



## **Abrupt early 20th century freshening of the western subtropical North Pacific Ocean**

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Instrumental climate observations provide robust records of global land and ocean temperatures during the 20th century, making it a key period for validating climate models used in climate predictions for the coming decades. Unlike for temperature, continuous observations of salinity in the surface ocean are scarce prior to 1970, and the dimension of salinity changes during the 20th century is largely unknown. Surface ocean salinity is a major component in climate dynamics, as it influences ocean circulation and water mass formation.

We reconstructed annually-resolved salinity variations in the western North Pacific Ocean since 1873, based on records of oxygen isotopes, Sr/Ca and U/Ca in an annually-banded reef coral from the subtropical Ogasawara Islands. The salinity reconstruction is highly correlated with gridded salinity estimates of the region based on reanalysis data (SODA 1.4.2) during the period of overlap (1958-1994;  $r = 0.5$ ). The reconstruction indicates that an abrupt regime shift towards fresher surface ocean conditions occurred between 1905 and 1910. Analyses of atmospheric datasets of sea level pressure identify a weakening of the winds that drive the Kuroshio Current system and the associated subtropical gyre circulation as the cause of the freshening. Interestingly, this

abrupt freshening of the western subtropical North Pacific was followed by an abrupt regime shift towards lower sea-ice export from the Arctic Ocean to the North Atlantic a few years later. The potential of such natural regime shifts in surface ocean salinity and associated large-scale teleconnections should be considered in climate predictions for the coming decades.