

Observing (non)meteorological features over sea and coastal areas

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Focus

Features observed by imaging radiometers on polar-orbiting and geosynchronous weather satellites,

e.g. SEVIRI-Meteosat, AVHRR-Metop, ABI-GOES, VIIRS-NOAA/JPSS

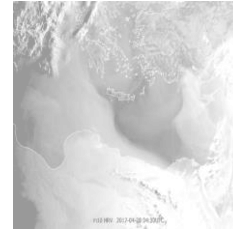
- 24-7 real-time data – real-time operations
- Hecto- to kilometric spatial resolution
- Infrared (IR) and visible (VIS) bands/channels
- Single-band and multi-band (RGB) imagery
- Static imagery and movies

Sea surface is special

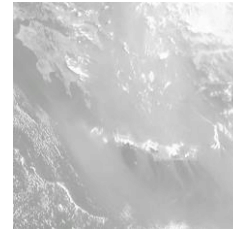
- Provides a homogeneous background to the scenes (at the spatial resolution at hand)
- VIS – very dark or black
- IR – constant (equivalent black-body) temperature
- Good contrast (as compared to features over irregular terrain) in
 - VIS – faint features
 - IR – small spatial temperature differences
- Features develop/evolve undisturbed (stirred by winds, etc.)

Considering features related to

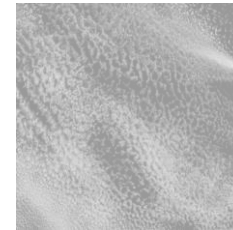
- Air pollution



- Wind systems

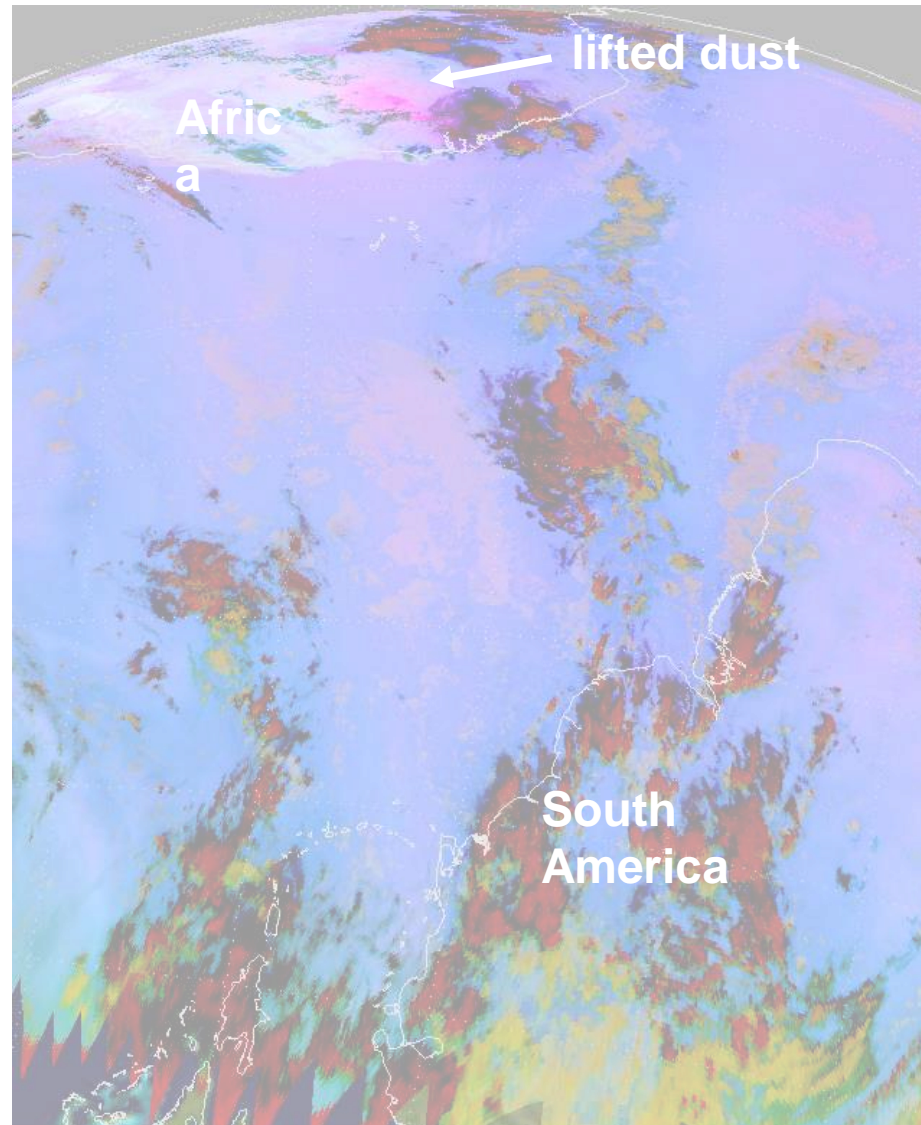


- Cloud patterns



Air pollution

Lifted Saharan dust crossing Atlantic in 6 days over

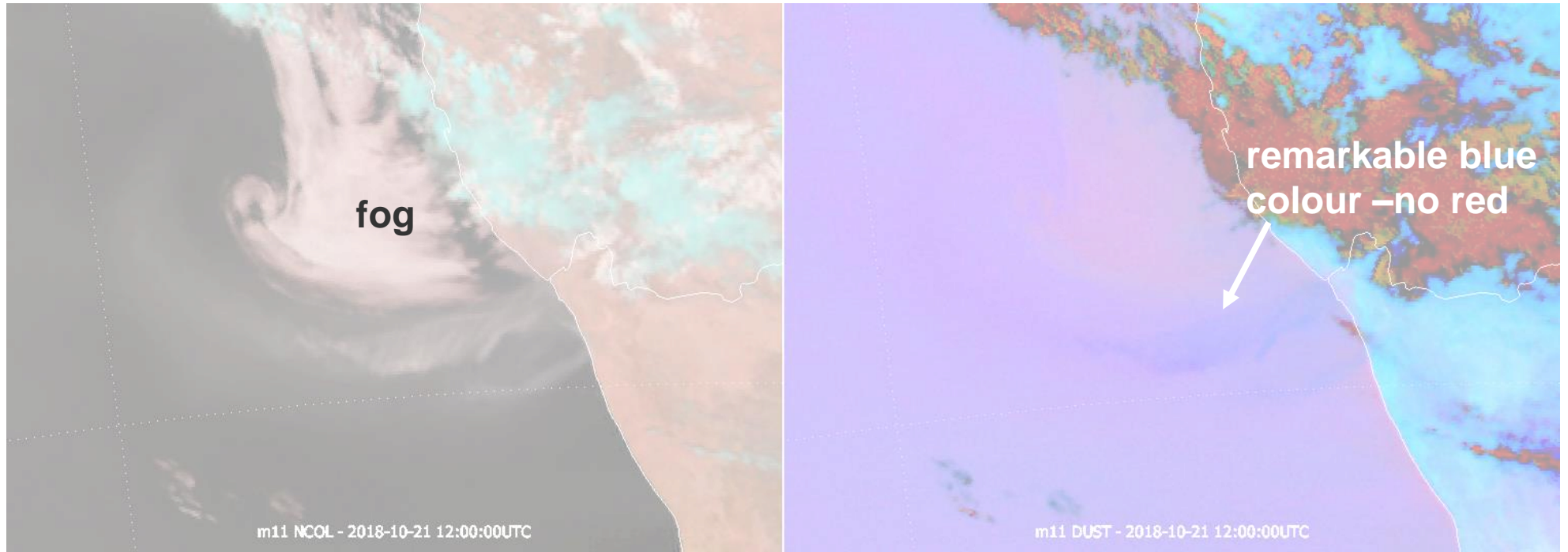


**Dust RGB
SEVIRI-Meteosat**

**R IR12.0-IR10.8 $\Delta T > 0K$
G IR10.8-IR8.7 $\Delta T > 0K$
B IR10.8**

**dust top fairly cool
→ coherent pink
colouring over time**

Hot Namibian dust over cold coastal waters



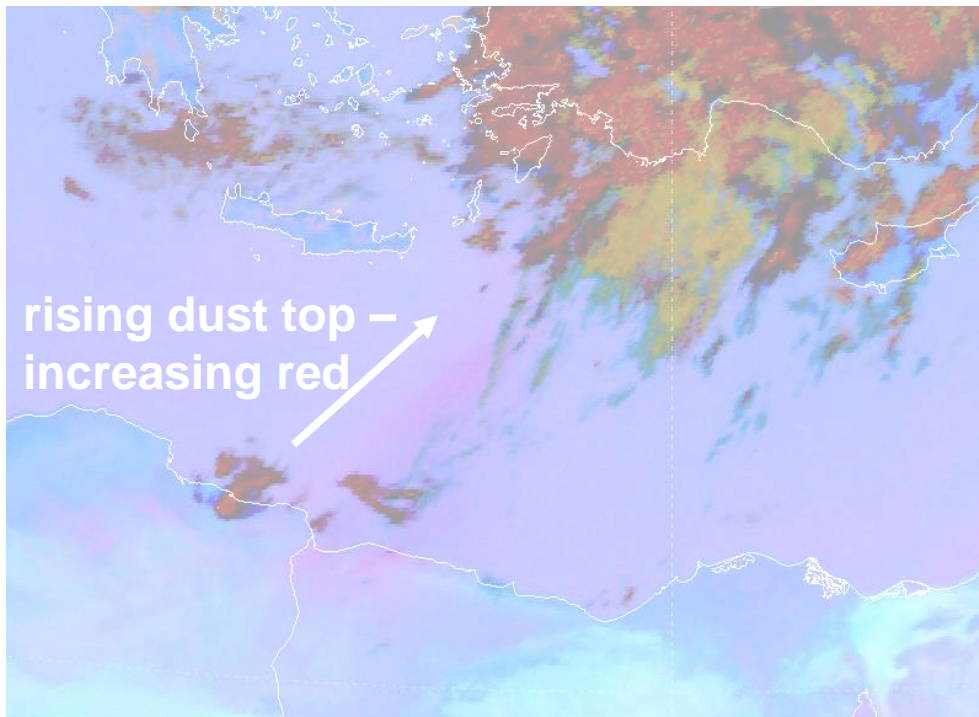
Natural-Colour RGB
SEVIRI-Meteosat

R NIR1.6
G VIS0.8
B VIS0.6

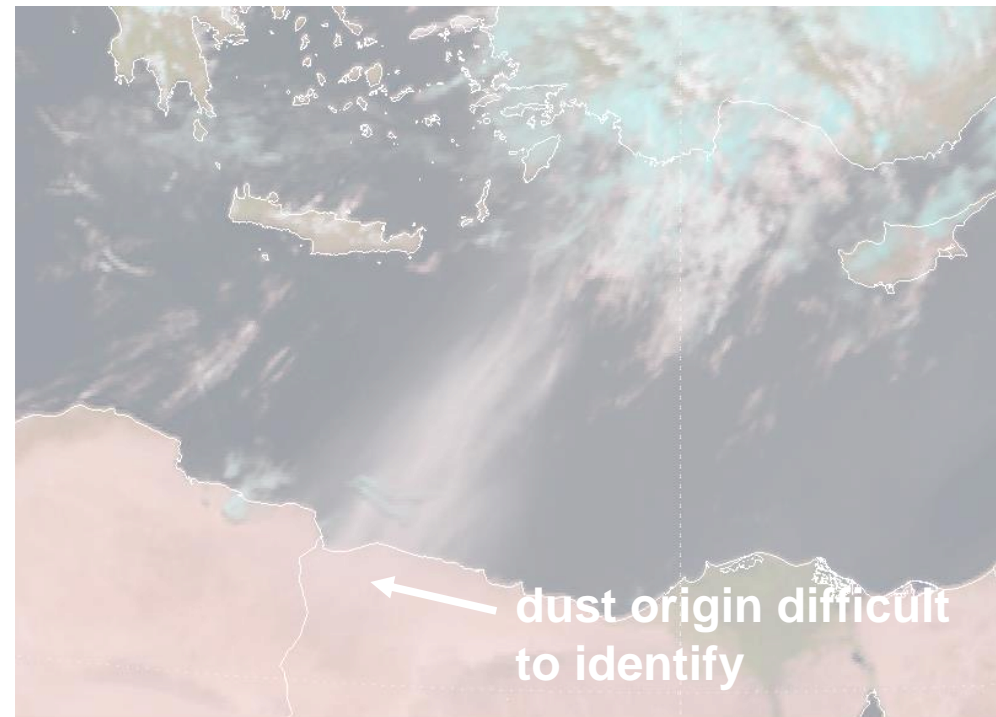
Dust RGB
SEVIRI-Meteosat

R IR12.0-IR10.8 $\Delta T \ll 0K$
G IR10.8-IR8.7
B IR10.8

Ascending top of Saharan dust over Central Mediterranean

