



Subtropical coral reveals abrupt early 20th century freshening in the western North Pacific Ocean

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Instrumental climate observations provide robust records of global land and ocean temperatures during the 20th century. 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. Here we present an annually-resolved reconstruction of salinity variations in the surface waters of the western subtropical North Pacific Ocean since 1873, based on bimonthly records of oxygen isotopes, Sr/Ca and U/Ca in a subtropical coral from the Ogasawara Islands (27° N, 142° E). The reconstruction indicates that an abrupt regime shift towards fresher surface ocean conditions occurred between 1905 and 1910. Analyses of observational data of the atmosphere suggest that the abrupt freshening was associated with a weakening of the winds that drive the Kuroshio Current system and the associated subtropical gyre circulation. We note that the abrupt early 20th century freshening in the western subtropical North Pacific precedes abrupt climate change in the northern North Atlantic Ocean by a few years. The potential for the occurrence of abrupt regime shifts in surface ocean salinity should be considered in climate predictions for the coming decades.