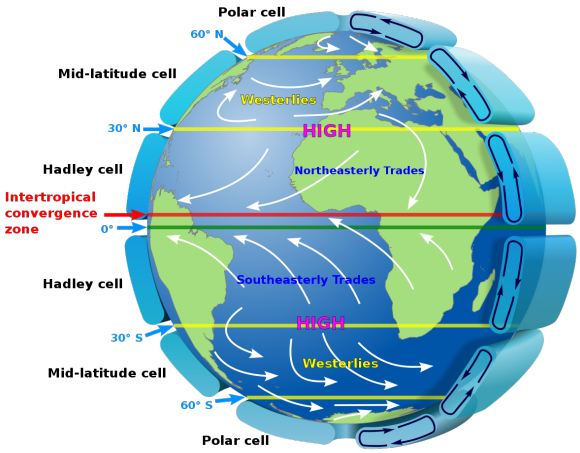
CLIMATE MACHINE

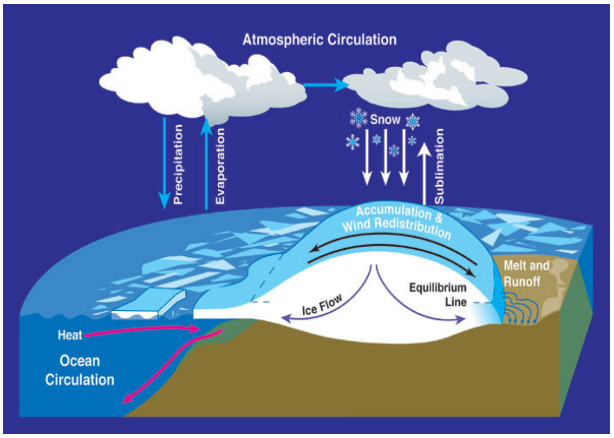
At the heart of the climate system, the atmosphere and oceans, through their winds and currents, distribute excess solar energy reaching the equator from low latitudes towards the poles, which are in deficit. It is in this sense that physicists speak of a “machine” looking to thermodynamic: temperature differences are converted into motion, whose kinetic energy is, of course, dissipated into heat.



This analogy can be used also in a more popular and less physical way. If we consider the climate as for example a car, the obvious questions are basically 4:
1 - who supplies the petrol? 2 - on what principle is the engine of this machine based?
3 - who finally turns the key and turns it on?
4 - can this machine ever stop?
And the answers to these questions provide the basic of the climate system functioning:
1 - the sun is our gas station, more generous with the equator and less with the poles;
2 - the engine of the car is the combination of the universal rule for which nature tries to bring everything to the same temperature ALWAYS and the luckiness have two willing helpers like the air and water to make the job;
3 - the sun that heats the equator more than the poles ends up starting the engine;
4 - as long as the sun gives us the energy and the hottest equator of the poles the machine will remain in motion (how however can be affected a lot by climate change)

INCOMING RADIATION AT EARTH SURFACE

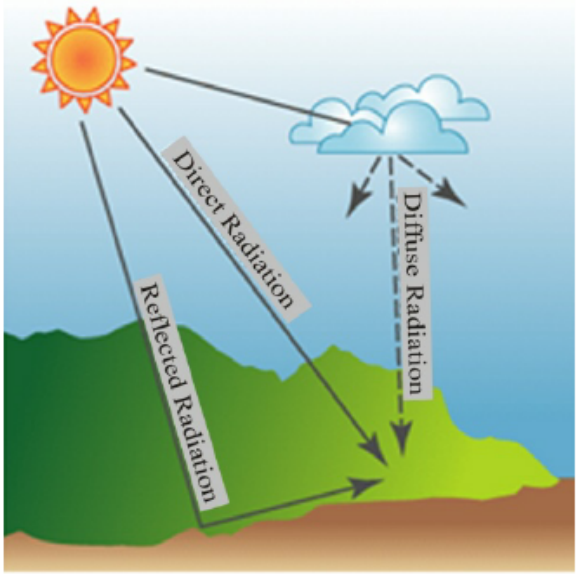
The foregoing highlights the extent to which the weather and the climatic machine are driven and regulated by the differences (of radiation, temperature, pressure, altitude, land and water distribution, etc.) both in space and in time.
This consideration makes clear the importance of monitoring the radiation that manages to reach the surface of the Earth. On the sea, this measure is clearly much more difficult than elsewhere. And satellites can only partially help us because they look from very far away and their vision is obstructed by the atmosphere (think when the sky is cloudy).
The importance can also be deduced by thinking about the water cycle and the fact that it is triggered by the radiation that heats the oceans and evaporates its waters. Without this process we could not have clouds and rain.



