

A detailed view of a satellite in space, showing its complex structure with multiple solar panel arrays and instruments. The satellite is set against a black background with a curved white line representing the Earth's horizon.

Detection of low-level humidity with FCI data

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27 September 2023 , EUMeTrain Event Week, Online



Low level moisture

Importance of moisture information

FCI moisture channels

Ways to detect moisture

View on low-level moisture

Examples of FCI proxy imagery



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Examples of FCI proxy imagery



MOISTURE in the atmosphere – can we see it?





MOISTURE in the atmosphere – where is it?

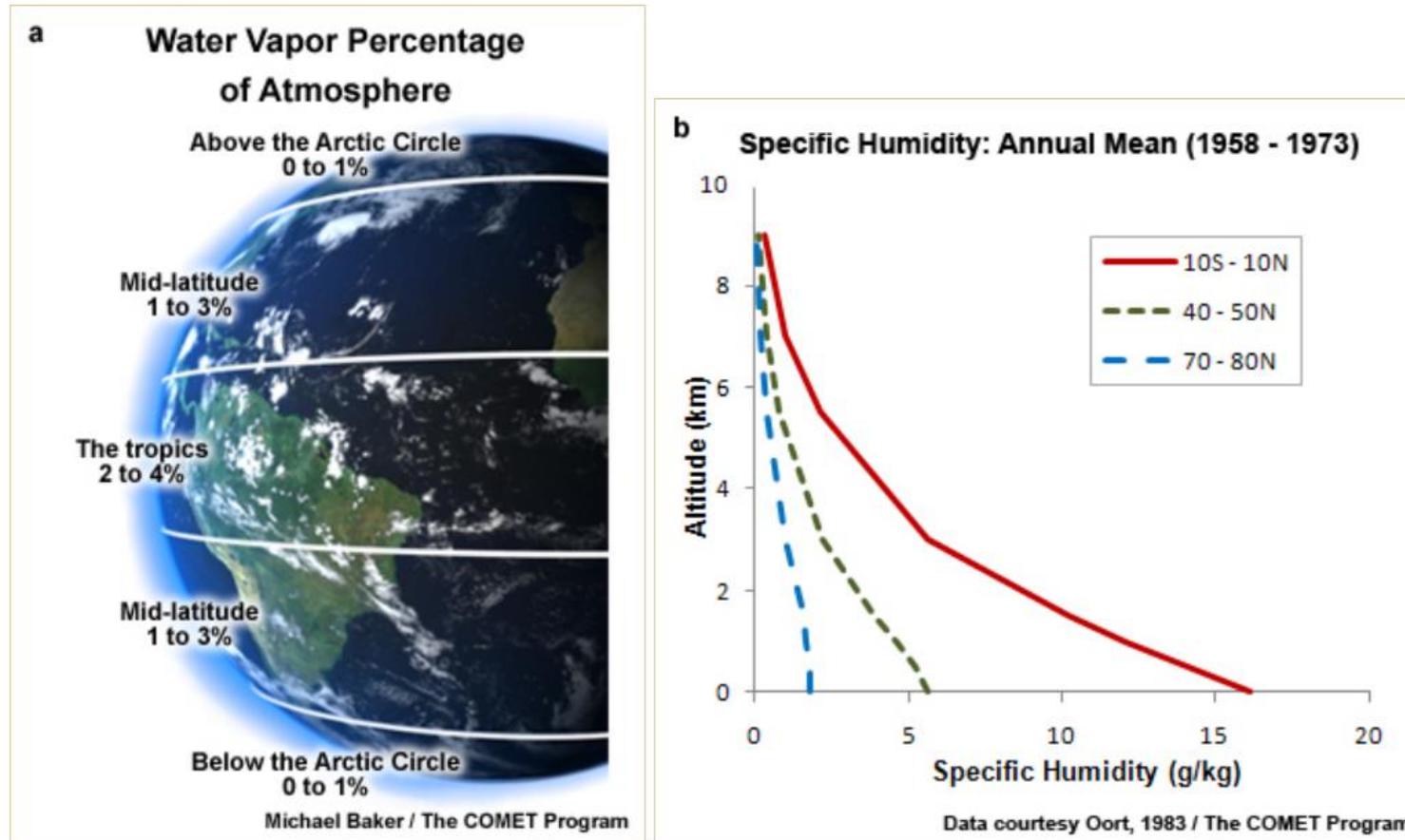


Fig. 1.19. (a) The distribution of surface water vapor percentage by latitude and (b) annual mean water vapor content (specific humidity) profile. Data in (b) from Oort (1983)²¹



Why do we want to know about low-level 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 moisture

Importance of moisture information

FCI moisture channels

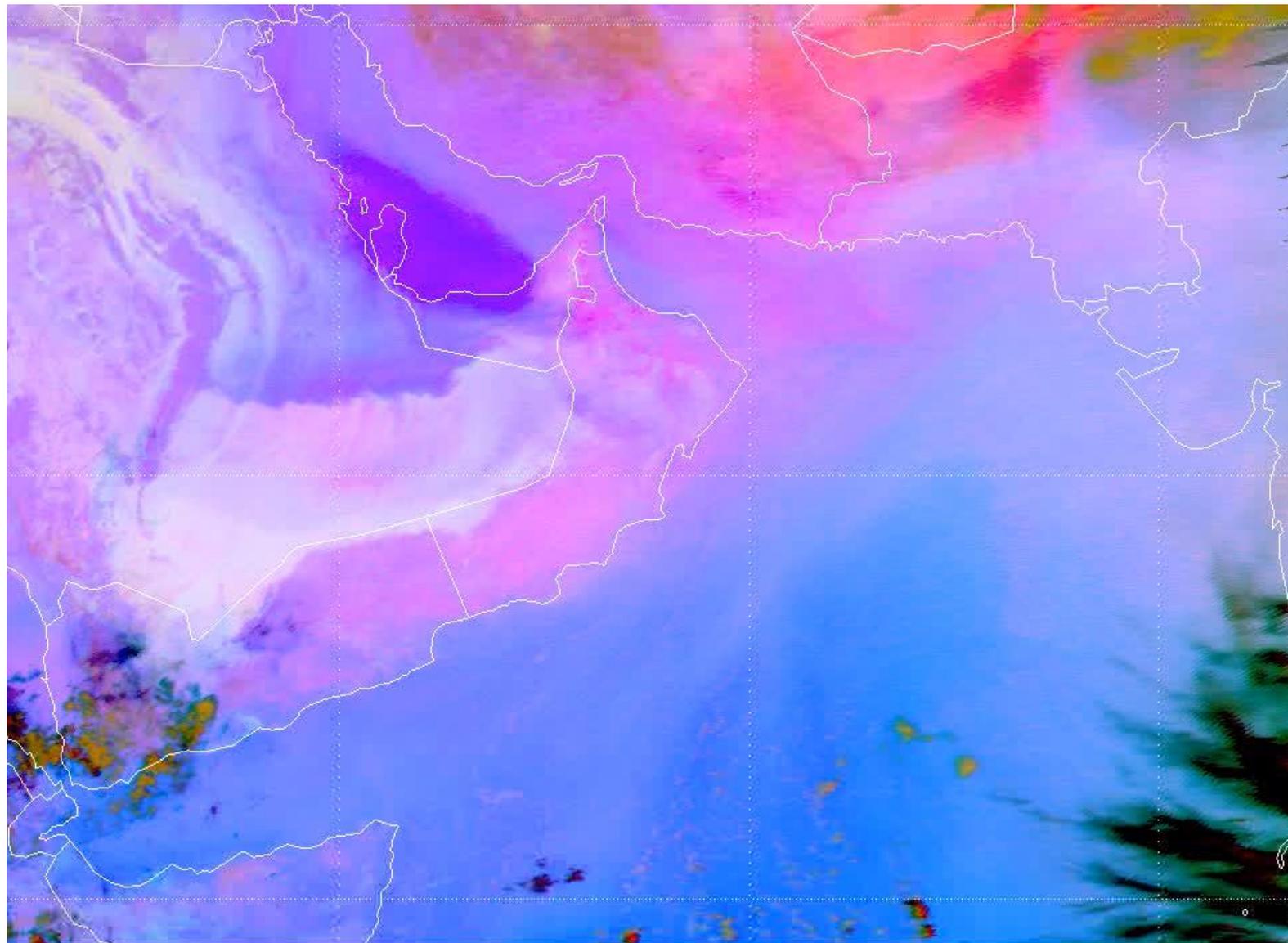
Ways to detect moisture

View on low-level moisture

Examples of FCI proxy imagery



Example of LL moisture



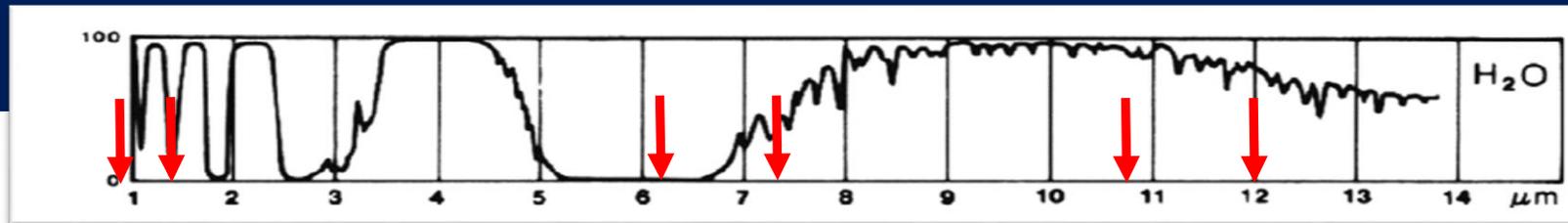
m9 DUST - 2012-05-25 00:00UTC

<https://www.eumetsat.int/diurnal-development-sea-breeze-front>

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



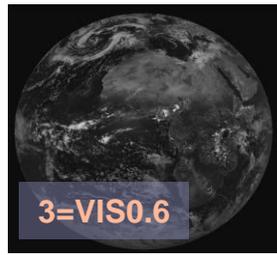
FCI vs SEVIRI



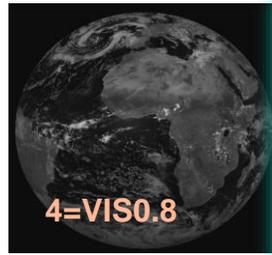
1=VIS0.4



2=VIS0.5



3=VIS0.6



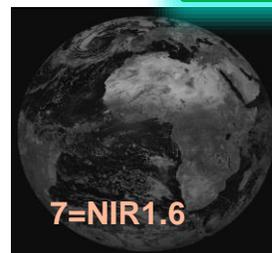
4=VIS0.8



5=NIR0.9



6=NIR1.3



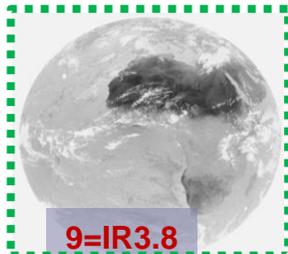
7=NIR1.6



8=NIR2.25

Solar
1.0 km (0.5 km)

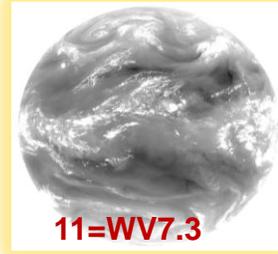
Thermal
2.0 km (1.0 km)



