Supplementary information
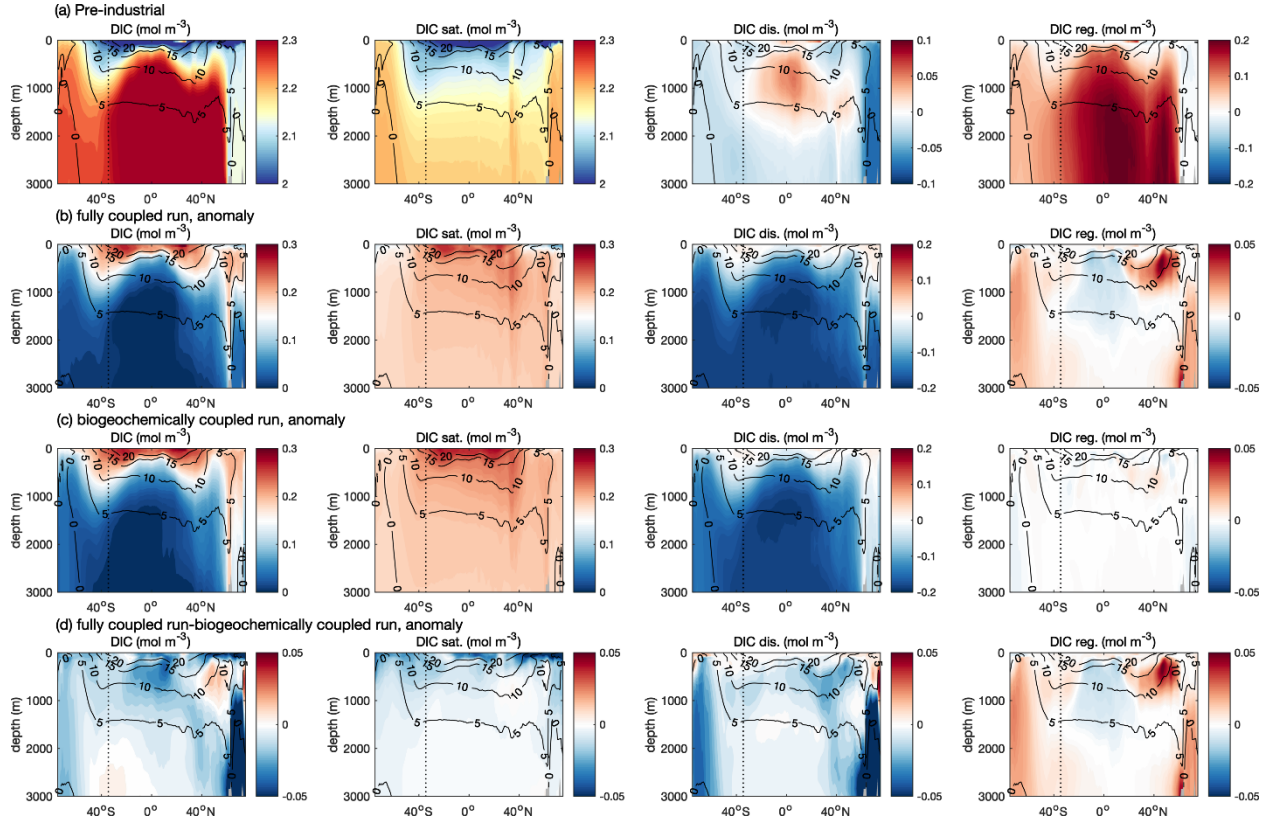
Figure S1. Meridional section of the dissolved inorganic carbon, *DIC* (mol m⁻³), and constituent carbon pools in **ACCESS-ESM1.5** for the zonally-averaged Atlantic and Southern Ocean: (a) the preindustrial absolute concentrations, and the anomalies relative to the preindustrial state at year 140 for (b) the COU configuration, (c) the BGC configuration and (d) the COU minus the BGC configuration. The *DIC* is separated into saturated carbon, DIC_{sat}, the disequilibrium carbon, $DIC_{disequilib}$, and the regenerated carbon, $DIC_{regenerated}$. The Atlantic and Southern Ocean domains are separated by a black vertical line.
