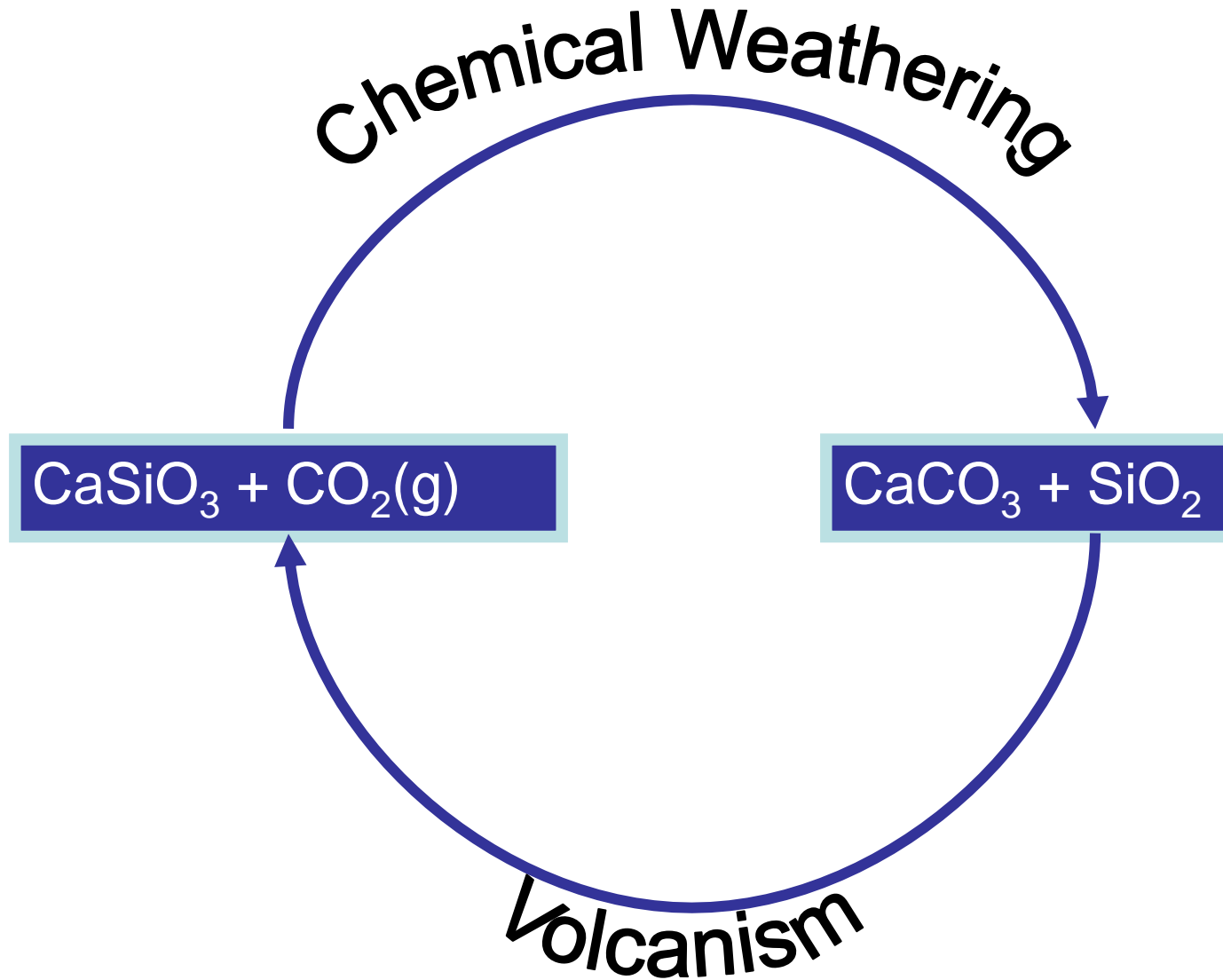


The “Ultimate” InorgC Cycle

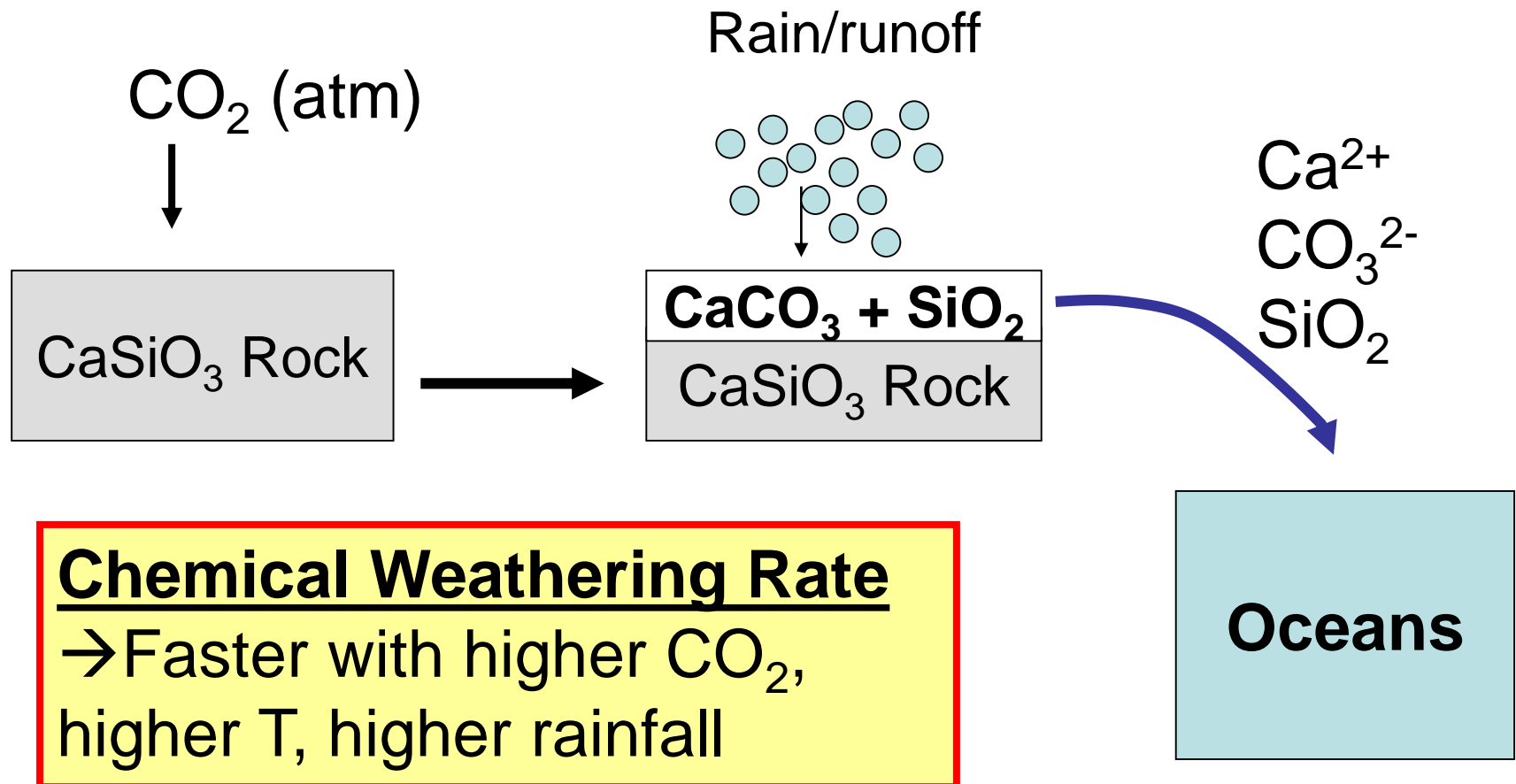


Weathering and Volcanism: Rocks Do Chemistry

Example of Weathering (CaCO_3 dissolution)