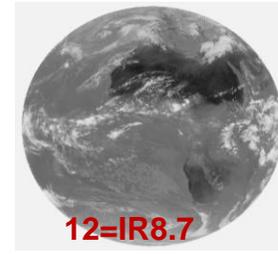
9=IR3.8



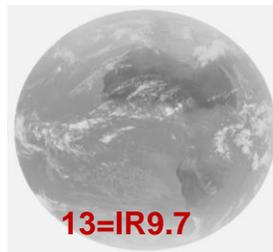
10=WV6.2



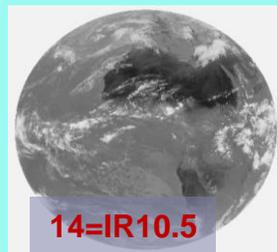
11=WV7.3



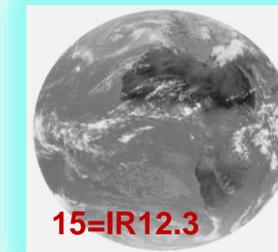
12=IR8.7



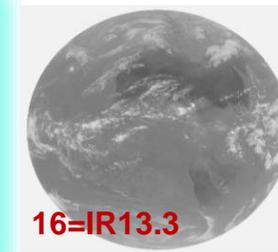
13=IR9.7



14=IR10.5



15=IR12.3



16=IR13.3



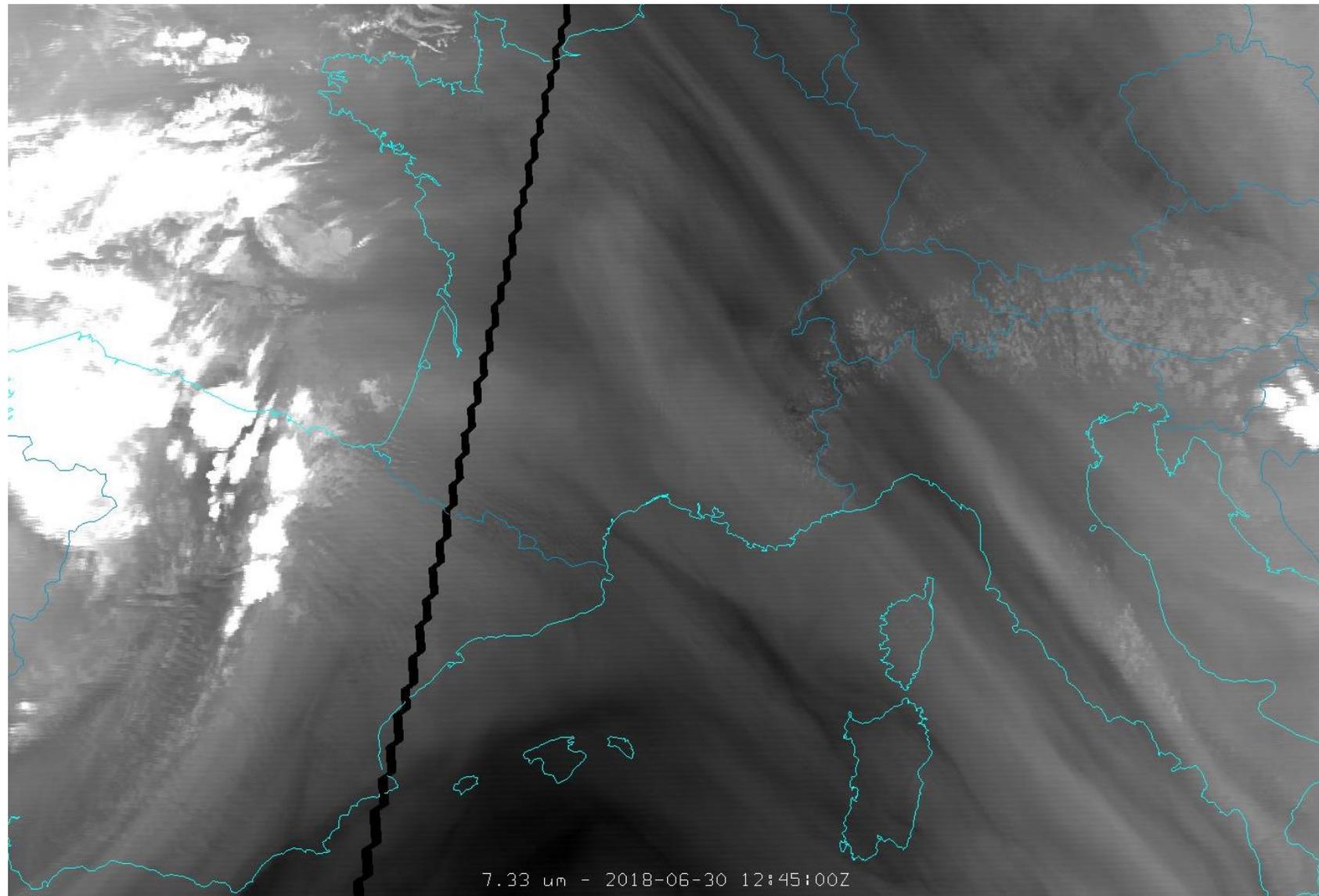
Higher level moisture

Mid-level moisture

MODIS

WV7.3 channel

Locate
moisture
boundaries!

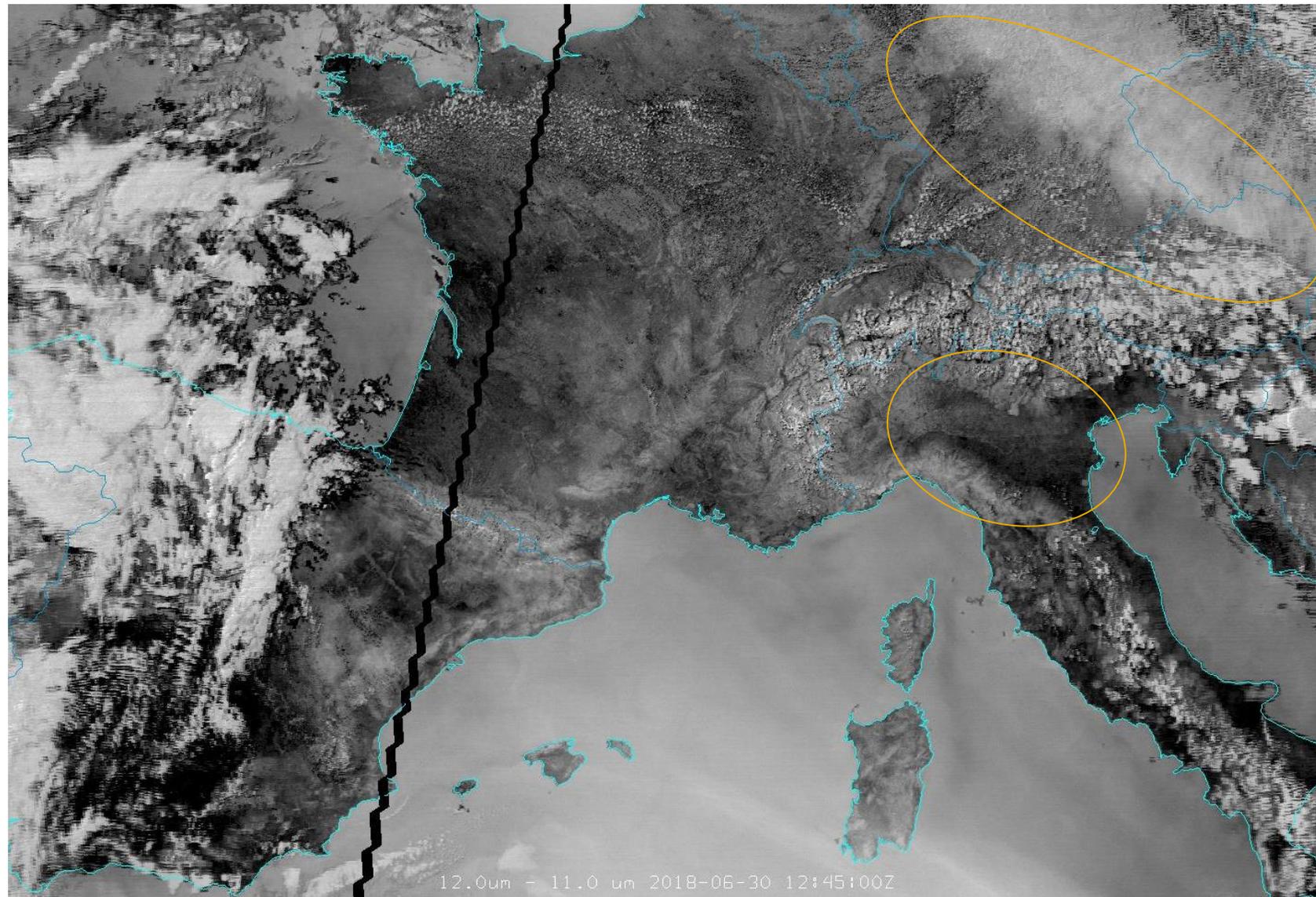




Higher level moisture vs low level moisture

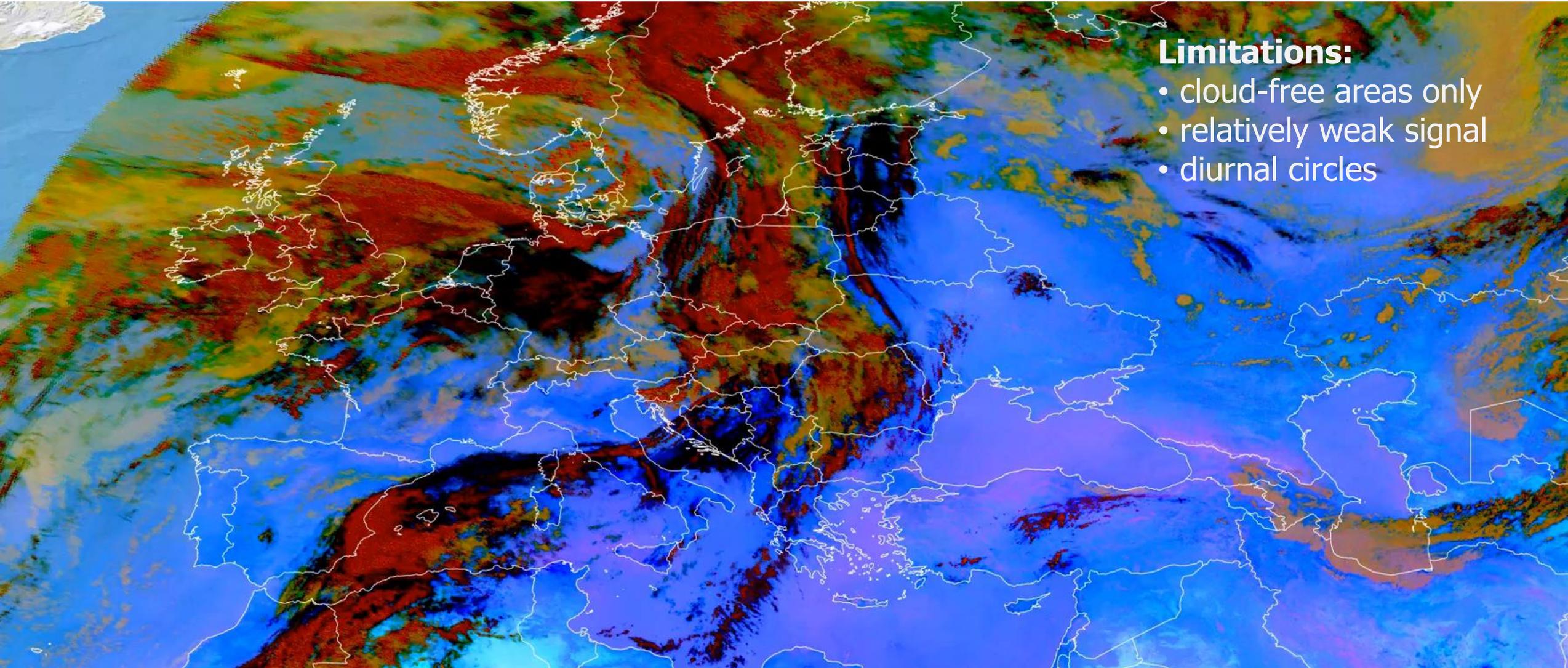
**Low-level
moisture**

**MODIS
BTD12-11
channel**





Examples of LL moisture

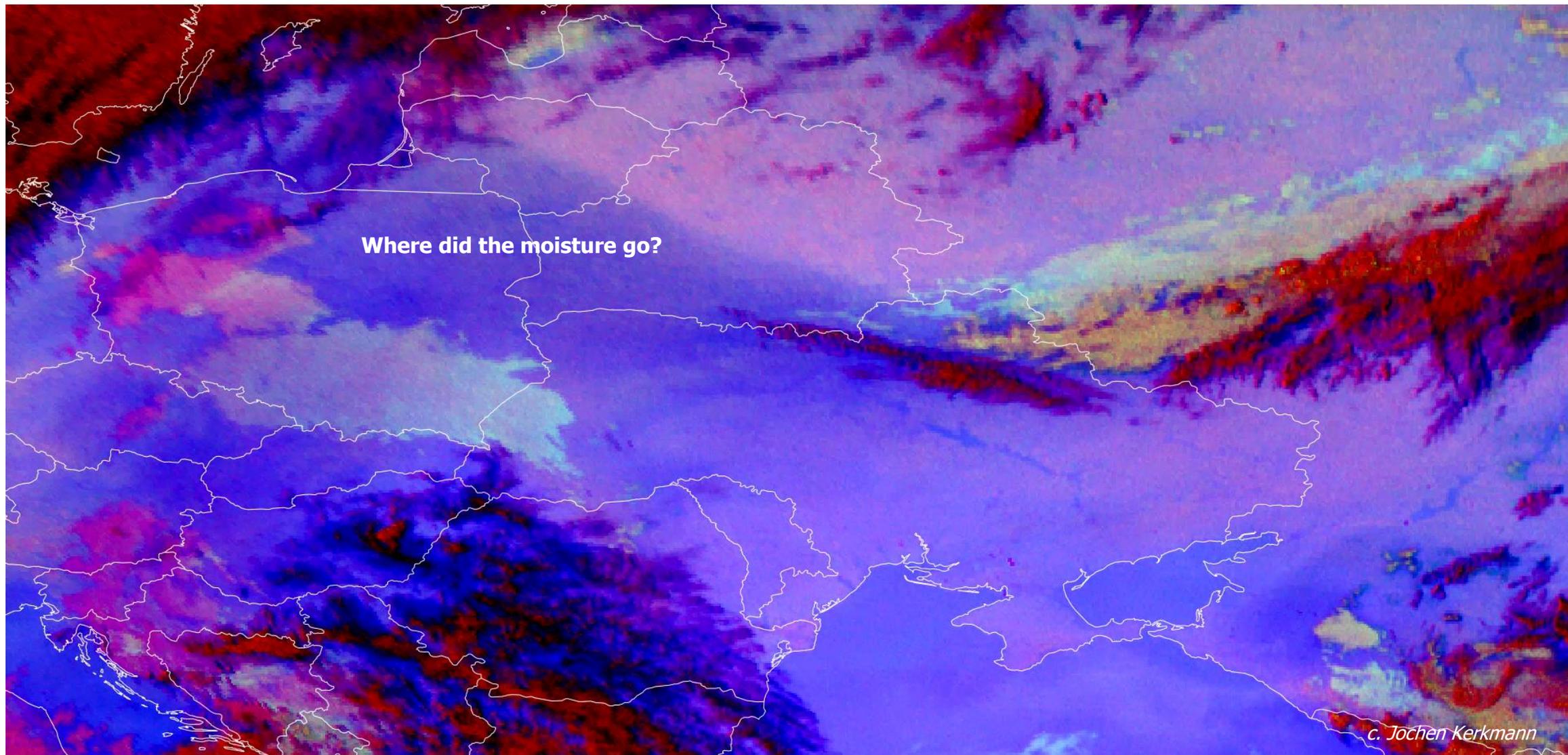


Limitations:

