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Oceans on the move

Immense currents, like gigantic rivers, flow within the oceans, driven by differences in temperature and salinity, says S.Ananthanarayanan.

The scale of these flows is incredible. The Gulf Stream, for instance, moves 30 million tonnes water every second, compared to just 1 million tonnes by all the world's rivers put together.

Regulate temperature

Ocean currents, like winds, are convection currents, of cool, dense water sinking and warm water flowing in to take its place. And like the cooling sea breeze that brings relief to the sun baked land at evenfall, ocean currents maintain steady temperatures in places blessed with extensive coastlines. The Labrador coast of Canada and the southwestern tip of Britain, for instance, are at the same latitude. But Labrador is frozen all year through, while Cornwall has palms and rarely sees frost, thanks to warm ocean currents.

Thermohaline circulation

Temperature and salinity change the density of water, the colder and saltier, the heavier. Ocean currents arise when heavier water sinks and lighter water flows in to take its place. Currents caused by these two effects, of temperature and salinity, are called 'thermohaline' circulation. Places where cold, salty water predominates are called '**sinks**' and those with more warm, fresher water, pushed up to the surface by cool water flowing in below, are called '**upwellings**'.

The Earth's largest ocean sinks are in the North Atlantic: the Labrador and Greenland seas. Now, when water cools below 4°C, its starts getting less dense, and remains afloat, which is why ice

forms at the surface of a pond while the warmer water stays below. For this reason, when arctic winds cool the surface of the North Atlantic, sea ice forms, which leaves behind salt, to increase the salinity of the remaining water. The very dense water that is left plummets into the depths.

As polar water sinks, warmer water is drawn in from the south, creating a current from south to north. This is the Gulf Stream, which contributes around 20% of the winter warmth in Northern Europe.

While warm, surface waters flow in, the cold, dense water deep down flows along the Atlantic bed to the south. It flows down to Antarctica, where it joins the 'Southern Ocean Raceway' a group of currents that circumnavigates the South Pole, common to the Atlantic, Pacific and Indian oceans

And the 'Upwellings'?

The vast sinking of dense water around the poles is not matched by comparable 'upwellings' of warmer water. Streams of water at different temperatures and salinity can retain their identity when they pass each other. Mixing takes special effort and consumes energy. So if we do not see 'upwellings' and still the waters mix, where does the energy come from?

The moon is at work

Recent studies have shown that the answer lies in the tidal energy from the moon. It is found that about a third of the energy that the moon supplies goes to create tidal flows in the deep ocean. Like the surging of surface tides at coastlines, these deep-sea tides result in turbulence and mixing. Dense water is thus not locked to the seabed but returns to circulate!