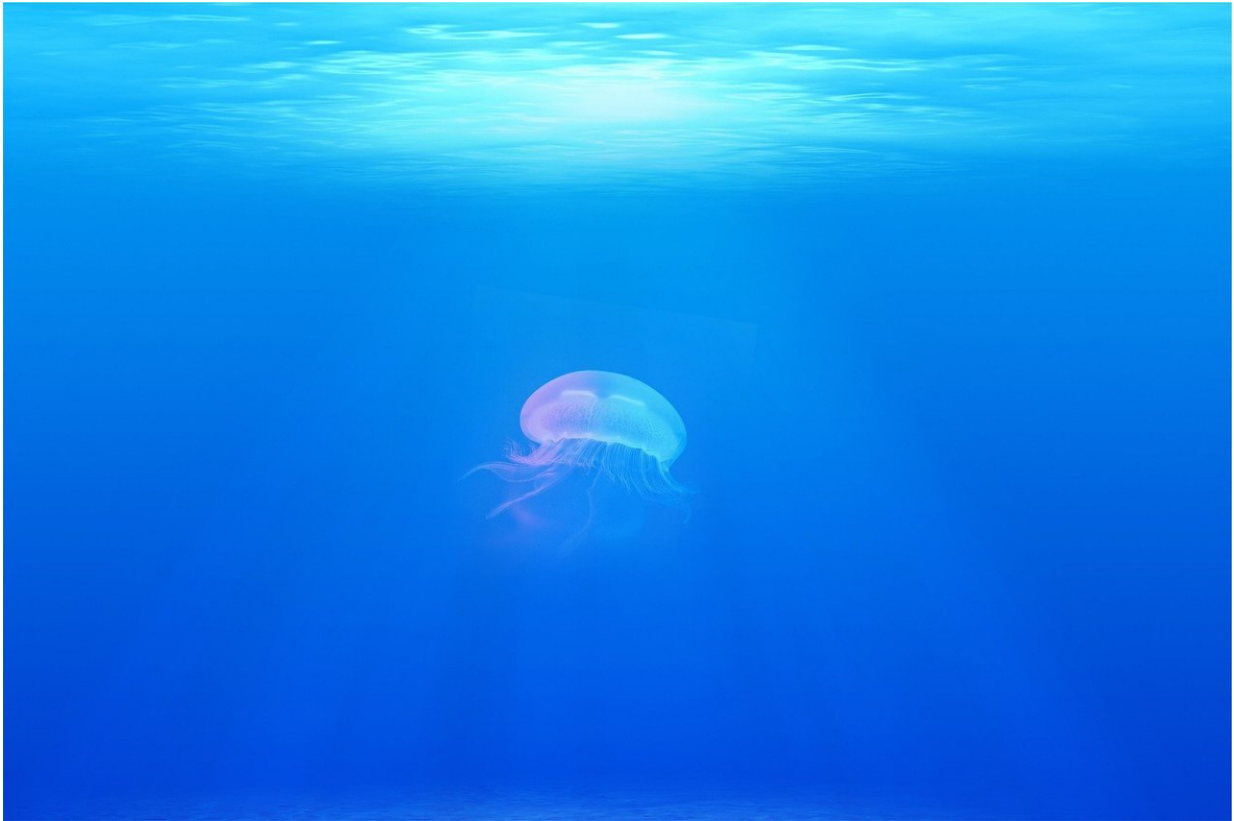


Quantifying global ocean inhomogeneity and exploring its evolution in climate change

June 30 2022, by Li Yuan



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The ocean is intrinsically inhomogeneous in temperature and salinity. This inhomogeneity fundamentally influences physical and biogeochemical processes of oceans, causing mixing of water masses,

and shaping three-dimensional geostrophic circulations. The ocean inhomogeneity ultimately determines marine biodistribution, ecosystem structure and functioning, and marine biodiversity.

Recently, a research team led by Prof. Wang Fan from the Institute of Oceanology of the Chinese Academy of Sciences (IOCAS) and Prof. Young-Oh Kwon from Woods Hole Oceanographic Institution quantified the global [ocean](#) inhomogeneity and explored how it has evolved in a changing [climate](#).

The study was published in *Geophysical Research Letters* on Jun 23.

Computing three-dimensional volume-weighted spatial standard deviation (SSD) maps of temperature and salinity (SSDT and SSDS) using multiple [datasets](#) and [climate model simulations](#) show a consensus on the increased global ocean inhomogeneity over the past half-century.

During 1960-2010, the global SSDT and SSDS in 0-2000 m increased by $1.4 \pm 0.1\%$, and $1.5 \pm 0.1\%$ relative to 1960-1980 average, respectively. A newly defined thermohaline inhomogeneity (THI) index, a holistic measure of both [temperature](#) and salinity changes, has increased by $2.4 \pm 0.1\%$. Climate model simulations suggest that the observed ocean inhomogeneity increase is dominated by anthropogenic forcing and projected to accelerate by 200%-300% during 2015-2100.

Furthermore, the regional contributions to global ocean inhomogeneity change suggest that global inhomogeneity increase largely results from the amplification of the corresponding climatological contrast patterns. "The rapid upper-ocean warming over mid-to-low latitude dominates the global SSDT increase, while the amplification of the [salinity](#) pattern, primarily in the subtropical Atlantic, causes increasing SSDS," said Ren Qiuping, first author of the study.

"Our quantifications of ocean inhomogeneity provide a novel perspective for understanding the ongoing climate change in oceans. The increase in ocean inhomogeneity implies that ocean hydrological structures are modulated to a new and more diverse equilibrium, which poses important enlightenment for future climate prediction, marine ecological environment and biodiversity," said Prof. Wang.

More information: Qiuping Ren et al, Increasing Inhomogeneity of the Global Oceans, *Geophysical Research Letters* (2022). [DOI: 10.1029/2021GL097598](https://doi.org/10.1029/2021GL097598)

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