

Albedo is a physical term that describes the ability of a surface to reflect light. The higher the albedo, the more light is reflected from the surface and the less it heats up. Albedo measurements are important for Earth's climate because they indicate how much solar energy reaches our planet's surface and atmosphere.

The surfaces of the seas and oceans have different albedos depending on many factors, such as the color of the water, ice cover, the presence of clouds, the angle of the sun's rays or water pollution. Water has a low albedo and absorbs a lot of light, which is why seas and oceans are an important source of heat for the climate. However, if the water is colored by algae, mineral dust or plastic, its albedo increases and reflects more light. This reduces the amount of heat absorbed by the water and can affect oceanic and atmospheric circulation.

Changes in the albedo of sea and ocean surfaces can have different effects on climate. For example, if the ice sheets in the polar seas melt due to global warming, the albedo of these areas decreases and more light is absorbed by the dark water. This, in turn, accelerates the melting of ice and global warming. On the other hand, if the albedo of seas and oceans increases due to pollution or algal blooms, it can slow down climate warming or even cause local or global cooling.

The albedo of the surface of seas and oceans is therefore an important factor indicating climate change and it is worth exploring the knowledge about it. This is in line with the current research on geoengineering projects, which is considering various solutions leading to a reduction in the energy balance of our planet. They are based on various methods. So there are those that consist in placing sails in space that partially cover the face of the Sun, others propose shooting additional aerosols into the stratosphere that would reflect sunlight. It is also proposed to sow clouds in tropical zones or, finally, to change the reflective properties of the planet's surface itself, e.g. by painting the roofs white.

The aim of this project is to find out how inclusions in the marine environment can change the albedo and thus the energy balance of the Earth. We intend to achieve this goal through the implementation of a number of tasks, which will include:

- Measurements of the spectrum of the refractive index of inclusions, including pollution of the marine environment. Obtaining such spectra in the widest possible range will allow to calculate the scattering properties of these inclusions
- Simulations of radiation transmission in the atmosphere-sea system, which will be carried out by two methods: the method of tracing the fate of virtual photons that will be subject to scattering and absorption phenomena in the system, and a simplified method obtained thanks to the Hydrolight software
- Environmental measurements of the albedo value above the sea surface, which will be performed periodically during cruises in the South Baltic region and in the North Sea and around Svalbard during cruises to Spitsbergen
- Verification measurements of the albedo value above the sea surface, which will be performed for inclusions in the marine environment in the form of, for example, emulsions of natural oils. The spread of these inclusions in the environment will be limited to the floating area of the transparent tank, which will allow concentration control and filtering out of inclusions after the measurements are completed.
- Evaluation of the influence of individual components of sea water and inclusions in this water on albedo changes

The expected result of our research will be the acquisition of input data that will allow the expansion and updating of models to more accurately predict future climate changes.