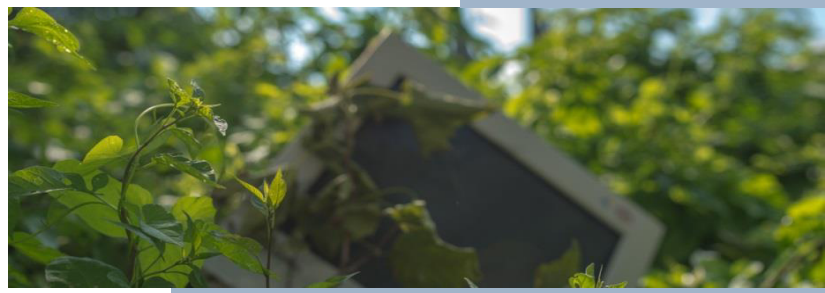
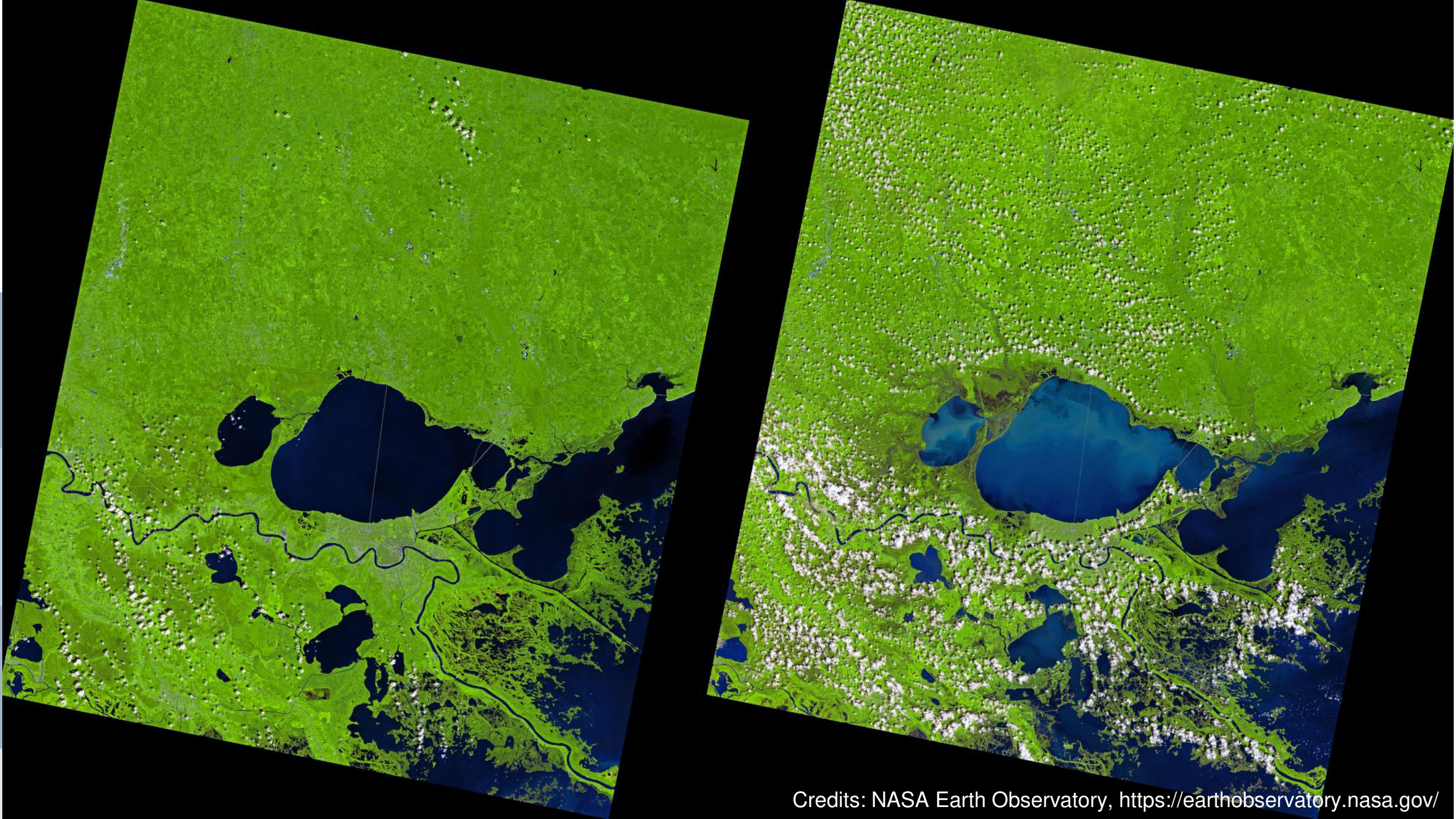
What is Remote Sensing?



Credits: NASA Earth Observatory, https://earthobservatory.nasa.gov/



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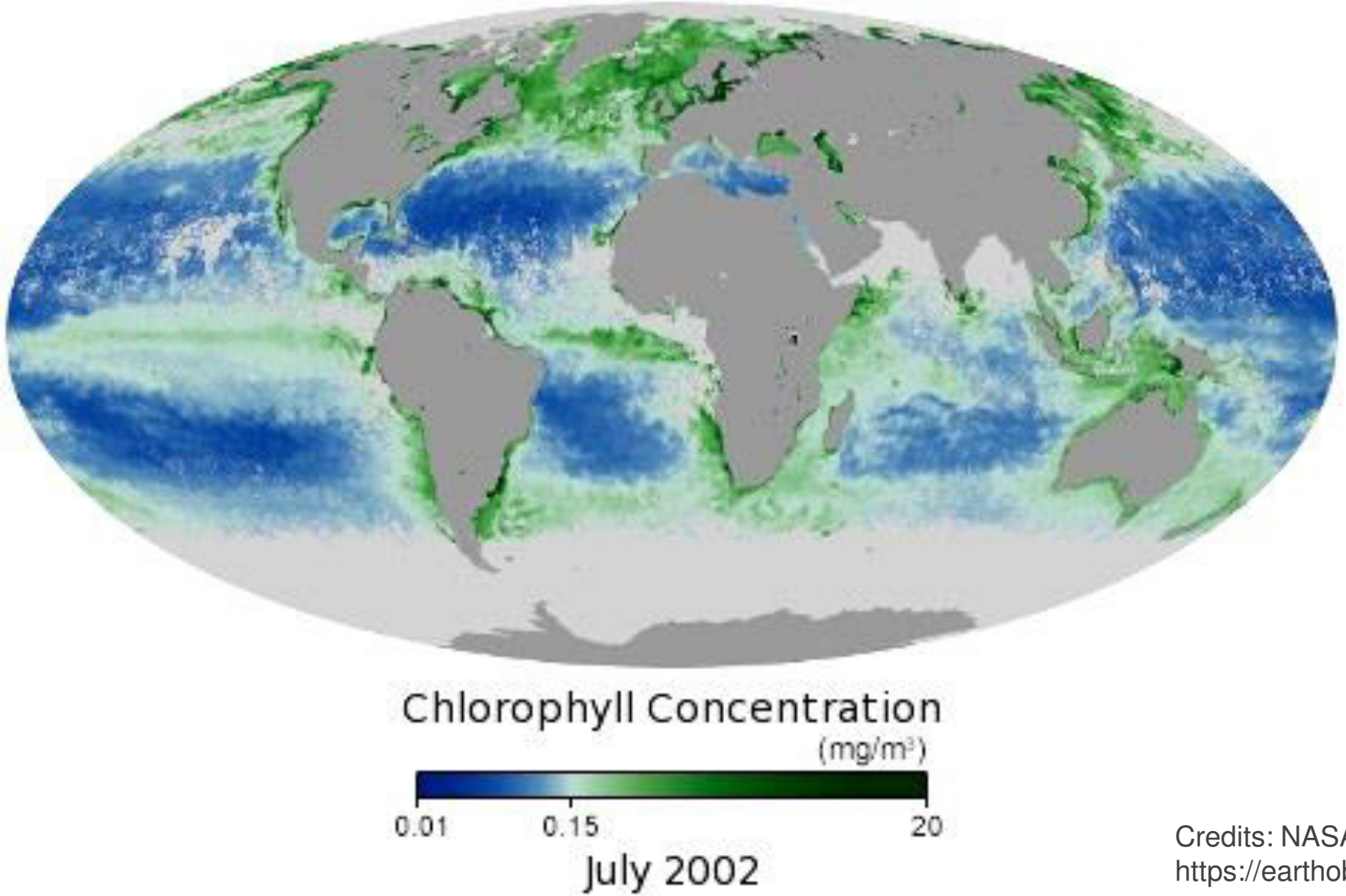

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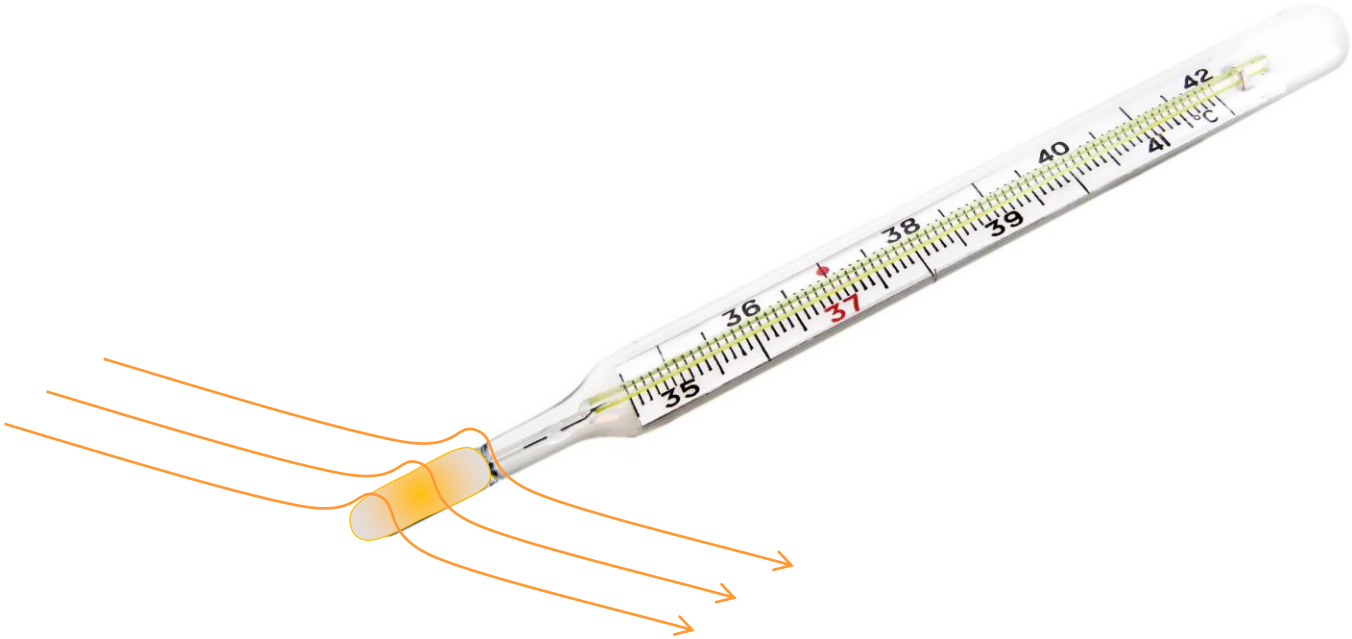
What is Remote Sensing?

Measure air temperature with a thermometer.



In a Nutshell

- Remote sensing observations are non-contact measurement.
- An information transport medium is required. Its source may be natural or artificial.
- The measured properties of the transport medium are not necessarily the properties we are interested in.
- A remote sensing system consists of a recording device and a recording platform.

See you next time!

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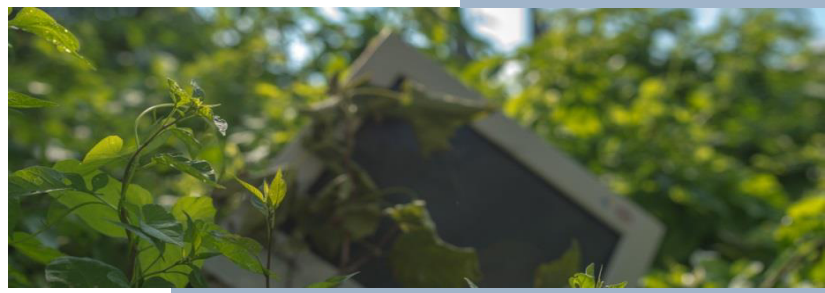
Optical Remote Sensing Basics



What are optical remote sensing systems?

