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Commentary

Influence of El Nino Events and Anthropogenic Carbon Dioxide on Sea Surface Salinity

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DESCRIPTION

One-fourth of all anthropogenic carbon emissions are absorbed by the ocean, which reduces global warming. The Southern Ocean hosts around 40% of this sink's carbon dioxide emissions. The circulation and carbon fluxes of the Southern Ocean, however, are difficult for Earth system models to replicate. In two multimodel ensembles, a strong correlation was found between the Southern Ocean's human carbon sink and the subtropical-polar frontal zone's current sea surface salinity. When compared to unconstrained estimates, the anthropogenic carbon sink is between 14 and 18 percent greater and 46 and 54 percent less unknown. The found restriction highlights how crucial the freshwater cycle is to the Southern Ocean circulation and carbon cycle.

Over the tropical Pacific, the El Nino event is a significant large-scale air-sea interaction phenomena. El Nino was divided into three varieties in earlier research: the conventional El Nino, El Nino Modoki I, and El Nino Modoki II. In the boreal autumn, different El Nino events have the substantial impact on the inter-annual variability of sea surface salinity over the central equatorial Indian Ocean. During the traditional El Nino and the EI Nino Modoki I (the EI Nino Modoki II) episodes, the decreasing (increasing) sea surface salinity is recognized. To determine the key elements driving the fluctuation of sea surface salinity over the central Indian Ocean, a salinity budget study is conducted.

The findings suggest that the sea surface salinity fluctuation during El Nino episodes related with the anomalous Walker circulation across the equatorial Indian Ocean is significantly influenced by the wind-driven anomalous zonal advection.

Since 1999, Thermo-Salinometer (TSG) data have been gathered by a French research vessels as part of the Global Ocean Surface Underway Data (GOSUD) initiative. The devices are routinely checked and calibrated on a regular basis. The staff collects water samples every day, which are then analyzed in the lab. Due to meticulous calibration and equipment maintenance, together with a strict correction on water samples, the Practical Salinity Scale (PSS) salinity measurement error was a few hundredths of a unit or less.

These data exhibit good consistency with an ARGO-based salinity gridded product when compared globally. The Soil Moisture and Ocean Salinity (SMOS) and Aquarius missions' new satellite observations may be "calibrated and validated" with the help of the Sea Surface Salinity and Temperature from French Research Ships (SSST-FRESH) dataset.

Analysis of sea surface salinity can be used to assess changes in the Earth's water cycle. Since the highest layers of the ocean are the ones that are most susceptible to interactions between the atmosphere and the ocean, this variable represents the equilibrium between precipitation and evaporation across the ocean. *In situ* measurements are generally taken a few metres below the surface and lack both geographical and temporal synopticity. On the other hand, satellite measurements are repeated, synoptic, and taken at the surface.

The purest waters get fresher and vice versa according to satellite-derived measures of sea surface salinity, which is not the case with *in-situ* near-surface salinity observations.

The areas with the largest positive differences between surface and near-surface salinity trends are those where there is a decrease in the depth of the mixed layer, an increase in sea surface temperature, a decrease in sea surface wind speed, and other characteristics that are consistent with increased stratification of the water column as a result of global warming.

These findings demonstrate how necessary it is to use satellites to identify important changes in ocean-atmosphere fluxes.

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