- cloud-free areas only
- relatively weak signal
- diurnal circles



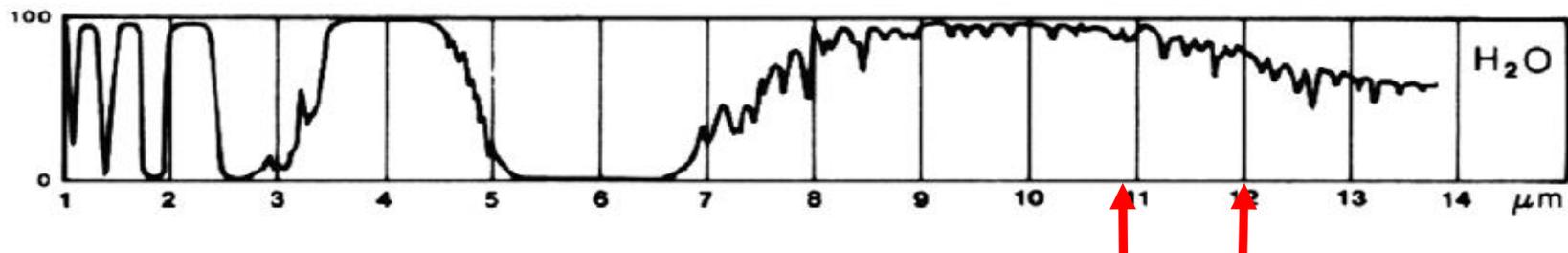
Examples of LL moisture



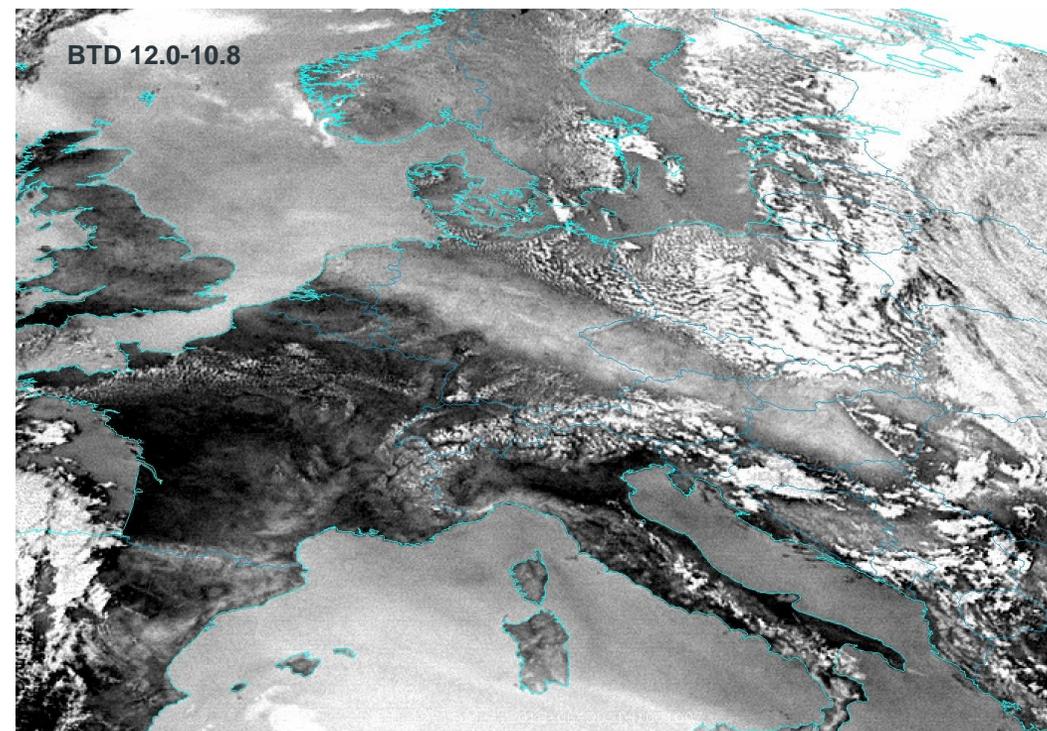
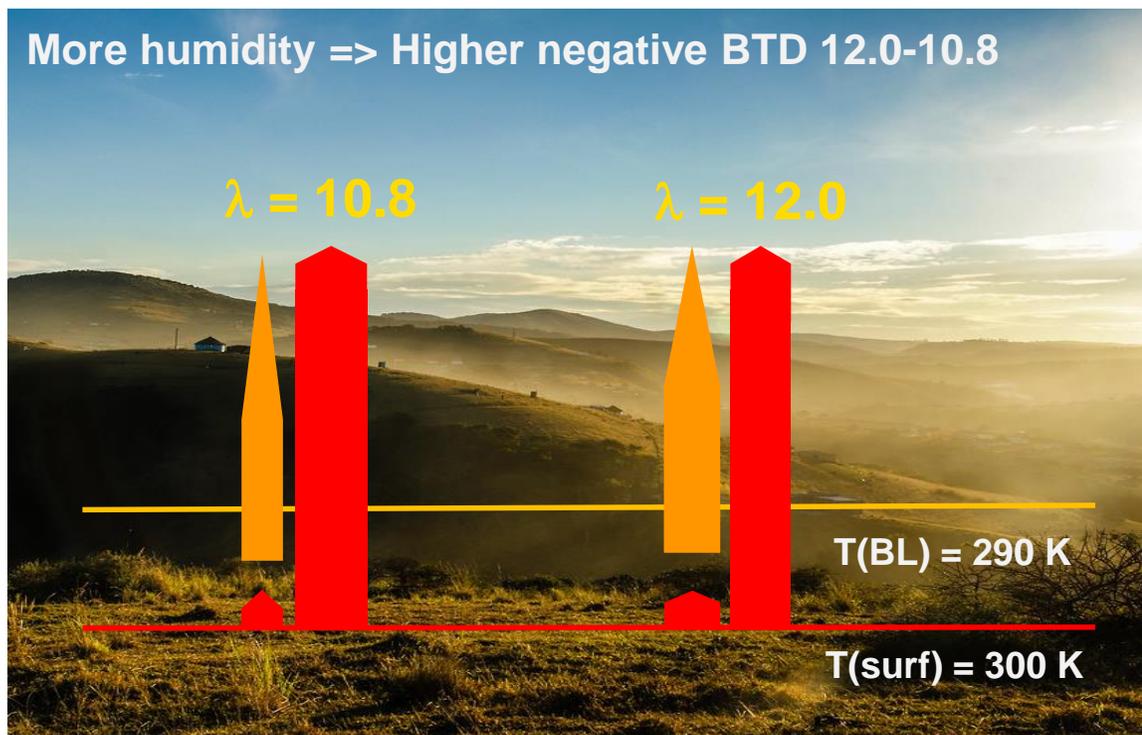


IR window region split difference:

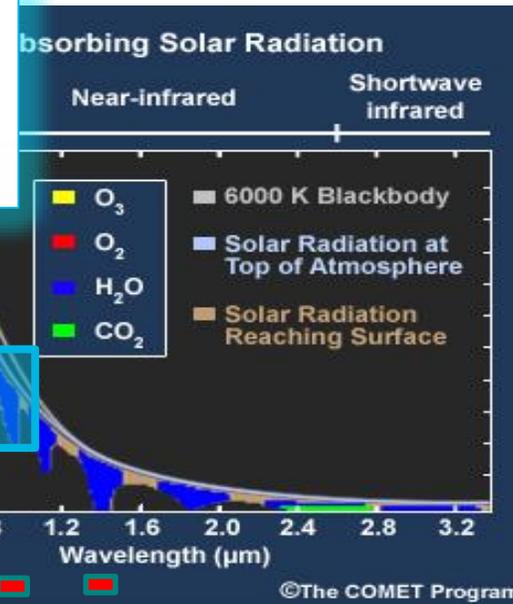
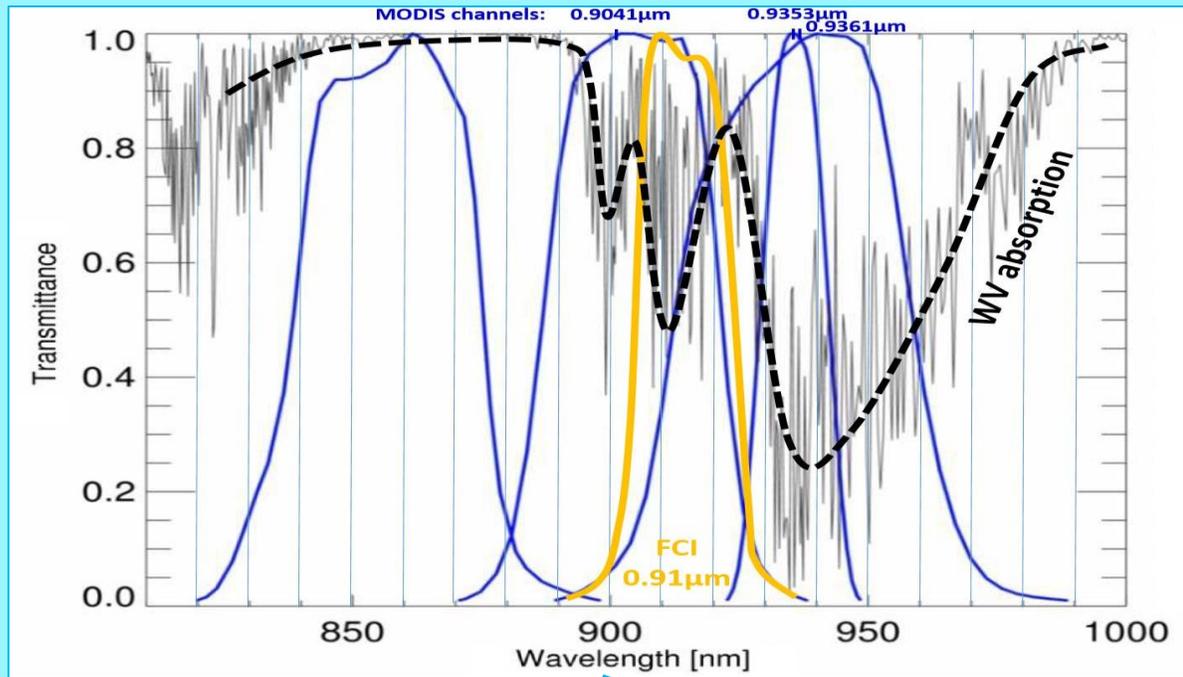
WV Absorption Bands in the IR 'window' region



More humidity => Higher negative BTD 12.0-10.8

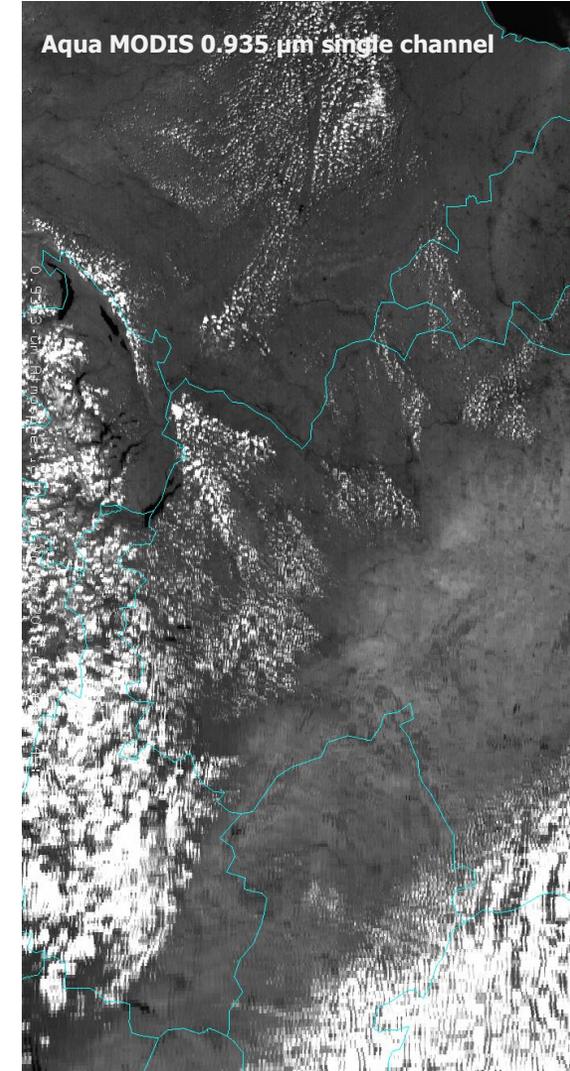
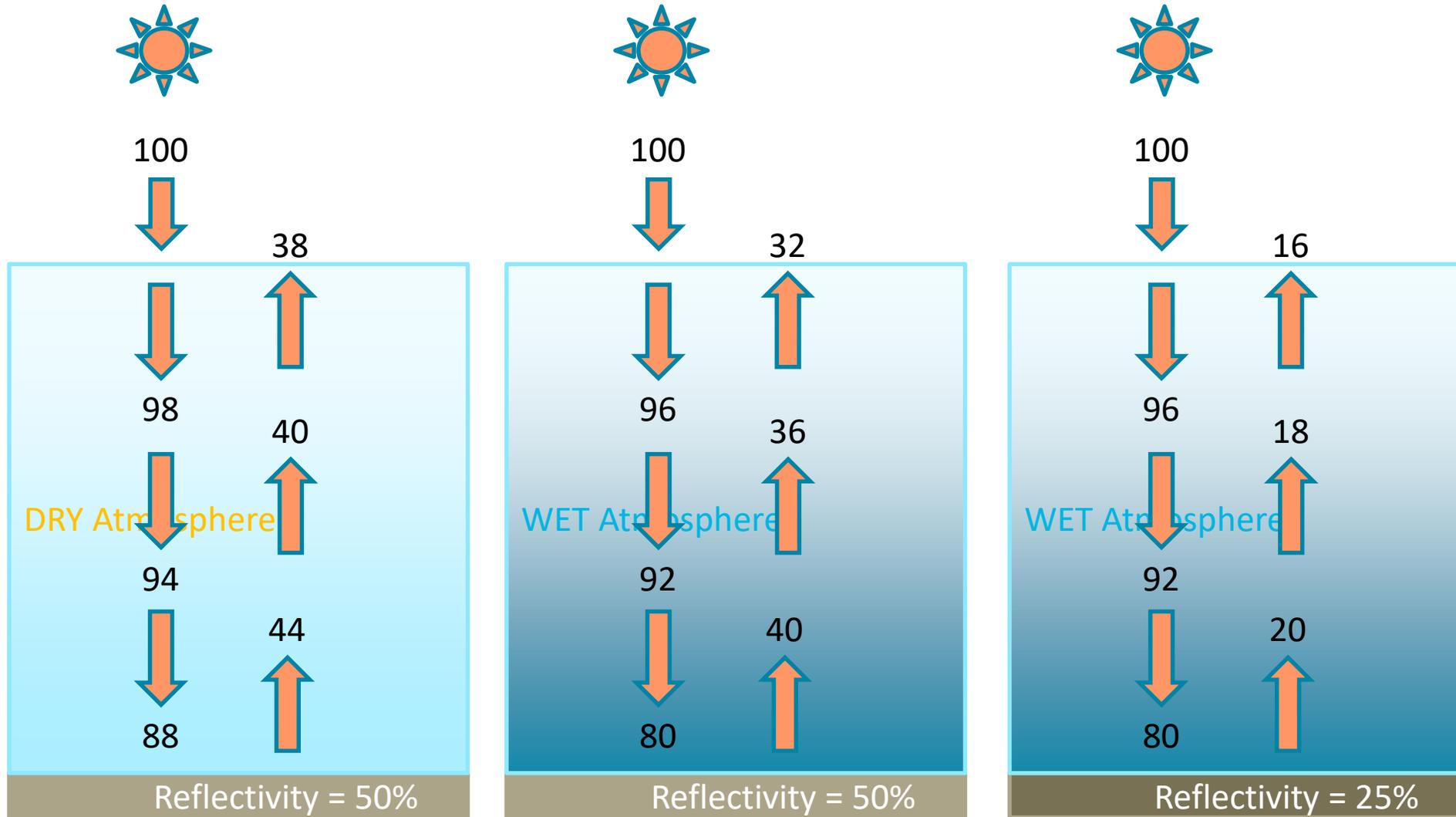


