

# Red sun in Lille on 17 October 2017,

and in other parts of France,  
in England, etc ...



© North News & Pictures Ltd

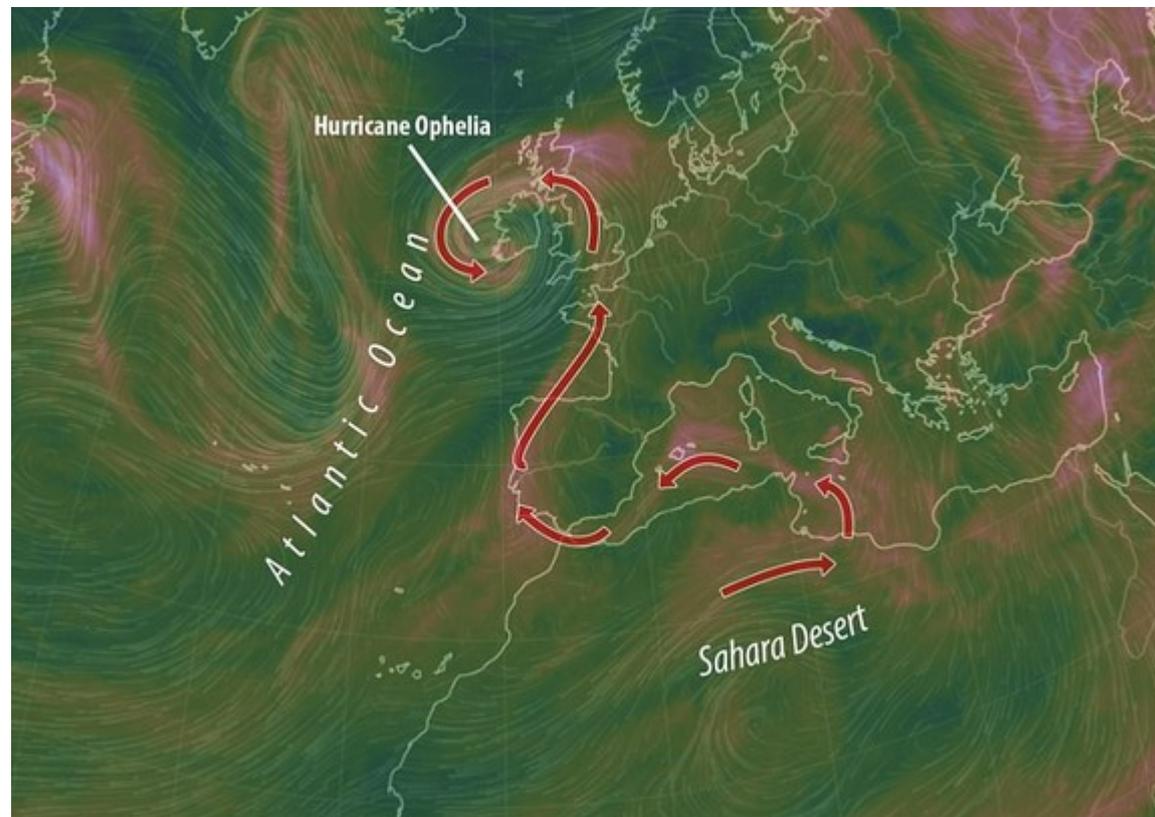
Picture grabbed on <http://www.dailymail.co.uk/news/article-4985116/Hurricane-creates-red-sun-skies-England.html>

## What happened ?

# Transport of desert dust from North Africa and forest fire smoke from the Iberian Peninsula to Eastern Europe

From <http://www.dailymail.co.uk/news/article-4985116/Hurricane-creates-red-sun-skies-England.html>:

*“The southerly winds that come with Ophelia have come up from Africa, picking up dust particles on their travels. The winds have also picked up smoke from wildfires over southern Portugal. All of that has come over the UK, and what we're seeing is the effect of the sunlight being scattered by the dust and smoke particles from Sahara wildfires.”*