Basic types of remote sensing sensors

Passive Sensors

Environmental source of the information carrier medium, such as electromagnetic radiation or noise.

Active Sensors

Artificial source of the information carrier medium, such LiDAR, RADAR or loudspeaker.

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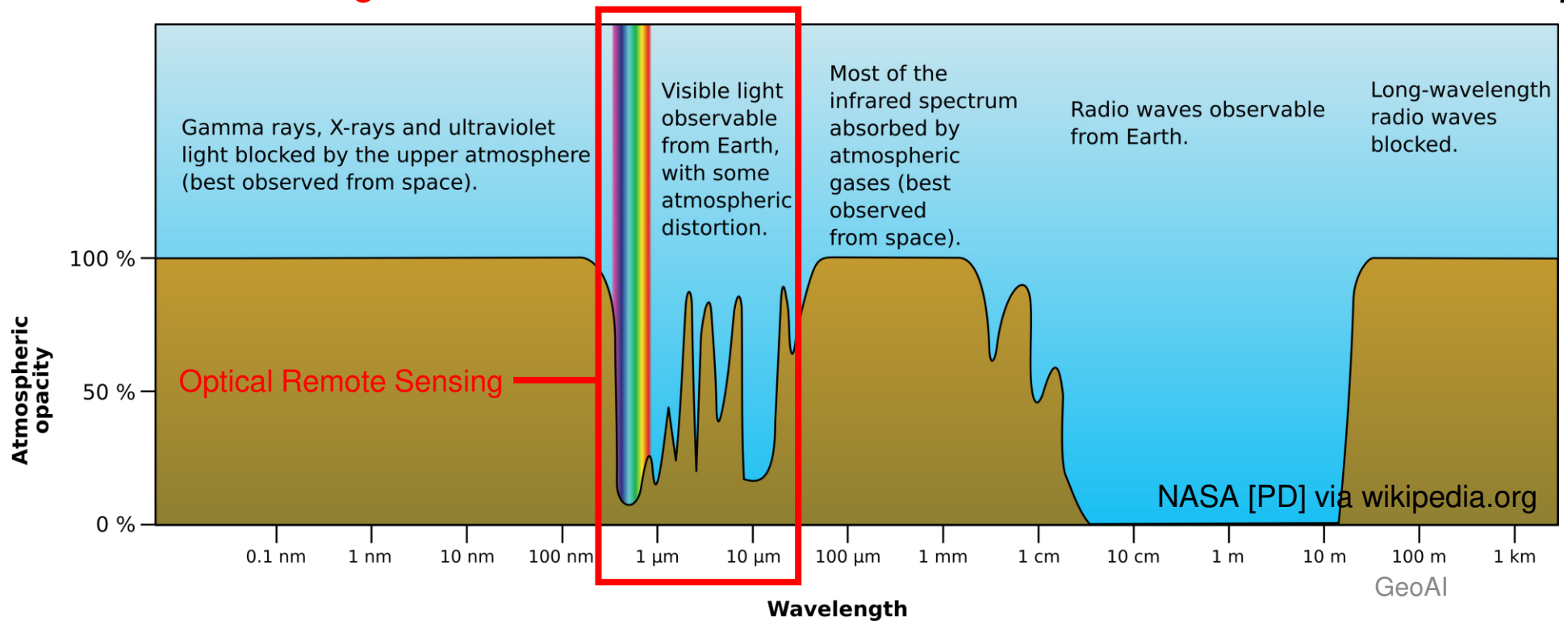
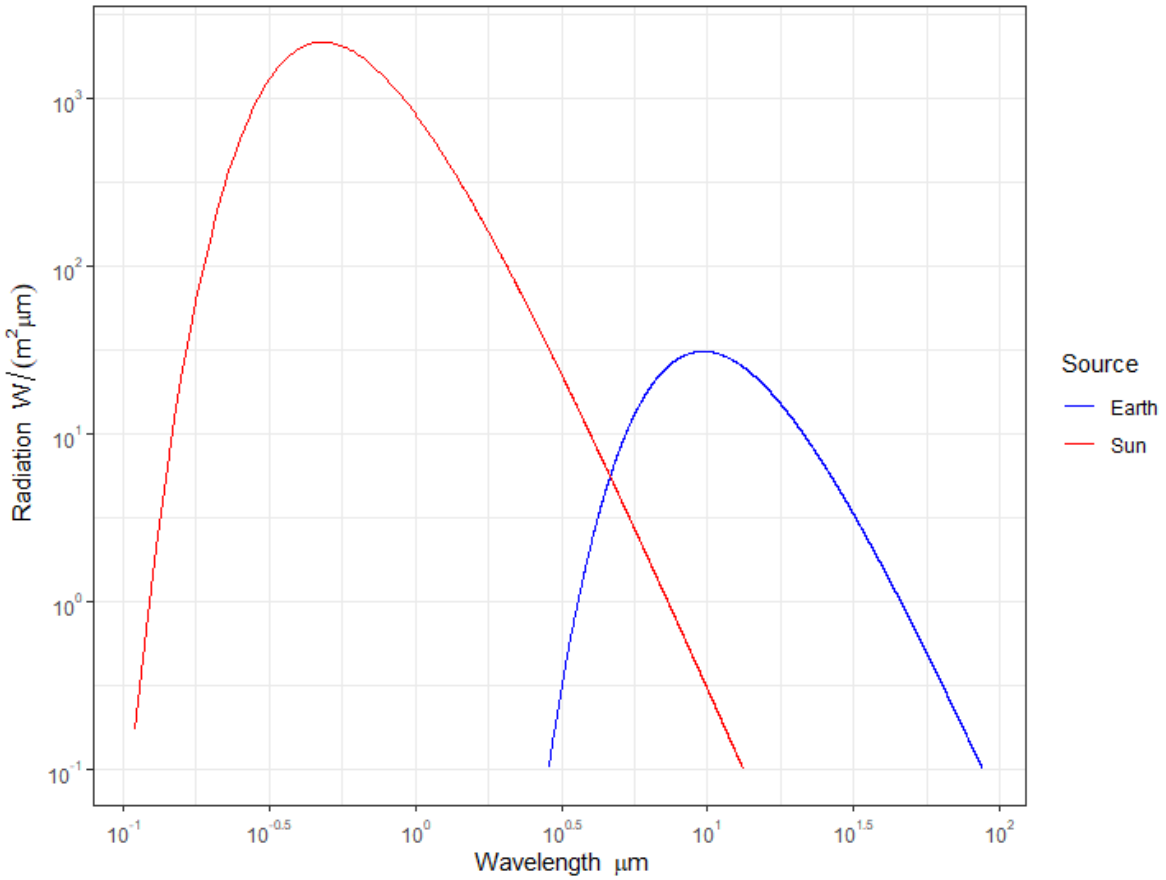


Background: Illumination source



Stefan-Boltzmann law: $j^\star = \sigma T^4$.

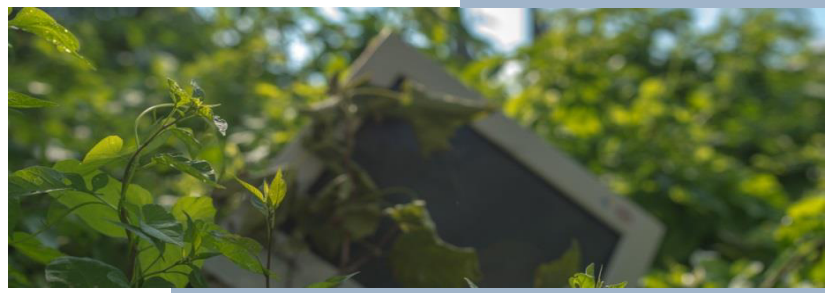
The emitted energy from a (near black) body is proportional to its temperature.
Hence, the sun emmits more radiation than the earth.

Wien's law: $\lambda_{\mathbf{max}} = \frac{2897{,}8\,\mu\mathrm{m}\cdot\mathrm{K}}{T}$

The wavelength of maxiumum emission from a (near black) body is inversly proportional to its temperature.
Therefore, this wavelengths is arround 0.5µm for solar radiation and 10 µm for terrestrial radiation.

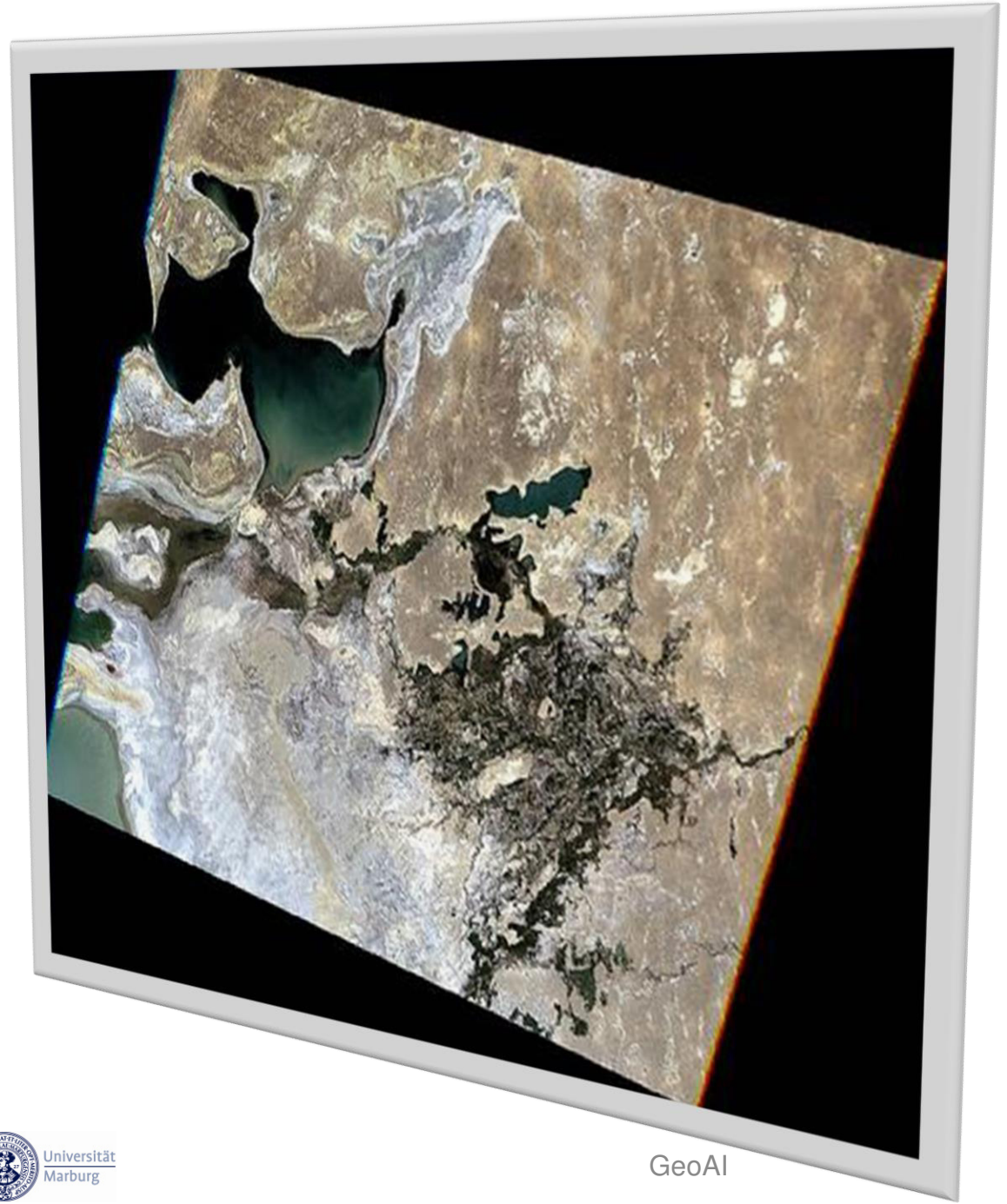
See you next time!