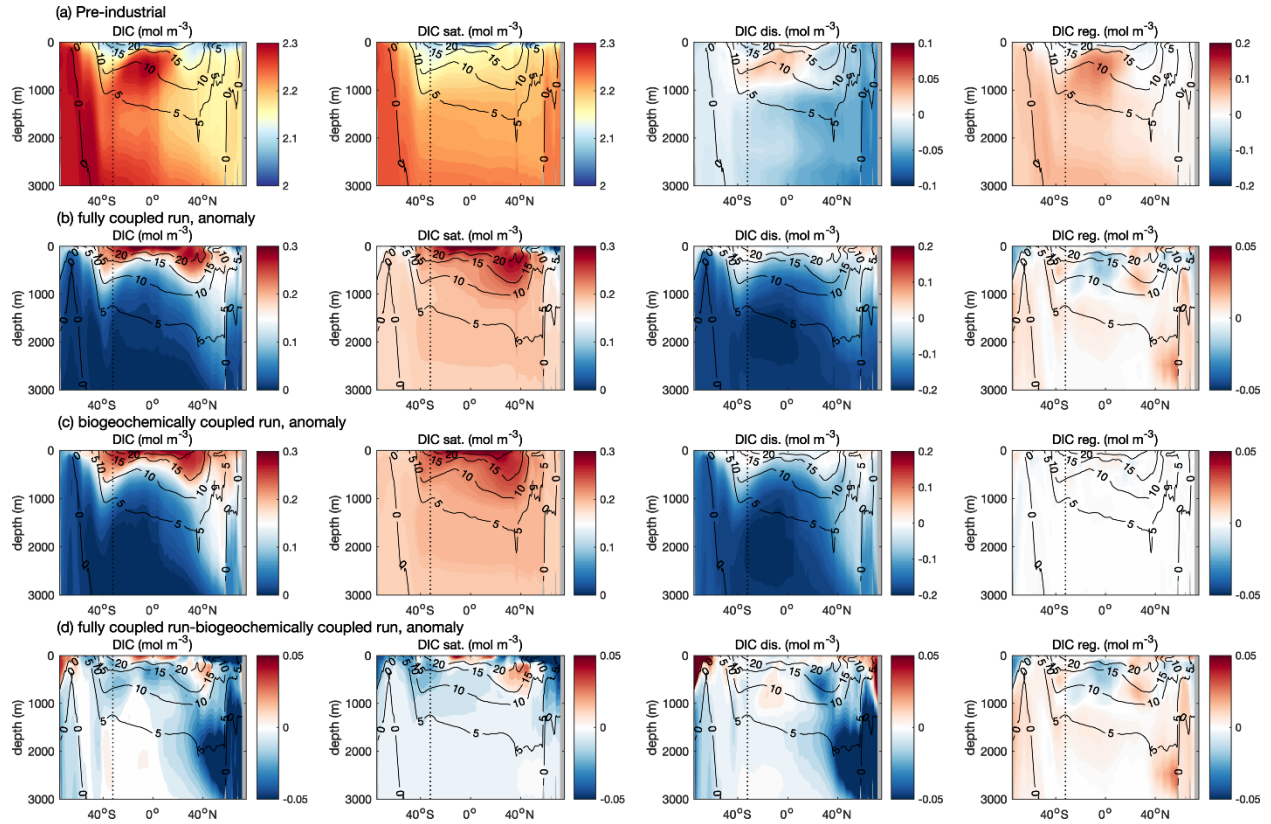
Figure S2. Meridional section of the dissolved inorganic carbon, *DIC* (mol m^{-3}), and constituent carbon pools in **CanESM5** for the zonally-averaged Atlantic and Southern Ocean: (a) the preindustrial absolute concentrations, and the anomalies relative to the preindustrial state at year 140 for (b) the COU configuration, (c) the BGC configuration and (d) the COU minus the BGC configuration. The *DIC* is separated into saturated carbon, *DIC$_{sat}$*, the disequilibrium carbon, *DIC$_{disequilib}$*, and the regenerated carbon, *DIC$_{regenerated}$*. The Atlantic and Southern Ocean domains are separated by a black vertical line.