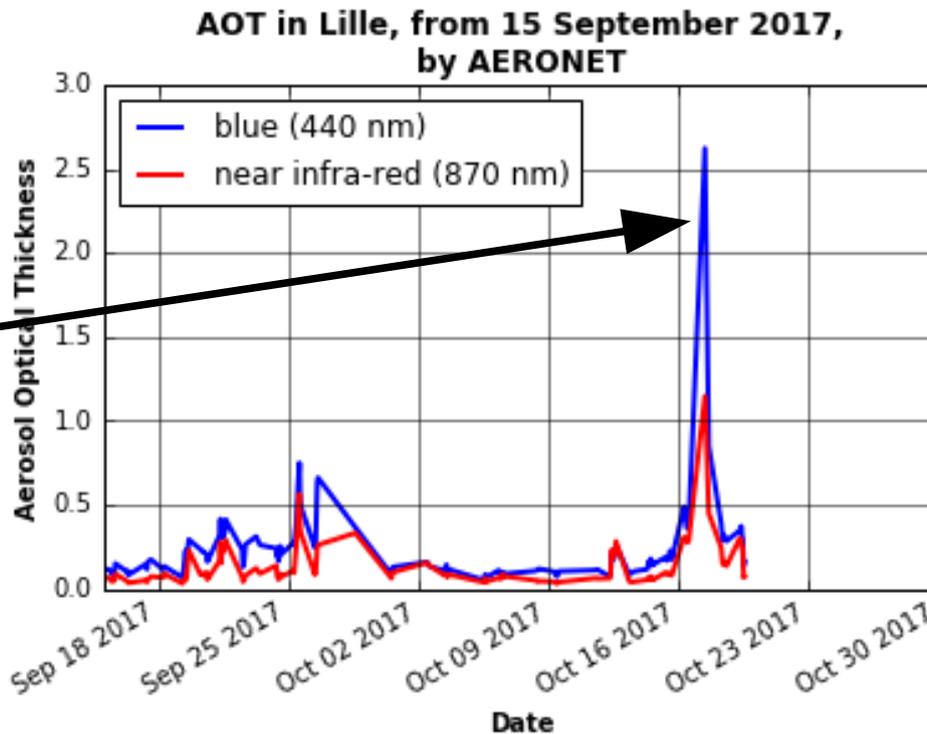
A nice video from NASA can be viewed there:

<https://www.youtube.com/watch?v=h1eRp0EGOmE&feature=youtu.be>

# Huge load of atmospheric particles (called aerosols) above Lille (France), as observed by AERONET

AERONET measures the capacity of the aerosols to attenuate the solar radiation (AOT) in several wavelengths of the solar spectrum

Exceptional value of AOT on 17 October at Lille



## Technical information:

Level 1.5 AERONET data, averaged over the hour.

## Credits:

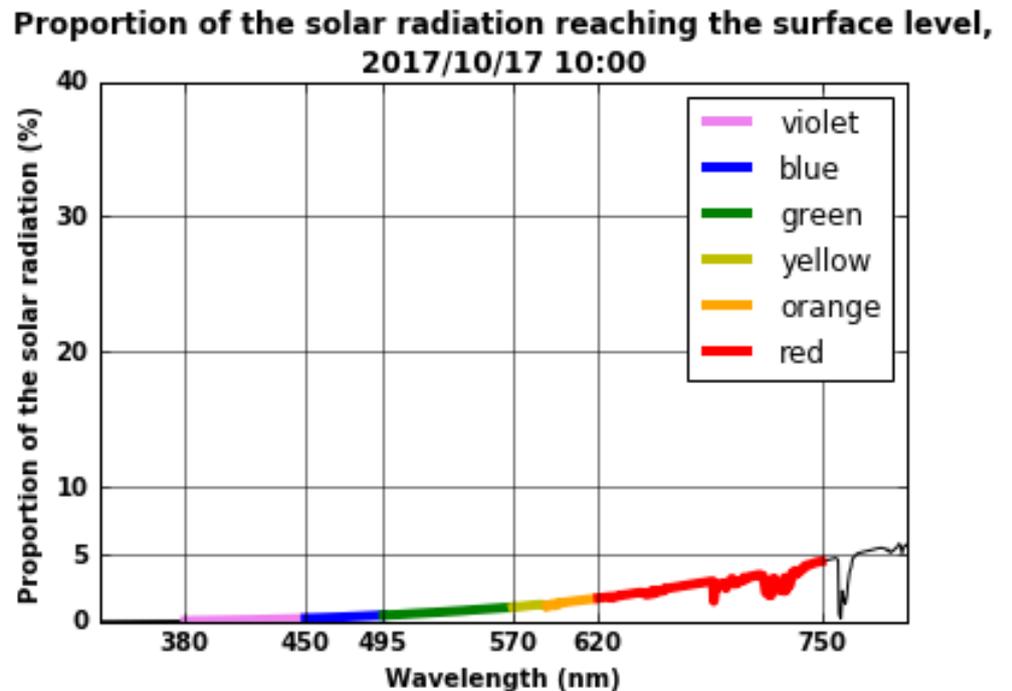
AERONET [https://aeronet.gsfc.nasa.gov/new\\_web/aerosols.html](https://aeronet.gsfc.nasa.gov/new_web/aerosols.html)

