Advantages and Challenges for geostationary ocean colour remote sensing

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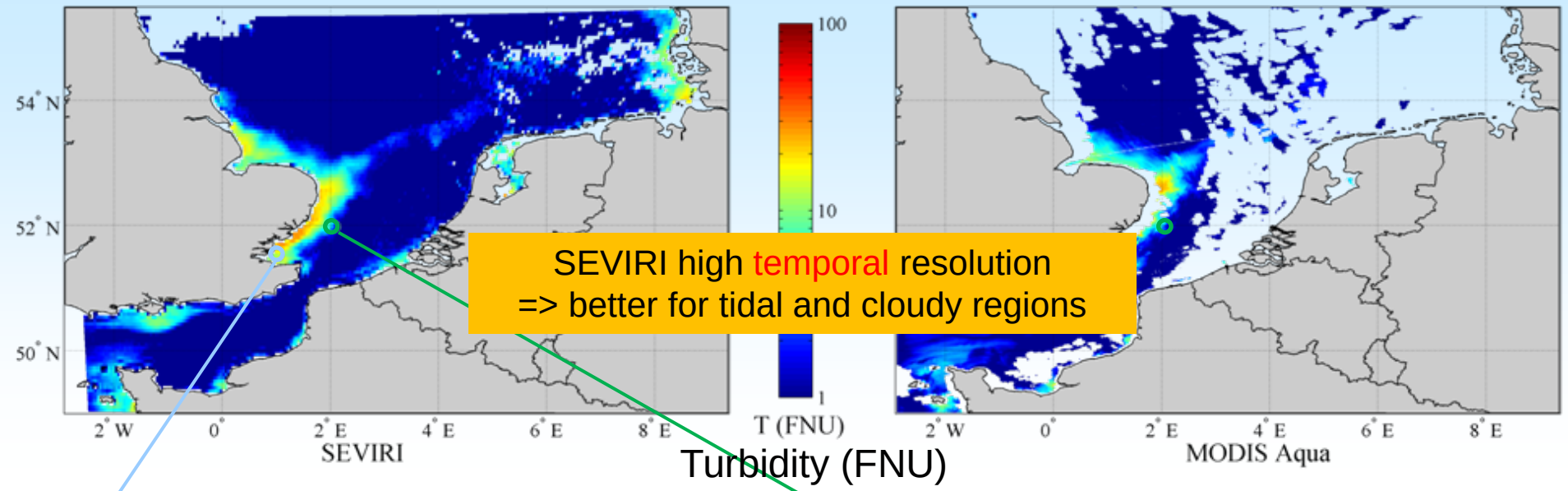
Including input from Quinten Vanhellemont and Griet Neukermans

Breakout Session 2

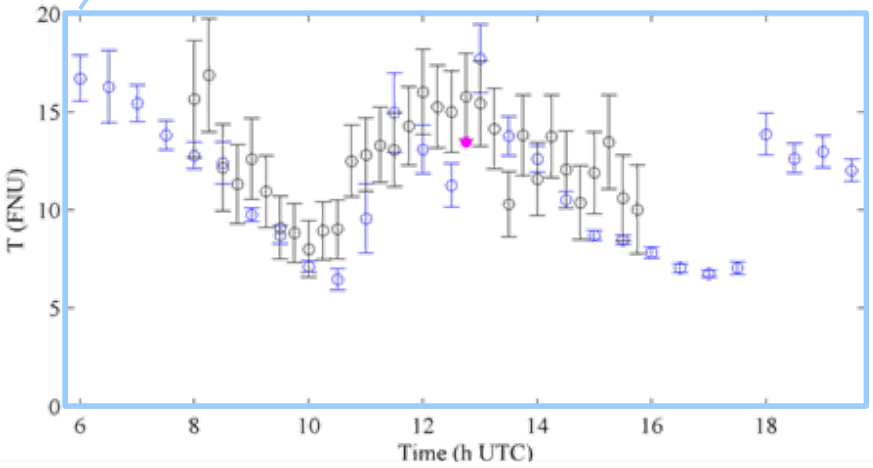
SEVIRI daily composite of 34 images
Quasi cloudfree