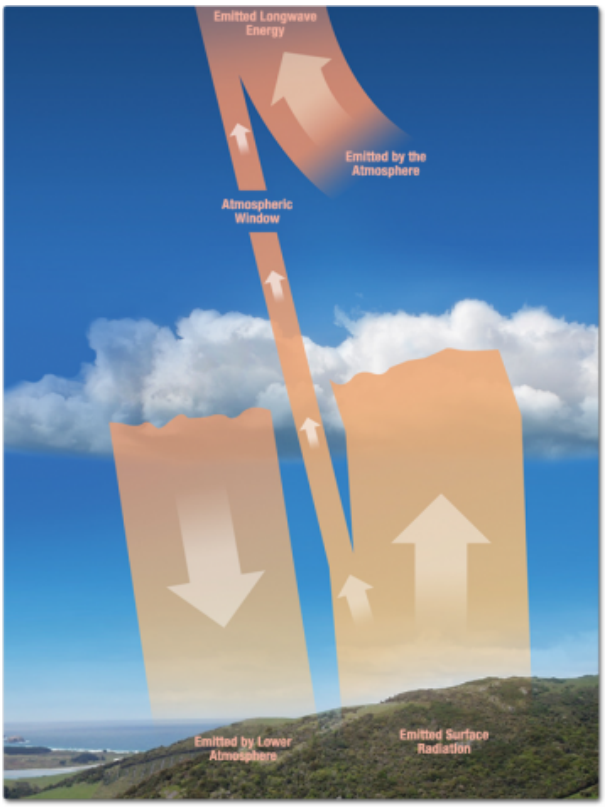
Measurements made on ships and platforms are very valuable, certainly simpler and more accurate than those that can be made on buoys. In seas that see the non-constant presence of ice they become even more important, both for the data they give and for the possibility of validating the information obtainable from the satellites.

SURFACE RADIATION COMPONENTS

Only about 50% of the solar radiation reaches the surface directly, but as we all know this quantity varies greatly with the season and above all the cloud conditions.
The solar radiation that remains trapped in the atmosphere is at the origin of the blue sky that we are able to appreciate, as well as the beautiful fiery red sunsets or the soft pink colors in the polar areas. Some of this scattered radiation manages to reach the surface.



Solar radiation is not the only radiation reaching the surface. The atmosphere, especially the lower part of the troposphere, is a "hot" place when compared with the temperature of space which is about -270 ° C, close to absolute zero. And this thanks to the surface that, when heated by the sun, ends up also heating the atmosphere.
A hot body emits radiation according to another universal thermodynamic law (this is what the Sun also does). As a consequence, surface also receive radiation emitted from the atmosphere.



For how it arises, thermal radiation emitted by the atmospheric is a parameter directly linked to the average temperature of our planet and one of those that first change (more sensitive) due to climate change.
Since the Sun has a temperature close to 6000 ° C and the atmosphere on average 20 ° C, it is not at all strange that the two radiations are very different: the solar radiation cover a shorter wavelength range (SHORTWAVE), while atmospheric radiation a longer one. (LONGWAVE or also INFRARED being its wavelength range just greater than that of the red end of the visible light spectrum but less than that of microwaves).

IMAGE CREDITS

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