HELMHOLTZ KLIMA INITIATIVE

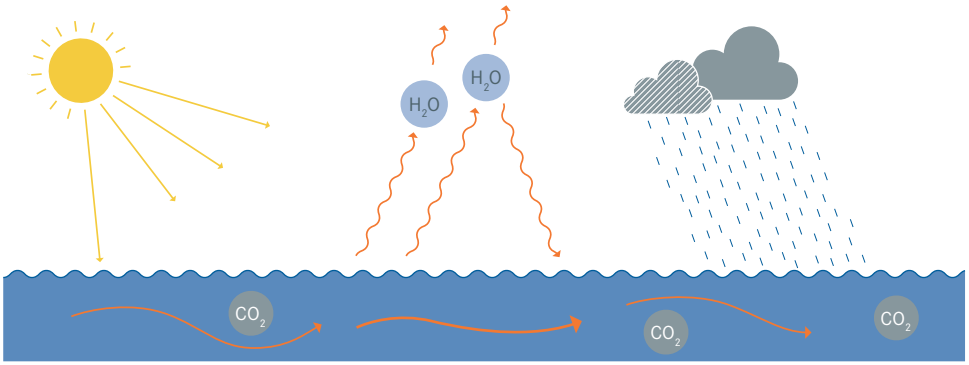
FACTSHEET

№ 03

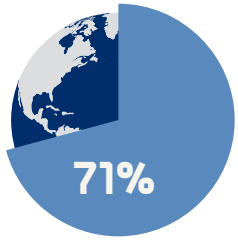
TOPIC: OCEANS

OCEANS AND CLIMATE

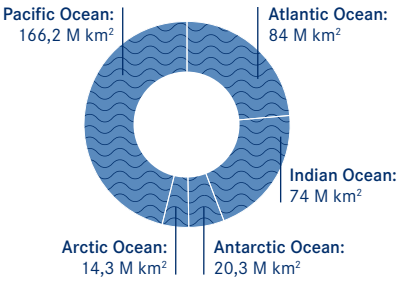
Oceans have a major impact on climate. They absorb a large part of the solar energy as warmth and release some of it back into the atmosphere as water vapor. This is how rain, hail or snow occur, for example. Oceans are also climate buffers: they store around 25% of the CO_2 that we humans emit every year, thus lessening the greenhouse effect (AWI).

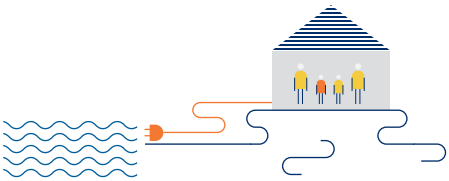


EARTH'S OCEANS



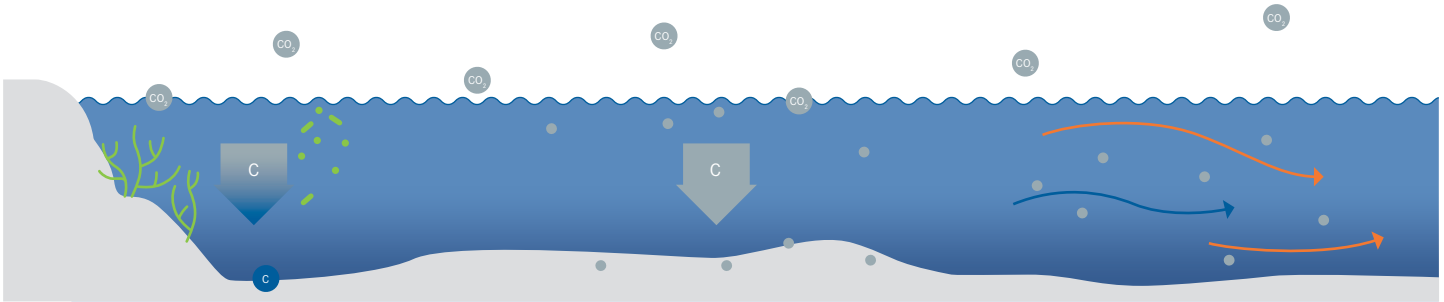
of the world's surface is covered by oceans





The energy that 11 m² ocean absorb during the summer in temperate parts of the world, can cover the average annual consumption of a four-person household in Germany (6,000 kilowatt hours) (Wissenschaftsjahr)

ROLE OF THE OCEAN IN THE GLOBAL CARBON CYCLE



BLUE CARBON

Coastal and marine ecosystems such as mangroves, salt marshes and seagrass meadows store CO_2 from the atmosphere as well as carbon from outside their boundaries. Our CO_2 emissions captured by these coastal plants are sequestered below ground and known as 'blue carbon'.