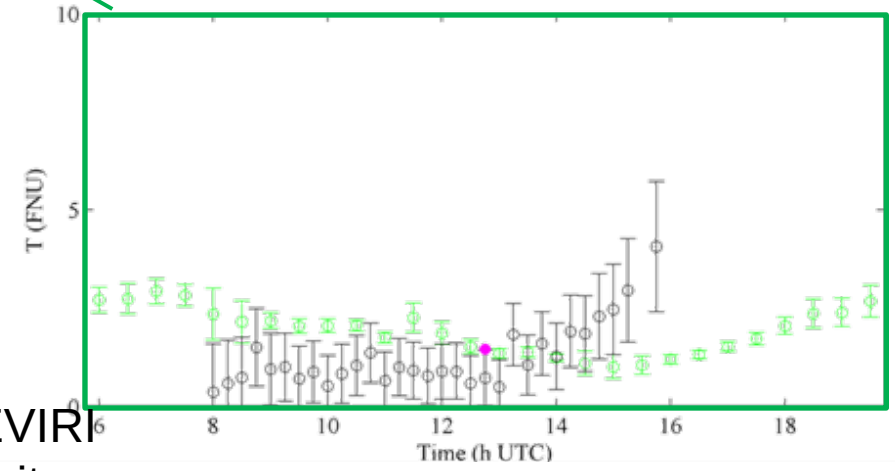
MODIS: 1 image
60% clouded



SEVIRI high temporal resolution
=> better for tidal and cloudy regions

Turbidity (FNU)



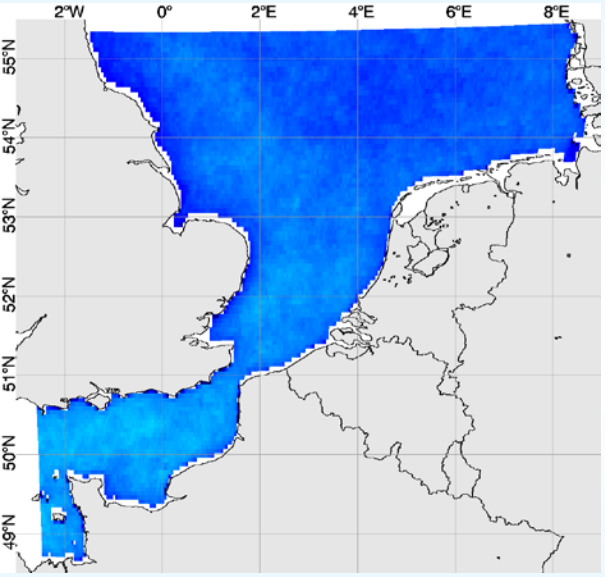


- SEVIRI
- In situ
- MODIS

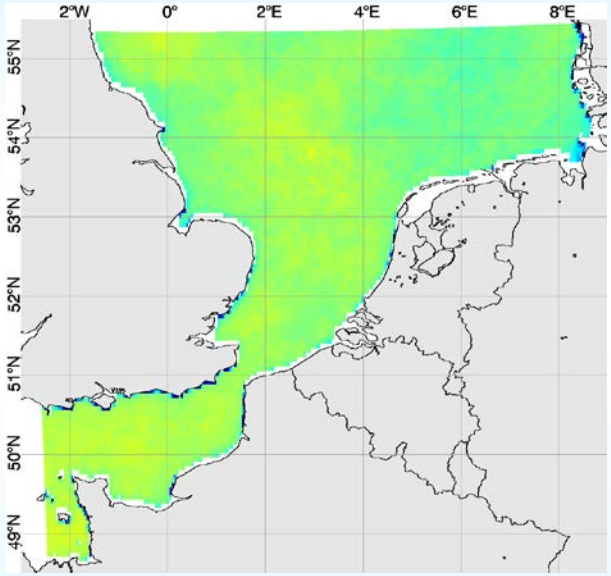
[Neukermans et al, 2012; Neukermans, 2012]

The advantages of GEO observations (North Sea)
a) scattered clouds, b) tidal variability)

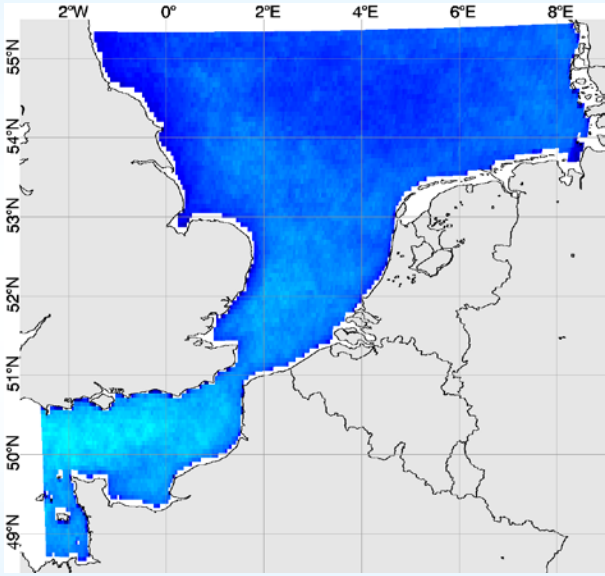
#days with
12:30 image OK



#days with
≥1image



#days with
≥4/6 images (10-15:00)

