Constraining the carbon fluxes during the onset of OAE 1a via inverse modelling

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The Oceanic Anoxic Event (OAE) 1a during the early Aptian (~120 Ma) represents a major disruption of the global carbon cycle and is recorded in marine sediments from all major ocean basins. Stable carbon isotope ($\delta^{13}C$) records show a significant decrease during the onset of OAE 1a, followed by a broad positive excursion. The initial negative $\delta^{13}C$ excursion that might be coupled with an observed CO_2 increase, suggests an input of isotopically-depleted carbon into the Earth system at the onset of OAE 1a. However, estimates of the duration of the different stages of OAE 1a, particularly the negative $\delta^{13}C$ excursion, vary and complicate the interpretation of the geological record. To test the implications of the proposed OAE 1a timescales and their reconcilability with other proxy data, we will use the biogeochemical ocean model of intermediate complexity cGENIE. In a series of experiments, our model will be forced to follow the atmospheric CO_2 concentration and $\delta^{13}C$ evolution, obtained from proxy data, throughout the onset of the OAE using a variety of OAE 1a timescale assumptions. We will compare the results to proxy data from sediment cores, including the extend of anoxia. For each experiment, we will also extract the magnitude and $\delta^{13}C$ signature of carbon inputs required to reproduce the recorded $\delta^{13}C$ and pCO_2 development.