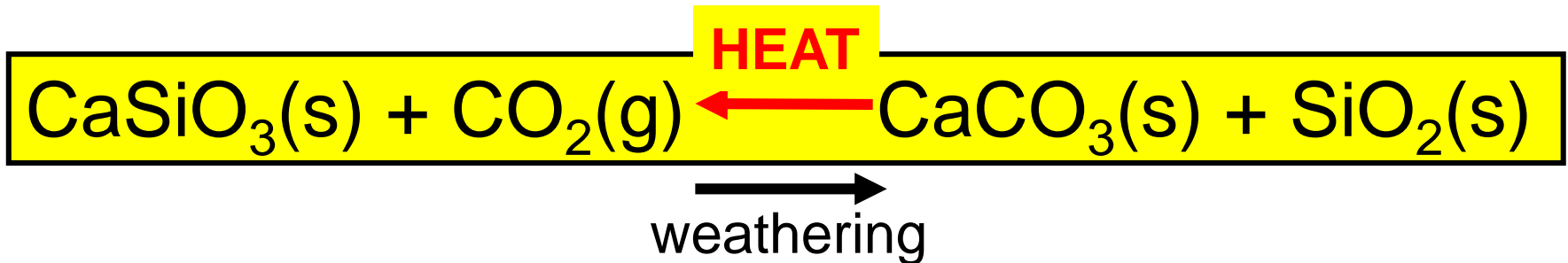


Silicate Weathering (simplified)



Volcanic Degassing

Volcanism causes reverse of weathering



Tectonic activity converts CaCO_3 rocks back to silicate rocks (CaSiO_3) in the mantle (magma).