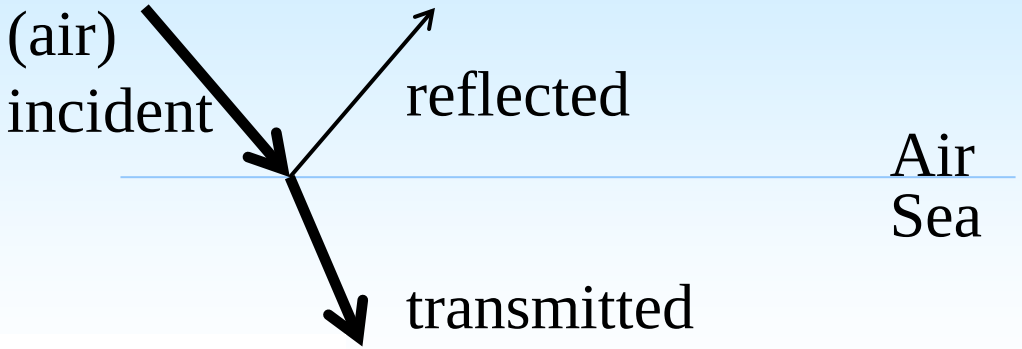


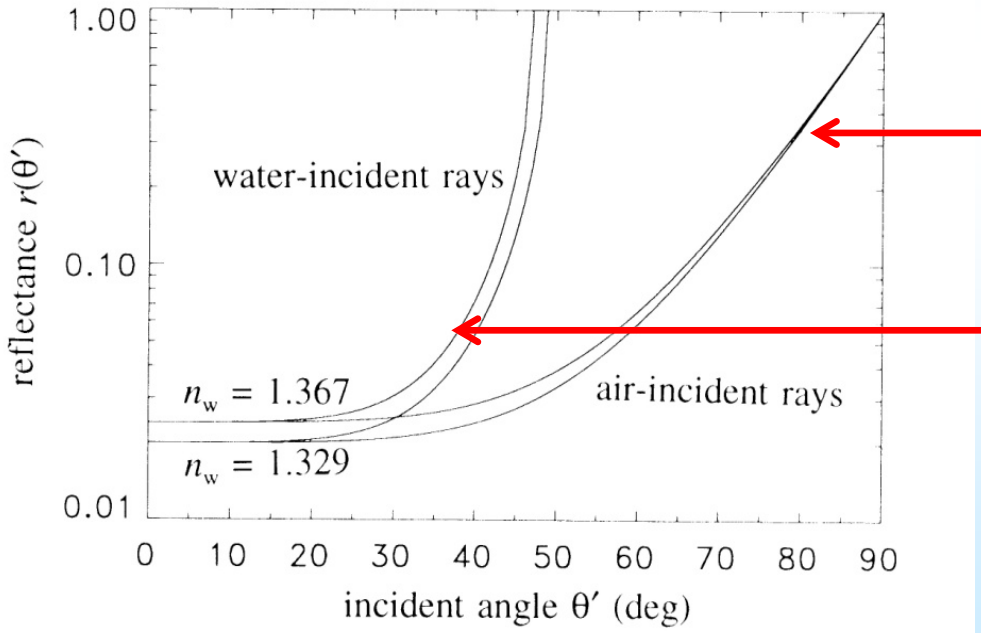
#days in 2008

[Ruddick et al, 2014]