Optical Sensor Characteristics

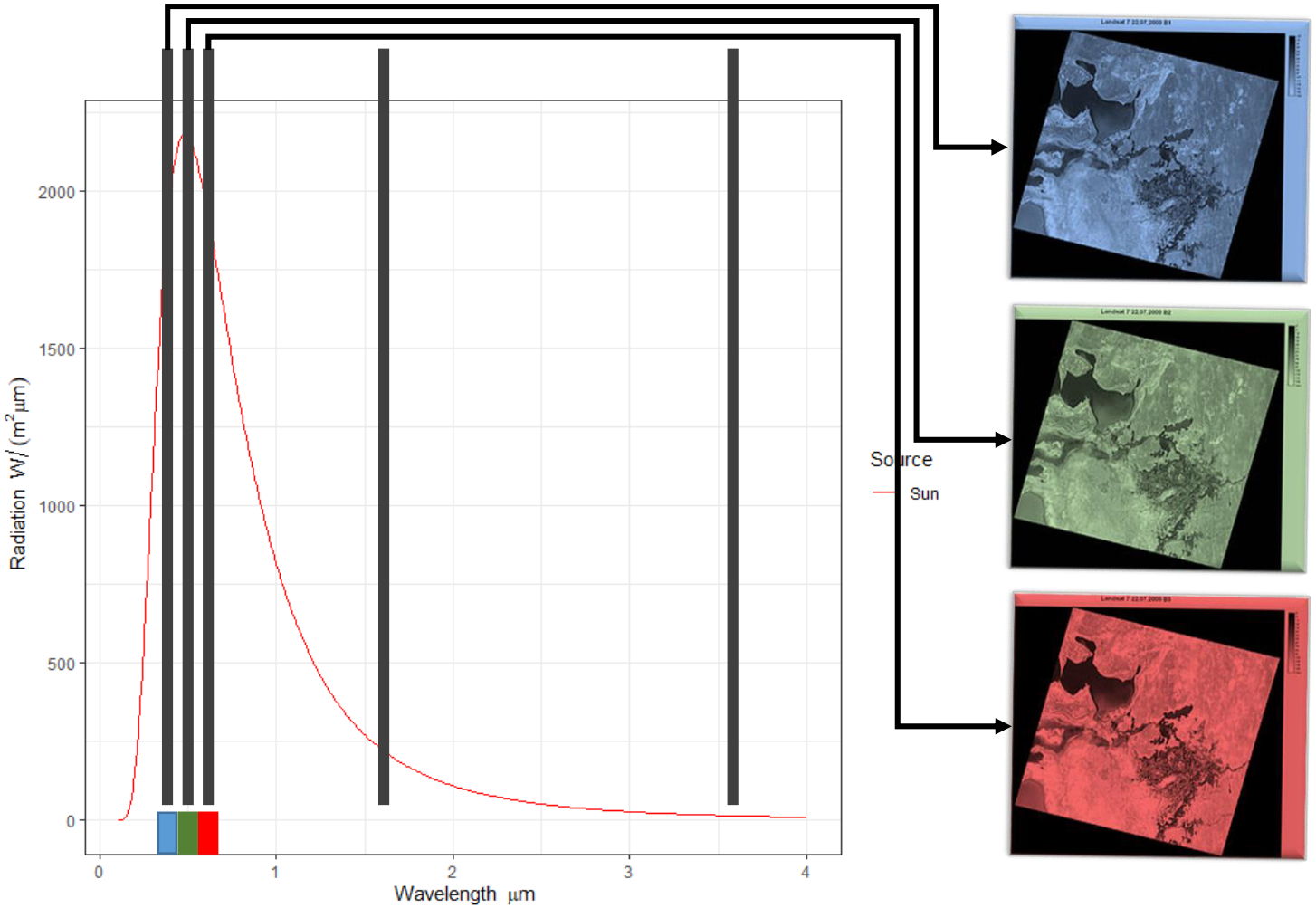


Characteristics of optical remote sensing systems?

