Late Quaternary climatic and oceanographic changes: faunal and isotopic ($\delta^{13}C$, $\delta^{18}O$, Δ_{47}) evidences from the NW Arabian Sea

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The Indian summer monsoon (ISM) is the most energetic and important climatic feature of the world, which has an excessive socioeconomic impact upon billions of people of the South Asia. Here we present planktic foraminifera abundances, stable isotopes ($\delta^{18}O$, $\delta^{13}C$) of *Globigerinoides ruber*, and emerging novel proxy of clumped isotope (Δ_{47}) of *Orbulina univera* from the ODP Hole 727B, NW Arabian Sea, to understand the Indian monsoon variability, paleotemperature changes and freshwater flux during the last 60 ka BP. The traditional ISM proxy *Globigerina bulloides* (%) show two stronger ISM phases during Marine Isotope Stage (MIS) 3 (~60 to 25 ka BP) and MIS 1 (14 ka to Recent), and a weaker ISM phase during the MIS 2 (Last Glacial Maximum and Younger Dryas) at 25 to 14 ka BP. The results of stable isotope ($\delta^{18}O$) analysis of *G. ruber* show enriched values during the MIS 2 and depleted values during the MIS 3 and MIS 1. The clumped isotope (Δ_{47}) based paleothermometry data suggest that the sea surface temperature (SST) value of ~20±2°C during the LGM and MIS 2, while maximum temperature of 32±2°C during MIS-3 (55-25 ka BP). Around 17°C sea surface temperature variation was occurring between the MIS 2 and MIS 3. The decreased *G. bulloides* (%), enrichment of $\delta^{18}O$ and SST drop during MIS 2 suggest that there was weakening of ISM, decrease of sea-level and northern hemisphere solar insolation, and increases of growth of the earth's ice sheet.