WV absorption (solar region)

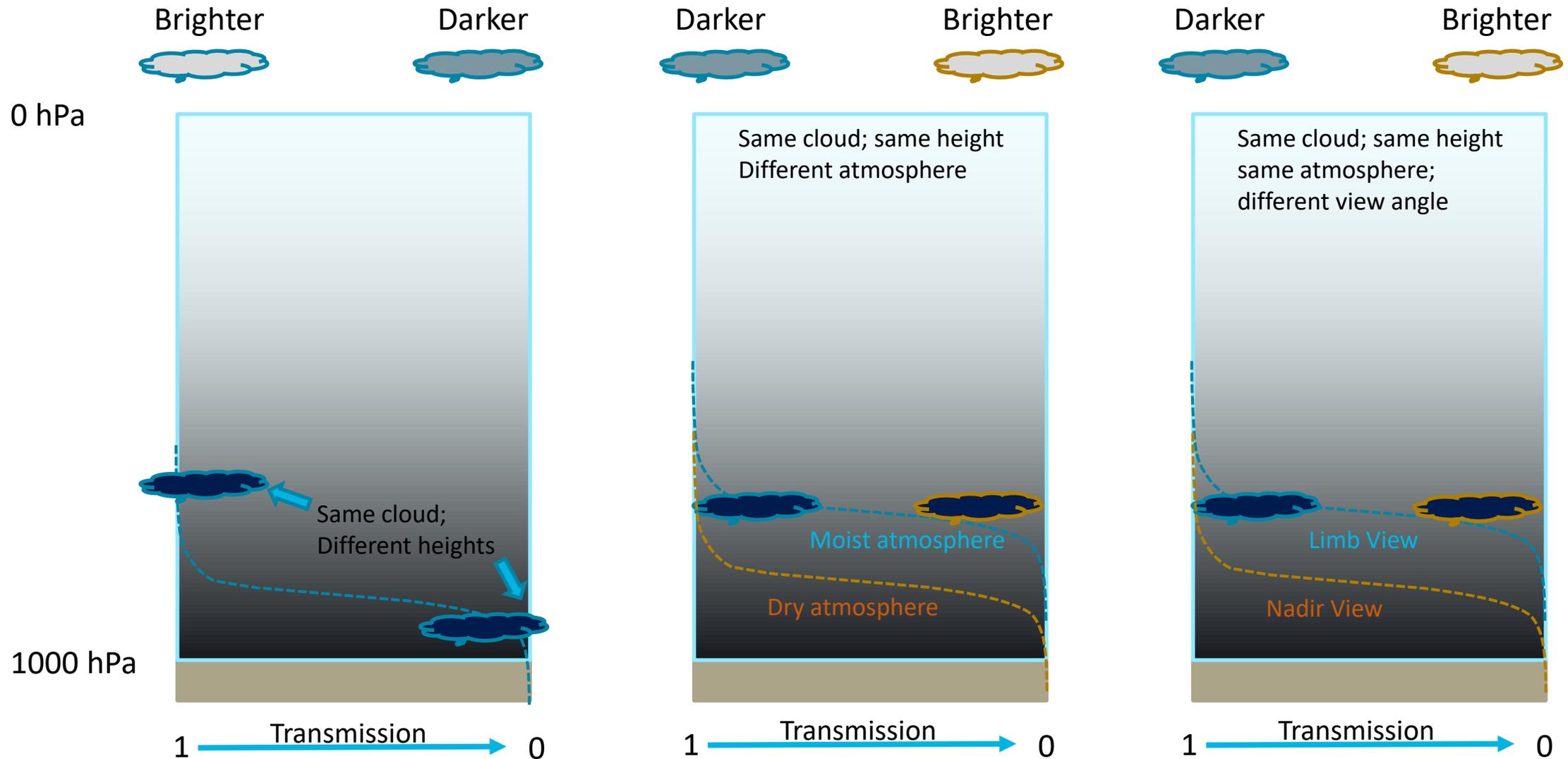


910 nm

WV Absorption: what does it mean in NIR0.91 region?



Regarding clouds, what can we say?





