Changes in Subantarctic Mode Water Properties and its Impact on Spiciness Variation in the Southern Indian Ocean

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Subantarctic Mode Water (SAMW) is formed by deep mixing in winter in the Subantarctic Zone and transported into the adjacent subtropical gyres after subduction, which plays a vital role in heat, freshwater, carbon and nutrient budgets in the global oceans. The changes in SAMW properties and its impact on spiciness variation in the southern Indian Ocean have been investigated using the gridded Argo dataset in 2004-2018. Annual mean potential temperature and salinity of the SAMW have undergone significant variations during 2004-2018, with an increase (a decrease) trend for potential temperature (salinity). An analysis of decomposition shows that the heaving process contributes to warming and salinification while spiciness causes cooling and freshening, both of which modulate the SAMW properties. A strong deepening of the isopycnal surfaces caused by positive wind stress curl anomalies over the subtropical southern Indian Ocean leads to warming/salinification heaving contribution to the changes in SAMW. The cooling/freshening contribution from spiciness process is due to a southward shift of sea surface potential density favoring colder and fresher water into the interior ocean, which is driven by an increase in wintertime sea surface temperature and salinity in the SAMW formation region. The colder and fresher water carried with the SAMW spreads along isopycnal surfaces via the Indian Ocean subtropical gyre, which results in cooling and freshening spiciness trends over the all basin of the subtropical southern Indian Ocean.