Released CO_2 finds way to atmosphere via vents

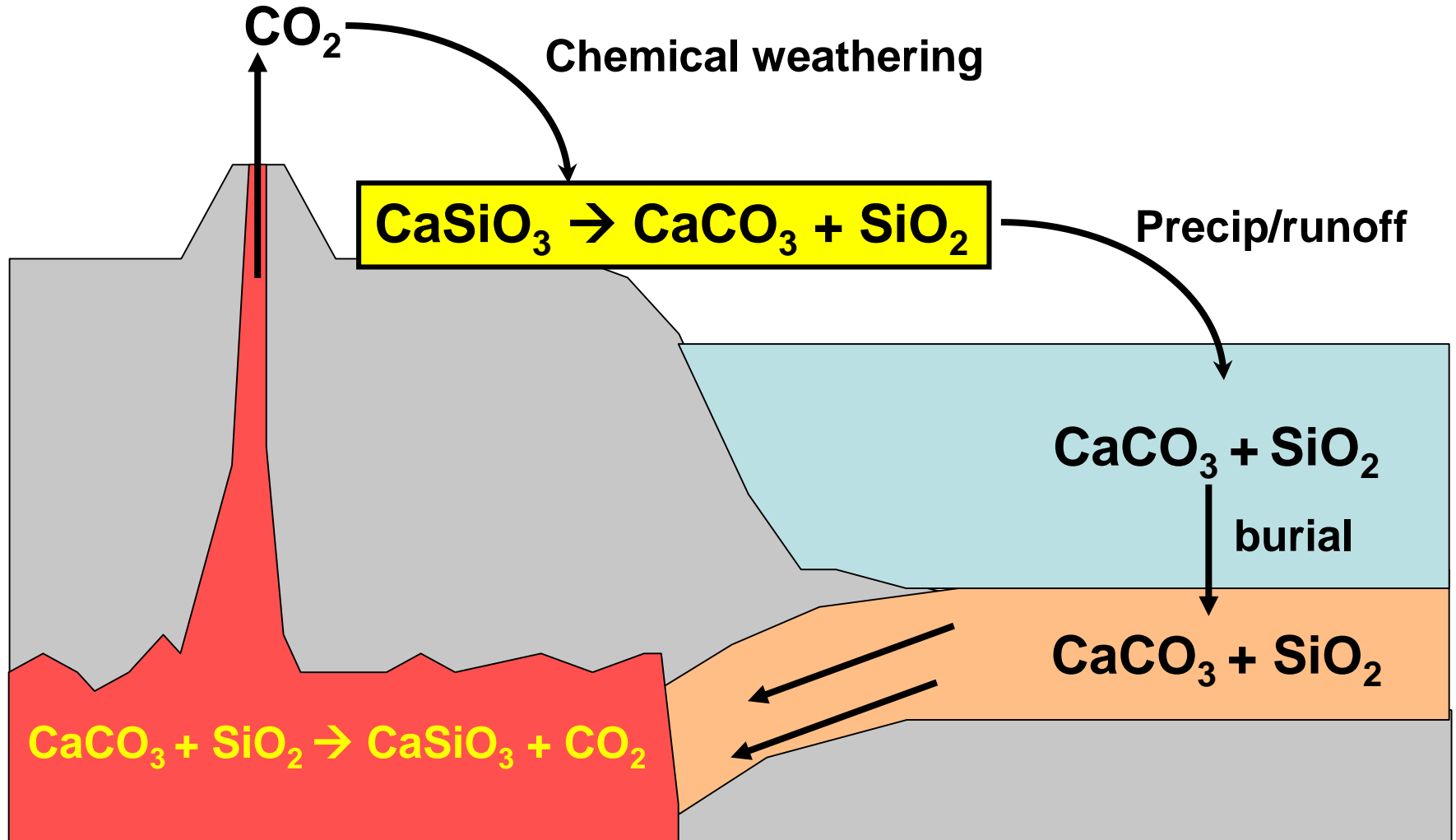
Volcanism in Action



May 4 2018



Silicate Weathering – Volcanism Cycle



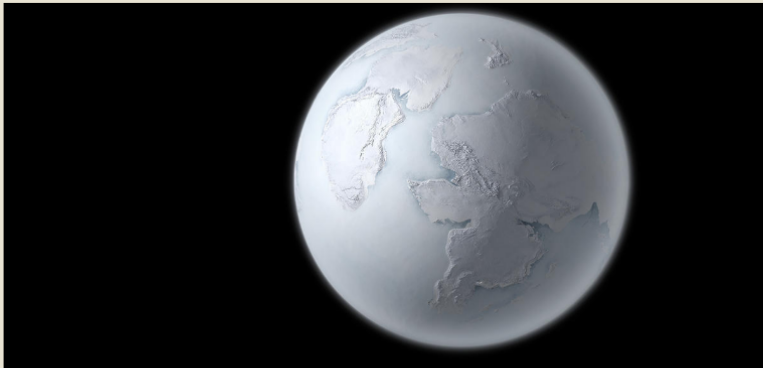
This cycle operates on 0.5 – 1 million year timescale.

Poll Question

W

Suppose there a massive ice age, where land oceans largely froze over...

 **Poll locked.** Responses not accepted.



The reduced water vapor and precipitation, and enhanced albedo would prevent recovery, and thus, unlikely to have happened

The weathering rate would slow, while volcanism and plate tectonics continued, causing an eventual melting back to a warm climate, and thus may have happened (or happen at some point)

Visual settings 

Activate 


Show results 

Show correct 

Lock 

Clear results 

Fullscreen 

Next 

Previous 

Silicate Weathering Feedback

**Atmospheric
CO₂**

**Silicate
Weathering Rate**

**Temperature/
Precipitation**

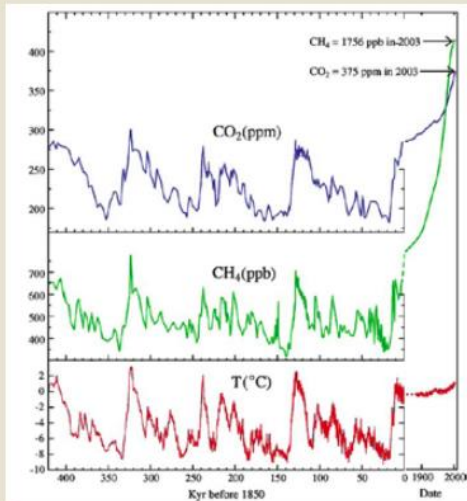
Poll Question

W

Does the silicate weathering feedback loop explain the glacial-interglacial cycling of atmospheric CO₂?