Extra GEO atm. Corr. Issues at air-sea interface

- Fresnel reflectance, Rf, of the sea surface!
- Rf=reflected/incident





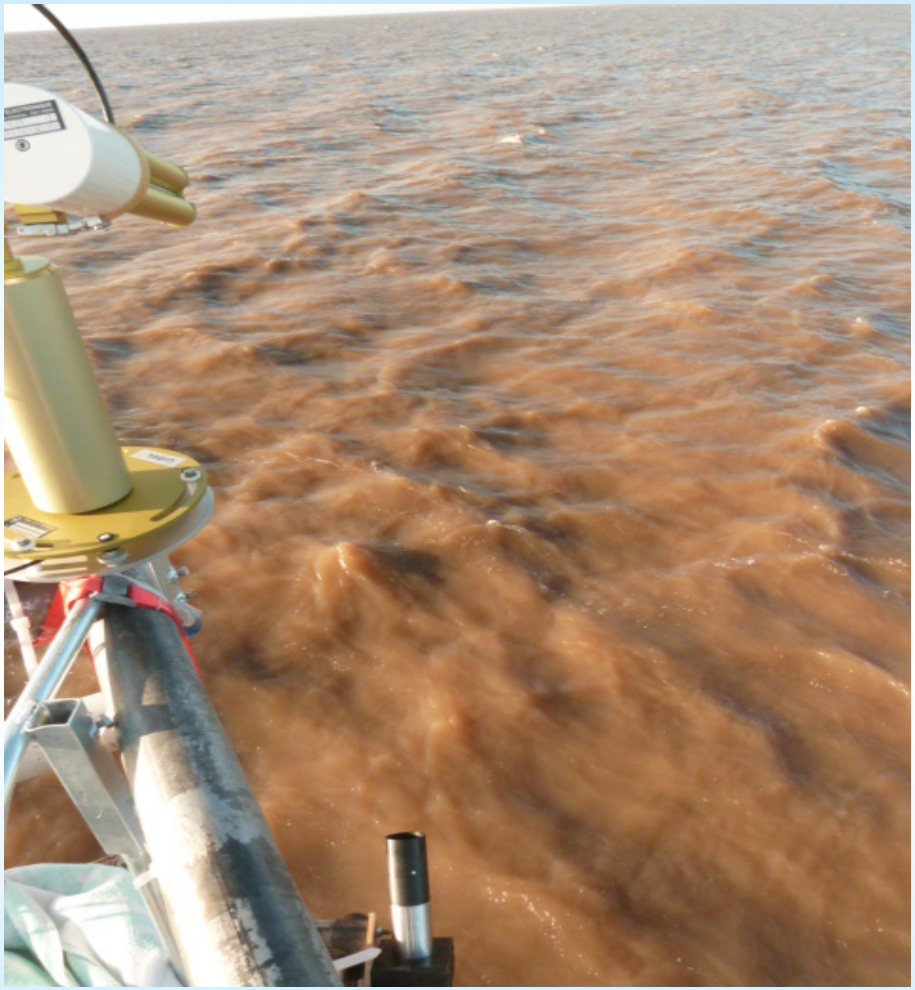
Strong sky/sun reflection at high VZA/SZA

Weaker water-leaving radiance for high VZA (marine BRDF)

[Mobley, 1994]

