

Effect of radiation

During a freezing period in NL (Tuesday 9 Jan 2024)





Measures from Wageningen University

Wageningen University has a website where a lot of daily earth surface measures are published:

<https://met.wur.nl/veenkampen/graphs/cur/>

The measures are valid for De Veenkampen, one of the outdoor research fields of Wageningen University.

The measures are kept for one week and then replaced by the days of the new week.



Zooming in on Tuesday 9 January 2024

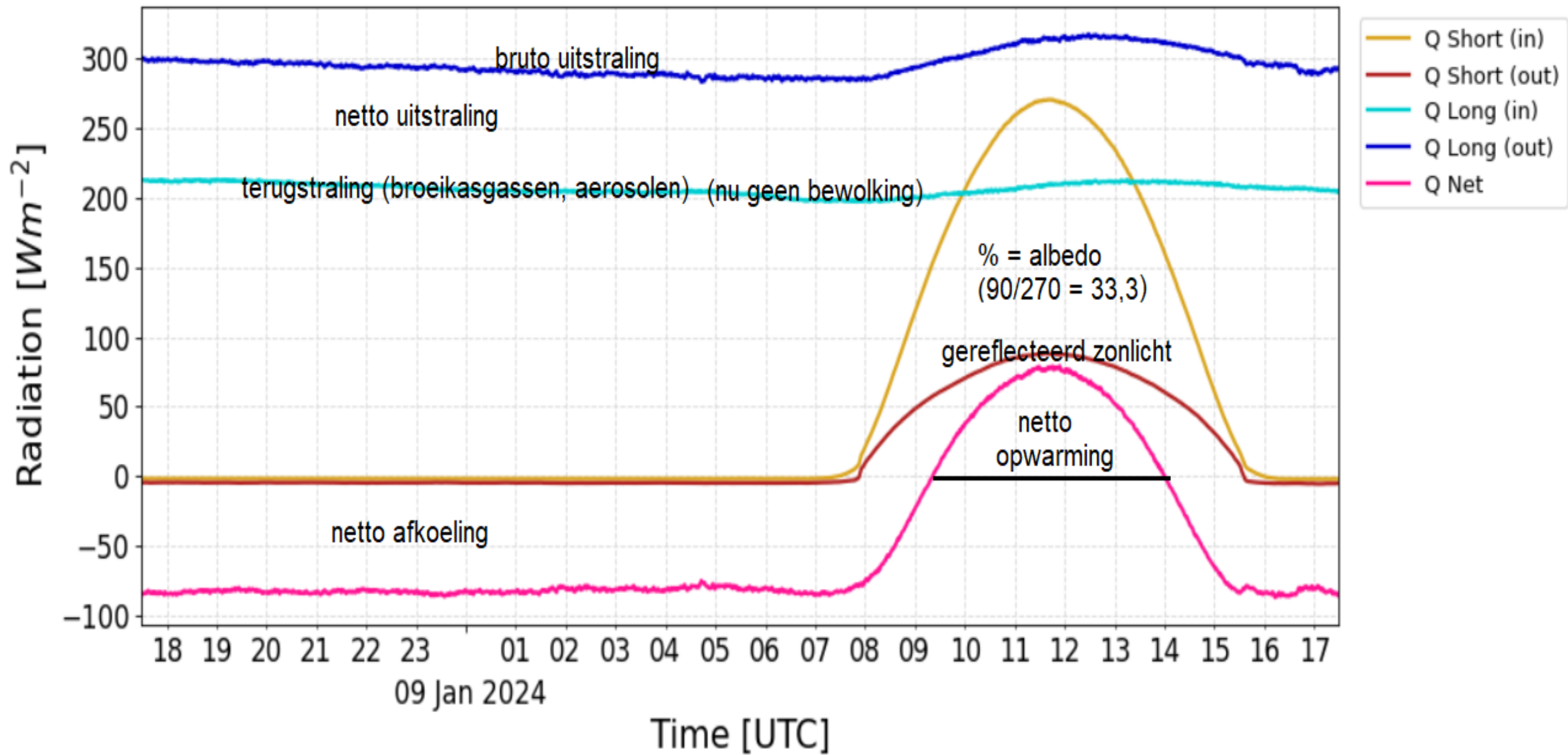
Tuesday 9 January 2024 had totally clear sky and was in the middle of a cold spell in The Netherlands.

With special thanks to Wageningen University in combination with Rutger (Meppel) and Bart (Abcoude) from the weather chatsite www.weerwoord.be the diagram on the next page was created.

The diagram shows the net balance between outgoing and incoming radiation during 24 hours.

Radiation 1

Tuesday 09-01-2024



Legenda



- **dark blue line** = energy that the earth surface radiates to space and to cold air layers in our atmosphere, the outgoing radiation.
- **mint green line** = the amount of outgoing radiation that reflects back to earth from particles in our atmosphere like aerosols, green house gases and other pollution.
- **light orange line** = the incoming radiation reaching the surface of the earth. On a clear sky day like 9/1/24, this is mostly direct sun light.
- Albedo is a term for the amount of light reflection. Wageningen uses 33% in this situation for the earth surface at De Veenkampen. The **dark orange line** is the amount of incoming radiation that is reflected.
- The **purple line** is the net balance of radiation. That means that earth surface at De Veenkampen gains energy by radiation from 9:15 to 14:00 o'clock and loses energy in all other hours of the 24 hour period shown by the diagram.



Some remarks

- Tuesday 9/1/2024 had totally clear sky. On a day with heavy clouds, the reflection of outgoing radiation is almost 100% which means **dark blue** and **mint green** are on the same level.
- The words netto afkoeling (net cooling) and netto opwarming (net warming) in the diagram are not fully correct. This should be net cooling *by radiation* and net warming *by radiation*.
- To calculate the total net cooling/warming, one should also take the other two energy transition factors in account: phase changes (like evaporation/condensation and sublimation/ripping) and convection. On www.weerwoord.be this is also stated by Rutger (Meppel).
- The diagram only incorporates radiation. Phase changes and convection are not incorporated in the diagram.

Some conclusions



- The reflection of outgoing radiation by aerosols, greenhouse gases and pollution is pretty high, also on a clear sky day.
- Happily for HLSK, the reflection of outgoing radiation is (on average) less in Scandinavia, due to cleaner air.
- With such a diagram, it is possible to calculate at which length of daylight the net balance for the whole day is positive or negative at De Veenkampen.
- To make calculations for other locations, the angle of incoming sunlight should also be incorporated.
- Happily for HLSK, the albedo for snow and ice surfaces is higher than the used 33% for the surface at De Veenkampen. That means that the net cooling by radiation for iced lakes and canals is higher (on the same day with the same weather).
- Fresh snow can reach an albedo of 85%. It is unknown what the albedo of black ice on lakes and seas is, but it is estimated to be between 50% and 70%, depending on the sun angle.

“Clean air helps us skate!”

HLSK

Questions?

By mail to Rob Mulders at rob@fire.ly