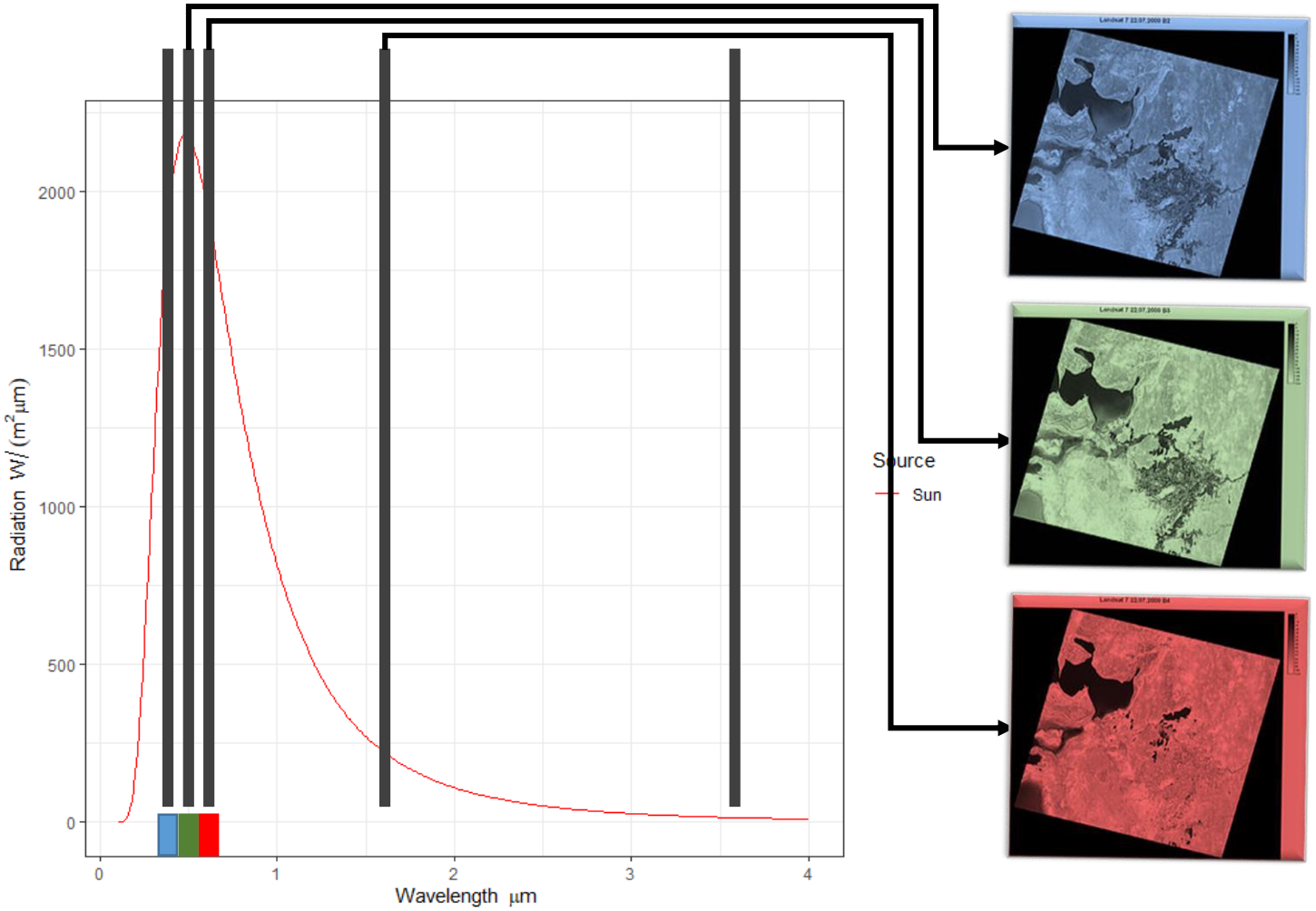
Spectral Resolution



Spectral Resolution



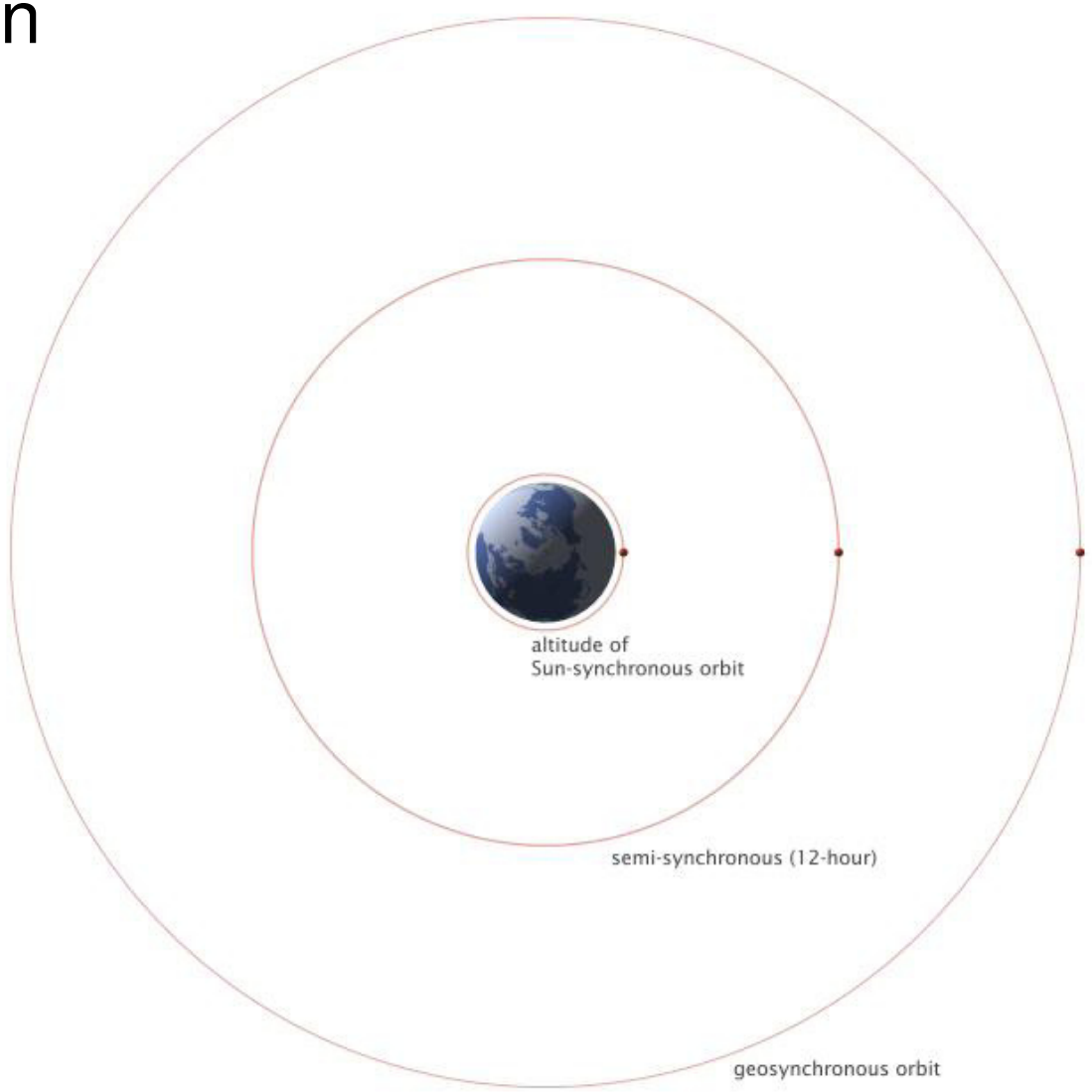
Spectral Resolution



Spatial Resolution

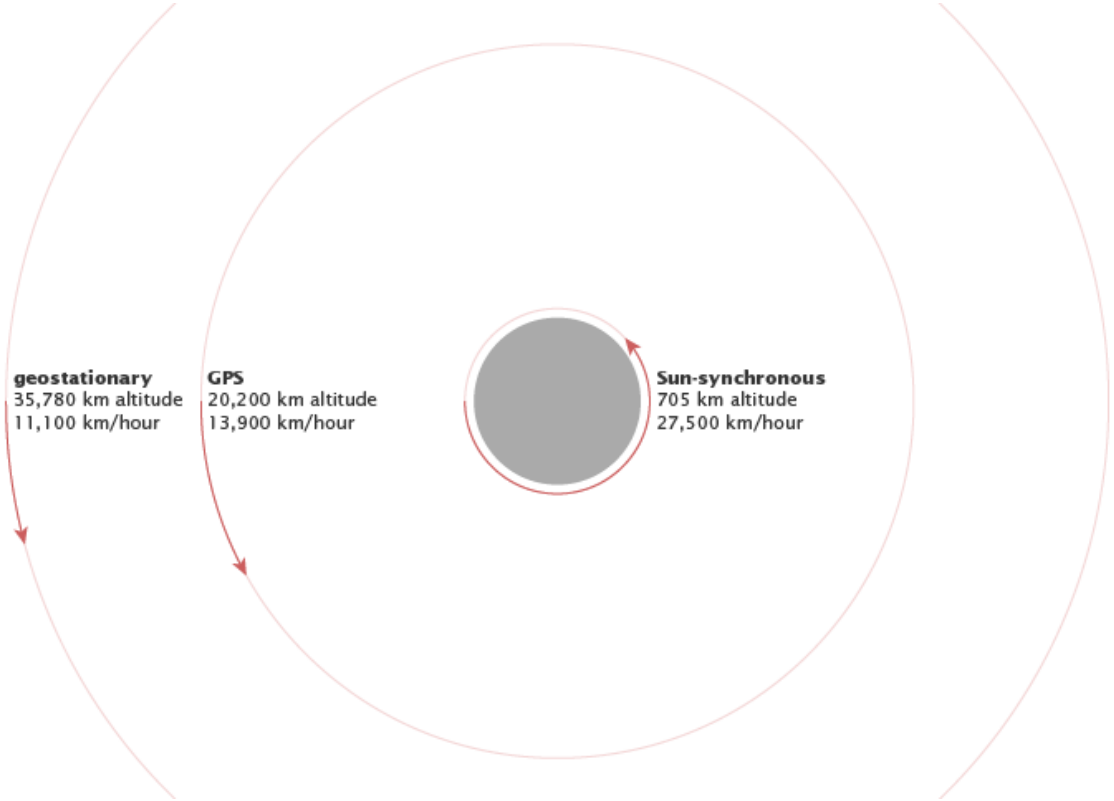
Spatial Resolution

Temporal Resolution



Credits: NASA Earth Observatory, https://earthobservatory.nasa.gov/

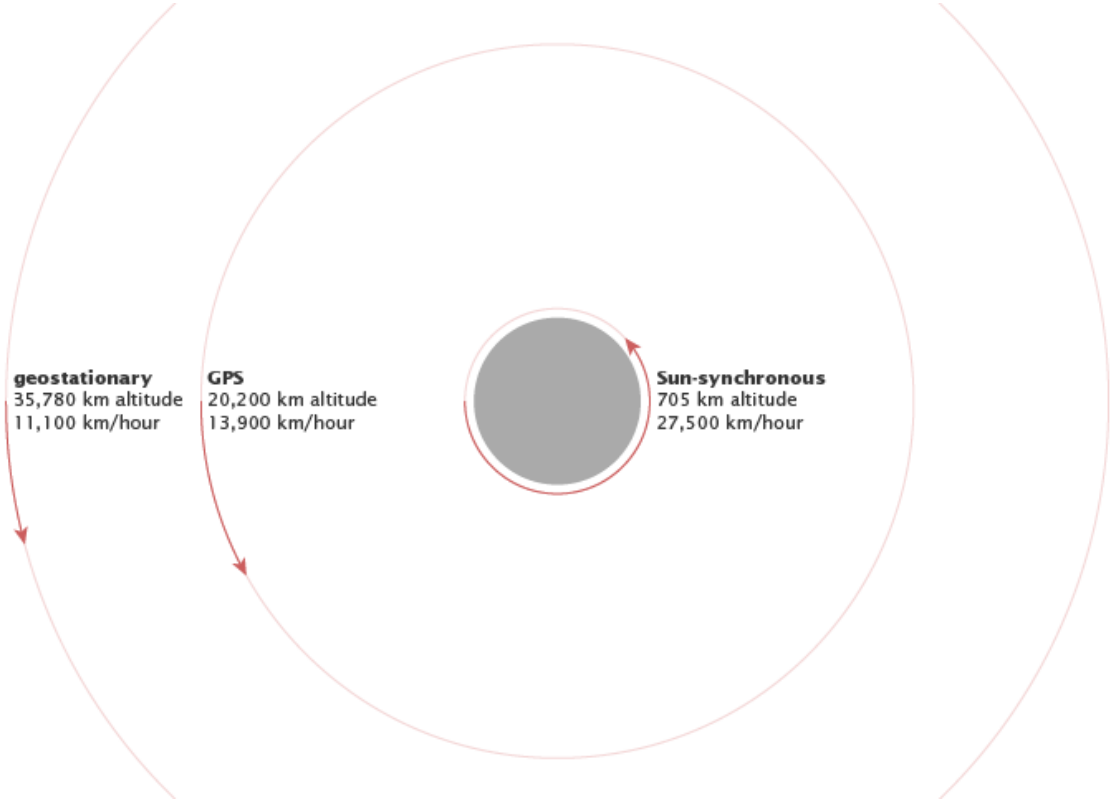
Temporal Resolution



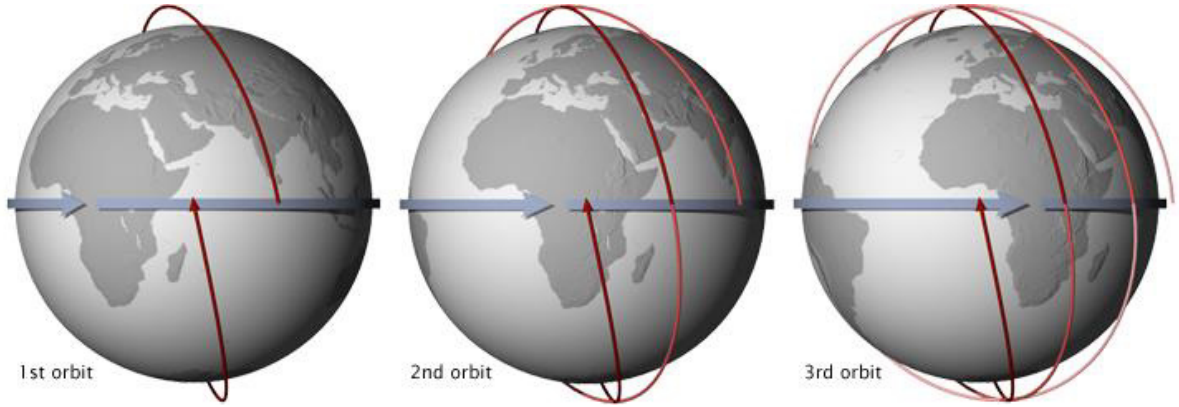
Geostationary orbit

Credits: NASA Earth Observatory, https://earthobservatory.nasa.gov/

Temporal Resolution



Sun-synchronous, low earth orbit



Credits: NASA Earth Observatory, https://earthobservatory.nasa.gov/

In a Nutshell

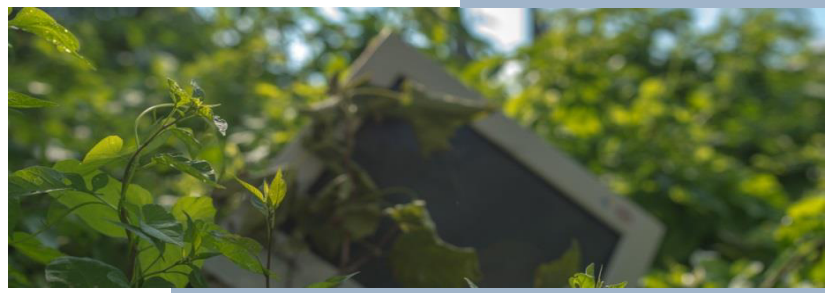
Optical remote sensing systems are characterized by their

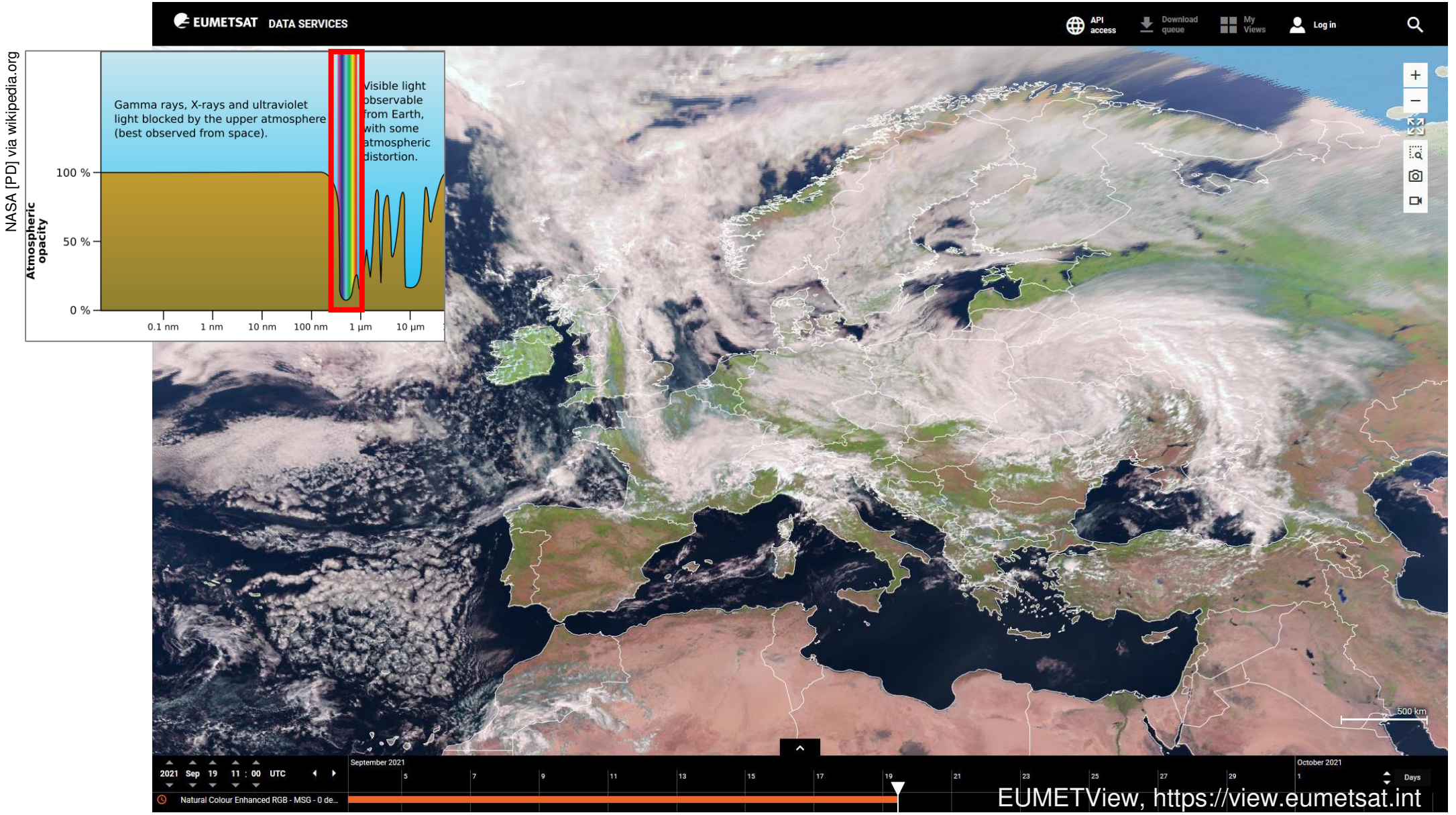
- Spectral resolution
- Spatial resolution
- Temporal resolution

See you next time!

