Glacial-Interglacial CO_2 Changes:

CO_2 and temperature vary inversely, which gives a positive feedback, or perhaps CO_2 is forcing temperature.

Why does CO_2 vary with temperature?

1. Solubility Effect: As water gets colder, solubility of most gases increases. "Coke™ Effect."

As climate cools, for whatever reason, the ocean-atmosphere chemical equilibrium reduces atmospheric carbon dioxide.

2. The Biological Pump: During glacial ages the terrestrial or marine biological (organic) pumping of CO_2 out of the atmosphere increases.

Observation: CO_2 and $\delta^{13}C$ tend to vary inversely. Since primary productivity (photosynthesis) tends to take ^{12}C out of system, this suggests that the biological pump is the main driver in lowering CO_2 during glacial ages.

Why does biological pump work better during glacial maximum?

• More productive land?

Not likely, since colder, drier and lots of ice sheets.

• More productive ocean?

More intense circulation driven by winds and temperature gradients brings nutrients Nitrogen and Phosphorus to the surfac euphotic zone.

More dust to provide trace metals to ocean.