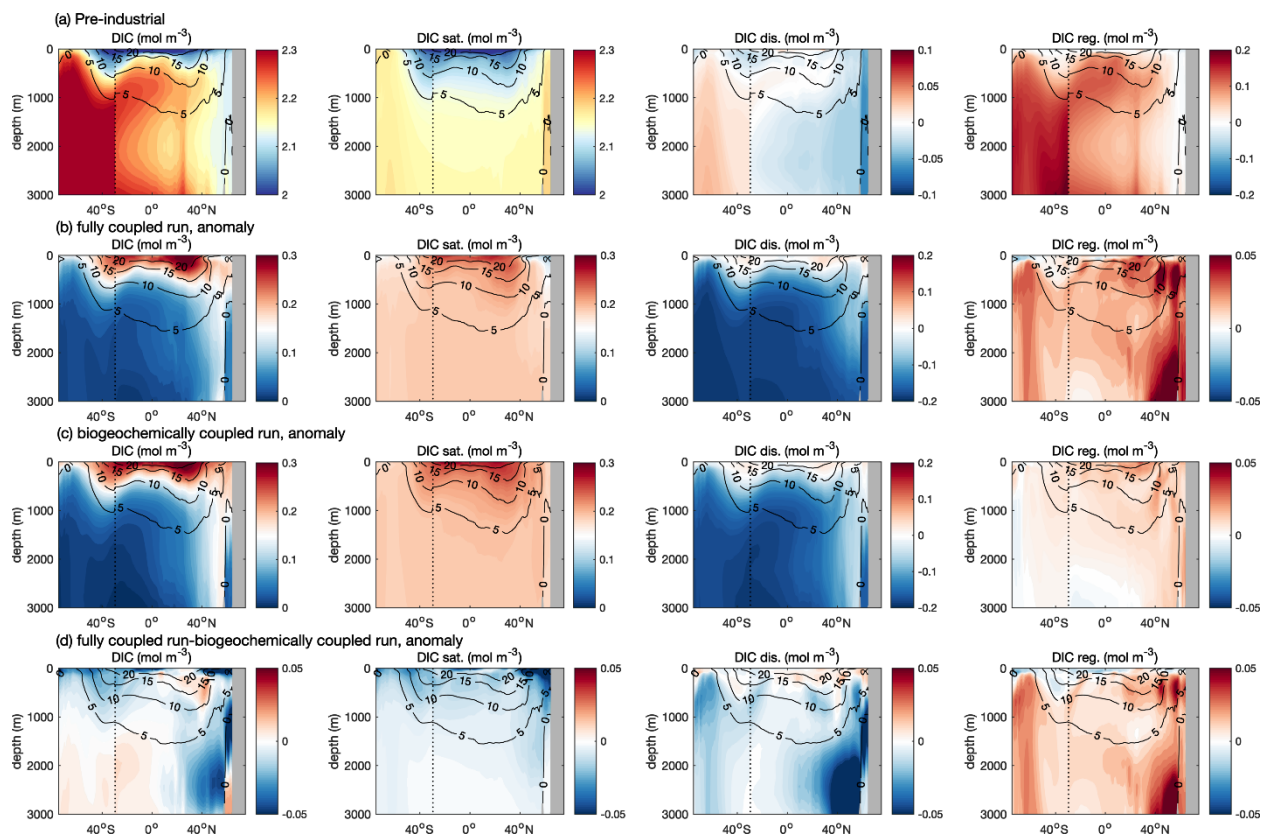
Figure S3. Meridional section of the dissolved inorganic carbon, *DIC* (mol m⁻³), and constituent carbon pools in **CNRM-ESM2-1** for the zonally-averaged Atlantic and Southern Ocean: (a) the preindustrial absolute concentrations, and the anomalies relative to the preindustrial state at year 140 for (b) the COU configuration, (c) the BGC configuration and (d) the COU minus the BGC configuration. The *DIC* is separated into saturated carbon, *DIC_{sat}*, the disequilibrium carbon, *DIC_{disequilib}*, and the regenerated carbon, *DIC_{regenerated}*. The Atlantic and Southern Ocean domains are separated by a black vertical line.