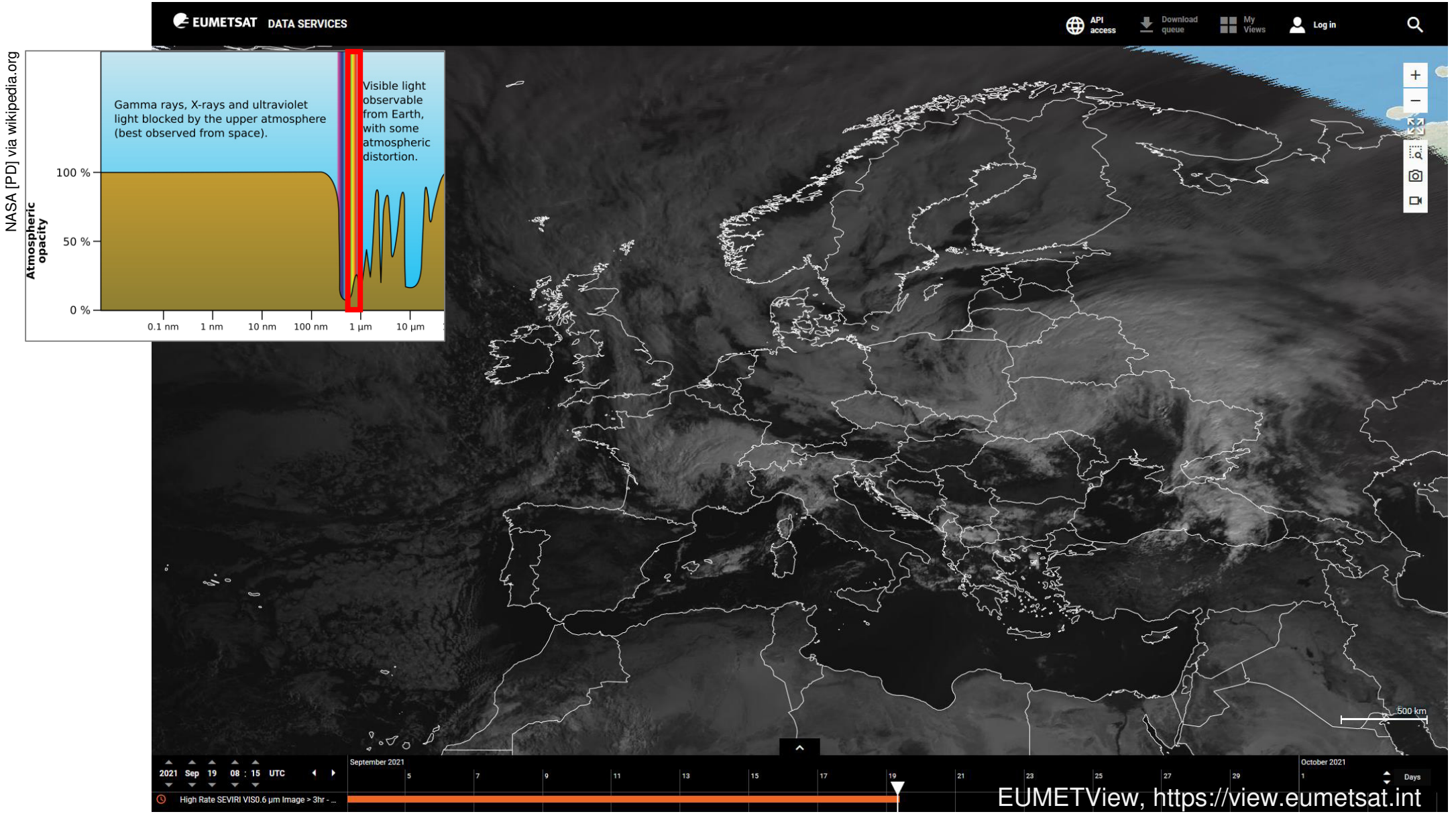
Philipps Universität Marburg

Using eyes, physics or AI in remote sensing



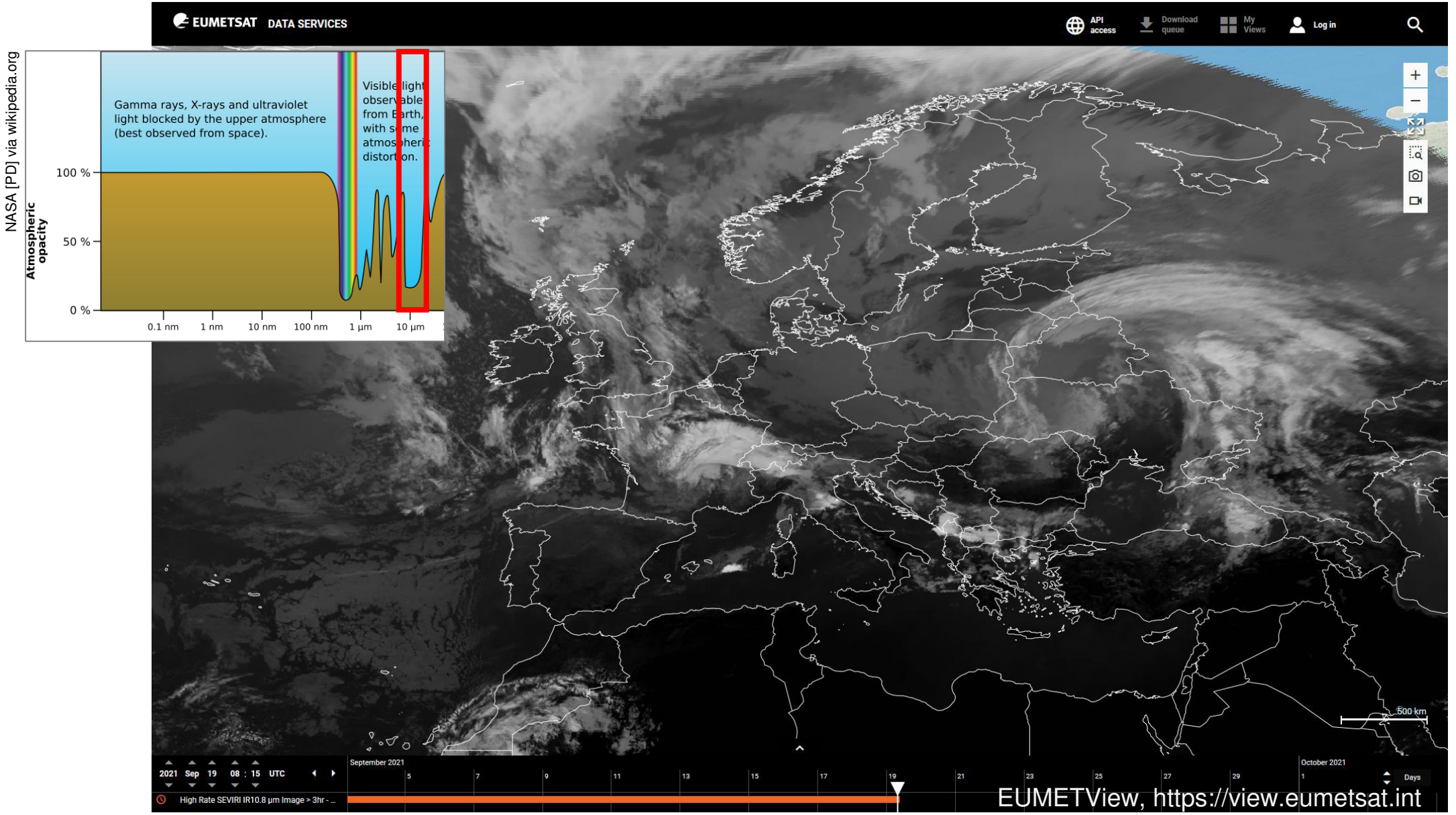


NASA [PD] via wikipedia.org

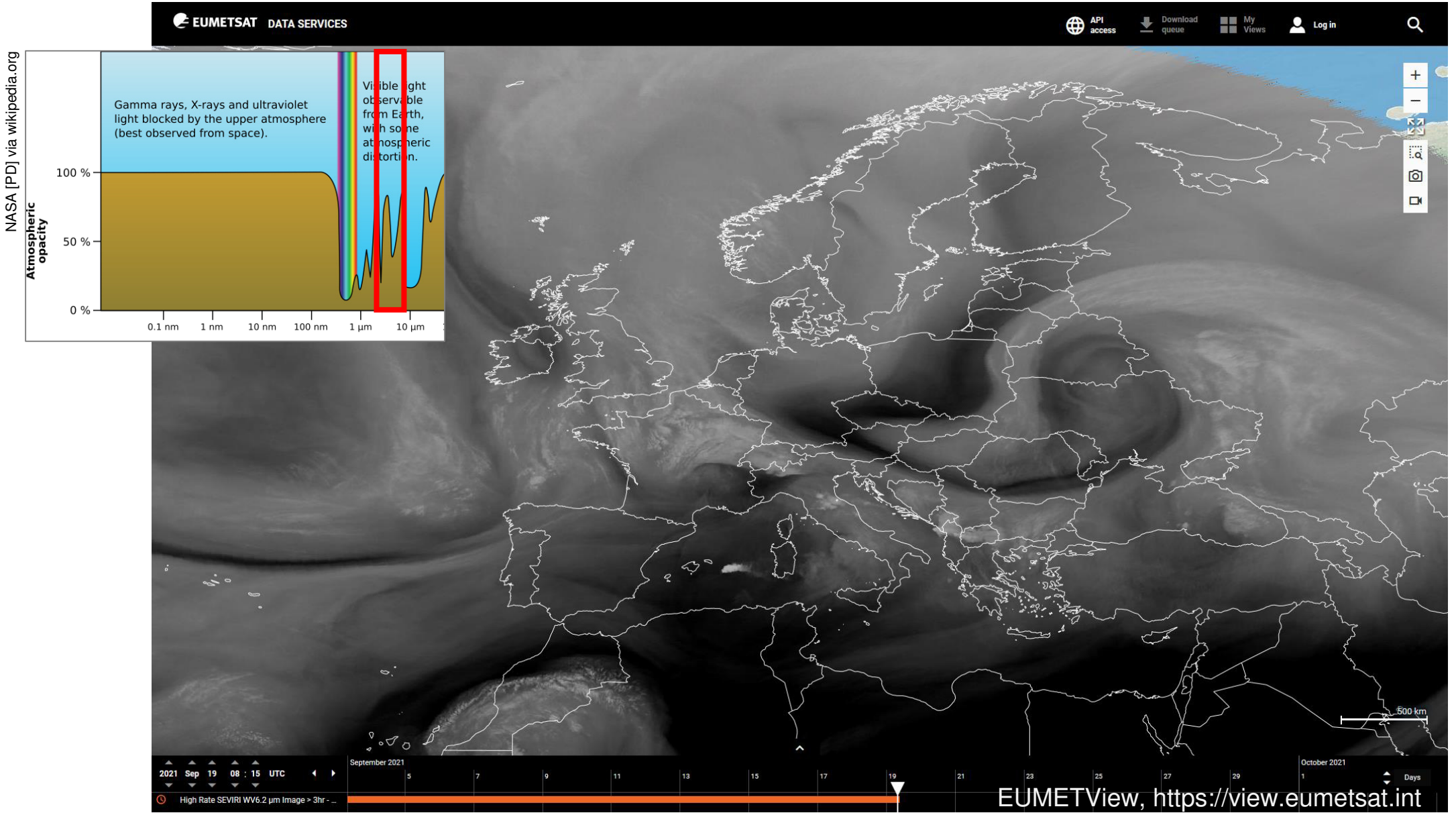


NASA [PD] via wikipedia.org

EUMETView, https://view.eumetsat.int



NASA [PD] via wikipedia.org



NASA [PD] via wikipedia.org

EUMETView, https://view.eumetsat.int

The visible question: Where are clouds?

The invisible question: What is the size of the cloud drops?

