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SE Asian and Australian monsoonal control on Indonesian Throughflow variability

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We monitored the intensity and vertical profile of the Indonesian Throughflow (ITF) and their relation to SE Asian and Australian monsoons over the last 140 kyr along two transects across the ITF outflow (R/V Sonne Cruise SO185). These transects allow comparison of water mass properties within the main outflow in the Timor Strait and within the mixing zone between ITF and eastern Indian Ocean waters. Millennial records over the last two glacial-interglacial cycles reveal higher thermocline temperatures in the Eastern Indian Ocean than in the Timor Strait during glacials and stadials, implying a decrease in the transport of ITF thermocline waters. Centennial records from IMAGES Core MD01-2378 spanning Terminations I and II reveal cooling and freshening of thermocline waters during the early part of MIS5e and early Holocene, indicating a change in the ITF vertical structure from surface to thermocline dominated flow. Today, the Makassar Strait surface flow is blocked by low salinity waters from the South China Sea and Java Sea, driven by the SE Asian winter monsoon. We speculate, that exposure of the Sunda Shelf during glacial lowstands prevented this blockage and resulted in increased surface flow and decreased thermocline flow. The Australian summer monsoon (boreal winter), which is related to insolation forcing over northwestern Australia, additionally influences the vertical structure of the ITF. During insolation maxima, strong northwesterly monsoonal winds reduce surface outflow from the Timor Strait into the eastern Indian Ocean, thus raising the thermocline in the eastern Indian Ocean. XRF scanning Fe and Ti data together with paleoproductivity proxy records from the Timor Sea closely track these relations between Australian monsoonal intensity variations and ITF outflow profile. Our results together with recent oceanographic observations indicate that the SE Asian and Australian monsoonal systems strongly modify the intensity and vertical structure of the ITF on several timescales: glacial-interglacial, precessional and ENSO.