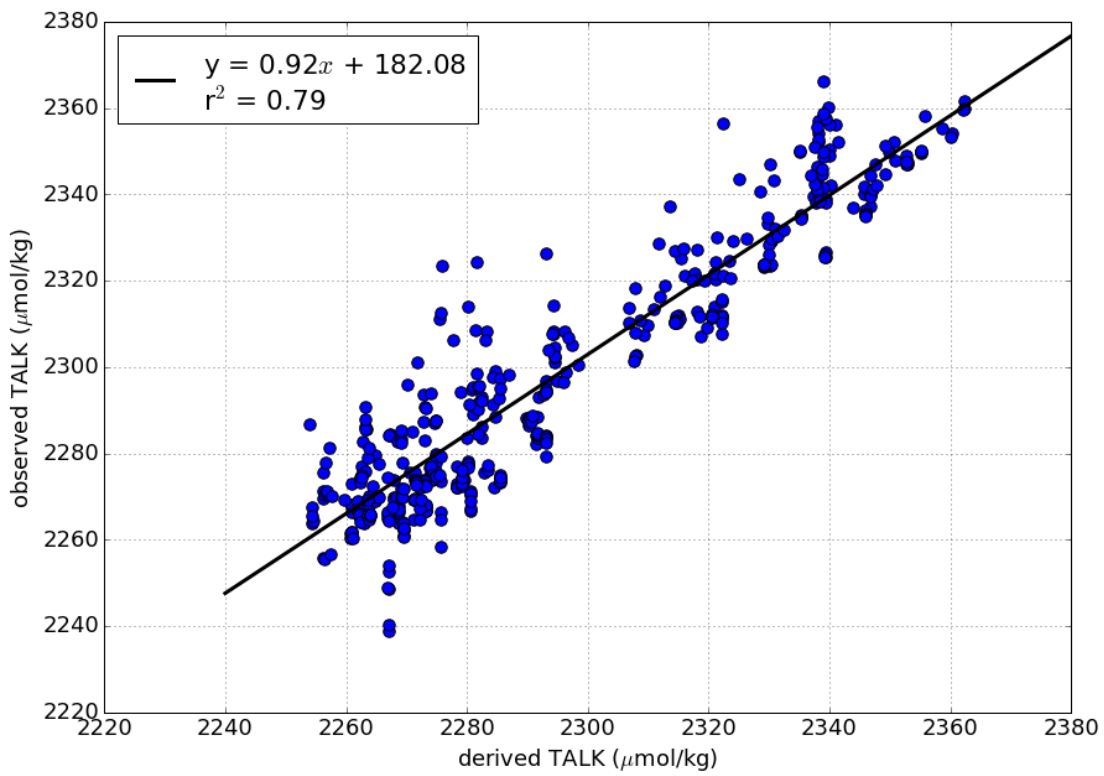


1 Supplementary

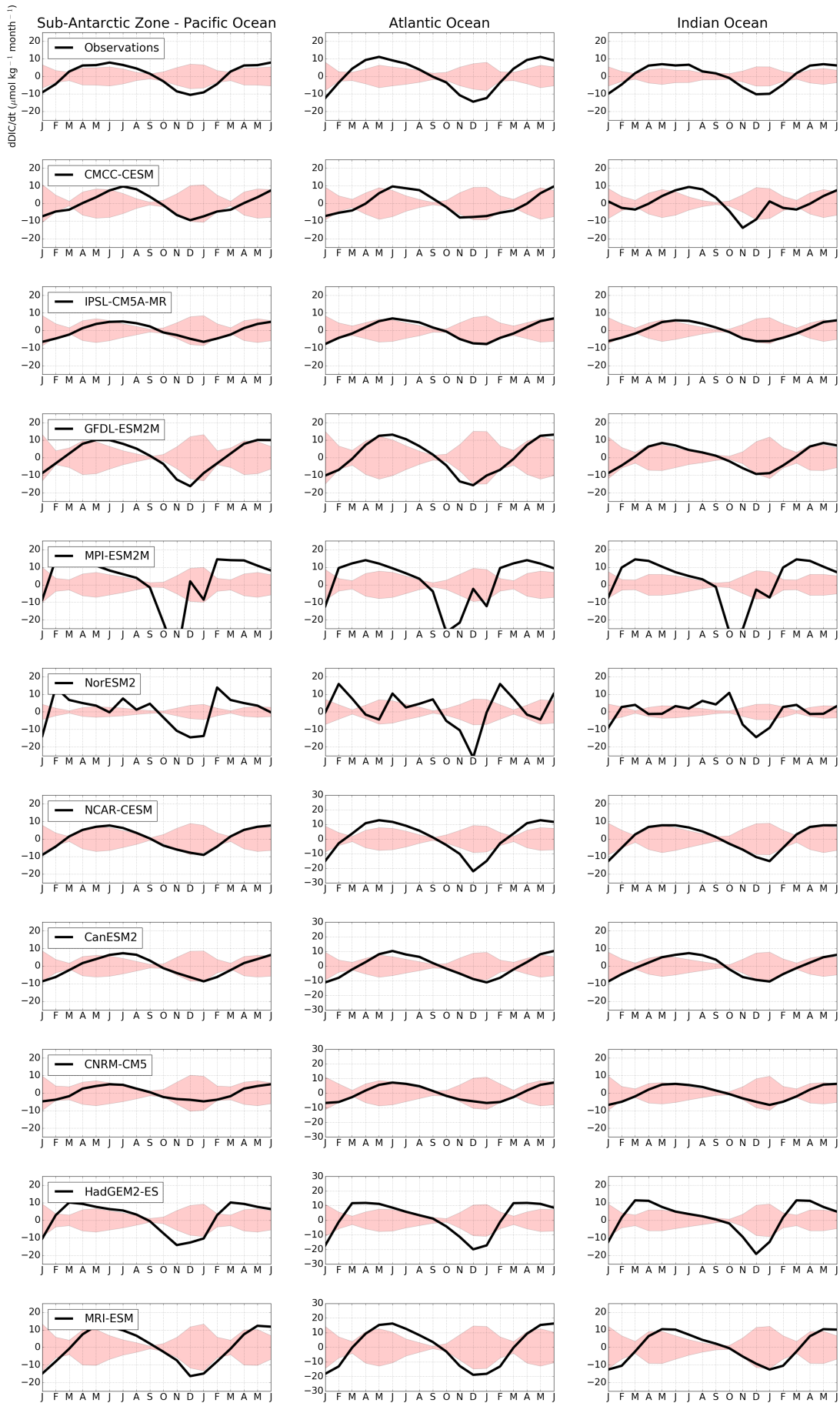


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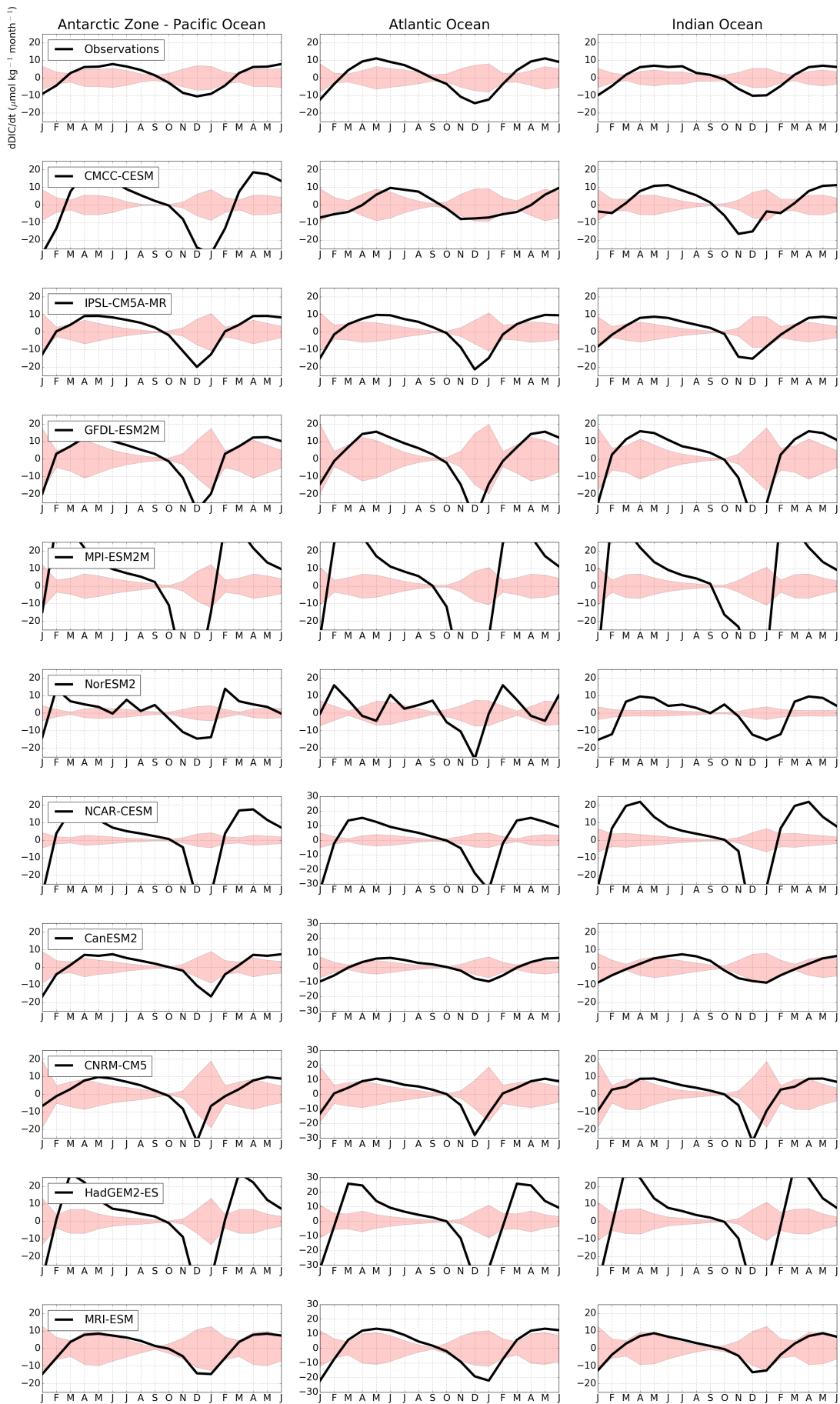
3 **Figure S1.** Regression plot comparing the derived (Lee et al., 2006) and observed TALK dataset for
4 about 500 surface TALK samples collected in the Indian Ocean of the Southern Ocean.

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8 **Fig. S2a.** Seasonal cycle of the rate of change of DIC $\left(\frac{\partial DIC}{\partial t}\right)$ *black line*, and the estimated maximum
9 DIC variability equivalent driven by temperature $\left(\frac{\partial DIC}{\partial t}\right)_{SST}$ *shaded area*, for monthly data given in
10 $\mu\text{mol kg}^{-1} \text{ month}^{-1}$ at the Sub-Antarctic zone i.e. Pacific Ocean (first column), Atlantic Ocean (second
11 column) and Indian Ocean (third column). The estimated $\left(\frac{\partial DIC}{\partial t}\right)_{SST}$ is then compared to the total DIC
12 seasonal cycle $\left(\frac{\partial DIC}{\partial t}\right)$ such that when $\left|\left(\frac{\partial DIC}{\partial t}\right)_{SST}\right| > \left|\left(\frac{\partial DIC}{\partial t}\right)\right|$, the role temperature dominates pCO_2
13 variability and conversely when $\left|\left(\frac{\partial DIC}{\partial t}\right)_{SST}\right| < \left|\left(\frac{\partial DIC}{\partial t}\right)\right|$, DIC is the dominant driver.
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16 **Fig. S2b.** Same as Fig. 2a for the Antarctic zone.