When poll is active, respond at Pollev.com/joelathornto254

Text **JOELATHORNTO254** to **22333** once to join



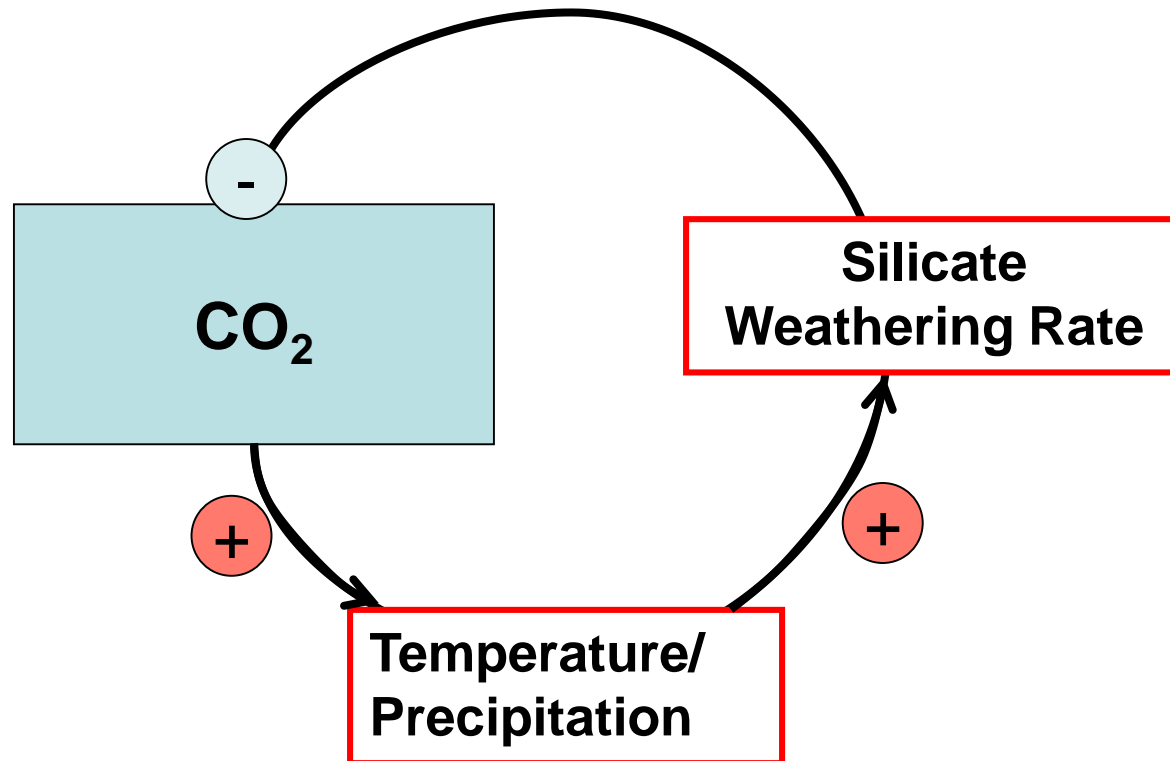
Yes

No

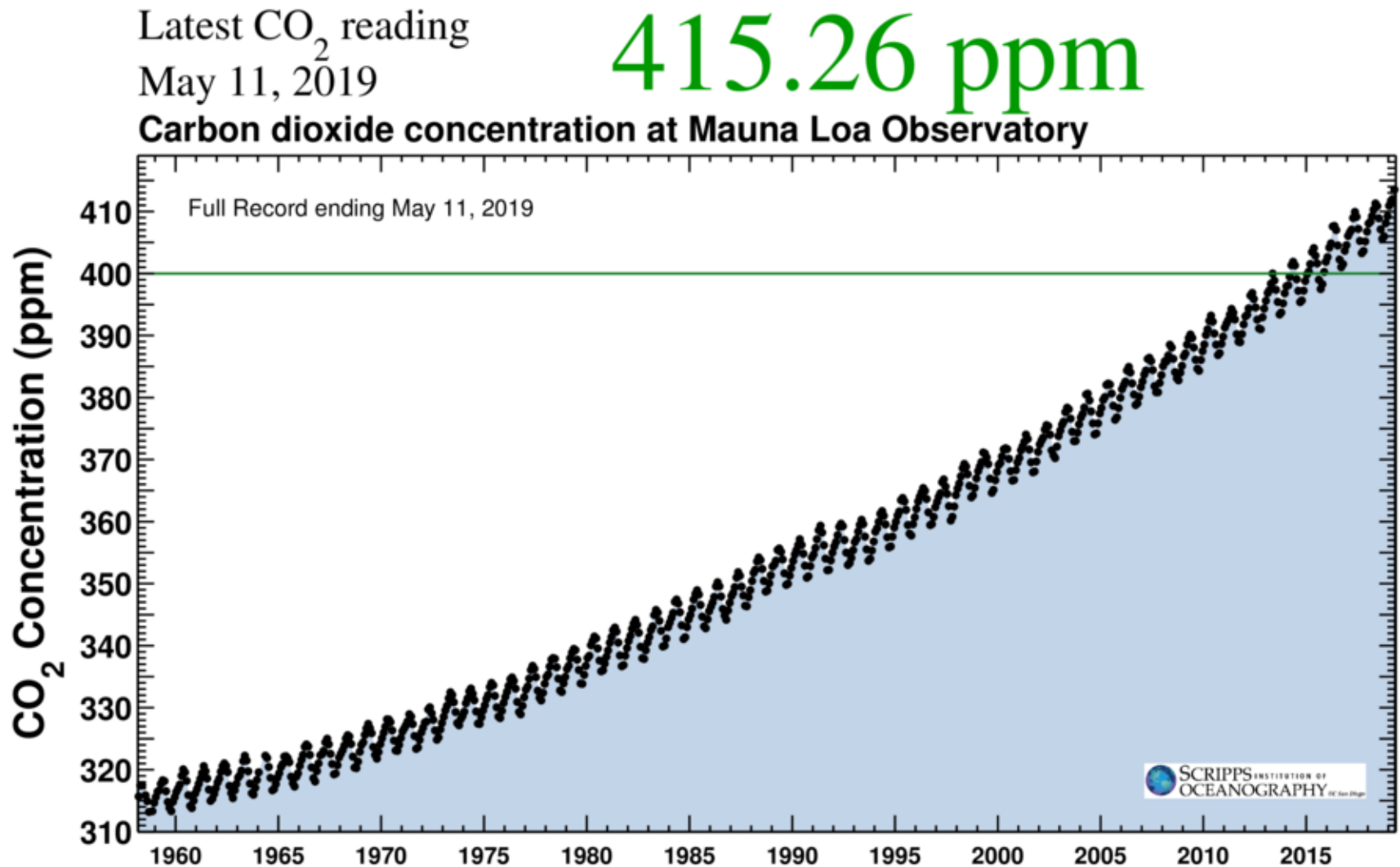
Total Results: 0

Silicate Weathering Feedback

Negative Feedback—Stabilizing Climate