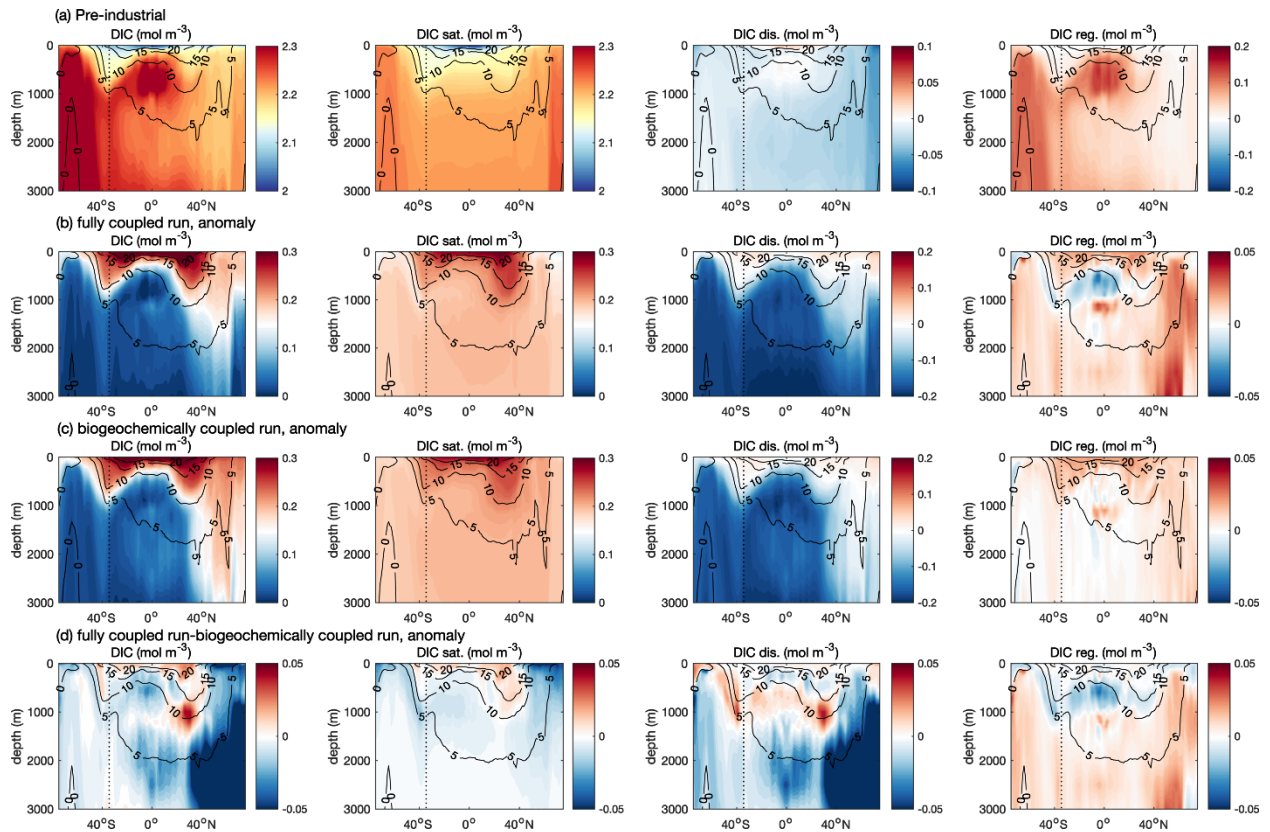
Figure S4. Meridional section of the dissolved inorganic carbon, *DIC* (mol m⁻³), and constituent carbon pools in **GFDL-ESM4** for the zonally-averaged Atlantic and Southern Ocean: (a) the preindustrial absolute concentrations, and the anomalies relative to the preindustrial state at year 140 for (b) the COU configuration, (c) the BGC configuration and (d) the COU minus the BGC configuration. The *DIC* is separated into saturated carbon, DIC_{sat}, the disequilibrium carbon, $DIC_{disequilib}$, and the regenerated carbon, $DIC_{regenerated}$. The Atlantic and Southern Ocean domains are separated by a black vertical line.