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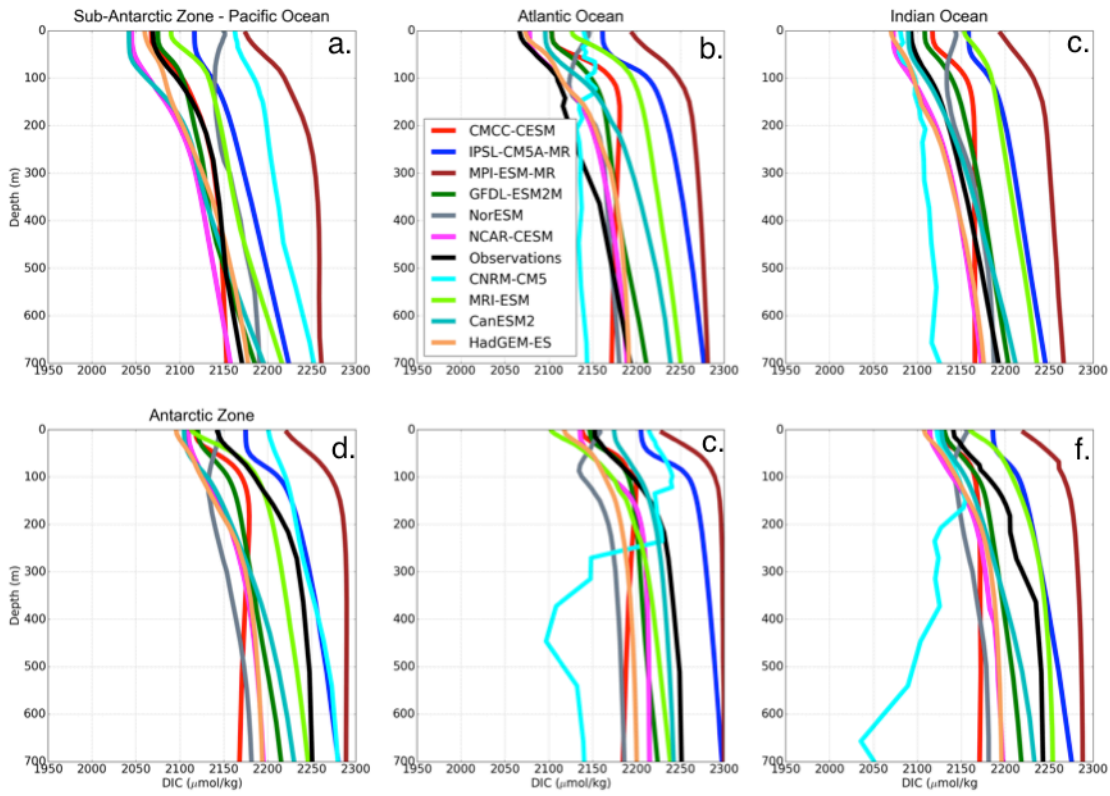
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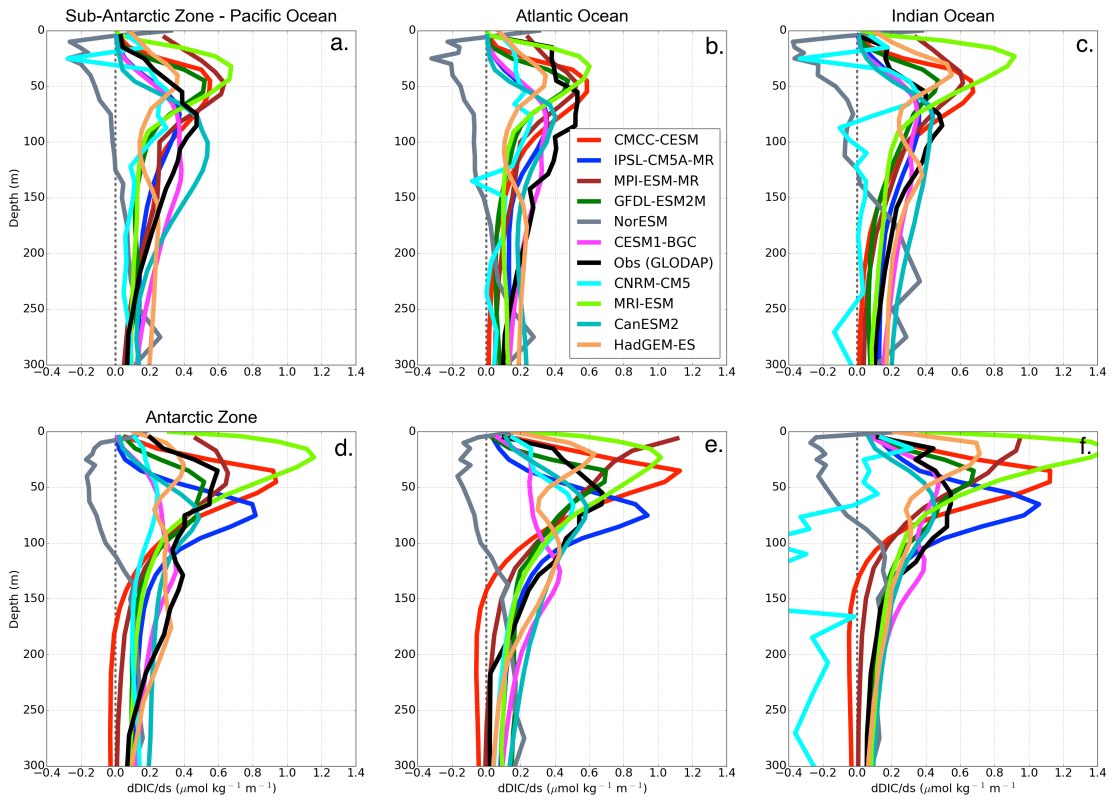
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 39 **Fig. S3:** Dissolved Inorganic Carbon (DIC) profiles at the three basins of the Southern Ocean for the
 40 Sub-Antarctic and Antarctic zone given in $\mu\text{mol kg}^{-1}$. Pacific Ocean (first column), Atlantic Ocean
 41 (second column) and Indian Ocean (third column)

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45 **Fig. S4** Vertical rate of change of DIC ($d\text{DIC}/dz$) at the Sub-Antarctic and Antarctic zone given in μmol
