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The unexpected salinity trend shifts in upper Tropical Pacific Ocean under the global hydrological cycle framework

Huangyuan Shi^{1,2} and Ling Du^{1,2}

¹Ocean University of China, College of Oceanic and Atmospheric Sciences, Qingdao, China (shihuangyuan@stu.ouc.edu.cn)

²Key Laboratory of Physical Oceanography, Qingdao, China

The secular change of ocean salinity is regarded as an indicator of the global water cycle by measuring the surface freshwater flux which is the most important component of earth hydrological budget. Under the effect of remarkable global warming, the surface salinity patterns in ocean basins illustrated that the intensified water cycle resulted in the continuous and significant freshening phenomena in tropical ocean. With the recent boom in salinity measurements and observations, the variability of surface salinity was examined to explore its relationship with anthropogenic warming. In this paper, we found that the salinity varied on the decadal to centurial time scales and responded significantly to the global warming in tropical Pacific Ocean by using the multi-source reanalysis datasets. An unexpected distribution was figured out and what is noteworthy is that, the robust salinification occurred in the central tropic Pacific in the first two decades of 21st which was demonstrated by Argo observations. Nevertheless, it did not follow the typical salinity patterns that 'wet get wetter' mentioned by several literatures and illustrated a significant trend shift. Similarly, the subsurface ocean salinity revealed the same shift but an opposite tendency to that on surface. It may involve that the controlling influence of surface freshwater reduced and the impact of ocean thermodynamic adjustment became gradually pronounced to the upper ocean. The salinity budget suggested that salinity advection and subsurface entrainment played key roles to induce the reversed trend of salinity change. In addition, the isopycnals variability caused by wind-driven ocean pumping and subtropical gyre may be acted as a trigger of the salinity enhancement in the upper ocean. What's more, the impact of PDO decadal shift and the moderate global warming was seemed to be the essential factors to change the feedback of ocean-atmosphere processes, potentially and was finally reflected on ocean salinity field.