Low level moisture

Importance of moisture information

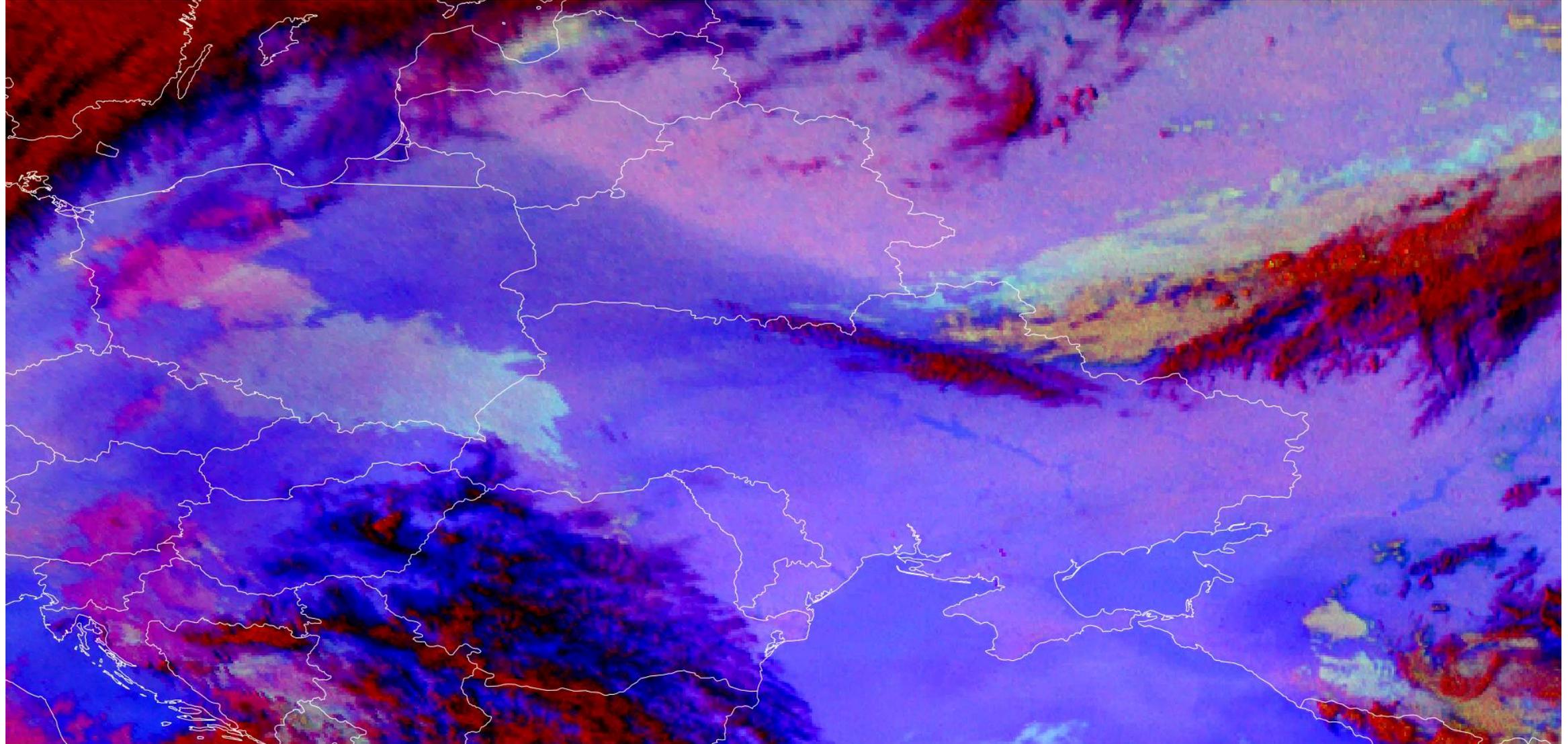
FCI moisture channels

Ways to detect moisture

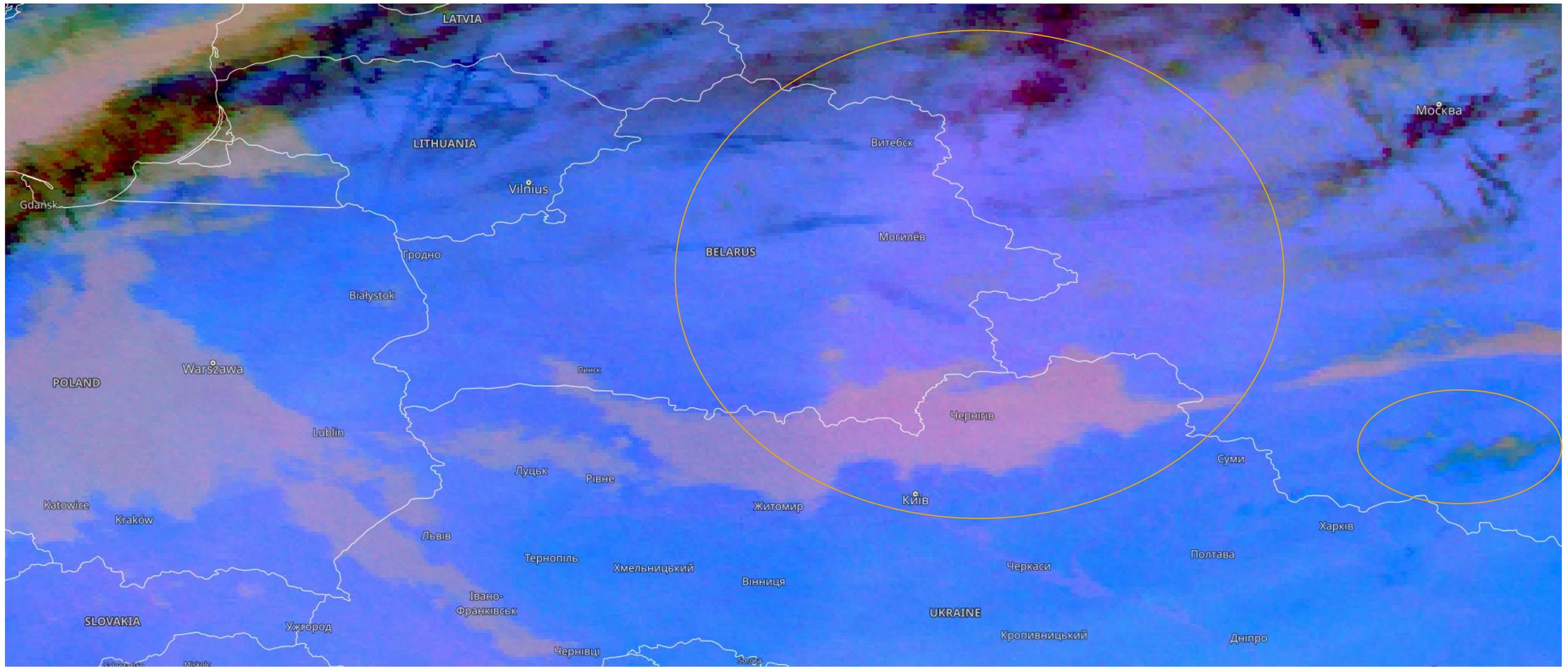
View on low-level moisture

Examples of FCI proxy imagery

Examples of LL moisture - BTD

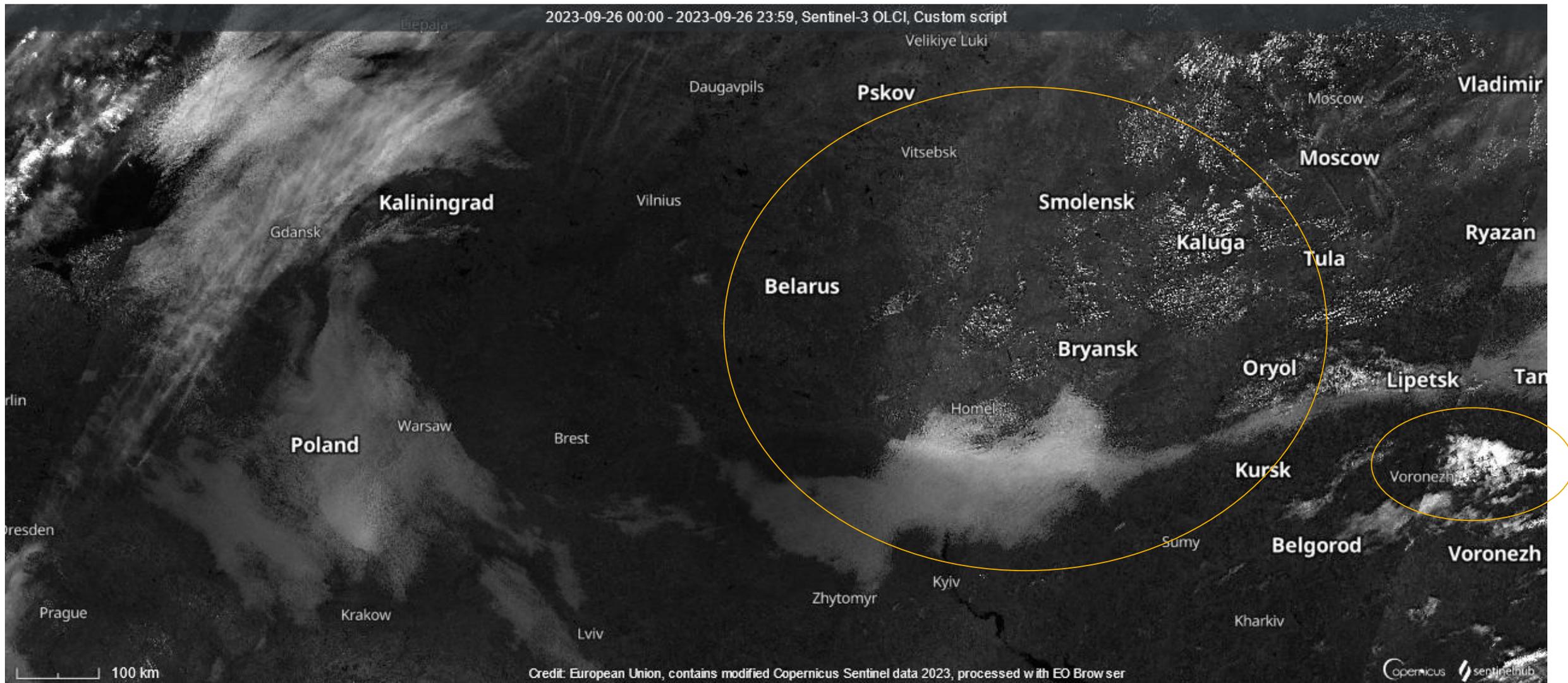


Examples of LL moisture - BTD



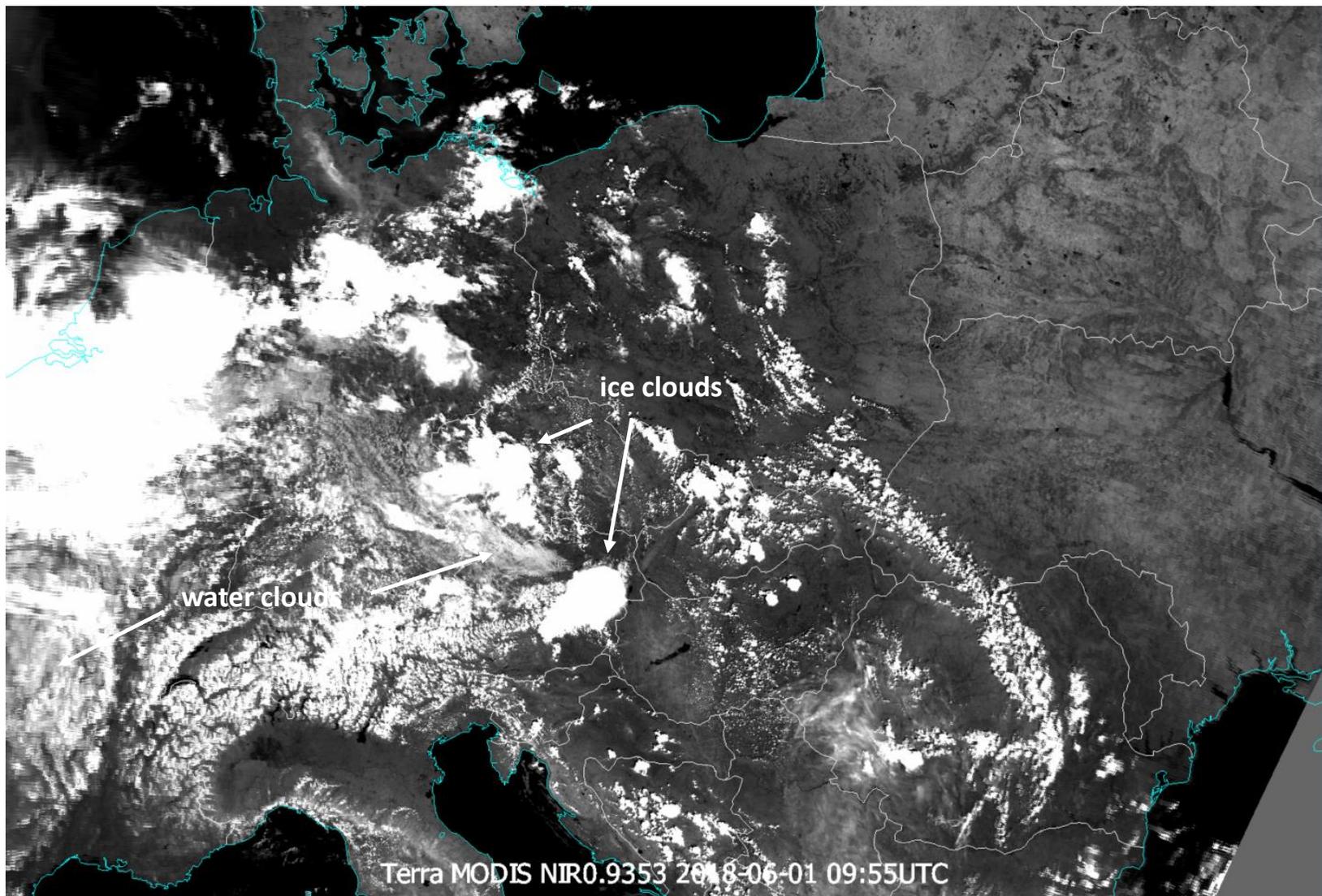


Examples of LL moisture – NIR0.9 channel





NIR0.9 imagery examples



World Political Boundaries
World Coastlines

Imagery

RGB 1.6 / 0.9 / 1.3
Level 1B data (All Bands)

DUST (cloud microphysics tuned for dust)
Level 1B data (All Bands)

0 241.8

RGB 0.9 / 0.9 / 1.3
Level 1B data (All Bands)

G_NCOL (generic natural colour)
Level 1B data (All Bands)

1.3820 um Cirrus Cloud Water Vapor
Level 1B data (All Bands)

0 2

0.5288 um Cirrus Cloud Water Vapor
Level 1B data (All Bands)

180 320

12.0325 um Surface:Cloud Temperature
Level 1B data (All Bands)

180 320

11.0186 um Surface:Cloud Temperature
Level 1B data (All Bands)

180 320

0.6465 um Land/Cloud Boundaries
Level 1B data (All Bands)

0 350

0.8567 um Land/Cloud Boundaries
Level 1B data (All Bands)

0 350

1.6291 um Land/Cloud Properties
Level 1B data (All Bands)

0 60

0.9041 um Atmospheric Water Vapor
Level 1B data (All Bands)

5 200

0.9361 um Atmospheric Water Vapor
Level 1B data (All Bands)

5 70

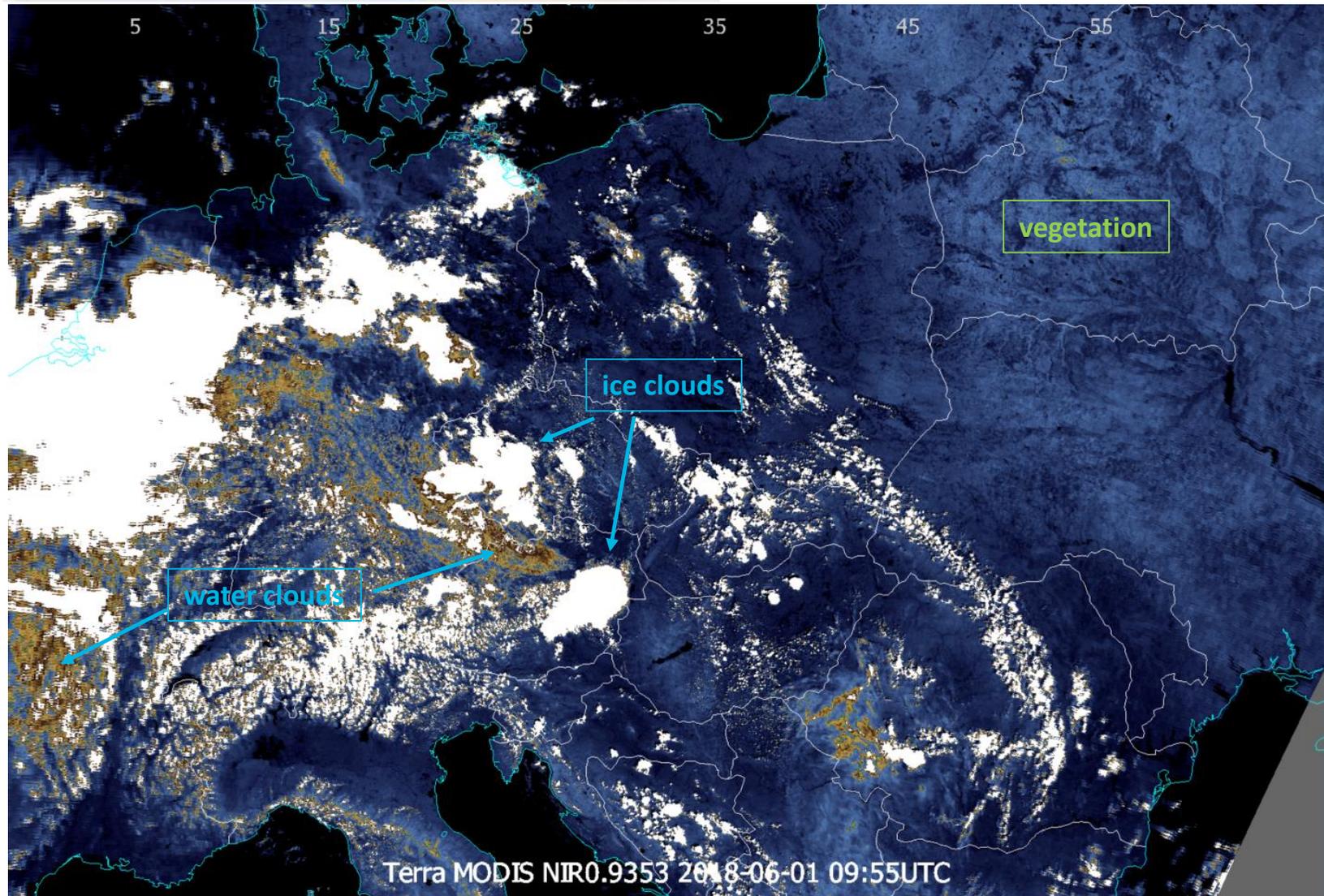
0.9353 um Atmospheric Water Vapor
Level 1B data (All Bands)

5 60

- NIR0.9 solar channel



NIR0.9 imagery examples – (cloud/vegetation classification?)



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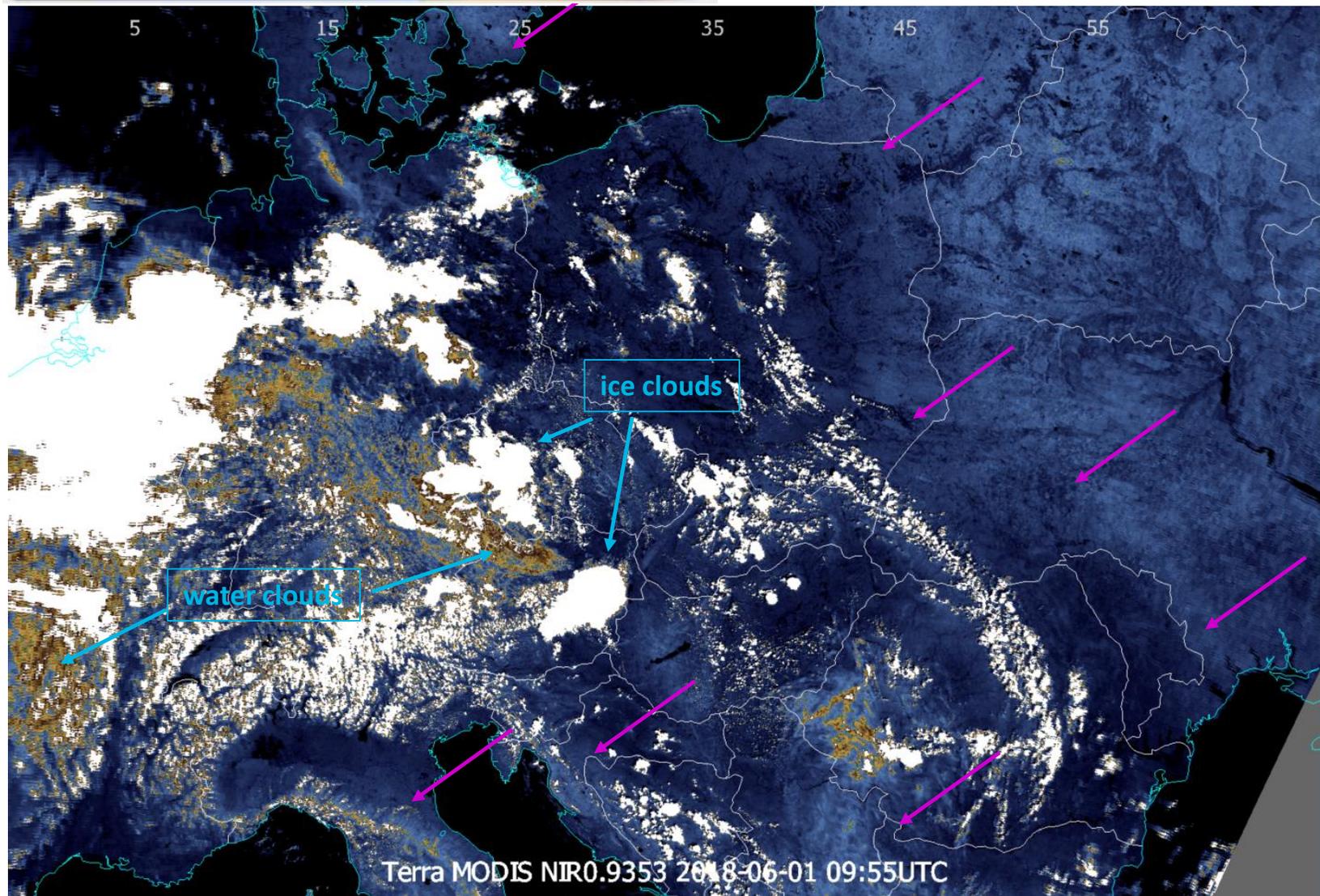
0.9353 um Atmospheric Water Vapor
Level 1B data (All Bands)

