THE SOUTHERN OCEAN

The Southern Ocean consists of a broad band of generally turbulent water surrounding the continent of Antarctica. The northern limit of this ocean is about 40°S latitude. Westerly winds and the associated West Wind Drift, or Antarctic Circumpolar Current, are outstanding features of the Southern Ocean. They cause massive amounts of water to move constantly from west to east around Antarctica. This involves water from the surface down to about 3,000m stretched over a distance of some 24,000 km. This averages some 130 million cubic meters of water per second continuously on the move.
Farther south, however, easterly winds cause a westward-flowing current close to the continent - the East Wind Drift. Along much of the coast, particularly East Antarctica, this is a relatively narrow band, but where deflected by deep embayments such as the Weddell, Bellingshausen and Ross Seas, it circulates in the form of clockwise gyres.
A ship sailing south to Antarctica will encounter a sharp drop in temperature between 49° and 55°S latitude. At this point one can detect subtle changes in both the ocean and the atmosphere. This delineates the "Antarctic Convergence", a zone that surrounds the continent.

Antarctic Convergence
The Antarctic Convergence is a natural boundary between the relatively warm Subantarctic Surface Water and the cold Antarctic Surface Water. The location of the convergence is not a precise line, but varies slightly throughout the year or from year to year or even century to century. This zone of the convergence is an important and distinctive biological phenomenon influencing the distribution of plankton, fish and birds. The species found arc quite distinct as one travels across it.
The water south of the convergence is often referred to as the **"Antarctic Ocean"**. This covers an area of about 35,000 square km, or 10% of the world's oceans. It contains the coldest and densest water on earth and is notable for its high biological productivity. It plays a major role in influencing oceanic circulation in the southern hemisphere, and indeed in governing the climate of the planet.

Antarctic Ocean
The Antarctic Ocean is made up of three distinct layers of water masses, which differ in their temperatures, salinity, and directions of flow. The three sandwiched layers are driven by westerly winds in constant, eastward-flowing spirals around Antarctica. The upper and lower layers also move gradually northwards, carrying cold waters from the Antarctic to the tropics, while the middle layer flows southward bringing nutrients and warmer water from temperate and tropical regions.

Antarctic Surface Water
The top layer or Antarctic Surface Water most directly affects Antarctic plants and animals. It originates at the Antarctic Divergence, a narrow zone closest to the continent. This layer is constantly chilled by ice and cold air from the continent and is characterised by low temperature and low salinity caused by the melting of sea ice and icebergs. At the Antarctic Convergence this water sinks below the warmer, saltier Subantarctic Surface Water and continues spiraling northward as the Antarctic Intermediate Current. This current cools the coasts of New Zealand Southern Australia and many oceanic islands. It is still detected north of the equator in the Atlantic Ocean.

Warm Deep Water
This middle layer is a southward-flowing water mass originating from the surface waters of the Atlantis, Pacific and Indian Oceans. This current wells up at the Antarctic Divergence, characterised by high salinity and relatively high temperature. Some of this water takes on a lower salinity and moves northwards as the Antarctic Surface Water.

Antarctic Bottom Water
The remainder of the Warm Deep Current is pushed towards the continent, becoming colder and sinking along the continental slope and along the ocean floor in a northward direction. This Antarctic Bottom Water has a low temperature (-0.5 °C) and high salinity. It spreads far into the Pacific and Atlantic Oceans carrying south polar water into the northern hemisphere.