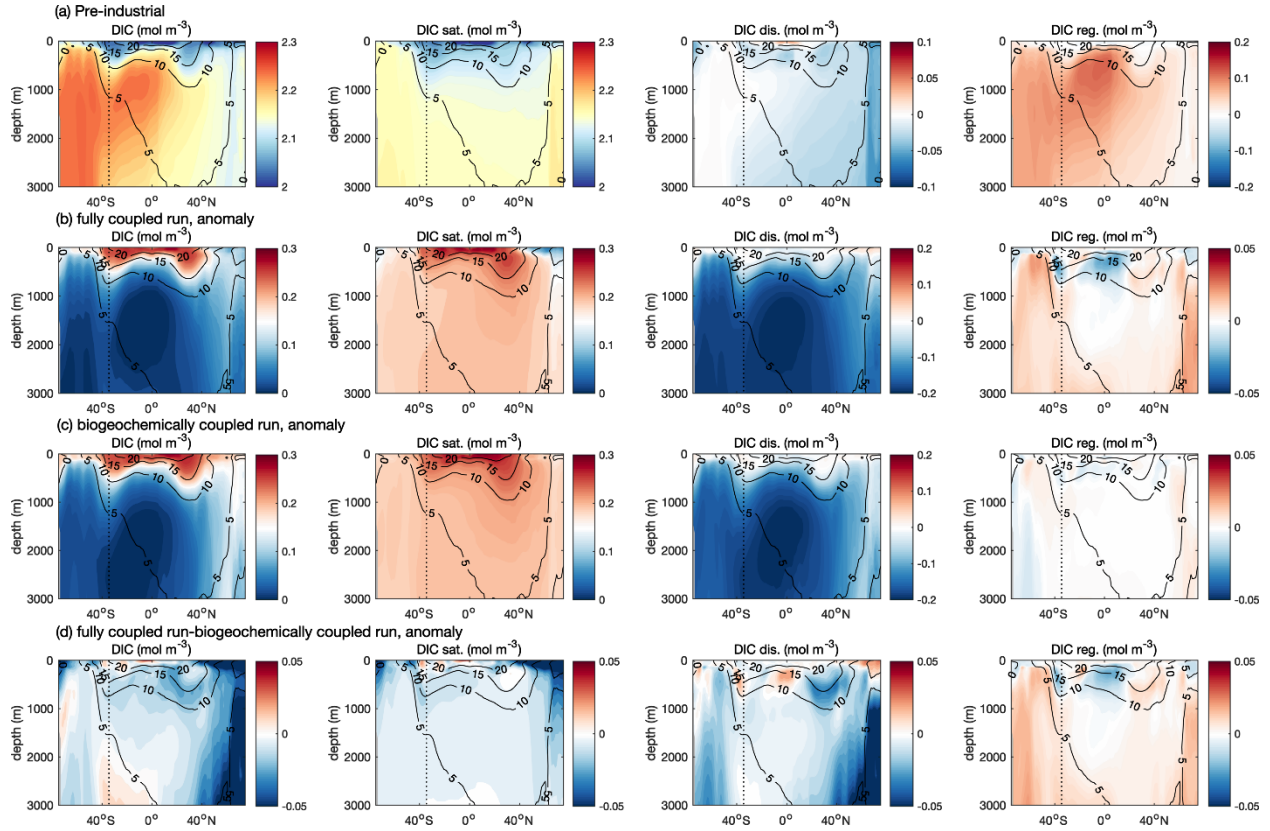
Figure S5. Meridional section of the dissolved inorganic carbon, *DIC* (mol m^{-3}), and constituent carbon pools in **MIROC-ES2L** for the zonally-averaged Atlantic and Southern Ocean: (a) the preindustrial absolute concentrations, and the anomalies relative to the preindustrial state at year 140 for (b) the COU configuration, (c) the BGC configuration and (d) the COU minus the BGC configuration. The *DIC* is separated into saturated carbon, *DIC$_{sat}$*, the disequilibrium carbon, *DIC$_{disequilib}$*, and the regenerated carbon, *DIC$_{regenerated}$*. The Atlantic and Southern Ocean domains are separated by a black vertical line.