PI of the AERONET station of Lille: [philippe.goloub@univ-lille1.fr](mailto:philippe.goloub@univ-lille1.fr)

More observation data can be found on <http://www-loa.univ-lille1.fr/index.php/observation/sites.html>

**Consequently,  
the solar radiation reaching the ground level was weak,  
and most radiation in blue was scattered  
→ the sun appears red !**

Solar radiation reaching the surface is computed with a radiative transfer code, And it is compared to the solar radiation at the top of the atmosphere, before entering the atmosphere.  
Proportion of solar radiation is computed, and plotted in function of the wavelength.  
Blue color is caused by radiation ~450 nm, red color ~700 nm.  
More explanations in the three following slides.



**Technical information:**

$$\text{Proportion} = \text{DNI}(\lambda) / \text{ESI}(\lambda)$$

DNI: direct normal irradiance, ESI: extraterrestrial solar irradiance,  $\lambda$ : wavelength

**Credits:**

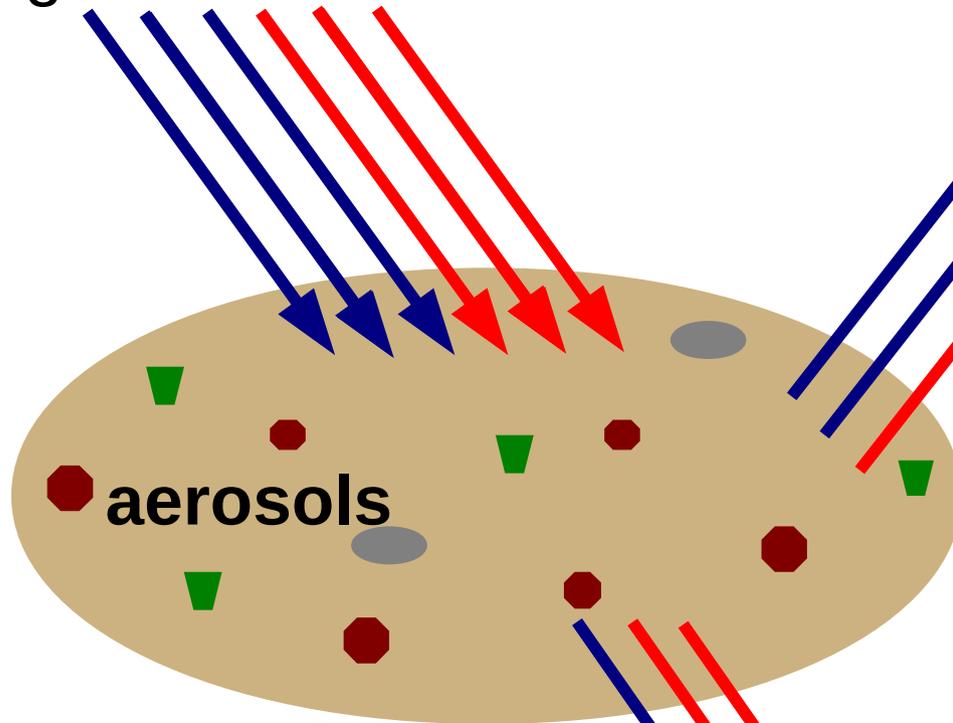
Radiative transfer code SMART-G, developed by HYGEOs <https://www.hygeos.com/project/smartg>

Input data from AERONET: AOT at 440 and 870 nm, water vapor content, solar zenith angle

