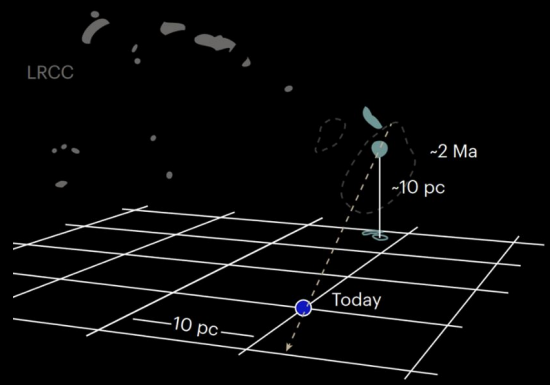
Impact of Galactic Cosmic Rays on Earth's Climate During an Encounter with the Local Lynx of Cold Clouds 2-3 Myr Ago

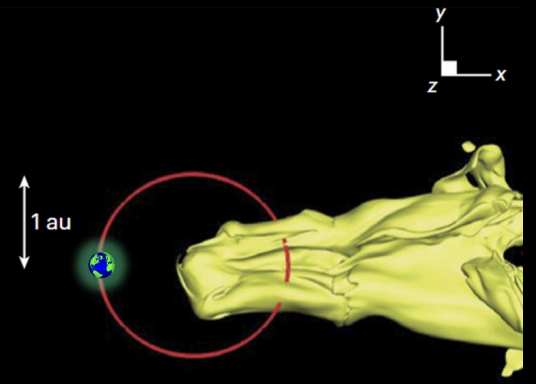
- Recent works suggest that the heliosphere may have crossed through a dense interstellar cold cloud 2-3 million years ago (Mya), called the Local Lynx of Cold Clouds. This compressed the heliosphere to sub-AU scales, exposing Earth to galactic cosmic rays (GCRs) from interstellar space.

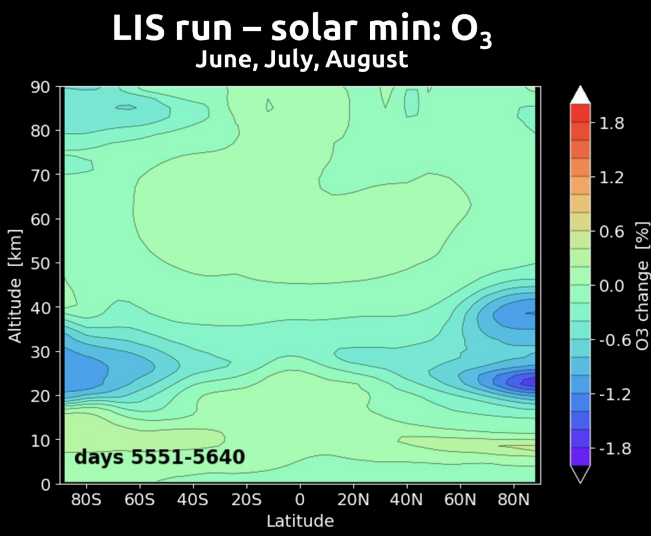
- During an interstellar cold cloud crossing, Earth will be exposed to an up to 10x higher flux of GCRs. Cosmic rays can ionize Earth's atmosphere and produce nitrogen oxide compounds which deplete stratospheric ozone.

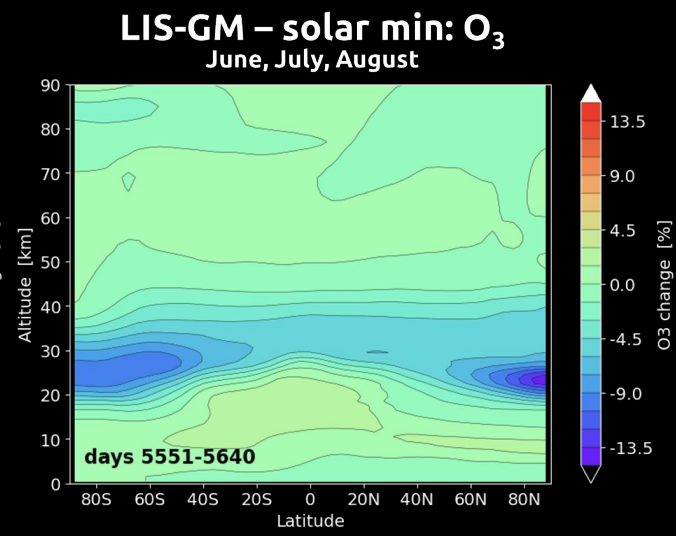
- We find that exposure to the interstellar flux of GCRs would deplete ozone by an additional 1-2% in the polar stratosphere. If the cold cloud crossing coincided with a geomagnetic pole reversal (such as the Gauss-Matuyama reversal 2.58 Mya), this can deplete up to 10-15% polar stratospheric ozone.

- Ozone depletion has important implications for surface-level UV exposure. Increased UV exposure can produce genetic mutations and reduce vegetative biomass, which could have influenced species and ecosystem evolution during this time.









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