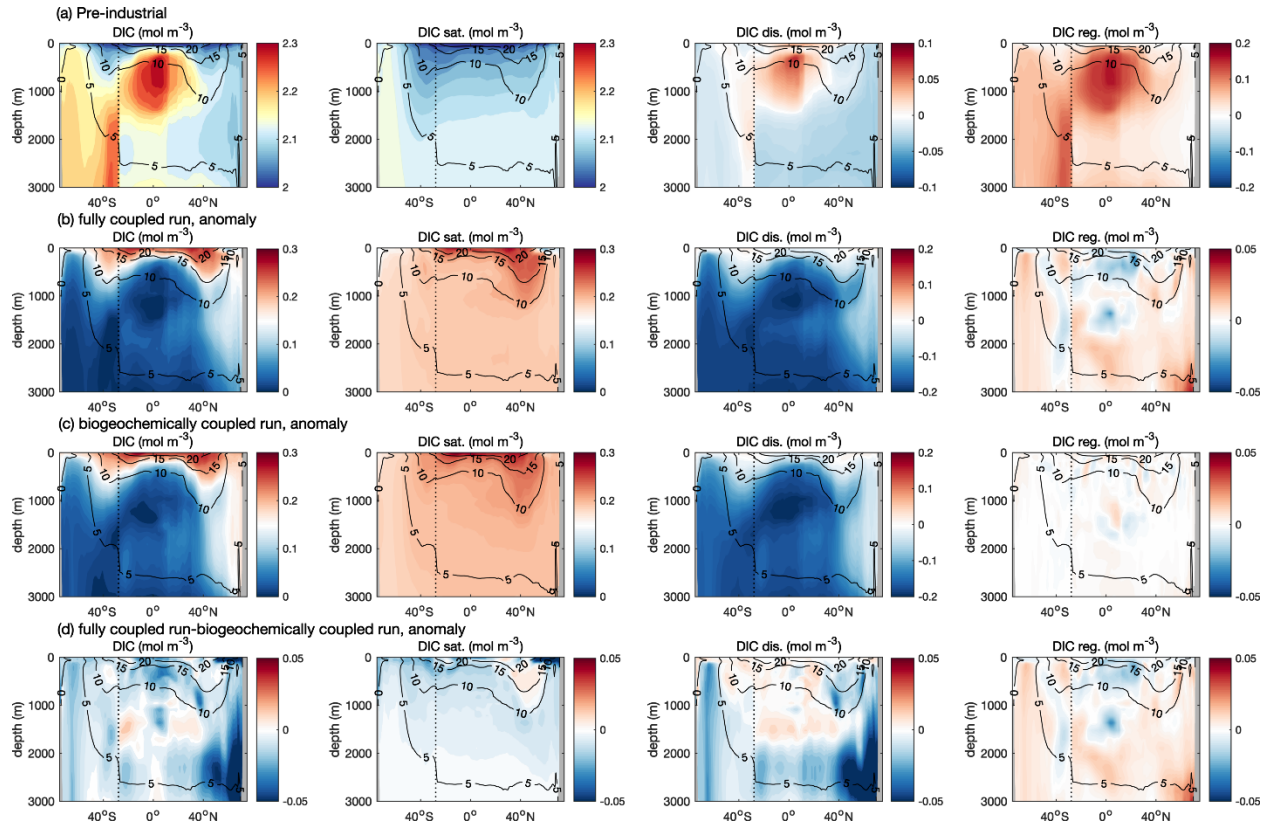
Figure S6. Meridional section of the dissolved inorganic carbon, *DIC* (mol m⁻³), and constituent carbon pools in **MPI-ESM1.2-LR** for the zonally-averaged Atlantic and Southern Ocean: (a) the preindustrial absolute concentrations, and the anomalies relative to the preindustrial state at year 140 for (b) the COU configuration, (c) the BGC configuration and (d) the COU minus the BGC configuration. The *DIC* is separated into saturated carbon, *DIC_sat*, the disequilibrium carbon, *DIC_disequilib*, and the regenerated carbon, *DIC_regenerated*. The Atlantic and Southern Ocean domains are separated by a black vertical line.