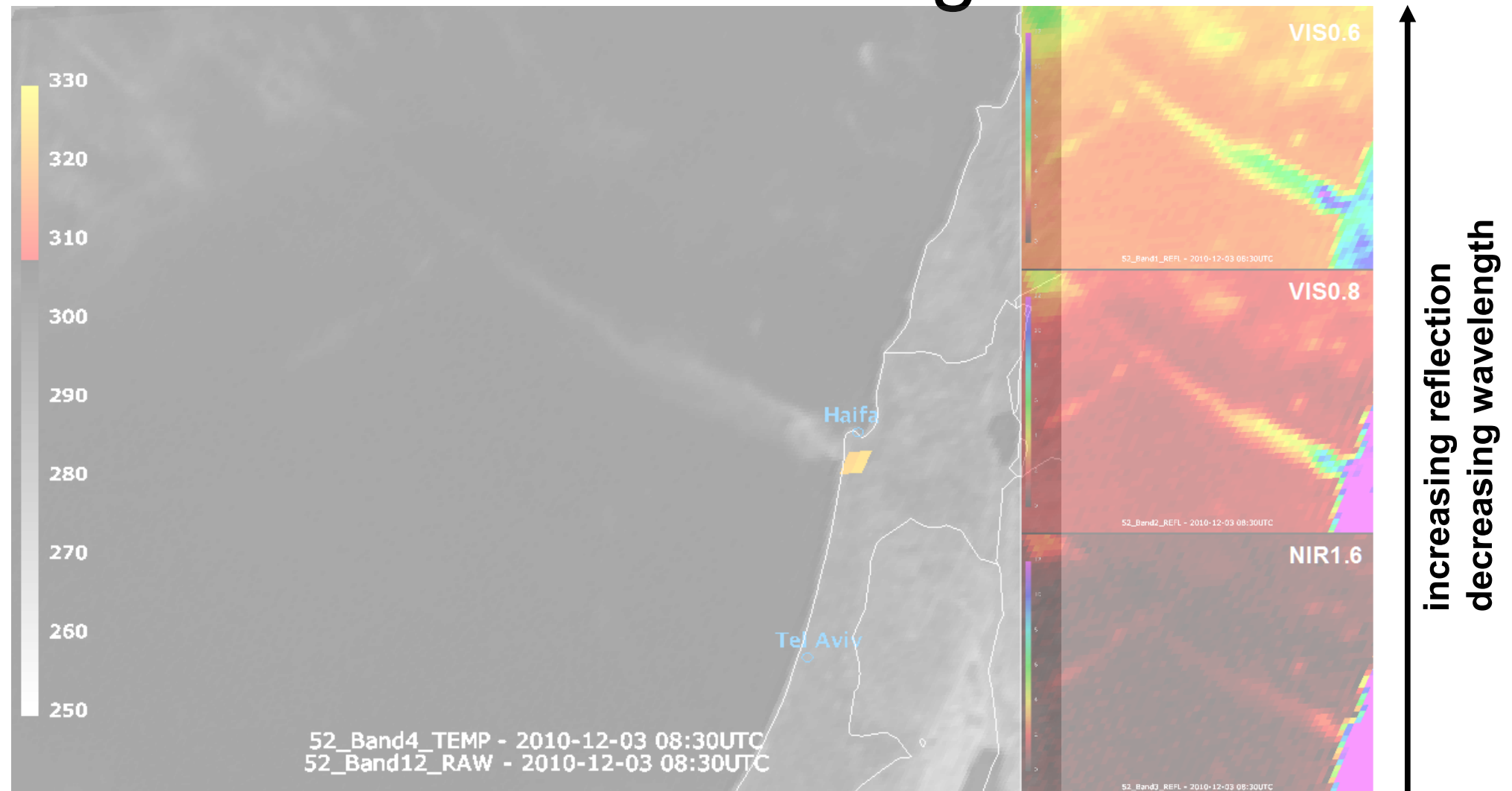


Dust RGB
SEVIRI-Meteosat



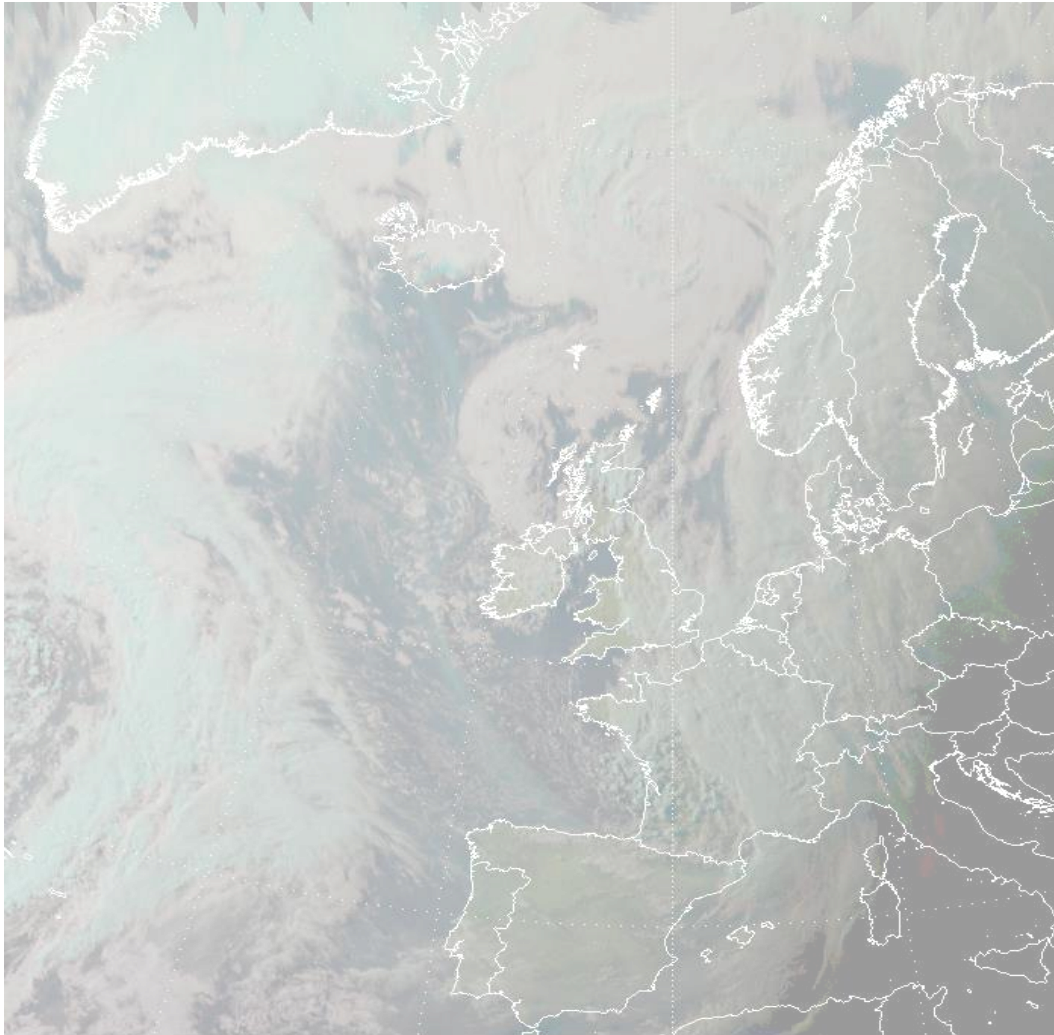
Natural-Colour RGB
SEVIRI-Meteosat

Smoke from forest fire – Rayleigh scattering



HRV & IR3.9
SEVIRI-Meteosat

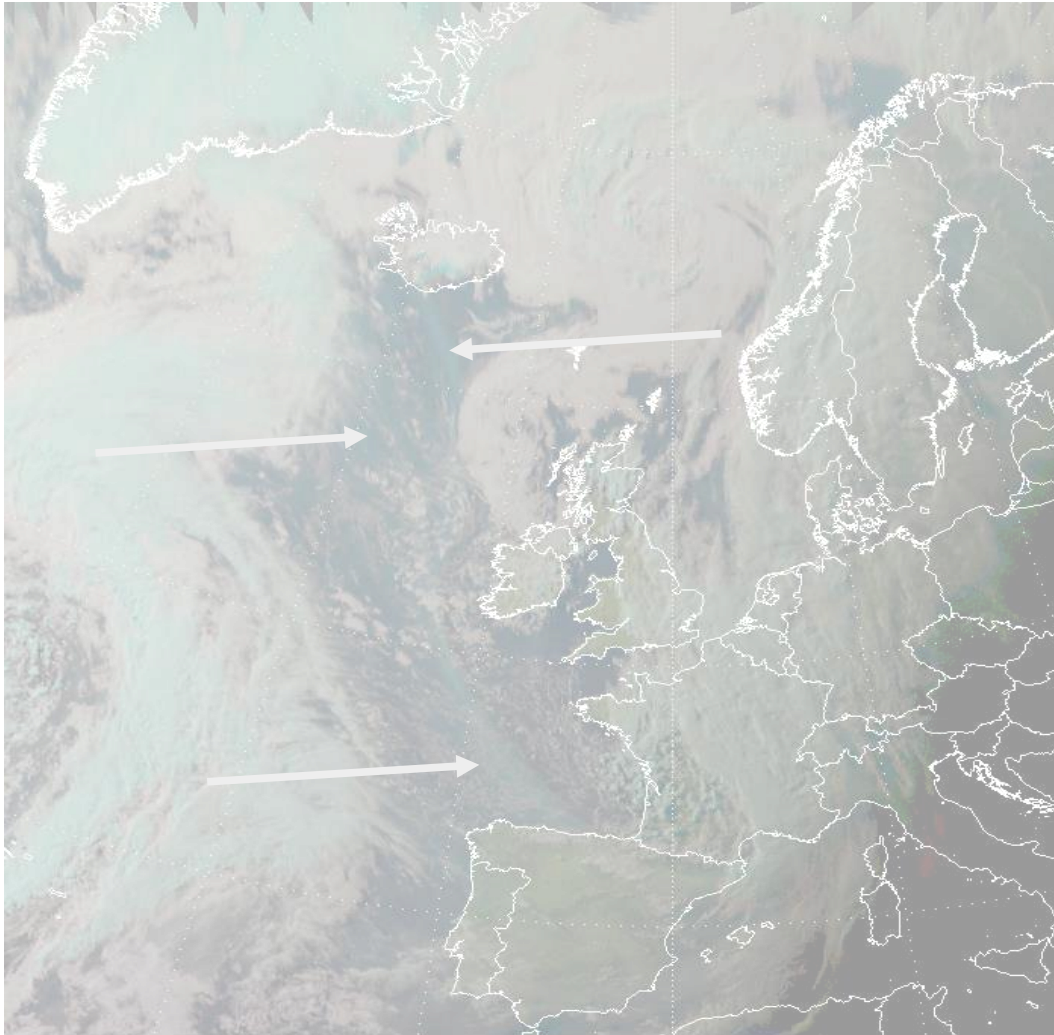
Smoke streak from Canadian fires over Eastern Atlantic



m10 NCOL - 2016-05-22 18:30UTC

Natural-Colour RGB
SEVIRI-Meteosat
evening sun → enhanced scattering

Smoke streak from Canadian fires over Eastern Atlantic



m10 NCOL - 2016-05-22 18:30UTC

Natural-Colour RGB
SEVIRI-Meteosat
evening sun → enhanced scattering
→ faint blue streaks

Indian-Pakistani aerosol – satellite vs solar position at mid-morning



**geostationary Meteosat 0°
low solar angle
Strong forward scattering**

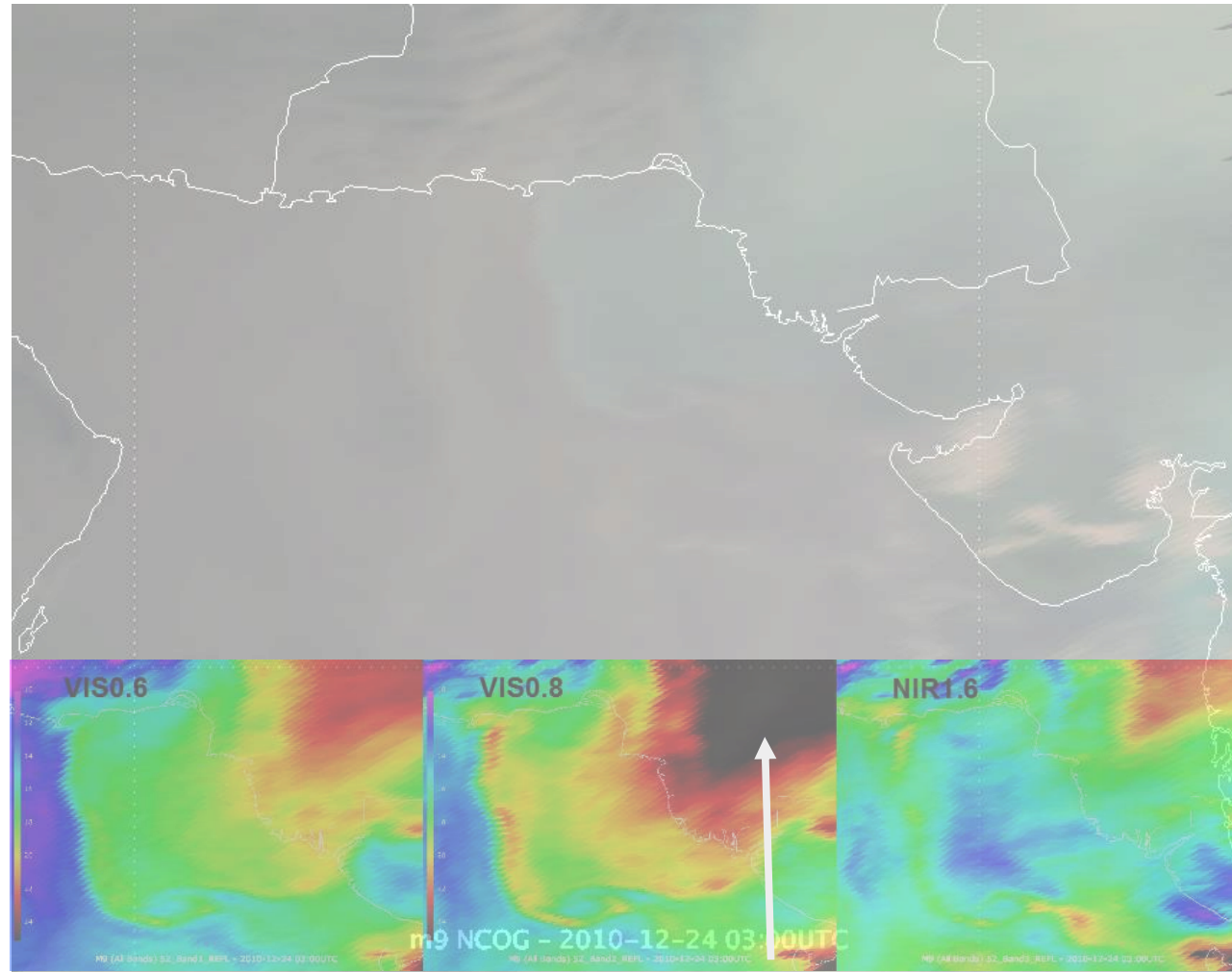
**mid-morning polar orbit Metop
higher solar angle
much less scattering**

