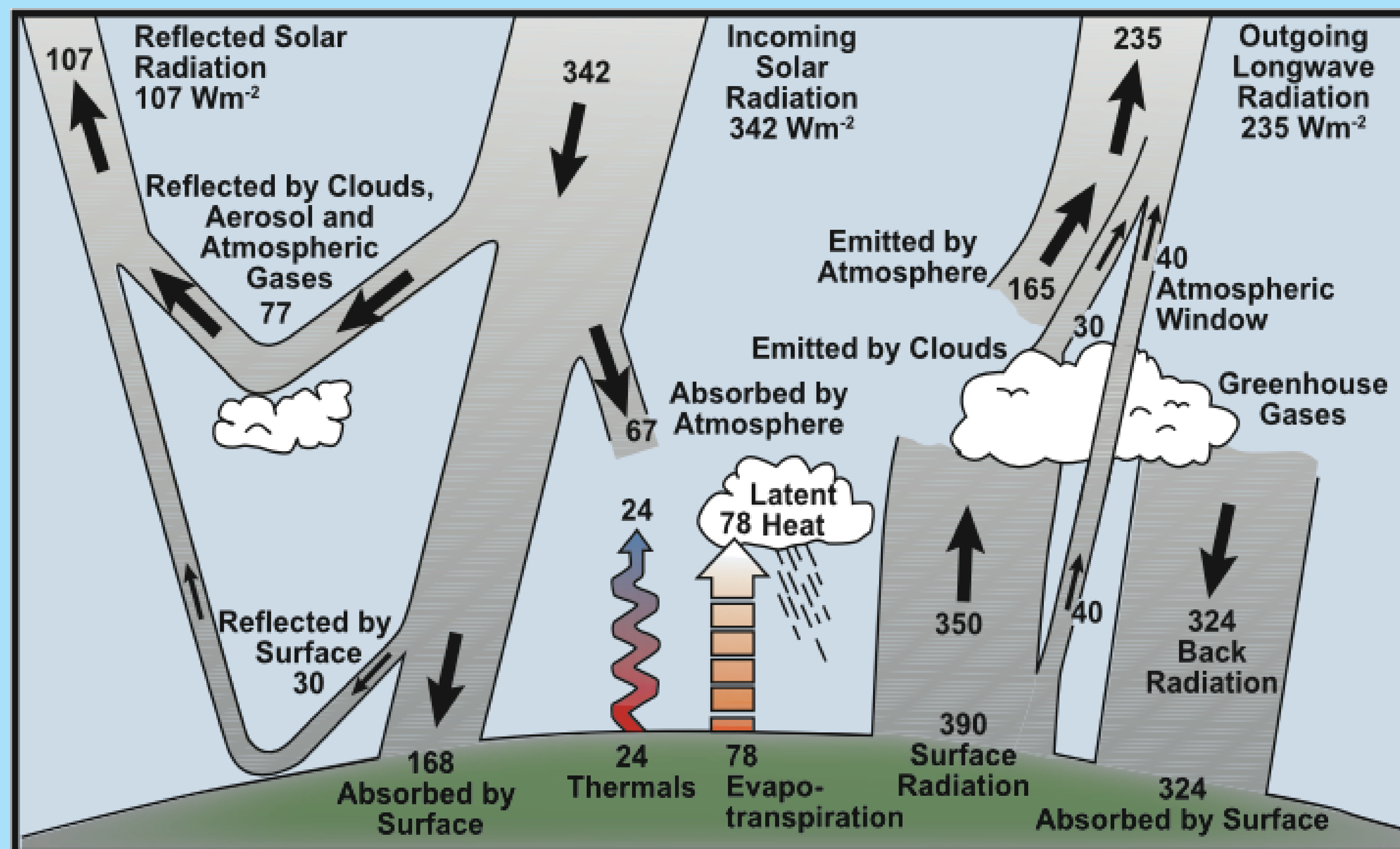


How greenhouse gases can change global temperature

Main Points

- * Carbon dioxide (CO₂) is the main greenhouse gas produced by humans
- * Fossil fuel use, agriculture and land use are the dominant cause of increases in greenhouse gases over the last 250 years
- * Carbon cycles through the Earth naturally, but the natural cycle has been significantly altered due to human activities
- * **In 2008, CO₂ concentrations reached 380 ppm, the highest in 650,000 years**

