See Lovenduski et al. 2007

sDIC Breakdown

How do biology, circulation, and CO_2 exchange individually influence sDIC anomalies during a climate event?

$$\frac{d(sDIC')}{dt} = J'_{circ} + \boldsymbol{J'_{bio}}** + \boldsymbol{J'_{ex}}*$$

(1) Create sDIC' for each simulation. This is $\frac{DIC}{S} * 35$ where DIC and S are integrated over the upper 100m.

(2) Take the central difference of (1) using `gradient` from Matlab or some equivelant function. This results in $\frac{d(sDIC')}{dt}$. Remove the ensemble mean to generate anomalies.

(3) Compute J'_{bio} by **Jint_100m_DIC** minus ensemble mean. Divide by 100m for unit consistency (see Lovenduski et al. 2007)

(4) Compute J'_{ex} by **FG_CO2/HMXL** (or by dividing by 100m for consistency?) minus ensemble mean.

(5) Compute J'_{circ} by (2) + (3) + (4). Although bad practice, this results in a residual, so no need to remove ensemble mean.

(6) Regress all four terms onto mode of interest (e.g. NPGO) for region of interest (e.g. CalCS). This gives you the relative contribution of each term to the sDIC anomaly.

***J'ex is positive for my study although Nikki's was negative. This is because I inverted the sign of CO2 flux and thus a positive FG_CO2 adds DIC to the ocean.**
****Also positive because Jbio in CESM is source-sink. So positive is source of DIC to water column.**

Unit Stuff

1. dsDIC/dt – native units are mmol/m^2/month (since gradient was done on monthly time series). Multiply by $12/10^3$ to convert to **mol/m^2/yr**
2. J_{bio} -- native units are mmol/m^3 cm/s → multiply by (60*60*24*365) / 10^5 to go to **mol/m^2/yr**.
3. J_{ex} – native units are mol/m^2/yr