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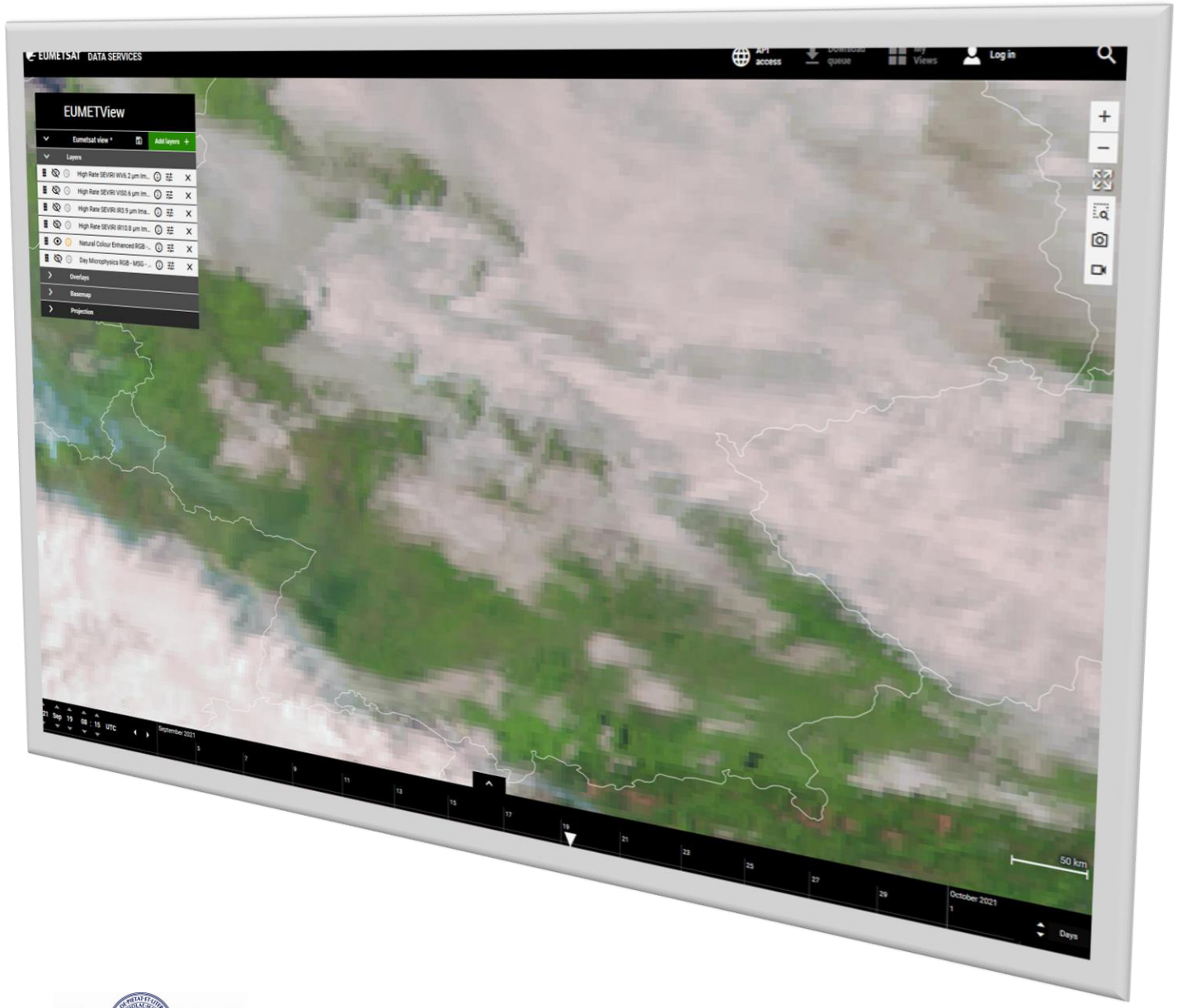
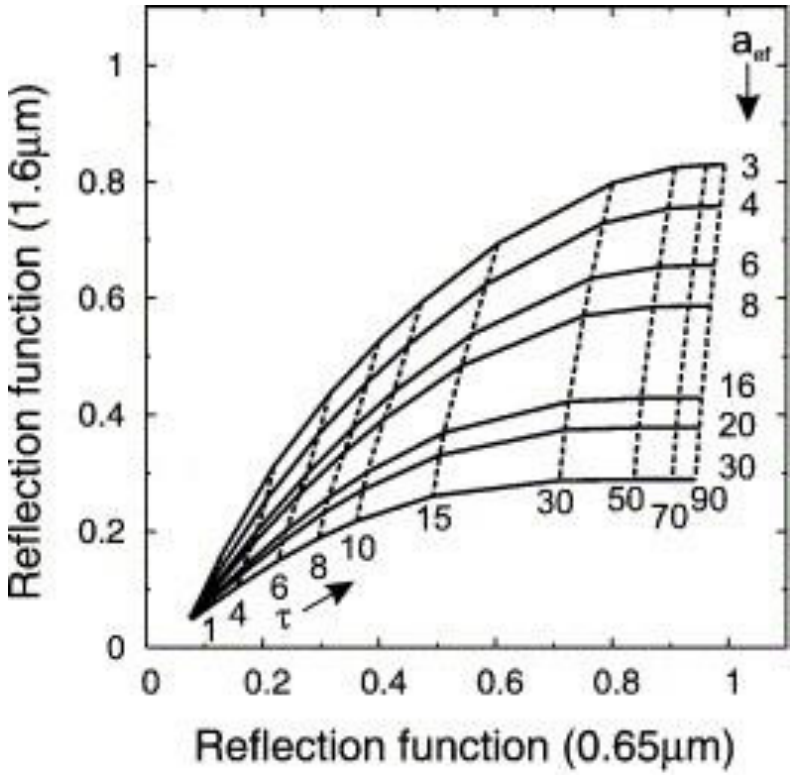
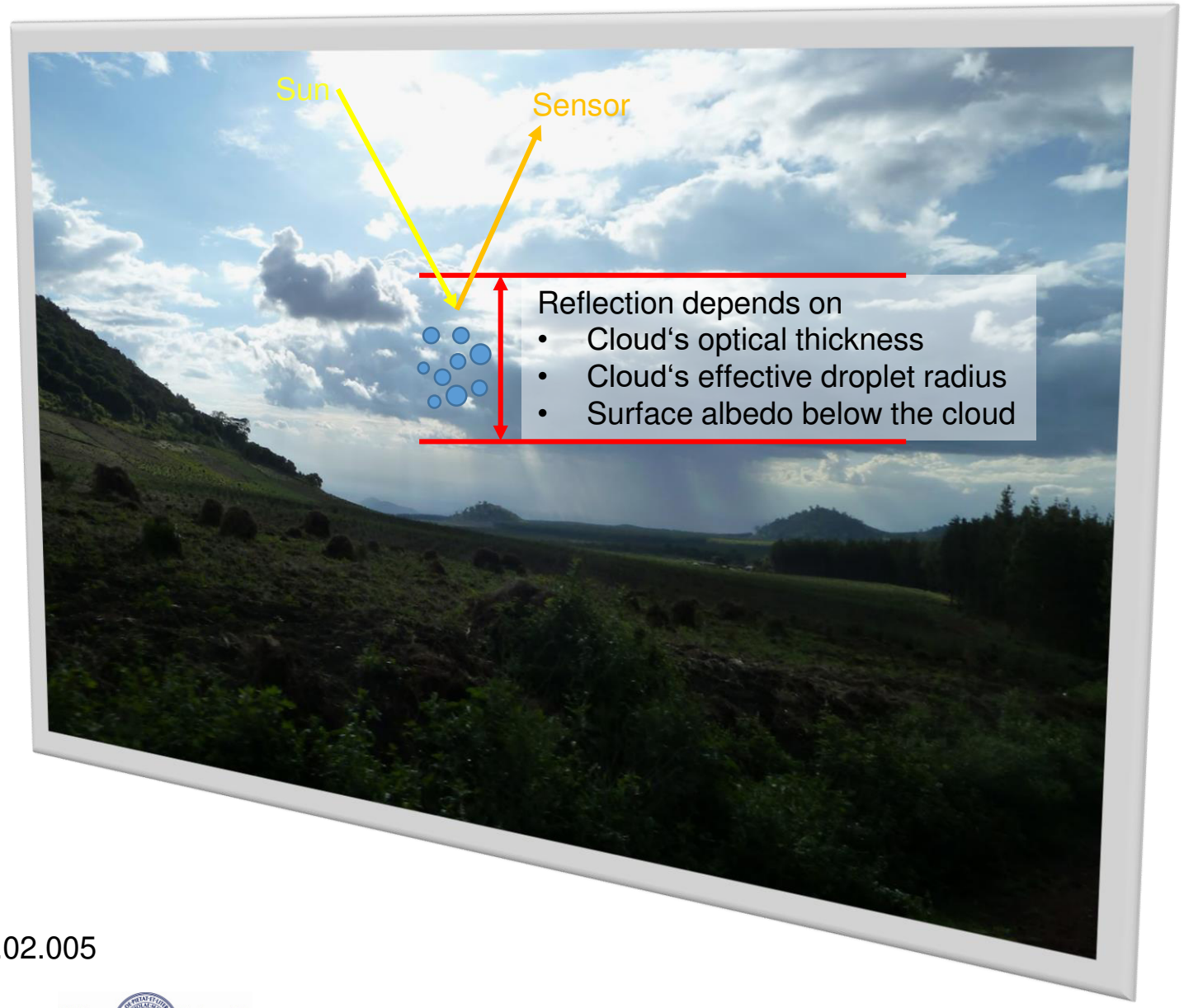


The invisible question: What is the size of the cloud drops?