Absorbing gases by REPTRAN

**Aerosols usually scatter radiation  
more efficiently  
in the blue spectrum than in the red spectrum**

**Solar radiation:  
blue+green+red +... = white**



**radiation  
scattered by  
aerosols,  
~ twice more in  
blue than in red**

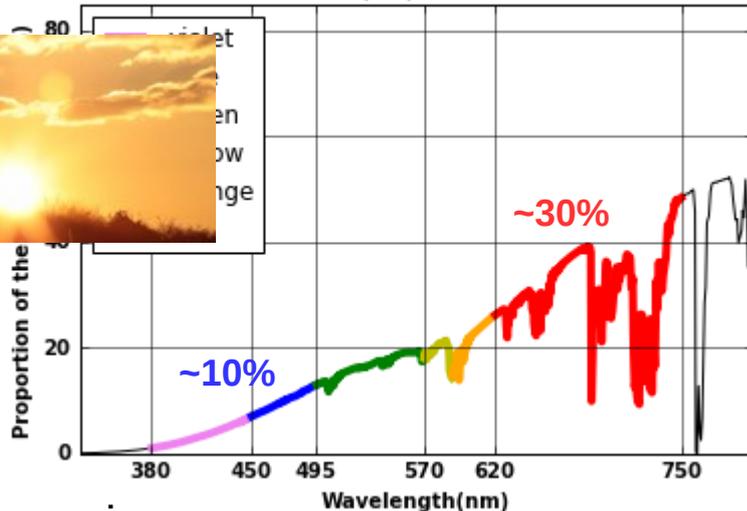
**Remains more  
red than blue  
in direct light**

# What happens on a usual day

The 'usual' day is for example 14 October 2017:

AOT ~ 0.12-0.18 (AOT > 2 on 17 October !!)

Proportion of the solar radiation reaching the surface level,  
2017/10/14 07:00

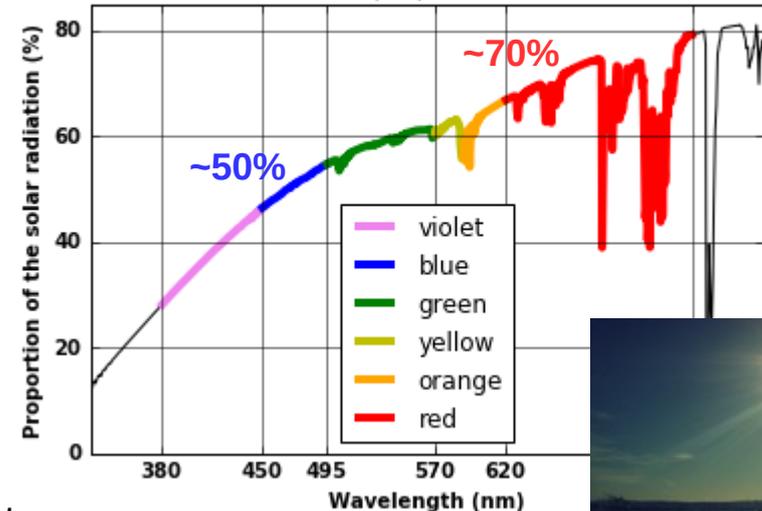


In the morning:

Only ~10% of the blue radiation from the sun reached the surface level, and ~30% of the red radiation,

→ **The sun is not so bright and appears ~orange**

Proportion of the solar radiation reaching the surface level,  
2017/10/14 12:00



At noon:

~50% of the blue radiation from the sun reached the surface level, and ~70% of the red radiation,

→ **The sun is bright and appears ~yellow**

## Technical information:

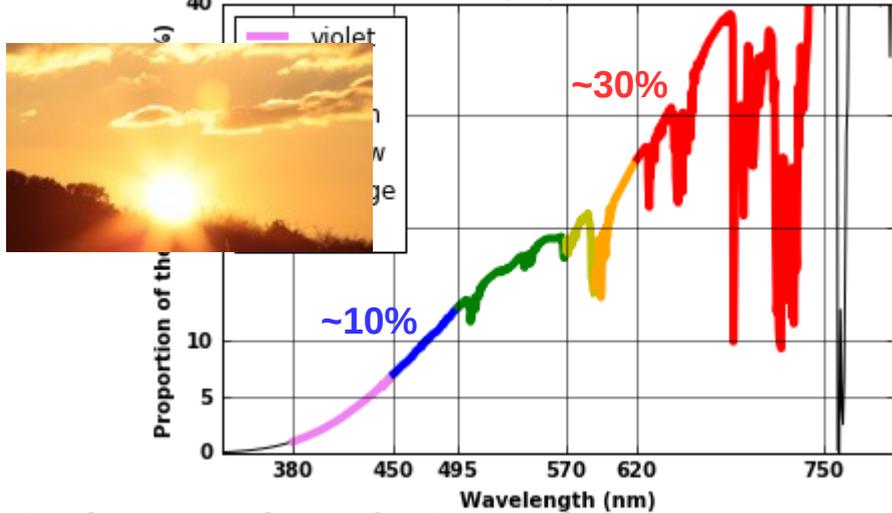
Universal Time (UT) is given.