(on *long time* scales 0.5 to 1 million years)

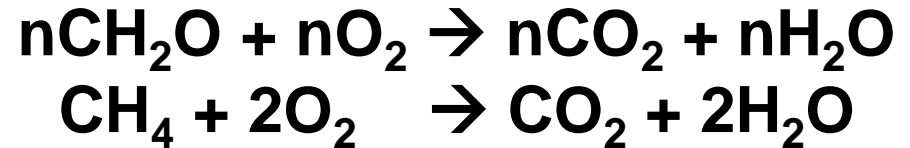


Anthropogenic Perturbations to Carbon Cycle



Atmospheric CO₂ and Source Attribution

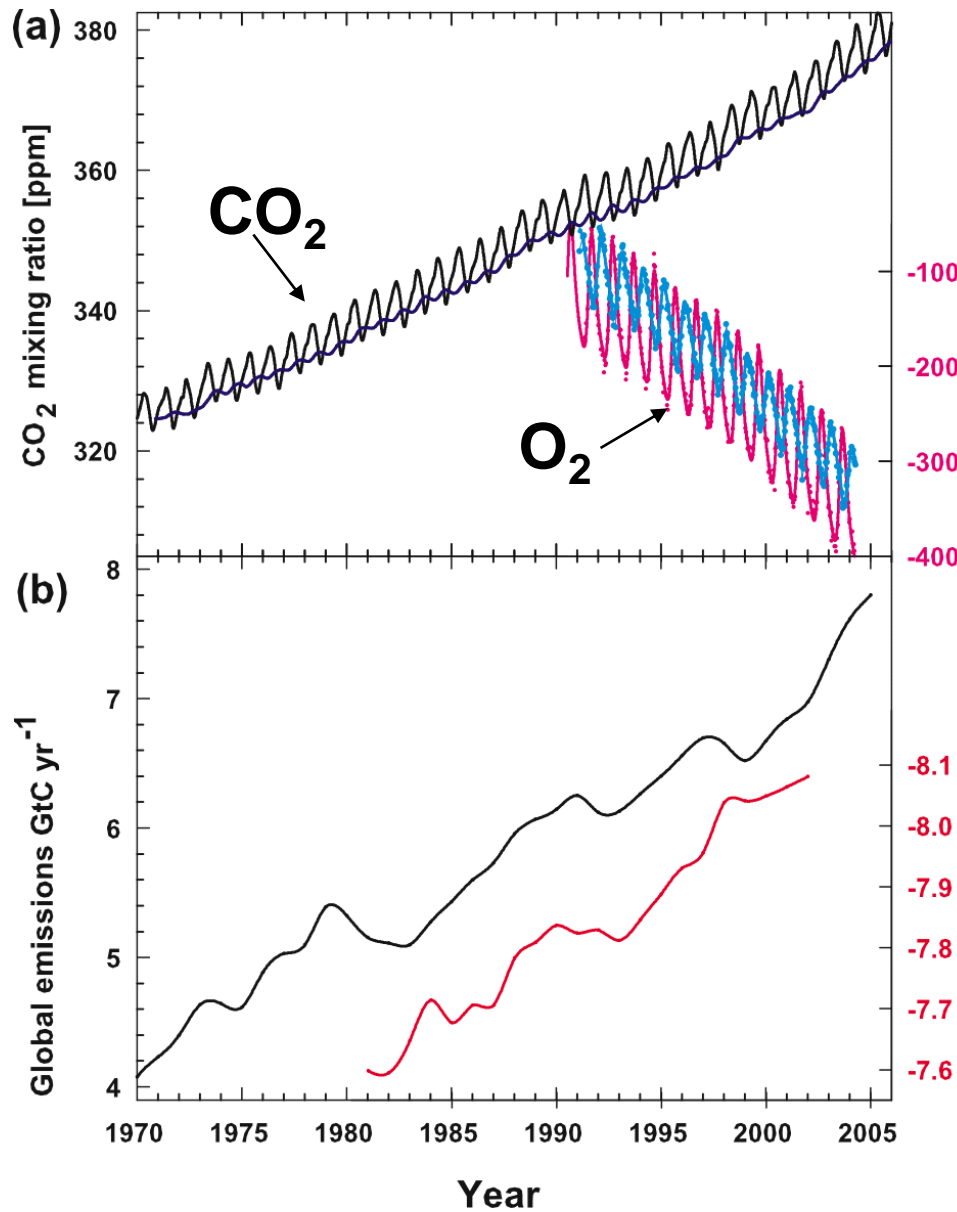
Fuel Combustion:



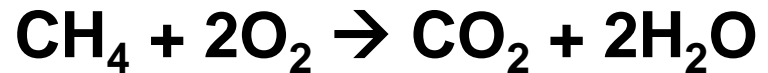
If CO₂ increase is due to
fuel burning...