Some “new” problems

- E.g. Wave shadowing

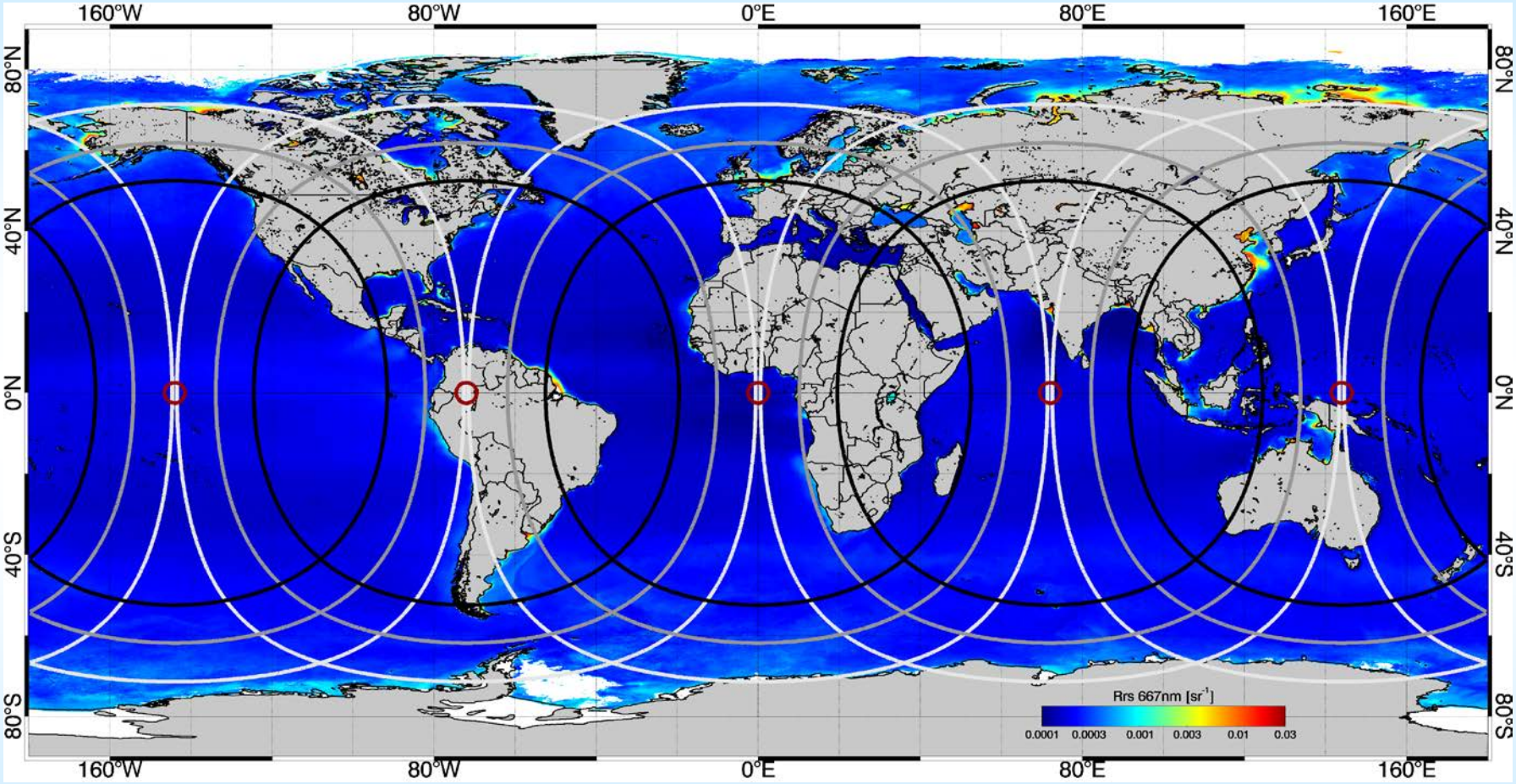


SeaSWIR campaign
Rio de la Plata, Nov2012
SZA=75°, wave height=10-20cm

[Ruddick et al, 2014]

Viewing Zenith Angle (VZA) and Geographic coverage

5 GEO coverage for VZA=60° (black), 70° (grey), 80° (white)



This is the challenge!

[Ruddick et al, 2014]

Challenges and Questions

- Multitemporal data processing?
- LEO-GEO synergy? Combined products?
- High sun and viewing zenith angle challenges:
  - What is the maximum air mass for atmospheric correction? 5? 8?
  - Is high air mass atmospheric correction best by direct ("Gordon-Wang") or indirect (e.g. neural network, POLYMER) methods?
  - Can we correct for air-sea interface at high sun/viewing zenith?
  - Can we correct for atmospheric "spherical shell" (earth curvature)? (YES)
- … Degradation of spatial resolution with viewing zenith angle

- Some references for SEVIRI work:

  - Alvera-Azcarate A. & Vanhellemont Q. & Ruddick K. & Barth A. & Beckers J.-M. Analysis of high frequency geostationary ocean colour data using **DINEOF** (2015) Estuarine, Coastal and Shelf Science, Vol. 159 pp. 28–36.
  - Ruddick K. & Neukermans G. & Vanhellemont Q. & Jolivet D. Challenges and opportunities for geostationary ocean colour remote sensing of regional seas: a **review** of recent results (2014) Rem Sens Env 146 p. 63-76.
  - Vanhellemont Q. & Neukermans G. & Ruddick K. **Synergy** between polar-orbiting and geostationary sensors: Remote sensing of the ocean at high spatial and high temporal resolution (2014) Rem Sens Env 145 pp. 49–62.
  - Vanhellemont Q. & Neukermans G. & Ruddick K. High frequency measurement of **suspended sediments and coccolithophores** in European and African coastal waters from the geostationary SEVIRI sensor (2013) EUMETSAT Meteorological Satellite.
  - Neukermans G. Optical in situ and **geostationary** satellite-borne observations of suspended particles in coastal waters. Ph.D. dissertation, Université du Littoral
  - Neukermans G. & Ruddick K. & Greenwood N. **Diurnal variability** of turbidity and light attenuation in the southern North Sea from the SEVIRI geostationary sensor (2012) Rem Sens Env 124 p. 564-580.
  - Neukermans G. & Ruddick K. & Bernard E. & Ramon D. & Nechad B. & Deschamps P.-Y. Mapping total suspended matter from geostationary satellites: a **feasibility study** with SEVIRI in the Southern North Sea (2009) Optics Express 17(16) 14029–14052.

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  - BELSPO-funded GEOCOLOUR project
  - … EUMETSAT SEVIRI-WT project
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