Natural-Colour RGB

SEVIRI-Meteosat

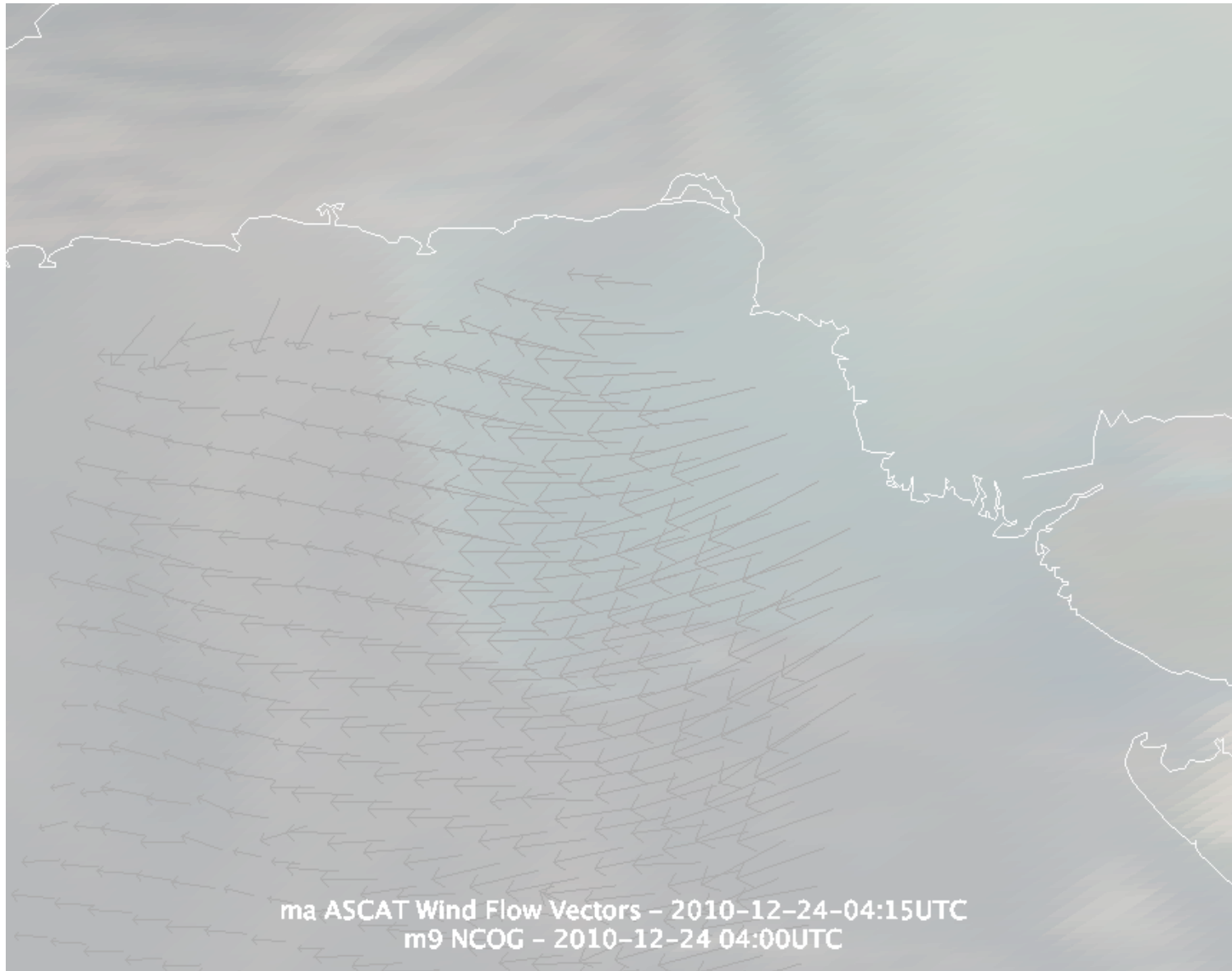
AVHRR-Metop

Indian-Pakistani aerosol – Mie scattering

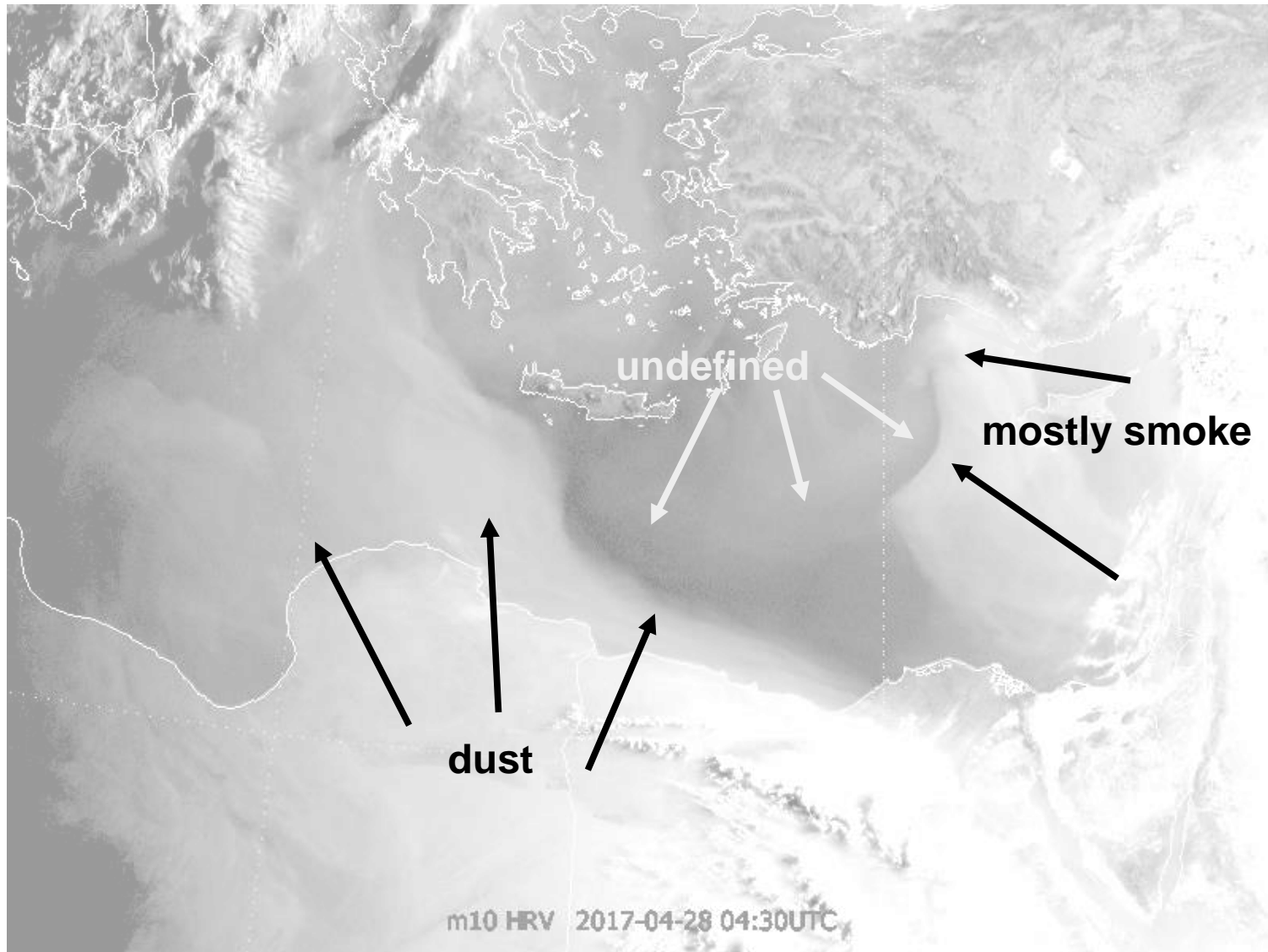


**VIS0.8 signal dominates
→ black carbon?
(hinted by research flights!)**

Indian-Pakistani aerosol – ASCAT winds match up with aerosol front



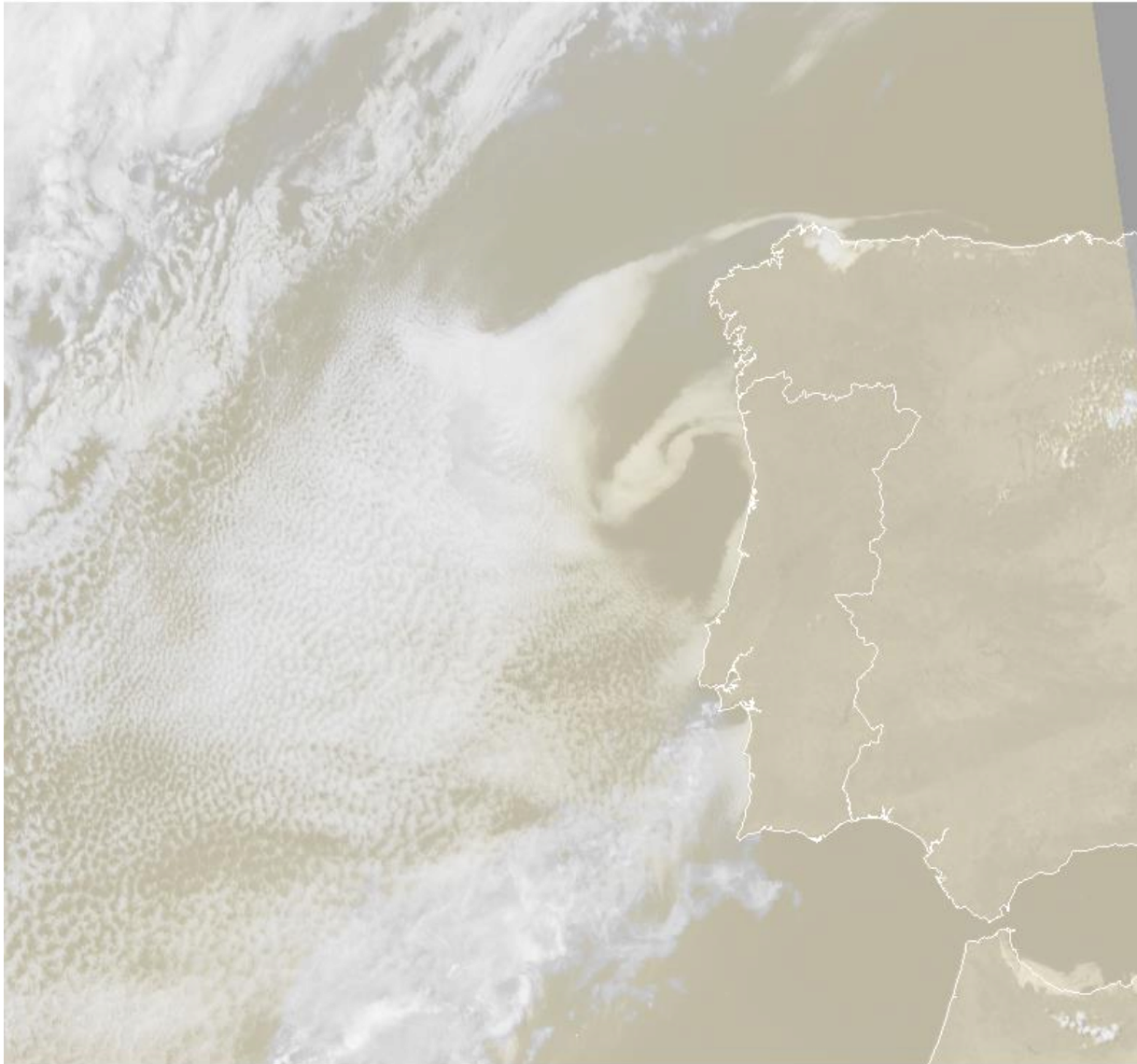
Complex aerosol mix over Eastern Mediterranean



