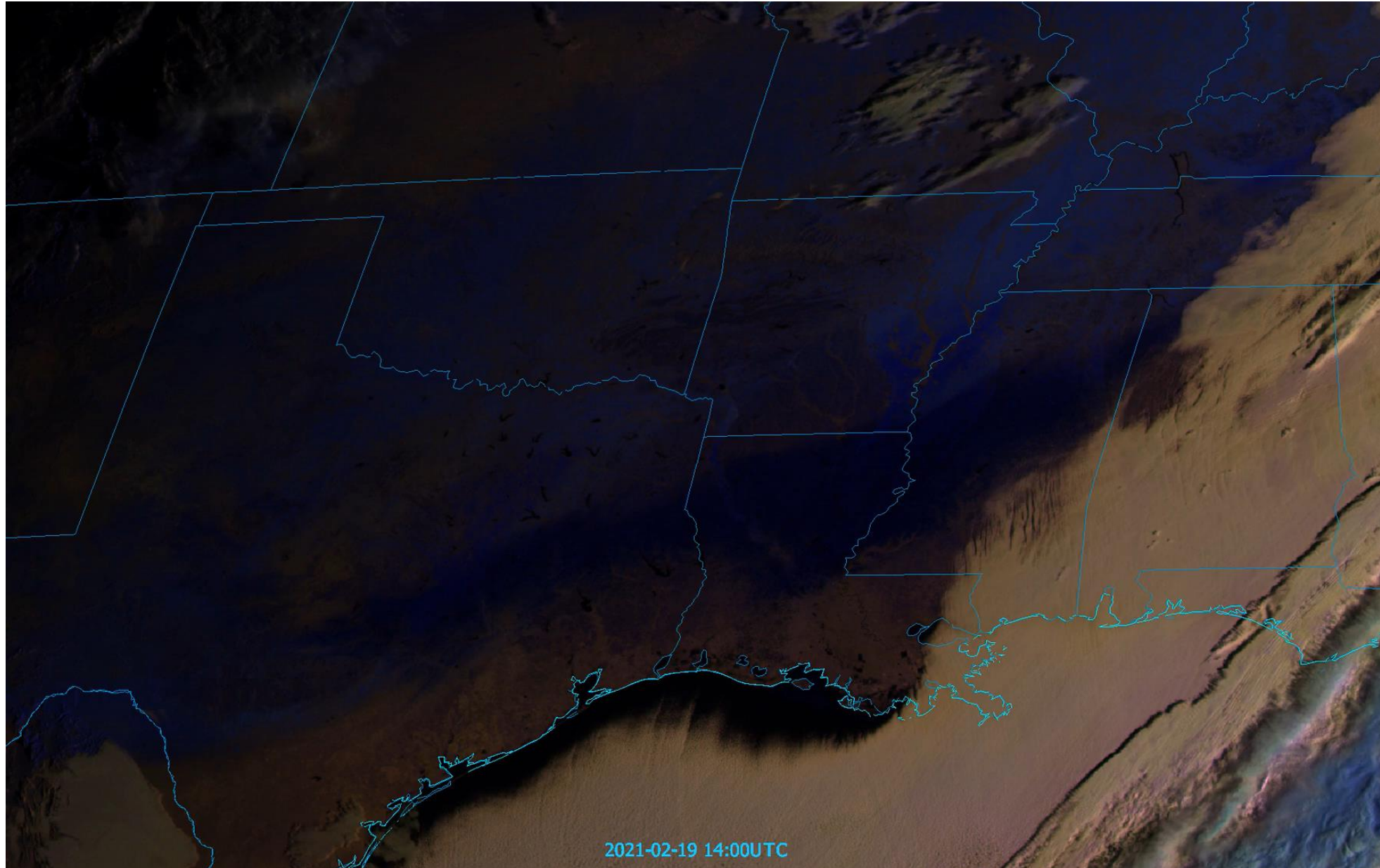


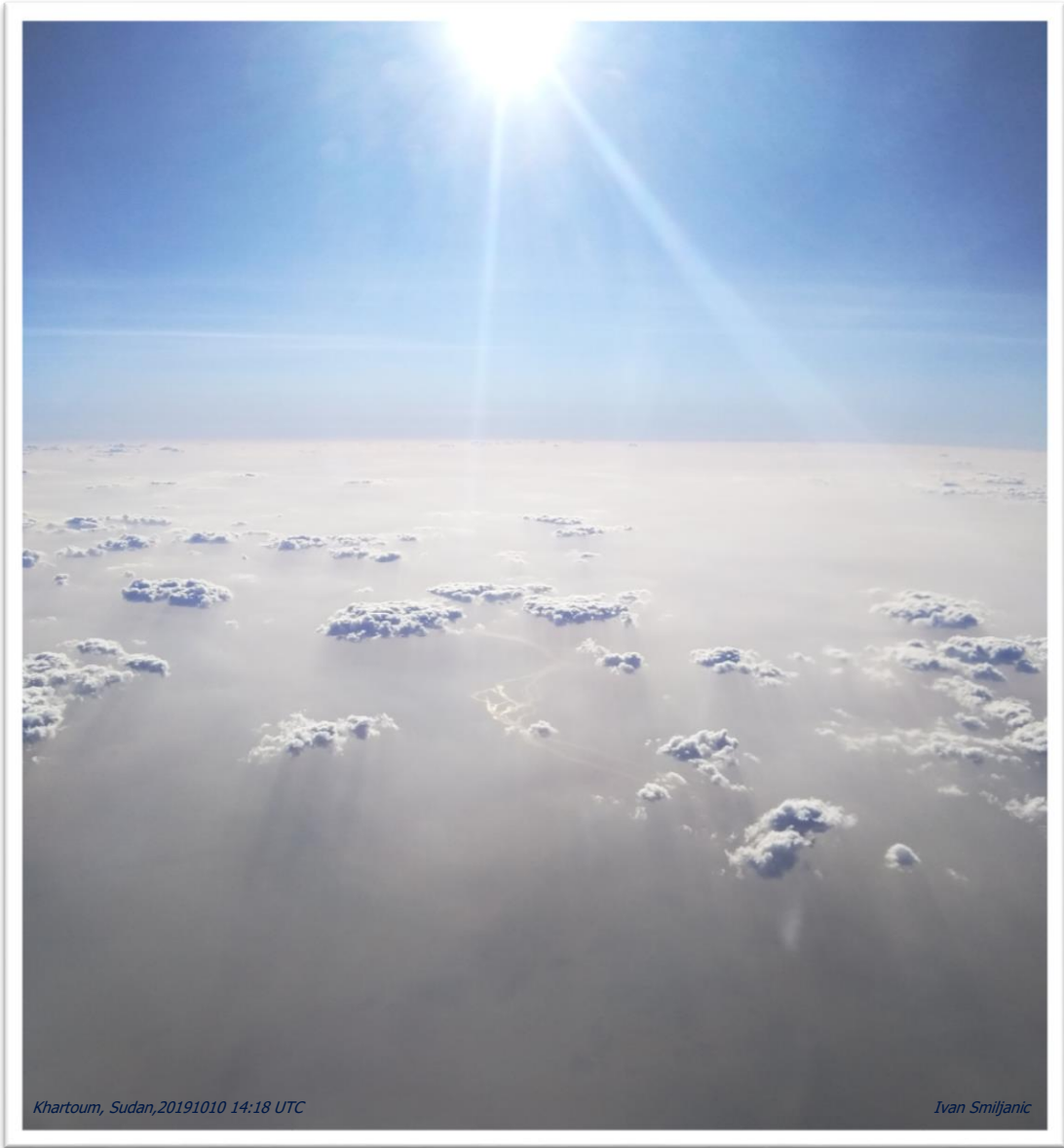


Examples of LL moisture/ cloud detection

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- Melting
freezing
rain
deposition
- Sublimation
into cloud
formation?





Khartoum, Sudan, 20191010 14:18 UTC

Ivan Smiljanic

Thank you.