5 60

- NIR0.9 solar channel
- Colour coded single channel



NIR0.9 imagery examples – low level moisture



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World Coastlines

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RGB 1.6 / 0.9 / 1.3
Level 1B data (All Bands)

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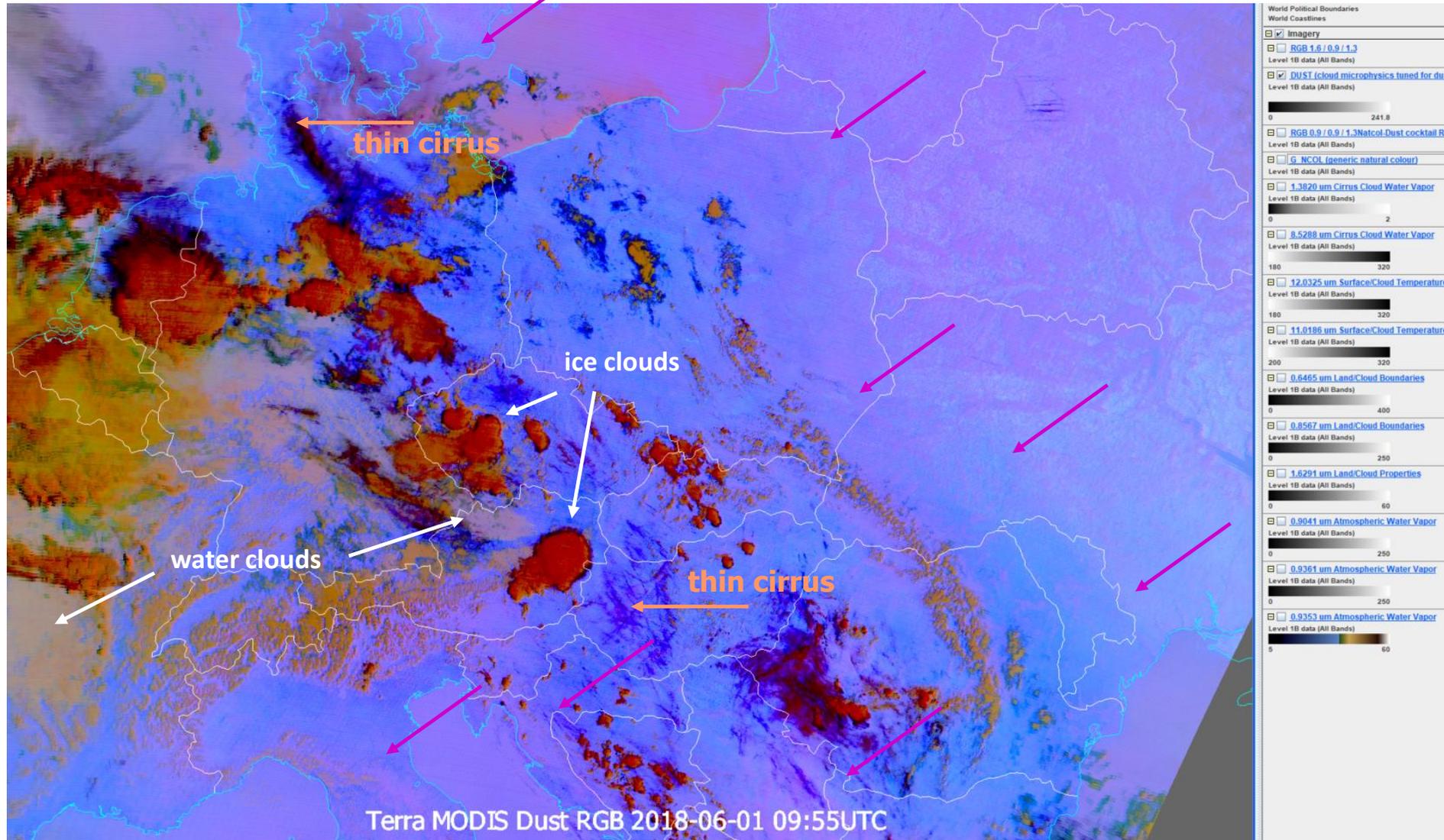
0.9361 um Atmospheric Water Vapor
Level 1B data (All Bands)

0.9353 um Atmospheric Water Vapor
Level 1B data (All Bands)

- NIR0.9 solar channel
- Colour coded single channel



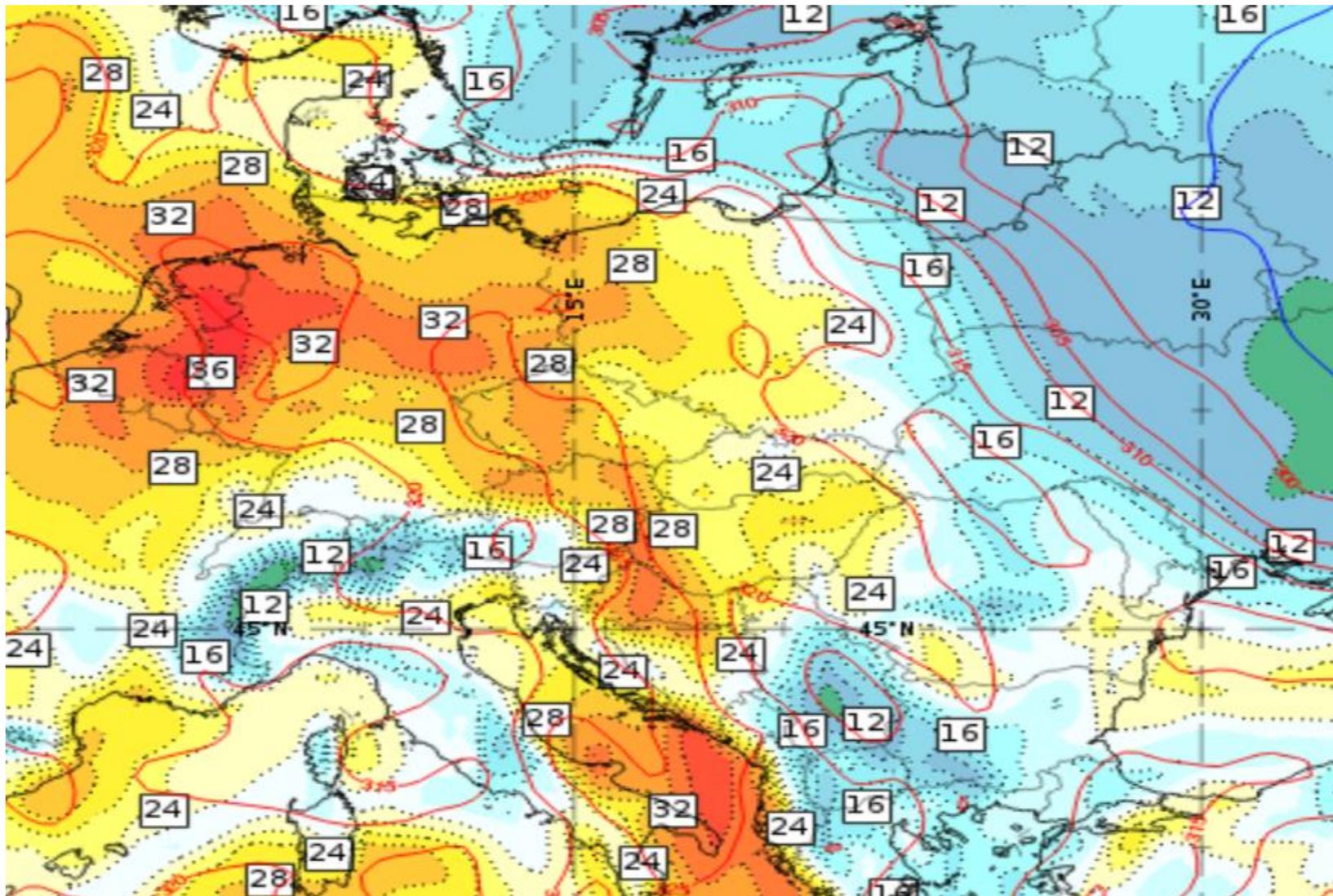
NIR0.9 imagery examples – thin cirrus/ low clouds / dry



- Dust RGB for comparison
 - Red component BTD12-10 (low level moisture, thin cirrus)