→ O₂ should decrease!

Atmospheric CO₂ and Source Attribution



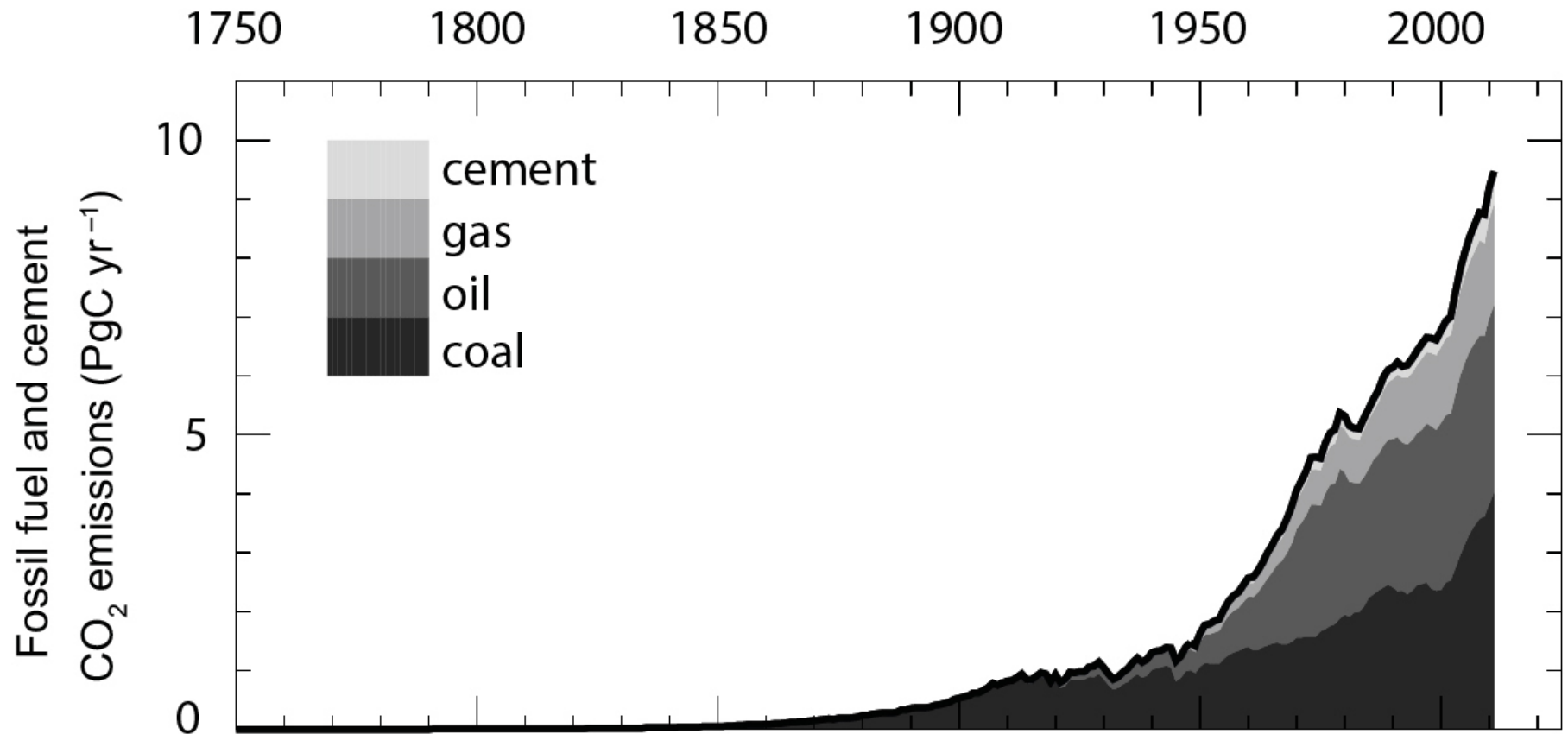
Fuel Combustion:



If CO₂ increase is due to fuel burning...

→ O₂ should decrease!

