doi.org/10.22498/pages.horiz.2.75

GLOSSARY

A greenhouse gas is a gas that warms the atmosphere due to its capacity to interact with infrared radiation emitted by the Earth. The main greenhouse gases on Earth are currently water (H_2O), carbon dioxide (CO_2), methane (CH_4) and nitrous oxide (N_2O). CO_2 concentration in the atmosphere is measured in parts per million (ppm); a concentration of 400 ppm means that there are 400 g of CO_2 for every 1,000,000 g of (all) gases in the atmosphere.

SSP stands for Shared Socioeconomics Pathways. The SSP scenarios are a series of scenarios of greenhouse gas emissions (such as carbon dioxide and methane) which depend on future human activities (Fig. 1). These emission scenarios are used as inputs for climate simulations with numerical models. To span a large range of possible emissions due to different societal choices, scientists/economists have defined several scenarios of human emissions, based on several scenarios of human societies' evolution. Climate models are then run with these different scenarios to evaluate the impact of different societal choices on future changes of temperature, sea level, etc.

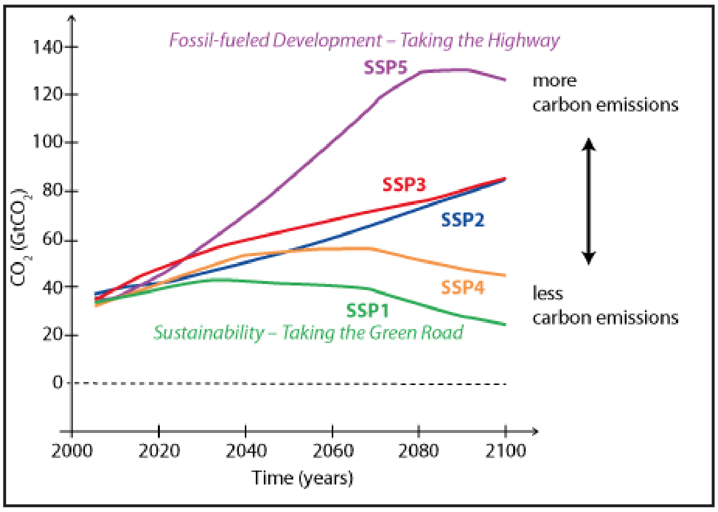

Figure 1. Scenarios of atmospheric CO_2 concentration evolution.

Times:

Time is referred to in thousands of years before present (kyr BP), or million years before present (Myr BP). The reference for the present is the year 1950, which corresponds to a time when many nuclear tests were done, and is easily seen in environmental records.

The **Pliocene** is the period from 5.3 to 2.6 Myr BP.

The **Plio-pleistocene** ranges from 12 to 5.3 Myr BP.

The **Miocene** is the period from 23 to 5.3 Myr BP.

The **Quaternary** corresponds to the last 2.6 million years.

A **glacial/ice age** is a relatively cold period of the Quaternary with large ice sheets.

An **interglacial** is a relatively warm period of the Quaternary with small ice sheets.

The **penultimate glacial period** is the cold period (glacial) that took place at ~130 kyr BP.

The **Last Interglacial** is the last warm period (interglacial) before the current one at around 130 to 115 kyr BP.

The **Last Glacial Maximum** is the last cold period (glacial) at ~21 kyr BP.

The **pre-industrial period** is the time around 1850, before the main industrialization that is associated with large greenhouse gas emissions in the atmosphere.

Ice sheets correspond to ice sitting on a continent (and not on the ocean; Fig. 2). Ice sheets are often very high, reaching a few kilometers. If an ice sheet melts, the water goes into the ocean and results in global sea-level increase. Today, the two main ice sheets on Earth are the Greenland Ice Sheet (in the Northern Hemisphere) and the Antarctic Ice Sheet (Southern Hemisphere). If they were to melt entirely, the global seal level would increase by around 7 m (23 ft) from the Greenland ice sheet, and around 60 m (200 ft) from the Antarctic ice. During glacial periods, additional ice sheets grew on both the American and Eurasian continents. Due to this additional ice on these continents, the global sea level was ~120 m (400 ft) lower.