Energy Budget and Greenhouse Gases

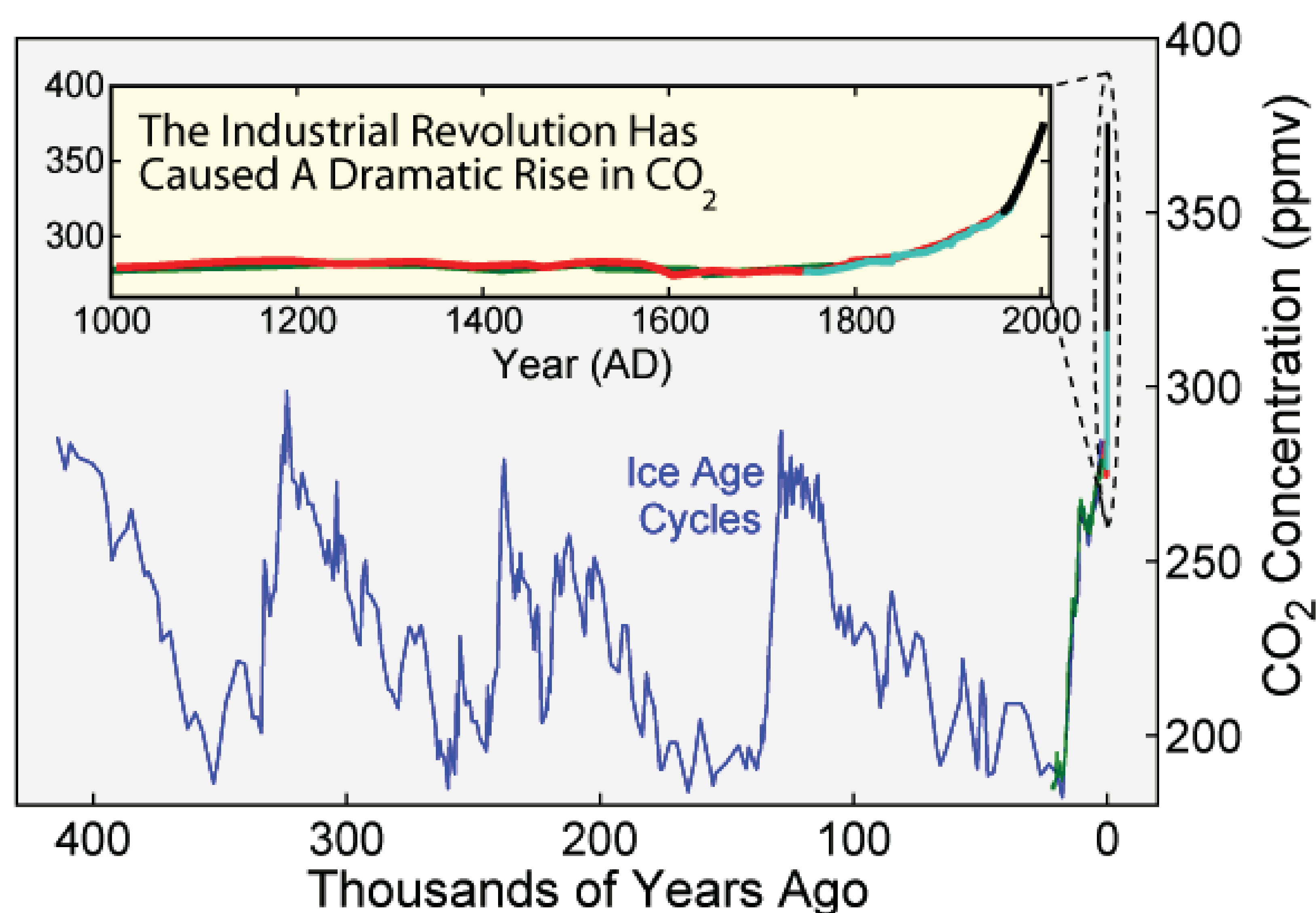


- * In order for Earth's temperature to remain stable, the current energy input must equal the energy output
- * Increasing greenhouse gas concentrations results in rising temperatures because they cause Earth to retain more energy in the form of heat
- * What are greenhouse gases (GHG)?
 - Main gases: water vapor (H₂O), carbon dioxide (CO₂), methane (CH₄), nitrous oxides (NO_x)
 - There are natural and human sources of GHG
 - GHG make Earth habitable
 - CO₂ is the most important GHG associated with human-induced climate change

"Fossil fuel use, agriculture and land use have been the dominant cause of increases in greenhouse gases over the last 250 years."