**enhanced HRV
SEVIRI-Meteosat
early morning**

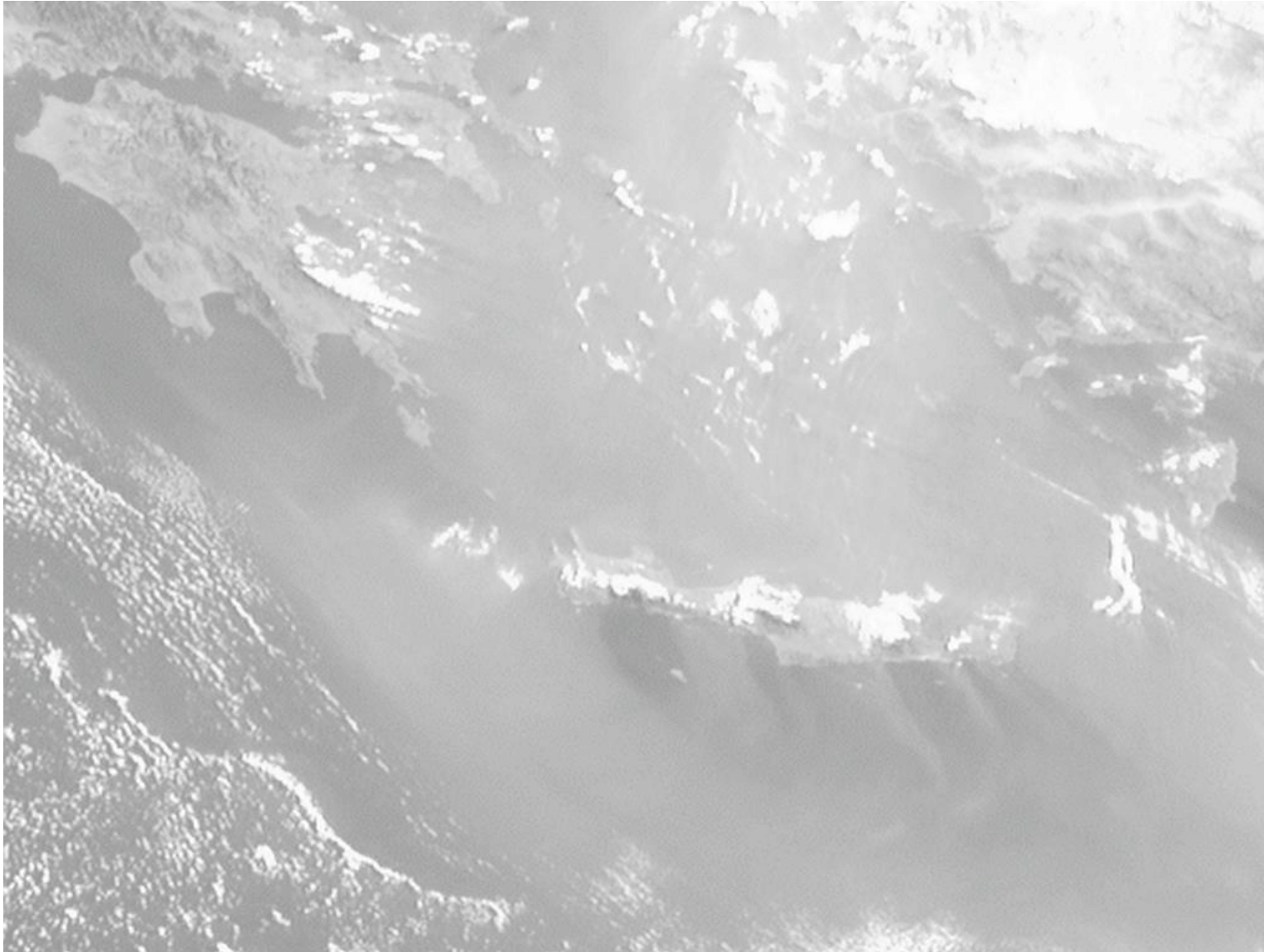
Wind systems

Low-level eddy revealed by Sc cloud deck



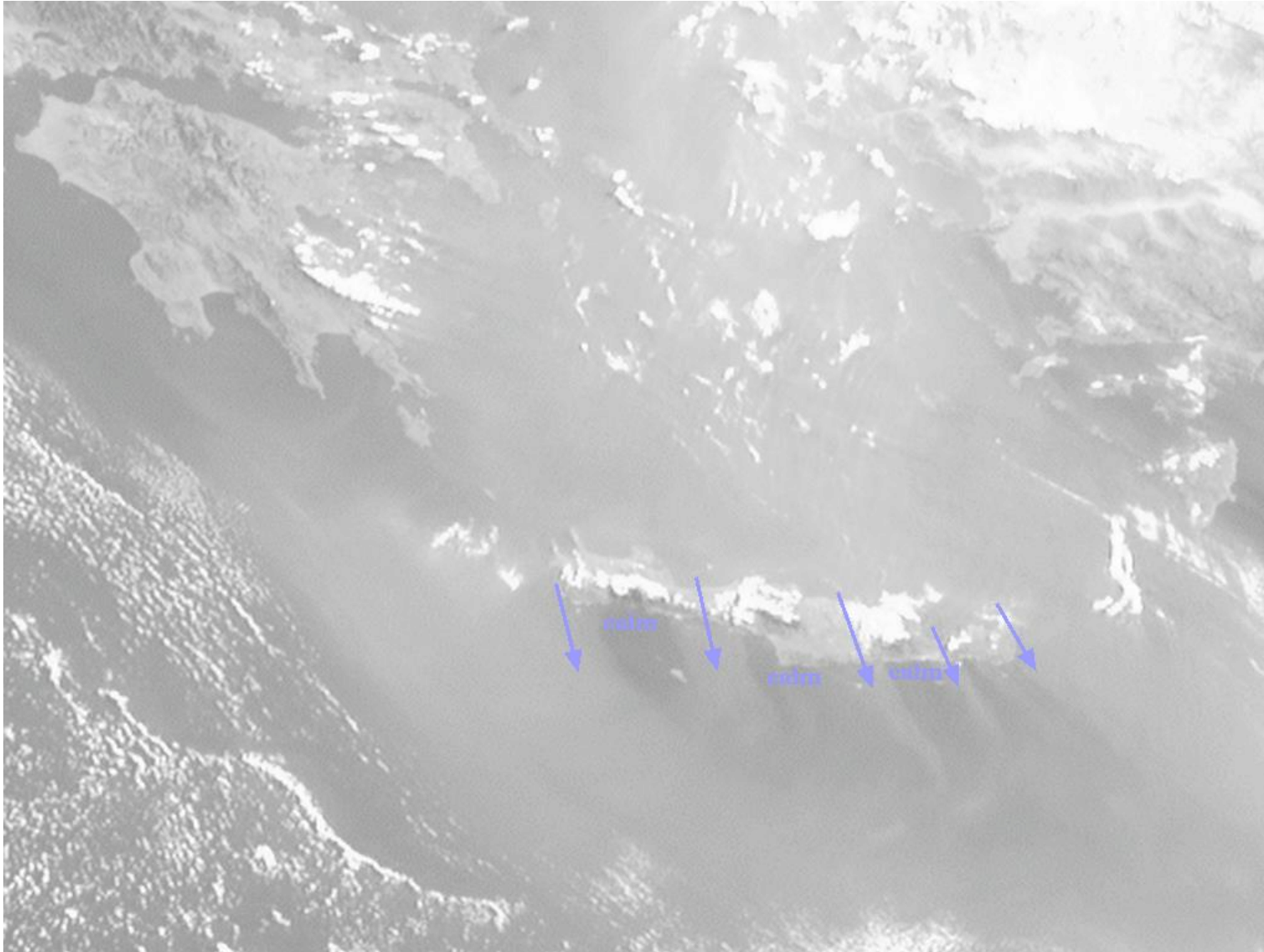
**HRV & IR10.8
SEVIRI-Meteosat**

Polluted Etesians modulated by Crete



**HRV
Meteosat**

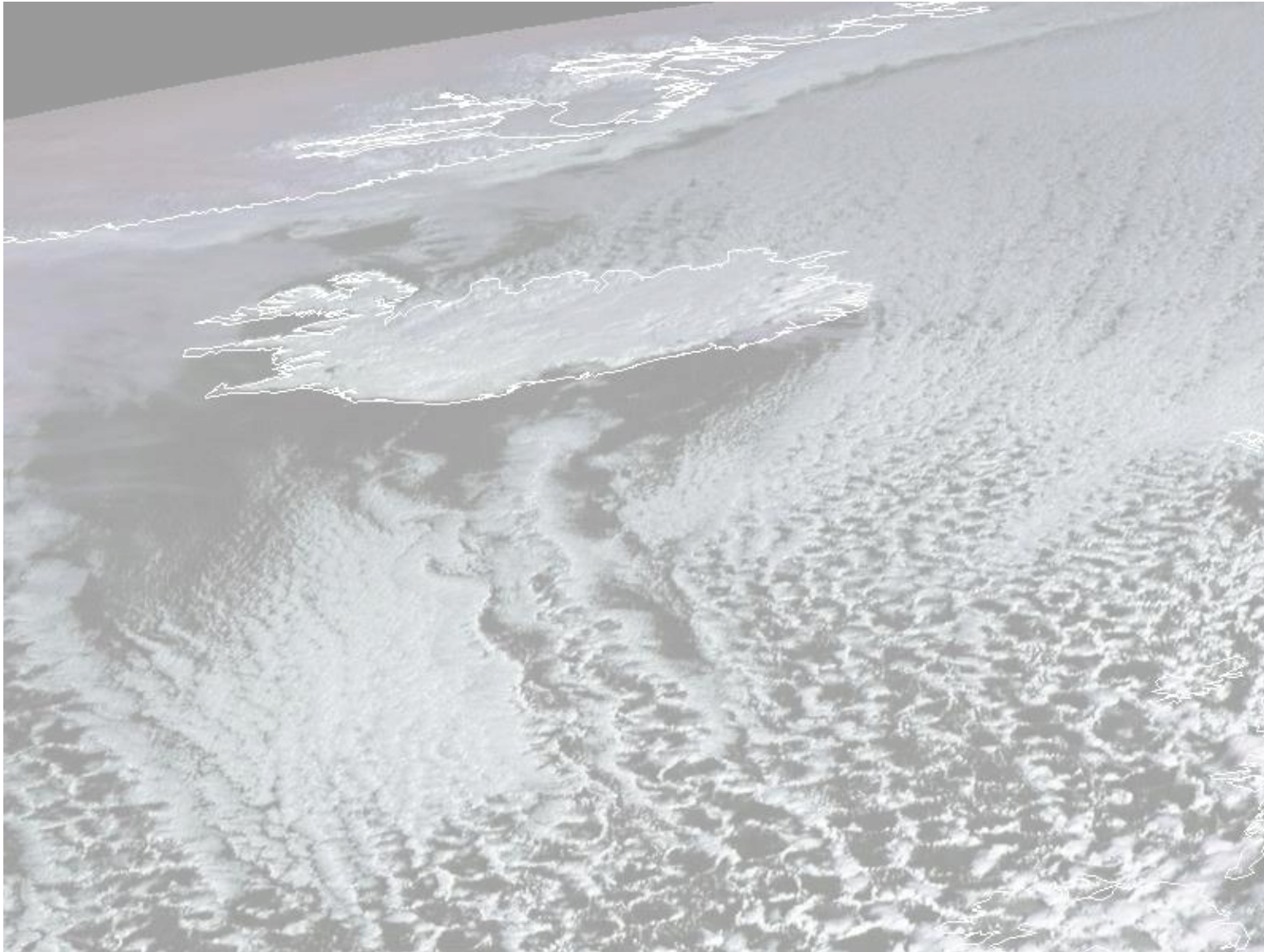
Polluted Etesians modulated by Crete