CARBON SINK

CO_2 from the air dissolves in water when it hits the ocean surface. Carbon is transported to the seafloor by cold-water masses. The ocean stores it here for centuries. In total, there are about 38,000 gigatons (Gt) stored in the seafloor (1 gigaton = 1 billion tons). (worldoceanreview) That is almost 1000 times the amount emitted by the entire world in 2018. (Global Carbon Project)

OCEANS AS A CONVEYOR BELT

The carbon is distributed via ocean currents such as the Gulf Stream. Like a 'global conveyor belt', these currents transport warm tropical waters to the poles. The water mass cools down and sinks, bringing its carbon along with it to the seafloor.

IMPACTS OF CLIMATE CHANGE

Oceans are warming and acidifying.

OCEAN WARMING

The oceans store up to 93% of the Earth's heat and are therefore the most important heat buffer on our planet. (ESKP)

Sea level is rising: From 1993 to 2019 the sea level rose by around 94 mm. (Nasa)

Glaciers are melting: Every year they lose around 335 billion tons of ice. (ETH Zürich, 2019)

Coral reefs bleach: When exposed to temperature stress, corals shed the algae that photosynthesize for them and thereby bleach

Climate is changing: Temperatures in the North Atlantic influence weather and climate events, e.g. the course of winter in Central Europe or amounts of precipitation in West Africa.

OCEAN ACIDIFICATION

Since the beginning of the industrial revolution, the oceans have become almost 30% more acidic due to CO_2 uptake.(AWI)

Storage function decreases: The more the ocean acidifies, the less additional CO_2 it can absorb from the atmosphere. (GEOMAR)

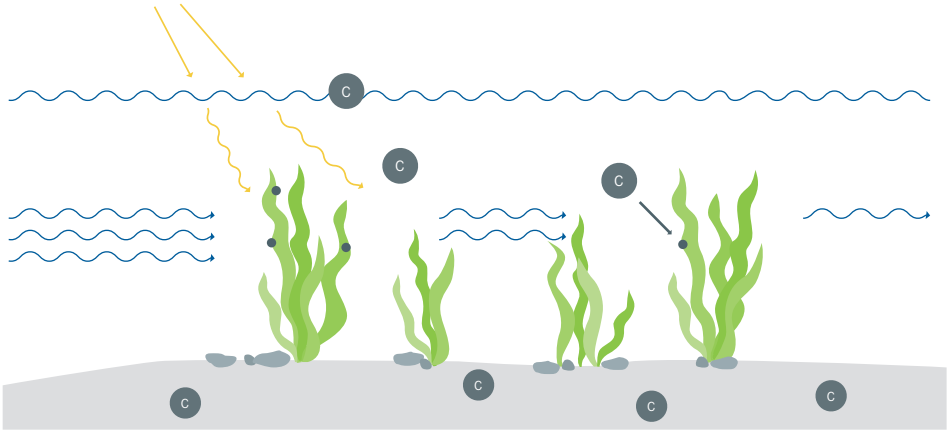
Marine life is changing: Many organisms show a reduced ability to form or maintain their shells and skeletons. (GEOMAR)

The oceans' ecosystem services for humans are changing: food, energy, living space. (GEOMAR)

Coral reefs are dying: Coral growth is reduced. (GEOMAR)

HELMHOLTZ' RESEARCH: SEAGRASS MEADOWS IN THE BALTIC SEA

Seagrass meadows in the Baltic Sea store between 627 and 4324 grams of carbon per square meter. They cover an area of around 285 km² - the rate of organic carbon storage here is 30 to 50 times higher than on land.



Seagrass has roots and rhizomes in the sea floor from which the above-ground shoots and leaves sprout. Like other plants, they need light to survive and absorb CO_2 during photosynthesis. The dense leaf canopy traps particles floating in the water and reduces the flow of water along the sea floor. The plant's leaves, roots and rhizomes, effectively help trap particles into the sediment, preventing them from being swirled up into the water again. This way the carbon in these particles is buried in the sediment below the seagrass meadow and protected for years to come.

INFO

The Marine C-Storage project examines the condition and potential of seagrass meadows along the German Baltic Sea coast.

Angela Stevenson, postdoc in the research unit "Marine Evolutionary Ecology" at **GEOMAR Helmholtz Centre for Ocean Research Kiel,** is researching how much CO_2 seagrass meadows in the German part of the Baltic Sea can store. This way, her team can determine how much CO_2 seagrasses are removing from the atmosphere and its contribution to the German national carbon budget and how we can protect and expand the stocks.

Would you like to know more?

Dr. Angela Stevenson
GEOMAR Helmholtz Centre for Ocean Research Kiel

Research unit "Marine Evolutionary Ecology"

eMail: astevenson@geomar.de

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HELMHOLTZ CLIMATE INITIATIVE
Markgrafenstraße 22, 10117 Berlin
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