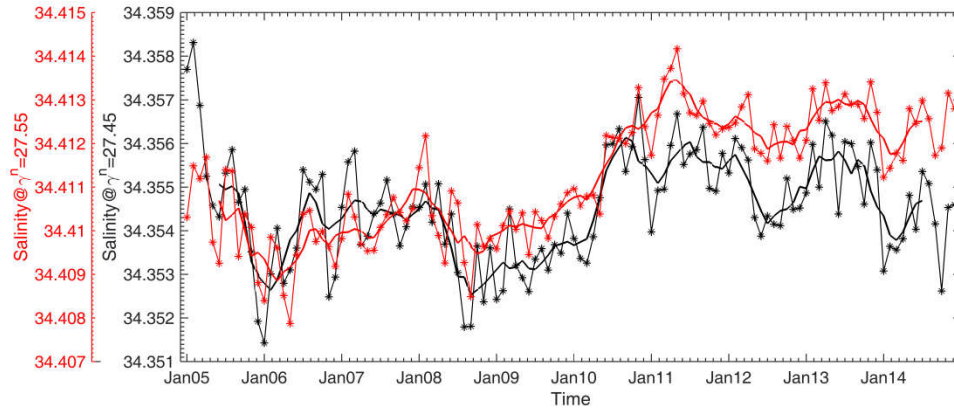
Supplementary 1 (a) Biennial mean $\theta$-$S$ diagram averaged over Region A for JAMSTEC data with $\gamma^n$ surfaces superimposed (gray solid-dotted lines). The inserted figure is the magnification of the area delineated by cyan solid-dotted box. The corresponding time for each $\theta$-$S$ curve in is listed in their bottom-right corner (i.e. 05/06 for 2005-2006). (b) Salinity trend along $\gamma^n$ surfaces for period Jan 2005 – Dec 2014 is displayed by the thick black line, and the 95% confidence intervals (*F*-test) are represented by the light gray shadings, calculated from JAMSTEC data.

Supplementary 2 Time series of monthly salinity on 27.45 (black) and 27.55$\gamma^n$ (red) neutral density surfaces, calculated from the IPRC data and averaged over the Region A shown in Fig. 2. Thin star lines and thick lines represent monthly and 13-month running mean values, respectively.