Anthropogenic Perturbations to Carbon Cycle

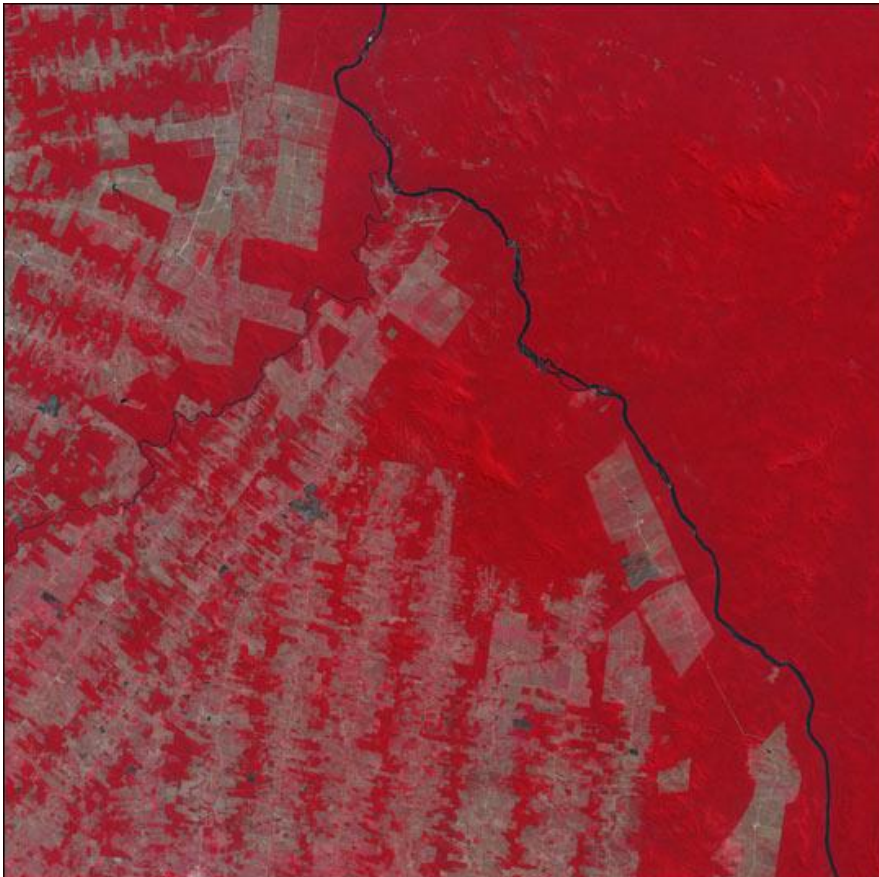


IPCC 2014

Human Perturbations to Carbon Cycle

Fossil Fuel Combustion ~ 8 GtC/yr currently

Deforestation ~ 2 GtC/yr (mostly in tropics)



Poll Question

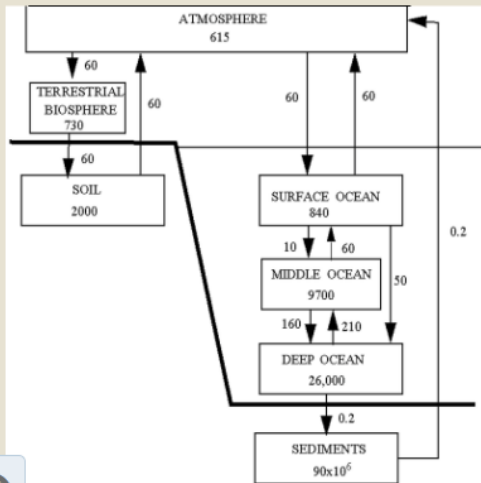
W Fossil fuel burning by humans injects ~ 8 Gt C per year into the atmosphere as CO₂, which is a ___ over the natural input rate of Carbon from the sediments to the atmosphere.



When poll is active, respond at [PollEv.com/joelathornto254](https://pollev.com/joelathornto254)



Text **JOELATHORNTO254** to **22333** once to join



4-fold increase

10-fold increase

40-fold increase

Total Results: 0

Poll Question

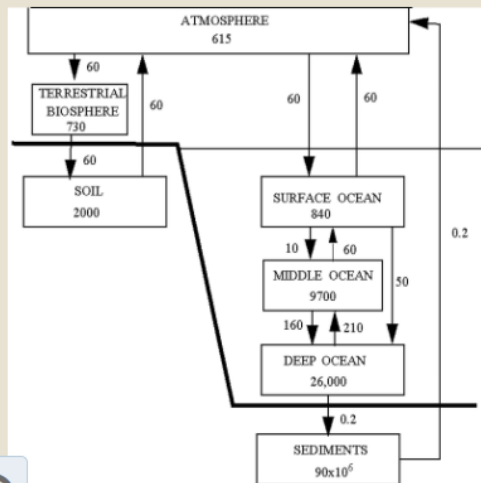
W If we ceased fossil fuel burning and deforestation, how long would it take the Earth system to fully recover from our current perturbation?



When poll is active, respond at [PollEv.com/joelathornto254](https://pollev.com/joelathornto254)