**HRV
Meteosat**

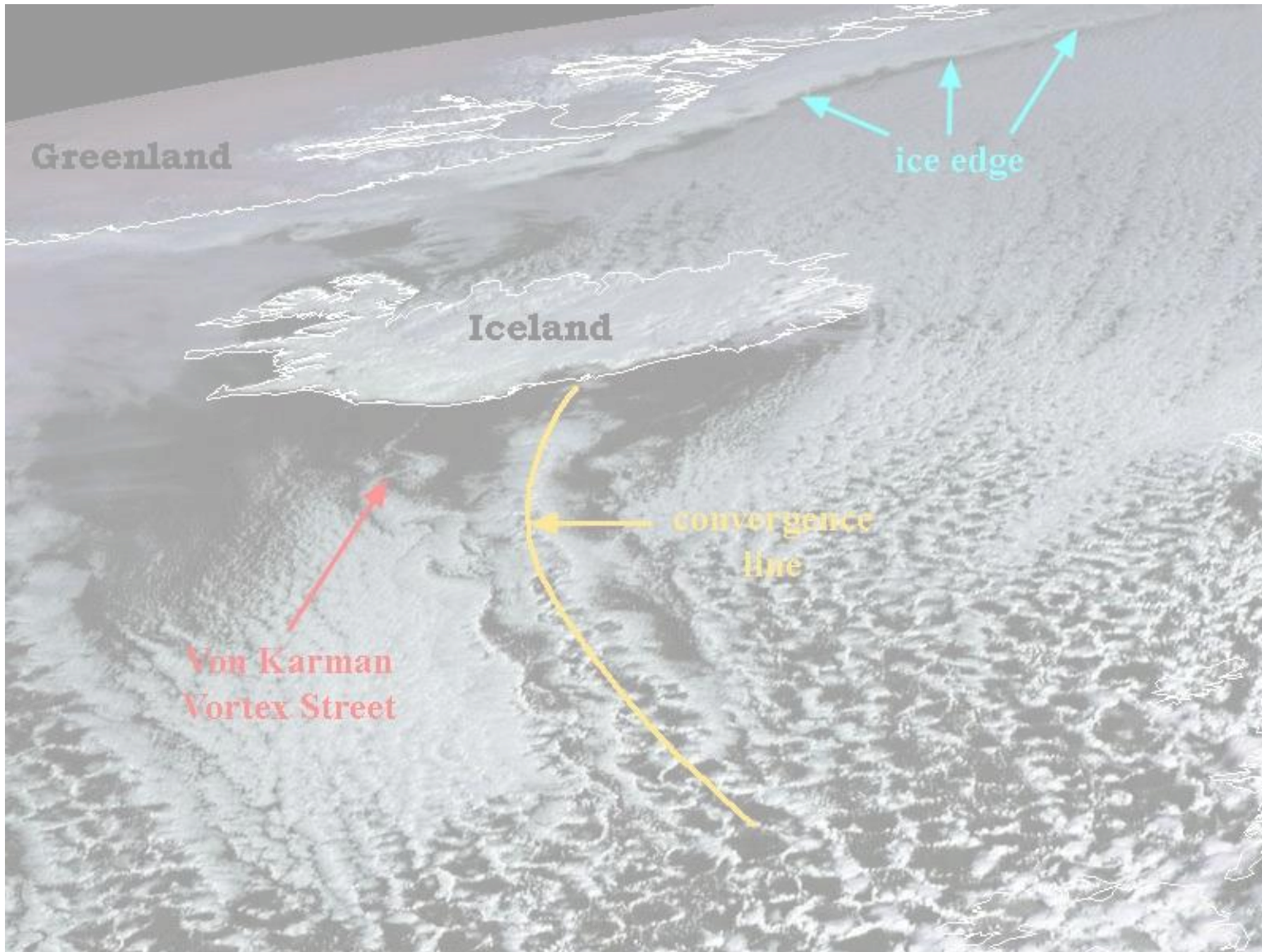
**movie with
5-minute imaging**

Cloud streets and convergence line in cold-air outbreak



**HRV & IR10.8
SEVIRI-Meteosat**

Cloud streets and convergence line in cold-air outbreak



**HRV & IR10.8
SEVIRI-Meteosat**

Cloud patterns

Von Kármán Vortex Street in the lee of Madeira