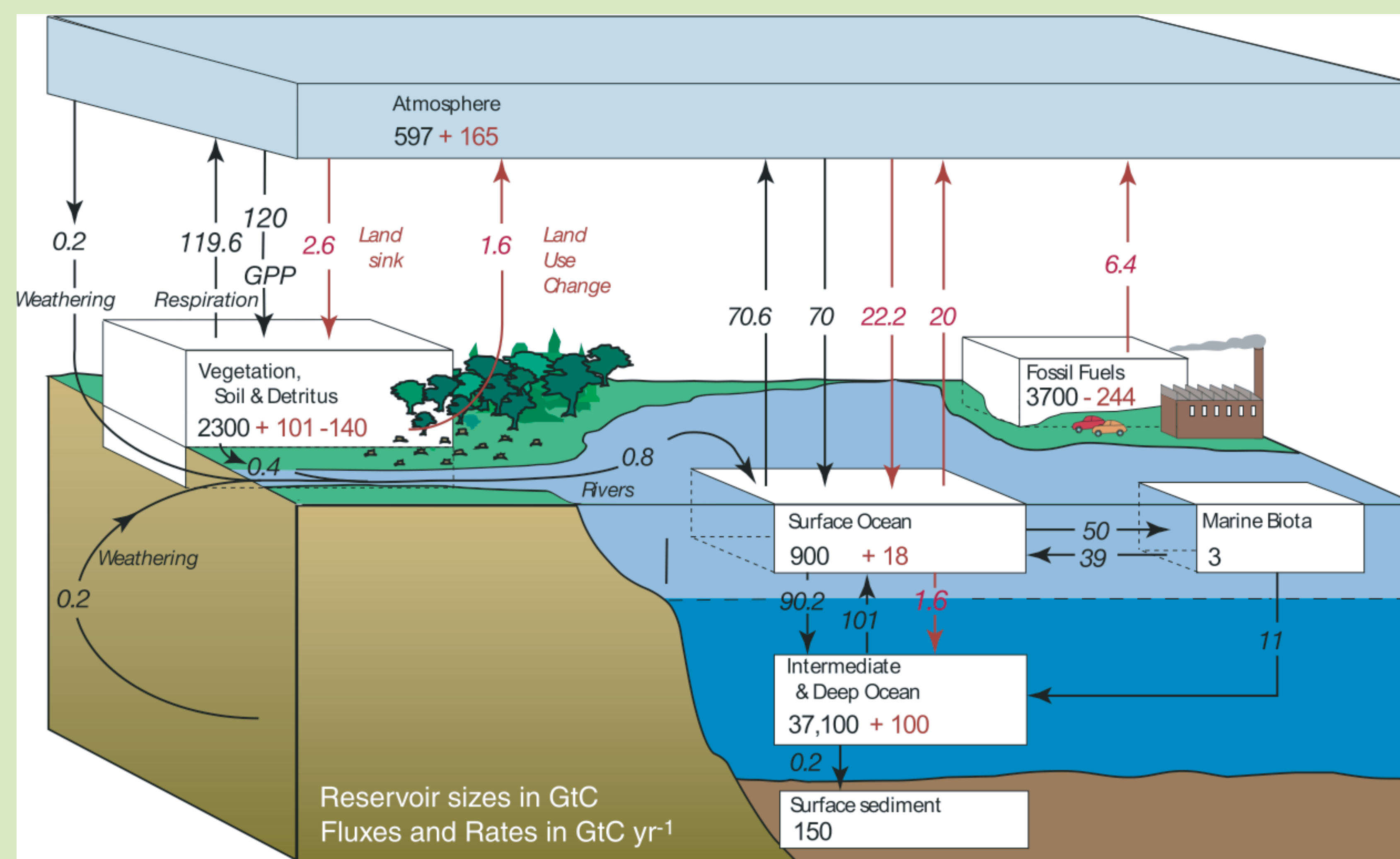
- IPCC, 2007

Carbon Dioxide Variations



- * Concentration of atmospheric CO₂ steadily increased since 1750
- * Steep increase in CO₂ is coincident with Industrial Revolution
- * In 2008, CO₂ concentrations reached 380 ppm, the highest in 650,000 years
- * Colored lines are from ice core data, black lines are from direct measurement

Carbon Cycle



Black indicates natural mass and flux of carbon; Red indicates human-induced mass and flux of carbon

- * The carbon cycle is the biogeochemical cycle by which carbon is exchanged between the 4 major carbon reservoirs including:
 - Biosphere: organisms living on land, in the ocean, or in the atmosphere
 - Geosphere: includes soil, minerals, and rocks
 - Hydrosphere: both fresh and salt water contained on land or in the ocean
 - Atmosphere: layer of gases that surrounds Earth
- * All reservoirs are connected with each other by various pathways