

POLAR REGIONS AND THE GLOBAL CLIMATE AND ENVIRONMENT

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Polar regions with its snow and ice cover play a dominant role in the Earth system. The particular significance of polar regions becomes evident when considering that about 90% of the volume of the world's oceans, comprising the deep cold waters, is connected to only 10% of their surface area, and most of these ventilation windows lie in the polar regions. Very specific physical and chemical processes shape this environment. Through atmospheric and oceanic teleconnections they influence the global environment and its changes. Examples are the formation of cold air above the white, highly reflective snow and ice surfaces and the production of cold, dense water masses, which drive the global atmospheric and oceanic circulations; the seasonal cycles in sea ice extent and thickness with resulting changes in ocean-atmosphere coupling; and the specific conditions for chemical reactions in the stratosphere during polar winters.

The cryosphere – a dominant feature in polar regions – is intricately linked to the surface energy budget, the water cycle and sea level change. It integrates climate variations over a wide range of time-scales making it a natural sensor of climate variability, and providing a visible expression of climate change. In the past, the polar regions have undergone significant variations on many time scales. Current variations are different in the Arctic and Antarctic. Changes in both polar regions from measurements and simulation experiments, their role in the climate system, their impact on the environment and scenarios of their future evolution will be discussed.