

Measurements of air trapped in polar ice reveals CO₂ variations associated with past AMOC and climate changes. We have used simulations with an Earth System Model in order to understand the mechanisms. On centennial to millennial time scales CO₂ increases (decreases) by about 20 ppm during cold (warm) periods in Greenland, which are thought to be associated with a reduced (increased) AMOC. These changes can be reproduced with the climate model. Analysis of the model output indicates that changes in biologically sequestered carbon in the ocean are mainly responsible for the CO₂ variations, in accordance with simple theory. However, new high-resolution measurements show abrupt CO₂ changes associated with rapid warming (AMOC resumption), which remain unexplained. We speculate that either changes in terrestrial or surface ocean carbon storage could explain the observed variations.