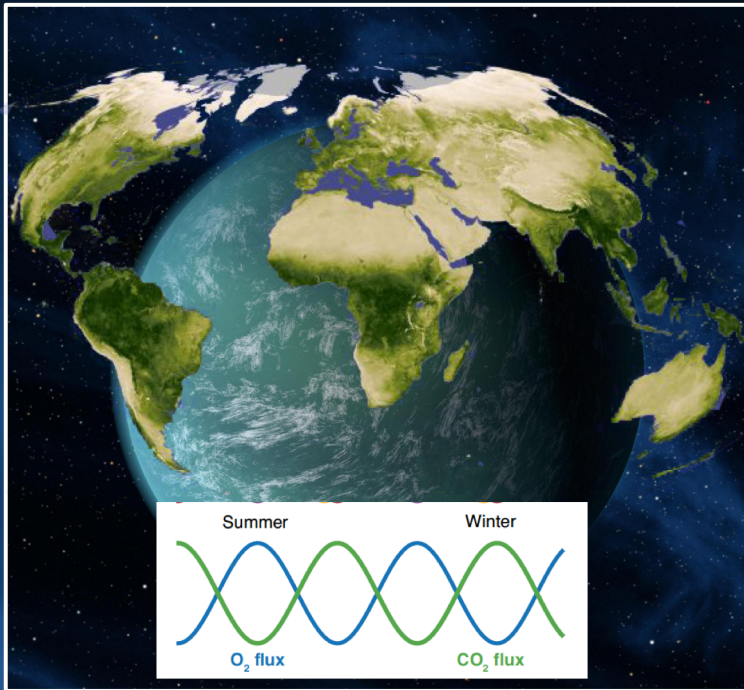


Atmospheric Seasonality as an Exoplanet Biosignature



EXPLORING EXO-SEASONS | Satellites monitor how 'greenness' changes with Earth's seasons (world map). This study assesses the accompanying changes in atmospheric composition of gases such as O₂ and CO₂ (graph) as a marker for life on distant planets like Kepler 22B (NASA artist's depiction in background).

A powerful way to assess exoplanets for inhabitation may be observations of their atmospheres throughout their orbits—potentially revealing life-driven changes in biosignature gases over the course of a year.

- In the first quantitative framework for dynamic biosignatures based on seasonal changes in the Earth's atmosphere, new research has characterized the seasonal formation and destruction of oxygen, carbon dioxide, and methane. These fluctuations were modeled for atmospheric oxygen on a life-bearing planet with low oxygen content, like that of Earth billions of years ago.
- Ozone is produced in the atmosphere through reactions involving oxygen gas (O₂) produced by life. On weakly oxygenated planets, ozone would be a more easily measured marker for the seasonal variability in O₂.
- Remote detection of life on exoplanets will require telescopes with broad spectral capabilities, and as these new telescopes are developed, studies like this show which capabilities would be essential. For example, if ozone is the only detectable biosignature on planets like the early Earth, ultraviolet and direct imaging would be the way to make these measurements.