The thermocline - and deep circulation of the Atlantic

*Thermocline* (a gradient in temperature) that is also a *pycnoline* (a gradient in density) so that the thermocline is a barrier to vertical mixing: less dense warm water rides over more dense cold water.

- Cold, and therefore more dense, deep water
  - which has been isolated from the atmosphere for centuries (approximately 80% of the oceans' water)
  - “Cold” = –1 to +5 °C
- Absence of a thermocline at high latitude allows vertical mixing, mostly as cold surface water sinks into the deep ocean.

- Warmer, and therefore less dense, surface water
  - rich in O₂ from mixing with the atmosphere, and depleted of nutrients by photosynthesizing plankton

Cold water
- Greenland/Alaska

Warmer, and therefore less dense, surface water
- Equator

Cold, and therefore more dense, deep water
- South Antarctica

Dynamic boundaries across which mixing occurs
- North Atlantic Deep Water (NADW)
- Antarctic Intermediate Water (AAIW)
- Antarctic Bottom Water (AABW)
- Mediterranean Intermediate Water (MIW)