Text **JOELATHORNTO254** to **22333** once to join



Decades

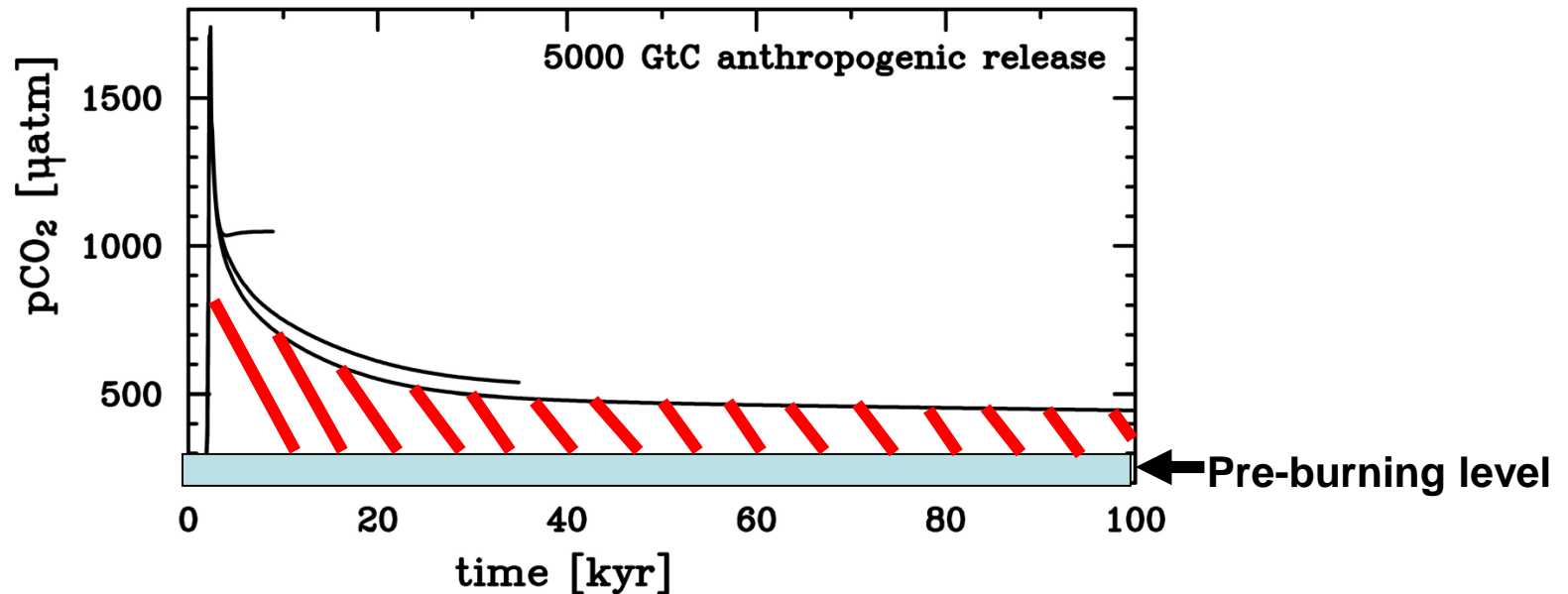
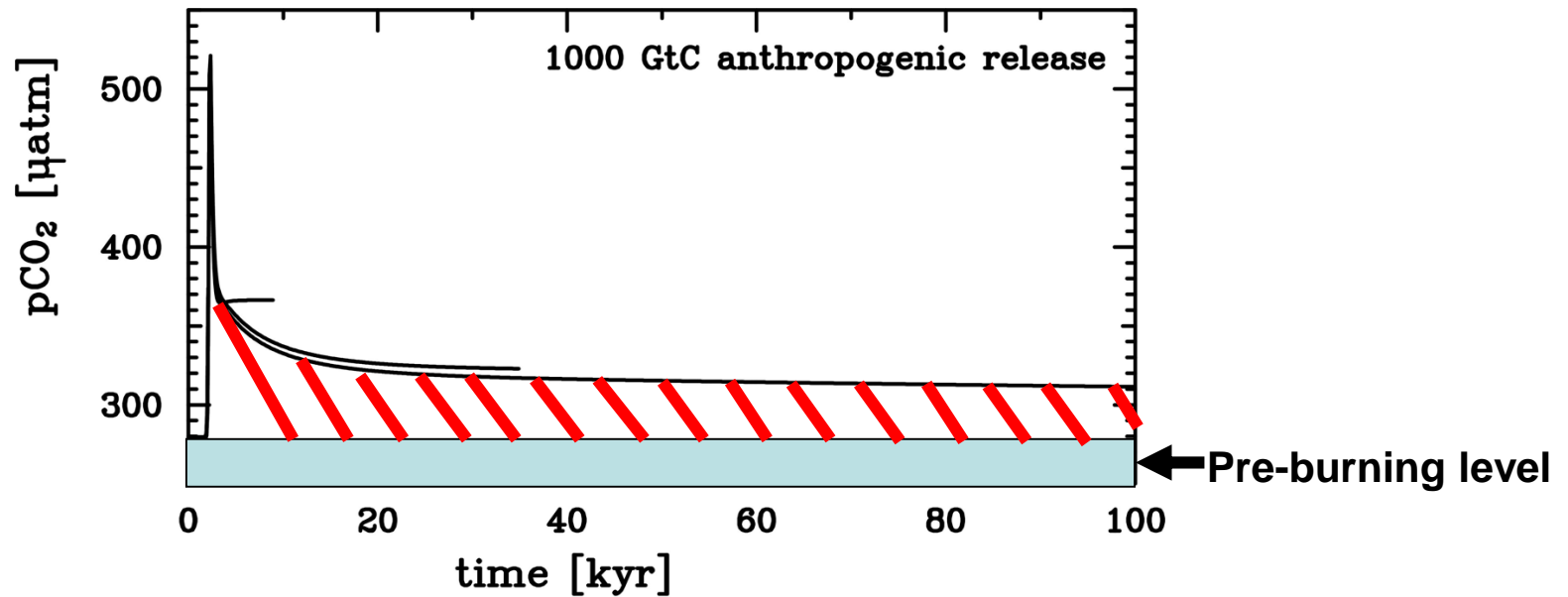
Centuries

Millenia

>100,000 years

Total Results: 0

A Long View of Fossil Fuel Perturbation



Adapted From: Archer, *J. Geophys. Res.*

W

Fossil fuel usage statistics and land use change suggest CO₂ emissions of approximately 8 GtC/year on average over the past couple decades, while atmospheric CO₂ measured at Mauna Loa increased by about 2 ppm/year on average, which is ~4 GtC/year.

Visual settings 

Activate 

Show results 

Show correct 

Lock 

Clear results 


Fullscreen 


 **Poll locked.** Responses not accepted.

Anthropogenic CO₂ emissions are likely overestimated by about 50%

Atmospheric CO₂ could be even higher than it is, but about 50% of what is added is being removed from the atmosphere each year

Mauna Loa trends are not representative of the global atmospheric CO₂

Next 

Previous 

Total Results: 0