Contrary to ice sheets, **sea ice** floats on water. While an ice sheet is formed from snow falling onto land, sea ice comes from freezing seawater. Sea ice is also much thinner – only a few meters (feet) thick. When sea ice melts, it does not cause any change in sea level because this type of ice floats on the ocean. Today, you can find a lot of sea ice in the Arctic ocean in the Northern Hemisphere, and in the Southern Ocean around Antarctica in the Southern Hemisphere.

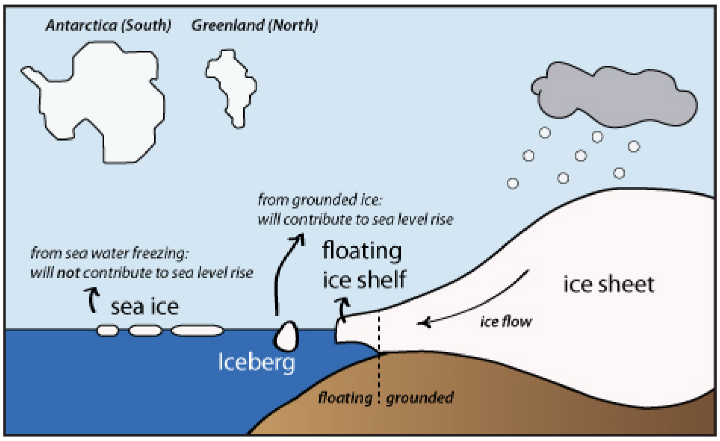

Figure 2. Ice sheet and sea ice.

Isotopes are atoms that have the same number of protons, but a different number of neutrons. For example, the most common oxygen isotope has 16 neutrons (^{16}O), but some isotopes have 17 (^{17}O), or 18 neutrons (^{18}O). This means that while they have very similar physical and chemical properties, they have a different mass (the more neutrons, the heavier). This mass difference leads to slight differences in some reactions, such as during phase changes. For example, when water from the ocean evaporates, the heavier oxygen isotope with 18 neutrons remains in the ocean more than the lighter isotope with 16 neutrons, which will be relatively more abundant in clouds (Fig. 3). Hence the relative proportion of these two isotopes is different in the ocean and in clouds. Often, the heavier isotope reacts less quickly. This property is used in analysis to infer climatic or environmental information. The most used isotopes in climate studies are the oxygen and carbon isotopes (^{12}C, ^{13}C and ^{14}C). In addition, some isotopes, such as ^{14}C, are unstable and decay radioactively. This is used to determine how old a substance containing carbon is.

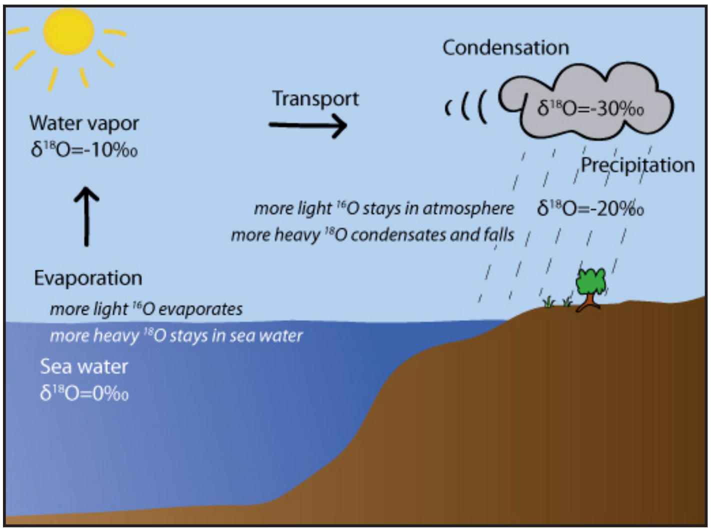

Figure 3. Schematic of isotopic fractionation during evaporation and precipitation.