2017/10/14 07:00: solar zenith angle (SZA)=77°

2017/10/17 10:00: SZA=59°

# What happened on 17 October 2017

Proportion of the solar radiation reaching the surface level,  
2017/10/14 07:00

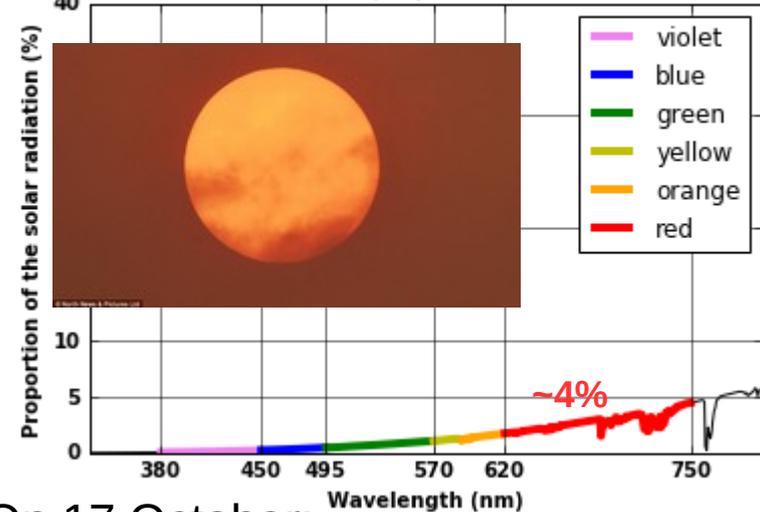


In the morning of 14 October:

Only ~10% of the blue radiation from the sun reached the surface level, and ~30% of the red radiation,

→ **The sun is not so bright and appears ~orange**

Proportion of the solar radiation reaching the surface level,  
2017/10/17 10:00



On 17 October:

Less than 5% of the red radiation reached the surface, and almost no blue radiation

→ **The sun can be watched with naked eyes, and it appears red**

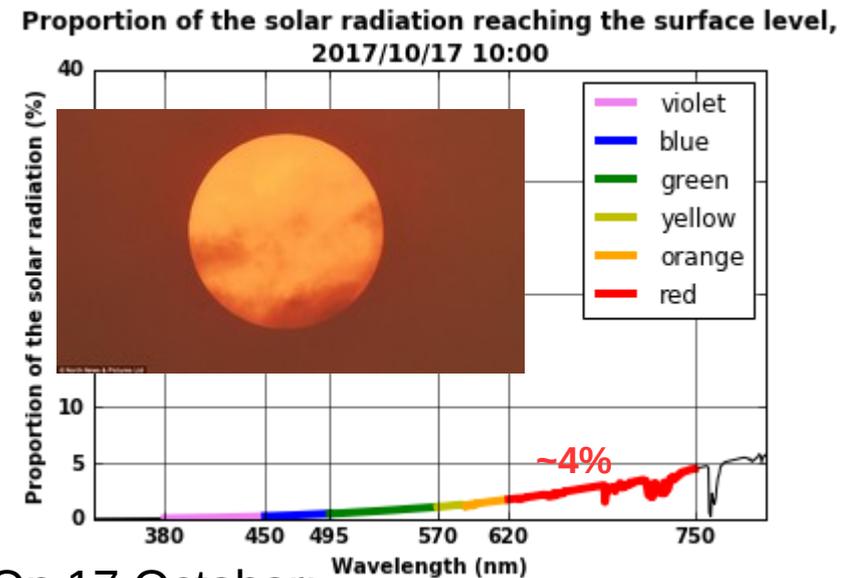
## Technical information:

2017/10/14 07:00: SZA=77°, Angstrom exponent=1.34

2017/10/17 10:00: SZA=63°, Angstrom exponent=1.14 (mixture of desert dust and forest fire smoke)

# What happened on 17 October 2017

Any question, comment  
welcome to [te@hygeos.com](mailto:te@hygeos.com)



On 17 October:

Less than 5% of the red radiation reached the surface, and almost no blue radiation

→ **The sun can be watched with naked eyes and it appears red**