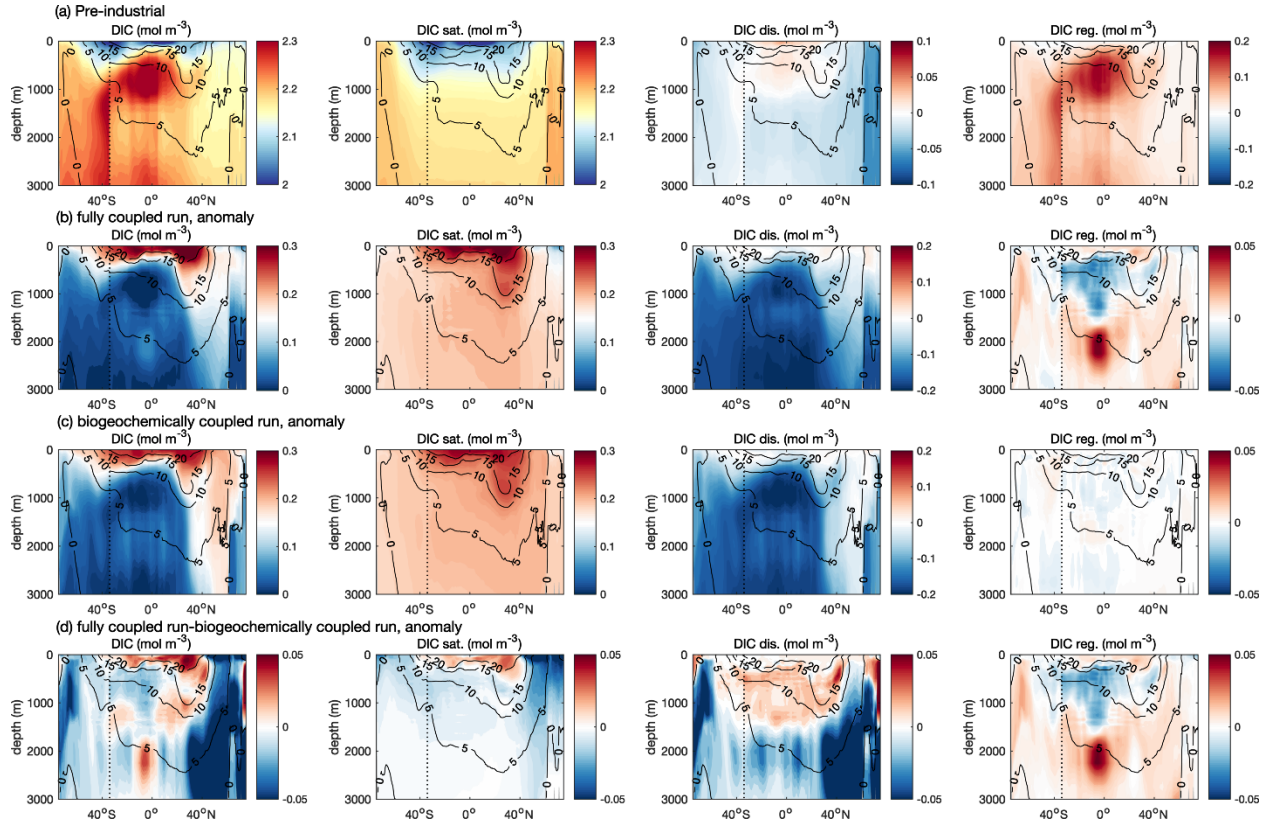
Figure S7. Meridional section of the dissolved inorganic carbon, *DIC* (mol m⁻³), and constituent carbon pools in **NorESM2-LM** for the zonally-averaged Atlantic and Southern Ocean: (a) the preindustrial absolute concentrations, and the anomalies relative to the preindustrial state at year 140 for (b) the COU configuration, (c) the BGC configuration and (d) the COU minus the BGC configuration. The *DIC* is separated into saturated carbon, *DIC$_{sat}$*, the disequilibrium carbon, *DIC$_{disequilib}$*, and the regenerated carbon, *DIC$_{regenerated}$*. The Atlantic and Southern Ocean domains are separated by a black vertical line.