NIR0.9 imagery examples

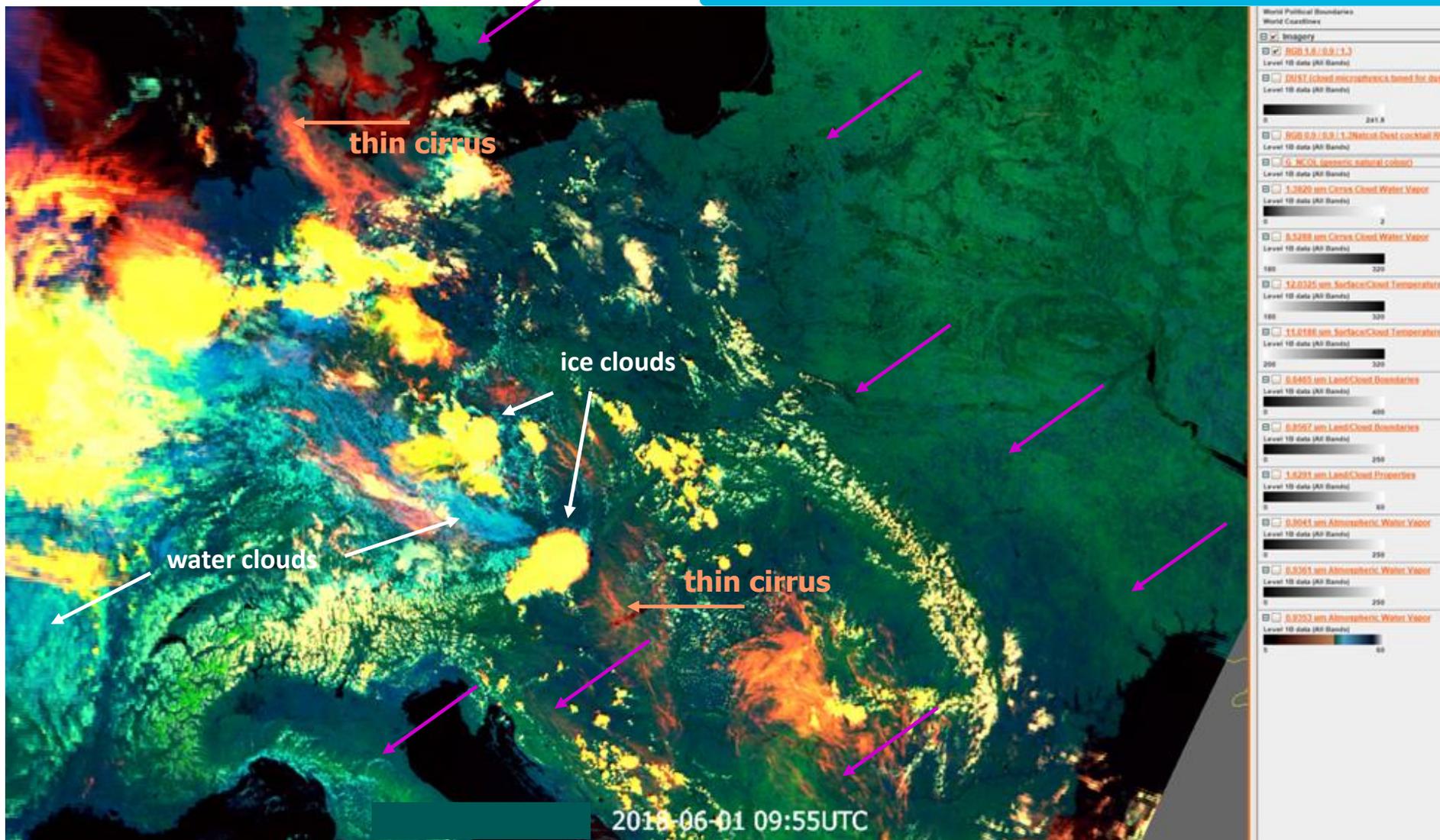


- NWP comparison
 - Total Column Water + ThetaE at 850hPa



NIR0.9 imagery examples

RGB: NIR1.38 (0-3%) - NIR0.9353 (lower end) - NIR1.64



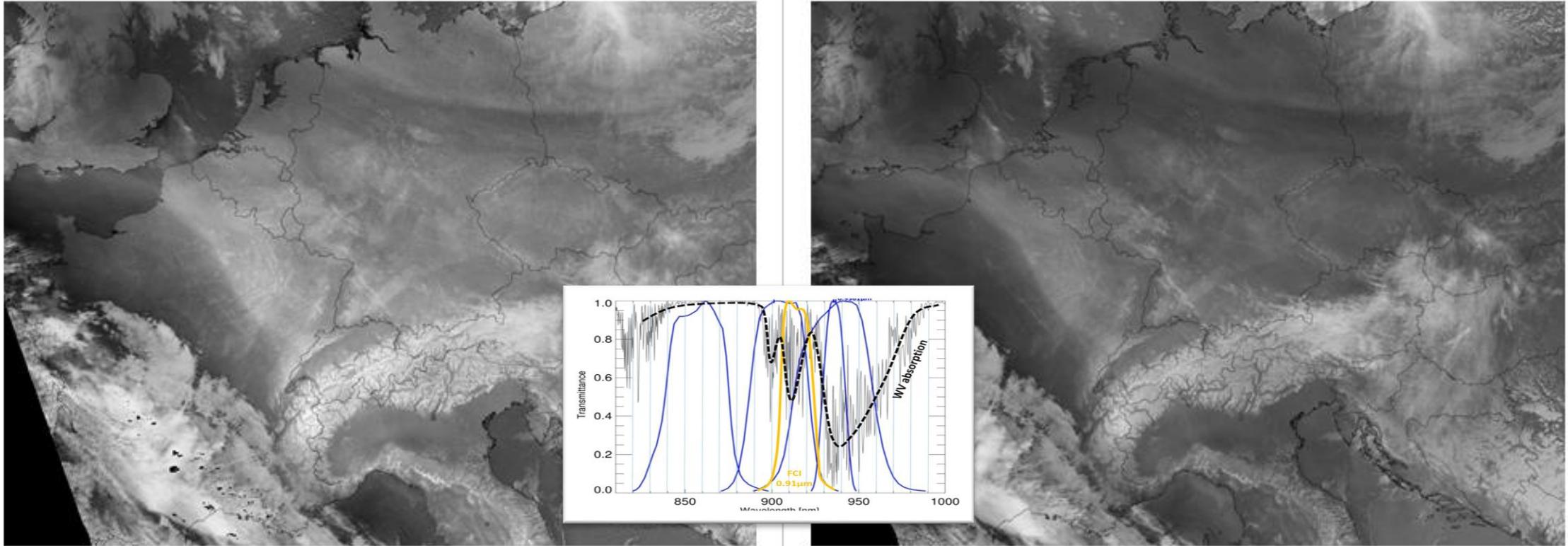
- 'LL moisture' RGB

- Similarity with Cloud Type RGB



NIR0.9 imagery examples – slant angle ('MODIS vs FCI')

Aqua SMT (Solar Moisture Transmittance) 2005-10-15 11:55UTC



SMTproxy (NIR 0.905)

SMT range: 0.6 .. 1.0

alternative SMT (NIR 0.940)

- **SMT range: 0.2 .. 1.0**



NIRO.9 imagery examples – smtNatcol: Natural Colour RGB heritage

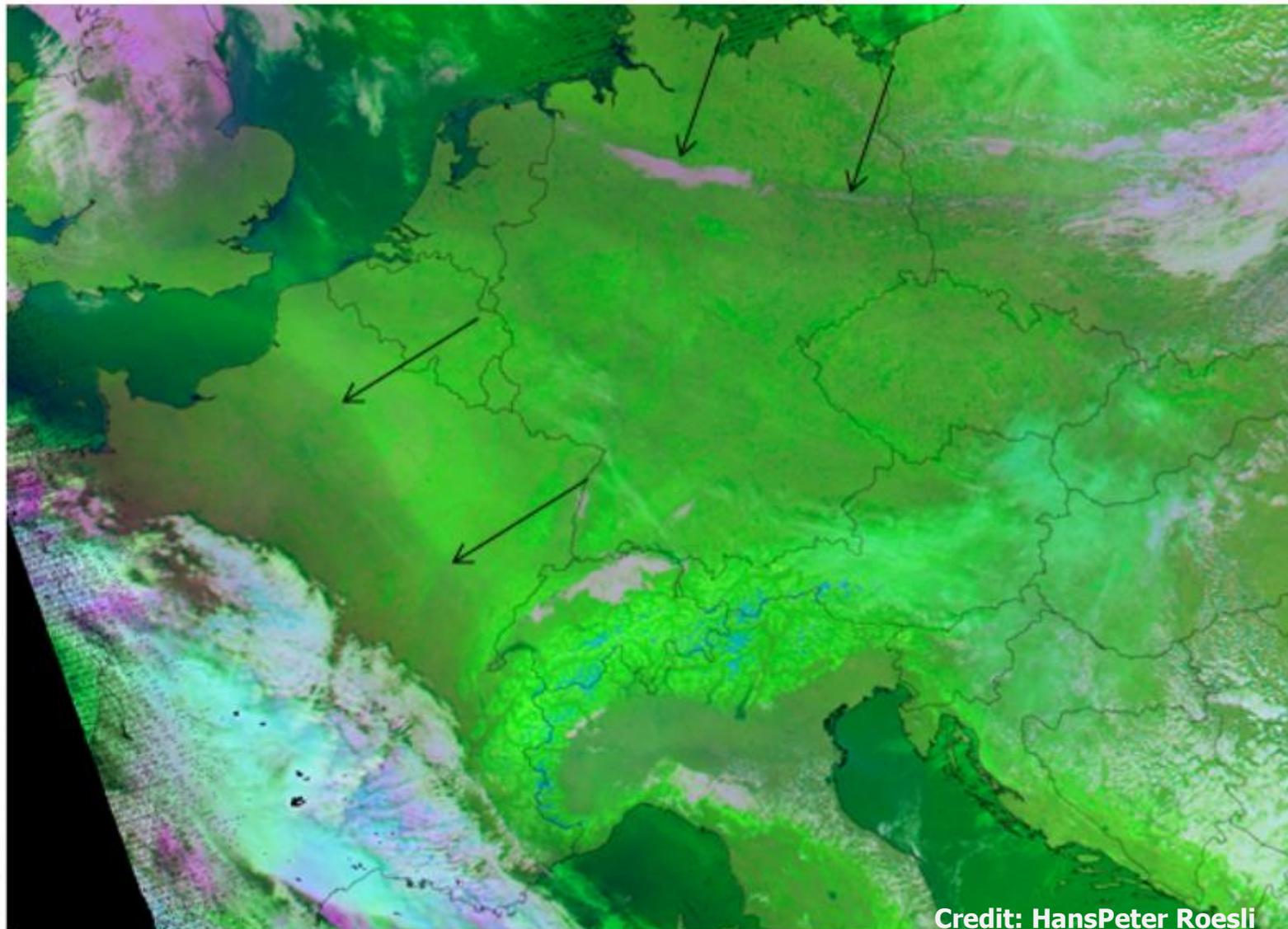
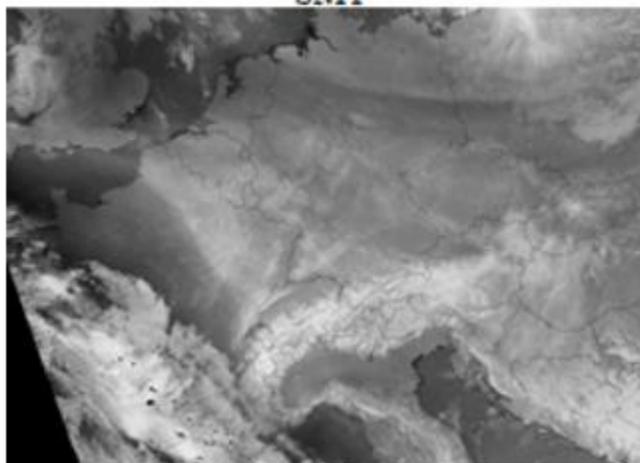
Aqua SMT Natural Colour RGB (SMT on green) 2005-10-15 11:55UTC



Natural Colour RGB

Aqua 2005-10-15 11:55UTC

SMT

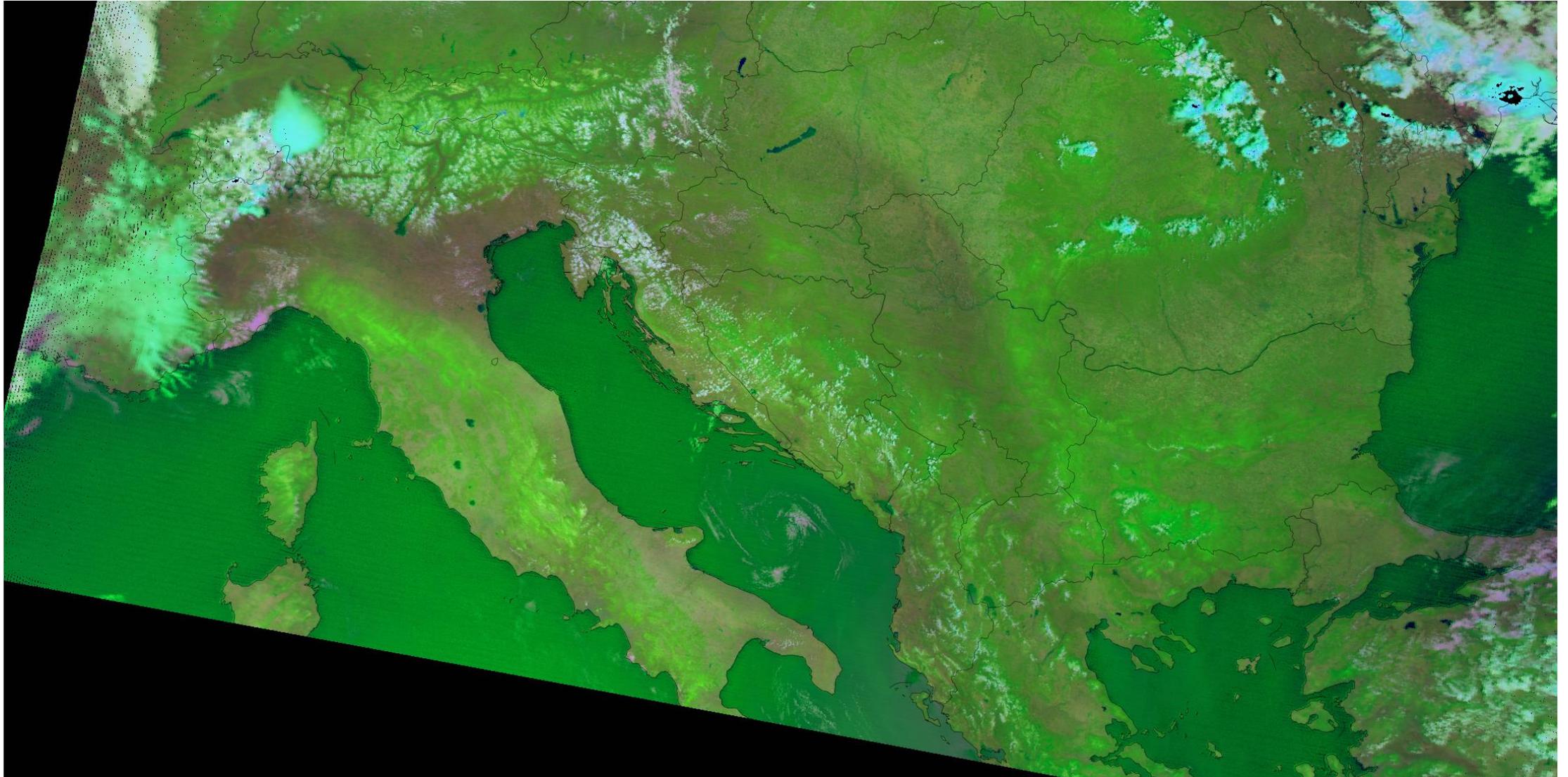


Credit: HansPeter Roesli



NIR0.9 imagery examples – ‘masked’ moisture

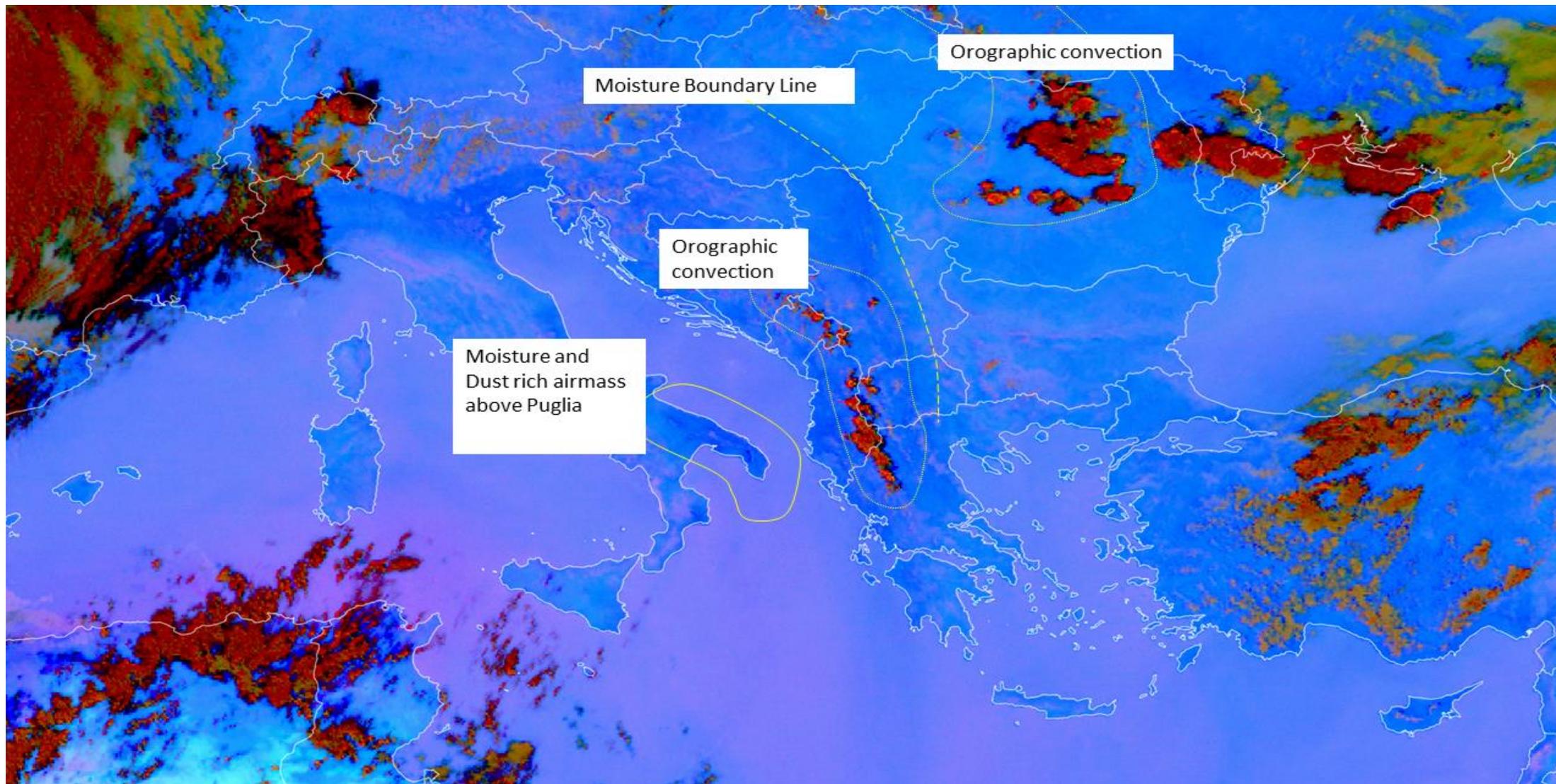
MODIS SMT Natural Colour RGB (SMT on green) 2022-06-30, 09:30UTC