 46 $\text{kg}^{-1} \text{m}^{-1}$. Pacific Ocean (first column), Atlantic Ocean (second column) and Indian Ocean (third column)

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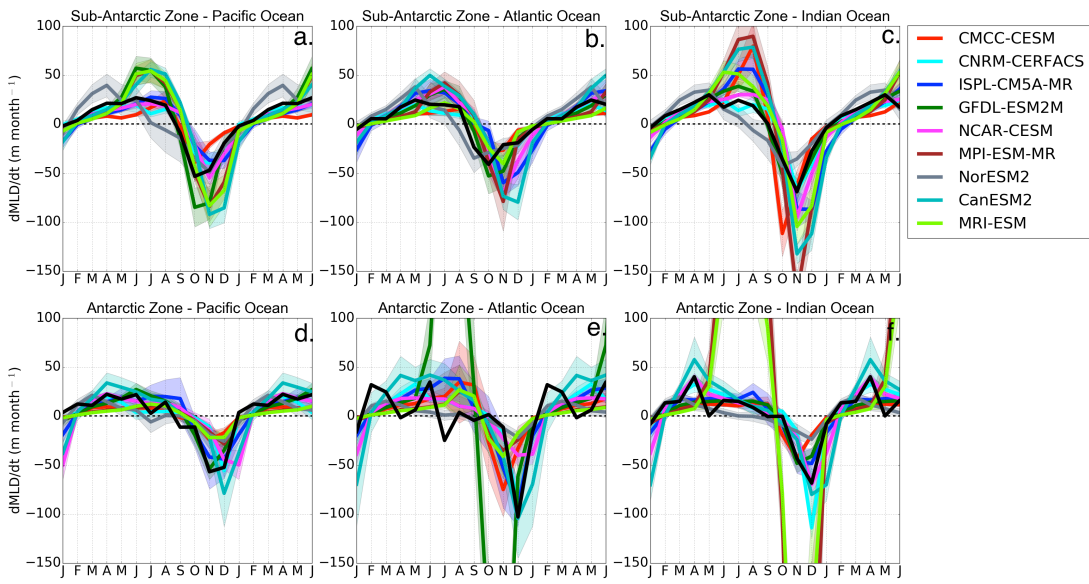
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57 **Fig. S5:** Seasonal cycle of the monthly rate of change of Mixed Layer Depth (m month⁻¹, g-l) in the Sub-
 58 Antarctic and Antarctic zones of the Pacific Ocean (first column), Atlantic Ocean (second column) and
 59 Indian Ocean (third column).

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