Nauss et al. 2005, https://doi.org/10.1016/j.atmosres.2005.02.005

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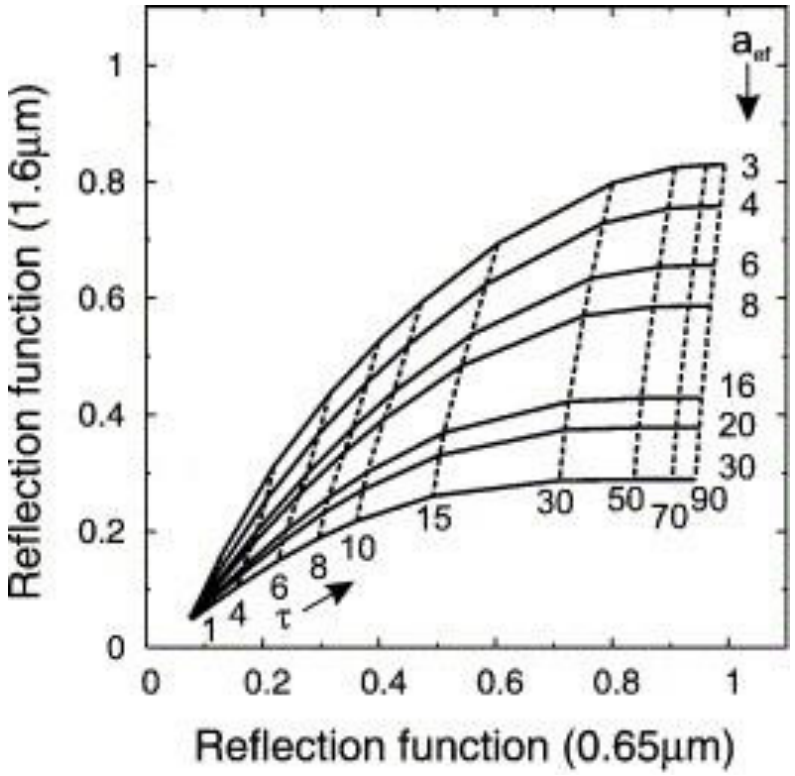
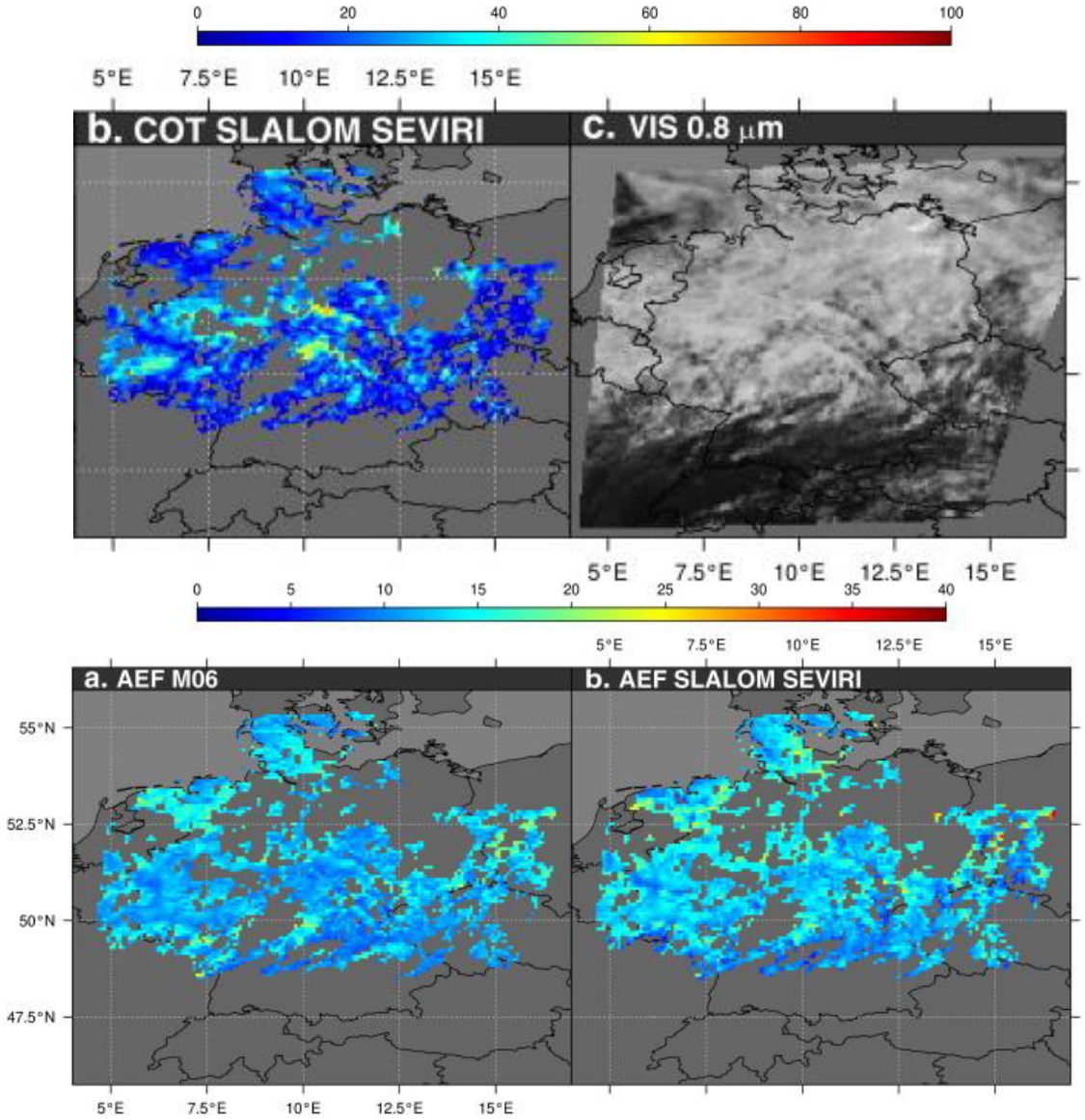
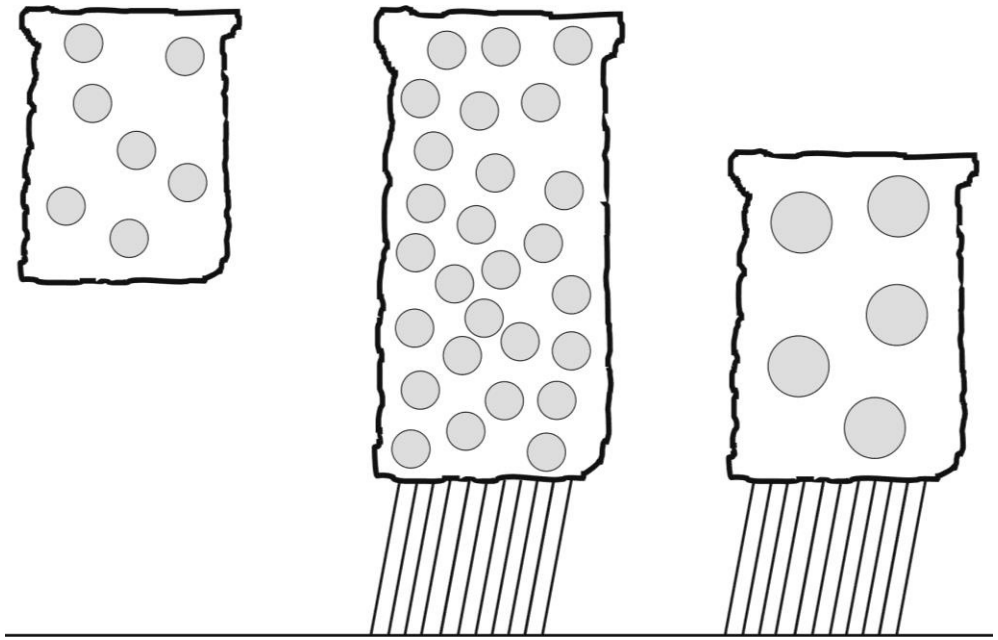
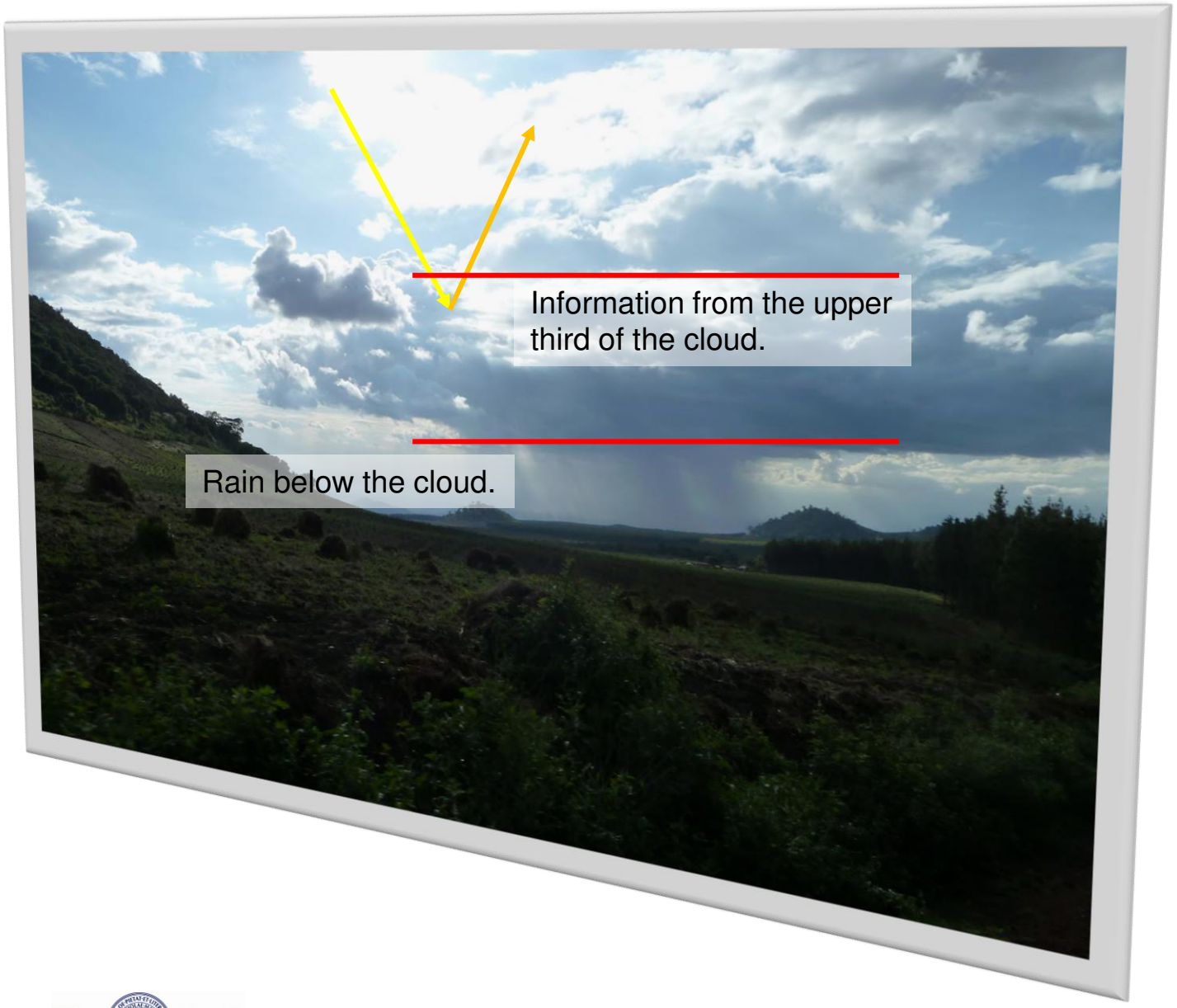




Kühnlein et al. 2013, https://doi.org/10.1016/j.atmosres.2012.10.029

The completely invisible question: Is it raining?