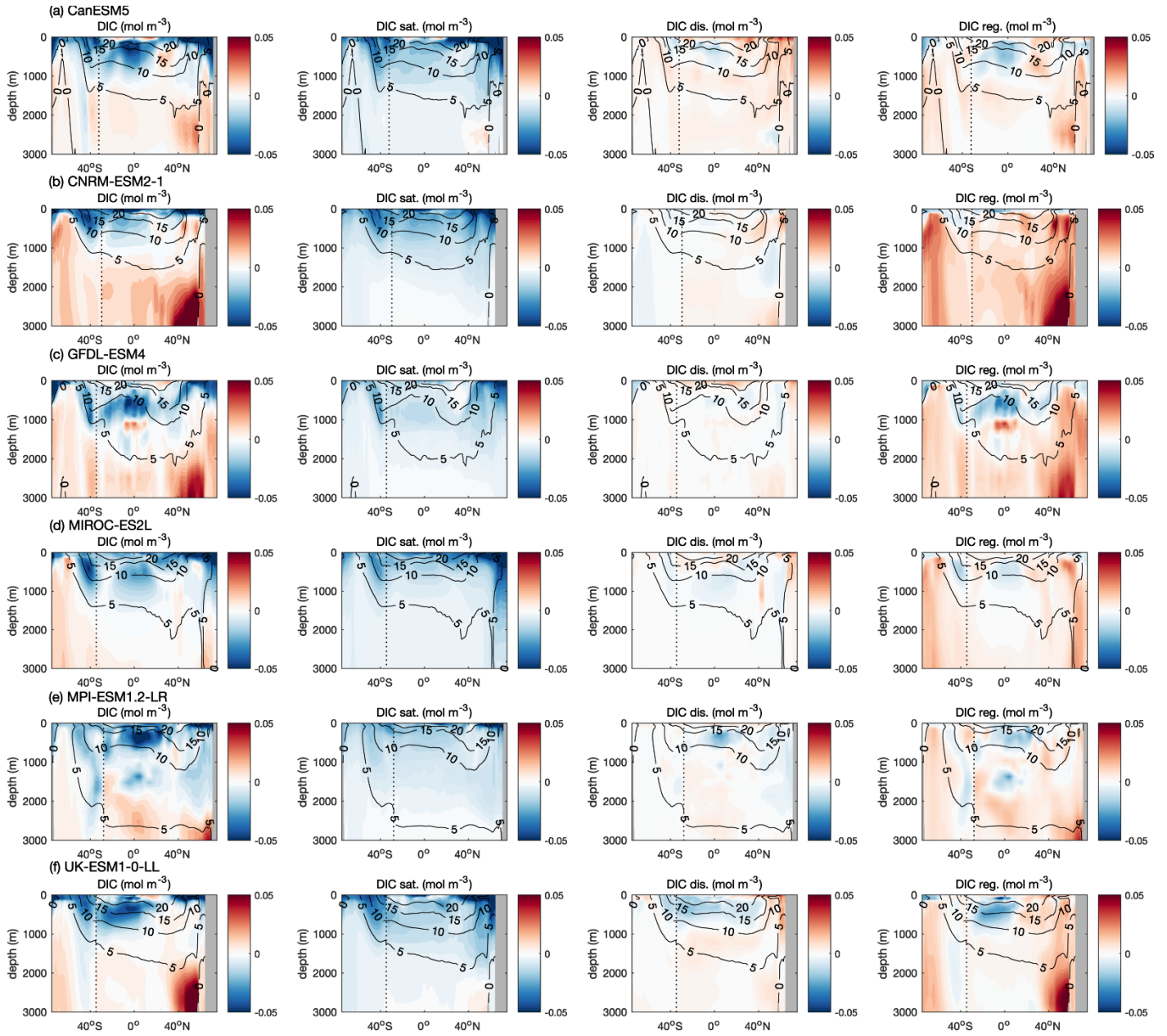
Figure S8. Meridional section of the dissolved inorganic carbon anomaly, *DIC* (mol m^{-3}), and constituent carbon pools in the radiatively-coupled run for the zonally-averaged Atlantic and Southern Ocean at year 140 relatively to the pre-industrial: (a) from CanESM5, (b) from CNRM-ESM2-1, (c) from GFDL-ESM4, (d) from MIROC-ES2L, (e) from MPI-ESM1.2-LR and (f) from UK-ESM1-0-LL. The *DIC* is separated into saturated carbon, *DIC$_{sat}$*, the disequilibrium carbon, *DIC$_{disequilib}$*, and the regenerated carbon, *DIC$_{regenerated}$*. The Atlantic and Southern Ocean domains are separated by a black vertical line.