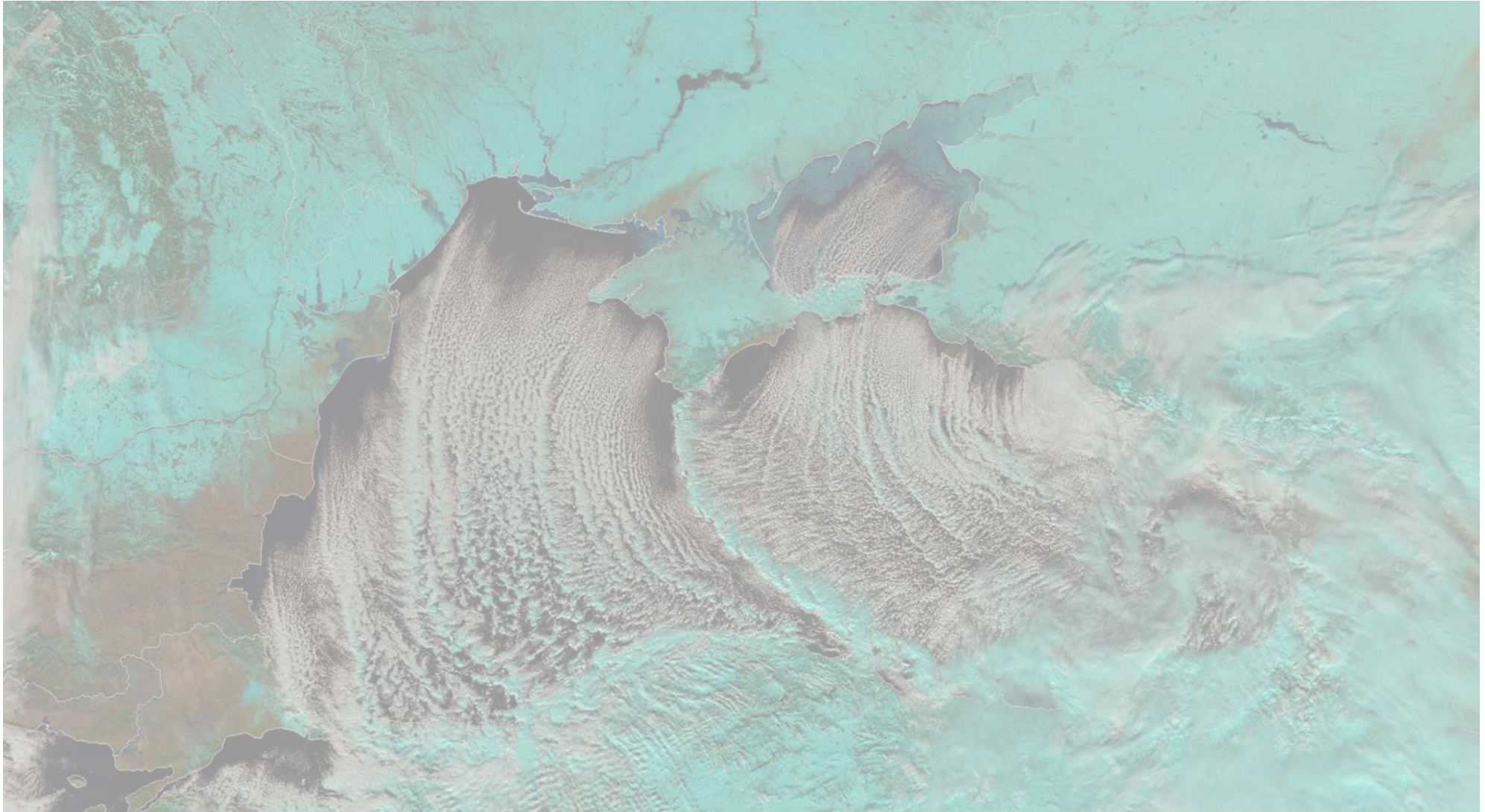
Natural-Colour RGB
AVHRR-Metop

Kelvin Ship Waves behind South Sandwich Islands in the South Atlantic



Natural-Colour RGB / VIIRS(375m)-SuomiNPP

Stratocumulus streets outline cold-air outbreak over the Black Sea



npp INCOL - 2015-01-08 10:38UTC

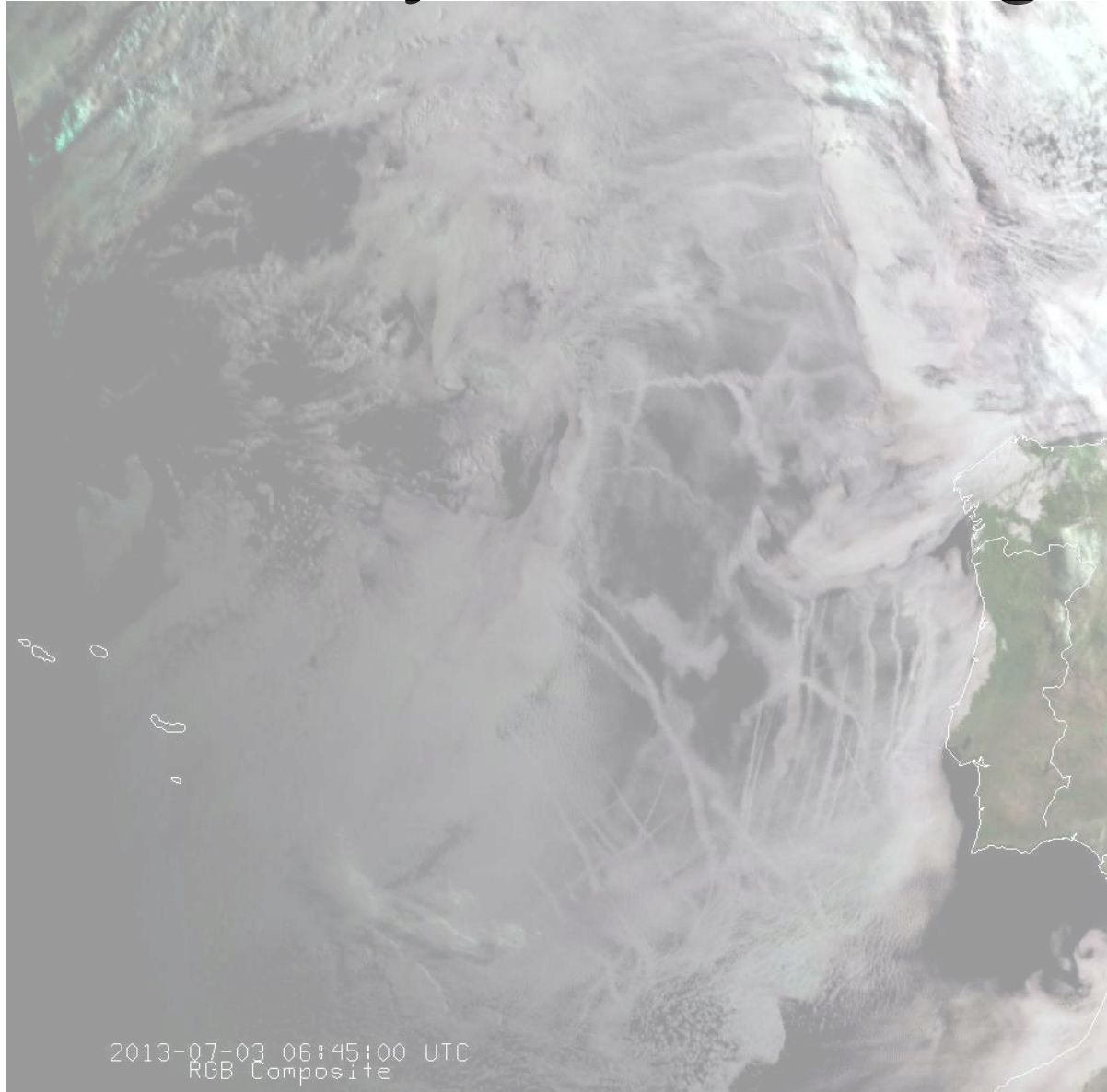
Natural-Colour RGB / VIIRS(375m)-SuomiNPP