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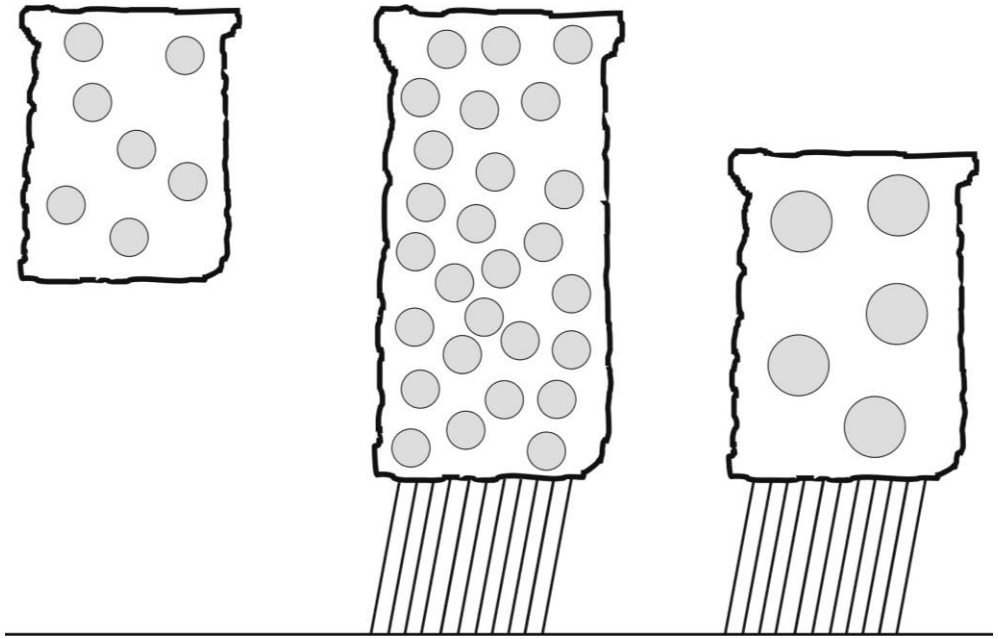
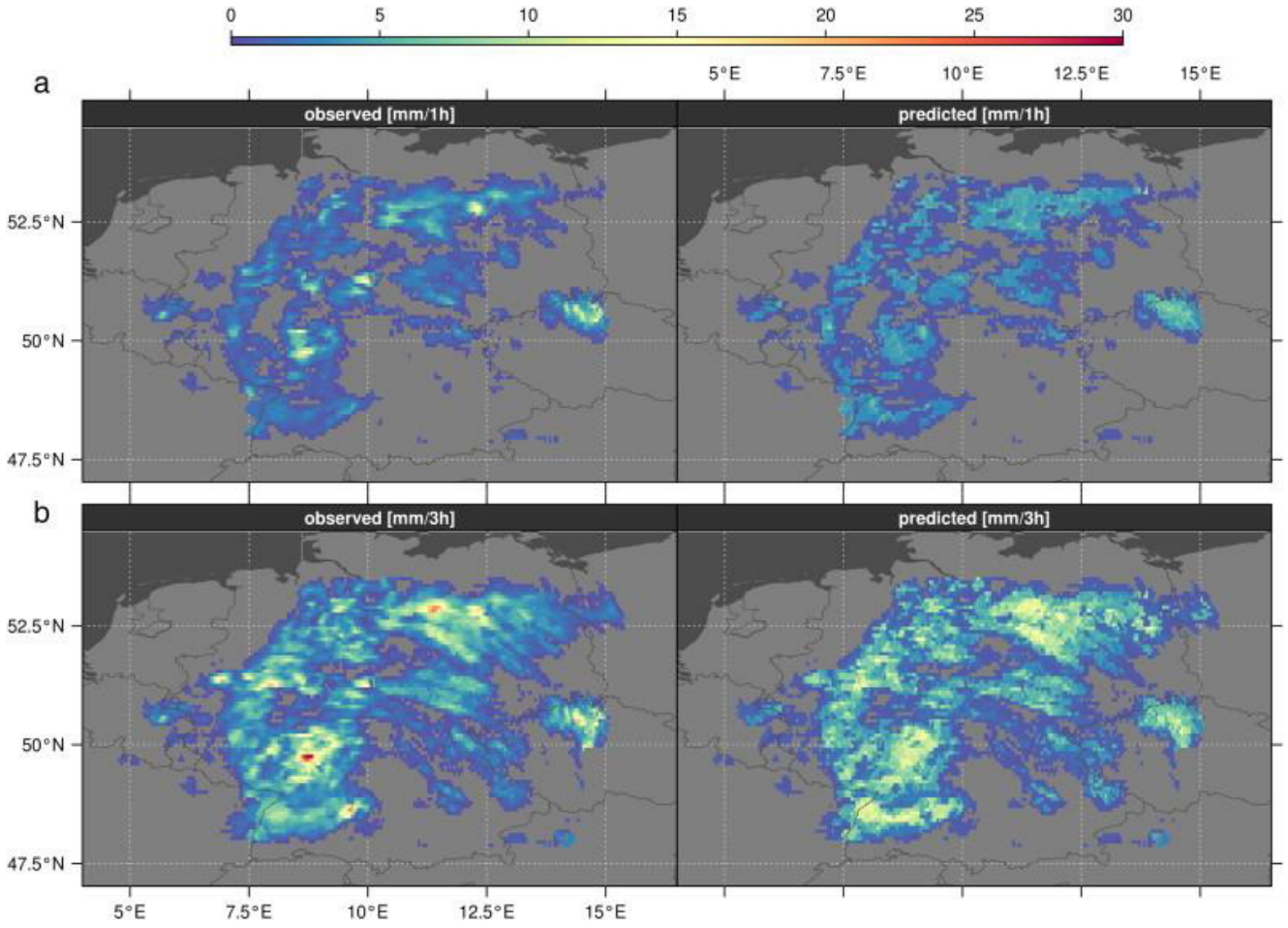
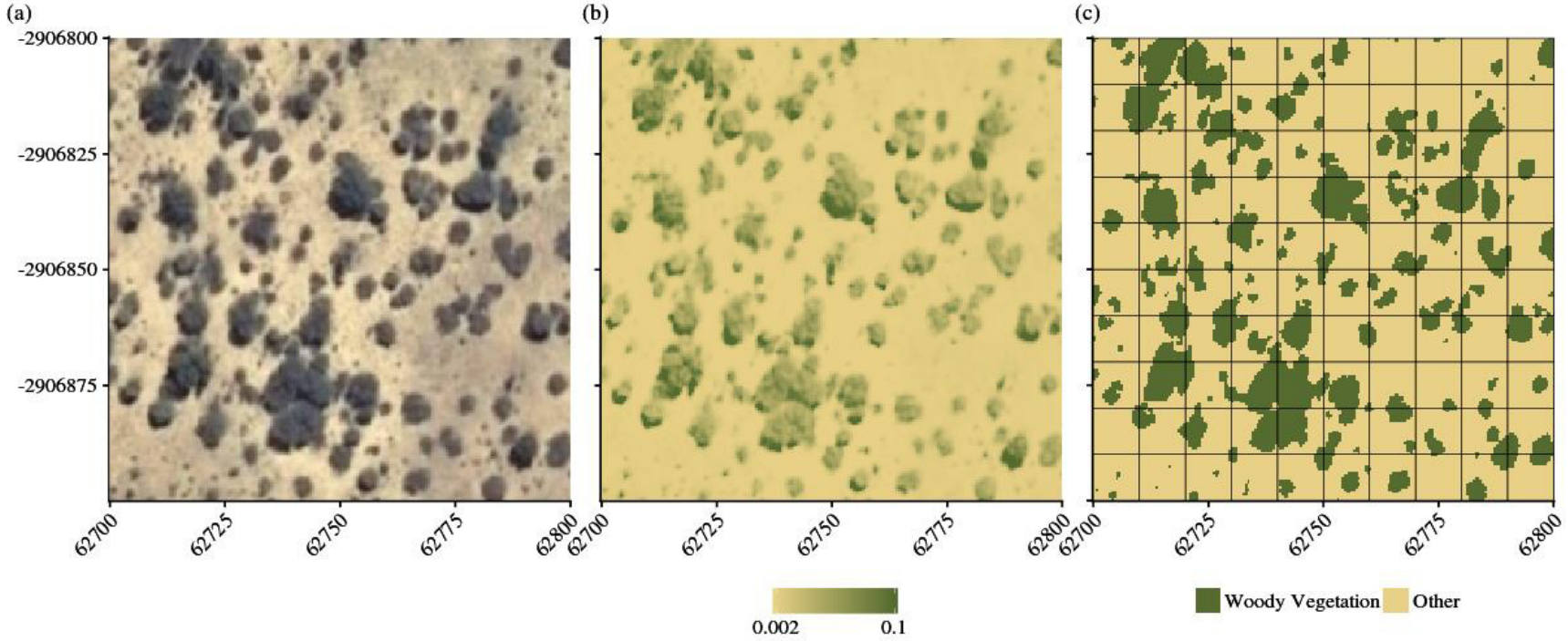




Kühnlein et al. 2014, https://doi.org/10.1016/j.rse.2013.10.026

All this applies not only to clouds, but also to other applications.



Ludwig et al. 2016, https://doi.org/10.1016/j.jag.2016.03.003

(Gottwald et al. 2017)

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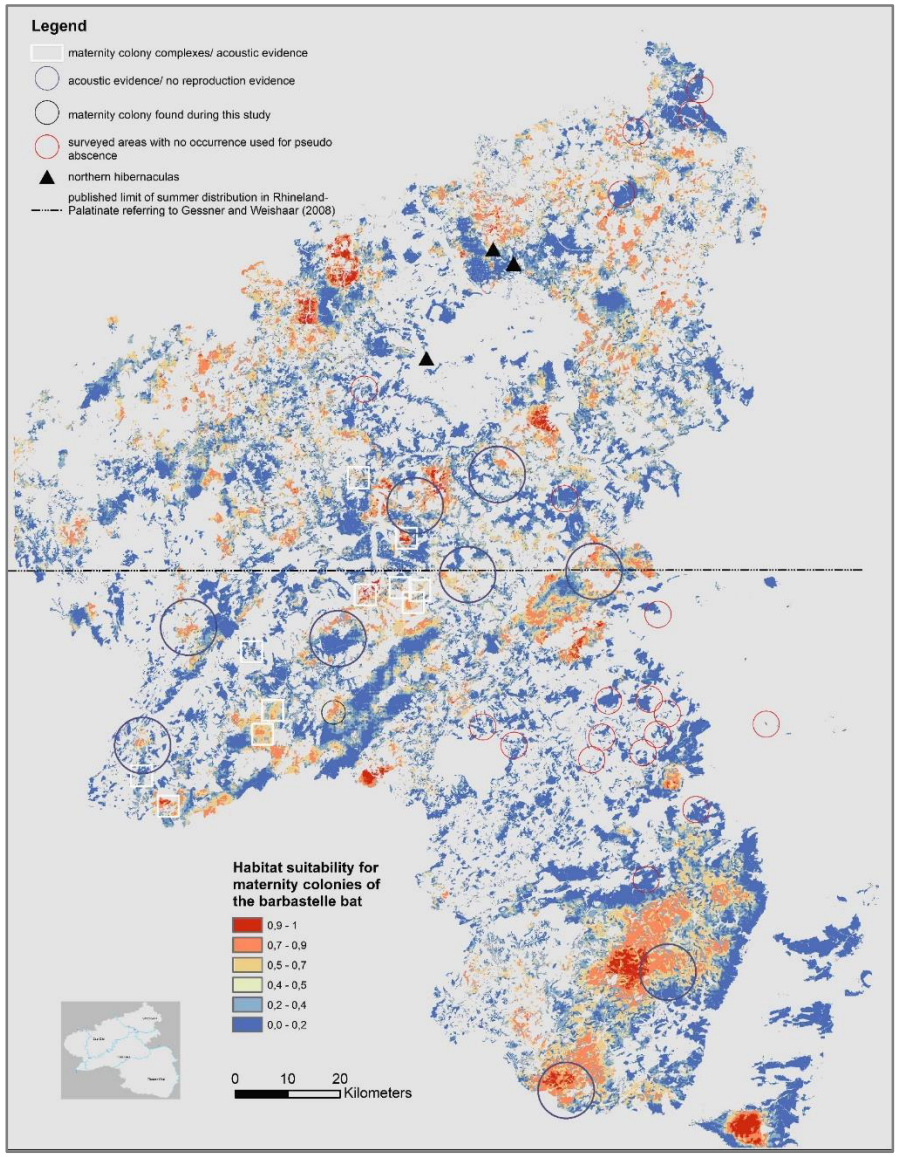
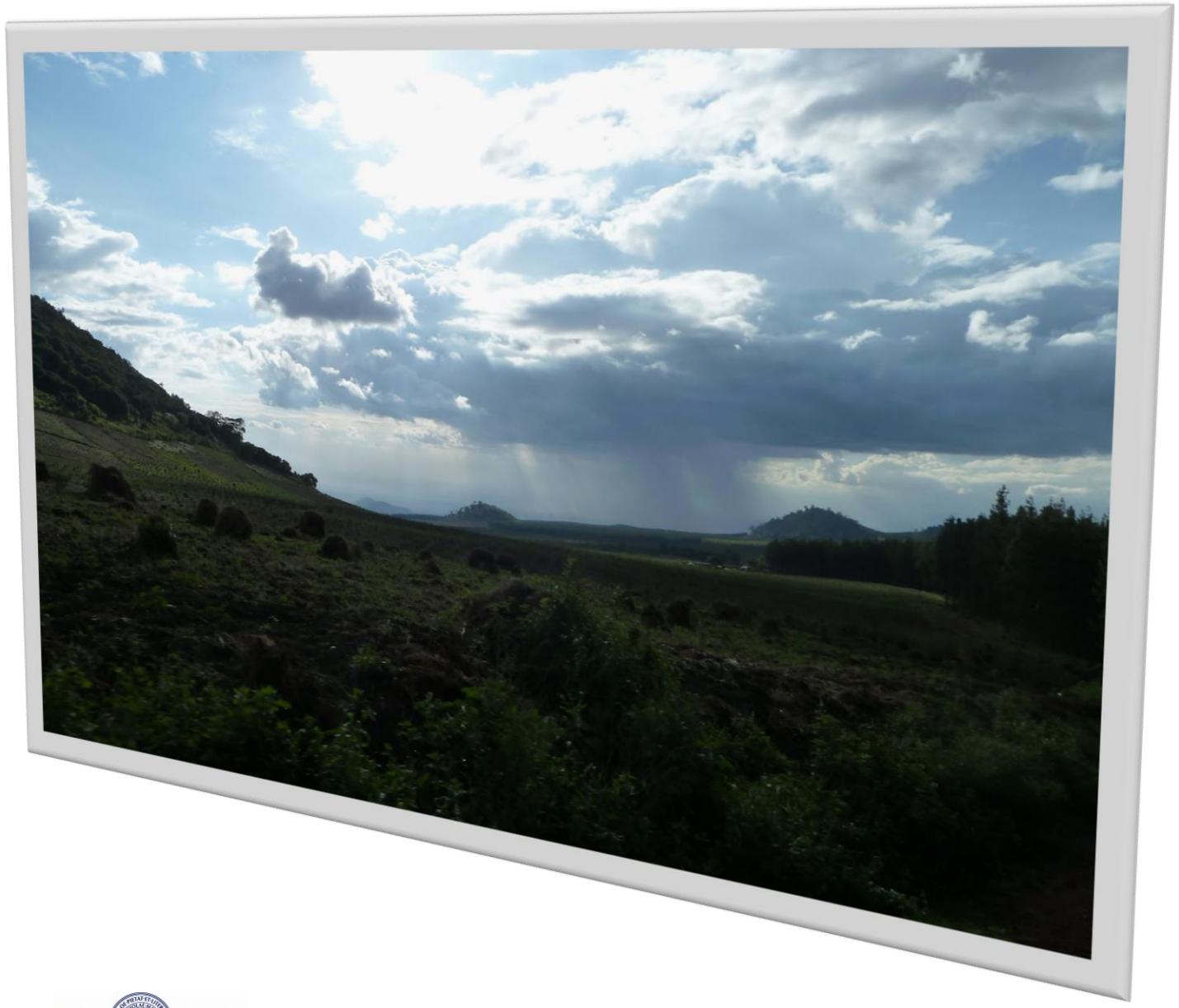


Gottwald et al. 2017, https://doi.org/10.3161/15081109ACC2017.19.2.015

(Gottwald et al. 2017)

In a Nutshell

Use physical models for physical relationships, AI for the “invisible” stuff beyond.



See you next time!