A **monsoon** is a seasonal change of winds due to the ocean-land temperature contrast, resulting in drastic changes in rain. In summer (Fig. 4a), land warms faster than the ocean, so that the winds rise above the continent (where it is warm and the air becomes lighter) and fall over the ocean. The winds blow from the ocean, where the air is very humid, to the land. When the air rises above the continent, the water vapor in the air condensates, resulting in a lot of rain and clouds on land. During winter (Fig. 4b), the land cools more than the ocean, and the winds descend over land and rise over the ocean. The rain (and clouds) thus remain over the ocean, and there is very little rain on land.

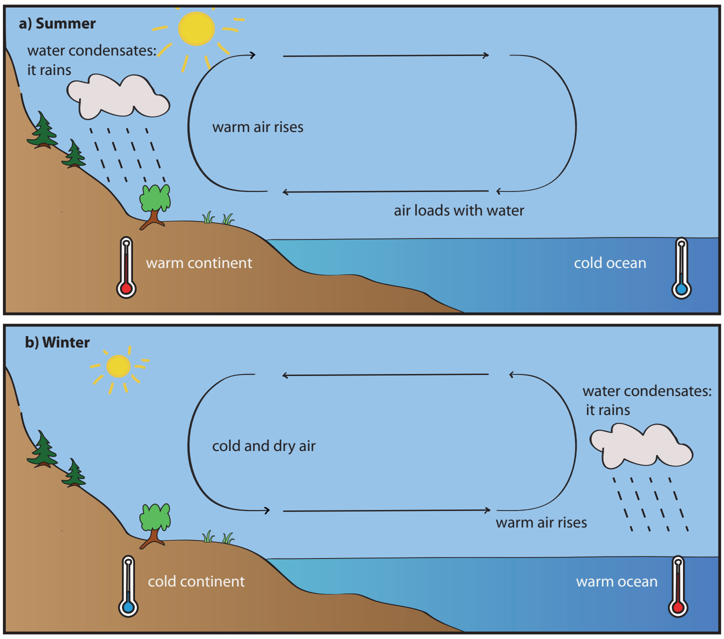

Figure 4. Schematic of the monsoon.

ACKNOWLEDGMENTS

The editors extend their sincere gratitude to Flavio Anselmetti, William Banks, Miguel Bartolomé, Juan Bernal Wormull, Estelle Camizuli, Nathan Chellman, Tiphaine Claveau, Xavier Crosta, Anne-Katrine Faber, Jerome Fort, Penélope González-Sampériz, Aline Govin, Alan Haywood, Sergio Henrique Faria, Iván Hernández Almeida, David Hutchinson, Pierre Jacquet, Amy McGuire, Encarni Montoya, Ana Moreno, Peter Neff, Marion Papanian, Graham Rush, and Christoph Spoetl for lending their expertise in reviewing the articles in this issue.

PAGES

PAGES International Project Office
Hochschulstrasse 4, CH-3012 Bern, Switzerland

Telephone +41 31 684 56 11
Email pages@pages.unibe.ch
Website pastglobalchanges.org
Twitter @PAGES_IPO
Facebook PastGlobalChanges

Find out more about PAGES Horizons at
pastglobalchanges.org/products/pages-horizons

Series Editors
Sarah Eggleston, Boris Vannière, Graciela Gil-Romera, Marie-France Loutre

Series Editors
Nathaelle Bouttes, Emilie Capron

Text Editing
Leigh Martens Winiger, Chené van Rensburg

Layout
Sarah Eggleston

Design
sujata.design

Printed on recycled paper by
Läderach AG, Bern, Switzerland

Parent program
PAGES is a Global Research Project of Future Earth.

Supporters
The PAGES International Project Office and its publications are supported by the Swiss Academy of Sciences (SCNAT), the Chinese Academy of Sciences (CAS), and the University of Bern, Switzerland.

doi.org/10.22498/pages.horiz.2