Open and closed Bénard cells



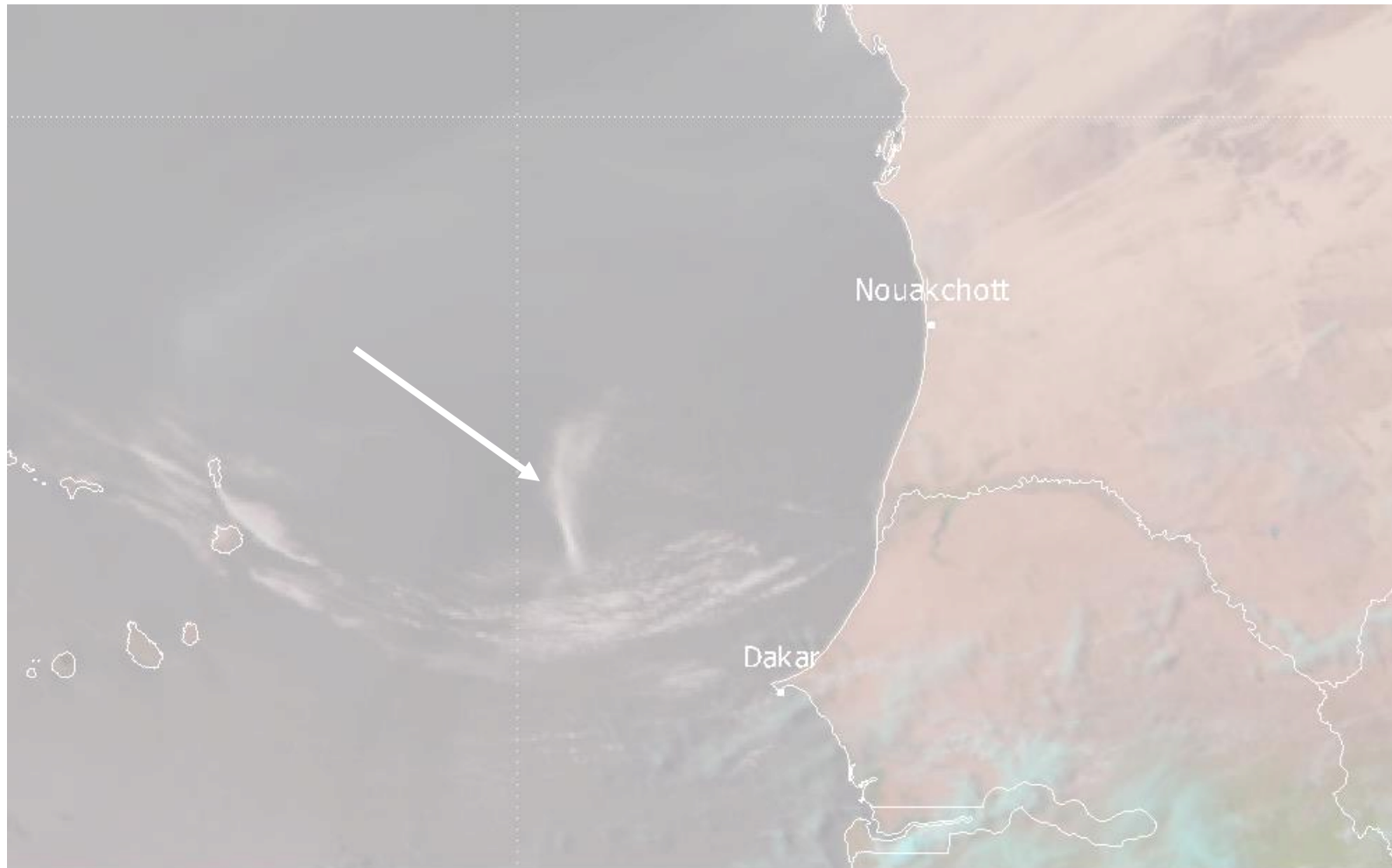
band VIS0.64 (I1) / VIIRS(375m)-SuomiNPP

Ship trails in maritime boundary layer off Portugal



**HRV & IR10.8
Meteosat**

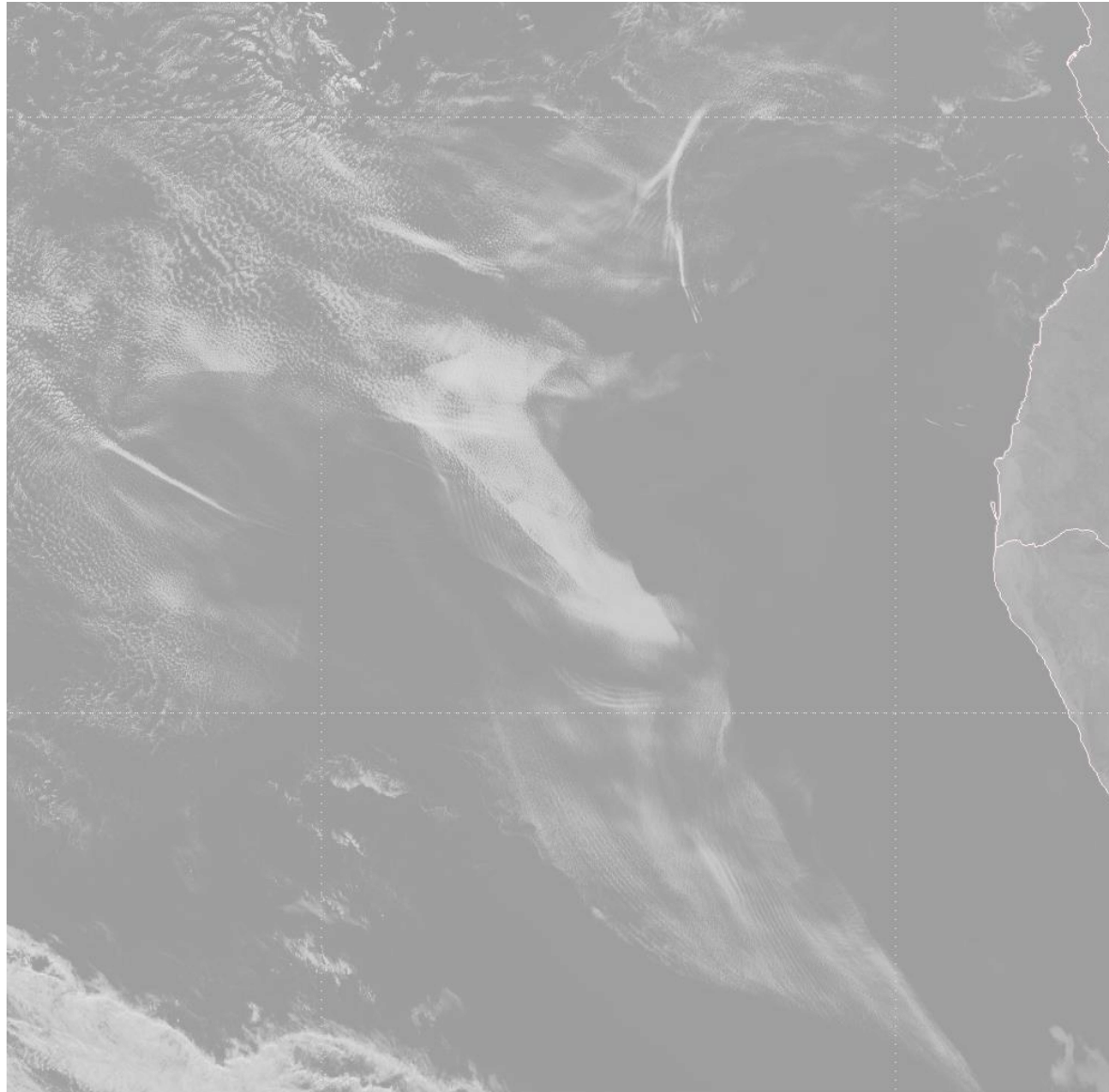
Undular bore travelling at 70km/h to Cape Verde Islands



**Natural-Colour RGB
SEVIRI-Meteosat**

m10 NCOL - 2014-07-02 15:30UTC

Wave interplay over South Atlantic, including undular bore



HRV
SEVIRI-Meteosat

5-day fog over North Sea and Norwegian Sea



24h-Cloud-Microphysics RGB
SEVIRI-Meteosat

R IR12.0-IR10.8

G IR10.8-**IR8.7**

B IR10.8

identical to Dust RGB, but
much different tuning

IR8.7 delivers **24-hour**
capability for detection of fog /
low cloud, as opposed to IR3.9
working at night only