NIR0.9 imagery examples – ‘masked’ moisture

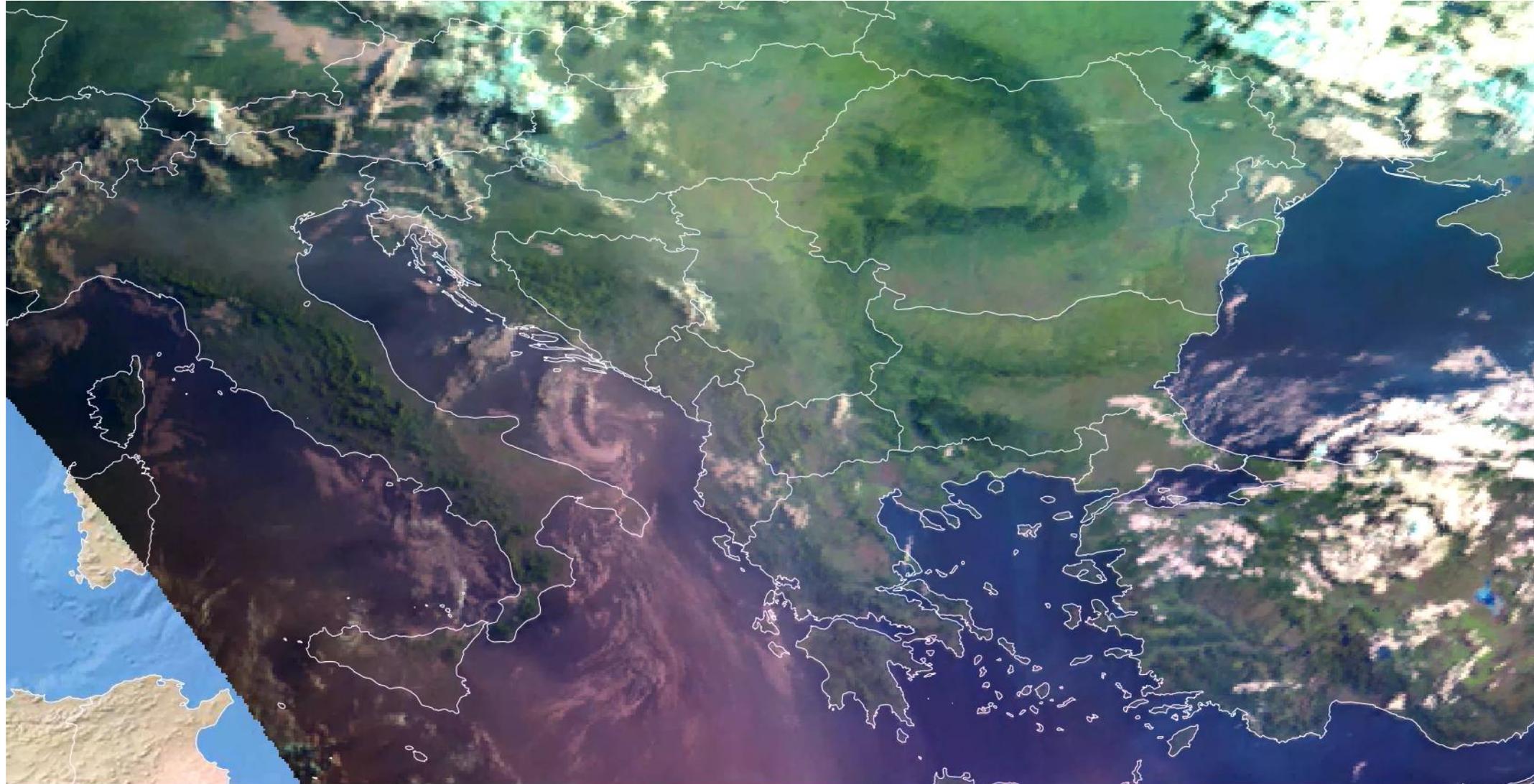
MODIS SMT Natural Colour RGB (SMT on green) 2022-06-30, 09:30UTC





NIR0.9 imagery examples – smtNatcol: Natural Colour RGB heritage

MODIS SMT Natural Colour RGB (SMT on green) 2022-06-30, 09:30UTC

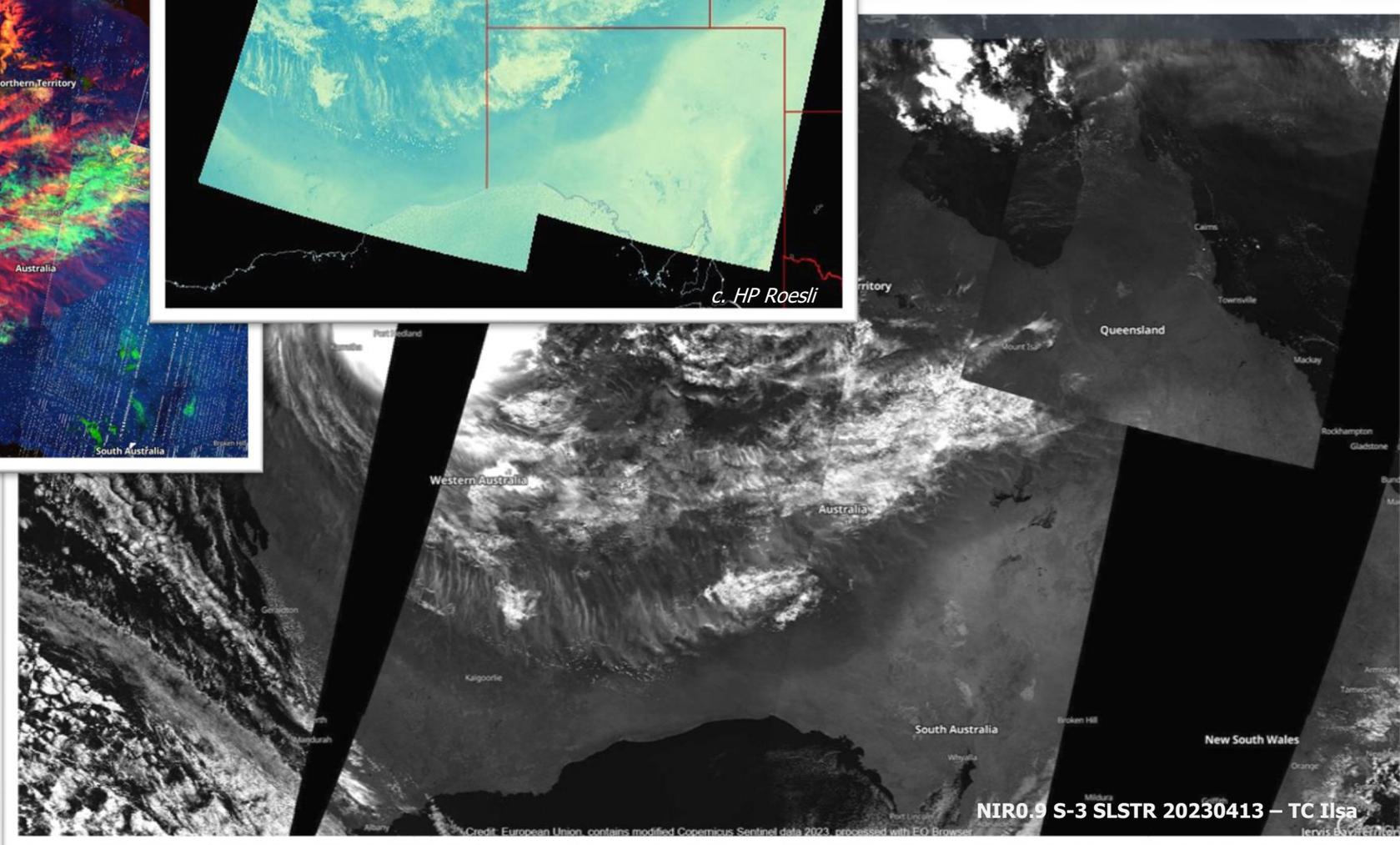
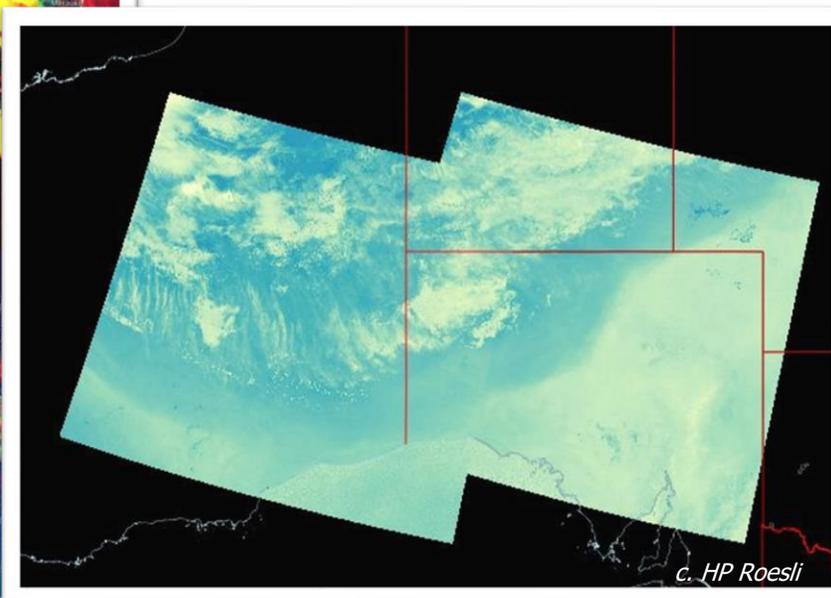
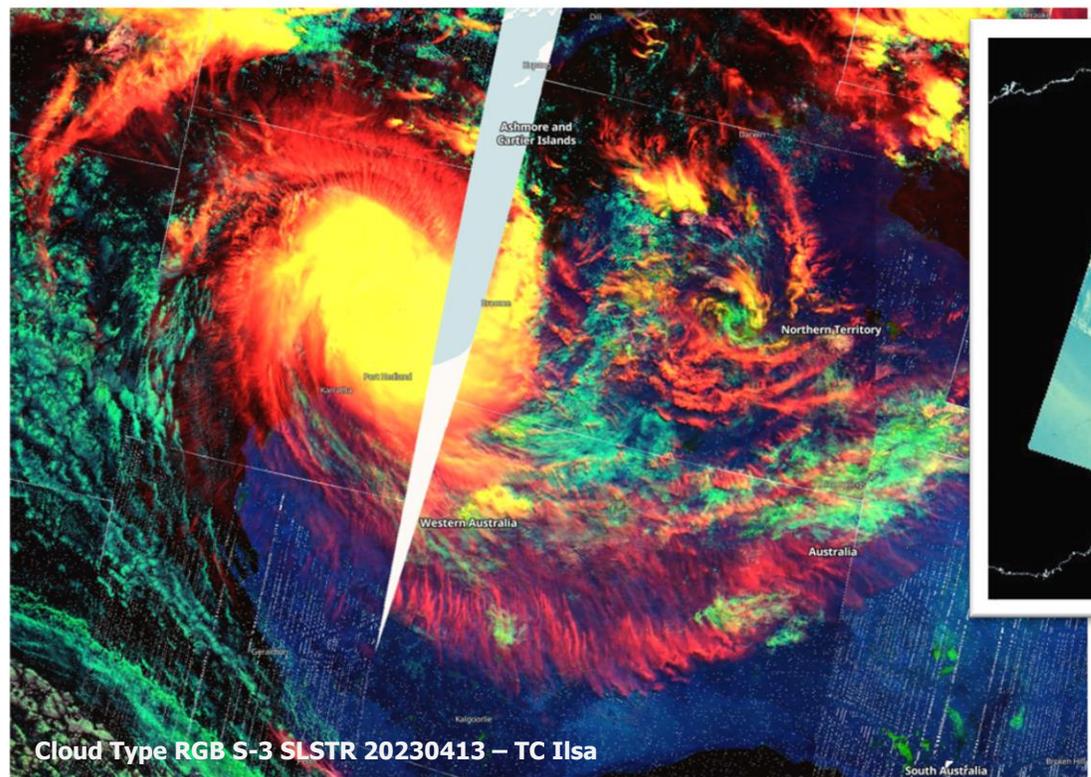


2022-06-30 04:00:00 UTC

Credit: Hans Peter Koesli



Thank you – questions?



- LL moisture
 - Clouds
 - Vegetation
 - Aerosols
 - ...